



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

दिनांक: 05.07.2024

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 51 वीं बैठक की कार्यसूची ।**

**Subject: Agenda for 51<sup>st</sup> Protection Sub-Committee Meeting.**

संरक्षण उप-समिति की **51 वीं बैठक**, दिनांक **12.07.2024** को **10:30** बजे से **वीडियो कॉन्फ्रेंसिंग** के जरिए आयोजित की जाएगी । उक्त बैठक की कार्यसूची संलग्न है । यह उत्तर क्षेत्रीय विद्युत् समिति की वेबसाइट (<http://164.100.60.165/>) पर भी उपलब्ध है । कृपया बैठक में उपस्थिति सुनिश्चित करें ।

The **51<sup>st</sup> meeting** of Protection Sub-Committee is scheduled to be held on **12.07.2024** at **10:30 Hrs** via **video conferencing**. The agenda for the meeting is attached herewith. The same is also available on NRPC website (<http://164.100.60.165/>). Kindly make it convenient to attend the same.

**Signed by Dharmendra  
Kumar Meena  
Date: 05-07-2024 17:30:55**

डी. के. मीणा  
अधीक्षण अभियंता (संरक्षण)

## **Agenda of 51<sup>st</sup> Protection Sub-Committee Meeting (12<sup>th</sup> July, 2024)**

### **Contents**

A.1.	Confirmation of minutes of 50 <sup>th</sup> meeting of Protection Sub-Committee.....	4
A.2.	Submission of protection performance indices to NRPC Secretariat on monthly basis (agenda by NRPC Secretariat).....	4
A.3.	Annual protection audit plan for FY 2024-25 and third-party protection audit plan (agenda by NRPC Secretariat).....	5
A.4.	Compliance of recommendations of protection audit (agenda by NRPC Secretariat).....	6
A.5.	Proposal for implementation of SPS at 400/200kV ICTs at 400kV S/S Muktsar (agenda by Punjab SLDC).....	7
A.6.	Frequent outage of 800kV HVDC Champa-Kurukshetra inter-regional link (agenda by NLDC & NRLDC).....	8
A.7.	Revision of System Protection Scheme for Anpara Complex (agenda by UPSLDC).....	9
A.8.	Review of SPS scheme no. SPS/NR/GEN/01 SPS for reliable evacuation of power from NJPS, Rampur, Swara Kuddu, Baspa Sorang and Karcham Wangtoo HEP (agenda by HPPTCL).....	9
A.9.	Proposal of System Protection Scheme (SPS) at 400kV Substation Jaunpur (agenda by UPSLDC).....	9
A.10.	Intimation of performance of SPS (agenda by NRPC Secretariat).....	10
A.11.	Non-availability of Bus Bar protection scheme at 220 KV GSS Sakatpura, RVPN, Kota (agenda by RVUNL).....	11
A.12.	Instantaneous Setting in 132 kV Chandak-Pithoragarh & 132 kV Chandak-Almora Line (agenda by PTCUL).....	11
A.13.	Implementation of 3-phase Auto-Reclosure for the Phase-to-Phase Tripping of Transmission Lines due to Kite threads. (Agenda by POWERGRID, NR3).....	12
A.14.	Sudden failure of 400/220/33KV, 315 MVA ICT-1 at Kaithal during external faults in 220KV Lines (Agenda by POWERGRID, NR-2).....	14
A.15.	Status of remedial actions recommended during 50 <sup>th</sup> PSC meeting (agenda by NRLDC).....	15
A.16.	Status of Bus bar protection (agenda by NRLDC).....	16
A.17.	Replacement of electromechanical relays with numerical relays (agenda by NRLDC).....	16
A.18.	Frequent multiple elements tripping at 220kV Kuniyar, Baddi, Upperla Nangal complex and load loss event in HP control area (agenda by NRLDC).....	17
A.19.	Availability and Standardization of recording instrument (Disturbance recorder and Station Event Logger) (agenda by NRLDC).....	18
A.20.	Analysis of load loss event occurred at 13:53 hrs on 17th June 2024 (agenda by NRLDC).....	19
A.21.	Analysis of the tripping events occurred during April-2024 to June-2024 and status of remedial action taken (agenda by NRLDC).....	20
A.22.	Review and uniformity of df/dt (ROCOF) protection philosophy in Northern Region (agenda by NRLDC & NLDC).....	21

**Agenda of 51<sup>st</sup> Protection Sub-Committee Meeting (12<sup>th</sup> July, 2024)**

A.23. Review of procedure of approval of Protection Settings in Northern Region (agenda by  
NRPC Secretariat)..... 22

**Agenda of 51<sup>st</sup> Protection Sub-Committee Meeting (12<sup>th</sup> July, 2024)**

---

**Agenda for  
51<sup>st</sup> Meeting of Protection Sub-Committee (PSC) of  
Northern Regional Power Committee**

---

**Date and time of meeting** : 12.07.2024 10.30 Hrs.  
**Venue** : Via video conferencing

**A.1. Confirmation of minutes of 50<sup>th</sup> meeting of Protection Sub-Committee**

A.1.1 50<sup>th</sup> PSC meeting was held on 29.04.2024. Minutes of the meeting were issued vide letter dtd. 06.06.2024. No comment has been received till the date.

**Decision required from Forum:**

*Forum may approve the minutes of 50<sup>th</sup> PSC meeting.*

**A.2. Submission of protection performance indices to NRPC Secretariat on monthly basis (agenda by NRPC Secretariat)**

**A.2.1** 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,*

### **Agenda of 51<sup>st</sup> Protection Sub-Committee Meeting (12<sup>th</sup> July, 2024)**

*Nu is the number of unwanted operations,*

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

- *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.2.2** In earlier PSC meeting, it was decided that each utility shall submit the Performance indices of previous month by 7<sup>th</sup> day of next month.

**A.2.3** Accordingly, the status of the indices reported for the months from April-2024 to May-2024 is attached as **Annexure- I**.

**A.2.4** Further, based on submitted data by the utilities as on date, the summary of events that caused indices less than unity is also attached as **Annexure-II**. The concerned utilities are requested to submit the reason for the same and corrective action taken to resolve the related issue.

**A.2.5** In view of above, it is requested that utilities may submit the performance indices of previous month by 7<sup>th</sup> day of next month element wise along with the reason for indices less than unity and corrective action taken.

#### **Decision required from Forum:**

*Members may deliberate on delay from utilities in submission of indices, and action taken in cases where indices are less than one.*

### **A.3. Annual protection audit plan for FY 2024-25 and third-party protection audit plan (agenda by NRPC Secretariat)**

#### **Annual Internal Audit Plan:**

**A.3.1** 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.*

**Agenda of 51<sup>st</sup> Protection Sub-Committee Meeting (12<sup>th</sup> July, 2024)**

A.3.2 In the 48<sup>th</sup>, 49<sup>th</sup> & 50<sup>th</sup> PSC meetings, all utility were requested to submit the annual protection audit plan.

A.3.3 In view of above, some utilities have submitted their annual audit plans (enclosed as **Annexure- III**) and others may submit annual audit plan for FY 2024-25 at the earliest.

**Third party protection audit:**

A.3.4 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.3.5 In view of above, some utilities have submitted their third-party protection audit plans (enclosed as **Annexure-IV**) and other remaining may submit the same at the earliest.

A.3.6 Further, the utilities may update the status of 3<sup>rd</sup> party protection audit as per the submitted audit plans. Subsequently, the audit reports along with compliance status may be submitted to NRPC Secretariat regularly.

**Decision required from Forum:**

*Utilities may submit annual audit plan for FY 2024-25 & 3<sup>rd</sup> Party Protection audit plan and comply the same timely. Compliance report for the audited substation may be submitted.*

**A.4. Compliance of recommendations of protection audit (agenda by NRPC Secretariat)**

A.4.1 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).*

**Agenda of 51<sup>st</sup> Protection Sub-Committee Meeting (12<sup>th</sup> July, 2024)**

- Utilities have submitted the internal audit report based on the audit done at their substations. The submitted reports are attached as **Annexure-V**. The submitted reports of 3<sup>rd</sup> Party audit are attached as **Annexure-VI**.

**A.4.2** However, compliance of audit recommendations has not been reported to NRPC Secretariat.

**A.4.3** Further, the concerned utilities may submit the protection audit report (for audited S/s as per submitted plan) to NRPC Secretariat and may update the compliance status regularly.

**Decision required from Forum:**

*Forum may discuss audit report as well as action taken by utilities on recommendations of audit.*

**A.5. Proposal for implementation of SPS at 400/200kV ICTs at 400kV S/S Muktsar (agenda by Punjab SLDC)**

**A.5.1** Punjab SLDC has informed that NRLDC issued detailed report in respect of Punjab's ATC/TTC limits for Summer/2024 on dated 24-05-2024. Vide the said report, NRLDC directed PSTCL to implement the SPS at 400/200kV ICTs at 400kV Substation Muktsar (PSTCL), considering the N-1 contingency at Muktsar substation.

**A.5.2** Punjab SLDC has mentioned that there are 3 no. 400/220Kv ICTs (2 x 315MVA + 1 x 500MVA) at 400kV Muktsar substation. Further, there are 6 no. 220kV downstream circuits at Muktsar.

**A.5.3** Punjab SLDC has submitted a proposal regarding implementation of SPS at 400/200kV ICTs at 400kV S/S Muktsar (PSTCL) in view of the N-1 contingency attached as **Annexure-VII**.

**Decision required from Forum:**

*Forum may deliberate on the above proposal and accord approval accordingly.*

**Agenda of 51<sup>st</sup> Protection Sub-Committee Meeting (12<sup>th</sup> July, 2024)**

**A.6. Frequent outage of 800kV HVDC Champa-Kurukshetra inter-regional link (agenda by NLDC & NRLDC)**

- A.6.1 NLDC has mentioned that during January, 24 to May, 24 Multiple pole tripping (28 no of times) of HVDC Champa-Kurukshetra has been observed. At 13:53hrs on 17.06.24 all poles of HVDC Champa-Kurukshetra tripped which followed by 16.5GW load loss in NR region and multiple 765kV Lines tripped on over voltage during Peak NR demand period. Reliability of HVDC Champa-Kurukshetra poles need to be ensured by POWERGRID for safe and secure grid operation.
- A.6.2 Further, NRLDC has submitted that the frequency of tripping of HVDC Champa-Kurukshetra has increased. There are 11 no of events of multiple pole trippings has been observed in this link since January 2024. List of all the tripping of HVDC Champa-Kurukshetra is enclosed as **Annexure-VIII**. The tripping of this high-capacity link may cause overloading of other parallel transmission lines and further tripping may cause cascade tripping.
- A.6.3 It is also well known that, on account of summer, the Northern Region load would remain high till September and therefore, high import requirement exists for the Northern Region. Thus, the HVDC Champa-Kurukshetra inter-regional link is a very important link for fulfilling the Northern Region demand requirement.
- A.6.4 In 17<sup>th</sup> June load loss event also happened, triggering event was tripping of all poles of 800kV HVDC Champa-Kurukshetra.
- A.6.5 It has been observed that in major of the events, tripping cause was mainly due to DC line fault, filter protection, software issues, protection mal-operation etc. The reason of most of the tripping seems similar indicating the repetitive nature of fault/tripping.
- A.6.6 POWERGRID(NR-1) is requested to share the Protection and control philosophy, power compensation philosophy of 800kV HVDC Champa-Kurukshetra inter regional link along with analysis of protection and control system operation during the grid event.
- A.6.7 Remedial measures taken/to be taken to avoid frequent tripping of this inter-regional link also to be shared.

*Agenda of 51<sup>st</sup> Protection Sub-Committee Meeting (12<sup>th</sup> July, 2024)*

**Decision required from Forum:**

*Forum may kindly discuss and issue necessary direction.*

**A.7. Revision of System Protection Scheme for Anpara Complex (agenda by UPSLDC)**

- A.7.1** UPSLDC vide letter (**Annexure-IX**) dated 01.7.2024 submitted the revised System Protection Scheme for Anpara Complex.
- A.7.2** The revised proposal is attached as **Annexure- X**.

**Decision required from Forum:**

*Forum may deliberate on the above proposal and accord approval accordingly.*

**A.8. Review of SPS scheme no. SPS/NR/GEN/01 SPS for reliable evacuation of power from NJPS, Rampur, Swara Kuddu, Baspa Sorang and Karcham Wangtoo HEP (agenda by HPPTCL)**

- A.8.1** HPPTCL vide letter dated 27.03.2024 has submitted proposal for review of SPS for evacuation of power from NJPS, Rampur, Swara Kuddu, Baspa Sorang and Karcham Wangtoo HEP (attached as **Annexure- XI**)

**Decision required from Forum:**

*Forum may deliberate on the above proposal.*

**A.9. Proposal of System Protection Scheme (SPS) at 400kV Substation Jaunpur (agenda by UPSLDC)**

- A.9.1** UPSLDC vide letter dated 15.6.2024 submitted the System Protection Scheme for 400kV Substation Jaunpur as additional agenda in the 220<sup>th</sup> OCC meeting (held on 19.6.2024).
- A.9.2** UPSLDC informed that 2x315 MVA ICT at 400kV Substation Jaunpur is not N-1 compliant. In order to ensure the reliability of Jaunpur Substation during peak demand, SPS is required.
- A.9.3** The OCC forum recommended to discuss the scheme in upcoming PSC meeting.
- A.9.4** Accordingly, the logic (**Annexure-XII**) is put up as agenda for deliberation.

**Agenda of 51<sup>st</sup> Protection Sub-Committee Meeting (12<sup>th</sup> July, 2024)**

- A.9.5 However, NRLDC vide mail dated 2.7.2024 commented that SPS action would only provide relief in case 220kV Jaunpur-Phulpur and 220kV Jaunpur-Jhusi are kept open. Incase these lines are kept closed, SPS relief may not be sufficient.
- A.9.6 Incase 220kV Jaunpur-Phulpur and 220kV Jaunpur-Jhusi are kept open, loading of 400/220kV Allahabad (PG) ICTs would increase. Further, reliability of supply for these substations would also be poor.

**Decision required from Forum:**

*Forum may deliberate on the above proposal and accord approval accordingly.*

**A.10. Intimation of performance of SPS (agenda by NRPC Secretariat)**

**A.10.1** As per clause 16 of IEGC 2023;

- *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.*
- *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.*

**A.10.2** However, it has been observed that reporting of operation/failure of operation of SPS is not being done by the utilities.

**A.10.3** Utilities may intimate the same to the NRPC and NRLDC timely. Further, utilities may submit the protection performance indices for the SPS also.

**Decision required from Forum:**

*Forum may kindly direct the utilities to comply the above regulation.*

**A.11. Non-availability of Bus Bar protection scheme at 220 KV GSS Sakatpura, RVPN, Kota (agenda by RVUNL)**

- A.11.1 Bus Bar protection scheme is not in operation at 220kV GSS sakatpura since long. Due to this reason, 220 kV Bus faults at GSS sakatpura are not cleared in time at GSS Sakatpura end.
- A.11.2 These faults are fed through 04 Nos. KTPS- sakatpura feeders and are cleared later during delayed tripping (in Zone 2 time or back up protection) creating system

**Agenda of 51<sup>st</sup> Protection Sub-Committee Meeting (12<sup>th</sup> July, 2024)**

instability at KSTPS, which many times results in tripping of running KSTPS generating units and feeders etc. causing huge revenue loss to RVUNL.

**Decision required from Forum:**

*Members may deliberate and resolve the issue accordingly.*

**A.12. Instantaneous Setting in 132 kV Chandak-Pithoragarh & 132 kV Chandak-Almora Line (agenda by PTCUL)**

- A.12.1 PTCUL has submitted that the matter of instantaneous setting in the Chandak-Pithoragarh and Chandak-Almora power transmission lines has also been raised in the 47<sup>th</sup> PSC meeting. Currently, the instantaneous setting of the Chandak-Almora Line is set at 1200 Amperes, which is deemed inadequate considering the fault level of the 132 kV Bus at 3938 Amperes and Chandak-Pithoragarh Line is set at 900 Amperes.
- A.12.2 Consequently, occasional tripping of the Chandak-Pithoragarh Line has been observed when faults occur in the 33 kV line nearer to the substation.
- A.12.3 A recent tripping incident that took place on 25/06/2024. During this event, the fault current in the y-Phase reached 1621 Amperes, surpassing the instantaneous setting of the line. It is crucial to address this issue promptly in order to ensure reliable and uninterrupted power transmission.
- A.12.4 Tripping details of 132 kV Chandak (PGCIL)-Almora Line & 132KV Chandak(PGCIL)-Pithoragarh line submitted by PTCUL are attached as **Annexure-XIII**.
- A.12.5 Based on the aforementioned circumstances, the following potential solution is proposed to mitigate the problem:  
**Disabling the instantaneous trip function:** The viable solution is to disable the instantaneous trip function entirely. Instead, reliance would be placed on other protective measures, such as backup overcurrent settings, to offer adequate fault protection. It is worth noting that instantaneous setting in backup overcurrent is not recommended for 132 kV lines. Nevertheless, under the given circumstances, it could prove to be more reliable than the current configuration.
- A.12.6 Ensuring the reliability and stability of the power transmission network in the Chandak-Pithoragarh and Chandak-Almora lines is crucial. By addressing the instantaneous setting issue, the occurrence of unnecessary tripping can be

**Agenda of 51<sup>st</sup> Protection Sub-Committee Meeting (12<sup>th</sup> July, 2024)**

minimized, thereby improving the overall efficiency of the power transmission system.

**Decision required from Forum:**

*Members may deliberate and resolve the issue accordingly.*

**A.13. Implementation of 3-phase Auto-Reclosure for the Phase-to-Phase Tripping of Transmission Lines due to Kite threads. (Agenda by POWERGRID, NR3)**

- A.13.1 POWERGRID, NR-3 has intimated that as per the analysis of the Tripping Incidents of the Phase-to-Phase Tripping of the transmission lines at NR-III Region of POWERGRID, it has been observed that the majority of the Phase-to phase Tripping of the Transmission Lines have occurred due to the presence of foreign material (such as Kite Threads).
- A.13.2 In last three years (from May'21 to April'24), a total of 76 phase-to-phase tripping instances have occurred at transmission lines of NR-III Region due to the presence of kite thread and the Line got charged during charging attempt (within 01-02 hrs. of tripping).
- A.13.3 List of Transmission Lines in which more than 02 instances/Line of such phase-to-phase tripping have occurred are presented below: -

Sl. No.	Description of the Transmission Line	No. of Phase-to-Phase fault Instances due to Kite thread in which Line held during charging attempt.
1.	400kV Bareilly Moradabad-1 Line	16
2.	400kV Jehta(UP)- Unnao(UP)-1 Line	6
3.	220kV Bareilly(UP)- Sitarganj Line	5
4.	400kV Jehta(UP)- Unnao(UP)-2 Line	3

- A.13.4 As per the protection scheme implemented at POWERGRID for Transmission Line Distance Protection, Auto Reclosure is only attempted in case of 1-phase to earth Faults. And if the fault is phase-to-phase/3-phase in nature, 3-phase tripping of the transmission line is issued and Auto-Reclosure is blocked.

**Agenda of 51<sup>st</sup> Protection Sub-Committee Meeting (12<sup>th</sup> July, 2024)**

- A.13.5 However, in the above-mentioned phase-to-phase tripping instances, Transmission Lines got three-phase tripped (as per the implemented protection scheme) but got charged/held during the charging attempt. During the tripping of the line due to Kite thread, in most of the cases the thread causing the tripping gets burnt during the first tripping instance and subsequently the transmission line holds during the charging attempt.
- A.13.6 Further, it could be observed that maximum number of Kite thread caused tripping pertain to a particular geographical section between Bareilly and Moradabad near Moradabad end where Kite Flying is prominent and even after multiple awareness drive and taking up the matter with local administration, the instances of Kite related tripping has not reduced. A total of 16 Nos. of instances are observed in 400kV Bareilly Moradabad-1 Line, whereas 400kV Bareilly Moradabad2 Line which has been done LILO at 765/400kV PRSTL Rampur Substation runs through different route near Moradabad section, therefore such trippings are not observed in 400kV Rampur Moradabad Line (Line formed after LILO of Bareilly Moradabad-2 Ckt).
- A.13.7 Due to multiple tripping of the same transmission element on such transient nature fault caused by Kite Thread, reliability and availability of the transmission system is heavily affected. Therefore to enhance the same, it is proposed that 3-phase Auto Reclosure for phase-to-phase faults may be implemented in such lines having tripping on account of kite thread so that the number of trippings and outage duration of the transmission line during phase-to-phase fault may be reduced.
- A.13.8 Since, Majority of such instances have been occurred in 400kV Bareilly Moradabad-1 Line, therefore the scheme for 3-phase Auto-reclosure on phase-to-phase faults may be implemented in the above line on pilot basis.
- A.13.9 Scheme proposed by POWERGRID, NR-3 for 3-phase auto-reclosure: -
- In the proposed scheme for 3-phase Auto-reclosure of Line on Phase-to-phase faults, Line shall auto-reclose on Single-phase to earth faults & Phase to Phase Faults. However, Auto-reclosure should get blocked in case of Three-phase faults and three phase to earth faults.
  - To achieve the above through scheme, auto reclosure initiation is to be taken from the pickup signals of Single-phase to earth fault loop and Phase to phase Selection (in case of Rph-Yph fault, Yph-Bph fault and Bph-Rph Fault).
  - Further in case actuation of all three phase to earth fault selection loops together or actuation of all phase-to-phase fault loops together, blocking of

**Agenda of 51<sup>st</sup> Protection Sub-Committee Meeting (12<sup>th</sup> July, 2024)**

Auto-reclosure is to be configured.

- A.13.10 With the implementation of the above proposed scheme, 3-phase Auto-reclosure shall be only permitted for phase to earth and phase to phase faults and Auto-reclosure shall remain blocked for more severe faults such as 3-phase faults and 3-phase to earth faults to ensure grid stability.

**Decision required from Forum:**

*Members may deliberate.*

**A.14. Sudden failure of 400/220/33KV, 315 MVA ICT-1 at Kaithal during external faults in 220KV Lines (Agenda by POWERGRID, NR-2)**

- A.14.1 POWERGRID, NR-2 has submitted that on 11.05.2024, there was fault in downstream network at Kaithal (PG). The sequence of events is as under:

1. 00:51:06.816 220kV Kaithal (PG)-HVPNL Neemwala-2 tripped on B\_N Line fault, with fault current 23.6KA. Due to successful A/R at Kaithal (PG) end at 00:51:08.258 Hrs, above fault was repeated and again fed by ICT with fault current 23.5kA.
2. 00:51:10.808 220kV Kaithal (PG)-HVPNL Kaithal-1 tripped on B-N Line fault, with fault current 20kA. Due to successful A/R at Kaithal (PG) end at 00:51:11.858 Hrs, above fault was repeated and again fed by ICT with fault current 23.5kA.
3. 00:51:11.878 Hrs: ICT-1 had failed on failure of HV B-Phase winding while feeding above fault.

- A.14.2 POWERGRID has mentioned that summary of faults fed by ICT in last 02 Years as below-

Total faults fed in last 24 months	23Nos	
Line faults with fault distance less than 2KM	10 Nos	Fault current in 20-24KA
Line faults with fault distance between 2-6kM	07 Nos	
Line faults with fault distance 7—20km	06 Nos	Fault current in 4-8KA

**Agenda of 51<sup>st</sup> Protection Sub-Committee Meeting (12<sup>th</sup> July, 2024)**

Note: Out of 23 No Line faults in 220KV Lines, 18 No Line faults were in B Phase and ICT also failed due to failure of B Phase winding.

- A.14.3 Further, POWERGRID NR-2 has submitted that AMP of ICT was carried out as per schedule and all test results including DGA results were normal before failure.
- A.14.4 In view of above, POWERGRID NR-2 submitted that said ICT had failed while feeding of faults in 220KV Lines.

**Decision required from Forum:**

*Members may please discuss.*

**A.15. Status of remedial actions recommended during 50<sup>th</sup> PSC meeting (agenda by NRLDC)**

- A.15.1 As per the discussion in 50<sup>th</sup> PSC meeting, 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 are requested to share the status of remedial actions taken. Constituents can email the details via mail to NRLDC and NRPC.

**Decision required from Forum:**

*Members may like to discuss.*

**A.16. Status of Bus bar protection (agenda by NRLDC)**

- A.16.1 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*".
- A.16.2 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

**Agenda of 51<sup>st</sup> Protection Sub-Committee Meeting (12<sup>th</sup> July, 2024)**

operational.

- A.16.3 Continuous follow-ups have 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.
- A.16.4 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-XIV**.
- A.16.5 Constituents are 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.

**Decision required from Forum:**

*Members may like to discuss.*

**A.17. Replacement of electromechanical relays with numerical relays (agenda by NRLDC)**

- A.17.1 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”.*
- A.17.2 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 recorders 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.
- A.17.3 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”*
- A.17.4 It is known that Disturbance recorder (DR) is essential for analysis of grid incidents/disturbances. Its non-availability eventually affects the proper analysis of

**Agenda of 51<sup>st</sup> Protection Sub-Committee Meeting (12<sup>th</sup> July, 2024)**

grid incidents/disturbances and monitoring of protection system.

- A.17.5 Continuous follow-ups have been 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 expedite actions to replace electromechanical relays with numerical relays.
- A.17.6 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-XV**.
- A.17.7 Constituents are requested 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 also expedite the process of replacement of static/electromechanical relay with numerical relays.

**Decision required from Forum:**

*Members may like to discuss.*

**A.18. Frequent multiple elements tripping at 220kV Kunihar, Baddi, Upperla Nangal complex and load loss event in HP control area (agenda by NRLDC)**

- A.18.1 Frequent event of multiple elements tripping has been reported at 220kV Kunihar, Baddi, Upperla Nangal complex of HP control area. Total six (06) number of grid events have been reported in this complex in 2024. Major affected substations were 220kV Kunihar, Baddi & Upperla Nangal. Significant quantum of load (400-700MW) affected during these grid events. Protection coordination and load management related issues were observed during these events however, tripping details and details of remedial action taken not received yet from HP. List of events is attached as **Annexure-XVI**.
- A.18.2 During Aug-Sept 2023 also, Grid events were reported in this complex. Those events were discussed in 48<sup>th</sup> PSC meeting and PSC forum had recommended third party protection audit of Kunihar S/s. Thereafter, in view of further grid events in 2024, deliberation on above subject had been done at various forums.
- A.18.3 PSC forum (49<sup>th</sup> & 50<sup>th</sup> PSC) recommended expeditious 3<sup>rd</sup> Party protection audit of this complex and to submit the report. However, no update on the details of remedial action taken same have received and multiple events in recent past indicates that issues related to protection system and their coordination at these affected stations are still existing.

**Agenda of 51<sup>st</sup> Protection Sub-Committee Meeting (12<sup>th</sup> July, 2024)**

- A.18.4 DR/EL and detail analysis of any of these events have not received from HP. Therefore, HP is requested to analyse the tripping events in detail and share the report along with remedial action taken to avoid such events in future.
- A.18.5 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.
- A.18.6 During 48<sup>th</sup>, 49<sup>th</sup> & 50<sup>th</sup> PSC meeting, third party protection audit of this complex i.e., 220kV Kunihar, Baddi & Upperla Nangal was recommended. However, no details in this regard received from HP. HP is requested to take necessary remedial actions on priority.

**Decision required from Forum:**

*Members may like to discuss.*

**A.19. Availability and Standardization of recording instrument (Disturbance recorder and Station Event Logger) (agenda by NRLDC)**

- A.19.1 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.*
- A.19.2 *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.*
- A.19.3 During FTC process, cases of non-availability of station event logger and non-standardisation of recording instruments have been observed. Undertaking received in this regard from UP & Punjab is attached with **Annexure-XVII**.
- A.19.4 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.
- A.19.5 Therefore, availability of disturbance recorder with standardisation, time sync and correct nomenclature and station event logger need to be ensured by users at the

**Agenda of 51<sup>st</sup> Protection Sub-Committee Meeting (12<sup>th</sup> July, 2024)**

station of their respective control area.

- A.19.6 Deliberation on this subject was done during 50<sup>th</sup> PSC meeting. Details were received from UP (Lucknow & Gorakhpur zone) & Haryana only.
- A.19.7 In view of above, all the constituents are requested 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-XVII**.

**Decision required from Forum:**

*Members may like to discuss.*

**A.20. Analysis of load loss event occurred at 13:53 hrs on 17th June 2024 (agenda by NRLDC)**

- A.20.1 At 13:53 Hrs of 17<sup>th</sup> June 2024, Northern Region demand experienced a reduction in load of the order of 16.5 GW. The incident occurred immediately after tripping of both bipoles of +/-800 kV HVDC Champa (WR) – Kurukshetra (NR) which was carrying 4,500 MW from the Western Region to Northern Region.
- A.20.2 After tripping of the HVDC link, low voltages were observed across the Northern region and the above load reduction occurred. Partial outage of the 765/400kV Aligarh (PGCIL) station occurred due to reported tripping of all five (5) nos 765 kV lines. In the incident, grid frequency increased from 50.03 Hz to 50.68 Hz and recovered back to ~50.0 Hz within 6 minutes.
- A.20.3 Constituents are requested to share their inputs/observations on following points:
- SLDCs may share the analysis of load reduction in their respective control area during the event. Kindly share details w.r.t. following points:
    - Supporting DR/EL if triggered during low and high voltage scenario at any substation may be shared.
    - Any analysis and feedback pertaining to distribution side may also be shared.
    - Categorisation of load affected (agricultural/industrial/domestic) during the event.
    - Any load relief occurred through Under voltage load shedding (UVLS).
    - Whether load restored automatically or through manual intervention during the grid event.
  - ISGS and state control generating stations may share the analysis of generator response during the event. Kindly share details w.r.t. following points:

**Agenda of 51<sup>st</sup> Protection Sub-Committee Meeting (12<sup>th</sup> July, 2024)**

- Primary response as per grid requirement during the event
  - PSS/AVR response and MVAR support as per grid requirement during the event
- c) Some of the generating units also tripped during the event. List of the generating units tripped is attached as **Annexure-XVIII**. Concerned constituents are requested to share the Disturbance recorder file (DR:.dat/.cfg), Station Event logger file (EL), Reason of tripping (Relay flags, control panel annunciation etc.) and protection setting of protection operated.

**Decision required from Forum:**

*Members may like to discuss.*

**A.21. Analysis of the tripping events occurred during April-2024 to June-2024 and status of remedial action taken (agenda by NRLDC)**

- A.21.1 The list of major tripping events occurred during January-2024 to March-2024 is attached as **Annexure-XIX**. Concerned constituents/utilities are requested to share the detailed analysis of the tripping elements along with status of remedial action taken/to be taken.

**Decision required from Forum:**

*Members may like to discuss.*

**A.22. Review and uniformity of df/dt (ROCOF) protection philosophy in Northern Region (agenda by NRLDC & NLDC)**

- A.22.1** NLDC has mentioned that multiple df/dt operation observed in Punjab, Haryana, Rajasthan, UP and Delhi for grid events involving single/multi-phase to ground faults and on few instances momentary RE generation dips has been observed along with line tripping. The reason of df/dt relay operation are suspicious as the delay and no of cycles taken for df/dt relay triggering are yet to be clarified by the Northern Regional states.
- A.22.2** The settings and operating philosophy of df/dt relay to be reviewed and the sub-committee and Task force report on AUFLS and df/dt scheme as approved in 14<sup>th</sup> NPC meeting to be endorsed by all states.
- A.22.3** NRLDC has also highlighted the same that multiple incidents of load shedding on df/dt (ROCOF) protection operation have been reported during recent past. Major

**Agenda of 51<sup>st</sup> Protection Sub-Committee Meeting (12<sup>th</sup> July, 2024)**

operations were reported from Punjab control area. Delhi, Rajasthan & UP have also reported load shedding on df/dt operation during some of the incidents. Incidents during which df/dt operation have reported is attached as **Annexure XX**.

- A.22.4** In view of frequent incidents of tripping of distribution feeders on df/dt operation, analysis and review of df/dt operation is necessary. Communication has already been sent to SLDCs via mail to provide details of stage wise quantum of load relief on df/dt operation and protection setting adopted (average cycle, time delay etc.)
- A.22.5** Partial details received from Delhi and Punjab.
- A.22.6** SLDCs are requested to share the adopted philosophy of df/dt protection and confirm whether uniform philosophy has been adopted throughout the state or not. SLDCs may share the details at the earliest so that analysis and review of df/dt operation and its philosophy may be done.
- A.22.7** Further review of df/dt protection setting also need to be done to ensure its uniformity and to avoid undesired operation and load loss.

**Decision required from Forum:**

*Members may like to discuss.*

**A.23. Review of procedure of approval of Protection Settings in Northern Region (agenda by NRPC Secretariat)**

- A.23.1** As per clause 14 (2) of IEGC 2023:
- All users connected to the grid shall:*
- *obtain approval of the concerned RPC for (i) any revision in settings, and (ii) implementation of new protection system;*
  - *intimate to the concerned RPC about the changes implemented in protection system or protection settings within a fortnight of such changes;*
- A.23.2** In view of above, the procedure for approval of settings was finalized in the 49<sup>th</sup> PSC meeting wherein it was decided that NRPC Secretariat will provide the approval of protection settings.
- A.23.3** Further, the agenda was again discussed in 50<sup>th</sup> PSC meeting (held on 29.05.2024), wherein the procedure was revised (attached as **Annexure-XXI**). The same was also taken in the 50<sup>th</sup> TCC and 74<sup>th</sup> NRPC meetings (held on 28-29 June, 2024) for final approval of forum. However, NRLDC requested to deliberate the revised

**Agenda of 51<sup>st</sup> Protection Sub-Committee Meeting (12<sup>th</sup> July, 2024)**

procedure again in the upcoming PSC meeting.

- A.23.4** NRLDC has submitted request for revision of procedure as attached as **Annexure-XXII**.

***Decision required from Forum:***

Members may deliberate on above proposal and accordingly, procedure may be reviewed.

\*\*\*\*\*

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

S. No.	NRPC Member Organization	Designation	Email-ID
1	Member (GO&D), CEA	Director, NPC Division	<a href="mailto:skdotancea@nic.in">skdotancea@nic.in</a>
2	Member (PS), CEA	Chief Engineer, PSPA-I Division	<a href="mailto:i.sharan@nic.in">i.sharan@nic.in</a>
3	CTUIL	Sr.GM	<a href="mailto:schakraborty@powergrid.in">schakraborty@powergrid.in</a>
4	PGCIL	GM	<a href="mailto:gunjan.agrawal@powergrid.in">gunjan.agrawal@powergrid.in</a>
5	NLDC*	Executive Director	<a href="mailto:scsaxena@grid-india.in">scsaxena@grid-india.in</a>
6	NRLDC*	Executive Director	<a href="mailto:nroy@grid-india.in">nroy@grid-india.in</a>
7	NTPC	GM(OS-NR)	<a href="mailto:dmandal@ntpc.co.in">dmandal@ntpc.co.in</a>
8	BBMB	Director (P&C)	<a href="mailto:dirpc@bbmb.nic.in">dirpc@bbmb.nic.in</a>
9	THDC*	Chief General Manager (EM-Design)	<a href="mailto:rrsemwal@thdc.co.in">rrsemwal@thdc.co.in</a>
10	SJVN	Additional General Manager	<a href="mailto:prakash_chand@sjvn.nic.in">prakash_chand@sjvn.nic.in</a>
11	NHPC	General Manager (O&M)	<a href="mailto:hod-om-co@nhpc.nic.in">hod-om-co@nhpc.nic.in</a>
12	NPCIL*	Director (Finance)	<a href="mailto:df@npcil.co.in">df@npcil.co.in</a>
13	Delhi SLDC	General Manager	<a href="mailto:gmsldc@delhisldc.org">gmsldc@delhisldc.org</a>
14	Haryana SLDC	Chief Engineer (SO&C)	<a href="mailto:cesocomml@hvpn.org.in">cesocomml@hvpn.org.in</a>
15	Rajasthan SLDC	Chief Engineer (LD)	<a href="mailto:ce.ld@rvpn.co.in">ce.ld@rvpn.co.in</a>
16	Uttar Pradesh SLDC	Superintending Engineer (R&A)	<a href="mailto:sera@upsldc.org">sera@upsldc.org</a>
17	Uttarakhand SLDC	Chief Engineer	<a href="mailto:anupam_singh@ptcul.org">anupam_singh@ptcul.org</a>
18	Punjab SLDC	Chief Engineer	<a href="mailto:ce-sldc@punjabsldc.org">ce-sldc@punjabsldc.org</a>
19	Himachal Pradesh SLDC	Chief Engineer	<a href="mailto:cehpsldc@gmail.com">cehpsldc@gmail.com</a>
20	DTL	AGM-Protection	<a href="mailto:bharatgujardti@gmail.com">bharatgujardti@gmail.com</a>
21	HVPNL	Chief Engineer (TS)	<a href="mailto:cetspkl@hvpn.org.in">cetspkl@hvpn.org.in</a>
22	RRVPNL	CE (M&P)	<a href="mailto:ce.mps@rvpn.co.in">ce.mps@rvpn.co.in</a>
23	UPPTCL*	Managing Director	<a href="mailto:md@upptcl.org">md@upptcl.org</a>
24	PTCUL	SE(T&C)	<a href="mailto:setandchld@gmail.com">setandchld@gmail.com</a>
25	PSTCL	Chief Engineer (P&M)	<a href="mailto:ce-pm@pstcl.org">ce-pm@pstcl.org</a>
26	HPPTCL*	Managing Director	<a href="mailto:md.tcl@hpmail.in">md.tcl@hpmail.in</a>
27	IPGCL	GM-T	<a href="mailto:satyendrap@ipgcl-ppcl.nic.in">satyendrap@ipgcl-ppcl.nic.in</a>
28	HPGCL	SE(Tech)	<a href="mailto:setechhg@hpgcl.org.in">setechhg@hpgcl.org.in</a>
29	RRVUNL*	CMD	<a href="mailto:cmd@rrvun.com">cmd@rrvun.com</a>
30	UPRVUNL	Chief Engineer, (L-2)	<a href="mailto:ce.pppmm@uprvunl.org">ce.pppmm@uprvunl.org</a>
31	UJVNL*	Managing Director	<a href="mailto:mdujvnl@ujvnl.com">mdujvnl@ujvnl.com</a>
32	HPPCL*	Managing Director	<a href="mailto:md@hppcl.in">md@hppcl.in</a>
33	PSPCL*	CMD	<a href="mailto:cmd-pppcl@pspcl.in">cmd-pppcl@pspcl.in</a>
34	UHBVN	Managing Director	<a href="mailto:md@uhbvn.org.in">md@uhbvn.org.in</a>
35	Jodhpur Vidyut Vitran Nigam Ltd.	Managing Director	<a href="mailto:MD.JDVVNL@RAJASTHAN.GOV.IN">MD.JDVVNL@RAJASTHAN.GOV.IN</a>
36	Paschimanchal Vidyut Vitaran Nigam Ltd.	Managing Director	<a href="mailto:md@pvvnl.org">md@pvvnl.org</a>
37	UPCL*	Managing Director	<a href="mailto:md@upcl.org">md@upcl.org</a>
38	HPSEB*	Managing Director	<a href="mailto:md@hpseb.in">md@hpseb.in</a>
39	Prayagraj Power Generation Co. Ltd.*	Head (Commercial & Regulatory), DGM - Elect	<a href="mailto:sanjay.bhargava@tatapower.com">sanjay.bhargava@tatapower.com</a> , <a href="mailto:dhananijay.singh@ppgcl.co.in">dhananijay.singh@ppgcl.co.in</a>
40	Aravali Power Company Pvt. Ltd*	CEO	<a href="mailto:brahmaiq@ntpc.co.in">brahmaiq@ntpc.co.in</a>
41	Apraava Energy Private Limited*	GM-Electrical	<a href="mailto:navin.chaturvedi@apraava.com">navin.chaturvedi@apraava.com</a>
42	Talwandi Sabo Power Ltd. *	COO	<a href="mailto:Vibhav.Agarwal@vedanta.co.in">Vibhav.Agarwal@vedanta.co.in</a>
43	Nabha Power Limited*	CEO	<a href="mailto:sk.narang@larsentoubro.com">sk.narang@larsentoubro.com</a>
44	Lanco Anpara Power Ltd*	President	<a href="mailto:sudheer.kothapalli@meilanparapower.com">sudheer.kothapalli@meilanparapower.com</a>
45	Rosa Power Supply Company Ltd	GM-ELECTRICAL	<a href="mailto:kesarinandan.pandey@relianceada.com">kesarinandan.pandey@relianceada.com</a>
46	Lalitpur Power Generation Company Ltd	President	<a href="mailto:rmbdi.ltp@lpgcl.com">rmbdi.ltp@lpgcl.com</a>
47	MEJA Urja Nigam Ltd.	DGM-EMD	<a href="mailto:rajeevpandey@ntpc.co.in">rajeevpandey@ntpc.co.in</a>
48	Adani Power Rajasthan Limited*	COO, Thermal, O&M	<a href="mailto:jayadeb.nanda@adani.com">jayadeb.nanda@adani.com</a>
49	JSW Energy Ltd. (KWHEP)*	Head Regulatory & Power Sales	<a href="mailto:jyotiprakash.panda@jsw.in">jyotiprakash.panda@jsw.in</a>
50	TATA POWER RENEWABLE*	Zonal Head, NR	<a href="mailto:dhmahabale@tatapower.com">dhmahabale@tatapower.com</a>
51	UT of J&K*	Chief Engineer, JKPCL	<a href="mailto:ceikpcl2@gmail.com">ceikpcl2@gmail.com</a>
52	UT of Ladakh*	Chief Engineer, LPDD	<a href="mailto:cepladakh@gmail.com">cepladakh@gmail.com</a>
53	UT of Chandigarh	Executive Engineer	<a href="mailto:elop2-chd@nic.in">elop2-chd@nic.in</a>
54	Noida Power Company Limited	Head – Power Purchase	<a href="mailto:ssrivastava@noidapower.com">ssrivastava@noidapower.com</a>
55	Fatehgarh Bhadla Transmission Limited	AGM- Protection and Metering	<a href="mailto:ashish.baviskar@adani.com">ashish.baviskar@adani.com</a>
56	NTPC Vidyut Vyapar Nigam Ltd.	CEO	<a href="mailto:ceonvvn@ntpc.co.in">ceonvvn@ntpc.co.in</a>

\* Organizations from where nominations are not received for PSC, members of NRPC have been mentioned. Nomination for PSC forum may be sent at the earliest.

Status of performance indices report of April 2024		
S. No.	Utility	Status of Protection Performance Indices
1	PGCIL	Received (NR-2,3)
2	NTPC	Not Received
3	BBMB	Received (Transmission)
4	THDC	Received
5	SJVN	Not Received
6	NHPC	Received
7	NPCIL	Received from RAP (1-8), NAP (1-2)
8	DTL	Received
9	HVPNL	Received
10	RRVPNL	Received
11	UPPTCL	Received combinedly
12	PTCUL	Received
13	PSTCL	Received
14	HPPTCL	Received
15	IPGCL	Not Received
16	HPGCL	Not Received
17	RRVUNL	Received
18	UPRVUNL	Received from DTPS Anpara
19	UJVNL	Received (Khodri, chibro, vyasi, Dharasu)
20	HPPCL	Not Received
21	PSPCL	Not Received
22	HPSEBL	Not Received
23	Prayagraj Power Generation Co. Ltd.	Received
24	Aravali Power Company Pvt. Ltd	Received
25	Apraava Energy Private Limited	Received
26	Talwandi Sabo Power Ltd.	Not Received
27	Nabha Power Limited	Received
28	Lanco Anpara Power Ltd	Not Received
29	Rosa Power Supply Company Ltd	Received
30	Lalitpur Power Generation Company Ltd	Received
31	MEJA Urja Nigam Ltd.	Not Received
32	Adani Power Rajasthan Limited	Received (Kawai)
33	JSW Energy Ltd. (KWHEP)	Not Received
34	AESL	Received
35	Tata Power Renewable Energy Ltd.	Received
36	UT of J&K	Received (Udhampur, Ramban, Bishnah, Budgam, Alusteng, Harwan, Glandi, Chowdi)
37	UT of Ladakh	Not Received
38	UT of Chandigarh	Not Received
39	ATIL, BKTL, FBTL	Not Received
40	INDIGRID	Received
41	POWERLINK	Not Received
42	ADHPL	Received
43	Sekura Energy Limited	Not Received
44	WUPPTCL	Received
45	SEUPPTCL	Received
46	Vishnuprayag Hydro Electric Plant (J.P.)	Received
47	Alaknanda Hydro Electric Plant (GVK)	Not Received

**Status of performance indices report of May 2024**

S. No.	Utility	Status of Protection Performance Indices
1	PGCIL	Received (NR-2)
2	NTPC	Received (Unchahar, Tanda, Rihand)
3	BBMB	Received (Transmission)
4	THDC	Received (Tehri, Koteshwar HEP)
5	SJVN	Not Received
6	NHPC	Not Received
7	NPCIL	Received (RAP- 1-6), NAP (1-2)
8	DTL	Received
9	HVPNL	Received
10	RRVPNL	Not Received
11	UPPTCL	Received
12	PTCUL	Received
13	PSTCL	Received
14	HPPTCL	Not Received
15	IPGCL	Not Received
16	HPGCL	Not Received
17	RRVUNL	Received
18	UPRVUNL	Received (DTPS-Anpara)
19	UJVNL	Received (Dharshu, Uttrakashi)
20	HPPCL	Not Received
21	PSPCL	Not Received
22	HPSEBL	Not Received
23	Prayagraj Power Generation Co. Ltd.	Not Received
24	Aravali Power Company Pvt. Ltd	Received
25	Apraava Energy Private Limited	Received
26	Talwandi Sabo Power Ltd.	Not Received
27	Nabha Power Limited	Received
28	Lanco Anpara Power Ltd	Not Received
29	Rosa Power Supply Company Ltd	Received
30	Lalitpur Power Generation Company Ltd	Received
31	MEJA Urja Nigam Ltd.	Not Received
32	Adani Power Rajasthan Limited	Received (Kawai)
33	JSW Energy Ltd. (KWHEP)	Not Received
34	AESL	Not Received
35	Tata Power Renewable Energy Ltd.	Received
36	UT of J&K	Not Received
37	UT of Ladakh	Not Received
38	UT of Chandigarh	Not Received
39	ATIL, BKTL, FBTL	Received (ATIL)
40	INDIGRID	Received
41	POWERLINK	Not Received
42	ADHPL	Received
43	Sekura Energy Limited	Not Received
44	WUPPTCL	Received
45	SEUPPTCL	Not Received
46	Vishnuprayag Hydro Electric Plant (J.P.)	Not Received
47	Alaknanda Hydro Electric Plant (GVK)	Not Received

**Performance Indices less than Unity- April 2024****RVPN**

**Case-1 220/132KV 160MVA BHEL Transformer at 220KV GSS HINDAUN on 10.04.2024**

No. of Unwanted operation – 1

**Reason of unwanted operation** – REF protection operated. After testing it is found that Easun Reyrolle make MIT161 REF relay(static) is defective and mal operating.

**Corrective Action taken** – The relay has been replaced with numerical relay.

**Case-2 220KV Bhilwara - HAMIRGARH Line at 220KV BHILWARA on 18.04.2024**

No. of Unwanted operation – 1

**Reason of unwanted operation** – Tripping relay 86 operated due to contact shorting done by reptile.

**Corrective Action taken** – The dead reptile has been removed from the 86 relay and entry point has been sealed to prevent reptile entry in the relay.

**Case-3 220KV Dausa- PGCIL Bassi line-II at 220KV GSS DAUSA on 25.04.2024**

No. of Unwanted operation – 1

**Reason of unwanted operation** – QMho Distance protection Relay operated on Power Swing indication. QMho being static relay, no DR is available. After testing NO result found abnormal.

**Corrective Action taken** – The relay is under observation, if such incident is repeated, the DPS relay shall be replaced.

## **UPPTCL**

### **Case-1 160MVA ICT-1 at 220kV Bagpat Substation**

No. of unwanted operation- 1

**Reason of unwanted operation-** OSR cable found damaged.

**Corrective Action taken-** faulty cable replaced.

### **Case-2 400kV Substation Sarnath, SPS issued command to gajokhar -1 & 2 on 26.04.2024**

No. of unwanted operation- one on each line

**Reason of unwanted operation-** Defective Three phase transducer of 315MVA ICT-1 caused wrong operation of SPS

**Corrective Action taken-** Not received from the utility

### **Case-3 DT received at Sarnath end on 400kV Anpara-3 to Sarnath line on 27.04.2024**

No. of unwanted operation- 1

**Reason of unwanted operation-** explanation not received from utility.

**Corrective Action taken –** Not received from the utility

## **INDIGRID**

### **Case-1 Tripping of 400kV Kadarapur(GPTL) - Sohna Road(GPTL) Ckt-2**

No. of unwanted operation- 2

**Reason of unwanted operation-** Overvoltage protection operated due to maloperation of L90 Relay

**Corrective Action taken-** Matter is taken up with OEM for the early resolution.

## **NHPC**

### **Case-1 Tripping of 132kV Sewa-2 to Kathua ckt-2**

No. of unwanted operation-1

**Reason of unwanted operation-** due to improper PSL, line tripped on LBB operation on bus-II

**Corrective Action taken-** Revised PSL has been implemented.

### **JKPTCL**

**Case-1 at 220/132/33 kV substation udhampur**

**No. of unwanted operation -1**

**Reason of unwanted operation-** not received from utility.

**Corrective Action taken – Not received from the utility**

### **PSTCL**

**Case-1** tripping of 220 kV Wdala Granthia-Sarna ckt.I on 9.4.2024

No of failure operation -1

**Reason of failure operation-** due to Y phase CVT damaged at Wdala Granthia line did not trip and tripped on zone -2 from Sarna end.

**Corrective action taken- Not received from the utility**

**Case-2** tripping of 220 kV G-2-Bhari ckt & 220 kV 220 kV G-2-Ganguwal ckt on 11.4.2024

No of failure operation -1 on each circuit

**Reason of failure operation-** B-ph CT Damaged at 220 kV S/S G-2 both lines did not trip at G-2 end and tripped in zone -1 at other ends for both the lines. (bus bar protection did not operate at G-2).

**Corrective action taken- Not received from the utility**

**Case-3** tripping of 220kV Bottianwala-GVK ckt.II on 11.4.2024 & 12.4.2024

No of unwanted operation-2

**Reason of unwanted operation-** Main II (D60) Mal-operated at Bottianwala end (Relay found to be defective as VT module is faulty)

**Corrective action taken- Not received from the utility**

**Case -4** tripping of 220 kV Mohali-Banur ckt on 24.4.2024 at Mohali end only.

No of unwanted operation-1

**Reason of unwanted operation-** Unwanted & incorrect E/F operation with Damaging of LA of transformer

**Corrective action taken- Not received from the utility**

**Case-5** tripping of 220 KV Sandhwan-Muktsar Line on 19.4.2024

No of unwanted operation-1

**Reason of unwanted operation-** Configuration issue regarding Z4 timer, line tripped on zone-4 at Sandhwan end, did not trip at Muktsar end.

**Corrective action taken- Not received from the utility**

**Case-6** tripping of NABHA-220/66 kV, 160 MVA Power T/F T-4 on 23.4.2024

No of unwanted operation-1

**Reason of unwanted operation-** Buchholz Relay (Stage-I) operated due to Due to ingress of Rain Water in M.B of T/F Marshalling box

**Corrective action taken- Not received from the utility**

**Case-7** tripping of 220/66 kV, 100 MVA P.T/F T-6 at 220 kV S/S G-1 on 26.4.2024

No of unwanted operation-1

**Reason of unwanted operation-** REF tripping as R-ph CT & CB damaged of 66 kV Focal Point ckt.II

**Corrective action taken- Not received from the utility**

**Case-8** tripping of 220/66 KV T/F T-2 100 MVA at 220kV s/S Majra on 26.4.2024

No of unwanted operation-1

**Reason of unwanted operation-** differential operation due to harmonic block setting issue

**Corrective action taken** Harmonics Block settings revised & issue resolved

**Case-9** tripping of 220 kV Sarna-Wadala Granthia ckt.IV on 9.4.2024

No of unwanted operation-1

**Reason of unwanted operation-** line tripped on zone-2 at Sarna end and zone-4 at other end.

**Corrective action taken- Not received from the utility**

**Case-10** tripping of 400 kV Muktsar-Makhu ckt.I on 19.4.2024

No of unwanted operation-1

**Reason of unwanted operation-** line tripped on DT received due to PLCC Cabinet (ABB mal functioning)

**Corrective action taken- Not received from the utility**

**Case- 11** tripping of 220 kV Verpal-Udhoke ckt on 9.4.2024

No of unwanted operation-1

**Reason of unwanted operation- Not received from the utility**

**Corrective action taken- Not received from the utility**

**Case-12** tripping of 220 kV Chogawan-Cvil Lines ckt.

No of unwanted operation-1

**Reason of unwanted operation- Not received from the utility**

**Corrective action taken- Not received from the utility**

**Case -13** Incorrect operations due to unhealthiness of carrier.

**Lines subjected-** 220 kV Sunam-Bangan ckt., 220 kV Kotla Janga-Kartarpur ckt.I, 220 KV Kotlajanga- Kartarpur Ckt.II, 220KV Katorewala-Mukatsar (220) Line, 220KV Botianwala-Ferozepur Line., 220 kV Jamsher-Rehana Jattan ckt., 220 kV Sultanpur-Patti ckt., 220 kV Patti-Cholla Sahib ckt.

Due to unhealthiness of carrier, the concerned end getting tripped in zone-2 leading to delayed clearance.

**Corrective action taken- Not received from the utility**

## Performance Indices less than Unity- May 2024

### **ATIL**

**Case-1 500kV Mundra - Mohindergarh HVDC Pole-1,2 tripped due to No RPC Filter alarm at Mahendragarh end on 17.5.2024**

No. of unwanted operation -1

No. of correct operation -1

**Reason for indices less than unity** - Alarm seems to be false as there is no such failure of reactive power compensation.

**Corrective action taken-** Detailed RCA under progress with OEM.

### **HVPNL**

**Case-1 220kV Panchkula(PG)-Pinjore ckt. -II**

No of failures to operate-1

No. of correct operation-1

**Reason for indices less than unity-** Not received from utility

**Corrective action taken-** Not received from utility

### **PTCUL**

**Case-1 Tripping of 220kv Jafarpur-TSS**

No. of unwanted operation -1

No. of correct operation -0

**Reason for indices less than unity** - Due to Malfunctioning of distance protection Main  
1 relay

**Corrective action taken-** Main 1 relay taken out of service and line is being protected by main -2 relay.

## **INDIGRID**

### **Case-1** Tripping of PARBATI2-BANALA (POOLING POINT)-I line

No. of unwanted operation -1

No. of correct operation -0

**Reason for indices less than unity-** Tripped at Parbati\_2 end Due to B-Phase to Earth Fault and idle charged from Parbati Pooling Banala end.

**Corrective action taken-** Not received from utility

### **Case-2** Tripping of 400kV Parbati-II HEP Sainj HEP

No. of unwanted operation -1

No. of correct operation -0

**Reason for indices less than unity-** Tripped at Sainj end Due to B-Phase to Earth Fault and idle charged from Parbati-2.

**Corrective action taken-** Not received from utility

## **UPPTCL**

### **Case-1** Tripping of 160MVA T/F-3 at 220kV S/s Baraut

No. of unwanted operation -1

No. of correct operation -0

**Reason for indices less than unity-** erratic tripping

**Corrective action taken-** Nothing found on inspection

**Case-2** tripping of 400kV Aligarh-Muradnagar line

No. of unwanted operation -1

No. of correct operation -4

**Reason for indices less than unity-** Auxiliary relay maloperated (85L/O)

**Corrective action taken-** attended and rectified

**Case-3** tripping of 220kV shamli to GIS shamli line

No. of unwanted operation -1

No. of correct operation -0

**Reason for indices less than unity-** resistive reach setting issue

**Corrective action Taken-** Not received from utility

**Case-4** tripping of 500MVA ICT-4 at 400kV Greater Noida

No. of unwanted operation -1

No. of correct operation -0

**Reason for indices less than unity-** Tripping due to PRD and OSR due to heavy jerk near ICT

**Corrective action Taken-** ICT was tested and taken into service

**Case-5** tripping of 220kV Khurja – Dadri line

No. of unwanted operation -1

No. of correct operation -0

**Reason for indices less than unity-** Maloperation of Main-2 relay

**Corrective action taken-** O&M wing is under process of replacement of relay.

**Case-6** Tripping of 220kV parichha Mahoba line (Jhansi zone)

No. of unwanted operation -1

**Reason for indices less than unity-** tripping of 220kV parichha Mahoba line in zone-3 due to fault in 132kV Mahoba TSS line

**Corrective action Taken-** Not received from utility

**Case-7** Tripping of Jhansi Sangrur line (Prayagraj zone)

No. of unwanted operation -

**Reason for indices less than unity -**Not received from utility

**Corrective action Taken-** Not received from utility

## **POWERGRID (NR-2)**

**Case-1** Tripping of 400kV KAITHAL-MALERKOTLA

NO of failure operation-1

**Reason for indices less than unity-** Line Auto-reclose on B-N fault from Malerkotla (PG) but tripped from Kaithal (PG)

**Corrective action Taken-** Not received from utility

**Case-2** tripping of JALANDHAR 25 MVAR BUS REACTOR-1

No. of unwanted operation- 1

**Reason for indices less than unity-** BR tripped due to REF relay maloperation

**Corrective action Taken-** Not received from utility

## **PSTCL**

**Case-1** Tripping of 500 MVA ICT-3 at 400 kV S/S Rajpura on 13.5.2024

No. of unwanted operation- 1

**Reason for unwanted operation-** Mal-operation due to filter change of dryout system

**Corrective action Taken-** Not received from utility

**Case-2** Tripping of 220/66 kV, 100 MVA P.T/F T-1 at 220 kV S/S Mansa on 10.5.2024

No. of unwanted operation- 1

**Reason for unwanted operation-** Moisture ingress due to rain led to tripping of ICT on Buchholz Relay

**Corrective action taken** – Now Buchholz relay covered.

**Case-3** Tripping of 220 kV BaghaPurana-Moga ckt.I & II on 21.5.2024

**No. of failure to operate** -1 on each line

**Reason for failure to operate-** tripping from one end while no tripping at other end on phase to earth fault

**Corrective action taken-** Not received from utility

**Case-4** tripping pf 220/66 kV, 100 MVA P.T/F T-2 at 220kV S/S Mohali on 5.5.2024

No. of unwanted operation- 1

**Reason for unwanted operation-** Damage of control cable (Shorted) by squirrel in terminal box NCT

**Corrective action Taken** - Not received from utility

**Case-5** tripping of 220 KV Sultanpur- Jamsher ckt on 8.5.2024

No. of unwanted operation- 1

**Reason for unwanted operation-** CB Low gas pressure trip due to control cable damage

**Corrective action Taken-** Not received from utility

**Case-6** tripping of 220/132 kV, 100 MVA P.T/F T-1 at 220 KV S/S Sultanpur on 11.5.2024

No. of unwanted operation- 1

**Reason for unwanted operation-** B phase Over current operation

**Corrective action Taken -** Not received from utility

Case- 7 tripping of 220kV Badshahpur-Sultanpur ckt on 7.5.2024

No. of unwanted operation- 1

**Reason for unwanted operation-** tripped at Badshahpur end in zone-3 and did not trip at other end

**Corrective action Taken -** Not received from utility

**Case- 8** tripping of 220KV Botianwala-Mastewala ckt-1 on 10.5.2024

No. of unwanted operation- 1

**Reason for unwanted operation-** tripped at Botianwala end with O/C E/F and did not trip at other end

**Corrective action Taken -** Not received from utility

**Case -9** tripping of 220 kV Bangan Chajali Ckt 1& II on 11.5.2024

No. of unwanted operation- 1 on each line

**Reason for unwanted operation-** Bus Bar mal operation

**Corrective action Taken -** Not received from utility

**Case-10** tripping of 220/66KV 100MVA T/F T-3 at 220KV Ikolaha on 18.5.2024 & 19.5.2024

No. of unwanted operation- 2

**Reason for unwanted operation-** Faulty Buchholz relay operated

**Corrective action Taken - Not received from utility**

**Case- 11** tripping of 220 kV Fatehgarh Churian - Kotli Surat Malhi Circuit on 15.5.2024

No. of unwanted operation- 1

**Reason for unwanted operation-** O/C Master operated at Fatehgarh Churian and did not trip at other end.

**Corrective action Taken - Not received from utility**

**Case – 12** tripping of 220 kV Gurdaspur - Sarna Circuit on 4.5.2024

No. of unwanted operation- 1

**Reason for unwanted operation-** tripped in zone -2 at Gurdaspur end & zone -4 at Sarna end.

**Corrective action Taken - Not received from utility**

**Case -13** tripping of 220 kV Sarna-Wadala Granthian ckt.I on 4.5.2024

No. of unwanted operation- 1

**Reason for unwanted operation-** tripped in zone -2 at Wadala Granthian end & zone -4 at Sarna end.

**Corrective action Taken – Not received from utility**

**Case- 14** tripping of 220 kV Dasuya-Sarna ckt.I & II on 4.5.2024

No. of unwanted operation- 1 on each line

**Reason for unwanted operation-** tripped in zone -2 at Dasuya end & zone -4 at Sarna end.

**Corrective action Taken - Not received from utility**

**Case – 15** tripping of 160MVA P/T/F T- 2 at 220 kV S/S Malerkotla on 21.5.2024

No. of unwanted operation- 1

**Reason for unwanted operation-** tripped due to defective OTI Gauge

**Corrective action Taken -** Not received from utility

**Case- 16** tripping of 220 kV BaghaPurana-Bajhakhana ckt.II

No. of unwanted operation- 1

**Reason for unwanted operation-** tripped as CT Polarity of Bajhakhana ckt-2 at Baghapurana was wrong

**Corrective action Taken -** Not received from utility

**Case- 17** 220 kV Rashiana-Makhu ckt.I on 29.5.2024

No. of unwanted operation- 1

**Reason for unwanted operation-** tripped on zone-1 at Makhu and tripped on earth fault at other end.

**Corrective action Taken -** Not received from utility

**Case- 18** Incorrect operations due to unhealthiness of carrier.

**Lines subjected-** 220KV RehanaJattan-Hoshiarpur ckt., 220 kV Gaunsgarh-Dhanansu ckt.I, 220KV Patti-Algon Kothi ckt.I , 220KV Patti-Algon Kothi ckt.II, 220KV Patti-Rashiana ckt., 220 kV Dharamkot-KotKaror ckt.II, 220 KV Rajpura-Banur ckt , 220 kV Bajhakhana-Baghapuran ckt.I, 220 kV Bajhakhana-Baghapuran ckt.I, 220 kV Bajhakhana-Lehra ckt.I, 220 kV Khassa-Civil Lines ckt., 220 kV Khassa-Chogawan ckt.

Due to unhealthiness of carrier, the concerned end getting tripped in zone-2 leading to delayed clearance.

**Corrective action taken-** Not received from utility

## Status of Protection Audit Plan for FY 2024 -25

S. No.	NRPC Member	Category	Status
1	PGCIL	Central Government owned Transmission Company	Received (NR-1,3)
2	NTPC	Central Generating Company	Received
3	BBMB		Received
4	THDC		Received
5	SJVN		
6	NHPC		Received
7	NPCIL		
8	DTL		
9	HVPNL		Received
10	RRVNL	State Transmission Utility	
11	UPPTCL		Received for Jhansi, Lucknow, Meerut zone
12	PTCUL		Received
13	PSTCL		Received
14	HPPTCL		Received
15	IPGCL	State Generating Company	
16	HPGCL		
17	RRVUNL		Received
18	UPRVUNL		Received (Obra-B)
19	UJVNL		
20	HPPCL		
21	PSPCL	State Generating Company & State owned Distribution Company	
22	HPSEBL	Distribution company having Transmission connectivity ownership	
23	Prayagraj Power Generation Co. Ltd.	IPP having more than 1000 MW installed capacity	Received
24	Aravali Power Company Pvt. Ltd		Received
25	Apraava Energy Private Limited		Received
26	Talwandi Sabo Power Ltd.		
27	Nabha Power Limited		
28	Lanco Anpara Power Ltd		
29	Rosa Power Supply Company Ltd		
30	Lalitpur Power Generation Company Ltd		Received
31	MEJA Urja Nigam Ltd.		
32	Adani Power Rajasthan Limited		Received (Kawai)
33	JSW Energy Ltd. (KWHEP)		
34	AESL	Other Transmission licensee	
35	Tata Power Renewable Energy Ltd.	IPP having less than 1000 MW installed capacity (alphabetical rotaional basis)	Received (TPGEL, BTPSL)
36	UT of J&K	UT of Northern Region	
37	UT of Ladakh		
38	UT of Chandigarh		
39	ATIL	Other transmission licensee in NR	
40	INDIGRID		Received
41	POWERLINK		
42	ADHPL		Received
43	Sekura Energy Limited		
44	WUPPTCI	Other transmission licensee in UP	
45	SEUPPTCL	Other transmission licensee in UP	
46	Vishnuprayag Hydro Electric Plant (J.P.)	Other Generating Units in UP	
47	Alaknanda Hydro Electric Plant (GVK)	Other Generating Units in UP	

## Status of 3rd Party Protection Audit Plan

S. No.	NRPC Member	Category	Status	Schedule submitted as per utility	Present Status Completed (yes/no)
1	PGCIL	Central Government owned Transmission Company			
2	NTPC	Central Generating Company	Received (Tanda)	By 17.07.2025	
3	BBMB				
4	THDC				
5	SJVN				
6	NHPC				
7	NPCIL				
8	DTL		State Transmission Utility		
9	HVPNL				
10	RRVNL				
11	UPPTCL				
12	PTCUL				
13	PSTCL				
14	HPPTCL				
15	IPGCL	State Generating Company			
16	HPGCL				
17	RRVUNL				
18	UPRVUNL		Received (DTPS-Anpara)	01.05.2024	
19	UJVNL				
20	HPPCL				
21	PSPCL	State Generating Company & State owned Distribution Company			
22	HPSEBL	Distribution company having Transmission connectivity ownership			
23	Prayagraj Power Generation Co. Ltd.	IPP having more than 1000 MW installed capacity			
24	Aravali Power Company Pvt. Ltd				
25	Apraava Energy Private Limited		Received	By May, 2025	
26	Talwandi Sabo Power Ltd.				
27	Nabha Power Limited				
28	Lanco Anpara Power Ltd				
29	Rosa Power Supply Company Ltd		Received	By 30.09.2024	
30	Lalitpur Power Generation Company Ltd				
31	MEJA Urja Nigam Ltd.				
32	Adani Power Rajasthan Limited		Received (Kawai)	September, 2024	
33	JSW Energy Ltd. (KWHEP)				
34	AESL	Other Transmission licensee			
35	Tata Power Renewable Energy Ltd.	IPP having less than 1000 MW installed capacity (alphabetical rotational basis)			
36	UT of J&K	UT of Northern Region			
37	UT of Ladakh				
38	UT of Chandigarh				
39	ATIL	Other transmission licensee in NR			
40	INDIGRID				
41	POWERLINK				
42	ADHPL		Received	30.09.2024	
43	Sekura Energy Limited				
44	WUPPTCI	Other transmission licensee in UP	Received	2023-24	
45	SEUPPTCL	Other transmission licensee in UP			
46	Vishnuprayag Hydro Electric Plant (J.P.)	Other Generating Units in UP			
47	Alaknanda Hydro Electric Plant (GVK)	Other Generating Units in UP			

## Protection Check-List

Rev-NR2- Dated 07 June'18

Name: 220kV/66KV Substation Khalsti Month and Year of Commissioning: Substation: JANUARY 2019 Date of Audit : 01.05.2024-02.05.2024		Status (OK/ Not Ok)	Remarks
Element	Description		
Main-I/Main-II	Check the settings Parameters with respect to the template updated with latest in-feed values	OK	
	Check the Signal Matrix/PSL/Application Configuration/Masking with respect to the Input and Output assignment as per scheme	OK	
	Check the Logic for DT send	OK	
	Check the Logic for 86A and 86B trip	OK	
	Check the Logic for single phase tripping	OK	
	Check the Logic for LBB Initiations	OK	
	Check the Logic for A/R starts	OK	
	Check the Logic of STUB protection & Line Isolator open status ( to be enable for one & Half CB scheme having no Line side CT and to be disable for DMT scheme & having Line side CT)	NA	
	Check that the wiring of Line Isolator open is connected at correct input for Stub Protection	NA	
	Check the Logic for SOTF protection	OK	
	Check that OV protection is analog (Voltage) as well as time graded for Double Ckt/Parallel lines	NA	
	Check that the VT fail shall block the tripping	OK	
	Check the current, and voltage and angle in the relay	OK	
	Check for mutual compensation wiring (if applicable) and Check setting and configuration according to wiring.	NA	
	Whether all relays are accessible from remote dedicated PC for setting & DR extraction in control room	OK	
	Whether Main-I & Main-II protections of all line are time synchronised with GPS based time synchronised equipment.	OK	
PLCC	Check the healthiness of PLCC protection panels	OK	
	Check alarm during OUT position of Carrier IN/OUT Switch in Control room as well as in RTAMC/NTAMC	OK	
Auto Reclosure	Check the logic and configuration of the AR Start and Block	OK	
	Check the dead time and reclaim time settings	OK	
	Check the Logic and Configuration of the AR Lockout	OK	

02/05/24

02/05/24

02/05/24

		Check the logic & wiring for Priority Ckt in one & Half CB scheme.	NA	
		Whether priority scheme is working properly. ( check previous A/R DR)	NA	
LBB relay/PU relay		Check the relay settings (particularly, pick-up, retrip time and back-trip time)	OK	
		Check that single phase initiation is wired and configured correctly for lines	OK	
		Check the logic that retrip trips the same breaker	OK	
		Check the Signal Matrix/PSL/Application Configuration with respect to the Input and Output assignment as per scheme	OK	
		Check the logic that back-trip trips the associated bus-bar(for Main-CB LBB) OR both the Main-CB (for Tie CB LBB )	NA	
		In case of half dia, check that the Tie Bay LBB instantaneously trips the Bus connected to future bay( also check the wiring)	NA	
		For bays commissioned in the extension projects have Tie-LBB wiring changed from "Tripping the bus" to "Tripping the Main CB"	NA	
		Dead Zone/ End zone Protection is disabled; Topology is independent of switch status in One and Half CB scheme	OK	
		Check/measure phase wise current in LBB/PU relay	OK	
Reactor/Transformer Differential		Check the differential current and bias current in the relay	OK	
		Check the relay settings as per the template	OK	
		Check the relay configuration for proper input and output contact assignment.	OK	
		Check the tripping logic wrt the scheme.	OK	
		In case of single phase transformer with spare, check the correct implementation of spare selection in trip logic	NA	
REF protection		Check the current in the relay	OK	
		Check the relay settings as per the template	OK	
		Check the relay configuration for proper input and output contact assignment.	OK	
		Check the tripping logic wrt the scheme.	OK	
		In case of single phase transformer with spare, check the correct implementation of spare selection in trip logic	NA	
		Check for the CT selection scheme and logic	NA	

02/05/24

02/05/24

02/05/24

Back-up Impedance	Check the current and voltage in the relay		OK
	Check the VT selection logic in BCU/relay panel		OK
	Check that at a time only one bus VT is selected		OK
	Check the relay settings as per the template		OK
	Check the relay configuration for proper input and output contact assignment.		OK
	Check the tripping logic wrt the scheme.		OK
	Check that VT fail blocks the tripping		OK
	Check for implementation of NGR protection scheme		NA
CSD	Check whether CSD installed with ICT/Reactor is working properly as per its requirement. ( Check recent graph/DR)		NA
	Check provision of bypassing of CSD is provided		NA
	Check DR triggering of other relay on Manual operation of CB in case CSD is not having the provision of extraction of DR/graph.		NA
General	Check that the two tripping of PRD, Bucholz etc are wired to two separate relays		NOT OK
	Check that the relays powered by DC-1 are supervised by relays powered by DC-2 and Vice-versa		OK
	Check the Opto Input pickup voltage for all the binary inputs		OK
	Check Relay Failure and Relay disconnected alarms for all the relays.		OK
	Check for time-sync status of the relay		OK
	Check the DR channel standardisation		OK
	Check pre-commissioning test reports (whether print-outs of DR and EL enclosed)		OK
	Check the logic of Bus earth switch interlock		OK
	Check the auto download of DR		OK
	Check for implementation of relevant CC-AM circulars		OK
	Check the single point earthing of CT secondary core on sample basis.		OK
	Check the earthing interconnecting link/strip connected in inter panel/adjacent panel		OK
	Check WTI & OTI trip modification as per latest circular. (20ms time delay)		OK
Check implementation of Bucholz Alarm/ Trip with 200ms time delay as per latest circular.		NOT OK	

*021*  
02/05/24

*021*  
02/05/24

*021*  
02/05/24

	Check PRV NO NC contact combination used for tripping (And 20ms time delay)		NOT OK	
	Check modification of tripping on OLTC OSR as per latest circular (Applicable for ICTs)		OK	
	Check NGR-Bypass CB/ isolator closing on broken conductor trip or earth fault in case of single phasing		NA	
	Check no element tripping on NGR Body Protection operation (Not applicable for 765Kv)		NA	
<b>Bus Bar Protection</b>	Whether duplicate bus bar protection provided in 400 & 765 kV Bus bar		NA	
	Check the topology of both the CUs		NA	
	Check the Diff current and restrain current		OK	
	Check /Measure the Spill current in bus-bar relay		OK	
	Check that CB status is permanently shorted in one and half CB scheme		NA	
	Check the operation of the selector switch and correct alarms in SCADA		OK	
	Check the settings and Configuration of the CU		OK	
	Simulate PU disconnected and check for Bus Bar Block		NA	
	Check the setting of CT supervision/CT fail/CT circuitry fault alarm		OK	
	Check logic for LBB initiation on bus bar trip		OK	
	Check the logic for BUS Bar Tripping on SF6 Gas compartment zone trip in case of GIS Station.		NA	
	Check that the Bus-Bar bay selection is independent of the topology status in One and Half CB schemes		NA	
<b>SAS</b>	As per Annexure-I (SAS Checklist)			
	Image CD of SAS PC should be available		OK	
	Back-up of all the ICD and SCD files available in hard disk/CD		OK	
<b>Alarms</b>	Simulate the alarms as per Annex-II for at least 20% bays, Minimum 6 bays.		OK	
<b>DC System</b>	Check DC voltage at the farthest point in the switchyard (+ to Earth, - to earth)		OK	S1: +123.44V & -120.1 V S2: +123.42 V & -122.22 V
<b>AC system</b>	Check auto operation of DG set		OK	
<b>FFPH</b>	Check auto operation of HVW and Diesel driven pump		NA	

*Dy*  
02/05/24

*AVH*  
02/05/24

*AVG*  
02/05/24

Smoke detection system	Simulate smoke detection in any kiosk and check for alarm		OK	
------------------------	---	--	----	--

## OBSERVATIONS:

**220KV Kargil Line:(21M1 P444):**

1. Setting Parameter to be implemented as per latest Template.
2. Vmem Validity to be kept 900ms in place of 3 Sec.
3. Aided Distance Delay to be 0 Sec in place of 20 ms.
4. In Earth Fault setting Block Pole Dead to be kept disabled as per template.
5. O/V Setting to be Kept Phase to Neutral In place of Phase to Phase as per Setting Template.
6. O/V stage-2 V>2 to be kept 150% in place of 140%
7. In Configuration system checks to be disabled as per template.
8. SF6 gas trip to be removed from 86A & 86B in PSL as the wiring is already removed from TB.

**220KV Kargil Line:(21M2 REL670):**

1. Setting Parameter to be implemented as per latest Template.
2. SF6 gas trip to be removed from 86A,86B & DT Send in PSL as the wiring is already removed from TB.

**220KV Leh Line:(21M1 P444):**

1. Setting Parameter to be implemented as per latest Template.
2. In Earth Fault setting Block Pole Dead to be kept disabled as per template.
3. In Configuration system checks to be disabled as per template.
4. SF6 gas trip to be removed from 86A & 86B in PSL as the wiring is already removed from TB.

**220KV Leh Line:(21M2 REL670):**

1. Setting Parameter to be implemented as per latest Template.
2. SF6 gas trip to be removed from 86A,86B & DT Send in PSL as the wiring is already removed from TB.

**ICT-1 Differential Relay & HV O/C E/F:**

1. Bucholz -1 & 2 Trip & Alarm are to be wired in two different Relays.
2. Overcurrent Setting I>1 & Earth Fault Setting IN>1 :
  - a. VTS Block I>1 & 2H I>3 to be set 1 as per template

**ICT-1 REF Relay & LV O/C E/F:**

1. Overcurrent Setting I>1 & Earth Fault Setting IN>1 VTS Block I>1 & 2H I>3 to be set 1 as per template.
2. PRV-1&2 NO NC combination to be implemented in ICT-1.

**66KV INTERCONNECTION LINE:**

1. Overcurrent setting Characteristics angle to be 60 degree in place of 45 degree.

02/05/24  
 विवेक राज / VIVEK RAJ  
 अभियंता / ENGINEER  
 पावर ग्रिड किशनपुर / POWER GRID KISHENPUR

कर्मवीर/Karamveer  
 अभियंता/Engineer  
 पावरग्रिड फयांग एव खलसी (लेह)  
 POWERGRID Phyang & Khaltsi (Leh)

जाविद अली/ JAVID ALI  
 अभियंता /ENGINEER  
 पाँवरग्रिड /POWERGRID  
 फयांग (लेह) /PHYANG(LEH)

POWERGRID NR-2 Phyang

Protection Check-List

Rev-NR2- Dated 07 June'18

Name: 220kV/66KV Substation Phyang Month and Year of Commissioning: Substation: JANUARY 2019 Date of Audit : 30.04.2024			Status (OK/ Not Ok)	Remarks
Element		Description		
Main-I/Main-II		Check the settings Parameters with respect to the template updated with latest in-feed values	OK	
		Check the Signal Matrix/PSL/Application Configuration/Masking with respect to the Input and Output assignment as per scheme	OK	
		Check the Logic for DT send	OK	
		Check the Logic for 86A and 86B trip	OK	
		Check the Logic for single phase tripping	OK	
		Check the Logic for LBB Initiations	OK	
		Check the Logic for A/R starts	OK	
		Check the Logic of STUB protection & Line Isolator open status ( to be enable for one & Half CB scheme having no Line side CT and to be disable for DMT scheme & having Line side CT)	NA	
		Check that the wiring of Line Isolator open is connected at correct input for Stub Protection	NA	
		Check the Logic for SOTF protection	OK	
		Check that OV protection is analog (Voltage) as well as time graded for Double Ckt/Parallel lines	NA	
		Check that the VT fail shall block the tripping	OK	
		Check the current, and voltage and angle in the relay	OK	
		Check for mutual compensation wiring (if applicable) and Check setting and configuration according to wiring.	NA	
		Whether all relays are accessible from remote dedicated PC for setting & DR extraction in control room	OK	
		Whether Main-I & Main-II protections of all line are time synchronised with GPS based time synchronised equipment.	OK	
PLCC		Check the healthiness of PLCC protection panels	OK	
		Check alarm during OUT position of Carrier IN/OUT Switch in Control room as well as in RTAMC/NTAMC	OK	
Auto Reclosure		Check the logic and configuration of the AR Start and Block	OK	
		Check the dead time and reclaim time settings	OK	
		Check the Logic and Configuration of the AR Lockout	OK	

*AK*  
20/04/2024

*AK*  
30.04.2024

*AK*  
30/4/24

Protection Check-List

Rev-NR2- Dated 07 June'18

	Check the logic & wiring for Priority Ckt in one & Half CB scheme.	NA	
	Whether priority scheme is working properly. ( check previous A/R DR)	NA	
<b>LBB relay/PU relay</b>	Check the relay settings (particularly, pick-up, retrip time and back-trip time)	OK	
	Check that single phase initiation is wired and configured correctly for lines	OK	
	Check the logic that retrip trips the same breaker	OK	
	Check the Signal Matrix/PSL/Application Configuration with respect to the Input and Output assignment as per scheme	OK	
	Check the logic that back-trip trips the associated bus-bar(for Main-CB LBB) OR both the Main-CB (for Tie CB LBB )	NA	
	In case of half dia, check that the Tie Bay LBB instantaneously trips the Bus connected to future bay( also check the wiring)	NA	
	For bays commissioned in the extension projects have Tie-LBB wiring changed from "Tripping the bus" to "Tripping the Main CB"	NA	
	Dead Zone/ End zone Protection is disabled; Topology is independent of switch status in One and Half CB scheme	OK	
	Check/measure phase wise current in LBB/PU relay	OK	
<b>Reactor/Transformer Differential</b>	Check the differential current and bias current in the relay	OK	
	Check the relay settings as per the template	OK	
	Check the relay configuration for proper input and output contact assignment.	OK	
	Check the tripping logic wrt the scheme.	OK	
	In case of single phase transformer with spare, check the correct implementation of spare selection in trip logic	NA	
<b>REF protection</b>	Check the current in the relay	OK	
	Check the relay settings as per the template	OK	REF Setting to be reviewed of ICT-1 & ICT-2
	Check the relay configuration for proper input and output contact assignment.	OK	
	Check the tripping logic wrt the scheme.	OK	

*dk4*  
30/04/24

*04*  
30.04.2024

*Atulya*  
30/04/24

	In case of single phase transformer with spare, check the correct implementation of spare selection in trip logic		NA	
	Check for the CT selection scheme and logic		NA	
<b>Back-up impedance</b>	Check the current and voltage in the relay		OK	
	Check the VT selection logic in BCU/relay panel		OK	
	Check that at a time only one bus VT is selected		OK	
	Check the relay settings as per the template		OK	
	Check the relay configuration for proper input and output contact assignment.		OK	
	Check the tripping logic wrt the scheme.		OK	
	Check that VT fail blocks the tripping		OK	
	Check for implementation of NGR protection scheme		NA	
<b>CSD</b>	Check whether CSD installed with ICT/Reactor is working properly as per its requirement. ( Check recent graph/DR)		NA	
	Check provision of bypassing of CSD is provided		NA	
	Check DR triggering of other relay on Manual operation of CB in case CSD is not having the provision of extraction of DR/graph.		NA	
<b>General</b>	Check that the two tripping of PRD, Bucholz etc are wired to two separate relays		NOT OK	
	Check that the relays powered by DC-1 are supervised by relays powered by DC-2 and Vice-versa		OK	
	Check the Opto Input pickup voltage for all the binary inputs		OK	
	Check Relay Failure and Relay disconnected alarms for all the relays.		OK	
	Check for time-sync status of the relay		OK	
	Check the DR channel standardisation		OK	
	Check pre-commissioning test reports (whether print-outs of DR and EL enclosed)		OK	
	Check the logic of Bus earth switch interlock		OK	
	Check the auto download of DR		OK	
	Check for implementation of relevant CC-AM circulars		OK	
	Check the single point earthing of CT secondary core on sample basis.			
	Check the earthing interconnecting link/strip connected in inter panel/adjacent panel			

AKY  
20/04/24

AKY  
30.04.2024

AKY  
30/04/24

	Check WTI & OTI trip modification as per latest circular. (20ms time delay)			
	Check implementation of Bucholz Alarm/ Trip with 200ms time delay as per latest circular.		NOT OK	Bucholz -1 & 2 Trip & Alarm are to be wired in two different Relays.
	Check PRV NO NC contact combination used for tripping (And 20ms time delay)		NOT OK	PRV-1&2 NO NC to be implemented in ICT-1,ICT-2 & Reactor
	Check modification of tripping on OLTC OSR as per latest circular (Applicable for ICTs)		OK	
	Check NGR-Bypass CB/ isolator closing on broken conductor trip or earth fault in case of single phasing		NA	
	Check no element tripping on NGR Body Protection operation (Not applicable for 765Kv)		NA	
<b>Bus Bar Protection</b>	Whether duplicate bus bar protection provided in 400 & 765 kV Bus bar		NA	
	Check the topology of both the CUs		NA	
	Check the Diff current and restrain current		OK	
	Check /Measure the Spill current in bus-bar relay		OK	
	Check that CB status is permanently shorted in one and half CB scheme		NA	
	Check the operation of the selector switch and correct alarms in SCADA		OK	
	Check the settings and Configuration of the CU		OK	
	Simulate PU disconnected and check for Bus Bar Block		NA	
	Check the setting of CT supervision/CT fail/CT circuitry fault alarm		OK	
	Check logic for LBB initiation on bus bar trip		OK	
	Check the logic for BUS Bar Tripping on SF6 Gas compartment zone trip in case of GIS Station.		NA	
	Check that the Bus-Bar bay selection is independent of the topology status in One and Half CB schemes		NA	
<b>SAS</b>	As per Annexure-I (SAS Checklist)			
	Image CD of SAS PC should be available		OK	

OK  
30/04/24

OK  
30.04.2024

OK  
30/04/24

	Back-up of all the ICD and SCD files available in hard disk/CD		OK	
<b>Alarms</b>	Simulate the alarms as per Annex-II for at least 20% bays, Minimum 6 bays.		OK	
<b>DC System</b>	Check DC voltage at the farthest point in the switchyard (+ to Earth, - to earth)		OK	S1: +122.15V & -119.61 V S2: +122.40 V & -119.3 V
<b>AC system</b>	Check auto operation of DG set		OK	
<b>FFPH</b>	Check auto operation of HVW and Diesel driven pump		NA	
<b>Smoke detection system</b>	Simulate smoke detection in any kiosk and check for alarm		OK	

## OBSERVATIONS:

**220KV Khalsti Line:(21M1 P444):**

1. SOTF/TOR Mode : SOTF I>3 (Bit-14) to be enabled.
2. O/V Setting to be Kept Phase to Neutral in place of Phase to Phase as per Setting Template.

**ICT-1 & ICT-2 Differential Relay & HV O/C E/F:**

1. Configuration of Record control, Control Inputs, Control Input Config, control Input labels to be kept Visible in place of Invisible as per template.
2. Overcurrent Setting I>1 & Earth Fault Setting IN>1 :
  - a. tReset to be kept 0 Sec as per template
  - b. VTS Block I>1 & 2H I>3 to be set 1 as per template
3. IN>3 current setting to be kept 1.66A in place of 1.5 A as per template.
4. Supervision setting to be reviewed as per template.

**ICT-1 & ICT-2 REF Relay & LV O/C E/F:**

1. Overcurrent Setting I>1 & Earth Fault Setting IN>1 VTS Block I>1 & 2H I>3 to be set 1 as per template.

**REACTOR Differential Relay:**

1. PRD NO NC Logic to be implemented.

**66KV Nimmu Line P442:**

1. Vmem Validity to be kept 900ms in place of 300ms.
2. In Earth Fault setting Block Pole Dead to be kept disabled as per template.

**66KV Leh Line P442:**

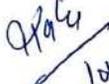
1. E/F O/C Setting IN>1 setting to be kept IEC S Inverse in place of DT as per template.
2. Power Swing I2(% I<sub>max</sub>) to be kept 40% in place of 30%
3. I<sub>max</sub> Line> to be kept 5A in place of 3A.

**66KV Kharu & Chuchot Line P442.**

1. IN>1 Current set to be Kept as 500 mA in place of 250mA as per template.

  
 20/04/2024  
 कर्मवीर/Karamveer  
 अभियंता/Engineer  
 पावरग्रिड फ्यांग एव खलसी (लेह)  
 POWERGRID Phyang & Khaltsi (Leh)

  
 20.04.2024  
 Vivek Raj  
 Asst. Manager

  
 20/04/24  
 जाविद अली/JAVID ALI  
 अभियंता /ENGINEER  
 पाँवरग्रिड /POWERGRID  
 फ्यांग (लेह) /PHYANG(LEH)

APRAVA ENERGY PVT. LTD.

30624

Format		
Internal Protection Audit		
As per annexure-1		
Part-A	General Information	Remarks
(i)	Substation name	
(ii)	Name of Owner Utility	M/a Jhajjar Power Limited, Vill-Khangpur, Jhajjar, Haryana
(iii)	Voltage Level (s) or highest voltage level?	M/a Aprava Energy Pvt. Ltd., Jhajjar, Haryana
(iv)	Short circuit current rating of all equipment (for all voltage level)	400KV
(v)	Date of commissioning of the substation	50KA
(vi)	Checking and validation date	Unit-1: March 2012, Unit-2: July 2012
(vii)	Record of previous tripping's (in last one year) and details of protection operation	400KV JPL-Kabulpur Ckt-I Tripped on Zone-1 Distance protection on 7.5.2024
(viii)	Previous Relay Test Reports	Available
(ix)	Overall single line diagram (SLD)	Available
(x)	AC aux SLD	Available
(xi)	DC aux SLD	Available
(xii)	SAS architecture diagram	Available
(xiii)	SPS scheme implemented (if any)	Not installed
Part-B History and current status		
(i)	Recommendation of last protection checking and validation	No observations
(ii)	Review of existing settings at substation	No observations
(iii)	Disturbance recorder out available for last 6 trippings (Y/N)	Y
(iv)	Chronic reason of tripping, if any	None
(v)	Major non-conformity/deficiency observed	None
Part-C The relay configuration checklist for available power system elements at station:		
(i)	Transmission Line	Available
(ii)	Bus Reactor/Line Reactor	Not applicable
(iii)	Inter-connecting Transformer	Not applicable
(iv)	Busbar Protection Relay	Available
(v)	AC auxiliary system	230VAC
(vi)	DC auxiliary system	220VDC
(vii)	Communication system	Available
(viii)	Circuit Breaker Details	LW25-420/Y 420KV
(ix)	Current Transformer Details	LVQBT-500W 2X1250/1A
(x)	Capacitive Voltage Transformers Details	TYD-400/1.732-0.01H
(xi)	Any other equipment/system relevant for protection system operation	None
Part-D The minimum set of points on which checking and validation carried out		
(i)	Transmission Line Distance Protection/Differential Protection	
a.	Name and Length of Line	400kv Kabulpur line 1&2/34.8KM; 400KV Dhanoda Line 1&2/21.01KM
b.	Whether series compensated or not	
c.	Mode of communication used (PLCC/OPGW)	Kabulpur-OPGW ABB FOX panel PLCC; Dhanoda-Conventional ABB PLCC
d.	Relay Make and Model for Main-I and Main-II	Make-Siemens, Model no. Main-I:7SA6111, Main-II:7SA5221
e.	List of all active protections & settings	Available
f.	Carrier aided scheme if any	Power swing: Active Out of Step: SOTF: Active Breaker Failure: Active STUB: Active Fault Locator: Active DR: Active VT Fuse fail: Active Overvoltage Protection: Active Trip Circuit supervision: Active Auto reclose/Load encroachment: Active
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[1]reclose/Load encroachment etc.	
h.	Relay connected to Trip Coil-1 or 2 or both	Both
i.	CT ratio and PT ratio	CT Ratio:2500/1A, PT Ratio: (400/3)/(0.11/0.1732)KV
j.	Feed from DC supply-1 or 2	Both
k.	Connected to dedicated CT core (mention name)	Yes, Core-1 & Core-2
Part-E Other requirements for protection checking and validation		
(i)	Busbar Protection Relay	
a.	Busbar and redundant relay make and model	PRC915AB-415A/B, Make:Nari Electric, China
b.	Type of Busbar arrangement	Double bus with bus coupler
c.	Zones	Check zone and Main Zone
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, Model-RCS923, Make-Nari Electric, China
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	
(iv)	AC auxiliary system	
a	Source of AC auxiliary system	NCR UPS
b	Supply changeover between sources (Auto/Manual)	Auto
c	Diesel generator (DG) details	available
d	Maintenance plan and supply changeover periodicity in DG	applicable
e	Single Line Diagram	Available
f	Other requirements for protection checking and validation	
(v)	DC auxiliary system	
a	Type of Batteries (Make, vintage, model)	VRLA, 220VDC, 300AH, Make-Amara Raja
b	Status of battery Charger	Functional
c	Measured voltage (positive to earth and negative to earth)	P-N:234VDC, P-E:117VDC, N-E:117VDC
d	Availability of ground fault detectors	Available
e	Protection relays and trip circuits with independent DC sources	Yes
f	Other requirements for protection checking and validation	
g	Communication system	
i	Mode of communication for Main-1 and Main-2 protection	RS232
ii	Mode of communication for data and speech communication	PLCC
iii	Status of PLCC channels	Healthy
iv	Time synchronization equipment details	NR and Massibus Make GPS Installed
v	7OPGW on geographically diversified paths for Main-1 and main-2 relay	
vi	Other requirements for protection checking and validation	
(vi)	Circuit Breaker Details	
a	Details and Status	Type: LW25-420/Y 420KV 400A 50KA, Healthy
b	Healthiness of Tripping Coil and Trip circuit supervision relay	Healthy
c	Single Pole/Multi pole operation	Multipole operation
d	Pole Discrepancy Relay available(Y/N)	Yes
e	Monitoring Devices for checking the dielectric medium	Available
f	Other requirements for protection checking and validation	
(vii)	Current Transformer (CT)/Capacitive Voltage Transformer (CVT) Details	
a	CT/CVT ID name and voltage level	CT:LVQBT-500W 2X1250/1A 400KV CVT:TYD-400/0.1732-0.01H, 400/0.11KV, 400KV
b	CT/CVT core connection details	2X1250/1A, 8 CORE (400/3)/0.11/0.1732)KV, 3 CORE
c	Accuracy Class	CT: 8 CORE, TPY/TPY/TPY/TPY/5P30/0.2/0.2S/0.2S CVT: 3 CORE, 0.2/0.2/3P
d	Whether Protection/Metering	Protection and metering
e	CT/CVT ratio available and ratio adopted	Yes
f	Details of last checking and validation of CT/CVT healthiness	Checked as per schedule
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.	Direction earth fault: Back up EF-Active in Distance protection relay Negative sequence: Active in GRP Over current: Disable in Distance protection relay Over voltage: Active in Distance protection relay Over frequency: Active in GRP Under voltage: Active in GRP Under frequency: Active in GRP Forward power: NA Reverse power: Active in GRP Out of step/power swing: Active in GRP HVDC protection: Not applicable
Part-E	Summary & Remarks	
(i)	The settings and scheme adopted are in line with agreed protection philosophy or any accepted guidelines	Yes
(ii)	Any deviations from the RPC protection philosophy	None
(iii)	Any major general deficiency	None
(iv)	Simulation or EMTP studies report	

*Handwritten signature:*  
 Sr. Mgr. E.M.D.



**H P POWER TRANSMISSION CORPORATION LIMITED.**  
**(A State Government Undertaking)**  
DGM (Protection & Communication), Chowki-Jamwalan, Hamirpur (HP).  
Email. [dgmprot.tcl@hpmail.in](mailto:dgmprot.tcl@hpmail.in)

No: HPPTCL/DGM (P&C)/NRPC/2024-25- 88-89

Dated:- 27/04/2024

To

**The Superintending Engineer (Operation),  
Northern Regional Power Committee,  
18-A, Shaheed Jeet Singh Marg,  
Katwaria Sarai, New Delhi-110016.  
Email: [seo-nrpc@nic.in](mailto:seo-nrpc@nic.in)**

**Subject: Protection audit report in r/o 400/220/66 kV GIS S/stn. Gumma.**

Sir,

With reference to the subject cited above, as per the agenda item no. A.8.1(d) of minutes of 49<sup>th</sup> protection sub-committee meeting, protection audit report of 400/220/66 kV GIS /Stn. Gumma is enclosed herewith for your reference please.

Yours faithfully,

DA: As above

  
DGM (Prot. & Comm.)  
HPPTCL, Chowki Jamwalan,  
Hamirpur (HP).

Copy to:

1. The General Manager (Projects), HPPTCL, Himfed Bhawan, Shimla-05.

  
DGM (Prot. & Comm.)  
HPPTCL, Chowki Jamwalan,  
Hamirpur (HP).

## Protection System Checklist Report

### 1) General information

- i) **Substation Name:** 400/220/66 kV GIS S/stn Gumma.
- ii) **Name of Owner Utility:** Himachal Pradesh Power Transmission Corporation Ltd.
- iii) **Voltage Level(s) or highest voltage level:** 400 kV & 220 kV
- iv) **Short circuit current rating of all equipments:** 63kA for 3 sec
- v) **Date of commissioning of the substation:** 30-10-2020
- vi) **Checking and validation date:**
- vii) **Record of previous tripping's (in last one year) and details of protection operation:** Annexure-A
- viii) **Previous Relay Test Reports:** Annexure-B
- ix) **Overall Single Line Diagram (SLD):** Annexure-C
- x) **AC aux SLD:** Annexure-D
- xi) **DC aux SLD:** Annexure-D
- xii) **SAS architecture diagram:** Annexure-E
- xiii) **SPS scheme implemented (if any):** Yes

### \* TABLE: FORMAT OF PRELIMINARY REPORT

S. No.	Issues	Remarks
1	Recommendation of last protection checking and validation	
2	Review of existing settings at substation	
3	Disturbance Recorder out available for last 6 tripping's (Y/N)	
4	Chronic reason of tripping, if any	
5	Major non-conformity/deficiency observed	In 400 kV, Y-Phase relay of Bus Bar main-1 is malfunctioning.

### 2) The relay configuration checklist for available power system elements at station

- i) **Transmission Line**  
400 kV & 200 kV Lines:

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 operating characteristic.	YES
5.	In the Main-I / Main-II Distance protection, Zone-1 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

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.	NA
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.	NO (500msec)
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, (Zone 3 - 1.5 Sec)
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?	YES
14.	Is reverse looking Zone-4 time delay set as Zone-2 time delay?	YES (500 msec)
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	YES YES YES
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 (Separate)
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?	
19.	In case of Cables, is unit protection provided as Main-I & Main-II protection with distance as back-up.	NO
20.	Are the line parameters used for setting the relay verified by field testing	NO
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 : (typical value - 106 to 112 % , delay : 4-7 Sec) Stage-II: (typical value - 140 % , delay: 0 to 100msec.)	YES YES 110%, 5 sec 140%, 100 msec
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)	YES
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.	YES No



6.	Is Restricted earth fault (REF) protection used a high impedance type	YES
7.	Are Main protection relays provided for transformers 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 YES 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 given in the setting document?	.....

**iii) Busbar Protection Relay**

1.	Bus Bar protection for 400 & 220kV buses is provided	YES
2.	Duplicated Bus bar protection is provided for 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.	NO
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?	NO
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?	.....
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?	.....
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 given in the setting document?	.....

**iv) AC auxillary system**

**v) DC auxillary system**

**vi) Communication system**

1.	<p>a) Do you use PLCC for tele-protection of distance relays at 765, 400 &amp; 220kV feeders</p> <p>b) Specify type of coupling</p> <p>c) Whether redundant PLCC channels provided for 400 &amp; 765kV lines</p> <p>d) Specify number of PLCC channels per circuit :</p> <p>e) Whether dependability &amp; security of each tele-protection channel measured &amp; record kept ?</p>	<p><b>YES</b></p> <p>(Ph-Ph / Ph-G/ Inter-ckt)</p> <p><b>YES</b></p> <p>(two)</p> <p><b>YES</b></p>
2.	<p>a) In case you use OPGW for tele-protection, are they on geographically diversified route for Main-I and Main-II relay?</p> <p>b) Whether dedicated fibre is being used for Main-I / Main-II relay or multiplexed channel are being used.</p>	

**vii) Circuit Breaker Details**

1.	Is breaker fail protection ( LBB / BFR) provided for all the Circuit Breakers at 220kV , 400kV & 765kV rating	<b>YES</b>
2.	For Circuit Breaker connected to line feeder / transformer feeder, whether operation of LBB / BFR sends direct trip signal to trip remote end breaker ?	<b>YES</b>
3.	For lines employing single phase auto reclosing, Is start signal from protection trip to LBB / BFR relay is given on single phase basis?	<b>YES</b>
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?	<b>YES</b>
5.	Is LBB relay provided with separate DC circuit independent from Group-A and Group-B Protections?	<b>YES</b>
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?	<b>YES</b>
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?	<b>NO</b>
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 buckholz operation?	.....
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)	<b>YES</b>
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)	<b>YES</b>
13.	Is the back-up fault clearance time is shorter than the operating time of the remote protections (distance relay Zone-2) ?	<b>NO</b>

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.	.....
15.	Is the breaker failure protection hardware provided is separate from line /transformer feeder protection?	YES

viii) **Current Transformer Details**

ix) **Capacitive Voltage Transformers Details**

x) **Station DC Supply System:**

1.	Do you have two separate independent DC system (220V or 110V) (Source-A and Source-B)	YES
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

xi) **Performance Indices:**

1.	Is there a system of periodically measuring Dependability & Security of Protection system (as given in CBIP manual 296) and recorded	YES
2.	Is there a system of periodically measuring Dependability of switchgear associated with Protection system and recorded	YES
3.	Is there a process of Root cause analysis of unwanted tripping events	YES
4.	Are improvement action like revision of relay setting, better maintenance practices, modernising & retrofitting of switching & protection system taken based on above data.	YES
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	YES

**xii) Disturbance recorder (DR) and event logger (EL):**

1	<p>a) Is the Disturbance recorder and Fault locator provided on all line feeders of 765, 400 &amp; 220kV substations?</p> <p>b) Whether standalone or built in Main relay</p> <p>c) Whether DR is having automatic fault record download facility to a central PC</p> <p>d) Whether Central PC for DR , EL are powered by Inverter (fed from station DC)</p>	<p>YES</p> <p>Built-in</p> <p>YES</p> <p>YES</p>
2.	<p>Whether DR is having the following main signals for lines:</p> <p><u>Analogue signals:</u></p> <ul style="list-style-type: none"> <li>• From CT: IA, IB, IC, IN</li> <li>• From VT: VAN, VBN, VCN</li> <li>• From Aux. VT: V0</li> </ul> <p><u>Digital Signals</u></p> <ul style="list-style-type: none"> <li>• Main 1 Carrier receive</li> <li>• Main 1 Trip</li> <li>• Line O/V Stage I / Stage II</li> <li>• Reactor Fault Trip</li> <li>• Stub Protection Operated.</li> <li>• Main II Trip</li> <li>• Main II Carrier Receive</li> <li>• Direct Trip CH I / II</li> <li>• CB I Status (PH-R, Y &amp; B)</li> <li>• CB II Status (PH R, Y &amp; B)</li> <li>• Bus bar trip</li> <li>• Main / Tie CB LBB Operated</li> <li>• Main / Tie Auto-reclose operated.</li> </ul> <p>DR for Transformer / Reactor feeder should contain analog channel like input currents &amp; voltage. Binary signal include all protection trip input, Main &amp; Tie CB status, LBB trip</p>	<p>YES</p>
3.	<p>Whether substation (765, 400 , 220kV) is having Event logger facility (standalone or built-in-SAS)</p>	<p>YES</p>
4.	<p>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</p>	<p>YES</p>

**xiii) Additional checks for series compensated lines:**

1.	<p>What is the operating principle of Main protection employed</p>	<p>NA</p>
2.	<p>Are both main-I &amp; Main-II distance relay are numerical design</p>	<p>NA</p>
3.	<p>Are both main-I &amp; Main-II distance relay suitable for Series compensated lines</p>	<p>NA</p>
4.	<p>Are POR tele-protection scheme employed for distance relays</p>	<p>NA</p>
5.	<p>Position of Line VT provided on series compensated line</p>	<p>NA</p>
6.	<p>What is the under reaching (Zone 1) setting used in teleprotection schemes (Local &amp; Remote end)</p>	<p>NA</p>
7.	<p>What is the overreaching (Zone 2) setting in used teleprotection schemes</p>	<p>NA</p>

8.	What kinds of measurement techniques are used to cope with voltage inversion?	NA
9.	Whether system studies carried out to check the possibility of current inversion due to series compensation	NA
10.	Whether any system studies conducted to find the impact of series compensation on the performance of protections installed on adjacent lines? If yes, how many lines were found to be affected. Pl. specify _____	NA
11.	If YES, are the affected protections on adjacent lines changed / setting revised after the introduction of series compensation?	NA
12.	Is dynamic simulation done to fine tune settings of distance relay installed on series compensated double circuit lines?	NA
13.	Whether performance of directional earth fault relay verifies by simulation studies	NA
14.	When is flashover of spark gaps expected?	NA
15.	Whether measures taken for under/overreach problems at sub-harmonic oscillations?	NA
16.	Whether MOV influence considered while setting the distance relay reach	NA
17.	Have you experienced any security problems (Relay mal-operation) with high frequency transients caused by Flashover of spark gaps Line energisation Other, specify:	NA
18.	If YES, how the above problem has been addressed?	

3) 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**

**a. Name and Length of Line  
400 kV**

		Line-1	Line-2	Line-3	Line-4	Line-5	Line-6	
Name of Line		400 kV Panchkul a ckt. 2	400 kV Jhakri ckt. 2	400 kV Jhakri ckt. 1	400 kV Panchkula ckt. 1	220 kV (Hatkoti ckt.-1)	220 kV (Hatkoti ckt.-2)	
Line length (km)		111.5	54.5	54.5	111.5	26	26	
Line Parameters ( In Ohms/Per KM/Per Phase Primary value)	R1	0.019387	0.019387	0.019387	0.019387	0.0208313	0.0208313	
	X1	0.275728	0.275728	0.275728	0.275728	0.28146	0.28146	
	R0	0.2858	0.2858	0.2858	0.2858	0.20328	0.20328	
	X0	1.0869	1.0869	1.0869	1.0869	1.1684	1.1684	
	R0M	0.266	0.266	0.266	0.266			
	X0M	0.7625	0.7625	0.7625	0.7625			
Relay setting	Adopted	Please enclose the settings for all lines, transformers, Reactors and Bus Bars as Annexure-I						
	Recommended	Please enclose the settings for all lines, transformers, Reactors and Bus Bars as Annexure-II						

- b. Whether series compensated or not :- **No**
- c. Mode of communication used (PLCC/OPGW) – **PLCC/OPGW**
- d. Relay Make and Model for Main-I and Main-II

**400 kV:**

		Main-I Protection (Make and Model)	Functional (Yes / No)	Date of testing	Main-II Protection (Make and Model)	Functional (Yes / No)	Date of testing	LBB Protection (Make and Model)	Functional (Yes / No)	Date of testing
1	Line-1 404 Panchkula - Ckt. 2	P443 MICOM	Yes	15.12.2021	REL 670 ABB	Yes	15.12.2021	P442 MICOM	Yes	30.10.2020
		PLCC/ Protection coupler (Make and Model)	Functional (Yes / No)	DR (Make & Model)	Functional (Yes / No)	Time Synch. Unit (Make & Model)	OK / Not OK			
		ALSTOM e- terragridcom	Yes	Inbuilt	Yes	Masibus	Ok			
2	Line-2 406 Jhakri Ckt. 2	Main-I Protection (Make and Model)	Functional (Yes / No)	Date of testing	Main-II Protection (Make and Model)	Functional (Yes / No)	Date of testing	LBB Protection (Make and Model)	Functional (Yes / No)	Date of testing
		P443 MICOM	Yes	14.12.2021	REL 670 ABB	Yes	14.12.2021	P442 MICOM	Yes	30.10.2020
		PLCC/ Protection coupler (Make and Model)	Functional (Yes / No)	DR (Make & Model)	Functional (Yes / No)	Time Synch. Unit (Make & Model)	OK / Not OK			
		ALSTOM e- terragridcom	Yes	Inbuilt	Yes	Masibus	OK			
3	Line-3 407 Jhakri Ckt. 1	Main-I Protection (Make and Model)	Functional (Yes / No)	Date of testing	Main-II Protection (Make and Model)	Functional (Yes / No)	Date of testing	LBB Protection (Make and Model)	Functional (Yes / No)	Date of testing
		P443 MICOM	Yes	21.10.2023	REL 670 ABB	Yes		P442 MICOM	Yes	
		PLCC/ Protection coupler (Make and Model)	Functional (Yes / No)	DR (Make & Model)	Functional (Yes / No)	Time Synch. Unit (Make & Model)	OK / Not OK			
		ALSTOM e-terragridcom	Yes	Inbuilt	Yes	Masibus	Ok			
4	Line-4 409 Panchkula Ckt. 1	Main-I Protection (Make and Model)	Functional (Yes / No)	Date of testing	Main-II Protection (Make and Model)	Functional (Yes / No)	Date of testing	LBB Protection (Make and Model)	Functional (Yes / No)	Date of testing
		P443 MICOM	Yes	21.10.2023	REL 670 ABB	Yes		P442 MICOM	Yes	
		PLCC/ Protection coupler (Make and Model)	Functional (Yes / No)	DR (Make & Model)	Functional (Yes / No)	Time Synch. Unit (Make & Model)	OK / Not OK			
		ALSTOM e- terragridcom	Yes	Inbuilt	Yes	Masibus	OK			

220 kV

1	Line-1 203 Hatkoti Ckt. 1	Main-I Protection (Make and Model)	Functional (Yes / No)	Date of testing	Main-II Protection (Make and Model)	Functional (Yes / No)	Date of testing	LBB Protection (Make and Model)	Functional (Yes / No)	Date of testing
		P443 MICOM	Yes	19.10.2023	REL 670 ABB	Yes		P746 MICOM	Yes	
		PLCC/ Protection coupler (Make and Model)	Functional (Yes / No)	DR (Make & Model)	Functional (Yes / No)	Time Synch. Unit (Make & Model)	OK / Not OK			
				Inbuilt	Yes	Masibus	OK			
2	Line-2 204 Hatkoti Ckt. 2	Main-I Protection (Make and Model)	Functional (Yes / No)	Date of testing	Main-II Protection (Make and Model)	Functional (Yes / No)	Date of testing	LBB Protection (Make and Model)	Functional (Yes / No)	Date of testing
		P443 MICOM	Yes	19.10.2023	REL 670 ABB	Yes		P746 MICOM	Yes	
		PLCC/ Protection coupler (Make and Model)	Functional (Yes / No)	DR (Make & Model)	Functional (Yes / No)	Time Synch. Unit (Make & Model)	OK / Not OK			
				Inbuilt	Yes	Masibus	OK			

e. List of all active protections & settings

f. Carrier aided scheme if any: **PUR**

g. Status of Power Swing/Out of Step/SOTF/Breaker Failure/Broken Conductor/STUB/Fault Locator/DR/VT fuse fail/Overtension Protection/Trip Circuit supervision/Auto-reclose/Load encroachment etc.

h. Relay connected to Trip Coil-1 or 2 or both: **Both**

i. **CT ratio and PT ratio**

i. **Location of CT** : Bay 401 ICT-1

ii. **Date of CT ratio Test Testing**

iii. **Test Results**

		Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	2000	2000	2000	2000	2000	2000
ii	Ratio measured						
iii	error calculated						
	Knee point voltage						

j. Feed from DC supply-1 or 2

k. Connected to dedicated CT core (mention name)

Sr. No.	CT Core used	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Line	Bus Bar-I	Bus Bar-II	BCU/Metering	Spare	Main-2 Distance/Backup	Main-1 Distance
ii	Transformer	Bus Bar-I	Bus Bar-II	BCU/Metering	Spare	Backup	Differential

1. Other requirements for protection checking and validation

**ii) Inter-connecting Transformer Protection**

- 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 Mode
- d. **400 kV ICTs:**

1	ICT-1 (400/220/66 kV)	Differential Protection (Make & Model)	REF Protection (Make & Model)	Back-up Over Current Protection (Make & Model)	Over Flu x Protection (Make & Model)	Other protection
		P643 MICOM	P643 MICOM	P643/P141 MICOM	P643 (REF) MICOM	
		Bucholtz / PRD	LA Rating HV Side	LA Rating LV Side	OTI/WTI Indication working or not	Date of last testing
		P643 (REF)	390 kV	198 kV	Yes	19/10/2023
2	ICT-2 (400/220/66 kV)	Differential Protection (Make & Model)	REF Protection (Make & Model)	Back-up Over Current Protection (Make & Model)	Over Flu x Protection (Make & Model)	Other protection
		P643 MICOM	P643 MICOM	P643/P141 MICOM	P643 (REF) MICOM	
		Bucholtz / PRD	LA Rating HV Side	LA Rating LV Side	OTI/WTI Indication working not	Date of last testing
		P643 (REF)	390 kV	198 kV	Yes	18/10/2023
3	ICT-3 (400/220/66 kV Spare )	Differential Protection (Make & Model)	REF Protection (Make & Model)	Back-up Over Current Protection (Make & Model)	Over Flu x Protection (Make & Model)	Other protection
			642 64R MICOM	P141 MICOM		
		Bucholtz / PRD	LA Rating HV Side	LA Side Rating LV	OTI/WTI Indication working or not	Date of last testing
			390 kV	198 kV	Yes	20/10/2023

**220/66 kV Power Transformer**

1	Power Transformer # 1 (220/66 kV)	Differential Protection (Make & Model)	REF Protection (Make & Model)	Back-up Over Current Protection (Make & Model)	Over Flux Protection (Make & Model)	Other protection
		87T-P643(HV) MICOM	64LV-P643(LV) MICOM	67/67N-P141 MICOM		
		Bucholtz / PRD	LA Rating HV Side	LA Side Rating LV	OTI/WTI Indication working or not	Date of last testing
2	Power Transformer # 2 (220/66 kV)	Differential Protection (Make & Model)	REF Protection (Make & Model)	Back-up Over Current Protection (Make & Model)	Over Flux Protection (Make & Model)	Other protection
		87T-P643(HV) MICOM	64LV-P643(LV) MICOM	67/67N-P141 MICOM		
		Bucholtz / PRD	LA Rating HV Side	LA Side Rating LV	OTI/WTI Indication working or not	Date of last testing

- e. List of all active protections along with settings
- f. Status of Differential Protection/Restricted Earth Fault Protection/Back-up Directional Overcurrent/Backup Earth fault/ Breaker Failure: **OK**
- g. Status of Oil Temperature Indicator/Winding Temperature Indicator/Bucholz/Pressure Release Device etc.: **Ok**
- h. Relay connected to Trip Coil-1 or 2 or both: **Both**
- i. CT ratio and PT ratio
- j. Feed from DC supply-1 or 2: **Both**
- k. Connected to dedicated CT core (mention name)
- l. Other requirements for protection checking and validation

**iii) Busbar Protection Relay**

- a. Busbar and redundant relay make and model

		400kV	220kV
i)	Make and Model of Bus Bar relay	P746 MICOM	P746 MICOM
ii)	Whether stability checks done or not	Yes	Yes

iii)	Date of testing	Oct, 2020	Oct, 2020
iv)	Remarks (if any)		

b. Type of Busbar arrangement

**400 kV: One and Half Breaker Scheme**

**220 kV: Double Bus Bar Scheme**

c. Zones: **Z<sub>A</sub>/Z<sub>B</sub>/Check zone.**

d. Dedicated CT core for each busbar protection: **Yes**

e. Breaker Failure relay included (**Yes** in 220 kV), if additional then furnish make and model :

**In 400 kV P442**

f. Trip issued to both Busbar protection in case of enabling: **No as per Isolator status.**

g. Isolator indication and check relays **Yes(Built in)**

h. Other requirements for protection checking and validation

**iv) AC auxiliary system**

a. Source of AC auxiliary system

**Auxiliary Supply-1:** Source of supply: ICT-1 Tertiary  
Reliability of Supply: 100%

Average trippings per month: 0

**Auxiliary Supply-2:** Source of supply: ICT-2 Tertiary  
Reliability of Supply: 100%

Average trippings per month: 0

b. Supply changeover between sources (**Auto**)

c. Diesel generator (DG) details

**DG Set-1:**

Make Jackson/Cummins

Rating 250 kVA

Weather on Auto or Manual: Auto

Fuel Level 802 Litre (as on dated 23.04.2024)

- d. Maintenance plan and supply changeover periodicity in DG
- e. Single Line Diagram
- f. Other requirements for protection checking and validation

**(v) DC auxiliary system**

- a. Type of Batteries (Make, vintage, model)

Make: **HBL** Type: **Tubular LMLA Battery** Model: **T400PNDP, 2V-400AH**

- b. Status of battery Charger: **OK**

- c. Measured voltage (positive to earth and negative to earth)

		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)	243.1 V	241 V	52.4 V	53 V
i.	Positive to Earth	121 V	120 V	NA	NA
ii.	Negative to Earth	- 120 V	- 120 V	- 52.4 v	- 52.9 V
b)	No. of Cells Per Bank	110	110	24	24
c )	Availability of Battery Charger	Yes	Yes	Yes	Yes

- d. Availability of ground fault detectors: **Yes/No**
- e. Protection relays and trip circuits with independent DC sources: **Yes**
- f. Other requirements for protection checking and validation
- g. Communication system

- i. Mode of communication for Main-1 and Main-2 protection
- ii. Mode of communication for data and speech communication
- iii. Status of PLCC channels
- iv. Time synchronization equipment details
- v. 7OPGW on geographically diversified paths for Main-1 and main-2relay.
- vi. Other requirements for protection checking and validation

**(vi) Circuit Breaker Details**

a. Details and Status

		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)
<b>A</b>	<b>400kV System</b>						
i	Bay-401 (ICT-1)	ALSTOM T155-3	Avilable	02 Trip coil/01 Close	Not	19.10.2023	
ii	Bay-401S (Spare ICT)	ALSTOM T155-3	Avilable	02 Trip coil/01 Close	Not	20.10.2023	
iii	Bay-402 (TIE)	ALSTOM T155-3	Avilable	02 Trip coil/01 Close	Not	18.10.2023	
iv	Bay-403 (ICT-2)	ALSTOM T155-3	Avilable	02 Trip coil/01 Close	Not	18.10.2023	
v	Bay-404 (Panchkula ckt-2)	ALSTOM T155-3	Avilable	02 Trip coil/01 Close	Not	17.10.2023	
vi	Bay-405 (TIE)	ALSTOM T155-3	Avilable	02 Trip coil/01 Close	Not	17.10.2023	
Vii	Bay-406 (Jakhri ckt-2)	ALSTOM T155-3	Avilable	02 Trip coil/01 Close	Not	17.10.2023	
Viii	Bay-407 (Jakhri ckt-1)	ALSTOM T155-3	Avilable	02 Trip coil/01 Close	Not	21.10.2023	
ix	Bay-408 (TIE)	ALSTOM T155-3	Avilable	02 Trip coil/01 Close	Not	21.10.2023	
x	Bay-409 (Panchkula ckt-1)	ALSTOM T155-3	Avilable	02 Trip coil/01 Close	Not	21.10.2023	
<b>B</b>	<b>220kV System</b>						
i	Bay-201 (ICT-1)	ALSTOM	Avilable	02 Trip coil/01 Close	Not	19.10.2023	
ii	Bay-203 (Hatkoti ckt-1)	ALSTOM	Avilable	02 Trip coil/01 Close	Not	19.10.2023	
iii	Bay-204 (Hatkoti ckt-2)	ALSTOM	Avilable	02 Trip coil/01 Close	Not	18.10.2023	
iv	Bay-205 (Bus-Coupler)	ALSTOM	Avilable	02 Trip coil/01 Close	Not	18.10.2023	

v	Bay-207 (ICT-2)	ALSTOM	Avilable	02 Trip coil/01 Close	Not	18.10.2023	
---	--------------------	--------	----------	--------------------------	-----	------------	--

- 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: **SF6 Gas Density Monitor**
- f. Other requirements for protection checking and validation

(vii) **Current Transformer (CT)/Capacitive Voltage Transformer (CVT) Details: (Attached as Annexure-F)**

- a. CT/CVT ID name and voltage level
- 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.

  
Er. Lalit Kumar  
Assistant engineer (E)  
O/o DGM(P&C), HPPTCL,  
Hamirpur (H.P.)

  
Er. Shubham Thakur  
Assistant engineer (E)  
O/o DGM(P&C), HPPTCL,  
Hamirpur (H.P.)

  
Er. Rajat Sharma  
Sr. Manager(E)  
O/o DGM(P&C), HPPTCL,  
Hamirpur (H.P.)

**Tripping Detail w.e.f 01/04/2023 to 31/03/2024 in r/o  
400/220/66 kv GIS s/stn. Gumma.**

Sr. No	Name of Element	Voltage Level	Date & Time of tripping	Date & Time of Restoration	Detailed reason of tripping	Remarks
1	Bay 406 Gumma Jhakri -2 Y- phase	400kv	18/04/2023 20:16hrs.	18/04/2023 21:28hrs.	Transient fault relay operated according to Z-1 trip on y phase. Auto recloser did not work	
2	DT received from Jhakri end	400kv	26/04/2023 06:32p.m	26/04/2023 11:05 p.m	DT received from Jhakri end on with circuit (Relay operated)	
3	ICT-2	220KV	15/08/2023 14:37hrs.	T/f under shut down	PRV operated ICT-2 in LV side due to moisture ingress ( relay operated)	
4	Bus 1 and Bus 2	400kv	16/11/23 02:01 hrs.	16/11/23 Bus-2 Time-08:19 AM  Bus-1 Time-08:53 PM	Bus 1 and Bus 2 were tripped due to malfunction of Y Phase main-1 Bus Bar Differential Relay i.e. P746	
5	DT received Hatkoti end	220kv	19/01/2024		DT received from Hatkoti end and tripping due over voltage .	



# H P POWER TRANSMISSION CORPORATION LIMITED.

(A State Government Undertaking)

Annexure-B

2021

222

Bay = 406 (Guma - Jhakar' CKP-2) Date = 15/12/2021

### D. Detailed of Equipment to be tested: Distance Protection Relay (Main -1 & Main - 2) & Back up Relay (Over current & Earth fault) - Details below:

#### Description of Test: Zone Reach Testing.

S. No.	Relay	Relay make & Model	Remarks
1	Distance relay (Main-I)	Alstom&P443	Zone reach Accuracy test conducted for Line to Earth, Line to Line & 3Ø fault by selecting different values of fault impedance (z) points for respective zones
2	Distance relay (Main-II)	ABB&REL670	Zone reach Accuracy test conducted for Line to Earth, Line to Line & 3Ø fault by selecting different values of fault impedance (z) points for respective zones
3	Backup Relay (O/C & E/F)	Alstom&P141	Pick up test of relay conducted by injecting current more than the current setting value for overcurrent in one Phase .

#### D.1 Main-I Relay

Fault type: Line to Earth fault (L1-E)

Sr. No.	Values selected for test			Result	Remarks
	(Z)Fault Impedance (Ω)	Phi (Angle)	Nominal Trip time(ms)		
1	17.89	50	30.0	Relay tripped in zone-1	Operation of the relay found satisfactory
2	44.72	63.43	530.0	Relay tripped in zone-2	
3	72.80	74.05	1.030	Relay tripped in zone-3	
4	6.622	170.0	530.0	Relay tripped in zone-4	

Fault type: Line to Line fault(L1-L2)

Sr. No.	Values selected for test			Result	Remarks
	(Z)Fault Impedance (Ω)	Phi (Angle)	Nominal Trip time(s)		
1	4.806	40.0	30.0	Relay tripped in zone-1	Operation of the relay



**H P POWER TRANSMISSION CORPORATION LIMITED.**  
(A State Government Undertaking)

223

2	20.00	60.0	530.0	Relay tripped in zone-2	found satisfactory
3	40.00	80.0	1.030	Relay tripped in zone-3	
4	8.084	180	530.0	Relay tripped in zone-4	

**Fault type: 3 Phase fault(L1-L2-L3)**

Values selected for test					
Sr. No.	(Z)Fault Impedance ( $\Omega$ )	Phi (Angle)	Nominal Trip time(s)	Result	Remarks
1	4.806	40.0	30.0	Relay tripped in zone-1	Operation of the relay found satisfactory
2	20.00	60.0	530.0	Relay tripped in zone-2	
3	40.00	80.0	1.030	Relay tripped in zone-3	
4	8.084	180	530.0	Relay tripped in zone-4	

**D.2 Main-II**

**Fault type: Line to Earth fault(L2-E)**

Values selected for test					
Sr. No.	(Z)Fault Impedance ( $\Omega$ )	Phi (Angle)	Nominal Trip time(s)	Result	Remarks
1	8.962	30.00	24.00	Relay tripped in zone-1	Operation of the relay found satisfactory
2	29.48	41.73	524.00	Relay tripped in zone-2	
3	38.50	48.76	1.024	Relay tripped in zone-3	
4	12.08	176.66	524.0	Relay tripped in zone-4	

**Fault type: Line to Line fault(L2-L3)**

Values selected for test					
Sr. No.	(Z)Fault Impedance ( $\Omega$ )	Phi (Angle)	Nominal Trip time (s)	Result	Remarks
1	5.5	40.0	24.00	Relay tripped in zone-1	Operation of the relay found satisfactory
2	14.64	34.39	524.00	Relay tripped in zone-2	
3	22.00	43.34	1.024	Relay tripped in zone-3	
4	5.5	180.0	524.0	Relay tripped in zone-4	



(224)

**H P POWER TRANSMISSION CORPORATION LIMITED.**  
(A State Government Undertaking)

**Fault type: 3 Phase fault(L1-L2-L3)**

Values selected for test					
Sr. No.	(Z)Fault Impedance ( $\Omega$ )	Phi (Angle)	Nominal Trip time(s)	Result	Remarks
1	5.5	40.0	24.00	Relay tripped in zone-1	Operation of the relay found satisfactory
2	14.64	34.39	524.00	Relay tripped in zone-2	
3	22.00	43.34	1.024	Relay tripped in zone-3	
4	5.5	180.0	524.0	Relay tripped in zone-4	

**D.3 Over Current & Earth fault Relay**

Sr. No.	Phase	Applied Voltage	Applied Current	Result	Remarks
1	R $\emptyset$	63.5 V	1.00 A	Relay Tripped for Y Phase over Current	Operation of the relay found satisfactory
2	Y $\emptyset$	63.5 V	1.50 A		
3	B $\emptyset$	63.5 V	1.00 A		

**2. Location: Bay no.405 (Tie Breaker)**

**A. Detailed of Equipment to be tested: Circuit Breaker**

Make	Alstom
------	--------

**A.1 Description of the test :Circuit Breaker Time Interval test**

**Results:**

Sr. No.	Operation Mode	R-Phase Time (mSec)	Y-Phase Time (mSec)	B-Phase Time (mSec)	Remarks
1.	Closing	19	19	20	Values are within permissible limits
2.	Opening	98	97	98	



**H P POWER TRANSMISSION CORPORATION LIMITED.**  
(A State Government Undertaking)

228

*Bay = 404*  
*Gumma - Jambhukula C&T-2*

**D. Detailed of Equipment to be tested: Distance Protection Relay (Main -1 & Main - 2) & Back up Relay (Over current & Earth fault) - Details below:**

**Description of Test: Zone Reach Testing.**

S. No.	Relay	Relay make & Model	Remarks
1	Distance relay (Main-I)	Alstom&P443	Zone reach Accuracy test conducted for Line to Earth, Line to Line & 3Ø fault by selecting different values of fault impedance (z) points for respective zones
2	Distance relay (Main-II)	ABB&REL670	Zone reach Accuracy test conducted for Line to Earth, Line to Line & 3Ø fault by selecting different values of fault impedance (z) points for respective zones
3	Backup Relay (O/C & E/F)	Alstom&P141	Pick up test of relay conducted by injecting current more than the current setting value for overcurrent in one Phase .

**D.1 Main-I Relay**

**Fault type: Line to Earth fault (L1-E)**

Sr. No.	Values selected for test			Result	Remarks
	(Z)Fault Impedance (Ω)	Phi (Angle)	Nominal Trip time(s)		
1	10.89	40.0	30.0	Relay tripped in zone-1	Operation of the relay found satisfactory
2	45.95	64.20	530.0	Relay tripped in zone-2	
3	75.35	74.61	1.530	Relay tripped in zone-3	
4	3.226	-150.00	530.0	Relay tripped in zone-4	

**Fault type: Line to Line fault(L1-L2)**

Sr. No.	Values selected for test			Result	Remarks
	(Z)Fault Impedance (Ω)	Phi (Angle)	Nominal Trip time(s)		
1	6.843	30.00	30.00	Relay tripped in zone-1	Operation of the relay found satisfactory
2	20.00	70.00	530.0	Relay tripped in zone-2	

*[Signature]*  
Assistant Engineer (P&C)  
O/o DGM (Prot. & Comm.)  
HPPTCL, Hamirpur (H.P.)



**H P POWER TRANSMISSION CORPORATION LIMITED.**  
(A State Government Undertaking)

(229)

3	37.45	70.00	1.530	Relay tripped in zone-3	
4	6.573	-180.0	530.0	Relay tripped in zone-4	

**Fault type: 3 Phase fault(L1-L2-L3)**

Values selected for test					
Sr. No.	(Z)Fault Impedance ( $\Omega$ )	Phi (Angle)	Nominal Trip time(s)	Result	Remarks
1	6.843	30.00	30.00	Relay tripped in zone-1	Operation of the relay found satisfactory
2	20.00	70.00	530.0	Relay tripped in zone-2	
3	37.45	70.00	1.530	Relay tripped in zone-3	
4	6.573	-180.0	530.0	Relay tripped in zone-4	

**D.2 Main-II**

**Fault type: Line to Earth fault(L2-E)**

Values selected for test					
Sr. No.	(Z)Fault Impedance ( $\Omega$ )	Phi (Angle)	Nominal Trip time(ms)	Result	Remarks
1	22.94	53.17	24.0	Relay tripped in zone-1	Operation of the relay found satisfactory
2	49.49	50.00	524.0	Relay tripped in zone-2	
3	76.89	60.00	1.524	Relay tripped in zone-3	
4	13.75	180.00	524.0	Relay tripped in zone-4	

**Fault type: Line to Line fault(L2-L3)**

Values selected for test					
Sr. No.	(Z)Fault Impedance ( $\Omega$ )	Phi (Angle)	Nominal Trip time (ms)	Result	Remarks
1	8.348	50.00	24.00	Relay tripped in zone-1	Operation of the relay found satisfactory
2	22.87	60.0	524.00	Relay tripped in zone-2	
3	35.289	70.00	1.524	Relay tripped in zone-3	
4	9.524	-170.00	524.00	Relay tripped in zone-4	



H P POWER TRANSMISSION CORPORATION LIMITED.  
(A State Government Undertaking)

230

**Fault type: 3 Phase fault(L1-L2-L3)**

Sr. No.	Values selected for test			Result	Remarks
	(Z)Fault Impedance ( $\Omega$ )	Phi (Angle)	Nominal Trip time(s)		
1	8.348	50.00	24.00	Relay tripped in zone-1	Operation of the relay found satisfactory
2	22.87	60.0	524.00	Relay tripped in zone-2	
3	35.289	70.00	1.524	Relay tripped in zone-3	
4	9.524	-170.00	524.00	Relay tripped in zone-4	

**D.3 Over Current & Earth fault Relay**

Sr. No.	Phase	Applied Voltage	Applied Current	Result	Remarks
1	R $\emptyset$	63.5 V	1.00 A	Relay Tripped for Y Phase over Current	Operation of the relay found satisfactory
2	Y $\emptyset$	63.5 V	1.50 A		
3	B $\emptyset$	63.5 V	1.00 A		

4. Location: Bay no.403 (400 kV bay ICT#1 400/220/33 kV)

Equipment to be tested: 3 x 1 $\emptyset$  Power Transformer

Make	GE T&D India Ltd		
Sr. No.	B-31182 T-7015E-3	B-31182 T-7015E-2	B-31182 T-7015E-1
Vector Group	YNa0d11		
Rating	105 MVA	105 MVA	105 MVA
Type of Cooling	OFAF	OFAF	OFAF
Voltage Ratio	400/ $\sqrt{3}$ /220/ $\sqrt{3}$ /33	400/ $\sqrt{3}$ /220/ $\sqrt{3}$ /33	400/ $\sqrt{3}$ /220/ $\sqrt{3}$ /33

  
Assistant Engineer (P&C)  
O/o DGM (Prot. & Comm.)  
HPPTCL, Hamirpur (H.P.)

  
Sr. Manager (P&C)  
O/o DGM (Prot.&Comm.)  
HPPTCL, Hamirpur (H.P.)



234

**H P POWER TRANSMISSION CORPORATION LIMITED.**  
(A State Government Undertaking)

**F. Detailed of Equipment to be tested : Differential Relay & Restricted Earth fault Relay**

Sr. No.	Relay Name	Relay make & Model	Remarks
1	Transformer Differential relay	Alstom & P 643	Slope test, 2 <sup>nd</sup> Harmonics test & 5 <sup>th</sup> Harmonics test of relay conducted successfully with the help of test universe software by selecting different values of Differential & Biased Currents in the operating region.
2	Restricted Earth Fault relay	Alstom & P 643	(i) Pick up test of relay conducted by injecting current in neutral CT circuit of ICT with the help of quick CMC Test software.  (ii) Over flux test of relay conducted by injecting 1.5 times the rated voltage in two Phases with the help of quick CMC Test software.

**F.1 Description of the test:**

**F.1.1. Differential Slope Test**

**Fault type: Line to Earth fault**

Sr. No.	Values selected for test			Remarks
	I-Diff	I-Bias	Trip Time(s)	
1	4.00In	6.30In	No Trip received	Operation of the relay found satisfactory
2	6.30In	8.50In	0.5822	
3	8.40In	12.10In	No Trip received	
4	9.90In	12.90In	0.5069	

**Fault type: Line to Line fault**

Sr. No.	Values selected for test			Remarks
	I-Diff	I-Bias	Trip Time(s)	
1	4.00In	6.30In	No Trip received	Operation of the relay found satisfactory
2	6.30In	8.50In	0.6860	
3	8.40In	12.10In	No Trip received	
4	9.90In	12.90In	0.5840	



H P POWER TRANSMISSION CORPORATION LIMITED.  
(A State Government Undertaking)

235

**Fault type: L-L-L fault**

Sr. No.	Values selected for test		Trip Time(s)	Remarks
	I-Diff	I-Bias		
1	4.00In	6.30In	No Trip received	Operation of the relay found satisfactory
2	6.30In	8.50In	0.6860	
3	8.40In	12.10In	No Trip received	
4	9.90In	12.90In	0.5840	

**F.1.2. 2<sup>nd</sup> Harmonic Test**

**Fault type: Line to Earth fault**

Sr. No.	Values selected for test		Result	Remarks
	I-Diff	I <sub>2f</sub> /I <sub>diff</sub>		
1	1.10I/In	20.30 %	No Trip received	Operation of the relay found satisfactory
2	3.70I/In	19.20 %	Trip received	
3	6.20 I/In	20.60 %	No Trip received	
4	7.50 I/In	19.80 %	Trip received	

**Fault type: L-L-L (3 Ø) fault**

Sr. No.	Values selected for test		Result	Remarks
	I-Diff	I <sub>2f</sub> /I <sub>diff</sub>		
1	1.10I/In	20.30 %	No Trip received	Operation of the relay found satisfactory
2	3.70I/In	19.20 %	Trip received	
3	6.20 I/In	20.60 %	No Trip received	
4	7.50 I/In	19.80 %	Trip received	

**F.1.3. 5<sup>th</sup> Harmonic Test**

**Fault type: Line to Earth fault**

Sr. No.	Values selected for test		Results	Remarks
	I-Diff	I <sub>2f</sub> /I <sub>diff</sub>		
1	1.00I/In	39.10 %	No Trip received	Operation of the relay found satisfactory
2	3.60I/In	35.40 %	Trip received	
3	7.20 I/In	33.50 %	Trip received	
4	7.80 I/In	30.80 %	Trip received	

**Fault type: L-L-L (3 Ø) fault**

Sr. No.	Values selected for test		Results	Remarks
	I-Diff	I <sub>2f</sub> /I <sub>diff</sub>		
1	1.00I/In	39.10 %	No Trip received	Operation of the relay found satisfactory
2	3.60I/In	35.40 %	Trip received	
3	7.20 I/In	33.50 %	Trip received	
4	7.80 I/In	30.80 %	Trip received	



**H P POWER TRANSMISSION CORPORATION LIMITED.**  
**(A State Government Undertaking)**

236

**F.2. Restricted earth fault Relay**

**F.2.1 Ref fault test**

Sr. No.	Phase	Applied Current (A)	Results	Remarks
1	R Ø	0.200	Trip Received	Operation of the relay found satisfactory
2	Y Ø	0.100	Trip received	
3	B Ø	0.100	Trip received	

**F.2.2 Over flux test**

Sr. No.	Phase	Applied Voltage	Results	Remarks
1	R Ø	0	Trip Received	Operation of the relay found satisfactory
2	Y Ø	96.00		
3	B Ø	96.00		

**5. Bay no. B 207 (220 kV bay of ICT#2 400/220/33 kV)**

**A. Detailed of Equipment to be tested: Circuit Breaker**

<b>Make</b>	ALSTOM
-------------	--------

**A.1 Description of the test :Circuit Breaker Time Interval test**

**Results:**

Sr. No.	Operation Mode	R-Phase Time (mSec)	Y-Phase Time (mSec)	B-Phase Time (mSec)	Remarks
1.	Closing	21	21	21	Values are within permissible limits
2.	Opening	70	70	69	

**B. Detailed of Equipment to be tested: Relay test**

**B.1 Description of the test :Over Current & Earth fault Relay**

  
Assistant Engineer (P&C)  
O/o DGM (Prot. & Comm.)  
HPPTCL, Hamirpur (H.P.)



**H P POWER TRANSMISSION CORPORATION LIMITED.**  
(A State Government Undertaking)

237

Sr. No.	Phase	Applied Voltage	Applied Current	Remarks
1	R Ø	63.50 V	1.00 A	operation of the relay found satisfactory
2	Y Ø	63.50 V	1.50 A	
3	B Ø	63.50 V	1.00 A	

**C. Detailed of Equipment to be tested : Lightning Arrester**

<b>Make</b>	OBLUM ELECTRICAL INDUSTRIES PVT. LTD.
-------------	---------------------------------------

**C.1 Description of the test: Third harmonic Resistive Current Measurement**

Ambient Temperature- 14deg.C      System Voltage - 220 kV

Phase	3 <sup>rd</sup> Harmonic Resistive Current (µA)	3 <sup>rd</sup> Harmonic Resistive Current (Corrected) (µA)	Remarks
R	12	21	Values are within permissible limits
Y	13	24	
B	9	17	

**Surge Counter Reading**

Sr. No.	Description	R Phase	Y Phase	B Phase
1	Counter Sr. No.		1487	1498
2	Counter Make & Model	Crompton Greaves Ltd. & SC07-1		
3	Counter Reading	9	9	7

**6. Location: Bay no. 302 (Transformer 630 KVA, 33/.415 kV)**

**A. Description of Test: INSULATION RESITANCE TEST**

Main Winding	IR VALUE (GΩ)			Dielectric Absorption Index (60s/15s)	Polarization Index (600s/60s)	Remarks
	Time15 Sec.	Time60 Sec.	Time 600 Sec.			
HV to LV	23.5	30.40	45.50	1.30	1.50	Values are within permissible limits
HV to E	15.6	20.3	34.0	1.30	1.67	

Assistant Engineer (P&C)  
O/o DGM (Prot. & Comm.)  
HPPTCL, Hamirpur (H.P.)



(243)

**H P POWER TRANSMISSION CORPORATION LIMITED.**  
(A State Government Undertaking)

R	9	18	Values are within permissible limits
Y	43	82	
B	14	27	

**F. Detailed of Equipment to be tested : Differential Relay & Restricted Earth fault Relay**

Sr. No.	Relay Name	Relay make & Model	Remarks
1	Transformer Differential relay	Alstom &P 643	Slope test, 2 <sup>nd</sup> Harmonics & 5 <sup>th</sup> Harmonics of relay conducted successfully with the help of test universe software by selecting different values of Differential & Biased Currents in the operating region.
2	Ref relay	Alstom &P 643	(i) Pick up test of relay conducted by simulating current in neutral CT circuit of ICT.  (ii) Over flux test of relay conducted by injecting 1.5 times voltage of one Phase.

**F.1 Description of the test:**

**F.1.1 Differential Slope Test**

**Fault type: Line to Earth fault**

Sr. No.	Values selected for test		Trip Time(s)	Remarks
	I-Diff	I-Bias		
1	1.2In	2.60In	No Trip received	Operation of the relay found satisfactory
2	3.6In	5.10In	0.7535	
3	7.00In	9.10In	0.5679	
4	10.10In	14.00In	No Trip received	

**Fault type: Line to Line fault**

Values selected for test
--------------------------

*[Signature]*  
Secretary  
D/S DOM, P&L & Gen. M.  
HPPTCL, Haridwar (U.P.)



**H P POWER TRANSMISSION CORPORATION LIMITED.**  
(A State Government Undertaking)

244

Sr. No.	I-Diff	I-Bias	Trip Time(s)	Remarks
1	1.2In	2.60In	No Trip received	Operation of the relay found satisfactory
2	3.6In	5.10In	0.8866	
3	7.00In	9.10In	0.6687	
4	10.10In	14.00In	No Trip received	

**Fault type: 3 Ø fault**

Values selected for test				
Sr. No.	I-Diff	I-Bias	Trip Time(s)	Remarks
1	1.2In	2.60In	No Trip received	Operation of the relay found satisfactory
2	3.6In	5.10In	0.8866	
3	7.00In	9.10In	0.6687	
4	10.10In	14.00In	No Trip received	

**F.1.2. 2<sup>nd</sup> Harmonic Test**

**Fault type: Line to Earth fault**

Values selected for test				
Sr. No.	I-Diff	I2f/Idiff	Results	Remarks
1	0.80I/In	19.20 %	Trip received	Operation of the relay found satisfactory
2	2.50I/In	22.70 %	No Trip received	
3	4.40 I/In	19.50 %	Trip received	
4	6.00 I/In	23.50 %	No Trip received	

**Fault type: 3 Ø fault**

Values selected for test				
Sr. No.	I-Diff	I2f/Idiff	Results	Remarks
1	0.80I/In	19.20 %	Trip received	Operation of the relay found satisfactory
2	2.50I/In	22.70 %	No Trip received	
3	4.40 I/In	19.50 %	Trip received	
4	6.00 I/In	23.50 %	No Trip received	

**F.1.3. 5<sup>th</sup> Harmonic Test**

**Fault type: Line to Earth fault**

Values selected for test				
Sr. No.	I-Diff	I2f/Idiff	Result	Remarks
1	0.80I/In	19.20 %	Trip received	Operation of the relay found satisfactory
2	2.50I/In	22.70 %	No Trip received	
3	4.40 I/In	19.50 %	Trip received	
4	6.00 I/In	23.50 %	No Trip received	

**Fault type: 3 Ø fault**



H P POWER TRANSMISSION CORPORATION LIMITED.  
(A State Government Undertaking)

245

Sr. No.	Values selected for test		Result	Remarks
	I-Diff	I <sub>2f</sub> /I <sub>diff</sub>		
1	0.80I/In	19.20 %	Trip received	Operation of the relay found satisfactory
2	2.50I/In	22.70 %	No Trip received	
3	4.40 I/In	19.50 %	Trip received	
4	6.00 I/In	23.50 %	No Trip received	

**F.2. Restricted earth fault Relay**

**F.2.1 Ref fault test**

Sr. No.	Phase	Applied Current (A)	Result	Remarks
1	R Ø	0.100	Trip Received	Operation of the relay found satisfactory
2	Y Ø	0.100		
3	B Ø	0.100		

**F.2.2. Over flux test**

Sr. No.	Phase	Applied Voltage	Result	Remarks
1	R Ø	0	Trip received	Operation of the relay found satisfactory
2	Y Ø	96.00		
3	B Ø	63.50		

**8. Bay no. B 207 (220 kV bay of ICT#1 400/220/33 kV)**

**A. Detailed of Equipment to be tested: Circuit Breaker**

<b>Make</b>	ALSTOM
-------------	--------

**A.1 Description of the test :Circuit Breaker Time Interval test**

**Results:**

Sr. No.	Operation Mode	R-Phase Time (mSec)	Y-Phase Time (mSec)	B-Phase Time (mSec)	Remarks
1.	Closing	20	21	20	Values are within permissible limits
2.	Opening	70	70	69	

246



**H P POWER TRANSMISSION CORPORATION LIMITED.**  
**(A State Government Undertaking)**

**B. Detailed of Equipment to be tested: Relay test**

**B.1 Description of the test :Over Current & Earth fault Relay**

Sr. No.	Phase	Applied Voltage	Applied Current	Results	Remarks
1	R Ø	63.50 V	1.00 A	No trip received	Operation of the relay found satisfactory
2	Y Ø	63.50 V	2.00 A	Trip received	
3	B Ø	63.50 V	1.00 A	No trip received	

**C. Detailed of Equipment to be tested : Lightning Arrester**

<b>Make</b>	OBLUM ELECTRICAL INDUSTRIES PVT. LTD.
-------------	---------------------------------------

**C.1 Description of the test: Third harmonic Resistive Current Measurement**

Ambient Temperature- 22 deg.C      System Voltage - 220 kV

Phase	3 <sup>rd</sup> Harmonic Resistive Current (µA)	3 <sup>rd</sup> Harmonic Resistive Current (Corrected) (µA)	Remarks
R	61	24	Values are within permissible limits
Y	14	5	
B	13	5	

**9. Location: Bay no. 301 (Transformer 630 KVA, 33/.415 kV)**

**A. Description of Test: INSULATION RESITANCE TEST**

Main Winding	IR VALUE (GΩ)			Dielectric Absorption Index (60s/15s)	Polarization Index (600s/60s)	Remarks
	Time15 Sec.	Time60 Sec.	Time 600 Sec.			
HV to LV	15.5	22.8	53.50	1.47	2.34	Values are within permissible limits
HV to E	25.5	35.04	56.30	1.38	1.61	

**10. Location: Bay no.402 (Tie Breaker b/w bay no.401 & 403)**

**A. Detailed of Equipment to be tested: Circuit Breaker**

<b>Make</b>	Alstom
-------------	--------

*(Signature)*  
Assistant Engineer (P&C)  
O/o DGM (Prot. & Comm.)  
HPPTCL, Hamirpur (H.P.)



**H P POWER TRANSMISSION CORPORATION LIMITED.**  
(A State Government Undertaking)

253

**D. Detailed of Equipment to be tested: Distance Protection Relay (Main -1 & Main -2) & Back up Relay(Over current & Earth fault) –Details below:**

**Description of Test: Zone Reach Testing.**

S.. No.	Relay	Relay make & Model	Remarks
1	Distance relay (Main-I)	Alstom&P443	Zone reach Accuracy test conducted for Line to Earth, Line to Line & 3Ø fault by selecting different values of fault impedance (z) points for respective zones
2	Distance relay (Main-II)	ABB&REL670	Zone reach Accuracy test conducted for Line to Earth, Line to Line & 3Ø fault by selecting different values of fault impedance (z) points for respective zones
3	Backup Relay (O/C & E/F)	Alstom&P141	Pick up test of relay conducted by injecting current more than the current setting value for overcurrent in one Phase .

**D.1 Main-I Relay**

**Fault type: Line to Earth fault(L1-E)**

Sr. No.	Values selected for test			Result	Remarks
	(Z)Fault Impedance (Ω)	Phi (Angle)	Nominal Trip time(ms)		
1	17.65	34.51	30.00	Relay tripped in zone-1	Operation of the relay found satisfactory
2	33.12	64.92	380.00	Relay tripped in zone-2	
3	50.00	72.90	830.00	Relay tripped in zone-3	
4	15.91	-170.00	530.00	Relay tripped in zone-4	

**Fault type: Line to Line fault(L1-L2)**

Sr. No.	Values selected for test			Result	Remarks
	(Z)Fault Impedance (Ω)	Phi (Angle)	Nominal Trip time(ms)		
1	5.951	30.0	30.00	Relay tripped in zone-1	Operation of the relay found satisfactory
2	14.85	74.88	380.00	Relay tripped in zone-2	



**H P POWER TRANSMISSION CORPORATION LIMITED.**  
(A State Government Undertaking)

254

3	25.97	77.31	830.00	Relay tripped in zone-3	
4	7.639	-180.0	530.00	Relay tripped in zone-4	

**Fault type: 3 Phase fault(L1-L2-L3)**

Values selected for test					
Sr. No.	(Z)Fault Impedance ( $\Omega$ )	Phi (Angle)	Nominal Trip time(ms)	Result	Remarks
1	5.951	30.0	30.00	Relay tripped in zone-1	Operation of the relay found satisfactory
2	14.85	74.88	380.00	Relay tripped in zone-2	
3	25.97	77.31	830.00	Relay tripped in zone-3	
4	7.639	-180.0	530.00	Relay tripped in zone-4	

**D.2 Main-II**

**Fault type: Line to Earth fault(L2-E)**

Values selected for test					
Sr. No.	(Z)Fault Impedance ( $\Omega$ )	Phi (Angle)	Nominal Trip time(ms)	Result	Remarks
1	11.10	30.0	24.00	Relay tripped in zone-1	Operation of the relay found satisfactory
2	20.00	60.0	374.0	Relay tripped in zone-2	
3	27.10	74.79	824.0	Relay tripped in zone-3	
4	12.60	-180.0	524.0	Relay tripped in zone-4	

**Fault type: Line to Line fault(L1-L2)**

Values selected for test					
Sr. No.	(Z)Fault Impedance ( $\Omega$ )	Phi (Angle)	Nominal Trip time(ms)	Result	Remarks
1	6.271	40.00	24.00	Relay tripped in zone-1	Operation of the relay found satisfactory
2	10.00	50.00	374.0	Relay tripped in zone-2	
3	14.68	60.00	824.0	Relay tripped in zone-3	
4	7.565	180.00	524.0	Relay tripped in zone-4	

**Fault type: 3 Phase fault(L1-L2-L3)**

Values selected for test					
Sr. No.	(Z)Fault Impedance ( $\Omega$ )	Phi (Angle)	Nominal Trip time(ms)	Result	Remarks
1	6.271	40.00	24.00	Relay tripped	Operation of



(255)

**H P POWER TRANSMISSION CORPORATION LIMITED.**  
(A State Government Undertaking)

				in zone-1	the relay found satisfactory
2	10.00	50.00	374.0	Relay tripped in zone-2	
3	14.68	60.00	824.0	Relay tripped in zone-3	
4	7.565	180.00	524.0	Relay tripped in zone-4	

**D.3 Over Current & Earth fault Relay**

Sr. No.	Phase	Applied Current	Result	Remarks
1	R Ø	1.00 A	No trip received	operation of the relay found satisfactory
2	Y Ø	1.00 A	No trip received	
3	B Ø	2.00 A	Trip received	

**14. Location: Bay no.204 (220 kV Line Gumma - Hatkoti) Spare bay**

**A. Detailed of Equipment to be tested: Circuit Breaker**

Make	Alstom
------	--------

**A.1 Description of the test :Circuit Breaker Time Interval test**

**Results:**

Sr. No.	Operation Mode	R-Phase Time (mSec)	Y-Phase Time (mSec)	B-Phase Time (mSec)	Remarks
1.	Closing	69	69	70	
2.	Opening	19	19	19	

**15. Location: Bay no.206 (220 kV Bus Coupler)**

**A. Detailed of Equipment to be tested: Circuit Breaker**

Make	Alstom
------	--------

Bay 407 Z1 , 407 Z2 , 407 Z3

Guwama - Thakri C&T-1

Annexure - B

407 Z1

**Distance:**

**Test Module**

Name:	OMICRON Distance	Version:	4.30
Test Start:	21-Oct-2023 16:11:43	Test End:	21-Oct-2023 16:11:46
User Name:		Manager:	
Company:			

**Test Results**

**Shot Test: Fault Type L1-E**

Z	Phi	t nom	t act.	Dev.	I Test	Result
14.61 $\Omega$	40.00 °	30.00 ms	24.20 ms	-19.33 %	2.000 A	Passed

**Test State:**

Test passed  
Overload occurred during testing!

  
(J.E)

Bay 407 Z1, 407 Z2, 407 Z3

407 Z2

**Distance:**

**Test Module**

Name:	OMICRON Distance	Version:	4.30
Test Start:	21-Oct-2023 16:13:02	Test End:	21-Oct-2023 16:13:06
User Name:		Manager:	
Company:			

**Test Results**

**Shot Test: Fault Type L1-E**

Z	Phi	t nom	t act.	Dev.	I Test	Result
24.15 $\Omega$	44.76 °	530.0 ms	522.3 ms	-1.453 %	2.000 A	Passed

**Test State:**

Test passed

  
(J.E)

407 23

**Distance:**

**Test Module**

Name: OMICRON Distance Version: 4.30  
Test Start: 21-Oct-2023 16:14:19 Test End: 21-Oct-2023 16:14:24  
User Name: Manager:  
Company:

**Test Results**

**Shot Test: Fault Type L1-E**

Z	Phi	t nom	t act.	Dev.	I Test	Result
35.31 $\Omega$	55.50 °	1.030 s	1.016 s	-1.32 %	2.000 A	Passed

**Test State:**

Test passed

(N)  
(J-E)

Panchkula CKT-1

409 21

**Distance:**

**Test Module**

Name: OMICRON Distance      Version: 4.30  
Test Start: 21-Oct-2023 15:24:32      Test End: 21-Oct-2023 15:24:36  
User Name:      Manager:  
Company:

**Test Results**

**Shot Test: Fault Type L1-E**

Z	Phi	t nom	t act.	Dev.	I Test	Result
17.97 $\Omega$	40.00 °	30.00 ms	19.60 ms	-34.67 %	2.000 A	Passed

**Test State:**  
**Test passed**

  
(J.E)

409 Z2

**Distance:**

**Test Module**

Name: OMICRON Distance      Version: 4.30  
Test Start: 21-Oct-2023 15:25:50      Test End: 21-Oct-2023 15:25:55  
User Name:      Manager:  
Company:

**Test Results**

**Shot Test: Fault Type L1-E**

Z	Phi	t nom	t act.	Dev.	I Test	Result
44.72 $\Omega$	63.43 °	530.0 ms	516.1 ms	-2.623 %	1.704 A	Passed

**Test State:**  
Test passed

  
(J.B)

409 23

**Distance:**

**Test Module**

Name:	OMICRON Distance	Version:	4.30
Test Start:	21-Oct-2023 15:27:05	Test End:	21-Oct-2023 15:27:10
User Name:		Manager:	
Company:			

**Test Results**

**Shot Test: Fault Type L1-E**

Z	Phi	t nom	t act.	Dev.	I Test	Result
71.05 $\Omega$	66.00 °	1.530 s	1.550 s	1.281 %	1.073 A	Passed

**Test State:**  
Test passed

  
(Se)

Bay 203 Zone-1 Gunna Hat Koti CKT-1

**Distance:**

**Test Module**

Name: OMICRON Distance Version: 4.30  
Test Start: 19-Oct-2023 17:21:34 Test End: 19-Oct-2023 17:21:37  
User Name: Manager:  
Company:

**Test Results**

**Shot Test: Fault Type L1-E**

Z	Phi	t nom	t act.	Dev.	I Test	Result
8.036 Ω	40.00 °	30.00 ms	21.30 ms	-29 %	2.000 A	Passed

**Test State:**  
Test passed

~~(N)~~  
(JE)

203 line-2 Zone-3

**Distance:**

**Test Module**

Name: OMICRON Distance Version: 4.30  
Test Start: 19-Oct-2023 17:29:14 Test End: 19-Oct-2023 17:29:21  
User Name: Manager:  
Company:

**Test Results**

**Shot Test: Fault Type L1-E**

Z	Phi	t nom	t act.	Dev.	I Test	Result
25.25 $\Omega$	73.81 °	830.0 ms	818.5 ms	-1.385 %	2.000 A	Passed

**Shot Test: Fault Type L2-E**

Z	Phi	t nom	t act.	Dev.	I Test	Result
26.37 $\Omega$	67.71 °	830.0 ms	817.8 ms	-1.47 %	2.000 A	Passed

**Test State:**

Test passed

  
(J.E)

Bang 204, 2020-1  
Guna - Hattkoti Oct-2

**Distance:**

**Test Module**

Name: OMICRON Distance      Version: 4.30  
Test Start: 19-Oct-2023 17:22:51      Test End: 19-Oct-2023 17:22:55  
User Name:      Manager:  
Company:

**Test Results**

**Shot Test: Fault Type L1-E**

Z	Phi	t nom	t act.	Dev.	I Test	Result
5.667 $\Omega$	40.00 °	30.00 ms	20.20 ms	-32.67 %	2.000 A	Passed

**Test State:**  
Test passed

  
(J.E)

Bay 204, 20W-3

**Distance:**

**Test Module**

Name:	OMICRON Distance	Version:	4.30
Test Start:	19-Oct-2023 17:32:11	Test End:	19-Oct-2023 17:32:16
User Name:		Manager:	
Company:			

**Test Results**

**Shot Test: Fault Type L1-E**

Z	Phi	t nom	t act.	Dev.	I Test	Result
30.00 $\Omega$	62.70 °	830.0 ms	818.5 ms	-1.385 %	2.000 A	Passed

**Test State:**  
**Test passed**



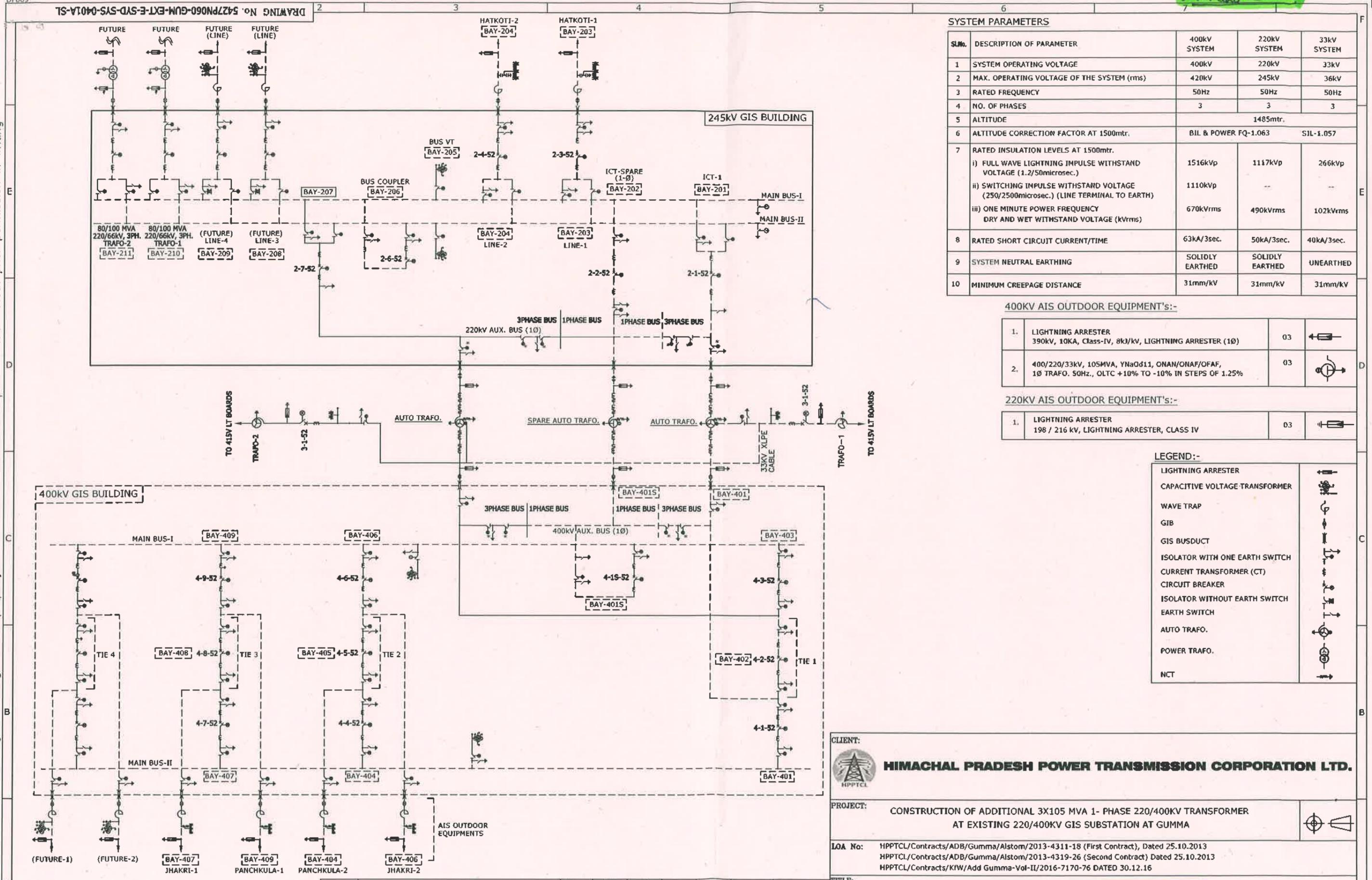
JE

Annexure-C

DF009

DRAWING No. 5427PN060-GUM-EXT-E-SYD-SYS-0401A-SL

This drawing and design is the property of GE and must not be copied or lent without prior permission in writing



SYSTEM PARAMETERS

Sl.No.	DESCRIPTION OF PARAMETER	400kV SYSTEM	220kV SYSTEM	33kV SYSTEM
1	SYSTEM OPERATING VOLTAGE	400kV	220kV	33kV
2	MAX. OPERATING VOLTAGE OF THE SYSTEM (rms)	420kV	245kV	36kV
3	RATED FREQUENCY	50Hz	50Hz	50Hz
4	NO. OF PHASES	3	3	3
5	ALTITUDE	1485mtr.		
6	ALTITUDE CORRECTION FACTOR AT 1500mtr.	BIL & POWER FQ-1.063		SIL-1.057
7	RATED INSULATION LEVELS AT 1500mtr.			
	i) FULL WAVE LIGHTNING IMPULSE WITHSTAND VOLTAGE (1.2/50microsec.)	1516kVp	1117kVp	266kVp
	ii) SWITCHING IMPULSE WITHSTAND VOLTAGE (250/2500microsec.) (LINE TERMINAL TO EARTH)	1110kVp	--	--
	iii) ONE MINUTE POWER FREQUENCY DRY AND WET WITHSTAND VOLTAGE (kVrms)	670kVrms	490kVrms	102kVrms
8	RATED SHORT CIRCUIT CURRENT/TIME	63kA/3sec.	50kA/3sec.	40kA/3sec.
9	SYSTEM NEUTRAL EARTHING	SOLIDLY EARTHED	SOLIDLY EARTHED	UNEARTHED
10	MINIMUM CREEPAGE DISTANCE	31mm/kV	31mm/kV	31mm/kV

400KV AIS OUTDOOR EQUIPMENT'S:-

1.	LIGHTNING ARRESTER 390kV, 10KA, Class-IV, 8kV/kV, LIGHTNING ARRESTER (10)	03	
2.	400/220/33kV, 105MVA, YNa0d11, ONAN/ONAF/OFAP, 10 TRAFO. 50Hz., OLTC +10% TO -10% IN STEPS OF 1.25%	03	

220KV AIS OUTDOOR EQUIPMENT'S:-

1.	LIGHTNING ARRESTER 198 / 216 kV, LIGHTNING ARRESTER, CLASS IV	03	
----	--	----	--

LEGEND:-

LIGHTNING ARRESTER	
CAPACITIVE VOLTAGE TRANSFORMER	
WAVE TRAP	
GIB	
GIS BUSDUCT	
ISOLATOR WITH ONE EARTH SWITCH	
CURRENT TRANSFORMER (CT)	
CIRCUIT BREAKER	
ISOLATOR WITHOUT EARTH SWITCH	
EARTH SWITCH	
AUTO TRAFO.	
POWER TRAFO.	
NCT	

CLIENT: **HIMACHAL PRADESH POWER TRANSMISSION CORPORATION LTD.**

PROJECT: CONSTRUCTION OF ADDITIONAL 3X105 MVA 1- PHASE 220/400KV TRANSFORMER AT EXISTING 220/400KV GIS SUBSTATION AT GUMMA

LOA No: HPPTCL/Contracts/ADB/Gumma/Alstom/2013-4311-18 (First Contract), Dated 25.10.2013  
 HPPTCL/Contracts/ADB/Gumma/Alstom/2013-4319-26 (Second Contract) Dated 25.10.2013  
 HPPTCL/Contracts/KPW/Add Gumma-Vol-II/2016-7170-76 DATED 30.12.16

TITLE: **KEY SLD FOR 400/220 KV SUBSTATION**

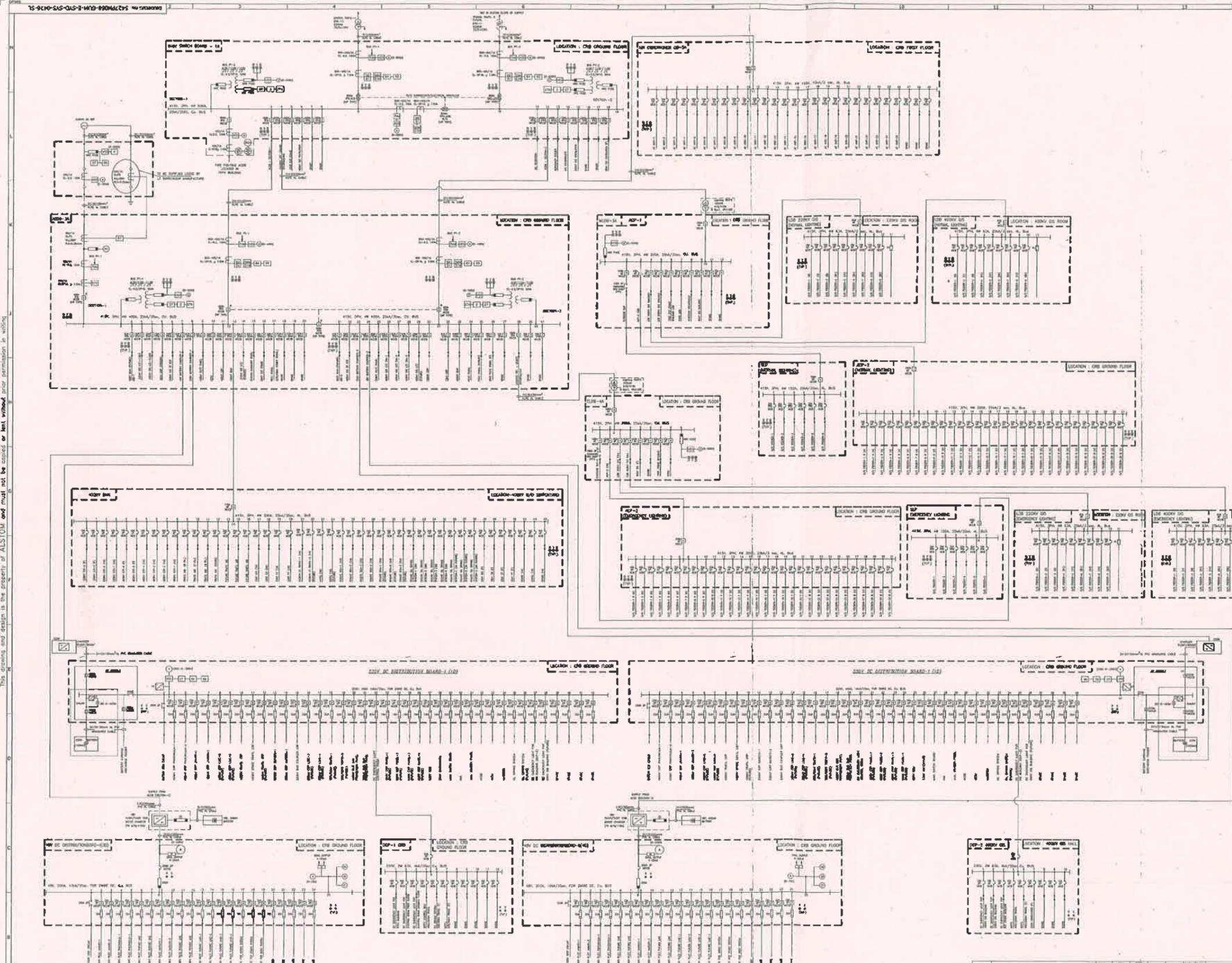
1	SECOND ISSUE	Name	SNT	KS	MGL	APPROVAL
		Date	08.11.19	08.11.19	08.11.19	
		Sign.				
0	FIRST ISSUE	Name	SNT	SCJ	DMH	APPROVAL
		Date	22.03.17	22.03.17	22.03.17	
		Sign.				
REV.No.	DESCRIPTION	DATE	DRAWN	ELE.	CIVIL	MECH.
				CHECKED		
				APPROVED		STATUS

A3 GE T&D INDIA LTD (Formerly ALSTOM T&D INDIA LTD) A-7, SECTOR-65 NOIDA - 201301 UTTAR PRADESH (INDIA).

DRAWING No. 5427PN060-GUM-EXT-E-SYD-SYS-0401A-SL

TOTAL SH. 1 SH.No. 1 REV. 1 SCALE NTS 1 OF 1

Annexure = D



NO.	DESCRIPTION	QTY
1	11KV SWITCH BOARD - 1A	1
2	MTR - 2A	1
3	MTR - 2A	1
4	ELCB - 6A	1
5	AIR CONDENSER 20 - 5A	1
6	ESSRY ODR - 10 x 20	1
7	MTR ODR - 30 x 40	1
8	ACP - 1 (SHEDD LIGHTING PANEL)	1
9	SLP (SHEDD SUB LIGHTING PANEL)	1
10	ELCB	1
11	ELCB	1
12	ELCB	1

NO.	DESCRIPTION	QTY
1	11KV SWITCH BOARD - 1A	1
2	MTR - 2A	1
3	MTR - 2A	1
4	ELCB - 6A	1
5	AIR CONDENSER 20 - 5A	1
6	ESSRY ODR - 10 x 20	1
7	MTR ODR - 30 x 40	1
8	ACP - 1 (SHEDD LIGHTING PANEL)	1
9	SLP (SHEDD SUB LIGHTING PANEL)	1
10	ELCB	1
11	ELCB	1
12	ELCB	1

NO.	DESCRIPTION	QTY
1	11KV SWITCH BOARD - 1A	1
2	MTR - 2A	1
3	MTR - 2A	1
4	ELCB - 6A	1
5	AIR CONDENSER 20 - 5A	1
6	ESSRY ODR - 10 x 20	1
7	MTR ODR - 30 x 40	1
8	ACP - 1 (SHEDD LIGHTING PANEL)	1
9	SLP (SHEDD SUB LIGHTING PANEL)	1
10	ELCB	1
11	ELCB	1
12	ELCB	1

NO.	DESCRIPTION	DATE	BY	CHKD	APPROVAL
05	REVIEW AS PER CUSTOMER COMMENTS DATED 26.06.2015	26.06.2015	[Signature]	[Signature]	[Signature]
04	REVIEW AS PER CUSTOMER COMMENTS DATED 27.06.2015	27.06.2015	[Signature]	[Signature]	[Signature]
03	REVIEW AS PER CUSTOMER COMMENTS DATED 27.06.2015	27.06.2015	[Signature]	[Signature]	[Signature]
02	REVIEW AS PER CUSTOMER COMMENTS DATED 27.06.2015	27.06.2015	[Signature]	[Signature]	[Signature]
01	REVIEW AS PER CUSTOMER COMMENTS DATED 27.06.2015	27.06.2015	[Signature]	[Signature]	[Signature]
00	PREP SHEET	27.06.2015	[Signature]	[Signature]	[Signature]

**HIMACHAL PRADESH POWER TRANSMISSION CORPORATION LTD.**

400/220KV GDS SUB STATION AT GEMBA

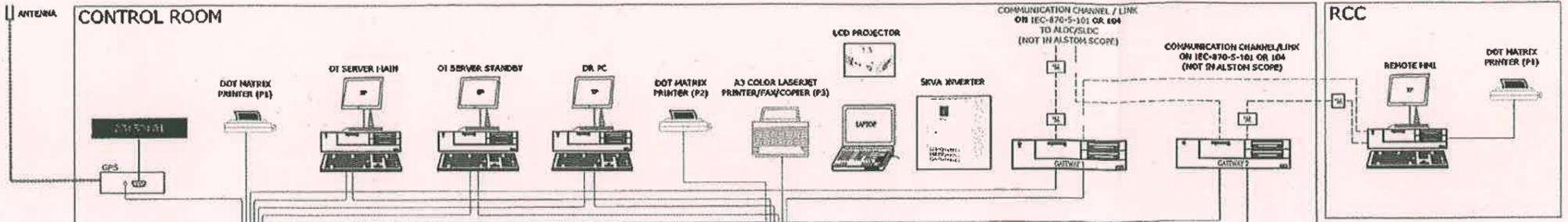
400/220KV GDS SUB STATION AT GEMBA

ALSTOM INDIA LTD.

400/220KV GDS SUB STATION AT GEMBA

NO.	DESCRIPTION	DATE	BY	CHKD	APPROVAL
05	REVIEW AS PER CUSTOMER COMMENTS DATED 26.06.2015	26.06.2015	[Signature]	[Signature]	[Signature]
04	REVIEW AS PER CUSTOMER COMMENTS DATED 27.06.2015	27.06.2015	[Signature]	[Signature]	[Signature]
03	REVIEW AS PER CUSTOMER COMMENTS DATED 27.06.2015	27.06.2015	[Signature]	[Signature]	[Signature]
02	REVIEW AS PER CUSTOMER COMMENTS DATED 27.06.2015	27.06.2015	[Signature]	[Signature]	[Signature]
01	REVIEW AS PER CUSTOMER COMMENTS DATED 27.06.2015	27.06.2015	[Signature]	[Signature]	[Signature]
00	PREP SHEET	27.06.2015	[Signature]	[Signature]	[Signature]

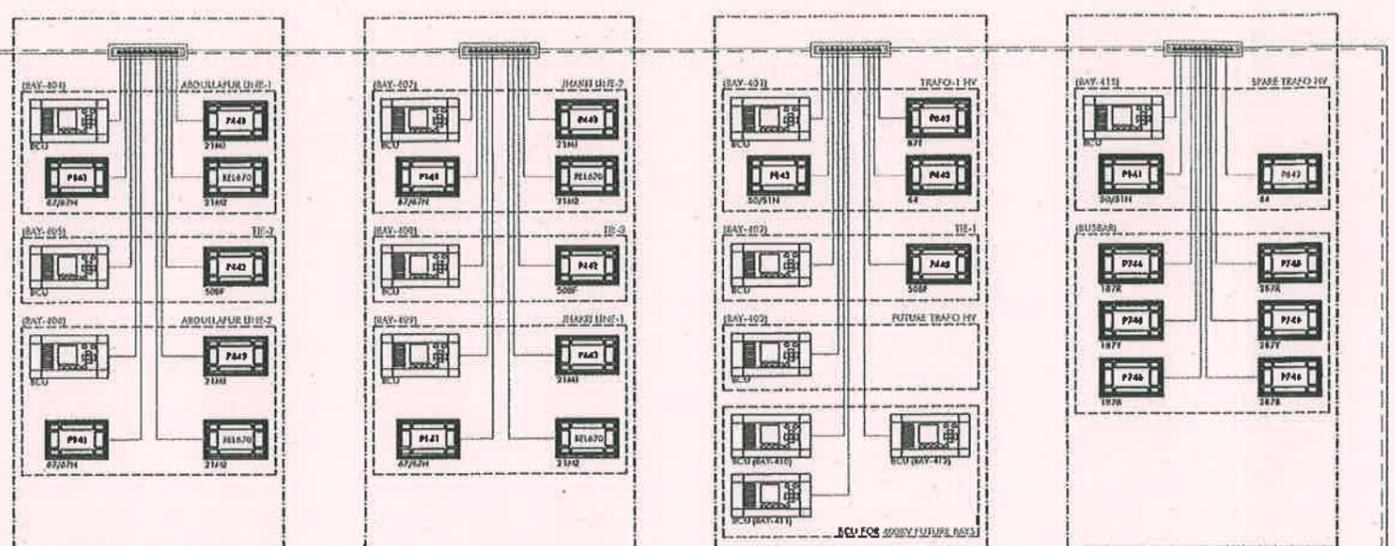
NOTE: \* IN CASE THE COMMUNICATION TO RCC & SLDC IS ON IEC-104/IEC-61850 THEN MODEMS WILL NOT BE SUPPLIED.



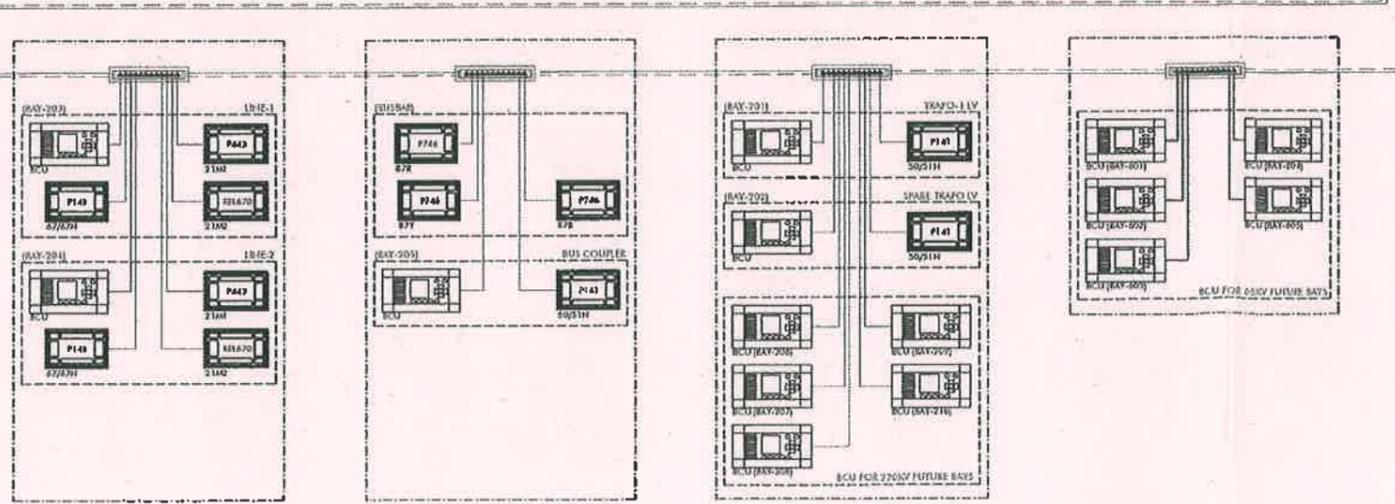
S.NO.	RELAY	DESCRIPTION
1	87T	TRAFQ DIFFERENTIAL PROTECTION
2	64	REF PROTECTION
3	50/51M	BACKUP O/C & E/F PROTECTION
4	50BF	TIE BREAKER FAILURE PROTECTION
5	21M1	DISTANCE PROTECTION MAIN-1
6	21M2	DISTANCE PROTECTION MAIN-2
7	67/67N	BACKUP DR O/C & E/F PROTECTION
8	187 RYB / 287 RYB	INTEGRATED BUSBAR PROTECTION RELAY

100Mbps DUAL REDUNDANT ETHERNET FIBRE RING - (PROTOCOL IEC - 61850)

400KV SIDE



220KV SIDE



S.NO.	DESCRIPTION	QTY.	HARDWARE/SOFTWARE SPECIFICATION
1	OI SERVER WORKSTATION (MAIN & STANDBY)	2	MAKE: ADVANTECH ; AS PER APPROVED GTP
2	ENGINEERING/DR WORKSTATION	1	MAKE: ADVANTECH ; AS PER APPROVED GTP
3	LAPTOP (PORTABLE ENGINEERING/DR WORKSTATION)	1	MAKE: HP/DELL ; AS PER APPROVED GTP
4	REMOTE HMI WORKSTATION	1	MAKE: ADVANTECH ; AS PER APPROVED GTP
5	GATEWAY WORKSTATION	2	MAKE: ADVANTECH ; AS PER APPROVED GTP
6	MONITOR 27"	4	MAKE: PREBONIC/DELL ; AS PER APPROVED GTP
7	DOT MATRIX PRINTER	3	MAKE: EPSON ; AS PER APPROVED GTP
8	COLOUR LASER JET PRINTER - A3	1	MAKE: HP/CANON/XEROX ; AS PER APPROVED GTP
9	MODEM (M)	4	MAKE: DECODE ; AS PER APPROVED GTP
10	LCD PROJECTOR	1	MAKE: PANASONIC/SANYO/NEC/CANON ; AS PER APPROVED GTP
11	INVERTER - 5KVA	1	MAKE: NUMERIC/DIGILINE/ALAN/APC ; AS PER APPROVED GTP
12	GPS RECEIVER (WITH ANTENNA & TIME DISPLAY UNIT)	1	MAKE: MASIBUS ; AS PER APPROVED GTP
13	BAY CONTROL UNIT (BCU)	28	MAKE: ALSTOM ; CONFIGURED AS PER SCHEMATIC ; REFER BOQ FOR DETAILS
14	EPS (12TX+4FX)	10	MAKE: RUGGEDCOM/ISS/HERSCHMANN/RAD ; AS PER APPROVED GTP ; REFER BOQ FOR DETAILS

**LEGEND**

- COAXIAL CABLE
- ETHERNET COPPER PATCH CORD
- FIBRE OPTIC PATCH CORD MAIN
- FIBRE OPTIC PATCH CORD REDUNDANT
- SERIAL LINK
- PARALLEL LINK

Note:- i) PLC/OPGW media selection facility should be available at remote end.  
 ii) DC battery charging +/- indication facility at remote end should be available.  
 iii) TVM making data should be available at SCADA/Remote end.  
 iv) Online DGA data, hydrant status etc. should be available at remote/SCADA.  
 v) All required facilities as per Annexure-1, Section VIII (CSAG), should be available.

*Jalinder*  
 Assistant Engineer (E)  
 DGM & Head Trans Design  
 HPPTCL, Anu, Hamirpur (HP)

*Prakash*  
 Sr. Manager  
 DGM & Head Trans Design,  
 HPPTCL, Hamirpur (H.P.)

Approved subject to incorporation of notes  
*Alexander*  
 DGM & Head Trans Design,  
 HPPTCL, Anu, Hamirpur (H.P.)

CUSTOMER : HPPTCL		PROJECT : 400/220KV CRP & S&S AT HPPTCL, GUMMA	
CLIENT BOQ NO: 5427PN060-GUM-U-SYD-S&S-7005-SY		LOA NO : LOA/5427/PCP/HPPTCL-GUMMA	
CONTRACTOR : ALSTOM T&D INDIA LTD.		DATE : 31.10.2013	
PROJECT : 400/220KV CRP & S&S AT HPPTCL, GUMMA		SYSTEM ARCHITECTURE DRAWING	
TITLE : SYSTEM ARCHITECTURE		ALSTOM	
ALSTOM T&D INDIA LIMITED - ASSOCIATION SAS PALLAURAM CHENNAI-600043		PREPARED BY: RA	
ENCLAVE NO. : 1028		SCALE : -	
SALES ORDER NO. : 318903867		SHT 2 OF 2	
REV		DATE	
REV 1		DATE: 28.10.2014	

Annexure-1

**CURRENT TRANSFORMER**  
According to IEC 60044-1

Ith = 63kA, 3s Idyn = 157.5kA Ict = 120% Ict = Ict

CT No	Bay Name	Customer Ref	Quantity (1 phase)	Alstom Ref	Application	Client Ref	Ratio (A)	Accuracy class	Burden (VA)	Max. kV (V/k)	RCT (Ω) at 75deg C	Max. Exciting Current (mA) at V/KZ	ISF
-------	----------	--------------	--------------------	------------	-------------	------------	-----------	----------------	-------------	---------------	--------------------	------------------------------------	-----

**LINE BAY CT**

CT-1	BAY 06 - BAY 04 BAY 09 - BAY 07	4-4-CT1, 4-6-CT2 4-7-CT1, 4-9-CT2	P1	F1	Busbar Differential Protection-2	CORE 1	4000 / 1	PS	-	4000	20	20	ISF < 5	
							2000 / 1	PS				10		30
							1000 / 1	PS				5		60
CT-2	BAY 06 - BAY 04 BAY 09 - BAY 07	4-4-CT1, 4-6-CT2 4-7-CT1, 4-9-CT2	P2	N2	Metering+BCU	CORE 3	4000 / 1	0.25	20	-	-	-	ISF < 5	
							2000 / 1	0.25				20		30
							1000 / 1	0.25				20		60
CT-3	BAY 03 - BAY 01 BAY 15	4-1-CT1, 4-3-CT2 4-1S-CT2	P1	F3	Busbar Differential Protection-2	CORE 1	2000 / 1	PS	-	2000	10	20	ISF < 5	
							1000 / 1	PS				5		30
							500 / 1	PS				2.5		60
CT-4	BAY 03 - BAY 01 BAY 15	4-1-CT1, 4-3-CT2 4-1S-CT1	P2	F3	Busbar Differential Protection-1	CORE 2	2000 / 1	PS	-	2000	10	20	ISF < 5	
							1000 / 1	PS				5		30
							500 / 1	PS				2.5		60
CT-5	BAY 05 - BAY 08 BAY 02	4-5-CT2, 4-8-CT2 4-2-CT2	P1	F5	Trafo Diff. Prot./ Line Distance Main I	CORE 1	4000 / 1	PS	-	4000	20	20	ISF < 5	
							2000 / 1	PS				10		30
							1000 / 1	PS				5		60
CT-6	BAY 05 - BAY 08 BAY 02	4-5-CT1, 4-8-CT1 4-2-CT1	P2	N2	Metering+BCU	CORE 3	4000 / 1	0.25	20	-	-	-	ISF < 5	
							2000 / 1	0.25				20		30
							1000 / 1	0.25				20		60

**TRANSFORMER BAY CT**

CT-3	BAY 03 - BAY 01 BAY 15	4-1-CT1, 4-3-CT2 4-1S-CT2	P1	F3	Busbar Differential Protection-2	CORE 1	2000 / 1	PS	-	2000	10	20	ISF < 5	
							1000 / 1	PS				5		30
							500 / 1	PS				2.5		60
CT-4	BAY 03 - BAY 01 BAY 15	4-1-CT1, 4-3-CT1 4-1S-CT1	P2	F3	Busbar Differential Protection-1	CORE 2	2000 / 1	PS	-	2000	10	20	ISF < 5	
							1000 / 1	PS				5		30
							500 / 1	PS				2.5		60
CT-5	BAY 05 - BAY 08 BAY 02	4-5-CT2, 4-8-CT2 4-2-CT2	P1	F5	Trafo Backup Protection	CORE 5	2000 / 1	PS	-	2000	10	20	ISF < 5	
							1000 / 1	PS				5		30
							500 / 1	PS				2.5		60
CT-6	BAY 05 - BAY 08 BAY 02	4-5-CT1, 4-8-CT1 4-2-CT1	P2	N2	Metering+BCU	CORE 3	4000 / 1	0.25	20	-	-	-	ISF < 5	
							2000 / 1	0.25				20		30
							1000 / 1	0.25				20		60

**TIE BREAKER CT**

CT-5	BAY 05 - BAY 08 BAY 02	4-5-CT2, 4-8-CT2 4-2-CT2	P1	F5	Trafo Diff. Prot./ Line Distance Main I	CORE 1	4000 / 1	PS	-	4000	20	20	ISF < 5	
							2000 / 1	PS				10		30
							1000 / 1	PS				5		60
CT-6	BAY 05 - BAY 08 BAY 02	4-5-CT1, 4-8-CT1 4-2-CT1	P2	N2	Metering+BCU	CORE 3	4000 / 1	0.25	20	-	-	-	ISF < 5	
							2000 / 1	0.25				20		30
							1000 / 1	0.25				20		60

**VOLTAGE TRANSFORMER DATA (EMVT)**

VT NO	BAY NAME	Quantity (1 phase)	Core	Ratio (kV)	Class	Output (VA)	Tr rmal Burden
T15	METERING	6 Nos	VT-1	400kV / 0.11kV	3P	50	1000
T25	METERING	6 Nos	VT-2	400kV / 0.11kV	3P	50	1000
			VT-3	400kV / 0.11kV	0.2	50	1000

CT DESIGNATION	BURDEN	CLASS	CORE NO.	RATIO
LINE CVTs (12 Nos.)	60 VA	0.2	1	400kV / 110V / 3
4-4-CVT, 4-4-CVT	60 VA	3P	2	400kV / 110V / 3
4-9-CVT, 4-7-CVT	60 VA	..	..	400kV / 110V / 3

**33KV CT**

CT No	Application	Core	Ratio	Accuracy class	Burden (VA)	ISF
3-1-CT	PROTECTION	CORE 1	50 / 1	SP10	10	-
	METERING	CORE 2	50 / 1	0.5	10	5

VT NO	Application	Ratio (kV)	Class	Output (VA)
3-1-VT	PROTECTION	33kV / 0.11kV	SP	10
	METERING	0.5	0.5	10

\* Insulation level and short-circuit current (I<sub>sc</sub>) to be intensified in separate drawing.

\* One minute power frequency withstand voltage dry/wet to be intensified in separate drawing.

**REPORT OF INTERNAL PROTECTION AUDIT**

As per IEGC-2023 & HQ, Internal Protection audit of NAPS is to be carried out Annually. Committee has been constituted against letter no. NAPS/CS/2.26/2023/S-142 Dt. 27.10.2023.

Annual Internal Protection audit of NAPS was done on **28.03.2024** and details of audit are tabulated below:-

A. General Information:								
1.	Name of Generating station:	Narora Atomic Power station, Narora, Bulandshahr (UP)						
2.	Type of Bus Switching Scheme:	Double Main & Transfer scheme						
3. Names of Audit Team:								
Sh. S.K. Goyal, SE(E&I), Team Leader								
Sh. Harish Sharma, EMU, Member								
Sh. Satish Kumar, Operation, Member								
Smt. Arpita Chakravorty, TSU(E&I), Member Secretary								
B. Instrument Transformer								
B1	Name of 220KV transmission bay	Current Transformer (CT)		Capacitive Voltage Transformer (CVT)		Voltage Transformer (VT)		Lightning Arrester (LA)
		Date of Ratio Testing	Date of Capacitance & tan delta Testing	Date of Ratio Testing	Date of Capacitance & tan delta Testing	Date of Ratio Testing	Date of Capacitance & tan delta Testing	
1	220KV Line-1 (Sambhal)	25.11.23	25.11.23	25.11.23	25.11.23	-	-	06.09.23
2	220KV Line-2 (Simbhoil)	30.11.23	30.11.23	30.11.23	30.11.23	-	-	03.12.23
3	220KV-LINE-3 (Dibai)	25.05.22	25.05.22	27.01.22	27.01.22	-	-	20.09.23
4	220KV-LINE-4 (Khurja)	29.05.22	29.05.22	27.01.22	27.01.22	-	-	17.12.23
5	220KV-LINE-5(Atrauli)	29.05.22	29.05.22	07.02.22	07.02.22	-	-	24.12.23
6	220KV Bus Coupler Bay	28.05.22	28.05.22	-	-	-	-	-
7	220KV Transfer Bay	26.05.22	26.05.22	-	-	-	-	-
8	220KV GT-1 Bay	09.12.23	10.12.23	-	-	-	-	21.11.23
9	220KV SUT-1 Bay	25.05.22	25.05.22	-	-	-	-	16.02.24
10	220KV GT-2 Bay	09.12.23	10.12.23	-	-	-	-	09.11.23
11	220KV SUT-2 Bay	26.12.23	26.12.23	-	-	-	-	21.12.23
12	220KV Bus-B	-	-	-	-	-	-	-
13	220KV Bus-C	-	-	-	-	-	-	-

*Sharma*  
28/3/24

*Asst. Secy*  
28.3.24

*S. K. Goyal*  
28.3.24

*S. K. Goyal*  
28/03/24

C. Availability of Protection System		Make and Model of Bus Bar relay		Date of testing	
C1)	Bus Bar relay (220 KV)				
1	Bus-B Bus Bar differential protection	ABB Make, Model-RADSS		20.12.2023	
2	Bus-C Bus Bar differential protection	ABB Make, Model-RADSS		03.01.2024	

D. Transmission Line Protection-											
D1	Name of Line	Main-I Protection	Availability (Yes or No)	Date of testing	Main-II Protection	Back up Protection	Availability (Yes or No)	Date of testing	LBB Protection	Availability (Yes or No)	Date of testing
1	NAPS-SAMBHAL	Make	Yes	02.08.2023	Not Provided	Make	Yes	02.08.2023	Make	Yes	02.08.2023
2	NAPS-SIMBHOLI	AREVA, Model-P442	Yes	01.08.2023	Provided	English Electric, Model CDD-26	Yes	01.08.2023	ABB, Model RAICA	Yes	01.08.2023
3	NAPS-DIBAI	Model-P442	Yes	28.08.2023			Yes	28.08.2023		Yes	28.08.2023
4	NAPS-KHURJA		Yes	15.12.2023			Yes	15.12.2023		Yes	15.12.2023
5	NAPS-ATRAULI		Yes	04.08.2023			Yes	04.08.2023		Yes	04.08.2023
D2	Whether all numerical relays are time synchronized										Yes
D3	Whether all numerical relays are configured for Disturbance recording										Yes
D4	Whether all numerical relays are provided with PLCC										Yes

E. Transmission line parameters										
E1	Name of the line	NAPS-Sambhal	NAPS-Simboli	NAPS-Dibai	NAPS-Khurja	NAPS-Atrauli				
1	Line length	64.01 Km	83.675 Km	21.0618 Km	60.05 Km	38.577 Km				
2	Line parameters (in ohms/ per KM/ per phase primary value)									
	R1	0.075	0.075	0.075	0.075	0.075				
	X1	0.399	0.399	0.399	0.399	0.399				
	R0	0.22	0.22	0.22	0.22	0.22				
	X0	1.339	1.339	1.339	1.339	1.339				
	Z0M	-	-	0.4524	0.4524	-				
Note- NAPS-Dibai (line-3) and NAPS-Khurja (line-4) were originally double Ckt lines from NAPS to Khurja. After LLO formation at Dibai in year-2015, Line-3 length got reduced to 21.06 Km and both lines still run on same tower i.e. NAPS to Dibai and further Dibai to Khurja in parallel with NAPS-Khurja line.										

*Atifullah*  
28.3.24

*Ummad*  
28/3/24

*Zaid Al-Sami*  
28.3.24

*Skani*  
28/3/24

F. Transmission line setting													
F1	Name of line	Zone-1		Zone-2			Zone-3			Zone-4		Remarks	
		Reach (%)	Reach (Ohm)	Reach (%)	Reach (Ohm)	TD (ms)	Reach (%)	Reach (Ohm)	TD (ms)	Reach (%)	Reach (Ohm)		TD (ms)
1	Narora-Sambhal	80% of line imp.	8.316	120% of line imp.	12.474	350	120% of (100% Protected Line + 100% adjacent Line)	17.155	1000	25% of Z-1 reach setting	2.079	350	Z-5 is enabled in forward direction (next to Z-3) with reach setting of 300% (100% Protected Line + 100% adjacent Line+100% next to adjacent Line) with TD of 2.5 sec.
2	Narora-Simbholi	80% of line imp.	10.871	120% of line imp.	16.307	350	120% of (100% PL + 100% AL)	26.329	1000	25% of Z-1 reach setting	2.7178	350	Z-5 is enabled in forward direction (next to Z-3) with reach setting of 300% with TD of 2.0 sec.
3	Narora-Dibai	80% of line imp.	2.696	120% of line imp.	6.572	350	120% of (100% PL + 100% AL)	10.449	1000	25% of Z-1 reach setting	0.674	350	Z-5 is enabled in forward direction (next to Z-3) with reach setting of 300% with TD of 2.5 sec.
4	Narora-Khurja	80% of line imp.	7.802	120% of line imp.	11.702	350	120% of (100% PL + 100% AL)	21.739	1000	25% of Z-1 reach setting	1.9505	350	Z-5 is enabled in forward direction (next to Z-3) with reach setting of 300% with TD of 3.0 sec.
5	Narora-Atrauli	80% of line imp.	5.012	120% of line imp.	7.518	350	120% of (100% PL + 100% AL)	10.960	1000	25% of Z-1 reach setting	1.253	350	Z-5 is enabled in forward direction (next to Z-3) with reach setting of 300% with TD of 2.0 sec
6	Power Swing Block (PSB) All zones are block except zone -1, Unblocking TD 2.0 sec												
7	Broken conductor Enabled, TD 5.0 sec												
8	Auto Reclose Single phase Auto Reclose scheme in all five lines is functional through a separate auto reclose EE make relay type VARRM-11. Reclosing time (dead time)-0.6 sec, Reclaim time- 25 sec												
9	Over Voltage Prot. Enabled in Main-I protection; Stage 1: Pickup>1.25 times rated with TD 5sec Stage 2: Pickup>1.45 times rated with TD 150msec												

*Ram*  
28/3/24

*Arpit*  
28.3.24

*Arpit*  
28.3.24

*Arpit*  
Page 3 of 5

G. Transformer Protection										
G1	Name of T/F	Differential Protection (Make & Model)	REF Protection (Make & Model)	Back-up Over Current Protect. (Make & Model)	Over Flux Protection (Make & Model)	OT/MTI	Buchholz & PRD	Date of testing	LA Rating HV Side	LA Rating LV Side
1	GT-1	Make ABB, Model RADSB	Make: ABB, Model: RADHD	Make-EE, Model CDG-31	Make: ABB, Model: RATUA	Working	Yes	09.06.2022	216 KV	NA
2	GT-2	Make ABB, Model RADSE	Make: ABB, Model RADHD	Make: EE, Model: CDD-23 & CDD-21	-	Working	Yes	21.01.2024	216 KV	NA
3	SUT-1	Make ABB, Model RADSE	Make: ABB, Model RADHD	Make: EE, Model: CDD-23 & CDD-21	-	Working	Yes	24.05.2022	216 KV	NA
4	SUT-2	Make ABB, Model RADSE	Make: ABB, Model RADHD	Make: EE, Model: CDD-23 & CDD-21	-	Working	Yes	25.12.2023	216 KV	NA

H. DC supply										
	Name of T/F	Differential Protection (Make & Model)	REF Protection (Make & Model)	Back-up Over Current Protect. (Make & Model)	Over Flux Protection (Make & Model)	OT/MTI	Buchholz & PRD	Date of testing	LA Rating HV Side	LA Rating LV Side
a	Measured voltage (to be measured at furthest Panel)	250V DC Bus-W	250V DC Bus-X	250V DC Bus-W	250V DC Bus-X	48 V DC BUS-J	48 V DC BUS-K	48 V DC BUS-L	48 V DC BUS-M	48 V DC BUS-N
b	No. of Cells Per Bank	261.0	261.3	261.2	261.3	49.1	49.1	48.2	49.7	49.7
c	Availability of Battery Charger	120	120	120	120	22	22	22	22	22

I. Circuit Breaker									
Sl. No.	Name of 220 KV Bay	Make and Model	Status of Breaker Available or Not	No. of trip/close coil & healthiness	Date of Last Over hauling				
1	220KV Bus Coupler Bay		Available		21.12.2023				
2	220KV GT-1 Bay		Available		20.05.2023				
3	220KV SUT-1 Bay		Available		12.05.2022				
4	220KV Sambhal Bay	MAKE: ABB, MODEL: DLF-245-NC-2	Available	TRIP COIL-02 nos. CLOSE COIL-01 no. all coils are healthy	20.12.2023				
5	220KV SUT-2 Bay	AIR BLAST CIRCUIT BREAKERS	Available		16.12.2023				
6	220KV Simbholi Bay		Available		25.03.2023				
7	220KV Dibai Bay		Available		10.12.2023				
8	220KV Khurja Bay		Available		17.12.2023				
9	220KV GT-2 Bay		Available		22.12.2023				
10	220KV Transfer Bus Bay		Available		07.03.2023				
11	220KV Atrauli Bay		Available		27.12.2023				

*Aspirite*  
28.3.24

*Shruti*  
28/3/24

*Chaitanya*  
28.3.24

*Shruti*  
28/3/24  
Page 4 of 5

J. Availability of UFR relay	
J1	Make
J2	Setting
K.	Status of Corrective action based on Tripping analysis
L.	Recommendation/ Suggestion

ALSTOM

- i) 48.0 Hz Alarm
- ii) 47.9 Hz Tripping of transmission lines (NAPP-SAMBHAL, NAPS-ATRAULI) when both units under operation.
- iii) 47.9 Hz Tripping of transmission lines ( NAPP-SAMBHAL, NAPS-ATRAULI & NAPS-KHURIA 1 & 2) when only one unit under operation
- iv) 47.5 Hz with 0.5 sec time delay- Tripping of SUT & initiation of ATS.
- v) 47.5 Hz with 1 sec time delay- Tripping of GT CB (Unit on house load operation) and all transmission lines.

i) On Aug-2021, NAPS both units tripped and NAPS switchyard got isolated from grid due to fault caused by bursting of R-phase CVT of Narora-Sambhal line. Subsequently NPCL designer, HQ suggested to implement two additional protections (Non-directional phase over current and Over voltage stage-1 & 2) in 220KV transmission line distance protection relay. Both the protections have been enabled in all lines after taking NRPC approval in PSC.

ii) Zone-4 time setting of all five 220KV transmission lines has been changed to 350 msec from 800 msec as per NPCL HQ designer's recommendation after CVT failure event.

Main-II protection is to be provided for all five 220KV transmission lines. (Agency-EMU)

To,  
SE (O), NRPC ([seo-nrpc@nic.in](mailto:seo-nrpc@nic.in))  
Sh. Ruchir V Oza, ACE, HQ ([rvoza@npcl.co.in](mailto:rvoza@npcl.co.in))

CC,  
SD/ CS for kind info.  
TSS/ MS/ OS  
SME/ STE (E&I)

*Arpita Chakravorty*  
28/03/24  
Arpita Chakravorty  
TSU (E&I), Member Secretary

*Harish Sharma*  
28/3/24  
Harish Sharma,  
EMU, Member

*Satish Kumar*  
28/03/24  
Satish Kumar,  
Operation, Member

*S.K. Goyal*  
28/3/24  
S. K. Goyal  
SE (E&I), Team Leader



# न्यूक्लियर पावर कॉर्पोरेशन ऑफ इंडिया लिमिटेड

NUCLEAR POWER CORPORATION OF INDIA LIMITED

भारत सरकार का उद्यम (A Government of India Enterprise)

रावतभाटा राजस्थान साइट 1 एवं 2 Rawatbhata Rajasthan Site-1&2

डाक: अणुशक्ति 323303-वाया: कोटा (राज.) PO: Anushakti-323303 Via: Kota (Raj.)



## Report of the Internal protection Audit

### A. General information

### B. Check list for protection Audit

- i. Name of Utility: RAPS-UNIT-1&2), NPCIL
- iii Date of commissioning: 1980
- v Name and Audit Team:  
1.0 Mr. Arvind Goyal, TE(E&I), TSU

- ii Name of Voltage level of Sub-Station :220KV
- iv Type of bus-switching scheme: Sectionalized Main Bus and Transfer Bus
- vi Name of representative from utility whose audit is being carried out:  
1.0 Mrs. Supriya Bhanja SME(Electrical).  
2.0 Mr.VirendraYadav, SO/E

S. No	Check		Functional/ non-functional/Enabled/ Disabled	Type of relay (Numerical/Static/Electro mechanical)	Setting as found in field	Remark
1	<b>DC system</b>					
1.1	No. of independent DC sources	3				
1.2	Potential between +ve & earth (250V Source- 1)	+120.5	Functional	Static, Model: S2 IL, E/F relay make: SIGMA	E/F Current setting: 3mA in 250V DC system and 0.03 mA in 48 V DC systems.	
1.3	Potential between –ve & earth (250V Source-I)	-138.2	Functional			
1.4	Potential between +ve & earth (250 V Source-2)	+123.0	Functional			
1.5	Potential between –ve & earth (250V Source-2)	-135.4	Functional			
1.6	Potential between +ve & earth (48 V Source-I)	+21.3	Functional			
1.7	Potential between –ve & earth (48 V Source-I)	-27.6	Functional			
2	Event logger panel	YES	Functional			
3	Event Logger Time Synchronised	Yes				
3.1	Disturbance recorder	Yes				
3.2	DR time Synchronised	Yes				

4	<b>Generator-Transformer Protection Panel:</b>					
4.1	<b>Tripping by Buchholz relay</b>	Yes	Functional	Electromechanical	200 CC alarm 400 CC Tripping	
4.2	<b>Differential Protection</b>	Yes	Functional	Electromechanical type, Model: BDD15B, Make. CGE Transformer Differential relay with percentage and harmonic restraint.	Slope: 25%, 2 <sup>nd</sup> Harmonic restraining=20%, Id=1.23 to 1.28 A, CTR=8000/5A, for generator side, 1265/5A for 230 KV Bus side and 2000/5 UT Side	
4.2.1	2 <sup>n</sup> Harmonic Block (setting)	Yes	Functional			
4.2.2	Event logger operation	Yes	Functional			
4.3.	<b>Restricted Earth Fault Protection (HV side)</b>	NO				
4.3.1	<b>REF protection (LV side)</b>	NO				
4.3.2	Event logger operation	Yes	Functional			
4.4	<b>Backup over current</b>	Yes	Functional	Electromechanical type, Model: IJCV51A, Make: CGE Inverse Time over current relay with voltage restrain	CTR=800/5A PSM=8 TMS=6	
4.4.1	Event logger operation	Yes	Functional			
4.5	Earth Fault protection	Yes	Functional	<b>HV Side-</b> Electromechanical type, Model- IAC53B Make-CGE Very Inverse Time 0.5-2A And 1-4A Instantaneous Over Current Relay <b>LV Side-</b> Protected by stator E/F protection of generator.	<b>HV Side-</b> Very Inverse type, CTR=800/5A, PSM=2, TMS=6 <b>LV Side-</b> NGT-21000/230 V Setting-10 V	

				Electromechanical type, Model- IAV51D Make-CGE Inverse Time 115 V Voltage Relay		
4.5.1	Event logger operation	Yes	Functional			
4.6	<b>Over flux Protection</b>	Yes	Functional	Electromechanical Type Model-GTT21 MAKE-EE	<b>Stage-I</b> 107.5% +5Sec alarm and AVR run back 107.5% +5 Min.-Trip <b>Stage-II</b> 112.5%+15Sec-Trip	
4.6.1	Event logger operation	Yes	Functional			
4.7	<b>Local Breaker Back up</b>	Yes	Functional	Electromechanical Type	R, B Phase=4A	
4.7.1	Re trip	Yes	Functional	Model-CTIG 39 MAKE-EE	Neutral Phase-1A	
4.7.2	Current and time setting	Yes	Functional		CTR=800/5 A	
4.7.3	Separate single and three phase initiation	Yes	Functional			
4.7.4	Earth fault	Yes	Functional			
4.7.5	Event logger	Yes	Functional			
<b>5</b>	<b>220KV transmission lines (Distance protection panel: M-I/II)</b>					
5.1	Pole discrepancy relay	Yes	Functional		PDR TIME (a) 100ms in 220kV Transmission Lines	
5.2	PLCC panel	Yes	Functional			
5.3	Zone-1/2/3/4/5 (Setting)	Yes	Functional	For-Kota & Debari Line Main-I-Micom-P-442 relay Main-II-Micom P-443 relay For-RAPP-A&B Tie Line Main-I-Micom-P-545 relay Main-II-Micom P-545 relay	As recommended by HQ /NRPC guideline.	
5.4	Time chek-Z-1/2/3/4/5 (settings)	Yes	Functional			
5.5	SOTF	No				
5.6	Aided scheme	Yes	Functional			

5.7	Fault locator	Yes	Functional			
5.8	power swing (setting R and X)	Yes	Only Alarm configured			
5.9	All zone block	No				
5.10	DR	Yes				
5.11	Binary inputs	Yes				
5.12	Breaker contacts	NO				
5.13	Carrier receive	Yes	Functional			
5.14	Time synchronization	Yes	Relay manually scheduled time adjusted & match with GPS timing			
6	Bus Bar Protection	Yes	Functional	Electromechanical Relay Differential relay Model-IFD52B Make-CGE Differential Relay with 2-8 A Instantaneous unit Impedance check Relay Model-CFZ17B Make-CGE	CTR=1200/5A PTR-230000/115 V Differential relay- Trip-6 A Impedance Relay- Trip-6A at 100V	
6.1	Stability Check	Yes				
6.2	EL output for this event	Yes				
6.3	DR if available	No				
7	Single Phase Auto Reclose Scheme	No				
8	CT					
9	Suitable as per fault level	Yes				
10	DG Set	Yes	2 No. 1500KVA, 3Ph. 415 V			
11	Mock testing of a sample protection associated with transmission line***	Yes	Functional test of protection scheme is carried out once in every two year.			

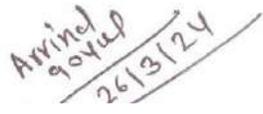
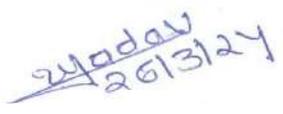
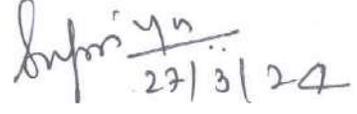
\*\*\* Purpose is to check whether the operation of that protection relay energizes the breaker trip coil.

**C. Observation w.r.t compliance to NRPC protection philosophy. AS MENTIONED ABOVE.**

**D. Any other Observation/ Suggestion by the team of protection expert: NIL**

**Copy to:**

- i. SE (O), NRPC
- ii. SD/CS/TSS/MS/SME(E), RAPP-A
- iii. Shri Ruchir OZA, ACE (Operations), HQ, Mumbai

 <p>Arvind Goyal TE (E&amp;I)</p>	 <p>Virendra Yadav SO/E, EMU</p>	 <p>Supriya Bhanja SME(E)</p>
--	--	--

**NUCLEAR POWER CORPORATION OF INDIA LTD.**

Report of the Internal Protection Audit (19.02.24 to 23.02.24)

**A. General Information**

- i) **Name of Utility:** RAPP-C (RAPS-Unit-5&6), NPCIL
- ii) **Date of commissioning:** 2006 (For 220KV), 2008 for 400KV
- iii) **Voltage level :** 220KV & 400 KV
- iv) **Type of bus-switching scheme:** DOUBLE MAIN BUS((I&II) for 220KV and 1/2 Breaker scheme in 400 KV Switchyard.
- v) **Name of Audit team:** Ranjeet Kumar, Jemini Vyas, G.S. Naruka, D.K. Shringi
- vi) **Name of Section Head and Section, whose audit is being carried out:** Sh. Ajay Arora, SME (Electrical)

**B. Check list for protection Audit**

S. No	Check	Yes/No/ Value	Functional/ non- functional/Enabled/ Disabled	Type of relay (Numerical/Static/ Electro mechanical)	Setting as found in field	Remark
<b>1.</b>	<b>DC system</b>					
	No. of independent DC sources	4				
	Potential between +ive & earth (220V Source-1)	+116.0 V	Functional	Static, Model: ALSTOM Make CAEM 21 E/F relay.	E/F Current setting: 07 mA	
	Potential between -ive & earth (220V Source-1)	-115.9 V	Functional			
	Potential between +ive & earth (220V Source-2)	+115.3 V	Functional			
	Potential between -ive & earth (220V Source-2)	-117 V	Functional			
	Potential between +ive & earth (48 V Source-1)	+25.6 V	Functional			
	Potential between -ive & earth (48V Source-1)	-24.9 V	Functional			

*[Signature]*

*[Signature]*

*[Signature]*

*[Signature]*

	Potential between +ive & earth (48 V Source-2)	+25 V	Functional			
	Potential between -ive & earth (48V Source-2)	-25 V	Functional			
2.	<b>Disturbance recorder</b>	Yes	Centralized type, make: Hathaway. Functional. DR is also inbuilt in all line numeric protection relays.	Hathaway		
	<b>DR time Synchronised</b>	No				
3.	<b>Generator-Transformer Protection Panel :</b>					
	Tripping by Buchholz relay (Alarm)	Yes	Functional	Electromechanical	Inbuilt	
	<b>Differential Protection</b>	Yes	Functional	RADSB	Id=25% of In, Iunrestrained	
	2 <sup>n</sup> Harmonic Block (setting)		Functional		=20 times of In, 2 <sup>nd</sup> harmonic blocking enabled	
	Event logger operation	Yes	Functional			
	<b>Restricted Earth Fault Protection (HV side)</b>	Yes	Functional	RADHD, ABB	Trip current=5% In	
	Event logger operation	Yes	Functional			
	<b>REF protection (L.V side)</b>	Yes	Covered/protected by 100% stator E/F protection of generator. Static Relay Type: REG 316 (ABB)			
	Event logger operation	Yes	Functional			
	<b>Backup over current</b>	Yes	Functional	ICM 21P, MAKE- ABB	PSM-50%, TMS-0.15, High set N/A	
	Event logger operation	Yes	Functional			
	<b>Earth Fault protection</b>	Yes	Functional	ICM 21P, MAKE- ABB	PSM=40% TMS-0.39	
	Event logger operation	Yes	Functional			
	<b>Over flux Protection</b>	Yes	Functional	ABB RALK	Pick up 110%	
	Event logger operation	Yes	Functional			

	<b>Local Breaker Back up</b>	<b>Yes</b>	Functional	ABB RAICA	I=0.2A, T=0.25Sec	
	Retrip	<b>Yes</b>	Functional			
	Current and time setting					
	Separate single and three phase initiation (Auto Reclose)	<b>Yes</b>	Functional, R-PH, Y-PH, B-Phase.		Single phase Auto Reclose	
	Earth fault	<b>Yes</b>				
	Event logger	<b>Yes</b>	Functional			
<b>5.</b>	<b>Distance protection panel: M-I/II</b>					
	Pole discrepancy relay	<b>Yes</b>	Functional in all lines	Areva	PDR TIME (a) 1.2 Sec in 220kV Anta Line & 300 mSec RAPS-B To RAPS-C Tie lines. (b) 400 m sec in 400kV Lines	
	PLCC panel	<b>Yes</b>	Functional in all lines except Tie Lines			
	Zone-1/2/3/4/5 (Setting)	<b>Yes</b>	<b>Functional</b> in all lines	<p>1 M-I relay: Micom P 442 &amp; Back up protection relay: RAPDK3 in 220 KV Anta line.</p> <p>2 M-I relay: Pilot wire diff protn (Micom P545) and M-II protection relay: Micom P543) in 220kV TIE line-I &amp; II to RAPS-5&amp;6.</p> <p>3 M-I relay: Micom P 442 &amp; M-II protection relay:</p>	<p>1. <b>220 KV Anta Line for main relay:</b> Z1=80 %, Z2=100%of protected line+50% of next shortest line. Z3=(100% of protected line+100% of longest line at remote end) X 1.2. Z4= 25%of Z1.</p> <p><b>220 KV Anta Line B/U O/C protection relays:</b> CTR=800/1 A, IDMT characteristic, PSM=100% TMS=0.20*, High set current=20A.</p>	

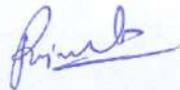
*[Handwritten signature]*

*[Handwritten signature]*

*[Handwritten signature]*

*[Handwritten signature]*

				Micom P 437 in 400 KV lines.	<p>2. <b>Tie line protection settings:</b> For 220 KV RAPS-C to RAPS-B Tie Lines Main I &amp; II protection Micom P545 current differential relay, dual slope characteristic Is1- 0.2In, Is2- 2In, K1- 30% &amp; K2- 150%. Zone-1 Setting-5.4 ohms, 0.35 Sec, Zone-2 Setting- 20.04 ohms, 0.85 Sec.</p> <p>3. <b>400 KV line Main:</b> Main-1 &amp; Main-2 relay settings: Z1=80%, Z2=100%of protected line+50% of next shortest line. Z3=(100% of protected line+100% of longest line at remote end)x1.2. Z4=25% of Z1. CTR=2000/1 A,</p>	
	Time check-Z-1/2/3/4/5 (settings)	Yes	Functional in all lines		<p>tZ1= 0.0 ms tZ2=0.350 sec tZ3= 1 sec tZ4= 0.450 sec for 220 KV Anta line</p> <p>tZ1= 0.0 ms tZ2=0.350 sec</p>	






					<p>tZ3=1 sec tZ4= 0.35 sec for 400 KV Chittor line</p> <p>tZ1= 0.0 ms tZ2=0.300 sec tZ3=0.800 sec tZ4= 1 sec for 400 KV Kankroli &amp; Kota line</p>	
SOTF	<b>Yes</b>	Functional in all lines having Main relay as Micom P 442 in 220 KV Anta Line. Main relay as Micom P 442 & P 437 in 400 KV Lines.			For all zones Tp=110 mSec Td=3 sec	
Aided scheme	<b>Yes</b>	Functional in all lines				
Fault locator	<b>Yes</b>	Available in all line protection relays.				
Power swing (setting R and X)		Functional in all lines	Inbuilt with main relays.		$\Delta R$ & $X=30\%$ of Z3 R3 Unblocking time 0.5 sec	
All zone block	<b>NO</b>				Z2,Z3,Z4 Block	
DR	<b>Yes</b>	1) Inbuilt in all line protection relays. 2) Centralized type, make: Hathaway. Functional				
Binary inputs						
Breaker contacts	<b>Yes</b>					
Carrier receive	<b>Yes</b>	Functional				

*[Handwritten signature]*

*[Handwritten signature]*

*[Handwritten signature]*

*[Handwritten signature]*

	Time synchronization	Yes	220KV: Tie Line-1, Tie Line-2, Anta line and 400KV: Kota Line-1 protection relays are time synchronized.	Micom P545, Micom P442		
6.	Bus Bar Protection	Yes	functional	Numeric P741 & P743 relay (Alstom) in 220 KV systems. High impedance PBDCB in 400 KV Main Bus 1 & Main bus 2.	Id = 1.2 In with dual slope characteristic. Slope 1 & slope 2 are 30 & 60 %. 310.88 Volt in 400 KV bus bar protection.	
	Stability Check		Checked at the time of new bay integration in Yr-2018 for 220 KV system & in Yr-2016 for 400 KV system.			
	EL output for this event	Yes				
	DR if available	Yes				
7.	Single Phase Auto Recloser Scheme	Yes	Functional in all lines except Tie Lines	Main-I protection relay Micom P442 Main-II protection relay Micom P437	1 pole auto-reclose in zone-1 Dead Time-1 sec (400KV) - 600ms (220KV)	
8.	CT					
	Suitable as per fault level	Yes	CT rating 40KA, 03sec for 220KV & 1Sec for 400KV. Station fault feeding capacity=39.36 KA			
9.	DG Set	NO				

*[Signature]*

*[Signature]*

*[Signature]*

*[Signature]*

10.	Mock testing of a sample protection associated with transmission line	No	It's a nuclear generating station. S/D could not be arranged and even minor disturbance due to malfunctioning or human error in the system is not tolerable.			
-----	---	----	--	--	--	--

**C. Recommendations/Suggestions by the Protection Audit Team:**

1. Back up protection relay of 220kV Anta Line is to be changed as Main-II and to be replaced by Numerical Relay.
2. Time Synchronization of distance protection relays (400kV lines Kankroli line and Chitorgarh Line) & disturbance recorder / event logger has to be done.

(Name, Signature and Designation of team comprising of carrying out protection audit, as per letter no. RR Site/Unit-5&6/SD/2024/S/39 dt. 16.02.2024).

To,  
SE (O), NRPC

- Copy to: (i) Station Director  
(ii) Chief Superintendent  
(iii) MS/ OS/ TSS  
(iv) SME (E)  
(v) STE(E&I)

*Ranjit Kumar*  
Ranjit Kumar  
SA/E, TU (ERI)

*B.P. Bhat*  
B.P. Bhat, SA/F

*G.S. Narulka*  
(G.S. Narulka)  
TO/E, EMU-586

*(Dr. S. Narulka)*  
(Dr. S. Narulka)  
SO/F, TSU

# CONSULTANCY REPORT

## Protection audit of 400/220 kV Substation at RVUNL-CTPP (250X4 MW) Chhabra

### VOLUME-I

**Clients Reference: PO NO: RVUNL/CTPP/SE(Elect)/F/D/1069**

**CPRI Reference: No. 2/9/PSD/CTPP/2023-24**

**CPRI Report: No. 2/9/PSD/RT100/2023**

### CUSTOMER

**M/s RVUNL-CTPP, Chhabra**

### 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/CTPP/2023-24

Dated.21-02-2024

<b>Title</b>	<b>Third Party Protection audit at for 400kV Substation at CTPP, Chhabra-RRVUNL (250X4 MW)</b>
Project Objectives	Review Of Protection Scheme, Relay Settings Of Various Element & Associated System Of for 400kV Substation at CTPP, Chhabra-RRVUNL (250X4 MW)
Name and Address of the Customer	M/S CTPP, Chhabra
Client's Reference and Date	RVUNL/CTPP/SE(Elect)/F/D/1069 Date :08.09.2023
CPRI report No:	2/9/PSD/RT100/2023
Name(s) of investigator(s) from CPRI	1. Mr. Ved Prakash Yadav, Engineering Officer 2. Mr. Pola Soma Sekhar Reddy, Engineering officer
Name of RRVUNL, Chhabra officers, associated in providing support to CPRI	1. Shri Pawan Kumar, XEN 2. Shri Jitender Gupta, AEN 3. Shri Peeyush Tripathi, JEN
Report contains	Number of pages : 51
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 CTPP,Chhabra for awarding the contract of Third Party Protection audit of *Third Party Protection audit at for 400kV Substation at CTPP, Chhabra-RRVUNL (250X4 MW)* PO No. RRVUNL/CTPP/SE(Elect)/F/D/1069 to CPRI. CPRI wishes to thank all the Officers/Engineers of CTPP,Chhabra, 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 Shri Pawan Kumar XEN
- 2 Shri Jitender Gupta AEN
- 3 Shri Peeyush Tripathi JEN

# 1. Executive Summary

Power Systems Division of Central Power Research Institute conducted the third Party protection audit at for 400kV Substation at CTPP, Chhabra-RRVUNL (250X4 MW) as per the PO No. RrVUNL/CTPP/SE(Elect)/F/D/1069 Dated 08/09/2023. The different protection that were covered under the audit are (i) Line Protection (ii) ICT&ST Protection (iii) Reactor protection and (iv) 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 400kV Substation at CTPP, Chhabra-RRVUNL (250X4 MW). The protection audit of the substation was carried out from 02/01/2024 to 05/01/2024. CTPP, Chhabra-RRVUNL (250X4 MW) have (a) Four 400 kV transmission lines (b) Two 220kV transmission lines (c) One ICT and Four ST's.

For Continuous & uninterrupted generation and transmission, CTPP Chhabra is connected to RRVPNL 400 kV GSS and 220 kV GSS. After viewing the downloaded settings at substation for lines, transformer and bus-bar 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. Chhabra Thermal Power Plant may review the suggested settings and adopt the settings as per local site condition requirements and remote end coordination.

1. The distance protection i.e. Main-I & II Zone 1, Zone 1B and Zone 3 impedance reach setting for 400KV BHILWARA line are properly set and some revisions are required in Zone-2 impedance reach settings.
2. Resistive reach setting of all the Zone may be reviewed for Main-I & II of 400KV 400kV BHILWARA line.
3. Quadrilateral reach settings of BHILWARA line may be reviewed.
4. The distance protection i.e. Main-I & II of all zones, impedance reach setting for 400KV ANTA line are properly set and some revisions are required in Zone-4, Main-I & II impedance reach settings.
5. Resistive reach setting of all the Zone may be reviewed for Main-I & II of for 400KV ANTA line.

6. The distance protection Main-I & II impedance reach setting for 400kV ADANI line are properly set and some revisions are required in Zone 1B and Zone 4.
7. Resistive reach setting of the all the Zone may be reviewed for Main-I & II of 400kV ADANI line.
8. The distance protection i.e. Main-I & II of all zones, impedance reach setting for 400KV HINDHAUN line are properly set and some revisions are required in Zone-3,4, Main-I & II impedance reach settings.
9. The distance protection i.e. Main-I & II of all zones, impedance reach setting for 220kV AKLERA line are not properly set and revisions are required in all the zones of Main-I & II impedance reach settings.
10. The resistance reach settings of, all the zones of both Main-I & II need to be reviewed for 220kV AKLERA line.
11. The distance protection Main-I & II impedance reach setting for 220kV KAWAI line are properly set and some revisions are required in Zone 2, Zone 4.
12. The resistance reach settings of, all the zones of both Main-I & II need to be reviewed for 220kV KAWAI line.
13. The zone 4 settings of all distance protections scheme are calculated according to NRPC guide lines but as the all lines are originating from generating station the settings may be reviewed according to the plant conditions.
14. The load blinder settings were recommended considering the capacity of transmission line. The load blinder settings may be reviewed.
15. The earth fault protection is also protected to all line protection. Power swing, is also provided on all lines. Minor changes in Power swing.
16. The Auto reclose function shall be enabled with the Dead time of 1 sec and Reclaim time of 25 Sec.
17. The Pole discrepancy time setting may be coordinate with the auto reclose function and shall be set as PD time setting = (Auto reclose dead time + time delay of 200-500ms)
18. 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 15  $\Omega$  & 5  $\Omega$  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.

19. Other Protection functionality for lines like SOTF, Voltage supervision and Carrier communication are working satisfactory.
20. It is observed that DC source for switchyard 3 & 4 is having earth fault. This has to be attended and rectify.
21. There is some oil seepage observed in switchyard from the ICT and it has to be attended whenever time permits as per scheduled shutdown.
22. The differential protection setting for transformers are properly set and stable.
23. The impedance protection setting for reactor are properly set and stable.
24. The differential protection setting for bus-bar are properly set and stable.
25. It is suggested to perform the third-party protection audit of substation/generating station periodically.

## Minutes of Meeting

<b>MOM Between</b>	<b>Date</b>
CPRI, Bangalore & M/s RRVUNL, CTPP	04/01/2024

### 1. Participants:

Organization	Name
CPRI, Bangalore	Shri Ved Prakash Yadav, Engineering Officer Shri Pola Soma Shekhar Reddy, Engineering Officer
RRVUNL, CTPP	Shri Pawan Kumar, XEN Shri Jitender Gupta, AEN Shri Peeyush Tripathi, JEN

### 2. Meeting Details:

Subject:	Visit for Protection Audit of M/s RRVUNL, CTPP Switchyard
Reference:	PO. No. RVUNL/CTPP/SE (Elct.)/F/D/1069 dated: 08/09/2023

### 3. Notes of Meeting:

- CPRI officials visited CTPP Switchyard on 03/01/24 and 04/01/24 and briefed about the protection audit of the M/s RRVUNL, CTPP Switchyard to the personnel.
- During the protection audit work, the existing setting of Numerical protection IEDs of all lines, power transformer, line & bus reactor, Busbar were downloaded and taken for setting calculations.
- There is some oil seepage observed in switchyard from the ICT and it has to be attended whenever time permits as per scheduled shutdown.
- It is observed that ARBITOR make time synchronization unit is available for switchyard 1 & 2 and SANDS make time synchronization unit is available for switchyard 3 & 4. The available IEDs are time synchronized. However, few ABB make IEDs having time sync fail intermittently which needs to be attended at earliest.
- CPRI Officers went around 400 kV and 220 kV Switchyard to check the maintenance of the substation and measured the DC voltage (lead acid) in CB panel as below. It is observed that DC source for switchyard 3 & 4 is having earth fault. This has to be attended and rectify.

	Positive to Negative	Positive to Earth	Negative to Earth
DC Bank 1	240	129	-113
DC Bank 2	240	113	-129
DC Bank 3	240	4	-236
DC Bank 4	240	4	-235

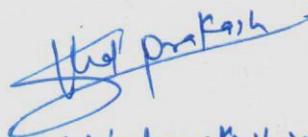
*[Signature]*  
P.S.S. Reddy

CP  
XEN (am-1)  
Jitender (AEN)  
Peeyush (JEN)

- There is no centralized DR, Event logger available on site. However, all the numerical IEDs are facilitated with the inbuilt DR & event logger and the healthiness of the same were reviewed and found satisfactory.
- The availability & healthiness of PLCC is reviewed and found satisfactory.
- 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 400 & 220 kV system and reviewed.
- It is suggested to conduct the breaker overhauling as per the best practice adopted by power utilities or OEM.
- It is recommended that the all the Numerical Protection IEDs shall be tested once in 3/4 years as per the best practices adopted by the other organization such as PGCIL etc.
- Switchyard of 400 & 220 kV CTPP switchyard is being maintained properly and it is neat and clean.
- It is recommended that Relay Test System and other testing equipment must be calibrated from NABL Accredited 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.
- It is suggested to have testing equipment on site such as leakage current tester and power analyzer is required at site for periodic testing and fault analysis.
- The report shall be submitted within 3 month of the site visit of protection audit subsequently followed by the training on findings of the protection audit.

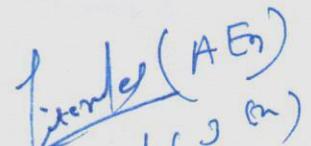
The CPRI audit team thanked to the personnel of arranging the protection audit.

For CPRI

  
(Vedprakash Yadav)

P.S.S. Reddy  
(Pola Soma Sekhar Reddy)

For RRVUNL, CTPP

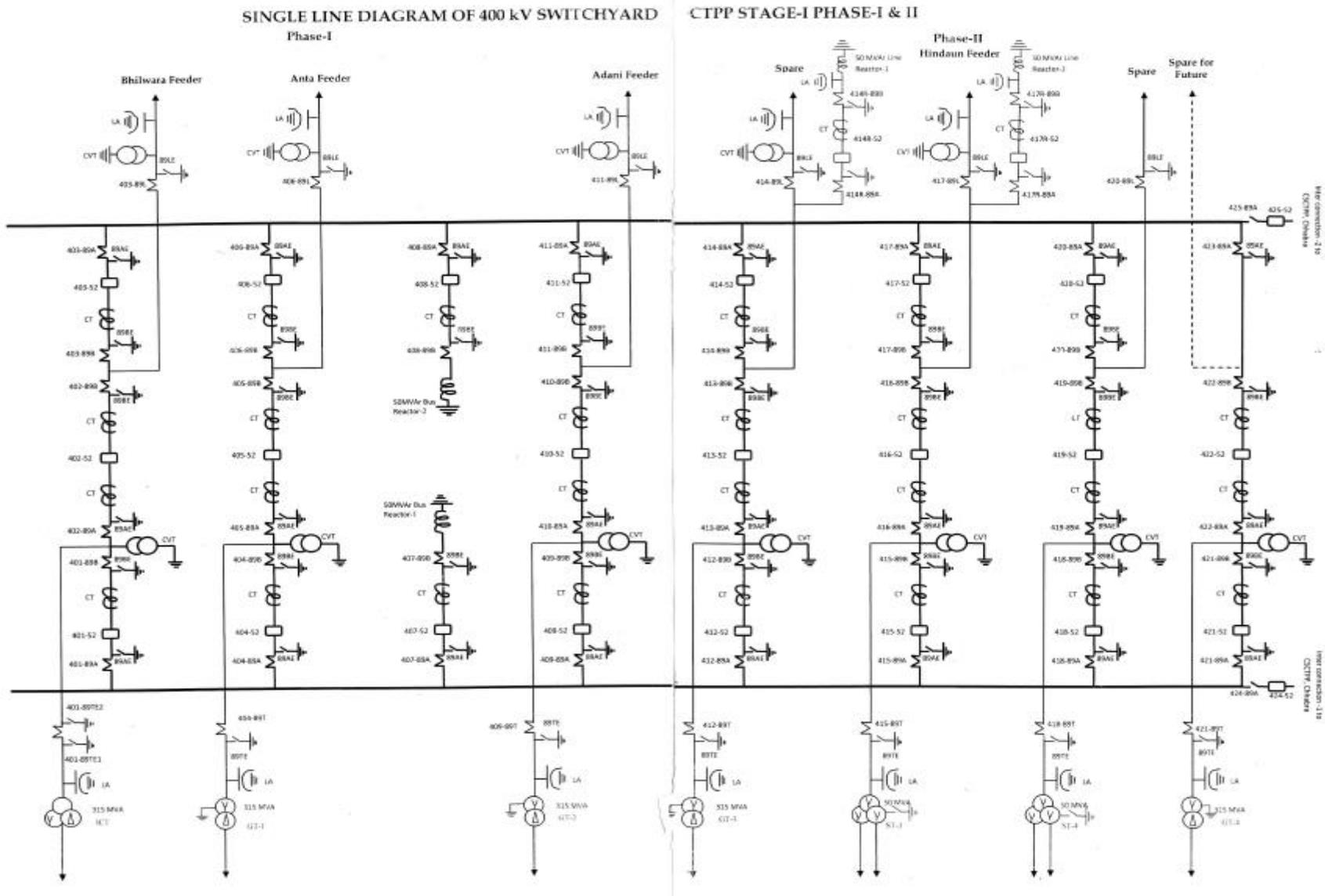
  
Anand (AEn)  
Prakash (J En)

  
KEN (GM-II)

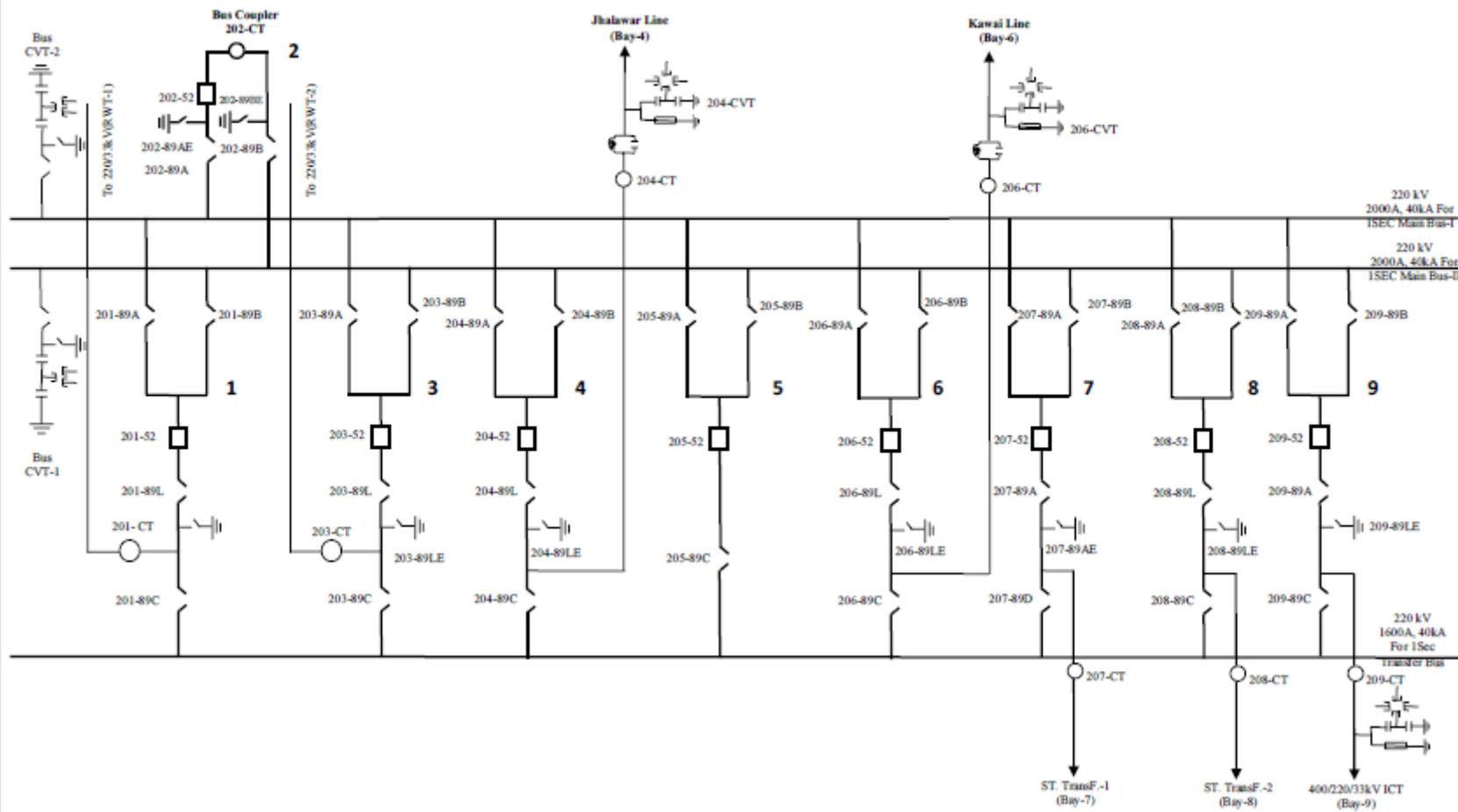
## CONTENTS

400 kV SWITCHYARD OF CTPP-RVUNL CHABBRA		
Sl. No.	Description	Page No
1.1	LINE DIAGRAM OF 400kV and 220kV SUBSTATIONS OF CTPP CHABBRA (4*250 MW)	1
1.2	PROTECTION SYSTEM OVERALL REVIEW	3
1.3	RELAYS USED FOR TRANSMISSION LINE, TRANSFORMER, REACTOR AND BUS BAR PROTECTION SUBSTATION	5
1.3.1	RELAYS USED FOR TRANSMISSION LINE PROTECTION	5
1.3.2	RELAYS USED FOR TRANSFORMER PROTECTION	6
1.3.3	RELAYS USED FOR REACTOR PROTECTION	7
1.3.4	RELAYS USED FOR BUSBAR PROTECTION	7
2.1	INPUT DATA FOR TRANSMISSION LINES	8
2.1.1	INPUT DATA FOR TRANSMISSION LINES SUBSTATION CTPP - BHILWARA	8
2.1.2	INPUT DATA FOR TRANSMISSION LINES SUBSTATION CTPP - ANTA	10
2.1.3	INPUT DATA FOR TRANSMISSION LINES SUBSTATION CTPP - ADANI	12
2.1.4	INPUT DATA FOR TRANSMISSION LINES SUBSTATION CTPP - HINDHAUN	14
2.1.5	INPUT DATA FOR TRANSMISSION LINES SUBSTATION CTPP - AKLERA	16
2.1.6	INPUT DATA FOR TRANSMISSION LINES SUBSTATION CTPP - KAWAI	18
3.1	TRANSMISSION LINE PROTECTIVE RELAY SETTINGS REVIEW	20
4.1	TRANSFORMER PROTECTION DATA	35
4.1.1	INPUT DATA FOR TRANSFORMER PROTECTION	35
4.2	TRANSFORMER PROTECTION RELAY SETTING REVIEW	38
5.1	REACTOR PROTECTION DATA	44
5.1.1	REACTOR PROTECTION SETTING REVIEW	44
6.1	BUSBAR PROTECTION DATA	47
6.1.1	BUSBAR PROTECTION SETTING REVIEW	47
7.1	DC MEASUREMENTS	48
8.1	PROTECTION REVIEW AND RECOMMENDATIONS	49
9.1	REVIEW OF TEST REPORTS	51

# 1.1: LINE DIAGRAM OF RVUNL-CTPP (Chhabra)



## SINGLE LINE DIAGRAM OF 220 kV BUSBAR PANEL SWITCHYARD CTPP STAGE-I PHASE-I & II



## 1.2: Protection system overall review

RVUNL-CTPP, Chhabra		
DATE OF AUDIT BY CPRI TEAM : 02/01/2024 to 05/01/2024		
Sl. No	Title	Details
1	Name Of Grid Substation	RVUNL-CTPP, Chhabra
2	Highest Voltage Level	400 kV
3	Year Of Installation	2010
4	No Of Feeders	Four 400 kV, Two 220 kV Feeder
5	No of Transformers, Make and Capacity	315 MVA ICT 4*50 MVA Station transformers
6	Busbar Arrangement	Double main transfer bus for 220kV One and half breaker for 400kV
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 System (1&2) [2] 220/110 V DC-II System (1&2) [3] 220/110 V DC-I System (3&4) [4] 220/110 V DC-II System (3&4) [5] 48 V DC-I System [6] 48 V DC-II System
11	DC Supply Capacity And Adequacy	Battery is adequate for the station load.
12	DC System Earth Fault Status	DC System in switch yard 1&2 is healthy. DC Earth fault is present in switch yard 3&4.
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:**

Organization	Name
CPRI, Bangalore	Shri Ved Prakash Yadav, Engineering Officer Shri Pola Soma Sekhar Reddy, Engineering Officer
RVUNL, CTPP	Shri Pawan Kumar, XEN Shri Jitender Gupta, AEN Shri Peeyush Tripathi, JEN

### 1.3: relays used for transmission line, transformer, reactor and bus-bar protection substation

#### 1.3.1: Relays used for Transmission Line Protection

Sl. No.	Name of the Feeder	Main-I	Main-II
1	CTPP-BHILWARA	SEIMENS&7SA522	SEIMENS&7SA612
2	CTPP-ANTA	SEIMENS&7SA522	SEIMENS&7SA612
3	CTPP-ADANI	SEIMENS&7SA522	SEIMENS&7SA612
4	CTPP-HINDHAUN	ABB&REL670	ABB&REL670
5	CTPP-KAWAI	SEIMENS&7SA522	SEIMENS&7SA612
6	CTPP-AKLERA	SEIMENS&7SA522	SEIMENS&7SA612

**1.3.2: Relays used for Transformer Protection:**

Sl. No.	Transformer	Primary Protection		Back Up protection		
		Differential Protection	Restricted Earth Fault	Over fluxing protection	HV back up over current and Earth	LV back up Over Current and Earth
1	ICT	SEIMENS&7UT613	SEIMENS&7SJ611	SEIMENS&7SJ613	SEIMENS&7SJ621	SEIMENS&7SJ621
2	ST-1	SEIMENS&7UT613	SEIMENS&7SJ611	SEIMENS&7SJ613	SEIMENS&7SJ621	SEIMENS&7SJ621
3	ST-2	SEIMENS&7UT613	SEIMENS&7SJ611	SEIMENS&7SJ613	SEIMENS&7SJ621	SEIMENS&7SJ621
4	ST-3	ABB&RET670	ABB&RET670	ABB&RET670	ABB&RET670	ABB&REF615
5	ST-4	ABB&RET670	ABB&RET670	ABB&RET670	ABB&RET670	ABB&REF615

**1.3.3: Relays used for Reactor Protection:**

Sl. No.	Reactor	Primary Protection	Backup protection
		Differential Protection	Over Current
1	BAY – 407 Bus reactor	SEIMENS&7SJ611	SEIMENS&7SA522
2	BAY – 408 Bus reactor	SEIMENS&7SJ611	SEIMENS&7SA522
3	BAY – 414R Line reactor	ABB&RET670	ABB&REL670
4	BAY – 417R Line reactor	ABB&RET670	ABB&REL670

**1.3.4: Relays used for bus bar Protection:**

Sl. No.	Voltage level	Make	Model
1	220kV	SIEMENS	7SS5220
2	400kV	SIEMENS	7SS5220
		SIEMENS	7SS5220

## 2.1. Input Data for Transmission Lines Substation

### 2.1.1. Input Data for Transmission Lines Substation – Bhilwara 400kv line

Sl. No.	Description	Units	Value
	<b>Station Name</b>	<b>RVUNL-CTPP, Chhabra</b>	
<b>1</b>	<b>Line Reference</b>	<b>CTPP-BHILWARA</b>	
1.1	Line voltage level	kV	400
1.2	Name of remote substation		Bhilwara
<b>2</b>	<b>Main 1 Protection</b>		
2.1	Protection Type		Numerical
2.2	Model & Make		SIEMENS&7SA522
<b>3</b>	<b>Main 2 Protection</b>		
3.1	Protection Type		Numerical
3.2	Model & Make		SIEMENS&7SA612
<b>4</b>	<b>Back-up Protection</b>		
4.1	Protection Type		-
4.2	Model & Make		-
<b>5</b>	<b>CT data for Main 1</b>		
5.1	Ratio	A/A	2000/1
5.2	Class		PS
5.3	Vk / VA burden	Vk/VA	1000/5
5.4	Rct	Ohms	5
5.5	Imag @ Vk/2	mA	30
<b>6</b>	<b>CT data for Main 2</b>		
6.1	Ratio		2000/1
6.2	Class		PS
6.3	Vk / VA burden		1000/5
6.4	Rct		5
6.5	Imag @ Vk/2		30
<b>7</b>	<b>PT Ratio</b>	kV/V	400kV/110V
<b>8</b>	<b>PROTECTED LINE DATA</b>		
8.1	Line Length	Km	303
8.2	Positive seq. RESISTANCE	Ohms/Km	0.0297
8.3	Positive seq. REACTANCE	Ohms/Km	0.332
8.4	Zero seq. RESISTANCE	Ohms/Km	0.162
8.5	Zero seq. REACTANCE	Ohms/Km	1.24
<b>9</b>	<b>ADJACENT SHORTEST LINE DATA (from remote bus)</b>		
9.1	Name of the substation to which the shortest adjacent line is connected		<b>CHITTOR</b>
9.2	Line Length of shortest adjacent line	Km	49.5
9.3	Positive seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.0297
9.4	Positive seq. REACTANCE of shortest adjacent line	Ohms/Km	0.332
9.5	Zero seq. RESISTANCE of	Ohms/Km	0.162

	shortest adjacent line		
9.6	Zero seq. REACTANCE of shortest adjacent line	Ohms/Km	1.24
<b>10</b>	<b>ADJACENT LONGEST LINE DATA (from remote bus)</b>		
10.1	Name of the substation to which the longest adjacent line is connected		<b>AJMER</b>
10.2	Line Length of longest adjacent line	Km	160
10.3	Positive seq. RESISTANCE of longest adjacent line	Ohms/Km	0.0297
10.4	Positive seq. REACTANCE of longest adjacent line	Ohms/Km	0.332
10.5	Zero seq. RESISTANCE of longest adjacent line	Ohms/Km	0.162
10.6	Zero seq. REACTANCE of longest adjacent line	Ohms/Km	1.24
<b>11</b>	<b>Is there a transformer connected to the remote bus</b>	Yes/No	YES
11.1	Number of Transformers		2
11.2	Voltage ratio of the Transformer	kV	-
11.3	MVA of the transformers 1	MVA	1*315,1*500 MVA
11.4	% Impedance of the transformers1	%	13.04,11.95

## 2.1.2 Input Data for Transmission Lines Substation – Anta 400kV line

Sl. No.	Description	Units	Value
	Station Name	RVUNL-CTPP, Chhabra	
<b>1</b>	<b>Line Reference</b>	CTPP-ANTA	
1.1	Line voltage level	kV	400
1.2	Name of remote substation		Anta
<b>2</b>	<b>Main 1 Protection</b>		
2.1	Protection Type		Numerical
2.2	Model & Make		SIEMENS&7SA522
<b>3</b>	<b>Main 2 Protection</b>		
3.1	Protection Type		Numerical
3.2	Model & Make		SIEMENS&7SA612
<b>4</b>	<b>Back-up Protection</b>		
4.1	Protection Type		-
4.2	Model & Make		-
<b>5</b>	<b>CT data for Main 1</b>		
5.1	Ratio	A/A	2000/1
5.2	Class		PS
5.3	Vk / VA burden	Vk/VA	1000/5
5.4	Rct	Ohms	5
5.5	Imag @ Vk/2	mA	30
<b>6</b>	<b>CT data for Main 2</b>		
6.1	Ratio		2000/1
6.2	Class		PS
6.3	Vk / VA burden		1000/5
6.4	Rct		5
6.5	Imag @ Vk/2		30
<b>7</b>	<b>PT Ratio</b>	kV/V	400kV/110V
<b>8</b>	<b>PROTECTED LINE DATA</b>		
8.1	Line Length	Km	91.1
8.2	Positive seq. RESISTANCE	Ohms/Km	0.0297
8.3	Positive seq. REACTANCE	Ohms/Km	0.332
8.4	Zero seq. RESISTANCE	Ohms/Km	0.162
8.5	Zero seq. REACTANCE	Ohms/Km	1.24
<b>9</b>	<b>ADJACENT SHORTEST LINE DATA (from remote bus)</b>		
9.1	Name of the substation to which the shortest adjacent line is connected		<b>Adani 400kV</b>
9.2	Line Length of shortest adjacent line	Km	50.29
9.3	Positive seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.0297
9.4	Positive seq. REACTANCE of shortest adjacent line	Ohms/Km	0.332
9.5	Zero seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.162
9.6	Zero seq. REACTANCE of	Ohms/Km	1.24

	shortest adjacent line		
<b>10</b>	<b>ADJACENT LONGEST LINE DATA (from remote bus)</b>		
10.1	Name of the substation to which the longest adjacent line is connected		<b>Nanta 400kV</b>
10.2	Line Length of longest adjacent line	Km	91
10.3	Positive seq. RESISTANCE of longest adjacent line	Ohms/Km	0.0297
10.4	Positive seq. REACTANCE of longest adjacent line	Ohms/Km	0.332
10.5	Zero seq. RESISTANCE of longest adjacent line	Ohms/Km	0.162
10.6	Zero seq. REACTANCE of longest adjacent line	Ohms/Km	1.24
<b>11</b>	<b>Is there a transformer connected to the remote bus</b>	Yes/No	YES
11.1	Number of Transformers		3
11.2	Voltage ratio of the Transformer	kV	-
11.3	MVA of the transformers 1	MVA	3*1500 MVA
11.4	% Impedance of the transformers 1	%	14

### 2.1.3.Input Data for Transmission Lines Substation – Adani 400kV line

Sl. No.	Description	Units	Value
	Station Name	RVUNL-CTPP, Chhabra	
<b>1</b>	<b>Line Reference</b>	CTPP-Adani	
1.1	Line voltage level	kV	400
1.2	Name of remote substation		Adani
<b>2</b>	<b>Main 1 Protection</b>		
2.1	Protection Type		Numerical
2.2	Model & Make		SIEMENS&7SA522
<b>3</b>	<b>Main 2 Protection</b>		
3.1	Protection Type		Numerical
3.2	Model & Make		SIEMENS&7SA612
<b>4</b>	<b>Back-up Protection</b>		
4.1	Protection Type		-
4.2	Model & Make		-
<b>5</b>	<b>CT data for Main 1</b>		
5.1	Ratio	A/A	2000/1
5.2	Class		PS
5.3	Vk / VA burden	Vk/VA	1000/5
5.4	Rct	Ohms	5
5.5	Imag @ Vk/2	mA	30
<b>6</b>	<b>CT data for Main 2</b>		
6.1	Ratio		2000/1
6.2	Class		PS
6.3	Vk / VA burden		1000/5
6.4	Rct		5
6.5	Imag @ Vk/2		30
<b>7</b>	<b>PT Ratio</b>	kV/V	400kV/110V
<b>8</b>	<b>PROTECTED LINE DATA</b>		
8.1	Line Length	Km	42
8.2	Positive seq. RESISTANCE	Ohms/Km	0.0297
8.3	Positive seq. REACTANCE	Ohms/Km	0.332
8.4	Zero seq. RESISTANCE	Ohms/Km	0.162
8.5	Zero seq. REACTANCE	Ohms/Km	1.24
<b>9</b>	<b>ADJACENT SHORTEST LINE DATA (from remote bus)</b>		
9.1	Name of the substation to which the shortest adjacent line is connected		<b>Anta 400kV</b>
9.2	Line Length of shortest adjacent line	Km	50
9.3	Positive seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.0147
9.4	Positive seq. REACTANCE of shortest adjacent line	Ohms/Km	0.2528
9.5	Zero seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.248
9.6	Zero seq. REACTANCE of	Ohms/Km	1

	shortest adjacent line		
<b>10</b>	<b>ADJACENT LONGEST LINE DATA (from remote bus)</b>		
10.1	Name of the substation to which the longest adjacent line is connected		<b>Anta 400kV</b>
10.2	Line Length of longest adjacent line	Km	50
10.3	Positive seq. RESISTANCE of longest adjacent line	Ohms/Km	0.0147
10.4	Positive seq. REACTANCE of longest adjacent line	Ohms/Km	0.2528
10.5	Zero seq. RESISTANCE of longest adjacent line	Ohms/Km	0.248
10.6	Zero seq. REACTANCE of longest adjacent line	Ohms/Km	1
<b>11</b>	<b>Is there a transformer connected to the remote bus</b>	Yes/No	-
11.1	Number of Transformers		-
11.2	Voltage ratio of the Transformer	kV	-
11.3	MVA of the transformers 1	MVA	-
11.4	% Impedance of the transformers 1	%	-

### 2.1.4. Input Data for Transmission Lines Substation – Hindhaun 400KV line

Sl. No.	Description	Units	Value
	<b>Station Name</b>	<b>RVUNL-CTPP, Chhabra</b>	
<b>1</b>	<b>Line Reference</b>	CTPP- Hindhaun	
1.1	Line voltage level	kV	400
1.2	Name of remote substation		Hindhaun
<b>2</b>	<b>Main 1 Protection</b>		
2.1	Protection Type		Numerical
2.2	Model & Make		ABB&REL670
<b>3</b>	<b>Main 2 Protection</b>		
3.1	Protection Type		Numerical
3.2	Model & Make		ABB& REL670
<b>4</b>	<b>Back-up Protection</b>		
4.1	Protection Type		-
4.2	Model & Make		-
<b>5</b>	<b>CT data for Main 1</b>		
5.1	Ratio	A/A	2000/1
5.2	Class		PS
5.3	Vk / VA burden	Vk/VA	1000/5
5.4	Rct	Ohms	5
5.5	Imag @ Vk/2	mA	30
<b>6</b>	<b>CT data for Main 2</b>		
6.1	Ratio		2000/1
6.2	Class		PS
6.3	Vk / VA burden		1000/5
6.4	Rct		5
6.5	Imag @ Vk/2		30
<b>7</b>	<b>PT Ratio</b>	kV/V	400kV/110V
<b>8</b>	<b>PROTECTED LINE DATA</b>		
8.1	Line Length	Km	305
8.2	Positive seq. RESISTANCE	Ohms/Km	0.0266
8.3	Positive seq. REACTANCE	Ohms/Km	0.33
8.4	Zero seq. RESISTANCE	Ohms/Km	0.261
8.5	Zero seq. REACTANCE	Ohms/Km	1.031
<b>9</b>	<b>ADJACENT SHORTEST LINE DATA (from remote bus)</b>		
9.1	Name of the substation to which the shortest adjacent line is connected		<b>Alwar 400kV</b>
9.2	Line Length of shortest adjacent line	Km	96
9.3	Positive seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.0266
9.4	Positive seq. REACTANCE of shortest adjacent line	Ohms/Km	0.33
9.5	Zero seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.261
9.6	Zero seq. REACTANCE of	Ohms/Km	1.031

	shortest adjacent line		
<b>10</b>	<b>ADJACENT LONGEST LINE DATA (from remote bus)</b>		
10.1	Name of the substation to which the longest adjacent line is connected		<b>Heerapura 400kV</b>
10.2	Line Length of longest adjacent line	Km	192.6
10.3	Positive seq. RESISTANCE of longest adjacent line	Ohms/Km	0.0266
10.4	Positive seq. REACTANCE of longest adjacent line	Ohms/Km	0.33
10.5	Zero seq. RESISTANCE of longest adjacent line	Ohms/Km	0.261
10.6	Zero seq. REACTANCE of longest adjacent line	Ohms/Km	1.031
<b>11</b>	<b>Is there a transformer connected to the remote bus</b>	Yes/No	YES
11.1	Number of Transformers		2
11.2	Voltage ratio of the Transformer	kV	-
11.3	MVA of the transformers	MVA	2*315 MVA
11.4	% Impedance of the transformers l	%	18.86,13.4

### 2.1.5.Input Data for Transmission Lines Substation – Aklera 220KV LINE

Sl. No.	Description	Units	Value
	Station Name	RVUNL-CTPP, Chhabra	
<b>1</b>	<b>Line Reference</b>	CTPP- Aklera	
1.1	Line voltage level	kV	400
1.2	Name of remote substation		Aklera
<b>2</b>	<b>Main 1 Protection</b>		
2.1	Protection Type		Numerical
2.2	Model & Make		SIEMENS&7SA522
<b>3</b>	<b>Main 2 Protection</b>		
3.1	Protection Type		Numerical
3.2	Model & Make		SIEMENS&7SA612
<b>4</b>	<b>Back-up Protection</b>		
4.1	Protection Type		
4.2	Model & Make		
<b>5</b>	<b>CT data for Main 1</b>		
5.1	Ratio	A/A	1000/1
5.2	Class		PS
5.3	Vk / VA burden	Vk/VA	1000/5
5.4	Rct	Ohms	5
5.5	Imag @ Vk/2	mA	30
<b>6</b>	<b>CT data for Main 2</b>		
6.1	Ratio		1000/1
6.2	Class		PS
6.3	Vk / VA burden		1000/5
6.4	Rct		5
6.5	Imag @ Vk/2		30
<b>7</b>	<b>PT Ratio</b>	kV/V	220kV/110V
<b>8</b>	<b>PROTECTED LINE DATA</b>		
8.1	Line Length	Km	116.7
8.2	Positive seq. RESISTANCE	Ohms/Km	0.0749
8.3	Positive seq. REACTANCE	Ohms/Km	0.3993
8.4	Zero seq. RESISTANCE	Ohms/Km	0.27
8.5	Zero seq. REACTANCE	Ohms/Km	1.24
<b>9</b>	<b>ADJACENT SHORTEST LINE DATA (from remote bus)</b>		
9.1	Name of the substation to which the shortest adjacent line is connected		<b>Jhalawar 220kV</b>
9.2	Line Length of shortest adjacent line	Km	82.7
9.3	Positive seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.1363

9.4	Positive seq. REACTANCE of shortest adjacent line	Ohms/Km	0.4048
9.5	Zero seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.0341
9.6	Zero seq. REACTANCE of shortest adjacent line	Ohms/Km	1.3253
<b>10</b>	<b>ADJACENT LONGEST LINE DATA (from remote bus)</b>		
10.1	Name of the substation to which the longest adjacent line is connected		<b>Jhalawar 220kV</b>
10.2	Line Length of longest adjacent line	Km	82.7
10.3	Positive seq. RESISTANCE of longest adjacent line	Ohms/Km	0.1363
10.4	Positive seq. REACTANCE of longest adjacent line	Ohms/Km	0.4048
10.5	Zero seq. RESISTANCE of longest adjacent line	Ohms/Km	0.0341
10.6	Zero seq. REACTANCE of longest adjacent line	Ohms/Km	1.3253
<b>11</b>	<b>Is there a transformer connected to the remote bus</b>	Yes/No	<b>YES</b>
11.1	Number of Transformers		1
11.2	Voltage ratio of the Transformer	kV	-
11.3	MVA of the transformers	MVA	160 MVA
11.4	% Impedance of the transformers1	%	9.13

### 2.1.6.Input Data for Transmission Lines Substation – Kawai 220KV LINE

Sl. No.	Description	Units	Value
	Station Name	RVUNL-CTPP, Chhabra	
<b>1</b>	<b>Line Reference</b>	CTPP- Kawai	
1.1	Line voltage level	kV	400
1.2	Name of remote substation		Aklera
<b>2</b>	<b>Main 1 Protection</b>		
2.1	Protection Type		Numerical
2.2	Model & Make		SIEMENS&7SA522
<b>3</b>	<b>Main 2 Protection</b>		
3.1	Protection Type		Numerical
3.2	Model & Make		SIEMENS&7SA612
<b>4</b>	<b>Back-up Protection</b>		
4.1	Protection Type		
4.2	Model & Make		
<b>5</b>	<b>CT data for Main 1</b>		
5.1	Ratio	A/A	1000/1
5.2	Class		PS
5.3	Vk / VA burden	Vk/VA	1000/5
5.4	Rct	Ohms	5
5.5	Imag @ Vk/2	mA	30
<b>6</b>	<b>CT data for Main 2</b>		
6.1	Ratio		1000/1
6.2	Class		PS
6.3	Vk / VA burden		1000/5
6.4	Rct		5
6.5	Imag @ Vk/2		30
<b>7</b>	<b>PT Ratio</b>	kV/V	220kV/110V
<b>8</b>	<b>PROTECTED LINE DATA</b>		
8.1	Line Length	Km	42
8.2	Positive seq. RESISTANCE	Ohms/Km	0.0794
8.3	Positive seq. REACTANCE	Ohms/Km	0.3993
8.4	Zero seq. RESISTANCE	Ohms/Km	0.27
8.5	Zero seq. REACTANCE	Ohms/Km	1.24
<b>9</b>	<b>ADJACENT SHORTEST LINE DATA (from remote bus)</b>		
9.1	Name of the substation to which the shortest adjacent line is connected		<b>Atru 220kV</b>
9.2	Line Length of shortest adjacent line	Km	11.53
9.3	Positive seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.1363
9.4	Positive seq. REACTANCE of shortest adjacent line	Ohms/Km	0.4048
9.5	Zero seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.0341
9.6	Zero seq. REACTANCE of	Ohms/Km	1.3253

	shortest adjacent line		
<b>10</b>	<b>ADJACENT LONGEST LINE DATA (from remote bus)</b>		
10.1	Name of the substation to which the longest adjacent line is connected		<b>Baran 220kV</b>
10.2	Line Length of longest adjacent line	Km	50.75
10.3	Positive seq. RESISTANCE of longest adjacent line	Ohms/Km	0.1363
10.4	Positive seq. REACTANCE of longest adjacent line	Ohms/Km	0.4048
10.5	Zero seq. RESISTANCE of longest adjacent line	Ohms/Km	0.0341
10.6	Zero seq. REACTANCE of longest adjacent line	Ohms/Km	1.3253
<b>11</b>	<b>Is there a transformer connected to the remote bus</b>	Yes/No	YES
11.1	Number of Transformers		2
11.2	Voltage ratio of the Transformer	kV	-
11.3	MVA of the transformers	MVA	100 MVA
11.4	% Impedance of the transformers1	%	12.48,12.68

### 3.1. Transmission line protective relay settings review

Line Name	BHILWARA 400KV LINE			
Main I/II	Main-I		Main-II	
Relay	SEIMENS&7SA522		SEIMENS&7SA612	
Description/Parameter	Existing setting	Reviewed setting	Existing setting	Reviewed setting
Line angle	85	84.93	85	84.93
Zero seq. compensation factor ( <b>Rg/RI</b> ) for Z1	1.48	1.48	1.48	1.48
Zero seq. compensation factor ( <b>Xg/XI</b> ) for Z1	0.91	0.91	0.91	0.91
Zero seq. compensation factor ( <b>Rg/RI</b> ) for >Z1	1.48	1.48	1.48	1.48
Zero seq. compensation factor ( <b>Xg/XI</b> ) for >Z1	0.91	0.91	0.91	0.91
<b>ZONE 1</b>				
Operating mode Z1	Forward	Forward	Forward	Forward
R(Z1) resistance for ph-ph faults	8.620	8.91	8.620	8.91
X(Z1), Reactance	44.262	44.26	44.262	44.26
RG(Z1),Resistance for ph-gnd faults	<b>22.402</b>	<b>25.21</b>	<b>22.402</b>	<b>25.21</b>
T1-1Phase,delay for single phase faults	0	0	0	0
T1 multi-ph, delay for multi phase faults	0	0	0	0
<b>ZONE 1B</b>				
Operating mode Z1B	Forward	Forward	Forward	Forward
zone 1B	<b>12.52</b>	<b>10.89</b>	<b>12.52</b>	<b>10.89</b>
X(Z1B), Reactance	66.39	66.39	66.39	66.39
RG(Z1B),Resistance for ph-gnd faults	<b>23.00</b>	<b>26.20</b>	<b>23.00</b>	<b>26.20</b>
T1B-1Phase,delay for single phase faults	0	0	0	0
T1B multi-ph, delay for multi phase faults	0	0	0	0
<b>ZONE 2</b>				
Operating mode Z2	Forward	Forward	Forward	Forward
R(Z2) resistance for ph-ph faults	11.430	10.89	11.430	10.89
X(Z2), Reactance	<b>59.841</b>	<b>66.39</b>	<b>59.841</b>	<b>66.39</b>
RG(Z2),Resistance for ph-gnd faults	<b>24.452</b>	<b>27.19</b>	<b>24.452</b>	<b>27.19</b>
T2-1Phase,delay for single phase faults	<b>0.3</b>	<b>0.5</b>	<b>0.3</b>	<b>0.5</b>
T2 multi-ph, delay for multi phase faults	<b>0.3</b>	<b>0.5</b>	<b>0.3</b>	<b>0.5</b>
<b>ZONE 3</b>				

Operating mode Z3	Forward	Forward	Forward	Forward
R(Z3) resistance for ph-ph faults	<b>16.86</b>	<b>12.96</b>	<b>16.86</b>	<b>12.96</b>
X(Z3), Reactance	90.08	89.57	90.08	89.57
RG(Z3),Resistance for ph-gnd faults	<b>32.80</b>	<b>29.26</b>	<b>32.80</b>	<b>29.26</b>
T3-1PHASE,delay for single phase faults	1	1	1	1
T3 multi-ph, delay for multi phase faults	1	1	1	1
<b>ZONE 4</b>				
Operating mode Z4	Reverse	Reverse	Reverse	Reverse
R(Z4) resistance for ph-ph faults	<b>1.71</b>	<b>5.94</b>	<b>1.71</b>	<b>5.94</b>
X(Z4), Reactance	<b>8.85</b>	<b>11.07</b>	<b>8.85</b>	<b>11.07</b>
RG(Z4),Resistance for ph-gnd faults	<b>4.02</b>	<b>22.24</b>	<b>4.02</b>	<b>22.24</b>
T4-1Phase,delay for single phase faults	1	1	1	1
T4 multi-ph, delay for multi phase faults	1	1	1	1
<b>Power Swing Settings</b>				
Power swing operating mode	All zones blocked	All zones blocked	All zones blocked	All zones blocked
Power swing trip	NO	NO	NO	NO
Trip delay after power swing blocking	0.10	0.10	0.08	0.10
<b>SOTF</b>				
Instantaneous SOTF O/C	On	On	On	On
SOTF O/C pickup	2.5	2.5	2.5	2.5
<b>Ground Over Current</b>				
Pickup	0.2	0.2	0.2	0.2
Time delay	1.25	1.25	1.25	1.25
<b>Over Voltage Protection</b>				
Ph-g over voltage protection	On	On	On	On
Pickup Overvoltage	70	70	70	70
Time delay	5	5	5	5
Pickup Overvoltage	95.3	95.3	95.3	95.3
Time delay	0.1	0.1	0.1	0.1

Line Name	ANTA 400KV LINE			
Main I/II	Main-I		Main-II	
Relay	SEIMENS&7SA522		SEIMENS&7SA612	
Description/Parameter	Existing setting	Reviewed setting	Existing setting	Reviewed setting
Line angle	85	84.93	85	84.93
Zero seq. compensation factor (Rg/Rl) for Z1	1.48	1.48	1.48	1.48
Zero seq. compensation factor (Xg/Xl) for Z1	0.91	0.91	0.91	0.91
Zero seq. compensation factor (Rg/Rl) for >Z1	1.48	1.48	1.48	1.48
Zero seq. compensation factor (Xg/Xl) for >Z1	0.91	0.91	0.91	0.91
<b>ZONE 1</b>				
Operating mode Z1	Forward	Forward	Forward	Forward
R(Z1) resistance for ph-ph faults	<b>3.012</b>	<b>6.14</b>	<b>3.012</b>	<b>6.14</b>
X(Z1), Reactance	13.301	13.31	13.301	13.31
RG(Z1),Resistance for ph-gnd faults	<b>17.468</b>	<b>22.44</b>	<b>17.468</b>	<b>22.44</b>
T1-1Phase,delay for single phase faults	0	0	0	0
T1 multi-ph, delay for multi phase faults	0	0	0	0
<b>ZONE 1B</b>				
Operating mode Z1B	Forward	Forward	Forward	Forward
zone 1B	<b>4.204</b>	<b>6.74</b>	<b>4.204</b>	<b>6.74</b>
X(Z1B), Reactance	19.951	19.96	19.951	19.96
RG(Z1B),Resistance for ph-gnd faults	<b>18.340</b>	<b>22.74</b>	<b>18.340</b>	<b>22.74</b>
T1B-1Phase,delay for single phase faults	0	0	0	0
T1B multi-ph, delay for multi phase faults	0	0	0	0
<b>ZONE 2</b>				
Operating mode Z2	Forward	Forward	Forward	Forward
R(Z2) resistance for ph-ph faults	<b>4.204</b>	<b>6.74</b>	<b>4.204</b>	<b>6.74</b>
X(Z2), Reactance	19.951	19.96	19.951	19.96
RG(Z2),Resistance for ph-gnd faults	<b>18.340</b>	<b>22.74</b>	<b>18.340</b>	<b>22.74</b>
T2-1Phase,delay for single phase faults	0.4	0.35	0.4	0.35
T2 multi-ph, delay for multi phase faults	0.4	0.35	0.4	0.35
<b>ZONE 3</b>				
Operating mode Z3	Forward	Forward	Forward	Forward
R(Z3) resistance for ph-ph faults	<b>6.904</b>	<b>7.92</b>	<b>6.904</b>	<b>7.92</b>

X(Z3), Reactance	34.990	33.25	34.990	33.25
RG(Z3),Resistance for ph-gnd faults	<b>22.006</b>	<b>24.22</b>	<b>22.006</b>	<b>24.22</b>
T3-1PHASE, delay for single phase faults	1	1	1	1
T3 multi-ph, delay for multi phase faults	1	1	1	1
<b>ZONE 4</b>				
Operating mode Z4	Reverse	Reverse	Reverse	Reverse
R(Z4) resistance for ph-ph faults	<b>0.602</b>	<b>5.25</b>	<b>0.602</b>	<b>5.25</b>
X(Z4), Reactance	<b>2.660</b>	<b>3.33</b>	<b>2.660</b>	<b>3.33</b>
RG(Z4),Resistance for ph-gnd faults	<b>3.494</b>	<b>21.55</b>	<b>3.494</b>	<b>21.55</b>
T4-1Phase, delay for single phase faults	1	1	1	1
T4 multi-ph, delay for multi phase faults	1	1	1	1
<b>Power Swing Settings</b>				
Power swing operating mode	All zones blocked	All zones blocked	All zones blocked	All zones blocked
Power swing trip	NO	NO	NO	NO
Trip delay after power swing blocking	0.10	0.10	0.10	0.10
<b>SOTF</b>				
Instantaneous SOTF O/C	On	On	On	On
SOTF O/C pickup	2.5	2.5	2.5	2.5
<b>Ground Over Current</b>				
Pickup	0.2	0.2	0.2	0.2
Time delay	1.25	1.25	1.25	1.25
<b>Over Voltage Protection</b>				
Ph-g over voltage protection	On	On	On	On
Pickup Overvoltage	70	70	70	70
Time delay	5	5	5	5
Pickup Overvoltage	95.3	95.3	95.3	95.3
Time delay	0.1	0.1	0.1	0.1

Line Name	ADANI 400KV LINE			
Main I/II	Main-I		Main-II	
Relay	SEIMENS&7SA522		SEIMENS&7SA612	
Description/Parameter	Existing setting	Reviewed setting	Existing setting	Reviewed setting
Line angle	85	84.93	85	84.93
Zero seq. compensation factor ( <b>Rg/RI</b> ) for Z1	1.48	1.48	1.48	1.48
Zero seq. compensation factor ( <b>Xg/XI</b> ) for Z1	0.91	0.91	0.91	0.91
Zero seq. compensation factor ( <b>Rg/RI</b> ) for >Z1	1.48	1.48	1.48	1.48
Zero seq. compensation factor ( <b>Xg/XI</b> ) for >Z1	0.91	0.91	0.91	0.91
<b>ZONE 1</b>				
Operating mode Z1	Forward	Forward	Forward	Forward
R(Z1) resistance for ph-ph faults	<b>3.850</b>	<b>5.50</b>	<b>3.850</b>	<b>5.50</b>
X(Z1), Reactance	6.135	6.14	6.135	6.14
RG(Z1),Resistance for ph-gnd faults	21.967	21.80	21.967	21.80
T1-1Phase,delay for single phase faults	0	0	0	0
T1 multi-ph, delay for multi phase faults	0	0	0	0
<b>ZONE 1B</b>				
Operating mode Z1B	Forward	Forward	Forward	Forward
zone 1B	3.988	5.77	3.988	5.77
X(Z1B), Reactance	<b>7.669</b>	<b>9.20</b>	<b>7.669</b>	<b>9.20</b>
RG(Z1B),Resistance for ph-gnd faults	22.133	21.93	22.133	21.93
T1B-1Phase,delay for single phase faults	0	0	0	0
T1B multi-ph, delay for multi phase faults	0	0	0	0
<b>ZONE 2</b>				
Operating mode Z2	Forward	Forward	Forward	Forward
R(Z2) resistance for ph-ph faults	<b>4.219</b>	<b>5.77</b>	<b>4.219</b>	<b>5.77</b>
X(Z2), Reactance	<b>11.327</b>	<b>9.20</b>	<b>11.327</b>	<b>9.20</b>
RG(Z2),Resistance for ph-gnd faults	22.410	22.60	22.410	22.60
T2-1Phase,delay for single phase faults	0.35	0.35	0.35	0.35
T2 multi-ph, delay for multi phase faults	0.35	0.35	0.35	0.35
<b>ZONE 3</b>				
Operating mode Z3	Forward	Forward	Forward	Forward

R(Z3) resistance for ph-ph faults	<b>4.587</b>	6.18	<b>4.587</b>	6.18
X(Z3), Reactance	16.517	16.16	16.517	16.16
RG(Z3),Resistance for ph-gnd faults	<b>22.852</b>	22.48	<b>22.852</b>	22.48
T3-1PHASE,delay for single phase faults	1	1	1	1
T3 multi-ph, delay for multi phase faults	1	1	1	1
<b>ZONE 4</b>				
Operating mode Z4	Reverse	Reverse	Reverse	Reverse
R(Z4) resistance for ph-ph faults	<b>8.69</b>	<b>5.09</b>	<b>8.69</b>	<b>5.09</b>
X(Z4), Reactance	<b>0.766</b>	<b>1.53</b>	<b>0.766</b>	<b>1.53</b>
RG(Z4),Resistance for ph-gnd faults	<b>38.890</b>	<b>21.39</b>	<b>38.890</b>	<b>21.39</b>
T4-1Phase,delay for single phase faults	1	1	1	1
T4 multi-ph, delay for multi phase faults	1	1	1	1
<b>Power Swing Settings</b>				
Power swing operating mode	All zones blocked	All zones blocked	All zones blocked	All zones blocked
Power swing trip	NO	NO	NO	NO
Trip delay after power swing blocking	0.10	0.10	0.10	0.10
<b>SOTF</b>				
Instantaneous SOTF O/C	On	On	On	On
SOTF O/C pickup	2.5	2.5	2.5	2.5
<b>Ground Over Current</b>				
Pickup	0.2	0.2	0.2	0.2
Time delay	1.25	1.25	1.25	1.25
<b>Over Voltage Protection</b>				
Ph-g over voltage protection	On	On	On	On
Pickup Overvoltage	70	70	70	70
Time delay	5	5	5	5
Pickup Overvoltage	95.3	95.3	95.3	95.3
Time delay	0.1	0.1	0.1	0.1

<b>Line Name</b>	<b>Hindhau 400KV LINE</b>	
<b>Main I/II</b>	<b>Main-I</b>	
<b>Relay</b>	<b>ABB&amp;REL670 QUADRILATERAL</b>	
<b>Description/Parameter</b>	<b>Existing setting</b>	<b>Reviewed setting</b>
<b>ZONE 1</b>		
Operation	On	On
IBase	2000.00	2000.00
UBase	400.00	400.00
OperationDir	Forward	Forward
X1	81.01	80.52
R1	6.49	6.49
X0	251.56	251.56
R0	63.73	63.68
RFPP	30	30.00
RFPE	50	50.00
TPP	0	0.00
TPE	0	0.00
<b>ZONE 2</b>		
X1	121.51	120.78
R1	9.73	9.74
X0	377.34	377.35
R0	95.52	95.53
RFPP	60	60.00
RFPE	75	75.00
TPP	0.3	0.50
TPE	0.3	0.50
<b>ZONE 3</b>		
X1	<b>185.26</b>	<b>197.05</b>
R1	14.84	15.88
X0	<b>575.29</b>	<b>615.63</b>
R0	<b>145.63</b>	<b>155.85</b>
RFPP	75	75.00
RFPE	125	125.00
TPP	0.8	0.80

TPE	0.8	0.80
<b>ZONE 4</b>		
X1	20.25	20.13
R1	1.81	1.62
X0	62.89	62.89
R0	15.92	15.92
RFPP	<b>75</b>	<b>60.00</b>
RFPE	<b>125</b>	<b>75.00</b>
TPP	1	0.50
TPE	1	0.50
<b>Residual over current</b>		
IN1>	20	20
T1Min	1.1	1.1
K1	0.48	0.48
<b>Automatic Switch Onto Fault Logic</b>		
Ib	2000	2000
UB	400	400
IPh<	20	20
UPh<	70	70
tDuration	0.02	0.02
tSOTF	0.2	0.2
tDLD	0.2	0.2
AutoInit	OFF	ON
<b>Over Voltage protection</b>		
Operation Step 1	ON	ON
U1>	110	110
T1	5	5
U2>	150	150
T2	0.1	0.1

Line Name	HindhauN 400KV LINE	
Main I/II	Main-II	
Relay	ABB&REL670 MHO	
Description/Parameter	Existing setting	Reviewed setting
<b>ZONE 1</b>		
Operation	On	On
IBase	2000.00	2000.00
UBase	400.00	400.00
OperationDir	Forward	Forward
Load ench mode	ON	ON
OpModePE	ON	ON
ZPE	81.325	80.78
ZAngPE	85	85
KN	<b>0.92</b>	<b>0.74</b>
KNAng	<b>-3</b>	<b>-13.89</b>
ZRevPE	81.325	80.78
Tpe	0.00	0.00
OpModePP	ON	ON
ZPP	81.325	80.78
ZAngPP	85	85
ZRevPP	81.325	80.78
Tpp	0.00	0.00
<b>ZONE 2</b>		
ZPE	121.988	121.17
ZAngPE	85	85
KN	<b>0.92</b>	<b>0.74</b>
KNAng	<b>-3</b>	<b>-13.89</b>
ZRevPE	121.98	121.17
Tpe	0.50	0.50
OpModePP	ON	ON
ZPP	121.98	121.17
ZAngPP	85	85
ZRevPP	121.98	121.17
Tpp	0.50	0.50

<b>ZONE 3</b>		
ZPE	<b>185.981</b>	<b>197.69</b>
ZAngPE	85	85
KN	<b>0.92</b>	<b>0.74</b>
KNAng	<b>-3</b>	<b>-13.89</b>
ZRevPE	<b>185.981</b>	<b>197.69</b>
Tpe	1.00	1.00
OpModePP	ON	ON
ZPP	<b>185.981</b>	<b>197.69</b>
ZAngPP	85	85
ZRevPP	<b>185.981</b>	<b>197.69</b>
Tpp	1	1.00
<b>ZONE 4</b>		
ZPE	<b>7</b>	<b>20.20</b>
ZAngPE	85	85
KN	<b>0.92</b>	<b>0.74</b>
KNAng	<b>-3</b>	<b>-13.89</b>
ZRevPE	<b>7</b>	<b>20.20</b>
Tpe	1	1.00
OpModePP	ON	ON
ZPP	<b>7</b>	<b>20.20</b>
ZAngPP	85	85
ZRevPP	<b>7</b>	<b>20.20</b>
Tpp	1	1.00
<b>Residual over current</b>		
IN1>	20	20
T1Min	1.1	1.1
K1	0.48	0.48
<b>Automatic Switch Onto Fault Logic (OFF)</b>		
Ib	-	2000
UB	-	400
IPh<	-	20
UPh<	-	70
tDuration	-	0.02
tSOTF	-	0.2

tDLD	-	0.2
AutoInit		ON
<b>Over Voltage protection</b>		
Operation Step 1	ON	ON
U1>	110	110
T1	5	5
U2>	150	150
T2	0.1	0.1

Line Name	AKLERA 220KV LINE			
Main I/II	Main-I		Main-II	
Relay	SEIMENS&7SA522		SEIMENS&7SA612	
Description/Parameter	Existing setting	Reviewed setting	Existing setting	Reviewed setting
Line angle	80	79.42	80	79.42
Zero seq. compensation factor ( <b>Rg/RI</b> ) for Z1	0.64	0.65	0.64	0.65
Zero seq. compensation factor ( <b>Xg/XI</b> ) for Z1	0.78	0.78	0.78	0.78
Zero seq. compensation factor ( <b>Rg/RI</b> ) for >Z1	0.64	0.65	0.64	0.65
Zero seq. compensation factor ( <b>Xg/XI</b> ) for >Z1	0.78	0.78	0.78	0.78
<b>ZONE 1</b>				
Operating mode Z1	Forward	Forward	Forward	Forward
R(Z1) resistance for ph-ph faults	<b>3.708</b>	<b>7.10</b>	<b>3.708</b>	<b>7.10</b>
X(Z1), Reactance	18.682	18.64	18.682	18.64
RG(Z1),Resistance for ph-gnd faults	<b>12.610</b>	<b>28.29</b>	<b>12.610</b>	<b>28.29</b>
T1-1Phase,delay for single phase faults	0	0	0	0
T1 multi-ph, delay for multi phase faults	0	0	0	0
<b>ZONE 2</b>				
Operating mode Z2	Forward	Forward	Forward	Forward
R(Z2) resistance for ph-ph faults	<b>5.562</b>	<b>9.16</b>	<b>5.562</b>	<b>9.16</b>
X(Z2), Reactance	28.022	27.98	28.022	27.98
RG(Z2),Resistance for ph-gnd faults	<b>18.915</b>	<b>27.30</b>	<b>18.915</b>	<b>27.30</b>
T2-1Phase,delay for single phase faults	0.3	0.35	0.3	0.35
T2 multi-ph, delay for multi phase faults	0.3	0.35	0.3	0.35
<b>ZONE 3</b>				
Operating mode Z3	Forward	Forward	Forward	Forward
R(Z3) resistance for ph-ph faults	<b>8.829</b>	<b>13.78</b>	<b>8.829</b>	<b>13.78</b>
X(Z3), Reactance	<b>44.480</b>	<b>40.54</b>	<b>44.480</b>	<b>40.54</b>
RG(Z3),Resistance for ph-gnd faults	<b>30.024</b>	<b>34.97</b>	<b>30.024</b>	<b>34.97</b>
T3-1PHASE,delay for single phase faults	0.8	0.8	0.8	0.8
T3 multi-ph, delay for multi phase faults	0.8	0.8	0.8	0.8
<b>ZONE 4</b>				
Operating mode Z4	Reverse	Reverse	Reverse	Reverse

R(Z4) resistance for ph-ph faults	<b>0.74</b>	<b>4.53</b>	<b>0.74</b>	<b>4.53</b>
X(Z4), Reactance	<b>3.736</b>	<b>4.66</b>	<b>3.736</b>	<b>4.66</b>
RG(Z4),Resistance for ph-gnd faults	<b>2.522</b>	<b>23.59</b>	<b>2.522</b>	<b>23.59</b>
T4-1Phase,delay for single phase faults	1	1	1	1
T4 multi-ph, delay for multi phase faults	1	1	1	1
<b>Power Swing Settings</b>				
Power swing operating mode	All zones blocked	All zones blocked	All zones blocked	All zones blocked
Power swing trip	NO	NO	NO	NO
Trip delay after power swing blocking	0.1	0.1	0.1	0.1
<b>SOTF</b>				
Instantaneous SOTF O/C	On	On	On	On
SOTF O/C pickup	4	4	4	4
<b>Ground Over Current</b>				
Pickup	0.2	0.2	0.2	0.2
Time delay	0.75	0.75	0.75	0.75
<b>Over Voltage Protection</b>				
Ph-g over voltage protection	On	On	On	On
Pickup Overvoltage	73.5	73.5	73.5	73.5
Time delay	2	2	2	2
Pickup Overvoltage	76	76	76	76
Time delay	1	1	1	1

Line Name	KAWAI 220KV LINE			
Main I/II	Main-I		Main-II	
Relay	SEIMENS&7SA522		SEIMENS&7SA612	
Description/Parameter	Existing setting	Reviewed setting	Existing setting	Reviewed setting
Line angle	80	78.79	80	78.79
Zero seq. compensation factor ( <b>Rg/RI</b> ) for Z1	0.65	0.80	0.65	0.80
Zero seq. compensation factor ( <b>Xg/XI</b> ) for Z1	0.78	0.70	0.78	0.70
Zero seq. compensation factor ( <b>Rg/RI</b> ) for >Z1	0.65	0.80	0.65	0.80
Zero seq. compensation factor ( <b>Xg/XI</b> ) for >Z1	0.78	0.70	0.78	0.70
<b>ZONE 1</b>				
Operating mode Z1	Forward	Forward	Forward	Forward
R(Z1) resistance for ph-ph faults	<b>7.55</b>	<b>4.93</b>	<b>7.55</b>	<b>4.93</b>
X(Z1), Reactance	6.66	6.71	6.66	6.71
RG(Z1),Resistance for ph-gnd faults	<b>16.25</b>	<b>24.00</b>	<b>16.25</b>	<b>24.00</b>
T1-1Phase,delay for single phase faults	0	0	0	0
T1 multi-ph, delay for multi phase faults	0	0	0	0
<b>ZONE 2</b>				
Operating mode Z2	Forward	Forward	Forward	Forward
R(Z2) resistance for ph-ph faults	<b>8.749</b>	<b>5.60</b>	<b>8.749</b>	<b>5.60</b>
X(Z2), Reactance	<b>13.317</b>	<b>10.06</b>	<b>13.317</b>	<b>10.06</b>
RG(Z2),Resistance for ph-gnd faults	<b>17.5</b>	<b>24.33</b>	<b>17.5</b>	<b>24.33</b>
T2-1Phase,delay for single phase faults	0.3	0.5	0.3	0.5
T2 multi-ph, delay for multi phase faults	0.3	0.5	0.3	0.5
<b>ZONE 3</b>				
Operating mode Z3	Forward	Forward	Forward	Forward
R(Z3) resistance for ph-ph faults	<b>9.68</b>	<b>7.04</b>	<b>9.68</b>	<b>7.04</b>
X(Z3), Reactance	<b>18.30</b>	<b>18.48</b>	<b>18.30</b>	<b>18.48</b>
RG(Z3),Resistance for ph-gnd faults	<b>18.43</b>	<b>26.10</b>	<b>18.43</b>	<b>26.10</b>
T3-1PHASE,delay for single phase faults	0.8	1	0.8	1
T3 multi-ph, delay for multi phase faults	0.8	1	0.8	1
<b>ZONE 4</b>				
Operating mode Z4	Reverse	Reverse	Reverse	Reverse

R(Z4) resistance for ph-ph faults	<b>6.641</b>	<b>3.93</b>	<b>6.641</b>	<b>3.93</b>
X(Z4), Reactance	<b>2.08</b>	<b>1.68</b>	<b>2.08</b>	<b>1.68</b>
RG(Z4),Resistance for ph-gnd faults	<b>15.391</b>	<b>23.00</b>	<b>15.391</b>	<b>23.00</b>
T4-1Phase,delay for single phase faults	1	1	1	1
T4 multi-ph, delay for multi phase faults	1	1	1	1
<b>Power Swing Settings</b>				
Power swing operating mode	All zones blocked	All zones blocked	All zones blocked	All zones blocked
Power swing trip	NO	NO	NO	NO
Trip delay after power swing blocking	0.08	0.1	0.08	0.1
<b>SOTF</b>				
Instantaneous SOTF O/C	On	On	On	On
SOTF O/C pickup	4	4	4	4
<b>Ground Over Current</b>				
Pickup	0.2	0.2	0.2	0.2
Time delay	0.5	0.5	0.5	0.5
<b>Over Voltage Protection</b>				
Ph-g over voltage protection	On	On	On	On
Pickup Overvoltage	73.5	73.5	73.5	73.5
Time delay	2	2	2	2
Pickup Overvoltage	76	76	76	76
Time delay	1	1	1	1

## 4.1. Transformer Protection Data

### 4.1.1. Input Data for Transformer Protection

Sl. No.	Description	Units	Value	Value	Value
Substation Name					
Transformer Name			ICT	ST 1&2	ST 3&4
1	Ratings				
1.1	MVA	MVA	315	50	50
1.2	Voltage Ratio	kV/kV	400/220/33	220/(6.9-6.9)	400/(6.9-6.9)
2	Impedance	%	12.50	17	17
3	Vector Group		YNa0d11	YNyn0yn0	YNyn0yn0
4	NGR Data (if Present)	Ohms	-	-	-
5	OLTC Present	Yes/No	Yes	Yes	Yes
5.1	OLTC Data				
5.2	Min Tap voltage	kV	350	192.5	350
5.3	Max Tap voltage	kV	434	236.5	430
5.4	No. of Steps		17	17	17
6	Differential Protection provided	Yes/No	Yes	Yes	Yes
6.1	Differential CT Ratio				

6.2	HV CT Ratio (Main & ICT)	A/A	1000/1	300/1	1000/1
6.3	LV CT Ratio (Main & ICT)	A/A	1000/1	2500/1	2500/1
7	Differential Relay				
7.1	Make		SIEMENS	SIEMENS	ABB
7.2	Model		SIEMENS 7UT613	SIEMENS 7UT613	ABB RET670
8	REF provided	Yes/No	Yes	Yes	Yes
8.1	REF Protection CTs Ratio (Main & ICT)	A/A	HV: 400 LV: 220	-	-
8.2	Acc Class		PS	PS	PS
8.3	RCT ( $\Omega$ )	Ohms	-	-	-
8.4	Vk(V)	V	-	-	-
8.5	Im@Vk/2	mA	-	-	-
8.6	Longest sec. one way lead R $\Omega$	Ohms	-	-	-
8.7	REF Relay				
8.8	Make		SIEMENS	SIEMENS	ABB
8.9	Model		SIEMENS 7UT613	SIEMENS 7UT613	ABB RET670
8.10	Rstab Range ( $\Omega$ )	Ohms	-	-	370
9	Over fluxing Protection provided	Yes/No	Yes	Yes	Yes
9.1	Over fluxing Protection Relay				

9.2	Make		SIEMENS	SIEMENS	ABB
9.3	Model		SIEMENS 7UT613	SIEMENS 7UT613	ABB RET670
10	HV Back-up Protection provided	Yes/No	Yes	Yes	Yes
10.1	HV Back-up Protection Relay				
10.2	Make		SIEMENS	SIEMENS	ABB
10.3	Model		SIEMENS 7SJ621	SIEMENS 7SJ621	ABB RET670
10.4	HV Back-up Protection CTs Ratio	A/A	1000/1	300/1	1000/1
10.5	Acc Class		PS	PS	PS
11	LV Back-up Protection provided	Yes/No	Yes	Yes	Yes
11.1	LV Back-up Protection Relay				
11.2	Make		SIEMENS	SIEMENS	ABB
11.3	Model		SIEMENS 7SJ621	SIEMENS 7SJ621	ABB RET670
11.4	LV Back-up Protection CTs Ratio	A/A	1000/1	2500/1	2500/1
11.5	Acc Class		PS	PS	PS

#### 4.2. Transformers Protection Relay Setting Review

Sl. No.	PROTECTION		ICT		
			Existing	Reviewed	
1	Differential	Relay Make & Model		SIEMENS 7UT613	
		Biased	Pickup value of diff.current	0.20	0.20
			T I-DIFF> Time delay	0.00	0.00
			Pickup value of High set trip	12.00	12.00
			T I-DIFF>>Time delay	0.00	0.00
			Slope 1	0.25	0.25
			Base point of slope 1	0.00	0.00
			Slope 2	0.5	0.5
Base point of slope 2	2.50	2.50			
2	Over Fluxing	Relay Make & Model		SIEMENS 7UT613	
		U/f > Pickup		1.15	1.15
		T U/f >> Time delay		Infinity	Infinity
		U/f > Pickup		1.40	1.40
		T U/f >>Time delay		5 sec	5 sec
3	HV Overcurrent	Relay Make & Model		SIEMENS 7SJ621	
		Pickup Current		0.6	0.6

		TSM(s)	0.3	0.3
4	LV Overcurrent	Relay Make & Model	SIEMENS 7SJ621	
		Pickup Current	1.10	1.10
		TSM(s)	0.3	0.3
5	HV Earth fault	Relay Make & Model	SIEMENS 7SJ621	
		PSM(A)	0.1	0.1
		TSM(s)	0.35	0.35
6	LV Earth fault	Relay Make & Model	SIEMENS 7SJ621	
		PSM(A)	0.18	0.18
		TSM(s)	0.35	0.35

Sl. No.	PROTECTION		ST 1&2		
			Existing	Reviewed	
1	Differential	Relay Make & Model		SIEMENS 7UT613	
		Biased	Pickup value of diff.current	0.20	0.20
			T I-DIFF> Time delay	0.00	0.00
			Pickup value of High set trip	8.00	8.00
			T I-DIFF>>Time delay	0.00	0.00
			Slope 1	0.25	0.25
			Base point of slope 1	0.00	0.00
			Slope 2	0.5	0.5
Base point of slope 2	2.50	2.50			
2	Over Fluxing	Relay Make & Model		SIEMENS 7UT613	
		U/f > Pickup		1.10	1.10
		T U/f >> Time delay		5 sec	5 sec
		U/f > Pickup		1.40	1.40
		T U/f >>Time delay		1 sec	1 sec
3	SEF Protection	Relay Make & Model		SIEMENS 7SJ611	
		I>>> Pickup		35	35
		T I>>> Time delay		0	0

		I>> Pickup	3.72	3.72
		T I>> Time delay	0	0
4	HV Earth fault	Relay Make & Model	SIEMENS 7SJ621	
		PSM(A)	0.25	0.25
		TSM(s)	0.45	0.45
5	LV1 Earth fault	Relay Make & Model	SIEMENS 7SJ621	
		PSM(A)	0.2	0.2
		TSM(s)	0.55	0.55
6	LV2 Earth fault	Relay Make & Model	SIEMENS 7SJ621	
		PSM(A)	0.2	0.2
		TSM(s)	0.55	0.55

Sl. No.	PROTECTION		ST 3&4				
			Existing		Reviewed		
1	Differential	Relay Make & Model		ABB&RET670			
				main1	main2	main1	main2
		Biased	IDiffAlarm	0.2	0.2	0.2	0.2
			tAlarmDelay	10	10	10	10
			IdMin	0.3	0.5	0.3	0.5
IdUnre	8	12	8	12			
2	Over Fluxing	Relay Make & Model		ABB&RET670 main1/2			
		V/Hz>>		170		170	
		V/Hz>		110		110	
		AlaramLevel		100		100	
		tAlarm		5		5	
3	Residual over current	Relay Make & Model		ABB&RET670 main1/2			
		IN1>		10		10	
		T1		1.5		1.5	
		IN1 Mult		1.0		1.0	
		K1 (TSM)		0.3		0.3	
		T1 min		0		0	

4	HV Overcurrent	Relay Make & Model	ABB&RET670 main1/2	
		I1>	1.2	1.2
		T1	0	0
5	LV Overcurrent	Relay Make & Model	ABB&RET670 main1/2	
		I1>	1.2	1.2
		T1	0	0
7	LV Earth fault	Relay Make & Model	ABB REF615	
		Start value	0.15	0.15
		Time multiplier	0.55	0.55

## 5.1. Reactor protection Data

### 5.1.1. Reactor Protection Relay Setting Review

Sl. No.	PROTECTION		BAY – 407 Bus reactor & BAY – 408Bus reactor	
			Existing	Reviewed
1	Earth fault Overcurrent	Relay Make & Model	SIEMENS&7SJ611	
		I > Pickup	0.46	0.46
		T I > Time delay	0.50	0.50
		IE > Pickup	0.11	0.11
		T IE > Time delay	0.50	0.50
2	High impedance diff protection R phase	Relay Make & Model	SIEMENS&7SJ611	
		1Phase o/c I > Pickup Current	0.03	0.03
		T 1Phase o/c I > Pickup time delay	0.1	0.1
3	High impedance diff protection Y phase	Relay Make & Model	SIEMENS&7SJ611	
		1Phase o/c I > Pickup Current	0.03	0.03
		T 1Phase o/c I > Pickup time delay	0.1	0.1
4	High impedance diff protection B phase	Relay Make & Model	SIEMENS&7SJ611	
		1Phase o/c I > Pickup Current	0.03	0.03
		T 1Phase o/c I > Pickup time delay	0.1	0.1

5	<b>Impedance protection</b>	<b>Relay Make &amp; Model</b>	<b>SIEMENS&amp;7SA522</b>	
		R(Z1) resistance for ph-ph faults	33.80	33.80
		X(Z1), Reactance	386.6	386.6
		RG(Z1),Resistance for ph-gnd faults	50.73	50.73
		T1-1Phase,delay for single phase faults	0.15	0.15
		T1 multi-ph, delay for multi phase faults	0.15	0.15

Sl. No.	PROTECTION		BAY – 414R Line reactor & BAY – 417R Line reactor		
			Existing	Reviewed	
1	High impedance Differential	Relay Make & Model		ABB&RET670 MAIN 1	
		High impedance Differential	U>Alarm	2	Stable
			tAlarm	5	
			U>Trip	5	
			Series resistor	250	
2	Phase Overcurrent	Relay Make & Model		ABB&RET670 MAIN 1	
		Pickup Current		1.3	33.80
		TSM(s)		1	386.6
3	Impedance protection	Relay Make & Model		ABB&RET670 MAIN 2	
		X1		2115	2115
		R1		0.6	0.6
		X0		1904	1904
		R0		0.54	0.54
		RFPP		75	75
		RFPE		125	125
		TPP		1	1
		TPE		1	1

## 6.1. Bus-bar protection data

### 6.1.1. Bus bar Protection (400kV) Relay Setting Review

Sl. No.	PROTECTION	400kV		220kV		
		Existing	Reviewed	Existing	Reviewed	
1	Bus bar protection	Relay Make & Model	SIEMENS 7SS522		SIEMENS 7SS522	
		Stabilising factor-BZ	0.6	0.6	0.6	0.6
		Diff current threshold-BZ	0.8	0.8	1.10	1.10
		Stabilising factor-CZ	0.5	0.5	0.6	0.6
		Diff current threshold-CZ	0.8	0.8	1.10	1.10
2	Breaker failure protection	Relay Make & Model	SIEMENS 7SS522		SIEMENS 7SS522	
		Stabilising factor-BF protection	0.5	0.5	0.5	0.5

## 7.1 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. 220 V DC Source:

Sl. No.	Description	Switch yard 1&2		Switch yard 3&4	
		DC1	DC2	DC1	DC2
1	Voltage	220V	220V	220V	220V
	1) Positive to earth	+129	+113	+5	+4
	2) Negative to earth	-113	-129	-237	-236
2	Number of cells per Bank	110	110	108	108
3	Availability of Battery charge	YES	YES	YES	YES

### B. 48V DC Source:

Sl. No.	Description	Switch yard 1&2	Switch yard 3&4
1	Voltage	48V	48V
	1) Positive to earth	0	0
	2) Negative to earth	-50.2	-47
2	Number of cells per Bank	38	36
3	Availability of Battery charge	YES	YES

## 8.1 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 i.e. Main-I & II Zone 1, Zone 1B and Zone 3 impedance reach setting for 400KV BHILWARA line are properly set and some revisions are required in Zone-2 impedance reach settings.
2. Resistive reach setting of all the Zone may be reviewed for Main-I & II of 400KV 400kV BHILWARA line.
3. Quadrilateral reach settings of BHILWARA line may be reviewed.
4. The distance protection i.e. Main-I & II of all zones, impedance reach setting for 400KV ANTA line are properly set and some revisions are required in Zone-4, Main-I & II impedance reach settings.
5. Resistive reach setting of all the Zone may be reviewed for Main-I & II of for 400KV ANTA line.
6. The distance protection Main-I & II impedance reach setting for 400kV ADANI line are properly set and some revisions are required in Zone 1B and Zone 4.
7. Resistive reach setting of the all the Zone may be reviewed for Main-I & II of 400kV ADANI line.
8. The distance protection i.e. Main-I & II of all zones, impedance reach setting for 400KV HINDHAUN line are properly set and some revisions are required in Zone-3,4, Main-I & II impedance reach settings.
9. The distance protection i.e. Main-I & II of all zones, impedance reach setting for 220kV AKLERA line are not properly set and revisions are required in all the zones of Main-I & II impedance reach settings.
10. The resistance reach settings of, all the zones of both Main-I & II need to be reviewed for 220kV AKLERA line.
11. The distance protection Main-I & II impedance reach setting for 220kV KAWAI line are properly set and some revisions are required in Zone 2, Zone 4.
12. The resistance reach settings of, all the zones of both Main-I & II need to be reviewed for 220kV KAWAI line.
13. The zone 4 settings of all distance protections scheme are calculated according to NRPC guide lines but as the all lines are originating from generating station the settings may be reviewed according to the plant conditions.
14. The load blinder settings were recommended considering the ampacity of transmission line. The load blinder settings may be reviewed.
15. The earth fault protection is also protected to all line protection. Power swing, is also provided on all lines. Minor changes in Power swing.
16. The Auto reclose function shall be enabled with the Dead time of 1 sec and Reclaim time of 25 Sec.
17. The Pole discrepancy time setting may be coordinate with the auto reclose function and shall be set as PD time setting = (Auto reclose dead time + time delay of 200-500ms)

18. 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 15  $\Omega$  & 5  $\Omega$  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.
19. Other Protection functionality for lines like SOTF, Voltage supervision and Carrier communication are working satisfactory.
20. It is observed that DC source for switchyard 3 & 4 is having earth fault. This has to be attended and rectify.
21. There is some oil seepage observed in switchyard from the ICT and it has to be attended whenever time permits as per scheduled shutdown.
22. The differential protection setting for transformers are properly set and stable.
23. The impedance protection setting for reactor are properly set and stable.
24. The differential protection setting for bus-bar are properly set and stable.
25. It is suggested to perform the third-party protection audit of substation/generating station periodically.

## **9.1 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.

<b>SPS for 400/220KV ICTs at 400KV Muktsar Substation, PSTCL</b>	
Reporting Party	PSTCL/Punjab
Scheme's Name	SPS for 400/220 KV ICTs at 400KV Muktsar Substation, PSTCL
Classification	SPS related to overloading of remaining ICTs after tripping of 500MVA ICT at 400KV Muktsar Substation, PSTCL
Reference No.	NRLDC report dated 24-05-2024 regarding Punjab's ATC/TTC limits
Design Objective	To avoid overloading of remaining 2 no. 315MVA ICTs due to tripping of 500MVA ICT
Operation	During tripping of 400/220kv 500MVA ICT
Modelling	<p><b><u>400/220kv ICT Details at 400kv Muktsar:</u></b> 2 x 315MVA + 1 x 500MVA = 1130 MVA</p> <p><b><u>220kv Transmission Lines at 400kv Muktsar:</u></b></p> <ol style="list-style-type: none"> <li>1. 220kv Muktsar-Abohar Ckt-1</li> <li>2. 220kv Muktsar-Abohar Ckt-2</li> <li>3. 220kv Muktsar-Ghubaya Ckt-1</li> <li>4. 220kv Muktsar-Ghubaya Ckt-2</li> <li>5. 220kv Muktsar-Katorewala Ckt</li> <li>6. 220 Muktsar-Sandhwan Ckt</li> </ol> <p><b>N-1 Contingency:</b> During tripping of 400/220KV 500MVA ICT at 400KV PSTCL Muktsar, the following feeders shall also be tripped automatically, to provide relief to the remaining 2 no. 400/220KV 315MVA ICTs at 400KV Substation Muktsar (PSTCL):</p> <p><b>Feeder details for tripping during SPS operation</b></p> <p><b>Case 1.</b> After tripping of 400/220KV 500MVA ICT, if loading at remaining ICTs is more than <b>95% for 5 sec</b>, 220kv Muktsar-Sandhwan circuit will be disconnected/tripped.</p> <p><b>Case 2.</b> After tripping of 400/220KV 500MVA ICT, if loading at remaining ICTs is more than <b>100% for 8 sec</b>, 220kv Muktsar-Sandhwan &amp; 220kv Muktsar-Katorewala circuits will be disconnected/tripped.</p> <p><b>NOTE: No load shedding shall be done during implementation of this SPS</b></p>
In-Service Period	Will be implemented at site after approval of the NRPC

**Tentative Loading Scenario of 400/220 KV ICTs at 400KV Muktsar Substation, PSTCL**

<b>Sr. No.</b>	<b>Normal Loading on 3 no. ICTs</b>	<b>Loading on 2 no. 315MVA ICTs during N-1 Contingency</b>	<b>Loading after tripping of 220kV Muktsar-Sandhwan Ckt</b>	<b>Loading after tripping of 220kV Muktsar-Katorewala Ckt</b>
<b>1</b>	<b>~ 70%</b>	<b>~ 100-107%</b>	<b>~ 95-100%</b>	<b>~ 85-90%</b>

HVDC Champa-Kurukshetra Outages during 2024			
S.No.	Outage		Name of Elements
	Date	Time	
1	9-Jan-24	14:01	1) 800 KV HVDC Kurukshetra(PG) Pole-01 2) 800 KV HVDC Kurukshetra(PG) Pole-02 3) 800 KV HVDC Kurukshetra(PG) Pole-03 4) 800 KV HVDC Kurukshetra(PG) Pole-04
2	2-Mar-24	19:24	1) 800 KV HVDC Kurukshetra(PG) Pole-2 2) 800 KV HVDC Kurukshetra(PG) Pole-4
3	21-Mar-24	18:19	1) 800 kV HVDC Kurukshetra(PG) Pole-02 2) 800 kV HVDC Kurukshetra(PG) Pole-04
4	27-Mar-24	15:04	1) 800 kV HVDC Kurukshetra(PG) Pole-02 2) 800 kV HVDC Kurukshetra(PG) Pole-04
5	29-Mar-24	20:26	1) 800 kV HVDC Kurukshetra(PG) Pole-02 2) 800 kV HVDC Kurukshetra(PG) Pole-04
6	7-Apr-24	18:07	1) 800 kV HVDC Kurukshetra(PG) Pole-01 2) 800 kV HVDC Kurukshetra(PG) Pole-03
7	10-May-24	19:41	1) 800 kV HVDC Kurukshetra(PG) Pole-02 2) 800 kV HVDC Kurukshetra(PG) Pole-04
8	30-May-24	09:07	1) 800 kV HVDC Kurukshetra(PG) Pole-03 2) 800 kV HVDC Kurukshetra(PG) Pole-04
9	17-Jun-24	13:53	1) 800 kV HVDC Kurukshetra(PG) Pole-01 2) 800 kV HVDC Kurukshetra(PG) Pole-02 3) 800 kV HVDC Kurukshetra(PG) Pole-03 4) 800 kV HVDC Kurukshetra(PG) Pole-04
10	23-Jun-24	09:11	1) 800 kV HVDC Kurukshetra(PG) Pole-01 2) 800 kV HVDC Kurukshetra(PG) Pole-03
11	27-Jun-24	21:17	1) 800 kV HVDC Kurukshetra(PG) Pole-01 2) 800 kV HVDC Kurukshetra(PG) Pole-02 3) 800 kV HVDC Kurukshetra(PG) Pole-03 4) 800 kV HVDC Kurukshetra(PG) Pole-04

उत्तरप्रदेशराज्य भारप्रेषणकेन्द्रलि०  
यू०पी०एस०एल०डी०सी०परिसर, विभूति  
खण्ड- II, गोमतीनगर, लखनऊ-226010  
ई-मेल : sera@upslcdc.org



U.P. State Load Despatch Centre Ltd  
UPSLDC Complex, Vibhuti Khand – II  
Gomti Nagar, Lucknow- 226010  
E-mail:sera@upslcdc.org

No: 2184 /SE(R&A)/EE-II/ Anpara SPS

Dated: -01/07/2024

SE (Operations), 18 – A SJSS Marg,  
Katwaria Sarai, New Delhi,  
110016. (seo-nrpc@nic.in)

**Subject: -Agenda item in 51th Protection Sub-Committee meeting regarding revision of System Protection Scheme (SPS) for Anpara Complex.**

It is to inform that revised System Protection Scheme (SPS) for Anpara Complex was discussed in 74<sup>th</sup> NRPC meeting held on 28&29 June, 2024. In the meeting said SPS scheme was deemed approved and it was instructed that the scheme be put up in 51th Protection Sub-Committee (PSC) for the discussion.

It is therefore, requested to include revised SPS scheme for Anpara Complex (Copy enclosed) in the agenda of 51th PSC meeting to be held on 12.07.2024.

**Encl: - As above**

*Amit Narain*

(Amit Narain)

Superintending Engineer (R&A)

No: /SE(R&A)/EE-II/ Anpara SPS

Dated: - 2024

Copy forwarded to following via e-mail for information and necessary action:-

1. Chief Engineer (PSO), UPSLDC Vibhuti Khand – II, Gomti Nagar, Lucknow.
2. Chief Engineer (Trans. South - East), U.P. Power Transmission Corporation Ltd., 57, George Town, Prayagraj- 211003.
3. Chief General Manager, Anpara, Thermal Power Station, Anpara.
4. Chief General Manager, (Obra) Thermal Power Station, Obra, Sonbhadra Pin code-231219.
5. Superintending Engineer (System Control), UPSLDC Vibhuti Khand – II, Gomti Nagar, Lucknow.
6. M/s LANCO – Anpara Power Ltd, 411/09 River Side Apartment, New Hyderabad Lucknow-226007(arun.tholia@meilanparapower.com)

*Amit Narain*

Superintending Engineer (R&A)

07.06.2024

## Study for Revision of SPS for Anpara Complex

**Objective:** To Review the System Protection Scheme for safe evacuation of power from Anpara Complex after commissioning of 2X1000 MVA ICTs at Obra C TPS

**Base case:**

Generator	MW
Anpara A&B	1475
Anpara C	1110
Anpara D	900
Obra Thermal	510
Rihand Hydro Complex	0
Obra C	1250
All India Demand	208186
All India Generation	215000
UP Demand	27800
UP Generation	15200

400 kV Obra C-Jaunpur and 400 kV Obra B-Jaunpur are in service.

2X1000 MVA ICTs at Obra C is in of service.

400 kV Anpara Singrauli line is out service.

## **Here studies have been carried out for following scenarios;**

**Case-1:** Tripping of 765 kV Anpara C-Unnao

**Case-2:** Tripping of 765 kV Anpara D-Obra C

**Case-3:** Tripping of 765 kV Obra C-Unnao

**Case-4:** Tripping of **Both 765kV Anpara C-Unnao AND Anpara D-Obra C**

**Case-5:** Tripping of **Both 765kV Anpara C-Unnao AND Obra C –Unnao**

**Case-6:** Tripping of **Both 765kV Anpara D-Obra C AND Obra C–Unnao**

**Case-7:** Tripping of Two ICTs (2X1000 MVA) at 765 kV substation Obra C

**Case-8:** Tripping of One ICT (1X1000 MVA) at 765 kV substation Unnao

**Case-9:** Tripping of Two ICT (2X1000 MVA) at 765 kV substation Unnao

**Case-10:** Tripping of Three ICTs (1X1000 MVA) at 765 kV substation Unnao

### **Inferences from studies:**

- 1. In case of single contingencies (Case No 1, 2, 3 and 8), there is no constraint observed.**
- 2. Overloading of 400kV Anpara-Obra B line**
  1. Overloading of 400kV Anpara –Obra line is observed in Case No.-4 and Case No.-7.
  2. As per study if loading of 400kV Anpara-Obra line is more than 1100MW, generation reduction of 1400MW is required.
  3. In case loading lies between 900MW and 1100MW, generation reduction of 900 MW is sufficient to keep the loading of the line below 800MW.
- 3. Overloading of 400kV Obra C-Obra B line**
  1. Overloading of 400kV Obra C- Obra B is observed in Case No.-5, 6 & 10.
  2. As per study, in case loading of 400kV Obra C- Obra B is more than 1100MW, tripping of one unit at Obra C is required.
  3. However if loading of the same line, lies between 900-1100MW, Automatic Run Back shall be done at Obra C to keep the loading below 900MW.

### Loading Scenario for various contingencies in Anpara Complex

S.No.	Cases	400kV Anpara-Obra B (MW)	765 Anpara_C-Unnao(MW)	400kV Obra C-Obra B(MW)	765kV AnparaD-ObraC-Unnao(MW)	765kV ObraC-Unnao(MW)	ICTs at 765 kV Unnao (MW)
1	Basecase flow (MW)	490	1011	523	503	998	664 each
2	765kV AnparaC-Unnao out	628	0	639	1126	1450	478 each
3	765kV Anpara D-Obra C out	757	1157	192	0	144	662 each
4	765kV Obra C-Unnao out	483	1426	834	-116	0	470 each
5	Both 765kV Anpara C-Unnao AND Anpara D-Obra C out	1406	0	-225	0	1221	403 each
6	Both 765kV AnparaC-Unnao AND ObraC-Unnao out	712	0	1273	471	0	0
7	Both 765kV Anpara D-ObraC AND Obra C-Unnao out	406	1405	942	0	0	463 each
8	Both ICT at Obra C Trip	954	1075	-173	-101	1148	735 each
9	One ICT at Unnao Trip	507	946	577	499	925	927 each
10	Three ICT at Unnao Trip*	709	0	1277	444	0	0

**\* Tripping of 2 ICTs at 765 kV Unnao leads to tripping of all the three ICTs**

**% Sensitivity of Transmission elements with respect to change in Generation**

S.No.	Transmission elements	Anpara A&B TPS	Anpara_C TPS	Anpara DTTPS	Obra CTTPS	Obra BTTPS
1	400 kV Obra C-Obra B	0 %	17.64%	18.00%	29.76%	-32.35%
2	400 kV Anpara-Obra B	28.70%	11.64%	11.33%	1.92%	-21.76%
3	400 kV Anpara –Mau	10.43%	8.36%	8.22%	7.52%	6.47%
4	400 kV Anpara Sarnath ckt 1	12.39%	9.64%	9.56%	8.48%	7.06%
5	400 kV Anpara Sarnath ckt 2	12.39%	9.64%	9.56%	8.48%	7.06%

**% Sensitivity = Change in Line Loading\*100/Change in Generation**

## **Logic for SPS**

### **Contingency related to overloading of 400 kV Obra C-Obra B line**

- i. If  $900 < P1 < 1100$ - Automatic backdown at Obra C till P 1, becomes less than 900.**
- ii. If  $P1 > 1100$ - Tripping of one Unit at Obra C.**

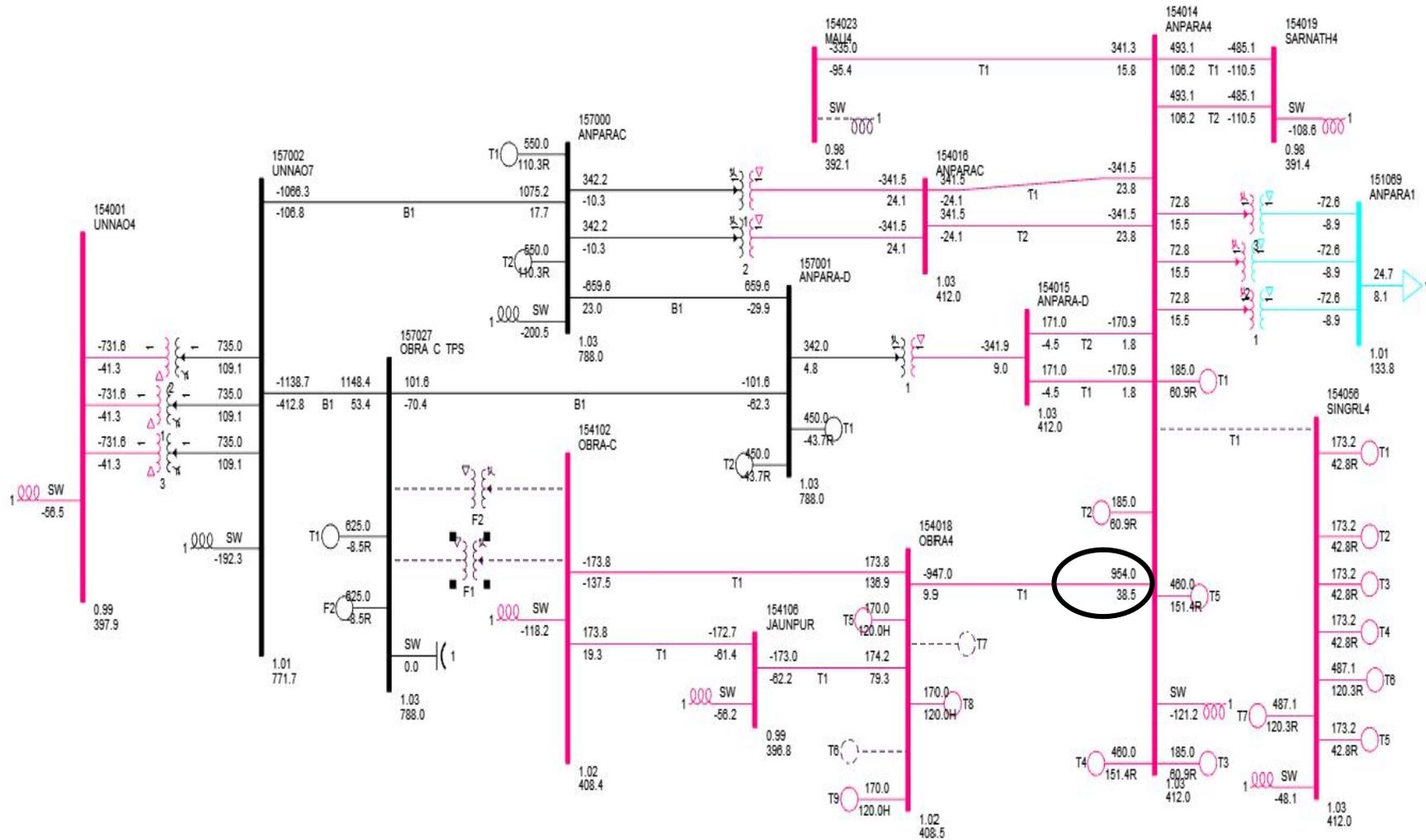
### **Contingency related to overloading of 400 kV Anpara-Obra B line**

- iii. If  $900 < P2 < 1000$ - Automatic backdown at Anpara C AND Anpara D till P2 , becomes less than 900**
- iv. If  $1000 < P2 < 1100$ - Tripping of one unit at Anpara C or D and automatic backdown of Generation of remaining Unit of Anpara C AND Anpara D till P2 , becomes less than 900**
- v. If  $P2 > 1100$ - Tripping of two units at Anpara C TPS AND Anpara DTPS and automatic backdown of Generation of remaining Unit of Anpara C AND Anpara D till P2 , becomes less than 900**

**Where P1= Loading of 400 kV Obra C-Obra B line**

**P2 = Loading of 400 kV Anpara-Obra B line**

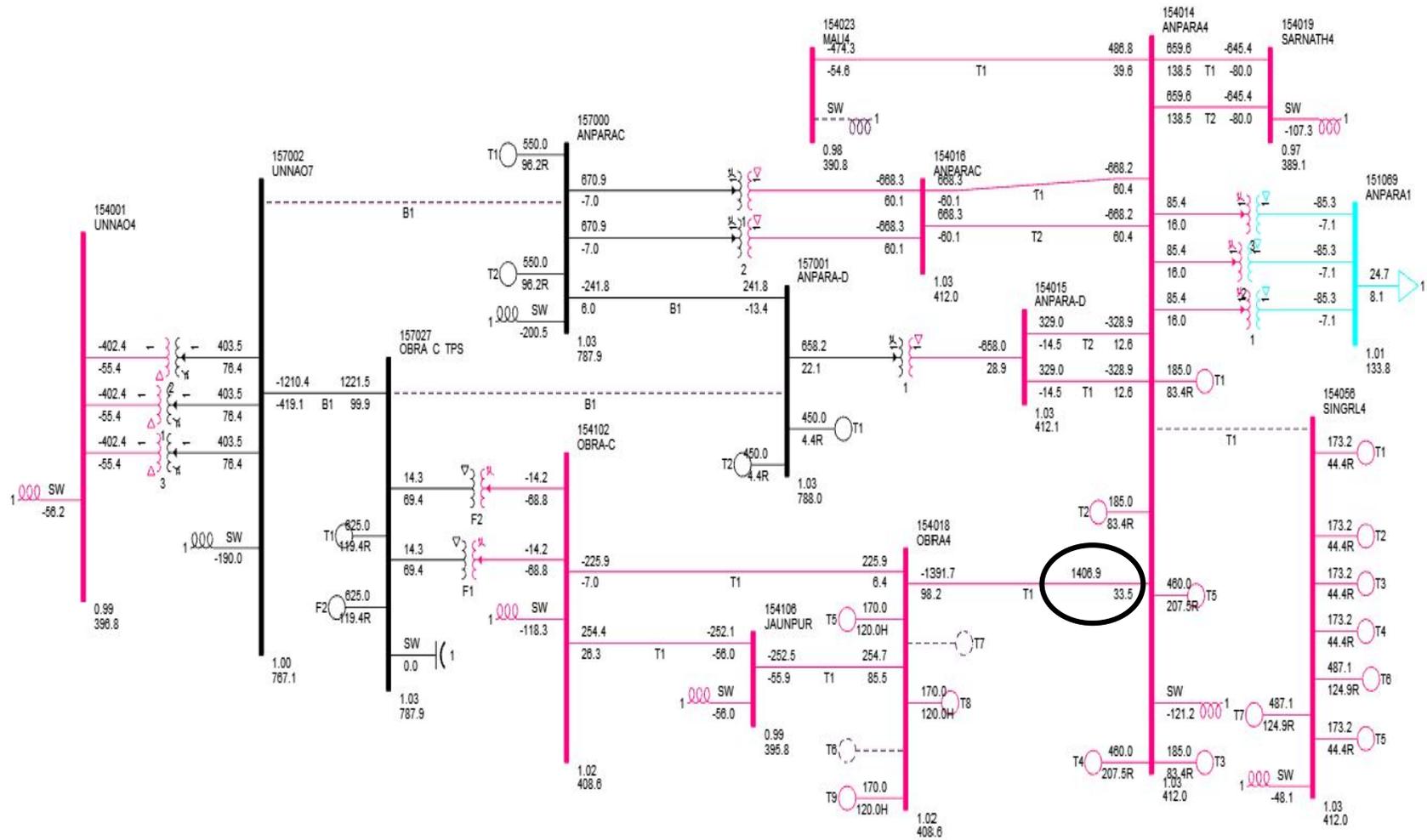
## Both ICT Trip at Obra C







## Both 765kV Anpara C-Unnao AND Anpara D-Obra C out





HPPTCL-PLG-79/2023-Planning Cell-HPPTCL HQ/374853/2024



# HIMACHAL PRADESH POWER TRANSMISSION CORPORATION LTD.

(A State Govt. Undertaking)

Regd. Office: Himfed Bhawan, New ISBT Road, Panjari, Shimla-171005

Ph.: 0177-2831283, 2831284 FAX:-0177-2831284

(CIN):U40101HP2008SGC030950

(GSTIN):02AACCH1548M1ZP

Web: - [www.hpptcl.com](http://www.hpptcl.com)

Date 27/03/2024

The

Member Secretary,  
NRPC,  
18-A, Shaheed Jeet Singh Marg, Katwaria Sarai,  
New Delhi-110016

**Sub: Review of SPS scheme No. SPS/NR/GEN/01 SPS for reliable evacuation of power from NJPS, Rampur, Sawra Kuddu, Baspa Sorang and Karcham Wangtoo HEP- Regarding agenda for 49TCC & 72<sup>nd</sup> NRPC.**

Sir,

HPPTCL had submitted the subject cited agenda for inclusion in 216<sup>th</sup> OCC committee vide email dated- 06.02.2024. The agenda item was not included in 216<sup>th</sup> OCC meeting. It is requested that matter may please be placed in upcoming **49TCC & 72<sup>nd</sup> NRPC for deliberations and discussions. The agenda item is attached along with for necessary action at your end please.**

Yours Faithfully

**DGM (Plg & IT)**  
**HPPTCL, Himfed Bhawan**  
**Panjari, Shimla -05**  
[dgmplgit.tcl@hpmail.in](mailto:dgmplgit.tcl@hpmail.in)

**Agenda: Review of SPS scheme No. SPS/NR/GEN/01 SPS for reliable evacuation of power from NJPS, Rampur, Sawra Kuddu, Baspa Sorang and Karcham Wangtoo HEP.**

**BACKGROUND:**

The System Protection Scheme is currently in operation i.r.o. reliable evacuation of the generation of Sawra Kuddu, Rampur, Karcham, Baspa, Sorang & Jhakri HEP, six outgoing circuits two from Jhakri/ Gumma, two from Rampur and two from Karcham Wangtoo are being used to evacuate power of these projects , which is adequate to take care of 'N-1' contingency of outgoing lines from Karcham/Jhakri/ Gumma & Rampur. The total injection of complex is as follows-

Sr. No.	Name of Project	Capacity including 10% O/L
1.	Baspa	330
2.	Karcham Wangtoo	1200
3.	Sorang	110
4.	Nathpa Jhakri	1650
5.	Rampur	453
6.	Sawra Kuddu	122
7.	Natwar Mori	66
8.	Small IPPs replecting at Gumma	55
9.	Max injection Wangtoo	150
10.	Total	4136

The modelling of SPS under operation is as follows-

- 1. Case-1:** Load on any of the lines at Jhakri, Rampur or Gumma towards Nalagarh or Panchkula exceeds 850 MW.

**Action:** Trip 1 unit of Karcham Wangtoo HPS, 1 unit of Jhakri HEP, 1 unit of Rampur HEP and 1 unit of Sawra Kuddu (Gumma) HEP.

**2. Case-2:** 400 kV bus voltage at Karcham Wangtoo drops below 395 kV.

**Action :** Trip 2 units of Karcham Wangtoo HPS.

**3. Case-3:** Any two outgoing lines of Jhakri (Jhakri-Rampur or Jhakri Gumma) or Rampur HPS (Rampur-Nalagarh D/C) or Gumma (Gumma-Panchkula) trip except in case of tripping of one ckt of 400 kV Jhakri-Gumma and one ckt of Gumma-Panchkula ckt or one ckt of Jhakri-Rampur and one ckt of RampurNalagarh ckt.

**Action-1:** Trip 2 units of Jhakri

**Action-2:** 2 units of Rampur HPS and

**Action-3:** 2 units of Karcham Wangtoo HPS

**Action-4:** 2 units of Sawra Kuddu (Gumma) HPS

No need to trip 2 units of Sawra-Kuddu HEP in case of tripping of 400kV JhakriGumma D/C as Sawra Kuddu generation will evacuate easily through 400 kV Gumma-Panchkula D/C.

**4. Case-4:** Both Karcham Wangtoo-Wangtoo(HP) lines trip or 400 kV Wangtoo(HP)-Kala Amb and 400kV Wangtoo(HP)-Sorang trip.

**Action:** Trip 2 units of Karcham Wangtoo HPS.

**5. Case-5:** Power Flow of any outgoing line of Rampur or Jhakri or Gumma Substation exceed by 800MW.

**Action:** Initiate the Alarm to the operators at Jhakri, Rampur, Karcham Wangtoo, Sorang HEP & Sawra Kuddu HEP.

**6. Case-6:** Both 400kV Kala Amb-Abdullapur lines trip or 400 kV Wangtoo(HP)- Kala Amb and 400kV Sorang HEP- Kala Amb trip.

**Action:** Trip 2 units of Karcham Wangtoo HPS & 1 unit of Sorang HEP.

The three corridors are as follows-

1. 400 kV D/C Jhakhri-Gumma-Panchkula- Abdullapur (Triple Snowbird)
2. 400 kV D/C Jhakri- Rampur- Nalagarh (Triple Snowbird)

3. 400 kV Karcham Wangtoo- Wangtoo-Kala Amb- Abdullapur (Quad Moose)
4. 400 kV interconnecting line between Nathpa Jhakhri and Karcham Wangtoo (Triple Snowbird).

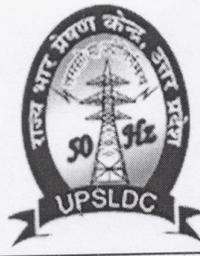
As such there are two 400 kV D/C triple snowbird corridors to Nalagarh and Panchkula respectively and One 400 kV Quad Moose Corridor to Abdullapur/Kala Amb from Karcham Wangtoo interconnected with Jhakhri through 400 kV D/C triple snowbird line. The triple snowbird lines under N-1 contingency shall be sufficient to carry around **1500 to 1600 MVA power at 45 Degree Ambient Temperature and 85 Degree conductor temperature**. The 400 kV Quad Moose has capacity to transfer 2100 MVA to 2200 MVA at **45 Degree Ambient Temperature and 85 Degree conductor temperature** power under N-1 contingency. The limit of 850 MW load on any of the 400 kV triple Snowbird line from Jhakhri, Rampur or Gumma towards Nalagarh or Panchkula seems to be on highly conservative side. It is therefore proposed that these limits may be got reviewed keeping in view the overall transmission system. Review of these limits can result in-

1. Removal/Revision of SPS from the generation complex of various HEPs in the region thereby ensuring no loss of generation.
2. Avoiding construction of 400 kV Transmission line from 400/220 kV Wangtoo Substation to Panchkula. (Planned for evacuation of Hydro projects in upper Satluj Basin). This apart from savings on account of Capital investment shall also save valuable R.O.W.

**Proposal- Considering above it is proposed that SPS scheme No. SPS/NR/GEN/01 for reliable evacuation of power from NJPS, Rampur, Sawra Kuddu, Baspa Sorang and Karcham Wangtoo HEP in state of Himachal Pradesh may be got reviewed keeping in view present system conditions.**



उत्तरप्रदेशराज्य भारप्रेषणकेन्द्रलि०  
यू०पी०एस०एल०डी०सी०परिसर, विभूति  
खण्ड- II, गोमतीनगर, लखनऊ-226010  
ई-मेल : sera@upsldc.org



U.P. State Load Despatch Centre Ltd.  
UPSLDC Complex, Vibhuti Khand – II  
Gomti Nagar, Lucknow- 226010  
E-mail:sera@upsldc.org

Annexure-XII

No: **2034**/SE(R&A)/EE-II/ SPS

Dated: - **15.06.** 2024

SE (Operations), NRPC  
18 – A SJSS Marg,  
Katwaria Sarai, New Delhi,  
110016. (seo-nrpc@nic.in)

**Subject: - Additional Agenda for approval of Proposed System Protection Scheme (SPS) at  
400kV substation Jaunpur.**

It is to inform that 2X315 MVA ICT at 400 kV substation Jaunpur is not N-1 compliant. In order to ensure the reliability of said substation during peak demand, System Protection Scheme is required. Proposed Logic for SPS of 2X315 MVA ICT at 400 kV substation Jaunpur is enclosed.

It is requested to kindly include Proposed SPS logic as an agenda of 220<sup>th</sup> OCC meeting of NRPC, so that the same may be discussed and approved.

**Enclosure: As above**

*Amit Narain*

**(Amit Narain)**

Superintending Engineer (R&A)

No: /SE(R&A)/EE-II/ SPS

Dated: - 2024

Copy forwarded to via e-mail following for information and necessary action:-

1. Director (Operation), UPPTCL, 11<sup>th</sup> Floor, Shakti Bhawan Extn., Lucknow.
2. Chief Engineer (PSO), UPSLDC Vibhuti Khand – II, Gomti Nagar, Lucknow.
3. Chief Engineer (Trans. South - East), U.P. Power Transmission Corporation Ltd., 57, George Town, Prayagraj - 211003.
4. General Manager, NRLDC 18-A, SJSS Marg, Katwaria Sarai, New Delhi-110016.
5. Superintending Engineer (System Control), UPSLDC, Vibhuti Khand – II, Gomti Nagar, Lucknow.

*Amit Narain*

**(Amit Narain)**  
Superintending Engineer (R&A)

**Logic for proposed SPS (System Protection Scheme) for ICTs at 400kV Substation Jaunpur**

Name of Substation	ICT Rating	Tripping Logic-I				Tripping Logic-II			
		% Setting	Time Delay	Priority of feeder for load cut off	% Setting	Time Delay	Priority of feeder for load cut off		
400kV Substation Jaunpur	315MVA ICT- I	100-110% of rated current	5 sec	1. 132kV Machhalishahar 2. 132kV Mungrabadshahpur 3. 220kV Bhadohi 4. 220kV Azamgarh(II)	Above 110% of rated current	1500 msec	1. 132kV Machhalishahar 2. 132kV Mungrabadshahpur 3. 220kV Bhadohi 4. 220kV Azamgarh(II)		
	315MVA ICT- II	100-110% of rated current	5 sec	1. 132kV Machhalishahar 2. 132kV Mungrabadshahpur 3. 220kV Bhadohi 4. 220kV Azamgarh(II)	Above 110% of rated current	1500 msec	1. 132kV Machhalishahar 2. 132kV Mungrabadshahpur 3. 220kV Bhadohi 4. 220kV Azamgarh(II)		

**Overcurrent setting of ICTs at Jaunpur**

Fault current with respect to full load (FL) current	OC trip time (in Sec)
100% of FL	Pickup
105% of FL	43.02346548
110% of FL	22.01532991
120% of FL	11.50012415
130% of FL	7.986157208
150% of FL	5.161265654

Note-132kV Machhalishahar and 132kV Mungrabadshahpur is likely to be charged in 15 days

*O/c Mungrabadshahpur*

### Tripping Details of 132 kV Chandak (PGCIL)-Almora Line

s.no	Name of line and CB No.	Date/Time of Tripping & Closing	Almora End Flag	Almora End Fault Current	Chandak End Flag	Chandak End Fault Current
1	132KV Chandak - Almora Line CB NO.- 72 CB NO. - 652	Trip - 14/09/2023 16.29 HRS Close - 14/09/2023 17.53 HRS Duration - 01.24 HRS	Distance protection operated, Zone 1 Fault loop Phase C-N , Distance=24.28 KM.	I1 = 187.6 A I2 = 446.2 A I3 = 555.9 A IN = 1.079 KA	Backup O/C protection operated, Distance= 66.79 KM	I1 = 33 KA I2 = 1.44 KA I3 = 0.34 KA
2	132KV Chandak - Almora Line CB NO.- 72 CB NO. - 652	Trip - 09/04/2024 17.08 HRS Close - 09/04/2024 19.03 HRS Duration - 01.55 HRS	Distance protection operated, Fault loop A-C-N Distance - 21.05 KM	I1 = 1.653 KA I2 = 228.7 A I3 = 1.737 KA IN = 1.305 KA	Backup O/C protection operated, Fault loop R-B Distance - 85.27 KM	IL1 =1357.0 A IL2 = 233 .0A IL3 = 1583.0 A
3	132KV Chandak - Almora Line CB NO.- 72 CB NO. - 652	Trip - 09/06/2024 16.07 HRS Close - 09/06/2024 16.57 HRS Duration - 00.50 HRS	Distance protection operated, Zone 1 Distance= 6.314 KM	IL1 = 242.5 A IL2 = 193.8 A IL3 = 429.1 A IN = 9.374 A	Backup O/C protection operated, Distance= 95.15 KM	IL1 = 266 A IL2 = 1450 A IL3 = 1230.0 A IN = 7.0 A
4	132KV Chandak - Almora Line CB NO.- 72 CB NO. - 652	Trip - 25/06/2024 16.43 HRS Close - 25/06/2024 17.26 HRS Duration - 00.50 HRS	Distance protection operated, Zone 1 Distance= 10.39 KM	IL1 = 251.6 A IL2 = 149.6 A IL3 = 394.1 A IN = 9.679 A	Backup O/C protection operated, Distance= 78.98 KM	IL1 = 270 A IL2 = 1621 A IL3 = 1373.0 A IN = 7.0 A

## 132KV CHANDAK (PGCIL)-PITHORAGARH LINE TRIPPING DETAILS

S.no	Name of line and CB No.	Date/Time of Tripping & Closing	Pithoragarh End Flag	Pithoragarh End Fault Current	Chandak End Flag	Chandak End Fault Current
1	132KV Chandak - Pithoragarh Line CB NO.- 72 CB NO. - 752	Trip - 04/05/2023 16.41 HRS Close - 04/05/2023 17.53 HRS Duration - 1.12 HRS	Not Trip	Nil	Distance & Backup O/C & E/F protecton operated, B phase E/F	I1 = 345 A I2 = 463 A I3 = 2497 A IN = 1701 A
2	132KV Chandak - Pithoragarh Line CB NO.- 72 CB NO. - 752	Trip - 14/06/2023 19.09 HRS Close - 14/06/2023 20.16 HRS Duration - 1.07 HRS	Not Trip	Nil	Backup O/C protecton operated , R phase Distance - 173.73 KM	I1 = 1019 A I2 = 865 A I3 = 268 A
3	132KV Chandak - Pithoragarh Line CB NO.- 72 CB NO. - 752	Trip - 08/05/2024 19.15 HRS Close - 08/05/2024 20.09 HRS by C.B 72	Not Trip	Nil	Backup O/C protecton operated , Zone 1 Distance - 202.64 KM	I1 = 710 A I2 = 228 A I3 = 910 A IN = 289 A
		Trip - 08/05/2024 20.27 HRS Close - 08/05/2024 20.44 HRS by C.B 74 and 22.48 by C.B 72	Not Trip	Nil	Backup O/C protecton operated , Zone 1 Distance - 204.89 KM	I1 = 713 A I2 = 206 A I3 = 899 A IN = 273 A
4	132KV Chandak - Pithoragarh Line CB NO.- 72 CB NO. - 752	Trip - 3/06/2024 18.11 HRS Close - 03/06/2024 18.16 HRS Duration - 0.05 HRS	Not Trip	Nil	Dir O/C B phase protecton operated Distance - 186.54 KM	I1 = 864 A I2 = 835 A I3 = 1.08 KA IN = 92 A

Status of Bus bar protection				
Constituent Name	Name of Station	Status of Bus bar protection(as reported)	Expected date of revival(as reported)	Present Status
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	31-Mar-24	Work is under process.
	220kv Haldwani	Not Available	31 December 2024	Budget for FY 2023-24.
	220kv Pantnagar	Available but Non operational	31-Mar-24	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	31.03.2024	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	31.03.2024	Material is not allocated so far. Installation will be carried out after allocation of material.
			31.03.2024	
	220kv S/Stn Narnaul	Not installed		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	30.06.2024	Panel has been installed. Commissioning is pending.
	220 KV S/Stn Rangala Rajpur	Installed and Operational		Commissioned on 22.06.2023
	220 kv Unisapur	Installed but Non-Operational	31.03.2024	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	31.03.2024	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. The same shall be made operational by 31.03.2024.
	220KV Pehowa	Installed but Non-Operational	31.03.2024	Old & Obsolete, Allocation of New BBP and allied material awaited.
			31.03.2024	
	220kv Kaithal	Not installed		Control Cable for Bus-Bar Protection Scheme has been drawn from DD Stores, 220KV Bus-Bar Protection panel is awaited.
			31.05.2024	
	220 KV Sonapat	Not installed		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.
			15.03.2024	
	220 KV REGC, Sonapat	Not installed		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 but Non-Operational	30.10.2023	Bus-coupler CB defective & new panel withdrawn from DD store. Erection work under progress & the same will be completed 31.08.23.
		31.12.2024		
220 KV Bhuna	Installed but Non-Operational		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. Not required being single source of supply	
220 KV Sirsa	Not installed		Estimate for Bus Bar Protection is sanctioned but C&R panel is not available in store.	
220 KV Rania	Not installed	31.03.2024	Bus Bar Protection scheme has been proposed in integrated planning meeting and requirement of material have been generated in PR.	
220 KV Bhiwani	Not installed	31.03.2024	Material is not allocated so far. Installation will be carried out after allocation of material.	
220KV Madanpur	Not installed	31.03.2024	Material is not allocated so far. Installation will be carried out after allocation of material.	
220kv Tepla	Installed but Non-Operational	31.03.2024	allocation is awaited.	
		31.03.2024		
220kv Rajokheri	Installed but Non-Operational		The S/Stn. Is being constructed on turnkey, BBP has been installed. Commissioning is yet to be completed by the firm. Matter is taken up with bus-bar protection firm engineer for commissioning.	
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 Parichha	Installed but Non-Operational	30.06.2023	
	220kv Partapur	Installed but Non-Operational	Jan-23	
	220kv Bareilly (400/220kv Bareilly)	Installed but Non-Operational	Dec-23	Old panel capacity exhausted. New relay panel supplied & need to be
	220kv Pilibhit	Installed and Operational		commissioned on 28.10.2023
	220kv Amariva	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 Shahjhanpur	Installed but Non-Operational	30.06.2024	Cable partially received, work will start soon
	220KV Aijpur	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	Jan-23	
	220KV IITGNL	Installed but Non-Operational	Mar-23	
	220KV Rampur	Installed but Non-Operational	31.03.2024	
	220KV Barahua	Installed and Operational		made operational on 28.01.2024
	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 Rasara	Not installed		
	220KV Rampur	Installed but Non-Operational	Jun-24	1) Central unit of bus bar protection faulty 2) Bus bar relay defective of 100MVA T/F-III
	220KV Sec. - 148, Noida	Installed but Non-Operational	31.01.2024	Work has been completed. Testing is due.
	220kv sec. 38A, Botanica Garden	Not installed		Panel allotment pending
	220kv sec.-62, Noida	Installed and Operational		made operational on 12.10.2023
	220KV Dadri	Installed but Non-Operational	Apr-24	Wiring work has been completed. BB relay testing is due.

UP	400KV S/S Agra	Installed and Operational		commissioned on 13th September 2023
	220KV S/S Bah	Not Installed		Requirement sent to design circle, awaited fro allotment.
	220KV Sirsaganj	Not Installed		Requirement sent to design circle, awaited fro allotment.
	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 Khair	Installed but Non-Operational	30.04.2024	New 160MVA transformer-3 is not configured with bus bar
	220KV Kidwainagar	Installed but Non-Operational		
	220KV Chhata	Installed but Non-Operational	30.04.2024	New 160MVA transformer-3 is not configured with bus bar
	220KV Harduaganj	Installed but Non-Operational	31.12.2023	
	220KV Lalitpur	Installed and Operational		commissioned on 09.02.2024
	220KV Mahoba	Installed but Non-Operational		Relay is faulty since 29.01.2024
	220KV Sarnath	Installed but Non-Operational	Nov-23	
	220KV Sirathu, Kaushambi	Not Installed	Mar-23	
	220KV substation Fatehpur	Installed and Operational		Operational
	220KV S/S Bhelupur	Not installed		Radial feeder
	220KV Hardoi Road, Lucknow	Installed and Operational		commissioned on 08th October 2023
	220KV CG City, Lucknow	Installed but Non-Operational	31.05.2024	Agency M/s. Electro Power is decided.
	220KV Barabanki	Installed but Non-Operational	31.05.2024	Agency M/s. Electro Power is decided. 02 no. Peripheral unit found defective.
	220KV Kursi Road, Lucknow	Installed but Non-Operational	31.05.2024	Retrofitting work of auxilliary relay completed. Dut to non-functioning of new
	220KV BKT, Lucknow	Installed but Non-Operational	31.05.2024	LOI issued on Dt. 28.02.24
	220KV Gombi Nagar, Lucknow	Installed but Non-Operational	31.05.2024	Agency M/s. Electro Power is decided.
	400 KV Substation Sarnath	Installed and Operational		Now operational
	220KV S/S Raja Talab	Installed but Non-Operational	May-24	Relay Defective, concern firm service engineer is awaited
	20kv S/S Harahua	Installed but Non-Operational	Jun-24	NOT COMMISSIONED
	220KV Rewa Road	Installed but Non-Operational	Jun-24	Due to Isolator & CB status not Proper. Informed to Transmission wing but
	220KV S/S Sahupuri	Installed but Non-Operational	Jun-24	Defective, Requirement for New panel has been raised, not received from
220kv Robertgani	partilly operational	May-24	Line and bus coupler and T/F-I under cover but T/F-II not cover	
220KV S/S Mirzapur	Not Installed	Jun-24	Bubar Protection Panel has been Received, construction of	
HP	220KV Chamba	Installed and Operational		commissioned in Jan-2024
	220KV MattaSiddh	Installed but Non-Operational	31.03.2024	Work in under progress
	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		
	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	30.06.2024	Commissioning is in process.
	220 KV S/S Goraya	Not Installed		
	220 KV S/S Badhni kalan	Not Installed		
	220 KV S/S Bhari	Not Installed		
	220 KV S/S Bhawanigarh	Not Installed		
Rajasthan	765 KV GSS Phagi	Installed but non operational		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.
	220 kv GSS Niwana	Not installed		Matter has been taken up with firm
	220 kv GSS Alwar	Not installed	Jun-24	To be commissioned shortly
	220 kv GSS Bansur	Not installed		CU defective in existing ABB make Bus bar Scheme. Matter has been taken up with firm
	220 kv GSS Behror	Not installed		To be commissioned shortly
	220KV GSS Hindaun	Not installed		To be commissioned shortly
	220KV GSS Dooni	Not installed		To be commissioned shortly
	220KV GSS Bhawanimandi	Not installed		commissioned
	220 KV GSS Sakatpura, Kota	Not installed		Work is pending on the part of M/s GE and S.E. (T&C), RVPN. Kota due to defective Central Control Unit. CU will be send to firm for repair
	400 KV GSS Ajmer (220 KV BUS)	Installed but non operational		Isolator status of in 87BB of respective 220 KV bay No. 213,214, 215 & 216 was not available due to this 220 KV Main Bus-bar-II is out of ckt. work under progress
	220 kv GSS, Beawar	Not installed		New Bus Bar protection commissioning work is ongoing of M/S Danish. Case has been taken up with firm
	220 KV GSS Jethana	Not installed		New Bus Bar protection commissioning work is ongoing of M/S Danish. To be commissioned shortly
	220 KV GSS Kuchaman City	Installed but non operational	Jun-24	due to problem in Central Unit Relay (87CU) Since 28.01.2022 , CU has been removed due to defective & replacement / repair under process at GSS Part. Case has been taken up with firm
	220 KV GSS Bherunda	Not installed		New Bus Bar protection commissioning work is ongoing of M/S Danish. To be commissioned shortly
	220 KV GSS Kuchera	Not installed		New Bus Bar protection commissioning work is ongoing of M/S Danish. To be commissioned shortly
	220 KV GSS Reengus	Installed but non operational		New Bus Bar Scheme has been proposed and approved for replacement from defective Bus-Bar Scheme. The Replacement work will be carried out by firm shortly
	220 KV GSS Laxmangarh	Not installed		Commissioned
	220KV GSS Khetri Nagar	Installed but non operational		The newly Bus bar protection scheme has been proposed and approved for replacement of defective bus bar scheme. hence the work of replacement will be carried out by the firm shortly
	400 KV GSS, Babai	Installed but non operational	Jun-24	PU of 315 MVA ICT-III is defective with error code 0X83720007. Matter has been taken up with firm
	220 KV GSS Chittorgarh	Installed but non operational		All bay units of the BUS BAR scheme are defective. Matter has been taken up with firm
	400 KV GSS BHILWARA(220 KV BUS)	Installed but non operational		BAY UNIT OF 220 KV TBC DEFECTIVE. Matter has been taken up with firm
	220 KV GSS MANDALGARH	Not installed		commissioned
	220KV GSS Debari	Not installed		Going to be install / commission new bus bar protection scheme supply by Danish.
	220KV GSS Amberi	Not installed		Going to be install / commission new bus bar protection scheme supply by Danish.
	220KV GSS Madri	Not installed		Going to be install / commission new bus bar protection scheme supply by Danish.
	400 KV GSS Surpura (Jodhpur) 220 KV	Installed but non operational		Allotted & Panel Received
400 KV GSS Akal (Jaisalmer) 220 KV BUS	Installed but non operational		One PU defective. Case has been taken up with firm	
220 KV GSS Jodhpur	Installed but non operational		A&FS and TS issued. Case has been send for approval	
220 KV GSS NPH Jodhpur	Not installed		To be commissioned shortly	
220 KV GSS Badisid	Not installed	Jun-24	Allotted & Panel Received. To be commissioned shortly	
220 KV GSS Bhadla	Not installed		Allotted & Panel Received. To be commissioned shortly	
220 KV GSS Pali	Installed but non operational		New bays to be incorporated and GPS defective. work under progress	
220 KV GSS Ramgarh	Not installed		Allotted & Panel Received. To be commissioned shortly	
220 KV GSS Balotra	Installed but non operational		Isolator status issue. work under progress	
220 KV GSS Sayla	Not installed		Allotted & Panel Received. To be commissioned shortly	
400 KV GSS Bikaner 400 KV BUS	Installed but non operational		Not operational (Areva Make) Communication fiber error. Matter has been taken	
220 KV GSS Ratangarh	Not installed		Allotted & Panel Received. To be commissioned shortly	
220 KV GSS Sujangarh	Not installed		Allotted & Panel Received. To be commissioned shortly	
220 KV GSS Halasar	Not installed		Allotted & Panel Received. To be commissioned shortly	
220 KV GSS Tehandesar	Not installed		Allotted & Panel Received. To be commissioned shortly	
220 KV GSS Rawatsar	Not installed		Allotted & Panel Received. 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 MattaSiddh	220kV transformer bank-1 & 2	Static relay	
Rajasthan	220 kV GSS Sanganer	220 kV HEERAPURA	Static	
	220 kV GSS Phulera	220 kV HEERAPURA	Static	
		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	
		220 kV Alwar Line	Static	
	220kV GSS Dausa	220 kV SawailMadhopur Line	Static	
		220 kV Bassi-I Line	Static	
		220 kV Bassi-II Line	Static	
		220 kV Alwar Line	Static	
	220kV BHARATPUR GSS	220 kV DHOLPUR	Static	
	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 DCPD	Static	
	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	
	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	
	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	Working properly, need to be replace with numerical relay
		220kV Bus-Coupler	Backup relay -Numerical all other relays are 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
	220 kV S/Stn Shahbad	100 MVA 220/66 KV T/F T-1	Electrostatic	Working properly, need to be replace with numerical relay
		220 kV Bus Coupler	Electrostatic	Working properly, need to be replace with numerical relay
		Incomer of 220/66 KV T/F T-1	Electrostatic	Working properly, need to be replace with numerical relay
		Incomer of 220/66 KV T/F T-2	Electrostatic	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 S/Stn Jorian	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
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	

Haryana

	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-1	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	All electromechanical type,except DPR relays	
	100 MVA 220/132kv T-8	All electromechanical type,except Differential relay	Differential relay replcaed with Numerical type
	220 kv Bus-coupler	All electromechanical type	C&R panel will be replaced soon
	220 KV DCRTPP-UNISPUR CKT-I	All electromechanical type,except DPR relays	
	220 KV DCRTPP-UNISPUR CKT-II	All electromechanical type,except DPR relays	
	220 KV KARNAL-UNISPUR LINE	All electromechanical type,except DPR relays	
	220/132 KV 100 MVA T/F T-1	All electromechanical type,except R.E.F & Differential relay	
	220/132 KV 100 MVA T/F T-2	All electromechanical type,except R.E.F & Differential relay	
220/132 KV 160 MVA T/F T-4	All electromechanical type,except R.E.F & Differential relay		
220KV S/Stn Palla	100MVA 220/66kv T-1	REF & backup Electromechanical	
	100MVA 220/66kv T-2	REF & backup Electromechanical	
	100MVA 220/66kv T-7	Diff & Backup lectromechanical and REF static	
	220kv Palla - Sector 78	backup Electromechanical	
	220kv Palla - FGPP ckt-II	backup Electromechanical	
220 kv S/Stn. Pali	100 MVA 220/66 kv T-1	REF & backup Electromechanical	
	100 MVA 220/66 kv T-3	REF & backup Electromechanical	
	220 kv Pali-BBMB Samaypur Ckt 1	backup Electromechanical	
	220 kv Pali-BBMB Samaypur Ckt 2	backup Electromechanical	
	220 kv Pali-Sector 46 Ckt 1	backup Electromechanical	
	220 kv Pali-Sector 46 Ckt 2	backup Electromechanical	
	220 kv Pali-Sector 65 Ckt 1	backup Electromechanical	
	220 kv Pali-Badshahpur Ckt 2	backup Electromechanical	
	220 kv Pali-Sector 56 Ckt 1	backup Electromechanical	
220 kv Pali-Sector 56 Ckt 2	backup Electromechanical		
220KV S/Stn Palwal	220/66kv 160MVA T-1 T/F	REF & backup Electromechanical	
	220/66kv 100MVA T-2 T/F	Diff, REF & Backup Electromechanical	
	220kv Prithala Palwal Ckt I	backup Electromechanical	
	220kv Prithala Palwal Ckt II	backup Electromechanical	
220kv S/Stn. Sector 52A GGM	Sec 56-Sec 52A ckt 1	NUMERICAL RELAY qty 02 and electromechanical qty 01 (backup)	LINE IS PROVIDED WITH 2 MAIN NUMERICAL DPR AND 01 ELECTROMECHANICAL FOR BACKUP
	Sec 56-Sec 52A ckt 2	NUMERICAL RELAY qty 02 and electromechanical qty 01 (backup)	LINE IS PROVIDED WITH 2 MAIN NUMERICAL DPR AND 01 ELECTROMECHANICAL FOR BACKUP
	Sec 72-Sec 52A	NUMERICAL RELAY qty 02 and electromechanical qty 01 (backup)	LINE IS PROVIDED WITH 2 MAIN NUMERICAL DPR AND 01 ELECTROMECHANICAL FOR BACKUP
	Sec 57-Sec 52A	NUMERICAL RELAY qty 02 and electromechanical qty 01 (backup)	LINE IS PROVIDED WITH 2 MAIN NUMERICAL DPR AND 01 ELECTROMECHANICAL FOR BACKUP
220KV S/Stn. Sonepat		(Diff-3 , REF-3, O/C/E/F-4 , Electromechanical Relays	The electromechanical differential and DPR are not available in the store. However, the same shall be replaced after availability in the store.
220KV Rohtak		(REF-2, O/C/E/F-12) Electromechanical Relays	
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) / Electromechanical	
	400 KV, TRANSFER BUS	LBB- English Electric(CTIG) / Electromechanical	
	400 KV, BUS COUPLER	LBB- English Electric(CTIG) / Electromechanical	
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	Will be replaced by July24
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.	

UP		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 electromechanical	
	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)	
	220kv Meetai	200MVA ICT-1	Electromechanical (E/F and O/C), Diff:Static	New panels are available at S/s and replacement work is under process
		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 RAPP	220KV Anta line	Backup relay: Static relay(RAPDK3)	Procurement of Numerical relay is in progress for replacement of Static relay (Backup protection).
	220kv NAPP	NAPP-SAMBHAL		Main-2 distance protection is under procurement. ECD- June2024
		NAPP-SIBHOLI		Main-2 distance protection is under procurement. ECD- June2024
		NAPP-DIBAI		Main-2 distance protection is under procurement. ECD- June2024
		NAPP-KHURJA		
		NAPP-ATRAULI		Main-2 distance protection is under procurement. ECD- June2024

<b>Grid event at 220kV Kunihar, Baddi &amp; Upperla Nangal complex</b>				
<b>S. No</b>	<b>Date of grid event</b>	<b>Time</b>	<b>S/s affected</b>	<b>Load of HP affected</b>
1	02.02.2024	15:37hrs & 15:34hrs	220kV Kunihar, Baddi	785MW
2	08.02.2024	10:41hrs	220kV Kunihar	525MW
3	16.02.2024	11.30hrs	220kV Kunihar, Jeori	400MW
4	18.05.2024	21:32hrs	220kV Kunihar, Baddi, Upperla Nangal	640MW
5	14.06.2024	23:16hrs	220kV Kunihar, Baddi, Upperla Nangal	296MW
6	16.06.2024	15:56hrs	220kV Kunihar, Baddi, Upperla Nangal	240MW





**PUNJAB STATE TRANSMISSION CORPORATION LIMITED**  
( Punjab Govt. Undertaking, Regd. Office – PSEB Head office, The Mall, Patiala )

**OFFICE OF THE Addl. S.E, Protection & OS Division, Ludhiana**  
(Phone & FAX – 0161-2462303, E mail – srxen-prot2-ldh@pstcl.org)

*Memo No. – 2448*

*Dated – 11-06-2024*

To

**SLDC - Punjab,  
Ablowal, Patiala**

**Subject : Regarding Station Event Logger at 220 kV Substation PSTCL  
Dhandhari Kalan**

In reference to the subject cited matter it is intimated that:-

- a) This substation is about 40 years old and is conventional type. So there is no Station Event Logger installed at this substation. However, case has been prepared for implementation of Substation Automation System (SAS). It will take about 3 months to install Station Event Logger at 220 kV Substation Dhandari Kalan.
- b) The PMU will be installed at this substation under URTDSM Project and requirement has been sent to Powergrid.

This is for your kind information and further action please.

**Addl S.E  
Protection & OS  
O/o EIC/ P&M  
PSTCL, Ludhiana**

Memo No.- 2615

Date- 21-06-2024

To

Power Controller  
SLDC, Ablowal  
Patiala

**Subject : Protection clearance of 220 kV PSTCL Mansa – PTCL (400 kV Patran)  
Circuit**

In reference to the subject cited matter it is intimated that Carrier Inter-tripping for 220 kV PSTCL Mansa – PTCL (400 kV Patran) circuit is working and End to end protection testing has been done. All the relay settings are as per NRPC/NRLDC guidelines. 220 kV PSTCL Mansa – PTCL (400 kV Patran) circuit is clear for charging from protection point of view.

Moreover, this substation is about 40 years old and is conventional type. So there is no Station Event Logger installed at this substation. However, case has been prepared for implementation of Substation Automation System (SAS). It will take about 3 months to install Station Event Logger at 220 kV Substation Mansa.

The PMUs will be installed at this substation under URTDSM Project and requirement has been sent to Powergrid.

This is for your kind information and further action please.



Addl S.E  
Protection & OS  
PSTCL, Ludhiana

2616-217  
21-06-2024

C/C:

1. Dy. C.E/P&M, PSTCL, Bathinda
2. Sr. Xen/P&M, PSTCL, Bathinda

Memo No.- 2618

Date- 24-06-2024

To

Power Controller  
SLDC, Ablowal  
Patiala

**Subject : Protection clearance of 220 kV PSTCL Sunam – PTCL (400 kV Patran) Circuit**

In reference to the subject cited matter it is intimated that Carrier Inter-tripping for 220 kV PSTCL Sunam – PTCL (400 kV Patran) circuit is working and End to end protection testing has been done. All the relay settings are as per NRPC/NRLDC guidelines. 220 kV PSTCL Sunam – PTCL (400 kV Patran) circuit is clear for charging from protection point of view.

Moreover, this substation is about 40 years old and is conventional type. So there is no Station Event Logger installed at this substation. However, case has been prepared for implementation of Substation Automation System (SAS). It will take about 3 months to install Station Event Logger at 220 kV Substation Sunam.

The PMUs will be installed at this substation under URTDSM Project and requirement has been sent to Powergrid.

This is for your kind information and further action please.



Addl S.E  
Protection & OS  
PSTCL, Ludhiana

2619-20  
24-06-2024

C/C:

1. Dy. C.E/P&M, PSTCL, Patiala
2. Sr. Xen/P&M, PSTCL, Patran

उत्तर प्रदेश पावर ट्रान्समिशन कारपोरेशन लिमिटेड

**U.P. POWER TRANSMISSION CORPORATION LIMITED**

कार्यालय अधिशासी अभियन्ता  
विद्युत 400 के०वी० उपकेन्द्र खण्ड  
उ०प्र० पावर ट्रान्समिशन कारपोरेशन लि०  
दहीचौकी, उन्नाव (उ०प्र०)-209801  
दूरभाष नं० (कार्यालय): 09450909439 /



Office of the Executive Engineer  
Electricity 400 KV Sub-Station Division  
U.P. Power Transmission Corporation Ltd.  
DahiChowki, Unnao (U.P.)-209801  
E-mail : [ee400unnao@upptcl.org](mailto:ee400unnao@upptcl.org)

GSTIN No. 09AAACU8823E1Z9/

पत्रांक/ Ref. No. 247 / ई०एस०डी०यू० / ESDU /

दिनांक / Dated : 22.04.2024

**UNDERTAKING**

It is to bring to your kind notice that a P.O. from Chief Engineer (T.C) U.P.P.T.C.L, Lucknow, Dated 19.04.2024 has been placed on M/s GE T&D India Ltd. Chennai for deputation of SCADA Engineer for following works :-

1. updating (re-name) the name of 400 KV Unnao-Lucknow line to 400 KV Unnao-Mohanlalganj line in station event logger at 400 KV Sub-Station Unnao.
2. To resolve the issue of some trouble in software of station Event Logger at 400 KV Sub-Station, Sarojininagar, Lucknow.

I Undertake to get the above work completed at 400 KV Sub-Station Unnao and 400 KV Sub-Station, Sarojininagar, Lucknow within 4 Weeks. It is requested to kindly issue the charging code for 500 MVA, 400/220/33 KV transformer at 400 KV Sub-Station Unnao.

*Ashok*  
22.04.2024

**Executed Engineer**  
**Electy. 400 KV Sub-Station Div.**  
**Dahi Chowki, Unnao**

1. Tripping of generating units during the load loss event on 17<sup>th</sup> June 2024:

Sr. No.	Generating unit	Control area/Owner	Gen Loss (MW)	Reason of Tripping / Relay flags
1	660 MW Lalitpur TPS - UNIT 2	UP	631	Tripped on high boiler pressure
2	250 MW Karcham Wangtoo HPS - UNIT 2 & 4	HP / JSW	560	On SPS operation (case 2: voltage less than 395kV); Voltage dropped to 382kV at Karcham HEP
3	135 MW Rajwest (IPP) LTPS - UNIT 1	Rajasthan / RVUNL	133	Turbine problem (exact detail yet to be received)
4	50 MW Sainj HEP - UNIT 1 & 2	HP / HPPCL	99	Tripped on over frequency (protection setting yet to be received)
5	126 MW Bhakra HPS (Left) - UNIT 5	HP / BBMB	586	Tripped on field(excitation) failure
6	157 MW Bhakra HPS (Right) - UNIT 6, 8 & 9	HP / BBMB		Tripped on overcurrent protection operation
7	250 MW Panipat TPS - UNIT 8	Haryana / HPGCL	230	Tripped on backup impedance protection.
8	150 MW RSDPH - UNIT 4	Punjab / PSPCL	135	O/C protection operation (51GA). Pole slip relay(78). Auxiliary overflux relay (88x).
9	Mahan Unit 1 & 2 (660 MW each)	WR (ADANI)	1117	Over Frequency
10	OTPC Palatana (363 MW each)	NER (OTPC)	418	Over Frequency

## Tripping events to be discussed in 51st PSC Meeting

S.No.	Category of Grid Disturbance (GD-I to GD-V)	Name of Elements (Tripped/Manually opened)	Affected Area	Owner/ Agency	Outage		Event (As reported)	Loss of generation / loss of load during the Grid Disturbance		Fault Clearance time (in ms)
					Date	Time		Generation Loss(MW)	Load Loss (MW)	
1	GD-1	1)220 KV Sarma(PS)-Dasuya(PS) (PG) Ckt-1 2)220 KV Sarma(PS)-Dasuya(PS) (PG) Ckt-2 3)220 KV Sarma(PS)-Udhampur(PDD) (PDD) Ckt 4)220 KV Sarma(PS)-Hiranagar(PDD) (PG) Ckt 5)220 KV Kishenpur(PG)-Sarna(PS) (PG) Ckt-1 6)220 KV Kishenpur(PG)-Sarna(PS) (PG) Ckt-2 7)220 KV Sarma(PS)-Wadala(PS) Ckt-1 8)220 KV Sarma(PS)-Wadala(PS) Ckt-2 9)220 KV Sarma(PS)-Wadala(PS) Ckt-3 10)220 KV Sarma(PS)-Wadala(PS) Ckt-4 11)220 KV Sarma(PS)-RSDPH(PS) Ckt-1 12)220 KV Sarma(PS)-RSDPH(PS) Ckt-2 13)220 KV Sarma(PS)-RSDPH(PS) Ckt-3 14)220 KV Sarma(PS)-RSDPH(PS) Ckt-4 15)220 KV Sarma(PS)-Railway Ckt	Punjab	PDD-JK, PSTCL, PGCIL	4-May-24	07:10	i)As reported, at 07:10 hrs, 220KV side R-Ph Ct of 220/132KV Auto T/F-1 at Sarma(PS) blasted which created bus fault at both the 220KV buses at Sarma(PS). ii)Bus-bar protection is not available at Sarma(PS). Hence, all the 220KV lines connected to Sarma(PS) tripped on zone-4 protection operation at Sarma(PS) end and lines tripped from remote ends on zone-2 protection operation. From DR at Sarma(PS), it was observed that zone-4 operated after a delay of ~500ms. iii)Due to tripping of all the 220KV lines connected to Sarma(PS), complete blackout occurred at iv)As per PMU at Kishenpur(PG), R-N phase to earth fault with fault clearing time of 120ms followed by R-B phase to phase fault converted to R-Y phase to phase fault with delayed fault clearing time of 560ms is observed. v)As per SCADA, no change in demand is observed in Punjab control area. But as reported by SLDC-Punjab, load loss of approx. 90MW occurred in Punjab Control area. vi)As per SCADA, change in demand of approx. 40MW is observed in J&K control area. But as reported by SLDC-J&K, no load loss occurred in J&K Control area.	0	90	560
2	GI-1	1)220 KV Sutanpur(PS)-Goindwal TPS(PS) Ckt-2 2)220 KV Sutanpur(PS)-Badshahpur(PS) Ckt 3)220 KV Sutanpur(PS)-Jamsher(PS) Ckt 4)270 MW Goindwal(GVK) - UNIT 1 5)270 MW Goindwal(GVK) - UNIT 2	Punjab	PSTCL, GVK	7-May-24	14:30	i)During antecedent condition, 220 KV Sutanpur(PS)-Chohla Sahib(PS) Ckt, 220 KV Sutanpur(PS)-Patti(PS) Ckt and 220 KV Chohla Sahib(PS)-Patti(PS) Ckt were not in service. ii)As reported, at 14:30 hrs, a piece of stray flexible conductor came within induction zone of 220 KV Sutanpur(PS)-Goindwal TPS(PS) Ckt-2 as it fell on tower location no. 16 which led to tripping of this circuit with fault distance of 5km from Goindwal TPS end. iii)Distance Protection Relay (DPR) at Goindwal TPS end sensed the fault in zone-1 and line tripped immediately from Goindwal TPS end. But Distance Protection Relay at Sutanpur end detected power swing scenario and due to PSD block of DPR for 2 seconds (de-blocking time) at Sutanpur end, fault continued to feed through 220 KV Sutanpur(PS)-Badshahpur(PS) Ckt, 220 KV Sutanpur(PS)-Jamsher(PS) Ckt and 220 KV Sutanpur(PS)-Goindwal TPS(PS) Ckt-1. iv)Badshahpur and Jamsher end DPRs issued trip command in zone-3 after 800ms and fault feeding stopped from these ends. But fault feeding continued through 220 KV Sutanpur(PS)-Goindwal TPS(PS) Ckt-1 as Goindwal TPS end DPR did not pick up the fault in zone-3. v)This led to tripping of 270 MW Goindwal(GVK) - UNIT 1 & 2 on earth-fault protection operation (51 NGT) after 1 sec. vi)As per PMU at Amritsar(PG), R-N phase to earth fault converted to 3-phase fault with delayed fault clearing time of 2120ms is observed. vii)As per SCADA, change in demand of approx. 100MW is observed in Punjab control area. viii)As reported by SLDC-Punjab, generation loss of approx. 500MW occurred at Goindwal TPS(PS).	500	100	2120
3	GD-1	1)220 KV Hissar(BB)-Hissar IA(HV) (HVPNL) Ckt-1 2)220 KV Hissar(BB)-Hissar IA(HV) (HVPNL) Ckt-2 3)220 KV Bhiwani-Hissar (BB) Ckt-1 4)220 KV Bhiwani-Hissar (BB) Ckt-2 5)220 KV Hissar-Sangur (BB) Ckt-1 6)220 KV Hissar-Sangur (BB) Ckt-2 7)220 KV Hissar(BB)-Jindal Steel(HR) (HVPNL) Ckt 8)220 KV Hissar(BB)-Chirawa (RS) (BB) Ckt 9)220 KV Barnala-Sangur(BB) Ckt 10)220KV Bus 1 at Hissar(BB)	Haryana	BBMB, HVPNL, RVPNL	7-May-24	11:16	i)220/132/33KV Hissar(BB) S/s has double main bus scheme at 220KV level. ii)During antecedent condition, all the 220KV feeders (Chirawa ckt, Jindal Steel ckt, Sangur ckt-1 & 2, Bhiwani ckt-1 & 2, Hissar I/A ckt-1 & 2) and 220/132KV 100MVA ICT-1, 2 & 3 were connected to 220KV Bus-1. 220KV Bus-2 was not in service. iii)As reported, at 11:16 hrs R-ph jumper of 220 KV Hissar-Sangur (BB) Ckt-1 snapped from common point of 220KV Bus isolator no. 223 & 224 at Hissar(BBMB) S/s which caused R-N phase to earth fault. iv)As reported, on this fault, Bus bar relay at 220KV Hissar(BBMB) didn't operate. 220 KV Hissar(BB)-Hissar IA(HV) (HVPNL) Ckt-1 & 2 tripped in zone-4 from Hissar(BB) end and other all 220KV feeders (Chirawa ckt, Jindal Steel ckt, Sangur ckt-1 & 2, Bhiwani ckt-1 & 2) tripped from the remote ends in Zone-2 protection operation. v)During the same time 220 KV Barnala-Sangur(BB) Ckt also tripped (exact reason of tripping need to be shared). vi)As per DR of 220 KV Hissar(BB)-Hissar IA(HV) end (BBMB) Ckt-2, R-N phase to earth fault (fault current I <sub>r</sub> =7.4kA) is observed in zone-4 with fault clearing time of 360ms. vii)As per DR of 220 KV Hissar-Sangur(end) (BB) Ckt-1, R-N phase to earth fault converted into R-Y phase to phase fault (fault current I <sub>r</sub> =1.3kA, I <sub>y</sub> =1.3kA) is observed in zone-2 with fault clearing time of 560ms. viii)As reported, Isolator status of 220 KV Hissar-Sangur (BB) Ckt-2 provided in the Bus bar relay settings were incorrect (status of isolator no. 227 & 228 were incorrect). Due to this, false differential current generated in Bus Bar Z-2 and differential current supervision feature of relay picked up which led to blocking of Bus bar relay. ix) Due to tripping of all the elements connected to 220KV Bus-1 (220KV Bus-2 was not in service) at Hissar(BB), the complete 220/132/33KV Hissar(BB) S/s became dead. x)As per PMU at Hissar(PG), R-N phase to earth fault with fault clearing time of 360ms (delayed) is observed. xi)As per SCADA, change in demand of approx. 150MW is observed in Haryana control area. But as reported by BBMB, load loss of 207MW occurred in Haryana control area.	0	270	360
4	GD-1	1)400 KV Parbati_2(NH)-Sainj(HP) (PKTCL) Ckt 2)400 KV Parbati_3(NH)-Sainj(HP) (PKTCL) Ckt 3)400 KV Parbati_2(NH)-Banala(PG) (PKTCL) Ckt 4)50 MW Unit-1 at Sainj HEP(HP)	Himachal Pradesh	NHPC, HPPTCL, PKTCL, PGCIL	7-May-24	16:17	i)Total generated power of Sainj HEP(HP), Parbati_2(NH) and parbati_3(NH) evacuates through 400 KV Parbati_2(NH)-Banala(PG) (PKTCL) Ckt and 400 KV Parbati_3(NH)-Banala(PG) (PKTCL) Ckt via 400 KV Parbati_2(NH)-Sainj(HP) (PKTCL) Ckt and 400 KV Parbati_3(NH)-Sainj(HP) (PKTCL) Ckt. ii)During antecedent condition, only 50MW Unit-1 at Sainj HEP(HP) was running (generating approx. ~30MW) and 50MW Unit-2 at Sainj HEP(HP), all four units (4*250MW) at Parbati_2(NH) and all four units (4*130MW) at Parbati_3(NH) were not in service. iii)As reported, at 16:17hrs, 400 KV Parbati_3(NH)-Sainj(HP) (PKTCL) Ckt tripped on B-N phase to earth fault with fault distance of 1.808km from Sainj end. From initial patrolling it was observed that a Pine Tree admeasuring approx. 50m fell from an upright position outside the transmission line corridor. The tree weight resulted in simultaneous failing of cross arm of Tower Location No. 7 of 400 KV Parbati_3(NH)-Sainj(HP) (PKTCL) Ckt as well as snapping of conductor leading to tripping of line. iv)As per DR of 400 KV Parbati_3(NH) end-Sainj(HP) (PKTCL) Ckt, B-N phase to earth fault is observed with fault clearance time of 400ms and fault current of 7.105kA from Parbati_3(NH) end. Fault was sensed in zone-2 from Parbati_3(NH). Due to non-receipt of carrier signal from remote end, three phase trip command issued after 22 time delay. v)As further reported, 400 KV Parbati_2(NH)-Sainj(HP) (PKTCL) Ckt also tripped at the same time (exact reason of the same yet to be shared). As per DR (time sync issue observed), B-N phase to earth fault with fault current of 1.212kA from Parbati_2(NH) end is observed. vi)During the same time, 400 KV Parbati_2(NH)-Banala(PG) (PKTCL) Ckt also tripped from Parbati_2(NH) end only on B-N phase to earth fault with fault distance of 22.5km and fault current of 1.304kA from Banala(PG) end. As per DR, fault was sensed in zone-1 at Banala(PG) end and carrier sent to Parbati_2(NH) end and line successfully auto-reclosed from Banala(PG). But as reported by NHPC, fault was sensed in zone-2 at Parbati_2(NH) end and upon receipt of carrier signal from Banala(PG) B-phase CB opened. But reclosing command was not extended to B-phase CB after dead time, hence, line tripped from Parbati_2(NH) on operation of Pole discrepancy relay. vii)As per PMU at Banala(PG), B-N phase to earth fault is observed with delayed fault clearing time of 400ms. viii)As per SCADA, generation loss of approx. 30 MW at Sainj HEP (HP) is observed.	30	0	400
5	GI-2	1)400KV Fatehabad(PG)-Nuhiyawali(HR) ckt 2)400KV Khetri-Kironi (HR) ckt-1 3)400KV Khetri-Kironi (HR) ckt-2 4)400KV Khetri(HR)-Fatehabad(PG) ckt 5)400KV Khetri-Nuhiyawali ckt 6)600MW Unit-1 at Khetar (RGTPS) 7)600MW Unit-2 at Khetar (RGTPS)	Haryana	PGCIL, HVPNL, HPGL	10-May-24	19:35	i)Generation of 600MW Unit-1 & 2 at Khetar TPS (total ~1072MW) was evacuating through 400KV Khetar(HR)-Fatehabad(PG) ckt (carrying ~858MW), 400KV Khetar-Nuhiyawali (HR) ckt (carrying ~174MW) only. ii)At 19:35:24:255 hrs, R-N phase to earth fault occurred on 400KV Khetar-Nuhiyawali (HR) ckt. As per DR of 400KV Khetar-Nuhiyawali (HR) ckt, distance protection relay at both end sensed R-N fault in Z-1 (Khetar end: Ir=12kA, 75km), R-ph A/R started from both ends. iii)At 19:35:24:291 hrs, as per DR of 400KV Khetar(HR)-Fatehabad(PG) ckt, distance protection relay at Khetar end sensed B-N fault in Z-1 (Khetar end: Ib=1.1kA, 8.5km) and initiated A/R in B-ph at Khetar end. Fatehabad(PG) end distance protection relay didn't sense this B-N fault and no operation occurred at Fatehabad end. iv)At 19:35:24:758 hrs, as per DR of 400KV Khetar(HR)-Fatehabad(PG) ckt, distance protection relay at Khetar end initiated 3-ph tripping command and R & Y ph pole also opened. v)As R-ph autoreclosing was also going on in 400KV Khetar-Nuhiyawali (HR) ckt at this time and all 3-ph pole of 400KV Khetar(HR)-Fatehabad(PG) ckt opened, all the power now started evacuating through Y & B phase of 400KV Khetar-Nuhiyawali (HR) ckt. Current in Y & B phase started increasing. It increased to ~1850A by 19:35:25:153 hrs. vi)At 19:35:25:376 hrs, R-ph pole of 400KV Khetar-Nuhiyawali (HR) ckt closed from both ends and line successfully autoreclosed. vii)At 19:35:25:421 hrs, all 3-ph pole at Khetar end of 400KV Khetar(HR)-Fatehabad(PG) ckt closed and line successfully autoreclosed. viii)At the same time, power swing also observed in DR of Unit-1&2 and evacuating lines. ix)At 19:35:25:944hrs, 600MW Unit-1 tripped on pole slip protection operation. x)At 19:35:25:974hrs, 600MW Unit-2 tripped on pole slip protection operation. xi)At 19:35:30:309 hrs and 19:35:30:350 hrs, over frequency protection also operated of Unit-1 & 2 respectively. xii)600MW Unit-1 at Khetar TPS revived at 04:26hrs on 11th May 2024 and Unit-2 have been kept out for inspection purpose.	1072	0	80
6	GI-2	1)400 KV Khetri (PKTSL)-Bhiwadi (PG) (PBSTL) Ckt-2 2)400 KV Khetri (PKTSL)-Bhiwadi (PG) (PBSTL) Ckt-1 3)400KV Bhiwadi-Neemrana (PG) Ckt-1 4)400 KV Bassi-Bhiwadi (PG) Ckt 5)500 KV HVDC Balia-Bhiwadi (PG) Ckt-1 6)500 KV HVDC Balia-Bhiwadi (PG) Ckt-2 7)220 KV Bhiwadi(PG)-Bhiwadi(RS) (RS) Ckt-1 8)220 KV Bhiwadi(PG)-Rewari(HV) (HV) Ckt-1 9)220 KV Bhiwadi(PG)-Rewari(HV) (HV) Ckt-2 10)220 KV Bhiwadi(PG)-HSIIDC Bawal(HV) (HVPNL) Ckt 11)220 KV Bhiwadi(RS)-Mau(HV) (HV) Ckt 12)220 KV Bhiwadi(PG)-Kushkhara (RS) (RS) Ckt 13)220 KV Neemrana(PG)-Neemrana(RS) (RS) Ckt-1	Rajasthan	RVPNP, POWRGRID	13-May-24	07:11	i)400/220KV Bhiwadi(PG) has one and half breaker bus arrangement at 400KV side and double main and transfer bus scheme at 220KV side. ii)During antecedent condition, 500 KV HVDC Balia-Bhiwadi (PG) ckt-1 & ckt-2 were carrying approx. 200 MW each. iii)As reported, at 07:11hrs, B-N phase to earth fault occurred (exact location of fault yet to be received). iv)As per DR of Bhiwadi(RS) end, 220 KV Bhiwadi(PG)-Bhiwadi(RS) (RS) Ckt-1 and 220 KV Bhiwadi(PG)-Kushkhara (RS) (RS) Ckt tripped from Bhiwadi(RS) end only on back up E/F protection operation. Line didn't trip from Bhiwadi(PG) end. v)At the same time, 400 KV Khetri (PKTSL)-Bhiwadi (PG) (PBSTL) D/C, 400KV Bhiwadi-Neemrana (PG) Ckt-1, 400 KV Bassi-Bhiwadi (PG) Ckt, 500 KV HVDC Balia-Bhiwadi (PG) D/C, 220 KV Neemrana(PG)-Neemrana(RS) (RS) Ckt-1 and 220KV lines from Bhiwadi(PG) to Rewari(HV) (HV) D/C, HSIIDC Bawal(HV), Mau(HV) also tripped (exact reason for multiple elements tripping yet to be received). vi)As per PMU at Bhiwadi(PG), at 07:11 hrs, B-N phase to earth fault with no A/R operation is observed with delayed fault clearing time of 1480ms. vii)As per SCADA, change in demand of approx. 136MW in Rajasthan control area is observed.	0	136	1480

S.No.	Category of Grid Disturbance (GD-I to GD-V)	Name of Elements (Tripped/Manually opened)	Affected Area	Owner/ Agency	Outage		Event (As reported)	Loss of generation / loss of load during the Grid Disturbance		Fault Clearance time (in ms)
					Date	Time		Generation Loss(MW)	Load Loss (MW)	
7	GI-2	1)500 KV HVDC Mahindergarh(APL) Pole-1 2)500 KV HVDC Mahindergarh(APL) Pole-1	Haryana	ADANI	17-May-24	16:21	<p>i)During antecedent condition, 500 KV HVDC Mundra-Mahindergarh(APL) bipole was carrying total ~1500MW.</p> <p>ii)As reported, at 16:21 hrs, 500 KV HVDC Mundra-Mahindergarh(APL) bipole blocked due to RPC No AC Filter alarm raised at Mohindergarh end. After thorough investigation, it was observed that RCI changeover has been initiated from RCI B to RCI A ACTIVE and after that "RPC SET RANGE EXCEED" event triggered followed by RPC NO AC FILTER, which caused blocking of both the Poles.</p> <p>iii)As per PMU at Mahindergarh(PG), no fault in system is observed, fluctuation voltage is observed.</p> <p>iv)Due to blocking of both the poles of 500 KV HVDC Mundra-Mahindergarh(APL), there was power order reduction of ~1500MW. As per HVDC Mundra-Mahendergarh SPS, SPS case-3 would have operated and as per action in this case, load relief in UP, Haryana, Punjab, Rajasthan &amp; Delhi and generation relief at Mundra Stage-III is desired.</p> <p>v) Details of load relief not received from SLDCs. Communication has been sent to all the SLDCs to share the quantum of load relief occurred in their respective control area due to SPS operation. SCADA data at NLRDC was not healthy during the event time.</p> <p>vi) As per detail BCU log of Mahindergarh end, DTPC fail alarm is recorded except Dhanoda. Any communication related issue need to be rectified at the earliest to ensure proper SPS operation.</p> <p>vii) Both RCI System was restarted and the system was normalized</p>			NA
8	GD-1	1)400 KV Tehri(THDC)-Koteshwar(PG) (PG) Ckt-1 2)400 KV Tehri(THDC)-Koteshwar(PG) (PG) Ckt-2	Uttarkhand	THDC, POWERGRID	17-May-24	17:21	<p>i)400KV Tehri(THDC) has double main bus scheme.</p> <p>ii)During antecedent condition, 250 MW TEHRI HPS – UNIT- 1, 2, 3 &amp; 4 were not in service.</p> <p>iii)As reported, at 17:21 hrs, 400KV Tehri(THDC)-Koteshwar(PG)(PG) ckt-1 tripped on Y-B phase to phase fault. Fault distance was ~2.8km from Tehri(THDC) end. At the same time, 400KV Tehri(THDC)-Koteshwar(PG)(PG) ckt-2 tripped from Koteshwar(PG) end only.</p> <p>iv)As per DR of Tehri end of 400KV Tehri(THDC)-Koteshwar(PG)(PG) ckt-1, directional earth fault started followed by sensing Y-B-N fault in Z-1. Fault current was Iy=-4.9kA, Ib=-4.2kA, Total fault clearance time was ~760ms..</p> <p>v)As per DR of Tehri end of 400KV Tehri(THDC)-Koteshwar(PG)(PG) ckt-2, distance protection sensed Y-B-N fault in Z-4, no tripping was initiated. Fault current was Iy=-4.8kA, Ib=-4.0kA.</p> <p>vi)As per PMU at Koteshwar(PG), Y-N phase to earth fault converted into Y-B phase to phase fault is observed with delayed fault clearance time of 760ms is observed.</p> <p>vii) As per SCADA no load loss/generation loss is observed during the tripping event (there was no generation at Tehri HEP during the event).</p>	0	0	760
9	GD-1	1)400/220 KV 315 MVA ICT 6 at Gr.Noida(UP) 2)220KV Gr. Noida – Noida Sec 20 ckt-1 3)220KV Gr. Noida – Noida Sec 20 ckt-2 4)220KV Gr. Noida – Noida Sec 129 ckt 5)220KV Greater Noida – Jalpura ckt	Uttar Pradesh	UPPTCL	18-May-24	17:25	<p>i)400/220KV Gr. Noida S/s has double main transfer bus scheme and feeds 220/132KV Noida Sec20, Noida RC Green, Noida Sec 129 substations through 220KV feeders.</p> <p>ii)As reported, at 17:25hrs, B-ph CT at Gr. Noida end of 220KV Gr. Noida – Noida sec 20 ckt-1 damaged and R-ph isolator arm of 220KV Gr. Noida – Noida sec 20 ckt-1 also broken.</p> <p>iii)As per PMU at Dadr Thermal(NTPC), B-N and R-N fault with delayed clearance in ~600msec is observed.</p> <p>iv)On this fault, 220KV Gr. Noida – Noida sec 20 ckt-1 tripped and supply to Noida Sec 20 S/s lost.</p> <p>v)At the same time, 400/220 KV 315 MVA ICT 6 at Gr.Noida(UP) tripped on of PRD (Pressure Relief Device) and OSR (Oil Surge Relay) protection operation.</p> <p>vi)As per SCADA SOE at NLRDC, 220KV Gr. Noida – Noida Sec 129 ckt and 220KV Greater Noida – Jalpura ckt also tripped at the same time.</p> <p>vii)As per SCADA, total change in demand of approx. 860MW occurred in UP control, area.</p> <p>viii)Partial supply of Noida Sec 20 restored at 18:00 hrs from 132KV Noida Sec. 45 and at 18:06 hrs from Noida Sec 66.</p>	0	860	600
10	GI-2	1) 400/132 KV 200 MVA ICT 1 at Masoli(UP) 2) 400/132 KV 200 MVA ICT 2 at Masoli(UP) 3) 400/132 KV 200 MVA ICT 3 at Masoli(UP) 4) 125 MVAR Bus Reactor No 1 at 400 KV Masoli(UP) 5) 132KV Masoli-Karchhana (UP) ckt 6) 132KV Masoli-Naini (UP) ckt	Uttar Pradesh	UPPTCL	29-May-24	15:57	<p>i)400/132KV Masoli(UP) S/s has one and half breaker bus scheme at 400KV voltage level side.</p> <p>ii)During antecedent condition, loading of 400/132 KV 200 MVA ICT 1,2&amp;3 at 400/132KV Masoli(UP) was approx. 162MW (approx. 54MW for each ICT) (As per SCADA).</p> <p>iii)As reported, at 15:57 hrs, during inclement weather condition, towers of 132KV feeders to Naini and Karchhana from Masoli(UP) damaged which created B-N phase to earth fault on 132KV Masoli-Naini (UP) ckt followed by Y-N phase to earth fault on 132KV Masoli-Karchhana (UP) ckt.</p> <p>iv)Y-B-N phase to earth fault on 132KV Masoli-Naini (UP) ckt cleared instantaneously (within 120msec as per PMU). CB of 132KV Masoli-Karchhana (UP) ckt could not open from Masoli(UP) end on Y-N phase to earth fault.</p> <p>v)As CB of 132KV Masoli-Karchhana (UP) ckt failed to open, fault cleared with the tripping of 400/132 KV 200 MVA ICT 1,2&amp;3 and 125 MVAR Bus Reactor at Masoli(UP) tripped on O/C E/F protection operation.</p> <p>vi)As per PMU at Altabad(PG), B-N followed by Y-A phase to earth fault is observed with fault clearing time of 120msec and 840msec respectively.</p> <p>vii)As per SCADA, change in demand of approx. 94MW is observed in UP control area. However, 100MW load loss is reported by SLDC-UP in UP control area.</p>	0	100	840
11	GI-1	1)220 KV Panipat(HV)-Panipat(BB) (HVPNL) Ckt-1 2)220 KV Panipat(HV)-Panipat(BB) (HVPNL) Ckt-2 3)220 KV Panipat(HV)-Panipat(BB) (HVPNL) Ckt-3 4)220 KV Panipat(HV)-Panipat(BB) (HVPNL) Ckt-4 5)220 KV Panipat(BB)-Narela(DV) (BBMB) Ckt-1 6)220 KV Panipat(BB)-Narela(DV) (BBMB) Ckt-2 7)220 KV Panipat(BB)-Narela(DV) (BBMB) Ckt-3 8)220 KV Panipat(BB)-Chajpur(HV) (HVPNL) Ckt-1 9)220 KV Panipat(BB)-Chajpur(HV) (HVPNL) Ckt-2 10)220 KV Panipat-Dhulkote (BB) Ckt-1 11)220 KV Panipat-Dhulkote (BB) Ckt-2 12)220 KV Panipat-Charhki Dadr (BB) Ckt 13)220 KV Panipat(BB)-Pipli Ckt 14)400/220KV 450 MVA ICT-1 at Panipat(BB) 15)400/220KV 500 MVA ICT-2 at Panipat(BB) 16)220/132KV 100 MVA ICT-1 at Panipat(BB) 17)220/132KV 100 MVA ICT-2 at Panipat(BB) 18)220/33KV 60 MVA ICT-1 at Panipat(BB) 19)220/33KV 60 MVA ICT-2 at Panipat(BB)	Haryana	BBMB, HVPNL, DTL	3-Jun-24	00:38	<p>i)As reported, at 00:38 hrs, bursting of B-ph CT of 220KV bus coupler-2 at Panipat(BB) end occurred which created B-N phase to earth fault in busbar differential zone. The reason of bursting of the B-ph CT was observed to be some internal fault in Heptacore make CT installed on the bay on 29th November 2018.</p> <p>ii)The Numerical low Impedance type MiCom P741 Bus-Bar Differential Protection Scheme (ALSTOM make) sensed the fault and operated tripping all the elements on either side of bus coupler i.e. 220KV Bus-1 &amp; Bus-2 at Panipat(BB).</p> <p>iii)As per PMU at Panipat(BBMB), Y-N phase to earth fault is observed with fault clearing time of 120ms. (phase sequence issue observed)</p> <p>iv)As per SCADA, load loss of approx. 565 MW (~445 MW in Haryana and ~120 MW in Delhi control area) is observed.</p> <p>v)As reported by BBMB, 220KV Bus-1 at Panipat(BB) was charged by closing A-17 Breaker of 220 KV Panipat-Dhulkote (BB) Ckt-1 at 01:26 hrs and 220KV Bus-2 at Panipat(BB) was charged by closing A-18 Breaker of 220 KV Panipat-Dhulkote (BB) Ckt-2 at 01:36 hrs.</p> <p>vi)As remedial action taken, on 03rd June 2024 an old and used Rade Koncar make CT of same ratio i.e. 1200V:1-1-1-1A was tested thoroughly and installed in place of bursted CT and bus coupler-2 was charged at 17:38 hrs on 03rd June 2024.</p>	0	565	120
12	GI-2	1)400 KV Akal-Jodhpur (RS) Ckt 2)400/220 KV 315 MVA ICT 3 at Akal(RS) 3)400/220 KV 500 MVA ICT 4 at Akal(RS) 4)220KV Akal-Lala (RS) ckt 5)220KV Akal-Mulana (RS) ckt 6)220KV Akal-Rajgarh (RS) ckt 7)220KV Akal-Amarsargar (RS) ckt 8)220KV Akal-Giral (RS) ckt 9)220KV Akal-Bhensara(RS) ckt-1 10)220KV Akal-Dangri (RS) ckt-1 11)220KV Akal-Dangri (RS) ckt-2 12)400 KV Akal-Kankani (RS) Ckt 13)400 KV Akal-Jaisalmer2(Bhainsra) (RS) Ckt 14)400 KV Akal-Barmer (RS) Ckt	Rajasthan	RVPNL	8-Jun-24	19:53	<p>i)As reported, at 19:53hrs, due to heavy thunderstorm weather condition, B-ph jumper of dead end tower of 220 KV Akal-Lala (RS) line got earthed at distance of 46.77 meter from Akal(RS) S/s which caused B-N phase to earth fault on 220 KV Akal-Lala (RS) ckt with fault current of I<sub>B</sub>=25kA from Akal(RS) end. As per DR at Akal(RS) end of 220 KV Akal-Lala (RS) ckt, R-N phase to earth fault in zone-1 with fault current of I<sub>r</sub>=25.4kA is observed (phase sequence issue).</p> <p>ii)As reported, during the same time, due to very high fault current, 400/220 KV 315 MVA ICT-3 and 400/220 KV 500 MVA ICT-4 tripped instantaneously on High Set overcurrent protection operation at Akal (RS) S/s. 400 KV Akal-Jodhpur (RS) Ckt also tripped from Akal(RS) end on zone-5 (reverse) distance protection operation (not tripped from the remote end). The CB of 400/220KV 315MVA ICT-3 also opened along with tripping of 400/220KV 315MVA ICT-3 which separated 400V Bus-1 &amp; Bus-2.</p> <p>iii)As reported, at the same time, Bus coupler of 220KV Bus-1 &amp; Bus-2 and all 220KV lines (Mulana, Rajgarh, Amarsargar, Giral, Bhensara(RS) ckt-1, Dangri ckt-1 &amp; ckt-2) connected to 220KV Bus-2 at Akal(RS) S/s also tripped (exact reason of tripping yet to be shared). Due to tripping of Bus coupler, 220KV Bus-1 and Bus-2 separated at Akal(RS).</p> <p>iv)As reported, further at 19:55 hrs, due to bad weather conditions, Y-N phase to earth fault occurred on 400 KV Akal-Kankani (RS) ckt &amp; 400 KV Akal-Jaisalmer2(Bhainsra) (RS) ckt (D/C lines on same tower) at a distance of approx. 3km from Akal(RS) S/s which led to tripping of both the mentioned lines (exact operation of protection yet to be shared).</p> <p>v)As reported, due to tripping of 400 KV Akal-Kankani (RS) ckt &amp; 400 KV Akal-Jaisalmer2(Bhainsra) (RS) ckt, high voltage was observed on the 400 KV Akal-Barmer (RS) Ckt and line voltage reached up to 436KV on the same line and 400 KV Akal-Barmer (RS) Ckt tripped from Barmer(RS) end on over-voltage protection operation and also from Akal(RS) end on receiving DT from Barmer(RS) end.</p> <p>vi)Due to tripping of 400 KV Akal-Barmer (RS) Ckt, 400KV Bus-1 lost its connectivity from grid and 400KV Bus-1 and elements connected to 400KV Bus-1 (400/220 KV 500 MVA ICT-1 &amp; 2, 220KV Bus-1 and 220KV lines connected to 220KV Bus-1) became dead at Akal(RS) S/s.</p> <p>vii)After all the above mentioned tripping events, only 400KV Bus-2 remain charged through 400KV Akal-Ramgarh (RS) D/C.</p> <p>viii)As per PMU at Jodhpur(RS), B-N phase to earth fault with delayed fault clearance time of 1080ms @19:53hrs and Y-B phase to phase fault followed by Y-N phase to earth fault with fault clearance time of 80msec and 240msec (delayed) respectively are observed.</p> <p>ix)As per SCADA, change in Rajasthan wind generation of approx. 168MW is observed</p>	168	0	1080
13	GD-1	1)400/220 KV 500 MVA ICT 1 at Mandaula(PG) 2)400/220 KV 500 MVA ICT 2 at Mandaula(PG) 3)400/220 KV 500 MVA ICT 3 at Mandaula(PG) 4)400/220 KV 500 MVA ICT 4 at Mandaula(PG)	Delhi	PGCIL	11-Jun-24	14:10	<p>i)During antecedent condition, 400/220KV 500MVA ICT-1, 2, 3 and 4 at Mandaula(PG) were carrying approx. 337MW, 337MW, 336MW and 337MW respectively with total loading of 1347MW (as reported by CPCC1, Power Grid). 104 MW GTC-1 &amp; 2 and 122 MW STG at Pragati were generating approx. 85MW, 85MW and 109MW respectively with total generation of 279MW (as reported by SLDC Delhi). 212 MAIN BAY - 400/220 KV 500 MVA ICT-3 at Mandaula(PG) was under planned shutdown and ICT-3 was charged from transfer bus through isolator.</p> <p>ii)As reported, at 14:10 hrs, fire was generated in isolator (transfer bus side) of 400/220 KV 500 MVA ICT-3 at Mandaula(PG). As per DR, Ir is reduced upto ~97.2A while Iy and Iz increased upto ~1.092kA and 1.107kA respectively and imbalance occurred in the system.</p> <p>iii)As reported by CPCC1, Power Grid, the sequence of the event is as follows: a. At 14:10:24hrs: 400/220 KV 500 MVA ICT 2 at Mandaula(PG) tripped on back-up earth fault protection operation due to system imbalance. As per DR, Ir=-615.8A, Iy=-488.8A and Iz=-498.3A before tripping of ICT-2. b. Due to tripping of ICT-2, loading of 400/220KV 500MVA ICT-1, 3 and 4 at Mandaula(PG) were increased to 457MW each. c. At 14:10:27hrs: 400/220 KV 500 MVA ICT 1 at Mandaula(PG) also tripped on back-up earth fault protection operation due to system imbalance. As per DR, Ir=-1.668kA, Iy=-1.214kA and Iz=-1.237kA before tripping of ICT-1. d. Due to tripping of both ICT-1 &amp; 2, loading of 400/220KV 500MVA ICT-3 and 4 at Mandaula(PG) were increased to 696MW each. e. At 14:10:29hrs: 400/220 KV 500 MVA ICT 3 at Mandaula(PG) hand-tripped due to melting of isolator which led to heavy sparking. f. Due to unavailability of ICT-1, 2 &amp; 3, loading of 400/220KV 500MVA ICT-4 at Mandaula(PG) was increased to 1454MW. g. At 14:10:30hrs: 400/220 KV 500 MVA ICT 4 at Mandaula(PG) tripped on back-up over-current protection operation due to excess over-loading. As per DR, maximum current recorded was: Ir=-2.09kA, Iy=-2.138kA and Iz=-2.124kA (max MW loading of approx. 1480MW as per DR).</p> <p>iv)As per PMU at Mandaula(PG), B-N phase to earth fault converted to Y-B-N double phase to earth fault with delayed fault clearing time of 2320ms is observed.</p> <p>v)As per SCADA, change in demand of approx. 1572 MW in Delhi Control area and change in generation of approx. 284 MW at Pragati are observed.</p> <p>vi)As per PMU at Mandaula(PG), B-N phase to earth fault converted to Y-B-N double phase to earth fault with delayed fault clearing time of 2320ms is observed.</p>	279	1601	2320

S.No.	Category of Grid Disturbance (GD-I to GD-V)	Name of Elements (Tripped/Manually opened)	Affected Area	Owner/ Agency	Outage		Event (As reported)	Loss of generation / loss of load during the Grid Disturbance		Fault Clearance time (in ms)
					Date	Time		Generation Loss(MW)	Load Loss (MW)	
14	GI-2	1.135 MW Rajwest (IPP) LTPS - UNIT 2 2.135 MW Rajwest (IPP) LTPS - UNIT 4 3.135 MW Rajwest (IPP) LTPS - UNIT 5 4.135 MW Rajwest (IPP) LTPS - UNIT 6 5.135 MW Rajwest (IPP) LTPS - UNIT 8	Rajasthan, Uttar Pradesh & Punjab	RVUNL	19-Jun-24	12:42	<p>i) During antecedent condition, low voltage scenario was prevailing in mainly Rajasthan, Delhi and UP control area. As per SCADA, voltage at 400kV Bikaner(RS), Bhadla(RS), Bhinmal(RS) and Kankani(RS) were 377kV, 382kV, 379kV and 375kV respectively.</p> <p>ii) As per PMU at Bhadla(PG), at 12:42:03:760 hrs, 3-phase to ground fault is observed with fault clearing time of (exact location of the fault yet to be shared). Voltage dipped upto 0.835 p.u. at Bhadla(PG).</p> <p>iii) As per SCADA, total NR RE generation drop/loss was approx. 4930MW (ISTS Solar: ~3490 MW, Rajasthan Solar: ~843 MW, Rajasthan Wind: ~597 MW).</p> <p>iv) As per SCADA, total change in demand of approx. 1215 MW (Punjab: ~730 MW, UP: ~180 MW, Rajasthan: ~305 MW) is observed in NR control area.</p> <p>v) As per PMU at Bassi(PG), frequency dropped by 0.409Hz (from 50.062 Hz to 49.653 Hz) due to significant dip in RE generation. Frequency recovered upto 49.865 Hz within 1 minute.</p> <p>vi) As per details received from SLDCs, total load relief of approx. 1050 MW observed in NR region (Punjab: ~723 MW, UP: ~220MW, Rajasthan: ~107 MW) on d/f/dt operation.</p> <p>vii) Due to significant dip in RE generation (as RE generation failed to recover 90% of pre-fault active power within 1 sec and further inverters tripping on OV, LVRT/HVRT Non-compliant), over voltage (1.075pu at 400kV Bhadla(PG)) scenario occurred immediately after the fault.</p> <p>viii) At the same time, 135 MW Rajwest (IPP) LTPS - UNIT 2, 4, 5, 6 and 8 also tripped due to "sudden change in speed protection" in turbine operated (protection logic: if 2 out of 3 sensors in turbine senses change in speed more than 20 rpm within 10ms then it sends tripping signal to turbine), as reported (further details yet to be received).</p> <p>ix) As per SCADA, generation loss of approx. 600 MW occurred at Rajwest(RS) LTPS.</p>	5530	1050	80
15	GI-1	1 220 KV KSTPS-Ranpur (RS) ckt 2 220 KV Kota(PG)-KTPS(RVUN) (RS) Ckt-1 3 220 KV KSTPS-Kota Sakatpura (RS) ckt-3 4 110 MW Unit-1 at KTPS(RS) 5 210 MW Unit-3 at KTPS(RS) 6 210 MW Unit-4 at KTPS(RS) 7 210 MW Unit-5 at KTPS(RS) 8 195 MW Unit-7 at KTPS(RS) 9 220 KV Duni(RS)-Kota(PG) (RS) Ckt	Rajasthan	RVPNL, RVUNL, PGCIL	21-Jun-24	11:37	<p>i) 220kV KTPS(RS) has double main Bus arrangement at 220kV side.</p> <p>ii) During antecedent condition, power generation of 110 MW Unit-1 &amp; 2, 210 MW Unit-3, 4 &amp; 5 and 195 MW Unit-6 &amp; 7 were 81MW, 95MW, 174MW, 150MW, 167MW, 171MW &amp; 172MW respectively. 210 MW Unit-5, 220 KV KSTPS-Kota Sakatpura (RS) ckt-3 &amp; station transformer (ST)-3 were connected to 220kV Bus-3 and 195 MW Unit-7 and 220 KV Kota(PG)-KTPS(RVUN) (RS) Ckt-1 were connected to 220kV Bus-5 at KTPS(RS). 220kV Bus-3 and Bus-5 were coupled through isolator only.</p> <p>iii) As reported, at 11:37hrs, due to inclement weather conditions, 220 KV KSTPS-Ranpur (RS) ckt tripped on R-Y phase to phase fault at a distance of 12.49km from KTPS(RS) end. Zone-1 distance protection operated from both ends. As per PMU, R-N followed by Y-N phase to earth fault is observed with fault clearing time of 120ms and 120ms.</p> <p>iv) As reported, at 11:38hrs, due to inclement weather conditions, 220 KV Kota(PG)-KTPS(RVUN) (RS) Ckt-1 tripped on B-N phase to earth fault (Ib= 14.1kA &amp; Ib= 11.7kA from Kota(PG) and KTPS(RS) ends respectively) at a distance of 2.96km from Kota(PG) end. Zone-1 distance protection operated from Kota(PG) end. However, B-phase CB pole lagged in opening while clearing the fault from KTPS(RS) end which led to LBB protection operation at KTPS(RS). As per PMU, B-N phase to earth fault with delayed fault clearing time of 320msec is observed.</p> <p>v) Since 220kV bus-3 &amp; bus-5 were coupled through isolator only, due to LBB operation all elements connected to 220kV bus-3 &amp; bus-5 tripped (210 MW Unit-5, 220 KV KSTPS-Kota Sakatpura (RS) ckt-3, ST-3, 195 MW Unit-7 and 220 KV Kota(PG)-KTPS(RVUN) (RS) Ckt-1).</p> <p>vi) Due to tripping of ST-3, auxiliary supply of 110 MW Unit-1 and 210 MW Unit-3 &amp; 4 disrupted which led to tripping of Unit-1, 3 &amp; 4 at KTPS(RS)</p> <p>vii) At the same time, 220 KV Duni(RS)-Kota(PG) (RS) Ckt also tripped on R-N phase to earth fault (I<sub>r</sub>= 21kA &amp; I<sub>r</sub>= 1.3kA from Kota(PG) and Duni(RS) end respectively) with fault distance of 75.2km from Kota(PG) end. Fault sensed in zone-1 from both ends. As per PMU, multiple R-N phase to earth fault with fault clearing time of 120ms, 120ms and 80ms.</p> <p>viii) As per SCADA, no change in demand in Rajasthan control area is observed.</p> <p>ix) As per SCADA, approx. 714 MW generation loss at KTPS(RS). However, 744 MW generation loss at KTPS(RS) is reported by SLDC-Rajasthan.</p> <p>x) As reported, the case for installation of bus coupler CB between 220kV Bus-3 and Bus-5 at KTPS(RS) is under process.</p>	0	744	320

Utilities are requested to prepare detailed analysis report and present the event details during 51st PSC meeting. Events involving more than one utility may be jointly prepared and presented.

## Summary of df/dt operation during May-June 2024

Date	Time	Load throw-off quantum (State-wise)						Total Load throw-off quantum	Remarks
		Delhi	Punjab	Haryana	Rajasthan	UP	Uttarakhand		
25-05-2024	12:46	82	1375	0	140	172	0	1769	as reported by SLDCs
27-05-2024	14:36	280	0	540	0	140	100	1060	as per SCADA data at NRLDC, SLDCs have not confirmed yet
01-06-2024	13:26	0	440	0	0	100	0	540	as per SCADA data at NRLDC, SLDC-Punjab have confirmed
01-06-2024	13:44	270	580	120	0	220	0	1190	SLDC-Punjab & UP have confirmed
03-06-2024	05:28	0	300	0	0	0	0	300	as reported by SLDC-Punjab
04-06-2024	12:35	0	400	0	0	0	0	400	as per SCADA data at NRLDC, SLDC-Punjab have confirmed
09-06-2024	11:21	0	435	0	0	0	0	435	as per SCADA data at NRLDC, SLDC-Punjab have not confirmed yet
19-06-2024	12:42	0	723	0	107	220	0	1050	as reported by SLDCs
23-06-2024	09:11	0	880	0	0	0	0	0	as reported by SLDC-Punjab

**Procedure for Approval of Protection Settings in Northern Region**  
**(Finalized in 50<sup>th</sup> PSC meeting held on 29.04.2024)**

1. ISTS users shall submit proposal for new/revised protection settings to NRLDC and similarly non-ISTS users shall submit to concerned SLDCs in the prescribed formats (of NRLDC/SLDC) in 2 weeks advance.
2. Further, NRLDC/SLDC (as the case may be) will scrutinize the proposal and any deficiency/additional data may be asked by NRLDC/NLDC. If required, NRLDC/SLDC may convene a meeting/interaction with stakeholders.
3. After scrutiny, NRLDC/SLDC will convey to user within 10 days (after receiving proposal) the accepted settings for implementation at site.
4. After implementation of approved settings, stakeholder will intimate to NRPC Secretariat via e-mail at [seo-nrpc@nic.in](mailto:seo-nrpc@nic.in) within a fortnight.
5. NRLDC/SLDCs shall place all accepted settings as agenda in upcoming PSC meeting for final approval of forum.

\*\*\*\*\*

## **Procedure for Approval of Protection Settings in Northern Region**

### **A. For 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 concerned SLDC and NRPC 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.

In case of intrastate elements, SLDC shall scrutinize the proposal and allow integration of new element in the system within ..... days. The settings shall be treated as provisional arrangement.

3. The concerned utility shall forward the agreed settings of its new element to NRPC within 15 days of implementation of provisional arrangement.
4. The concerned utility (both ISTS and intrastate) shall also put up an agenda for getting final approval in next PSC.
5. NR PSC will review and approve the final settings based on the inputs submitted by the utility. In case of any change required in 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.
6. Utility shall intimate to NRLDC/SLDC (as applicable) and NRPC within 7 days after implementation of final approved settings.

### **B. For change in protection settings of any existing element:**

1. Any change in the existing protection settings shall be carried out only after prior approval from 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 next 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.