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

दिनांक: 07.10.2024

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 52 वीं बैठक की कार्यवृत्त |
Subject: Minutes for 52nd Protection Sub-Committee Meeting.

संरक्षण उप-समिति की **52 वीं बैठक, दिनांक 20.09.2024 को 10:30 बजे** से **एनआरपीसी सचिवालय, कटवारिया सराय, नई दिल्ली-110016 में** आयोजित की गयी थी | उक्त बैठक की कार्यवृत्त संलग्न है । यह उत्तर क्षेत्रीय विद्युत् समिति की वेबसाइट (http://164.100.60.165/) पर भी उपलब्ध है |

The **52nd meeting** of Protection Sub-Committee was held on **20.09.2024** at **10:30 Hrs** at **NRPC Secretariat, Katwaria Sarai, New Delhi-110016**. The minutes of the meeting is attached herewith. The same is also available on NRPC website (http://164.100.60.165/).

Signed by Dharmendra Kumar Meena
Date: 07-10-2024 18:01:28

(डी.के. मीना)
(D.K. Meena)
अधीक्षण अभियंता (संरक्षण)

Contents

Minutes of
52nd Meeting of Protection Sub-Committee (PSC) of
Northern Regional Power Committee

Date and time of meeting : ***20.09.2024 10.30 Hrs.***

Venue : ***NRPC Secretariat, Katwaria Sarai, New Delhi-110016***

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

A.1. Confirmation of minutes of 51st meeting of Protection Sub-Committee

A.1.1 AEE (P), NRPC apprised that the 51st PSC meeting was held on 23.07.2024. Minutes of the meeting were issued vide letter dtd. 17.08.2024. No comment has been received till the date.

Decision taken by Forum:

Forum approved the minutes of 51st PSC meeting as issued.

A.2. Submission of protection performance indices along with reason and corrective action taken for indices less than unity to NRPC Secretariat on monthly basis (agenda by NRPC Secretariat)

A.2.1 AEE (P), NRPC apprised that as per clause 15 (6) of IEGC 2023;

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

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

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

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

  where,

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

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

Nu is the number of unwanted operations,

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

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

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

A.2.2 In earlier PSC meetings, it was decided that each utility shall submit the Performance indices of previous month by 7th day of next month.

A.2.3 Accordingly, the status of the indices reported for the months from June-2024 to August-2024 were presented and utilities have not started submission the performance indices were asked to submit the same at the earliest.

A.2.4 SE (O), NRPC stressed that many utilities have not started submission the performance indices even after sensitization in each PSC meeting. These concerned may look into this and send the indices timely.

A.2.5 Forum highlighted that reporting of performance indices has not been started by HPGCL, HPSEBL, HPPCL, MEIL Anpara Energy Ltd, MEJA Urja Nigam Ltd., UT of J&K, Ladakh, and Chandigarh. There was no representative in the meeting from the above-mentioned power utilities.

A.2.6 MS, NRPC emphasized that protection is utmost requirement for our power system to operate smoothly and uninterruptedly. All power utilities should participate in the PSC meeting.

A.2.7 Further, he highlighted that all the concerned power utilities need to stream line the submission of performance indices in pursuance to the IEGC 2023 for every month. He commented that this agenda may be placed in OCC meeting also.

A.2.8 PSPCL representative conveyed to submit the performance indices data timely in future. UPSLDC representative mentioned that they have been coordinating with UPRVUNL for protection related data. UPSLDC has been taking up the matter with IPPs of its control area also. NTPC were directed to share the performance indices of all plants regularly.

A.2.9 The current status of the performance indices reported for the months from June-2024 to August-2024 is attached as **Annexure-I**.

A.2.10 Further, the summary of events, reported prior to this meeting which caused indices less than unity was discussed. The concerned utilities were supposed to submit the reason for the same and corrective action taken to resolve the related issue. Accordingly, concerned utilities were asked about the reason and remedial action taken for unwanted, incorrect operation and failure of operation.

A.2.11 AEE (P), NRPC mentioned that ICT trippings have been reported in many of the cases due to water/moisture ingress in Buccholz, PRV, OSR. POWERGRID representative suggested that a plastic canopy may be placed to cover these mechanical relays of ICT. APCPL representative added that silicon sealant may be placed to avoid moisture/water ingress.

A.2.12 RVPNL representative informed that entrance of cable in the relay is now being done from the bottom side so that water may not rise due to capillary action.

A.2.13 Forum suggested PSTCL, RVPNL, UPPTCL to implement the above-mentioned practices at its substations to avoid water/moisture ingression so that unwanted tripping of ICTs may be prevented. Others may also adopt these practices and take control measures to avoid tripping of elements.

A.2.14 Further, AEE (P), NRPC mentioned that utilities have reported many trippings because of control cable damage/cut and DC problem. Forum recommended concerned utilities to increase the inspection frequency of cable and must avoid water logging in trenches.

A.2.15 Regarding un-healthiness of carrier on most of the lines, PSTCL representative informed that matter is being taken up to resolve. He was also informed that it involves a huge procurement. Forum advised PSTCL to expedite the process.

A.2.16 Based on the detailed discussion and submission of information by utilities, the reason and corrective action taken for Performance Indices less than Unity related to events of June, 2024 to August, 2024 are attached as **Annexure- II.**

A.2.17 CGM, NRLDC stated utilities to take the matter seriously and need to increase efforts for sending the performance indices. This helps in monitoring the system performance and utilities may also increase best practices after analysing events causing indices less than unity.

A.2.18 MS, NRPC emphasized that repetitive tripping due to same causes may be avoided and review of protection settings may be done timely. He stressed that Bus Bar relay should be operational as per applicability, numerical relay should be available. He

directed that relay settings coordination may be implemented properly. Inspection frequency of cable may be increased as required.

A.2.19 Subsequently, MS, NRPC highlighted that utilities may submit the performance indices of previous month by 7th day of next month. Utilities may submit the element wise performance indices along with the reason for indices less than unity and corrective action taken. He directed all concerned utilities to send their reasons within a week via email along with corrective action taken for indices less than unity. SLDCs may send the compiled data of all utilities (GENCOs, & TRANSCOs) under their jurisdiction.

Decision taken by Forum:

Concerned utilities were requested to submit the Protection performance indices of previous month by 7th day of next month element wise along with corrective action taken for indices less than unity. It was also decided that letters may be sent to concerned utilities from where indices are not being reported for sensitizing higher management of the utilities. Moreover, agenda shall be discussed in upcoming OCC meeting also.

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

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

A.3.2 In the 48th, 49th, 50th and 51st PSC meetings, all utilities were requested to submit the annual protection audit plan.

A.3.3 In view of above, some utilities have submitted their annual audit plans and others were requested to submit annual audit plan for FY 2024-25 at the earliest.

Third Party Protection Audit Plan:

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 and other remaining were requested submit the same at the earliest.

A.3.6 SE (O), NRPC observed that those who have not been submitting protection performance indices, have also not sent the Protection audit plan.

A.3.7 CGM, NRLDC stated to take this agenda in the OCC meeting, highlighting the concerned from Protection audit plan has not been received. MS, NRPC was also of the same view.

A.3.8 POWERGRID representative informed that third party protection audit plan will be submitted within 2 to 3 days.

A.3.9 UPPTCL representative intimated that third party protection audit plan finalization is under process at higher authorities which is going to be decided combinedly for all the zones.

A.3.10 UPSLDC representative informed that tender of third-party protection audit for UPRVUNL plants will be finalized within 1-2 months. Further, he asked for any designated authority that will do 3rd party protection audit.

A.3.11 EE (P), NRPC replied that in IEGC 2023, there is no mandate given regarding designated authority. Therefore, it is at disposal of utilities to find audit parties as per rules of their organization.

A.3.12 RVUN stated that there must be some criteria for selection of parties for audit such as minimum experience of protection domain.

A.3.13 MS, NRPC directed that concerned SLDCs shall send the internal annual audit plan for FY 2024-25 and third protection audit plan of all utilities in its control area. The status of audit as per submitted schedule, audit report and compliance of observations shall also to be updated by SLDCs of all utilities (Genco, Transco) in its control area.

A.3.14 MS, NRPC also directed that Utilities may send the 3rd party protection audit plan. Subsequently, the audit reports along with compliance status may be submitted to NRPC Secretariat regularly.

A.3.15 Subsequently, MS, NRPC stated to send a letter for the concerned utilities whose audit plan has not been received.

A.3.16 Status of Internal Protection Audit plan for FY 2024-25 and third-party protection audit plan is attached as **Annexure-III** & **Annexure-IV**.

Decision taken by Forum:

Utilities were requested to submit the Annual Internal Protection Audit plan for FY 2024-25 and third-party protection audit plan at the earliest and comply the same timely. Audit report along with action plan for deficiency detected, if any may be submitted. It was also decided that letters may be sent to concerned utilities from where audit plan are not being reported for sensitizing higher management of the utilities. Moreover, agenda shall be discussed in upcoming OCC meeting also.

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

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

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

A.4.2 Utilities have submitted the internal audit report based on the audit done at their substations. The submitted reports after the 51st Protection sub-committee are attached as **Annexure-V**. However, observations and compliance of audit recommendations have not been reported to NRPC Secretariat.

A.4.3 The reports were presented and discussed. All members of PSC and concerned utilities were asked to share their findings and observations based on audit report.

A.4.4 POWERGRID NR-2 was requested to submit the compliance report.

A.4.5 EE (P), NRPC conveyed that as per IEGC 2023, **compliance report of action taken against any deficiency is to be submitted within one month after the audit.**

A.4.6 SE (O), NRPC conveyed that no observations have been mentioned in many audit reports even after the report has visible deviations as per the NRPC protection philosophy.

A.4.7 Further, AEE (P), NRPC highlighted that as per audit report submitted by RVPN, variances have been observed in the adopted settings with respect to finalized NRPC Protection philosophy viz. PD relay setting, Zone-4 time setting, Overcurrent adopted in the 220kV lines, SOTF disabled and Time Synchronization problems.

A.4.8 However, no such observations have been mentioned in the audit report submitted by audit team. Forum noticed the same.

A.4.9 In view of above, Forum directed RVPN to look into the matter and do compliance after finding out such observations. The same may be taken care by RVPN in the future also.

A.4.10 RVPN representative conveyed that overcurrent setting has been kept on 220kV lines at higher side based on limit of CTs for safety purpose of equipment. Forum decided to review the overcurrent protection enabling in the protection philosophy.

Decision taken by Forum:

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

A.5. Violation of protection standard in case of tripping of the Inter-Regional lines of voltage class 220 kV and above (agenda by NRPC Secretariat)

A.5.1 AEE (P), NRPC apprised that NLDC vide letter dated 21.8.2024 has informed the violation of protection standard in case of tripping of Inter Regional Lines of voltage class 220 kV and above.

A.5.2 As per section 3.e of Grid Standards Regulation of CEA, 2010, fault is to be cleared within the following time:

Sl. No.	Nominal System Voltage	Maximum time of fault clearing

	in kV rms	**in msec**
1	400	100
2	220	160

A.5.3 NLDC has prepared the list of tripping of Inter Regional Lines of voltage class 220 kV and above, during the month of July 2024 in which violations have been observed. The same is attached as **Annexure-VI**.

A.5.4 It has been observed that fault had not cleared within specified time during these incidents (Annexure-VI).

A.5.5 UP representative informed that there was fault in GIS compartment of 400kV Sahupuri-Varanasi ckt-2 at Sahupuri(UP) end. Multiple incidents occurred on 10th July 2024 was due to this fault only.

A.5.6 Regarding reason of delayed clearance of fault, it was informed that bus bar protection was not in service during the time of incident. Currently Station is being operated by GE and UPPTCL was also not informed about unavailability of bus bar protection. Therefore, time delay setting of Z-4 distance protection was also not reduced to 160msec. Now, bus bar protection has been taken into service. However, rectification of fault in GIS compartment is under process.

A.5.7 NRLDC representative raised concern over reliability of inter-regional link. Due to non-availability of 400kV Sahupuri-Varanasi ckt-2, Varanasi & Biharsharrif (ER) are connected with single circuit only which affects the reliability and security of the system. UP was requested to rectify the fault and restore the line at the earliest. Being an inter-regional link, more vigilant operation and maintenance of protection system also need to be ensured.

A.5.8 CGM, NRLDC also requested concerned to take appropriate actions/remedial measures to get fault cleared within specified time abovementioned.

A.5.9 Further, all the utilities were also requested to ensure the fault clearance of the 220kV and above Inter-Regional lines within specified time to avoid any violation of protection standards.

Decision taken by Forum:

Forum directed all utilities to ensure the fault clearance of the 220kV and above Inter-

A.6. Review of Overvoltage protection stage -1 settings across Northern Region (agenda by NLDC)

A.6.1 AEE (P), NRPC apprised that in the 75th NRPC meeting (held on 28.08.2024), the grid event happened at 13:53 hrs on 17th June 2024 due to tripping of HVDC Champa-Kurukshetra was briefed and recommendation of committee constituted by MoP to analyse the above event, were discussed.

A.6.2 Further, it was directed that overvoltage protection settings of 765kV and 400kV line of Northern Region may be reviewed and proper grading may be done by the utilities.

A.6.3 The Committee, constituted by MoP has recommended the followings for implementing overvoltage Stage-I protection settings:

a) Pick up voltage & time delay setting of Antitheft lines to be kept low with sufficient time gap from other lines at S/s
b) Parallel lines grading to be done such that one line should trip early by setting at low voltage and other line should trip last by keeping setting at high voltage.
c) Highly loaded lines should be given last priority in tripping.
d) Net MVAr relief (based on line charging MVAr & MVAr compensation in line) based on the simulation to be considered for arriving at the priority of line tripping. Lines providing high net MVAr relief to be tripped early.
e) Grading to be done in such a manner that one major incoming and outgoing line shall remain connected after tripping of lines at any node.
f) Protection setting of remote end station of a line need to be coordinated so as to avoid tripping of line from other end.
g) Drop-off to pick-up ratio of Relays implemented for overvoltage protection shall be more than 99.5%.

A.6.4 Further, NLDC & NRLDC representative highlighted that during analysis of 17th Grid event of load loss of 16.5 GW in Northern Region, multiple 765kV line in Aligarh, Agra complex tripped. Overvoltage protection setting of Aligarh s/s was reviewed and revised settings were recommended.

A.6.5 NRLDC representative informed that details of overvoltage protection setting of

765kV & 400kV lines have been received from POWERGRID(NR-2), ADANI (Mahendergarh) and Rajasthan only. Other constituents are requested to share the overvoltage setting in lines of their respective control area at the earliest.

A.6.6 MS, NRPC also emphasized that grading of the overvoltage setting is utmost requirement from the protection point of view.

A.6.7 He conveyed that a Committee under the chairmanship of SE (Protection), NRPC may be formed having members from Grid-India (NRLDC & NLDC), PowerGrid, STUs, SLDCs, NTPC, RRVUNL. Committee shall review the existing overvoltage protection setting and propose the revised settings.

A.6.8 He also conveyed that simulation study (PSSe) is required to be done for all states having 400kV and 765kV transmission lines. A member from SLDC and an expert from protection wing may be included from State TRANSCOs.

A.6.9 After the constitution of Committee, report may be submitted within 2 months and recommended setting will be implemented within next one month after approval of Protection Sub-Committee (PSC) Forum.

A.6.10 In view of above, nominations may be asked from Grid-India (NRLDC & NLDC), PowerGrid, STUs, SLDCs, NTPC, RRVUNL.

Decision taken by Forum:

Forum agreed for constitution of Committee under the chairmanship of SE (Protection), NRPC having members from Grid-India (NRLDC & NLDC), PowerGrid, STUs, SLDCs, NTPC, RRVUNL to review Overvoltage protection settings of transmission lines across Northern Region.

A.7. Sensitive Earth Fault relay (to be kept on Alarm Mode only) of 440/220KV 315MVA ICT at 2X600MW Kalisindh Thermal Power Station, Jhalawar (agenda by RVPN)

A.7.1 RVPN representative apprised that RVPN vide letter (**Annexure-VII**) dated 12.8.2024 intimated that Sensitive Earth Fault protection (SEF) is used on 400/220kV, 315 MVA ICT at Kalisindh with tripping mode, and recently few tripping occurred on 400/220 kV, 315 MVA lCT due to SEF Protection (details attached in the annexure-VII)

causing a large area disturbance i.e. Jhalawar, Bhawanimandi & Aklera.

A.7.2 RVPN has mentioned that 220kV GSS Jhalawar, Bhawanimandi and Aklera supply is presently fed radially through (400/220kV,315MVAICT) Kalisindh Generating Station (KSTPS).

A.7.3 SEF (Sensitive Earth Fault) protection is used in 440/220kV 315MVA ICT with tripping mode having time 1.5Sec. (DT).

A.7.4 Recently few trippings occurred on 440/220kV,315MVA ICT on SEF (Sensitive Earth Fault) because of jumper snapping (Broken Conductor) in 220 KV lines. Due to this, supply of large area having 03 Nos. above 220kV GSS& connected 132kV GSS disturbed.

A.7.5 RVPN has submitted that SEF Protection may operate because of unbalance current due to broken conductor of 220 kV line. The RVPN has enabled broken conductor protection in 220 & 132 KV lines on alarm mode. In case any alarm observed, the line shall be manually tripped after checking current in all phases.

A.7.6 SEF relay is connected on neutral CT having CT ratio 500/1 and current plug setting is 0.l A (i.e. 45.4 Amp only), TMS- 1.5 Sec. DT mode.

A.7.7 At Kalisindh Thermal Power Station, Jhalawar the backup protection is also available on ICT which may take care of unbalance current in case of jumper snapping or actual phase to earth fault.

A.7.8 Such protection with tripping mode is nowhere used in RVPN Transmission system, this protection (SEF) is also not included in the recent Protection Philosophy.

A.7.9 In view of above, RVPN requested to disable tripping through SEF relay or increase the setting from existing value & keep it on alarm mode only for 440/220kV,315MVA ICT at Kalisindh Thermal Power Station, Jhalawar.

A.7.10 RVUNL representative highlighted that in case of broken conductor there is no zero-sequence current. Hence, without involvement of earth, there cannot be sensitive earth fault relay operation technically. However, he also agreed that there has been 2 times operation of sensitive earth fault relay observed in case of broken conductor of

lines. This thing is under investigation because shutdown availability of ICT is quite difficult.

A.7.11 He conveyed that after the availability of shutdown of ICT, this malfunctioning of SEF relay will be checked. Till then remedial measures are being taken up by RVUNL.

A.7.12 RVPN representative requested RVUN to keep the SEF relay operation on alarm mode or pick up setting may be increased to 10% of LV side current rating (~80amp). By this immediate solution will be possible. Further, based on shutdown availability, RVUN may test the relay and take appropriate action. RVUN representative agreed with this proposal of RVPN.

A.7.13 MS, NRPC guided that all utilities should try to resolve issues mutually at the first stage.

Decision taken by Forum:

In line with mutual agreement of RVPN and RVUNL, Forum directed RVUNL to keep either SEF relay operation on alarm mode or may increase its pick up current setting to 10% of LV side current rating (~80amp)***.***

A.8. Excessive SPS tripping of 2x315 MVA, 400/220kV ICTs at STPS Suratgarh (agenda by RVPN)

A.8.1 RVPN representative apprised that RVPN vide letter (**Annexure-VIII**) dated 20.8.2024 submitted there was excessive trippings on SPS at 400/220kV 2X315MVA ICTs at STPS, Suratgarh causing a large area disturbance.

A.8.2 SPS of 400/220kV 2x315 MVA ICTs at STPS Suratgarh was approved in the 49th PSC meeting held on 25.1.2024 and has been commissioned on dated 06.05.2024 to meet out the N-l contingency.

A.8.3 Further, RVPN submitted that excessive interruptions (i.e. 39 Nos w.e.f. 18/5/24 to 22/7/24) has been observed due to operation of newly commissioned SPS at STPS Suratgarh since commissioning and a large load approx. 150 MW was affected due to same.

A.8.4 After analysis of trippings, it is observed that these trippings were due to operation of

Over Current element of relay either by gradual overloading, poor power factor, poor voltage profile, Traction load etc. or some other reasons instead of "N-l contingency".

A.8.5 RVPN mentioned that after analyzing fault records /DR & discussion with RVUN officials, it is found that the present settings of Over current protection element of numerical relay used for SPS initiation is "Anyone Phase" on full Load current.

A.8.6 In view of above, RVPN recommended the followings to update in the existing approved SPS scheme of STPS Suratgarh to avoid the power supply disturbance caused by gradual overloading instead of "N-l Contingency".

a) To update the settings of over current element used for SPS start on "ALL Phase" instead of "Any Phase". As in most of the trippings, there is very much unbalance between the phases and the same may cause undesired initiation of SPS.

b) To update the Current Setting (I>) from full load to 125 % of load on each ICT as per thermal capability of each ICT's.

c) To incorporate C.B. status in the tripping circuit of SPS on each 220 KV lines at both ends to avoid unnecessary trippings.

d) To Split the first stage of time delay of 1.0 sec (approx load relief of 150MW) at 220 KV GSS Bhadra by providing timer with 0.85 Sec (with load relief of 20 MW) and with 1.0 Sec (with load relief of rest 140 MW).

A.8.7 Further, RVUNL vide mail dated 06.09.2024 shared the comments on the proposal of RVPN. The same is attached as **Annexure-IX**.

A.8.8 RVPN representative stated that overcurrent means rise in current in all three phase, then an SPS should operate. If there is rise in current on one phase, then it may be taken care by earth fault and other protective relays. Hence RVPN requested RVUNL to change the current setting of SPS operation from one phase to three phase.

A.8.9 RVUNL representative replied that all windings of ICT are of same capacity. Therefore, increase of current of any of the winding should not be ignored from the point of load shedding or SPS operation. He disagreed with the proposed changes of RVPN regarding single phase to three phase overcurrent SPS operation.

A.8.10 Further, RVPN representative stated the 2nd proposal for updating the Current Setting (I>) from full load to 125 % of load on each ICT as per thermal capability of each ICT's. NRLDC representative conveyed that from the RVUNL comments, it seems that they have misunderstood this proposal of RVPN. RVUNL representative stated that overcurrent protection is going to operate in case of phase fault. Therefore, overcurrent and overload are two different phenomena.

A.8.11 Further, 3rd and 4th proposals of RVPN were discussed. RVPN and RVUNL agreed mutually with respect to comments mentioned at S. No. 3rd and 4th of Annexure-IX. RVPN agreed to take action as suggested by RVUNL at S.No. 3rd and 4th point.

Decision taken by Forum:

In line with mutual agreement of RVUNL and RVPN, Forum accorded consent on S. No. 3rd and 4th mentioned at the Annexure-IX and directed RVPN to install underpower relay at the GSS and implement bifurcation of load relief at each stage. The overcurrent protection settings of transformer will be discussed in the meeting of 'Power Transformer and Reactor protection philosophy finalization' scheduled on 27.09.2024.

A.9. Status of remedial actions recommended during 51st PSC meeting (agenda by NRLDC)

A.9.1 NRLDC representative apprised that as per the discussion in 51st PSC meeting, necessary remedial actions were recommended based on the analysis and discussion of the grid events. Constituents were requested to share the details of actions taken and present status via mail to NRLDC and NRPC. However, details not received on mail. During the meeting constituents were requested to apprise the status of the same. Constituents informed following during the meeting:

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

51 PSC recommendations:

PSC Forum requested HP to complete the protection audit as per mentioned timelines (protection audit of 220kV Kunihar has been awarded and it would be completed within next 15-20 days. In next phase, by 15th September, protection

audit of substations in downstream and upstream of 220kV Kunihar S/s would be completed.) and resolve the protection related issues. HP was also requested to share the reports of protection audit to NRPC & NRLDC after completion of audits.

HPSEBL representative informed that protection audit of 220kV Kunihar has been awarded to POWERGRID on 09th July 2024 and it would be completed by October 2024. In next phase, protection audit of substations in downstream and upstream of 220kV Kunihar S/s would be completed, tender process of rest of the stations is in process.

NRLDC representative requested POWERGRID to expedite the protection audit of 220kV Kunihar S/s and HPSEBL was requested to expedite the process at their end and submit the report of protection audit after its completion.

Forum requested POWERGID to complete the protection audit of Kunihar S/s at the earliest and requested HPSEBL to expedite the process of other upstream end. HP was also requested to share the reports of protection audit to NRPC & NRLDC after completion of audits.

b) Multiple elements tripping at 220kV Hissar(BBMB) 07th May 2024, 11:16 hrs: 51 PSC recommendations:

Expedite the implementation of differential protection in short lines to avoid undesired operation of distance protection.

HVPNL representative informed that clearance related to OPGW received from POWERGRID. Matter was forwarded to design team and is pending at that stage.

NRLDC representative requested HVPNL to expedite the process as it is long pending issue which leads to undesired tripping of multiple transmission lines due to overreach of distance protection.

HVPNL agreed to expedite the process of implementation of differential protection in short lines in coordination with POWERGRID & BBMB.

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

51 PSC recommendations:

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

Rajasthan representative stated that three faulty PU were replaced from the future bay and one PU is still unhealthy which is in warranty period. Process is getting delayed due to lack of response from the OEM. Process will be expedited and will try to resolve the bus bar protection issue on priority.

NRLDC representative requested Rajasthan to expedite the process as Akal S/s is in RE complex and important S/s for evacuation of RE generation. Rajasthan agreed to resolve the issues on priority.

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

51 PSC recommendations:

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

NHPC representative informed following during the meeting:

i. Material for differential protection has been purchased.
ii. A/R scheme at Parabati2 is healthy as per preliminary test, further test needs to be done by taking shutdown.
iii. Shutdown has been planned in 1st week of November 2024, testing of A/R scheme and implementation of differential protection will be done during that period.

iv. Issue of time sync of recording instruments (GPS synchronisation) at Parbati2(NHPC) has been resolved.

v. PLCC card at Parabti3 end will be replaced by the end of September 2024. For dual test of PLCC operation, PLCC at Sianj end also need to be healthy.

Sainj HEP representative was not present in the meeting. HPPTCL was requested to intimate concerned person of HPPCL to taken necessary corrective actions and ensure healthiness of PLCC at Sainj end.

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

51 PSC recommendations:

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

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

NRLDC representative requested HVPNL to confirm whether necessary changes required in protection setting has been done or not. Necessary actions need to be expedited.

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

51 PSC recommendations:

i. Punjab shall expedite the commissioning of new bus scheme.

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

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

POWERGID(NR-2) representative informed that Z-4 time delay setting of lines of their control area has been revised.

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

51 PSC recommendations:

UP shall implement the bus bar protection at 132kv level at 400/132kV Masoli S/s.

UP representative informed that this case has been communicated to design team. In response, they have asked the list of all such stations in UP control area. Further follow up actions is expected in due time course.

A.10. Status of Bus bar protection (agenda by NRLDC)

A.10.1 NRLDC representative apprised that Clause - 4 in schedule - V of Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2022 reads as

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

A.10.2 During analysis of many grid incidents/disturbances, it has been found that the Busbar protection at the affected substation was not present or non-operational which resulted in considerably increasing both the number of affected elements and fault clearance time. Accordingly, it becomes critical to monitor and keep Busbar protection at all the 220 kV and above voltage level substations healthy and operational.

A.10.3 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 the status of bus bar protection has been improved however, further improvement is desired.

A.10.4 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-X**.

A.10.5 Constituents were requested to share the present status of remedial action taken/to

be taken regarding commissioning and healthiness of bus bar protection at 220kV & above substations and also expedite the implementation of bus bar protection.

A.10.6 Members were requested to appraise the status of bus bar protection in their respective control areas.

A.10.7 UP, Haryana, Punjab and Rajasthan shared the updated status of bus bar protection in their control area. State wise summary of updated status of bus bar protection is attached as **Annexure-XI**.

A.10.8 HP and Uttarakhand were requested to share the updated status of their control area.

Decision taken by Forum

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

A.11. Replacement of electromechanical relays with numerical relays (agenda by NRLDC)

A.11.1 NRLDC representative apprised that Clause-37.2(c) of IEGC, clause-15(4) of CEA Grid standards and clause-48(4) of CEA Construction Standards 2022 mandates that ''each line or transformer or reactor or any other bay shall be provided with facility for disturbance recording, event logging and time synchronizing equipment''.

A.11.2 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 recorder are not available there which accounts for violation of Clause-37.2(c) of IEGC, clause-15(4) of CEA Grid Standards and clause 48(4) CEA Construction Standards 2022.

A.11.3 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.11.4 It is known that Disturbance recorder (DR) is essential for analysis of grid incidents/disturbances. Its non-availability eventually affects the proper analysis of grid incidents/disturbances and monitoring of protection system.

A.11.5 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.11.6 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-XII**.

A.11.7 Constituents were 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.

A.11.8 Rajasthan representative informed that procurement process of 350 numbers of numerical relays is in pipeline and it is expected to be completed by December 2024. Thereafter, all the Main protection relays up to 132kV which are of electromechanical / static type will be replaced by numerical relays.

A.11.9 Haryana representative informed that except few lines, all the line protection relays have been retrofit with numerical relays. Except few of the transformers, differential protection relay in all the transformers have been replaced with numerical relay. Mainly back up protection relays are of electromechanical type. Necessary actions and follow ups are being done to replace them also with the numerical relays.

A.11.10 UP representative informed that in this regard Director Operation UPPTCL has also asked complete list of electromechanical relays in UP control area to initiate further follow up actions.

A.11.11 Haryana, UP and Rajasthan shared the updated status. Based on details received from states, the updated status of relay type is attached as **Annexure-XIII**.

A.11.12 Other states were also requested to share the updated status of their control area.

Decision taken by Forum

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

A.12. Availability and Standardization of recording instrument (Disturbance recorder and Station Event Logger) (agenda by NRLDC)

A.12.1 NRLDC representative apprised that as per IEGC clause 17

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

A.12.2 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.12.3 NRLDC representative highlighted that during FTC process, cases of non-availability of station event logger and non-standardisation of recording instruments have been observed.

A.12.4 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.12.5 Therefore, availability of disturbance recorder with standardisation, time sync and correct nomenclature and station event logger need to be ensured by users at the station of their respective control area.

A.12.6 Deliberation on this subject was done during 50th & 51st PSC meeting. Details were received from UP & Haryana only.

A.12.7 In view of above, all the constituents were 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-XIV.**

Decision taken by Forum

PSC forum requested all the members to share the status of availability and standardisation of disturbance recorder and event logger at the station of *their control area and ensure the standardisation of recording instruments at all the stations of their control area.*

A.13. Analysis of the tripping events occurred during July-2024 to August-2024 and status of remedial action taken (agenda by NRLDC)

A.13.1 Followings were discussed as below:

a) Frequent forced outages of transmission elements in the month of August'24:

The following transmission elements were frequently tripping during the month of **August'24**:

S. No.	Element Name	No. of forced outages	Utility/SLDC
1	220 KV Anta(NT)-Sakatpura(RS) (RS) Ckt-1	4	NTPC/Rajasthan
2	220 KV DandhariKalanI(PS)-Ludhiana(PG) (PSTCL) Ckt-2	3	PG/Punjab
3	220 KV NAPP(NP)-Khurja(UP) (UP) Ckt-1	6	NAPP/UP
4	220 KV Saharanpur(PG)-Shamli(UP) (UP) Ckt-1	4	PG/UP
5	400 KV Agra-Unnao (UP) Ckt-1	4	UP
6	400 KV Bhadla-Merta (RS) Ckt-1	5	Rajasthan
7	400 KV Dadri(NT)-Panipat(BB) (PG) Ckt-1	3	NTPC/PG

The complete details are attached at **Annexure-XV.**

Discussion during the meeting:

i. **220 KV Anta(NT)-Sakatpura(RS) (RS) Ckt-1:** NRLDC representative raised concern over frequent incidents of faults and non-operation of A/R at Sakatpura end.

Rajasthan representative informed that two of the fault incidents occurred due to flashover of disc insulators and regarding non-operation of A/R, it was informed that relay penal is old, same is planned to be replaced with new within one month.

ii. **220 KV DandhariKalanI(PS)-Ludhiana(PG) (PSTCL) Ckt-2:** NRLDC representative raised concern over non-operation of A/R at Dandharikalan(PS) end. Punjab representative informed that in Main-2 relay, A/R lockout was coming. Issue in PSL (feedback of CB through auxiliary contacts) was found and same has been rectified.

iii. **220 KV NAPP(NP)-Khurja(UP) (UP) Ckt-1:** NRLDC representative raised concern over frequent trippings of transmission lines connected at 220kV NAPP in the recent past. As per details available at NRLDC, 220kV NAPP(NP)-Khurja(UP) line tripped 16 (sixteen) times during the year 2024, A/R operation was also not observed at Khurja end during most of the incidents . Being a Nuclear Power Station, evacuating transmission lines are important and critical for safe evacuation of power. Such frequent tripping of evacuating transmission lines may lead to challenges in safe evacuation of generation at NAPP, which is a must run generating station. It is desirable that the transmission system remains intact and in healthy condition.

iv. **220 KV Saharanpur(PG)-Shamli(UP) (UP) Ckt-1:** NRLDC representative raised concern over frequent incidents of faults and non-operation of A/R in line. UP representative informed that most of the faults occurred due to flashover of disc insulators, damaged insulators have been replaced. Regarding non-operation of A/R, it was informed that A/R is healthy and operational at Shamli(UP) end and it was successful during some of the transient fault cases. However, A/R is off at Sharanpur(PG) end. NRLDC requested POWERGID to share the status of A/R operation at their end and ensure proper operation of A/R during single phase to earth fault. POWERGRID(NR-1) representative informed that there is no direction to OFF the A/R in line. However, they will review the status of A/R operation at Baghpat(PG) and shall ensure its proper operation in future.

v. **400 KV Agra-Unnao (UP) Ckt-1:** NRLDC representative raised concern over frequent incidents of faults and non-operation of A/R during some incidents. UP representative informed that tripping on 3rd August was due to pole discrepancy and

on 28th A/R didn't operate at Unnao end. Fault was in Z-2 from Unnao end. During investigation, PLCC channel-1 was found unhealthy, and channel-2 was in OFF condition during the event. Channel-2 has been taken into service and status of healthiness of channel-1 will be confirmed.

vi. **400 KV Bhadla-Merta (RS) Ckt-1:** NRLDC representative raised concern over frequent incidents of faults. Rajasthan representative informed that there was incident of tower collapse of this line during which ERS was installed. There was some design related defect in ERS due to which ph-ph faults were occurring. During 1st week of September, ERS has been removed and healthy tower has been installed. Further incidents was such fault not occurring now.

vii. **400 KV Dadri(NT)-Panipat(BB) (PG) Ckt-1:** NRLDC representative raised concern over frequent incidents of faults and non-operation of A/R at Dadri(NTPC) end. Non submission of DR/EL from Dadri end was also highlighted. NTPC representative stated that they will look into the issue and share the updated on the same.

A.13.2 NRLDC representative emphasized that A/R (auto re-closer) issue was found in many of these tripping. He sensitized all the utilities to ensure healthiness/in service of A/R in 220 kV and above transmission lines in compliance to CEA Grid Standards. He further informed that most of the tripping are transient in nature but due to non-operation of A/R, it resulted into tripping of the transmission element thus reducing the reliability of the grid. All the utilities shall endeavour to keep auto re-closer in service and healthy condition of 220 kV and above voltage level transmission line. The issue of time syncing of DR/EL at many of the stations was highlighted, constituents were requested to ensure the time syncing of DR/EL. In addition, necessary actions also need to be taken to ensure the Right of Way and other operation & maintenance issues to minimize the frequent faults in the line. All utilities agreed for the same.

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

b) Protection related issues in multiple elements tripping and status of remedial measures:

In some of the tripping incidents occurred during July-August 2024, there was some issues related to protection system. List of the such tripping incidents is attached as **Annexure-XVI.** Concerned utilities were requested to apprise the status of remedial actions to forum.

Discussion during the meeting:

i. Frequent tripping of 220 KV Khara(UP)-Saharanpur(PG) (UP) Ckt-1 during July24:

NRLDC representative stated that during 222nd OCC meeting UP intimated that static/electromechanical relays at Khara(UP) will be replaced by numerical relay. UP was requested to apprise forum about present status.

UP representative informed that new relay is available at site. Relay will be replaced during lean season as per the shutdown opportunity.

ii. Frequent tripping of 400 KV Bikaner-Bhadla (RS) Ckt-1 during July24:

NRLDC representative stated that during 222 OCC meeting Rajasthan intimated that a) issue in BCU at Bikaner end due to which command is not reaching to breaker. b) dead time setting in A/R, it seems that it is kept as 600msec which need to be ~1sec

Rajasthan representative informed that protection system is not healthy at both the stations and dead time is also as per standard (1sec).

iii. Multiple elements tripping event at Baghpat(PG) & Baghpat(UP):

NRLDC representative stated that A/R operation was not observed in 220 KV Baghpat(PG)-Baghpat(UP) (UP) Ckt-1 on B-N fault.

POWERGRID(NR-1) representative informed that there is no direction to OFF the A/R in line. However, they will review the status of A/R operation at Baghpat(PG) and shall ensure its proper operation in future.

iv. Multiple elements tripping event at Ziankote(J&K) & Amargarh(INDIGRID):

NRLDC representative asked J&K to apprise the forum about status of carrier communication and A/R scheme implementation at Ziankote end.

J&K representative was not present in the meeting.

INDIGRID representative informed that PLCC is not installed at Ziankote end therefore, line is charged without carrier aided tripping since commissioning and Z-2 time delay is kept as instantaneous (0 sec).

MS NRPC instructed to prepare a dedicate agenda for discussion with J&K and conduct a separate meeting with J&K to discuss the issues and status of follow up action at J&K end.

v. **Multiple elements tripping event at Patiala(PG):** NRLDC representative asked POWERGRID(NR-2) to apprise the forum about status of replacement of bus bar relay.

POWERGRID(NR-2) representative informed that LOA was placed last year, material yet not received due to delay in supply. Continuous follow ups are being done for expeditious delivery of material. Thereafter, new bus bar protection will be implemented.

vi. **Multiple elements tripping event at Mandaula(PG), Bawana(DTL) & Maharani Bagh(PG):** NRLDC representative asked POWERGRID(NR-1) about the reason of tripping of 400 KV Mandala(PG)-Maharani Bagh(PG) (DTL) Ckt-1 from Mandaula end during the event without any fault on the line.

POWERGRID(NR-1) representative informed that issue was found in tripping initiation logic in Main-1 relay at Mandaula end which led to undesired tripping of line from Mandaula end. Same has been rectified.

vii. **Multiple elements tripping event at Nara(UP):** NRLDC representative asked UP to share the status of work related to relay communication cables replacement of Muzaffarnagar & Jansath Ckt bay at Nara(UP) S/s.

UP representative informed that earlier assumed reason was wrong. Actual issue identified is that new distance protection relays were installed in Roorkee, Jansath & Muzaffarnagar line. During this work, tripping of these bays through bus bar was not completely configured (96 relay). Due to this, on LBB operation of Matore bay, bus bar protection initiated tripping command however aforementioned three lines didn’t trip and later tripped on remote end Z-2/Z-3 protection operation. Now, this

issue has been resolved and recent operation of bus bar protection at Nara(UP) on 10th September was correct.

viii. Multiple elements tripping event at Vishnuparyag HEP: NRLDC representative asked UP to share the status of remedial action taken w.r.t. O/C protection applied on bus coupler at Vishnuprayag.

UP representative informed that Vishnuprayag HEP kept O/C protection setting due to safety concern. However, now they have increased the O/C protection setting at bus coupler from 2*In to 6*In.

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ix. Multiple elements tripping event at Bawana(DV), Mundka (DV) & Maharanibagh(PG): NRLDC representative asked DTL about the status of remedial action taken for issue of overreaching of distance relays at Mundka(DTL) end.

DTL representative informed that there was issue in blinder setting of Z-2 in Main-2 relay (D60) at Mundka end. Necessary changes in PSL of relay has been done.

c) Analysis of the tripping events occurred during July-2024 to August-2024 and status of remedial action taken:

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

A.13.3 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

Tripping Events

A. Multiple elements tripping at 400/220kV Akal(RS) 06th July 2024, 05:26 hrs

1. **Discussion during the meeting:**

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

- 400/220kV Akal(RS) has one and half breaker scheme at 400kV level and double main and transfer bus scheme at 220kV level.
- During antecedent condition, incoming power at Akal(RS) S/s through 220 KV Akal-Akal(Suzlon) (RS) D/C and 220 KV Akal-Mulana (RS) Ckt were approx. 235 MW and 125 MW respectively.
- As reported, at 05:26 hrs, R-phase conductor of 220 KV Akal-Akal(Suzlon) (RS) ckt-2 broke at a distance of approx. 160m from Akal(RS) S/s which caused R-N phase to earth fault and subsequently 220 KV
- Akal-Akal(Suzlon) (RS) ckt-2 tripped on zone-1 distance protection from Akal(RS) end.
- As per PMU at ASPS1(IP), R-Y phase to phase fault followed by R-N phase to earth fault with fault clearance time of 80msec and 80msec respectively are observed.
- At the same time, 220 KV Akal-Akal(Suzlon) (RS) Ckt-1 and 220 KV Akal-Mulana (RS) Ckt also tripped from Akal(RS) end (Reason of tripping yet to be received).
- During this event, dip in Rajasthan wind generation of approx. 1800 MW is observed out of which approx. 1150 MW recovered within 10 minutes. (As per SCADA).
- As per SCADA, no change in demand is observed in Rajasthan control area.
- As per SCADA, change in Rajasthan wind generation of approx. 168MW is observed.
- Major observations:
  - Reason for tripping of 220 KV Akal-Akal(Suzlon) (RS) Ckt-1 and 220 KV Akal-Mulana (RS) Ckt need to be shared.
  - SCADA data was freeze during the event. Availability and healthiness of SCADA data need to be ensured.
  - DR/EL (.dat/.cfg file) of all tripped elements along with detailed tripping report and remedial action taken report need to be shared.
  - Trippings at Akal(RS) S/s are not recorded in SCADA SOE. Availability of SCADA SOE data needs to be ensured.

b. Rajasthan representative and others informed the following:

- 220kV Akal-Suzlon D/C are on same tower (D/C tower). B-ph conductor of Suzlon ckt-2 snapped at distance approx. 400meter from Akal end, this fault converted into Y-B fault. Further after ~200msec, snapped conductor of Suzlon ckt-2 touched Suzlon ckt-1 also.
- Both 220kV Akal-Suzlon ckt-1&2 tripped from Akal end on distance protection operation in Z-1.
- 220kV Akal-Mulana ckt tripped on undervoltage protection from Mulana end.

NRLDC representative raised concern over non submission of DR/EL files due to which complete analysis of the event couldn't done. During the event, significant quantum of RE generation was affected therefore, complete analysis, findings of shortcomings and subsequent remedial actions are important to avoid such event in future. Issue of phase sequence was also highlighted (reported fault signature is not matching with PMU fault signature).

Forum's Recommendations:

- *Timely submission of disturbance recorder (DR) and event logger (EL) files need to be ensured. As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event.*
- *Detailed analysis along with remedial action taken report need to be shared.*
- *Issue of mismatch in phase sequence need to be resolved.*

B. Multiple elements tripping at 400/220kV Bhadla(RS) on 30th July 2024, 11:38 hrs

1. **Discussion during the meeting:**

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

- 400/220kV Bhadla(RS) has double main and transfer bus arrangement at 220kV side.

- During antecedent condition, 220 kV Bhadla(RS)-Saurya Urja-2 and 220kV Bhadla(RS)-RSDCL I Ckt-2 were carrying approx. 242 MW & 128 MW respectively (reported data).
- As reported, at 11:38hrs, B-ph jumper of 220kV Bhadla(RS)-Saurya Urja Ckt-2 snapped from Main Bus at Bhadla(RS) which led to tripping of 220kV Bhadla(RS)-Saurya Urja Ckt-2.
- During the same time, 220 kV Bus sectionalizer-I (Bay no. 09) and 220 kV Bus Coupler-I (Bay no. 13) at Bhadla(RS) also tripped due to B-N phase to ground fault (As per PMU, Y-N fault; phase sequence issue is observed).
- Further as reported, 220kV Bhadla(RS)-RSDCL I Ckt-2 also tripped from RSDCL I end only due to LBB operation at the same time (exact reason of LBB operation yet to be shared).
- As per PMU at Bhadla(PG), Y-N phase to ground fault is observed with delayed fault clearing time of 160 ms.
- As per SCADA, change in solar generation of approx. 905MW is observed in Rajasthan control area.
- As reported by SLDC Rajasthan, approx. 370 MW of solar generation loss occurred in Rajasthan control area and there is total approx. 730 MW reduction in solar generation by RE plants connected at Bhadla(RS).
- Major observations:
  - Exact reason of LBB operation at RSDCL need to be shared.
  - Phase sequence issue need to be resolved at the earliest.
  - Tripping is not recorded in SCADA SOE. Availability of SCADA SOE data needs to be ensured.
  - DR/EL (.dat/.cfg file) along with tripping report need to be shared for each element from both the ends.
  - Remedial action taken report to be shared.

b. Rajasthan representative and others informed the following:

- Fault occurred due to snapping of bus post jumper of 220kV Bhadla-Saurya Urja ckt-2 at Bhadla end leading to bus fault on 220kV Bus B.
- Bus bar protection is not in service at 220kV Bhadla(RS). Commissioning work of the same is in process and it is getting delayed due to non-

availability of shutdown of bus sectionalizer. However, it will be expedited.

- As bus bar protection is not available, time graded overcurrent protection has been implemented on bus sectionalizer to isolate the faulty bus section and to avoid complete blackout of station.
- However, during this event, both bus sectionalise-1&2 opened due to delayed opening of bus sectionliser-1.
- To avoid such incident in future, plug setting of bus sectionalise-2 has been increased from 20% to 30%.
- Regarding reason of LBB operation at RSDCL, it was informed that analysis in this regard is yet to be done. DR files are not received yet from site.

NRLDC representative requested Rajasthan to identify the root cause of LBB operation at RSDCL. Incidents of LBB operation at RSDCL were reported in past also. Therefore, root cause behind this maloperation need to be identified and any shortcomings in protection system may be rectified. Issue of phase sequence was also highlighted (reported fault signature is not matching with PMU fault signature).

Forum's Recommendations:

- *Commissioning of Bus bar protection at 220kV bus at 400/220kV Bhadla(RS) need to be expedited.*
- *Timely submission of disturbance recorder (DR) and event logger (EL) files need to be ensured. As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event.*
- *Detailed analysis along with remedial action taken report need to be shared.*
- *Issue of mismatch in phase sequence need to be resolved.*

C. Multiple elements tripping at 220kV Chinhat(UP) on 01st July 2024, 00:15 hrs

1. **Discussion during the meeting:**

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

- 220kV Chinhat(UP) has main and transfer bus scheme at 220kV level.
- During antecedent condition, incoming power at Chinhat(UP) was through 220kV Satrikh ckt (~100MW), Kursi Road ckt (~30MW) and Lucknow(PG) ckt (~80MW) and outgoing power was through 220kV
- Gomatinagar ckt (~30MW) and load at Chinhat(UP) S/s (~90MW). All 220kV lines and ICTs connected to 220kV main bus at Chinhat(UP) S/s. 220kV Chinhat-LMRC D/C is radial line from Chinhat(UP) S/s.
- As reported, at 00:15 hrs, LA of 220 KV Chinhat-Satrikh Road (UP) Ckt bay burst at Chinhat(UP) S/s which caused R-N phase to earth fault.
- On this fault 220kV lines from Chinhat(UP) to Satrikh Road (UP), Gomtinagar (UP), Kursi Road (UP) & Lucknow_1(PG) tripped (Reason of tripping and type of protection operated for all elements yet to receive).
- Due to these trippings at Chinhat(UP) S/s, 220kV Chinhat-LMRC D/C, 220/132kV ICT-1 & 2 became dead and blackout occurred at 220kV Chinhat(UP) S/s.
- As per PMU at Lucknow(PG), R-N phase to earth fault with delayed fault clearance of 440msec is observed (reason for delayed fault clearance yet to receive).
- As per SCADA, change in demand of approx. 195 MW in UP control area.
- Major observations:
  - Reason for delayed fault clearance need to be shared.
  - Type of protection operated in tripping of all elements need to be shared.
  - DR/EL (.dat/.cfg file) of all the tripped elements along with detailed tripping report need to be shared.
  - Remedial action taken report to be shared.

b. UP representative and others informed the following:

- Fault occurred on 220kV Chinhat-Satrikh Road line due to damage of R-ph LA at Chinhat end. Distance protection relay of the line got blocked due to initiation of Power Swing Blocking (PSB).
- Thereafter, fault cleared with the tripping of adjacent lines from remote end in Z-2.
- Distance relay of Satrikh Road line was found OKAY during testing. Double earthing also found in PT of this line at Chinhat end however this wouldn't have led to initiation of PSB. Issue related to earthing has been rectified.
- 220kV Bus coupler at Satrikh Road also tripped during this event due to sensitive overcurrent protection on bus coupler. This issue also has been rectified.
- In Gomati Nagar line, back up E/F protection operated at Chinhat end due to non-configuration of direction feature. Same has been incorporated.

NRLDC representative raised concern over non submission of DR/EL files and requested UP to share the DR/EL files w.r.t. this event.

Forum's Recommendations:

- *Proper operation of protection system needs to be ensured.*
- *Any issue in protection settings may be revised and corrected.*
- *Timely submission of disturbance recorder (DR) and event logger (EL) files need to be ensured. As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event.*

D. Multiple elements tripping at 400/132kV Mau(UP) at 07th July 2024, 11:44 hrs

1. **Discussion during the meeting:**
   a. **Brief of the event shared by NRLDC representative based on detail available is as follows:**
      - 400/132kV Mau(UP) has double main and transfer bus scheme at 400kV level.

- During antecedent condition, 400 KV Azamgarh-Mau (UP) Ckt, 400 KV Mau(UP)-Balia(PG) (PG) Ckt & 400/132 kV 200 MVA ICT-3 connected to 400kV bus-1 and 400kV Mau-Rasra (UP) ckt, 400/132/33kV 200MVA ICT-1 & 2 connected to 400kV bus-2. 400 KV Anpara_B(UPUN)-Mau(UP) (UP) Ckt was not in service during the event.
- As reported, at 11:44 hrs, B-phase CT of 400 KV Azamgarh-Mau (UP) Ckt burst which caused bus fault on 400kV bus-1 which led to bus bar protection operation on 400kV bus-1 at Mau(UP) S/s.
- As per PMU at Azamgarh(UP), B-N phase to earth fault converted into Y-B phase to phase fault with delayed fault clearance time of 560ms is observed
- Due to bus bar protection operation, all elements connected to 400kV bus-1 (400kV Azamgarh(UP) ckt, Balia(PG) ckt and 400/132 kV 200 MVA ICT-3) tripped at 400kV Mau(UP) S/s.
- As per SCADA, change in demand of approx. 60 MW in UP control area.
- Major observations:
  - Nature of fault and reason for delayed fault clearance need to be shared.
  - Reason for delayed operation of bus bar protection and protection settings at Mau(UP) S/s need to be shared.
  - DR/EL (.dat/.cfg file) of all the tripped elements along with detailed tripping report need to shared.
  - Remedial action taken report to be shared.

b. UP representative and others informed the following:

- Fault occurred on 400kV Mau-Azamgarh line (connected at 400kV Bus-1) due to damage of B-ph CT at Mau end.
- Distance protection at Mau end sensed fault in Z-1 with ~25kA and initiated tripping. However, B-ph pole got stuck and CB failed to open.
- LBB should have operated instantaneously however due to lack of sufficient current it didn't operate.
- Further after ~280msec, fault converted into Y-B phase to phase fault. With the inclusion of Y-ph, sufficient current received in LBB CT core

and after further ~200msec, LBB initiated tripping to all the elements connected at 400kV bus-1.

NRLDC representative raised concern over no submission of DR/EL files and requested UP to share the DR/EL files w.r.t. this event.

Forum's Recommendations:

- *Proper operation of protection system needs to be ensured.*
- *Routine maintenance of circuit breakers and their associated equipment's need to be done to avoid frequent incidents of breaker failure.*
- *Timely submission of disturbance recorder (DR) and event logger (EL) files need to be ensured. As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event.*

E. Multiple elements tripping at 400/220kV Lucknow(UP) on 14th July 2024, 15:53 hrs

1. **Discussion during the meeting:**
   a. Brief of the event shared by NRLDC representative based on detail available is as follows:
   - 400/220kV Lucknow(UP) has double main and transfer bus scheme at 220kV level.
   - During antecedent condition, 400/220kV 500 MVA ICT-1 & 2, 220/132kV 200 MVA ICT-1 & 2, 220kV Lucknow-Hardoi Road (UP) ckt & 220kV Lucknow-Unnao (UP) ckt were connected to 220kV bus-1 and
   - 220kV lines from Lucknow(UP) to Bachrawan, Gomatinagar, Kanpur Road & 220/132kV 200MVA ICT-1 & 2 connected to 220kV bus-2 at 220kV Lucknow(UP) S/s. 220kV Lucknow-Kanpur Road (UP) ckt was not in service during the event.
   - As reported, at 15:53 hrs, R-N phase to earth fault occurred on 220kV bus-1 which led to tripping of all elements connected to 220kV bus-1 at 220kV Lucknow(UP). Bus bar protection failed to operate and 400/220

kV 500 MVA ICT-1 & 2 tripped on LBB protection (Type of protection operated in tripping of other elements is yet to receive)

- As per PMU at Lucknow(PG), R-N phase to earth fault with delayed fault clearance time of 880ms is observed (Reason for delayed fault clearance is yet to receive).
- As per SCADA, change in demand of approx. 280 MW in UP control area. However, approx. 250 MW load loss in UP control area as per SLDC-UP.
- Major observations:
  - Reason of fault and reason for delayed fault clearance at 220kV Lucknow(UP) S/s need to be shared.
  - Reason for failed operation of bus bar protection at 220kV Lucknow(UP) S/s need to be shared.
  - Relay flag details and type of protection operated for all tripped elements need to be shared.
  - DR/EL (.dat/.cfg file) of all the tripped elements along with detailed tripping report need to shared.
  - Remedial action taken report to be shared.

b. UP representative and others informed the following:

- 220kV Bus A & B were running in split mode. Fault on 220kV Bus-A occurred due to conductor drop by bird on Bus-A.
- Bus bar protection didn't operate as it was in blocked condition due to CT supervision alarm which was already persisting due to already existing fault in CT circuit.
- During inspection it was found that CT ratio configuration in bus bar relay of 02 number of bays were incorrect. Actual CT ration was 800:1 and in bus bar relay it was configured as 1000:1. This issue has been rectified now.
- Reason of tripping of 400/220kV ICT on LBB protection is not identified yet.
- As a remedial measure, process of replacing bus bar relay with numerical bus bar has been started.

Forum's Recommendations:

- *Healthiness of protection system need to be ensured. Proper operation of protection system needs to be ensured.*
- *Replacement of bus bar relay with numerical bus bar relay need to be expedited.*
- *Timely submission of disturbance recorder (DR) and event logger (EL) files need to be ensured. As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event.*

F. Multiple elements tripping at 400/220kV Muzaffarnagar(UP) on 21st August 2024, 09:02 hrs

1. **Discussion during the meeting:**
   a. **Brief of the event shared by NRLDC representative based on detail available is as follows:**
      - During antecedent condition, 400/220kV 315 MVA ICT-1, 400/220kV 500 MVA ICT-4, 220kV Muzaffarnagar-Shamli (UP) Ckt, 220kV Muzaffarnagar-Khatauli (UP) Ckt, 220kV Muzaffarnagar-Badhni kalan (UP) Ckt & 220/132kV 160MVA ICT-4 were connected to 220kV bus-1 and 400/220 kV 315 MVA ICT-2, 400/220 kV 315 MVA ICT-3, 220kV Muzaffarnagar-Charla (UP) Ckt, 220kV Muzaffarnagar-Jansath (UP) Ckt & 220/132kV 160MVA ICT-5 were connected to 220kV bus-2 at Muzaffarnagar(UP) S/s. Bus coupler of 220kV bus-1 and 220kV bus-2 was in ON condition and 220kV Muzaffarnagar-Nara (UP) Ckt was not in service (under shutdown) during the tripping event.
      - As reported, at 09:02 hrs, R-N phase to earth fault occurred on 220kV Muzaffarnagar-Badhni kalan (UP) Ckt with fault distance of 3.8km from Muzaffarnagar(UP) end and 20.4km from Badhni kalan(UP) end. Fault was sensed in zone-1 from both ends.
      - On this fault 220kV Muzaffarnagar-Badhni kalan (UP) Ckt tripped from Badhni kalan end on zone-1 distance protection on R-N fault. During fault clearing process at Muzaffarnagar(UP) end, R-phase CB interrupting chamber got damaged which resulted into continuation of sparking between R phase male contact and R phase dropper wire of

breaker. The circuit breaker operated mechanically (auxiliary contacts operated properly) and thus breaker status reflected as OPEN.

- As breaker didn't open completely (sparking between R phase male contact and R phase dropper wire of breaker was still there), fault was not cleared yet. Due to continuous fault feeding 400/220kV 315MVA ICT-1 & 2 and 400/220kV 500 MVA ICT-4 tripped on directional earth fault protection and 400/220kV 315 MVA ICT-3 tripped on back up impedance protection. 220 kV Charla line, 220 kV Jansath line and 220 kV shamli line tripped from remote ends on zone-3 distance protection (it is confirmed from respective DRs also).
- Ideally, this fault would have been cleared by LBB protection of Badhni kalan bay, but as CB status changed from ON to OFF due to proper operation of breaker auxiliary contacts, LBB initiation got reset.
- Further, as reported, bus bar protection of 220kV bus-1 at Muzaffarnagar(UP) also operated after 1 second of fault starting time due to persisting differential current.
- As per DR of bus bar protection at Muzaffarnagar(UP), busbar protection operated on 220kV bus-1 after 1.05 second of fault starting time. On this, all remaining elements also tripped which were connected to 220kV bus-1 i.e. 220kV Muzaffarnagar-Khatauli (UP) Ckt, 220/132kV 160MVA ICT-4 and bus coupler of 220kV bus-1 and bus-2.
- As per PMU at Meerut(PG), R-N phase to earth fault with delayed fault clearing time of 1080 msec is observed.
- As per SCADA, load loss of approx. 290 MW in UP control area. However, SLDC-UP reported load loss of 127 MW in UP control area.
- Major observations:
  - Logic of identification of breaker ON & OFF status may be reviewed if needed.
  - Reason for bus bar protection operation need to be shared.
  - Remedial action taken report to be shared.

b. UP representative and others informed the following:

- R-N Fault occurred on 220kV Badhai kalan line due to snapping of OPGW.

- On this fault, distance protection of this line at Muzaffarnagar end initiated tripping command. Auxiliary contact of the R-ph pole of CB opened but mechanically it didn't open completely, and sparking was persisting.
- In bus bar protection (SEL make relay) logic for bay assignment is based on the AND logic on 52A (braker auxiliary contact status) & 89A (isolator status).
- During this event, auxiliary contact of the R-ph pole of CB opened leading to isolation of Badhai Kalan bay from Bus-1 in bus bar logic. Due to this, LBB protection also not operated.
- Now, in actual, fault was of through fault nature but due to isolation of this bay from bus bar logic, differential current reading of ~8kA was coming in bus bar relay.
- However, operation of bus bar protection got delayed by 1sec. As fault was of through fault nature and there is logic to increase the slope (I diff pick up) for 1sec to avoid undesired tripping due to CT saturation during through fault cases. In this case it increased from 60% to 80%.
- After 1sec, when slope again reduced back to 60%, on the already existing reading of bus bar differential of ~8kA, bus bar protection initiated tripping command, and all the elements connected to 220kV Bus-1 tripped.
- To avoid such event in future, it is proposed to exclude the status of 52A (braker auxiliary contact status) in bay assignment logic. Isolator status may also serve the purpose of proper operation of bus bar protection.

Forum's Recommendations:

- *Healthiness and proper operation of protection system need to be ensured.*
- *Necessary changes in logic of bay assignment may be done to ensure reliable operation of LBB and bus bar protection.*

G. Multiple elements tripping at 220kV Palli(HR) on 16th July 2024, 22:10 hrs

1. **Discussion during the meeting:**

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

- During antecedent condition, 220 kV Palli S/S importing load from 220 KV Samaypur (BB)-Palli (HV) (HVPNL) Ckt-1 & Ckt-2, 220 KV Bad-shahpur (HV)-Palli (HV) (HVPNL) Ckt-1 & ckt-2 and 220 KV Sector-56 (Gurgaon) -Palli (HV) (HVPNL) Ckt-1 & Ckt-2 and feeding that load to 220 KV Palla (HV) (Sec-46) & 220 KV Palli (2*100MVA+1*160MVA) S/S.
- As reported, to manage the line loading on sector-72 Gurgaon ckt, 220 KV Sector 52 (HV) (Sec-56 Gurgaon)-Palli (HV) (HVPNL) Ckt-1 was opened at 22:10 hrs on the instruction of SLDC-Haryana. This led to sparking on the 220 KV Sector 52 (HV) (Sec-56 Gurgaon)-Palli (HV) (HVPNL) Ckt-2 at Palli S/S end.
- At the same time, busbar protection operated at 220kV Palli(HV) due to which all the elements connected to 220kV Bus-1 and 2 at Palli(HV) tripped and complete blackout occurred at Palli(HV) S/s.
- As per PMU, R-Y phase to phase fault with delayed fault clearing time of 880 ms was observed.
- As per SCADA, change in demand of approx. 600 MW and 980 MW in Delhi and Haryana control area respectively were observed. However, as reported, approx. 400 MW load loss occurred at Palli & Sec-46 (Faridabad). Rest of the change in demand is suspected due to stalling of induction motor.
- Major observations:
  - Exact reason, location and nature of fault need to be shared.
  - Reason of delayed clearance of fault need to be shared.
  - Reason of tripping of multiple elements.
  - Feeder-wise load loss details need to be shared.
  - SCADA data issue was observed at 220/66kV Palli(HV) during the event. Availability and healthiness of SCADA data need to be ensured.
  - DR/EL (.dat/.cfg file) of all tripped elements need to be shared.
  - Remedial action taken report need to be shared.

b. Haryana representatives and others informed the following:

- Ph-Ph fault occurred due to snapping of R-ph jumper of 220kV Palli-Gurgaon Sec 56 ckt-2 which fall on Y-ph.
- On this fault, CB of Gurgaon Sec 56 end opened however, breaker of Palli end failed to open. LBB protection also didn't operate, and fault persisted.
- After few msec, conductor fall on jack bus and created bus fault. On this, bus bar protection operated and due to bus tied condition (incorrect isolator status) elements connected to both the 220kV bus at Palli tripped.
- Overhauling of CB and routing maintenance has been recommended to the site.
- On query of sequence of event, it was informed that time is not synced in DR & EL therefore sequence of event couldn't be ascertained.
- On non availability of SCADA data, it was informed that SCADA system at Palli S/s is not healthy.

NRLDC representative requested to resolve following issues:

- Healthiness of SCADA system and availability of SCAD data during grid event.
- Time sync issue of recording instrument.
- Correct isolator status needs to be ensured.

Forum's Recommendations:

- *Healthiness and proper operation of protection system need to be ensured.*
- *Time sync and standardisation of recording instrument (DR/EL) need to be ensured.*
- *Timely submission of disturbance recorder (DR) and event logger (EL) files need to be ensured. As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event.*

H. Multiple elements tripping at 220kV Khodri(Utt) on 19th July 2024 at 21:31hrs:

1. **Discussion during the meeting:**

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

- During antecedent condition, all the four 30MW units of Khodri and 60 MW units of Chhibro were running and total active power generation of Khodri and Chhibro was approx. 89 MW and 196 MW (as per SCADA). Total generation of Chhibro was evacuating through 220 KV Khodri-Chhibro (UK) Ckt-1 & 2.
- As reported, at 21:31 hrs, while taking out 30MW Khodri Unit-2, B-phase pole of CB of Unit-2 did not open. This led to LBB protection operation which further resulted in tripping of all the elements connected to both the buses at 220kV Khodri(UK) and complete blackout occurred at 220kV Khodri(UK) S/s.
- Due to tripping of 220 KV Khodri-Chhibro (UK) Ckt-1 & 2, 60 MW Chhibro Unit-1, 2, 3 & 4 also tripped due to loss of evacuation path and complete blackout occurred at 220kV Chhibro(UK) S/s.
- As per PMU, no fault was observed in the system.
- As per SCADA, change in demand and generation of approx. 30 MW and 300 MW respectively in Uttarakhand control area were observed.
- As remedial action taken, over hauling & testing of generator CB has been performed and found satisfactory.
- Major observations:
  - Due to LBB operation, only the elements connected to the same bus as Unit-2 should have tripped. Exact reason of ripping of the elements connected to the other bus at Khodri need to be shared.
  - Wrong status of CB at Khodri and Chhibro was observed during the event. Availability and healthiness of SCADA data need to be ensured.
  - DR/EL (.dat/.cfg file) of all tripped elements need to be shared.

d. Uttarakhand representatives and others informed the following:

- During shutdown of Unit-2 at Khodri HEP, CB of Unit-2 (connected at 220kV Bus-1) failed to open which led to LBB operation.
- During pole stuck situation, reverse power fed to Unit-3 (connected at another 220kV bus-2) at Khodri HEP. Due to this unbalance current,

standby earth fault (SEF) protection operated in Unit-3 and initiated tripping. However, CB of Unit-3 also failed to open and LBB of Unit-3 bay also operated.

- Operation of bus bar protection of both the bus led to blackout of the Khodri S/s.
- NRLDC representative asked the reason of SEF protection without any earth fault in system and the delay of LBB protection.
- On this query, it was informed that reason of SEF relay will be re-viewed and delay of LBB was 150msec which now revised to 200msec.
- Regarding unavailability of SCADA data if CB status, it was informed that there are issues related to CMR relay. Old breakers will also be replaced, their RMU is in pipeline

NRLDC representative raised concern over incorrect SCADA data and improper operation of protection system. Being an generating station which operate in tandem with Chibro HEP, Uttarakhand was requested to review the protection system to ensure the reliable operation of power station.

Forum's Recommendations:

- *Review of protection system need to be done to avoid such undesired operation and proper operation of protection system need to be en-sured.*
- *Proper maintenance and healthiness of CB also need to be ensured.*
- *Timely submission of disturbance recorder (DR) and event logger (EL) files need to be ensured. As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event.*

I. Multiple elements tripping at 220kV Shahbad(HR) and 220kV Rajokheri(HR) on 26th August 2024, 22:58 hrs

1. **Discussion during the meeting:**
   a. **Brief of the event shared by NRLDC representative based on detail available is as follows:**

- 220kV Rajokheri(HV) & 220kV Shahbad(HV) S/s have double main bus arrangement at 220kV side.
- During antecedent condition, incoming power at Rajokheri(HV) S/s through 220 KV Abdullapur(PG)-Rajokheri (HV) (HVPNL) D/C was approx. 115 MW and outgoing power from Rajokheri(HV) through 220 KV Shahbad-Rajokheri(HV)(HVPNL) D/C was approx. 90 MW. Loading of 220 KV Shahbad-Joria(HV)(HVPNL) D/C and 220 KV Shahbad-Durla(HV)(HVPNL) D/C were approx. 100 MW and 75 MW feeding to Shahbad(HV) and Durla(HV) respectively.
- As reported, at 22:58 hrs, due to inclement weather conditions, Y-B phase to phase occurred on 220 KV Shahbad-Rajokheri(HV)(HVPNL) Ckt-1 & 220 KV Abdullapur(PG)-Rajokheri (HV) (HVPNL) Ckt-1.
- As reported, 220 KV Abdullapur(PG)-Rajokheri (HV) (HVPNL) D/C tripped only from Abdullapur(PG) end not from Rajokheri(HV) end. 220 KV Shahbad-Rajokheri(HV)(HVPNL) Ckt-1 tripped on zone-1 distance protection on Y-B-G double phase to ground fault with fault distance of 29km and fault current of Iy=~5.79kA & Ib=~5.39kA from Rajokheri(HV) end. 220 KV Shahbad-Rajokheri(HV)(HVPNL) Ckt-2 & 220 KV Tepla-Rajokheri(HV)(HVPNL) Ckt-2 tripped on direction earth fault from Rajokheri(HV) end. 220 KV Tepla-Rajokheri(HV)(HVPNL) Ckt-1 tripped on zone-3 distance protection on Y-B phase to phase fault from Rajokheri(HV) end (details regarding trippings at Shahbad(HV) S/s is yet to be received).
- As per PMU at Abdullapur(PG), Y-B phase to phase fault converted into R-Y-B three phase fault with delayed fault clearing time of 2040msec is observed.
- Due to tripping of all 220kV lines at Rajokheri(HV) & Shahbad(HV), both sub-stations lost their connectivity from Grid which led to blackout of 220kV Rajokheri(HV) S/s & 220kV Shahbad(HV) S/s.
- As per SCADA, change in demand of approx. 350 MW in Haryana control area.
- Major observations:
  - Exact location of fault seen by distance protection relay at Rajokheri end at 22:58:19:800 hrs ?

- Protection operation at 22:58:19:800 hrs at Rajokheri end on Y-B fault? Delayed clearance of fault is observed.
- DR/EL of all the tripped lines at Rajokheri end not received. Same need to be submitted.
- As reported, Bus bar differential relay maloperated at 220kV Shahbad(HR) due to issue in isolator status. Exact details of issues need to be shared.
- DR of bus bar relay need to be shared.
- Remedial action taken report to be shared.

b. Haryana representative and others informed the following:

- Haryana representative informed that fault occurred on 220kV Shahbad-Rajokheri ckt. CB opened at Rajokheri end but failed to open at Shahbad end which cleared with the LBB operation.
- NRLDC representative stated that based on PMU plot of fault signature (phase voltage), delayed fault clearance of ~2sec is observed and no recovery of voltage is observed at time delay of LBB. Hence, LBB operation can't be verified.
- POWERGRID (NR-2) representative informed that Abdullapur end distance protection of 220kV Abdullapur-Rajokheri ckt-1 sensed Y-B fault in Z-1 (1.3km) with ~28kA fault current. CB at Abdullapur end opened however there was no operation at Rajokheri end.
- Further, 220kV Abdullapur-Rajokheri ckt-2 tripped from Abdullapur end in Z-2. During patrolling also, burnt tree signature was observed at fault location.

NRLDC requested Haryana representative to analyse the event in detail and submit revised detailed tripping report along with details of action taken to avoid such event in future.

Haryana representative agreed to share the revised details analysis of the event.

Forum's Recommendations:

- *Review of protection system need to be done to avoid such un-desired operation and proper operation of protection system need to be ensured.*
- *Proper maintenance and healthiness of CB also need to be ensured.*
- *Timely submission of disturbance recorder (DR) and event logger (EL) files need to be ensured. As per IEGC clause 37.2 (c), Disturb-ance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event.*

J. Multiple elements tripping at 220kV Barn(J&K) on 02th August 2024, 15:03 hrs

1. **Discussion during the meeting:**
   a. Brief of the event shared by NRLDC representative based on detail available is as follows:
   - As reported, at 15:03hrs, 220/132kV 160MVA ICT-1, 132kV Barn-Canal (JK) D/C tripped at Barn(JK) S/s on Y-B phase to phase fault which occurred on 132kV Barn-Canal (JK) D/C.
   - As reported, due to tripping of ICT-1, the complete load shifted on 220/132kV 160MVA ICT-2 & 3 which led to tripping of 220/132kV 160MVA ICT-2 & 3 on overloading at Barn(JK) S/s.
   - As per PMU at Kishenpur(PG), Y-B phase to phase fault with fault clearing time of 120ms is observed.
   - As per SCADA, load loss of approx. 345MW occurred in J&K control area.
   - Major observations:
     - Exact reason and location of fault need to be shared.
     - Details of protection operated during the tripping event need to be shared.
     - Loading of all three ICTs just before the tripping event need to be shared.
     - Overloading protection settings of all three ICTs at Barn(JK) need to be shared.
     - DR/EL (.dat/.cfg file) of all the tripped elements along with tripping report of the event need to be shared.

- SLD of 220/132kV Barn(JK) S/s need to be shared.
- Remedial action taken report to be shared.

J&K representatives were not present in the meeting due to which event couldn't be discussed.

Forum's Recommendations:

- *A separate meeting with J&K shall be conducted to discuss the issues and status of follow up action at J&K end. A dedicated agenda for discussion with J&K may be prepared in this regard.*

A.13.4 Tripping analysis details of all the tripping discussed during 52 PSC meeting is attached as **Annexure-XVIII.**

d) Frequent operation of breaker failure protection and necessary remedial actions

NRLDC representative highlighted that in many of the events, LBB operations was reported due to failure of breaker opening on protection operation. It shows that there are issues related circuit breaker healthiness. Following multiple elements tripping occurred due to non-opening of breaker and LBB operation:

i) Multiple elements tripping at 400/220kV Lucknow(UP) on 14th July
ii) Multiple elements tripping at 220kV Khodri(Utt) on 19th July
iii) Multiple elements tripping at 400/220kV Patiala(PG) on 19th July
iv) Multiple elements tripping at 220kV Nara(UP) on 11th August
v) Multiple elements tripping at 400/220kV Muzaffarnagar(UP) on 21st August
vi) Multiple elements tripping at 220kV Laltokalan(PS) on 22nd August
vii) Multiple elements tripping at 400/220kV Unnao(UP) on 17th September

In view of above, constituents were requested to ensure proper maintenance of circuit breakers and their associated equipment's.

UP representative stated that timely instructions are being given at sites for routine maintenance of circuit breakers and their associated equipment's. However, in view of increase in such incidents we will again instruct sites to be vigilant in this regard.

Decision taken by Forum:

Forum requested all the members to ensure timely maintenance of circuit breakers and their associated equipment's so that such incidents of breaker failure during switching may be minimised and undesired events of multiple elements tripping may be avoided.

A.14. Corrective action for healthiness of 500kV Mundra-Mahindergarh SPS (agenda by NRLDC)

A.14.1 NRLDC representative apprised that on 17th May 2024 on outage of both pole (carrying total ~1500MW), SPS of 500kV HVDC Mundra-Mahindergarh inter regional link didn't operate. This issue was discussed during 51st PSC meeting and ADANI was requested to share the details w.r.t. SPS operation during the meeting.

A.14.2 Further, NRLDC in coordination with NLDC conducted an online discussion meeting with concerned stakeholders (SLDCs, ADANI, POWERGRID) on 12th August 2024, for further remedial actions required to make this SPS healthy.

A.14.3 Following actions were decided during the meeting:

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

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

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

A.14.4 Load end details received from UP, Haryana, Rajasthan & Delhi. Details are attached as **Annexure-XIX**. Details yet to be received from Punjab.

A.14.5 Regarding communication network and hardware system, ADANI has submitted the status of their healthiness. As per details submitted, counter status was found OFF at Alwar, Ratangarh, Gobindgarh, Malerkotla, Bamnauli, Shamli and Dhanonda.

A.14.6 NRLDC representative requested Punjab to share their input with respect load details at the earliest. Further POWERGRID and ADANI were requested to share the status of remedial action taken / planned to be taken. Desired remedial actions need to be expedited.

A.14.7 Delhi representative informed that SPS system at Bamnuali(DTL) is in OFF condition.

A.14.8 ADANI representative informed that SPS & communication link is healthy at Mahindergarh and Bhiwani (PG) S/s. Healthiness at further linked stations need to be ensured for complete healthiness of SPS system.

A.14.9 NRLDC representative requested ADANI to confirm the healthiness of SPS and communication system of their control area / ownership. Further, ADANI shall coordinate with POWERGRID and other stations to check issues at load stations. ADANI agreed for the same.

Decision taken by Forum:

Forum requested ADANI and concerned constituents to take necessary remedial actions and make the SPS link healthy and operational.

A.15. Implementation and updation of Protection setting Database (agenda by NRPC Secretariat)

A.15.1 AEE (P), NRPC apprised that as per clause 14(3) of IEGC, 2023

RPCs shall:

(a) maintain a centralized database and update the same on periodic basis in respect of their respective region containing details of relay settings for grid elements connected to 220 kV and above (132 kV and above in NER). RLDCs shall also maintain such database

(b) ……

(c) provide the database access to CTU and NLDC and to all users, RLDC, SLDCs, and STUs of the respective regions. The database shall have different access rights for different users.

A.15.2 Further as per clause 14(4) of IEGC, 2023:

(4) The changes in the network and protection settings of grid elements connected to 220kV and above (132 kV and above in NER) shall be informed to RPCs by CTU and STUs, as the case may be.

A.15.3 In view of above, all the utilities have to submit the protection settings of their elements connected to 220kV and above. Further, the revisions in the settings need to update in the database.

A.15.4 However, reporting of protection settings is not regularised by utilities. In view of above, it was requested that all utilities may submit the protection settings of their elements connected to 220kV and above. Revision of settings may also be intimated in order to update the protection setting database.

A.15.5 MS, NRPC commented that NERPC, ERPC and SRPC have already got implemented the protection setting related database portal. NRPC and WRPC will also implement the same in pursuance of the IEGC 2023. Due to lack of PSDF fund, this could not be implemented as of now.

A.15.6 He stated that utilities may send the settings in excel format till the portal gets implemented.

A.15.7 EE (P), NRPC highlighted that after the implementation of the setting database, this process of setting submission will be smoothening and streamlined

Decision taken by Forum:

Forum directed all utilities to report the protection settings of their elements connected to 220kV and above along with revision of the settings if any.

A.16. Review and uniformity of df/dt (ROCOF) protection philosophy in Northern Region (agenda by NLDC)

A.16.1 NRLDC representative apprised that multiple incidents of load shedding on df/dt (ROCOF) protection operation have been reported during recent past. Major

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.16.2 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.).

Name of State	**df/dt settings (average cycles considered, time delay etc)**	**Maximum quantum of relief (MW)**		
		Stage-1	**Stage-2**	**Stage-3**

A.16.3 NRLDC representative also highlighted that df/dt protection is not uniformly implemented at all India level. As intimated df/dt protection is not implemented in Eastern region and setting is different in Southern Region. Therefore, review of ROCOF protection need to be done to ensure its uniformity and its proper operation. In this regard members were requested to share their inputs so that further follow up discussion can be done to ensure the uniform df/dt protection setting in Northern Region.

A.16.4 SLDCs were requested to share the adopted philosophy of df/dt protection and confirm whether uniform philosophy has been adopted throughout the state or not.

A.16.5 Details have been received from Haryana, UP & Rajasthan and partial detail received from Delhi & Punjab. All the constituents were requested to share the setting details along with quantum of load mapped in respective df/dt protection stage.

A.16.6 UP representative informed that most of df/dt relays in their control area is Siemens make 7SJ relay in which this df/dt setting is implemented in extra functions and value of average cycle, validation etc. can’t be ascertained. UP was requested to consult with the Siemens in this regard.

A.16.7 Rajasthan representative asked whether mapped feeder can be revised as some of the mapped feeders have become essential (industrial/essential load). NRLDC representative stated that it can be done with the intimation to the NRPC & NRLDC.

A.16.8 NRLDC representative stated that further review of df/dt protection setting also need to be done to ensure its uniformity and to avoid undesired operation and load loss.

A.16.9 NRLDC requested all the members to ensure the DR triggering in case of tripping of feeders on df/dt. It would be helpful in analysis of the event.

Decision taken by Forum:

Forum requested all the states to share the details related to df/dt protection in their control area. Based on those details, further discussion would be done in next PSC meeting to review the ROCOF (df/dt) protection and ensure its uniformity.

A.17. Provisional protection clearance during FTC in July-August-September 2024 (agenda by NRLDC)

A.17.1 NRLDC representative apprised that Provisional protection clearance during FTC in July-August-September 2024 allowed by NRLDC is attached as **Annexure-XXI.** As per the approved protection setting procedure, concerned utilities need to send the agenda for Protection Sub-Committee meeting to get the final approval of its protection settings provisionally approved in FTC or any revision done in the settings.

A.17.2 MS, NRPC highlighted that all concerned utilities may ensure the final approval of protection settings of their elements and send the agenda in the upcoming Protection Sub-Committee after obtaining provisional approval from NRLDC/SLDC as the case applicable.

Decision taken by Forum:

Forum requested all the concerned utilities to send the agenda items for final approval of the Protection settings of their elements.

A.18. Recommendations of the committee to analyse the grid event happened at 13:53 hrs on 17th June 2024 due to tripping of HVDC Champa-Kurukshetra (agenda by NRPC Secretariat)

A.18.1 AEE (P), NRPC apprised that on 17th June 2024, a grid event occurred at 13:53 hours in the Northern Region, leading to a substantial load reduction of approximately

16.5 GW. This event started with the tripping of both bipoles of the +/-800 kV HVDC Champa (WR) – Kurukshetra (NR) link, which was transferring 4500 MW of power from the Western Region (WR) to the Northern Region (NR). The tripping of this HVDC link triggered a series of events. There was a sudden voltage drop across the stations in the Northern region which resulted in a significant load drop of around 16.5 GW in the Northern region. There was simultaneous reduction of around 2800 MW of RE-based generation in the Rajasthan RE complex. There was also trippings of conventional generating units leading to a generation loss of 3909 MW at the all-India level. The significantly higher load loss resulted in the rise in frequency of the Indian power system from 50.03 Hz to 50.68 Hz. The load drop resulted in a rise in the voltages of stations in the Northern region. This high voltage resulted in the tripping of 18 nos. of EHVAC lines in the Northern Region on over-voltage protection. The power system was normalised after the revival of all the poles of HVDC Champa-Kurukshetra by 15:51 Hrs.

A.18.2 Further, he added that Ministry of Power vide its order no. 6/3/2024-Trans dated 25.06.2024 constituted a Committee under the Chairmanship of Member (GO&D), CEA to analyse the above-mentioned issues during which about 16.5 GW of consumer load in Northern Region got interrupted for a brief period. The composition of the Committee is given as under:

(i) Member (GO&D), CEA Chairman
(ii) Director (SO), GRID-INDIA Member
(iii) Deputy Chief Operating Officer, CTUIL Member
(iv) Executive Director, NTAMC (POWERGRID) Member
(v) Professor, Electrical Engineering, IIT Delhi Member
(vi) Member Secretary, NRPC Member Convener

A.18.3 Accordingly, the Committee conducted five meetings and detailed analysis of the grid event was carried out by teams of CEA, IIT-Delhi, NRPC, NLDC, NRLDC, POWERGRID, SLDC Delhi & DISCOMs of Northern Region States and the Report was finalized and submitted its report to MoP on 24.7.2024.

A.18.4 The committee has found some major observations, the brief of which are as below-

(i) **Outage of all four poles of HVDC Champa - Kurukshetra link (N-4 scenario)-** There was tripping of +/-800 kV HVDC Champa-Kurukshetra link (4500 MW) triggered load loss event. Localized storm caused jumper swing and flashover. It Redundancy in DMR has also been observed. Over 30 trippings of

HVDC link from Jan-Jun 2024. Detailed fault analysis and remediation needed to enhance reliability.

(ii) **Cause of Voltage dip and high Reactive Power Drawl by loads: -** There was significant voltage drops across Northern Region and Reactive power absorption increased, exacerbating voltage issues.

(iii) Analysis of behavior of Load during the event: Voltage reduction caused stalling of induction motors: total 16.5 GW load Reduced in NR. Stalling of motors at comparatively higher voltages (~0.85 - 0.9 p.u. voltage).

(iv) **Impact on Conventional and Renewable Energy Generation:** Approximately 2800 MW of RE generation was reduced with around 1500 MW recovering within 4 minutes. 16 Conventional Generating Units tripped.

(v) Reactive Power Support from Generating Units in NR: Heavy reactive power drawl by loads were observed. Many RE plants have opposite response.

(vi) High Voltage Scenario: Total 18 (no.) of transmission lines (765kV and 400kV) tripped on OV, causing a partial blackout at the 765/400kV Aligarh (PG) S/s.

(vii) Frequency Response by Generating Units: More than 50% capacity of the inter-state generators and more than 85% capacity of the intrastate generators exhibited inadequate governor response during the event.

(viii) Reactive Power Management: The event highlighted the need for effective reactive power management. Heavy reactive power drawl was observed, leading to further voltage reductions.

(ix) Information sharing and Co-ordination: Timely report submissions and communication are essential.

A.18.5 The committee recommended the following remedial measures for avoiding the recurrence of such grid event:

(i) **Reactive Power Management (Dynamic/Static) by STU and DISCOMs:** In order to maintain voltage stability, reactive power support is desired from all grid connected utilities without leaning over each other so as to ensure minimum reactive exchange at different voltage levels.

(ii) **Planning for dynamic reactive power sources near load centers based on load composition:** Adequate static/dynamic reactive devices may be planned at the distribution level near loads so that there is minimum drawl from reactive sources at the transmission (STU) level. The dynamic reactive power sources shall be commissioned near load centre stations based on the composition and quantum of individual load type.

(iii) **Enhance reliability of HVDC Link:** Committee recommended POWERGRID to the followings-

- **a.** Review of protection schemes to avoid frequent outages.
- **b.** Review of transmission line design including cross arms, jumpers, etc.
- **c.** Design of filter switching logic to support system voltage.

(iv) Implementation of Overvoltage protection setting: followings were recommended for implementing overvoltage Stage-I protection settings:

- **a.** Pick up voltage & time delay setting of Antitheft lines to be kept low with sufficient time gap from other lines at S/s
- **b.** Parallel lines grading to be done such that one line should trip early by setting at low voltage and other line should trip last by keeping setting at high voltage.
- **c.** Highly loaded lines should be given last priority in tripping.
- **d.** Net MVAr relief (based on line charging MVAr & MVAr compensation in line) based on the simulation to be considered for arriving at the priority of line tripping. Lines providing high net MVAr relief to be tripped early.
- **e.** Grading to be done in such a manner that one major incoming and outgoing line shall remain connected after tripping of lines at any node.
- **f.** Protection setting of remote end station of a line need to be coordinated so as to avoid tripping of line from other end.
- **g.** Drop-off to pick-up ratio of Relays implemented for overvoltage protection shall be more than 99.5%.

(v) Frequency Response by Generating Units as per IEGC 2023: It was recommended that the performance of generating units where inadequate primary response was observed shall be discussed at RPC level.

(vi) **Compliance of CEA Standards by Renewable Generating Plants:** RE generators must comply the CEA Standards. Committee recommended the followings-

- **a.** Protection settings of inverters/WTG shall be coordinated in such a way that it accounts for the voltage rise/drop between inverter/WTG terminal & Point of interconnection (POI). Overvoltage /undervoltage trip settings should be configured accordingly.
- **b.** The reactive power controller settings (droop, deadband, power factor, operating modes) in inverters/WTGs should be configurable and shall be set in consultation with the respective load dispatch centre.

c. The protection settings of elements in collector system viz. transformers, cables etc. shall such that it allows RE plants to ensure the compliance of CEA standards at POI.

d. RE plants shall ensure that the event records shall be shared with SLDC/ RLDC within the stipulated time for event analysis. All such data shall be retained in a retrievable format in a suitable archival system.

(vii) Retain of Conventional generators near load centers for providing grid support during such events: The presence of thermal generators near the load centres may significantly improve the voltage profile and can provide dynamic reactive power support in case of contingencies improving the stability.

(viii) Compliance of Standards by Load Serving Machines: The stalling of motors at high voltage (0.85-0.9 pu) is to be investigated and the motors serving load need to be compliant with IS/IEC.

(ix) **Amendments in Existing Regulations:** For ensuring reliable operation, provisions related to different emerging types of loads (Electrolysers etc.) may be added in the existing CEA standards.

A.18.6 NRLDC representative highlighted following points during the meeting:

i) Poor primary frequency response of state controlled generating stations. States were requested to follow up with the intrastate generating station for testing and tuning of their governor system and organise workshop with generating stations for familiarization with Grid Code requirement w.r.t. governor response.

ii) Poor power factor and high MVAr drawl from the grid. Majority of the states were drawing significant quantum of MVAr from the grid leading to poor voltage profile. States were requested to install additional capacitor banks at load levels in sync with the rise in demand and ensure good power factor at load level.

A.18.7 Regarding corrective actions at HVDC Champa-Kurukshetra link, NRLDC representative requested POWERGRID to apprise the forum about details of corrective measure taken / planned to be taken during ongoing shutdown of HVDC Champa-Kurukshetra link.

A.18.8 POWERGRID representative informed that shutdown of both the bipole was taken for 04 days each during which issues related to DCCT was attended and rectified. During upcoming 03 days shutdown of both the bipole together, software upgradation work will be done. After aforementioned modifications, major issues related to maloperation and undesired tripping will get rectified.

A.18.9 Rajasthan SLDC representative informed that Rajasthan has planned three

STATCOM as of now. (one at 400kV level in Bhadla and 2 nos. at 220kV level).

A.18.10 MS, NRPC highlighted that every stakeholder has its importance to operate the power system smoothly and should function collaborative manner.

Decision taken by Forum:

Forum acknowledged the sensitivity of event and directed the concerned to take appropriate actions based on the recommendations of Committee.

A.19. Issues with 400KV JPL-Kabulpur Ckt-1&2 PLCC Spare management & Maintenance (agenda by Apraava Energy Private Limited)

A.19.1 Apraava Energy Private Limited representative apprised the followings:-

Overview of Incident:

- On 7th August 2024, a scheduled shutdown of the 400KV MGTPS-Kabulpur Ckt-1 was initiated from the MGTPS side for meter replacement work.
- The breaker on the MGTPS side was manually opened; however, the Kabulpur end breaker failed to open on Direct Transfer Trip (DTT).
- Upon investigation, multiple cards of the FOTE PLCC Panel at the Kabulpur substation were found to have failed. Unfortunately, the Kabulpur team did not have spare cards available.
- The line was re-energized without the PLCC operational, with the Zone-2 timer setting temporarily adjusted to zero seconds.
- On the next day, during shutdown of the 400KV MGTPS-Kabulpur Ckt-2, it was again observed that the Kabulpur end breaker did not open on DTT.
- The Kabulpur team confirmed that multiple cards in the PLCC had failed.
- The line was re-energized without the PLCC operational, with the Zone-2 timer setting temporarily adjusted to zero seconds.
- However, after 2-3 days, Kabulpur team has replaced the PLCC cards and operationalised the PLCC.

Operational Concerns:

- This transmission line is managed by M/s Indigrid Pvt. Ltd., who have not maintained the necessary spare parts for PLCC (critical equipment).
- Additionally, it has been observed that regular maintenance of the PLCC equipment at the MGTPS Substation end is not being conducted by M/s Indigrid

team.

A.19.2 In view of above, Apraava Energy Private Limited representative requested Forum to direct the relevant HVPN authorities to instruct the Indigrid team to resolve the PLCC issues at both ends, ensure effective spare management and regular maintenance to prevent any future operational disruptions. Because any prolonged shutdown of 400KV line may significantly affect power evacuation from our generating station.

A.19.3 IndiGrid representative stated that on August 7 and 9, 2024, a shutdown was initiated by JPL (Apraava) for the 400kV Jharli-Kabulpur Ckt-1 to replace meters. During the shutdown, a failure in the FOTE panel at Kabulpur was detected, which impacted the receipt of the Direct Trip (DT) command at JPL. To address this, IndiGrid recommended temporary protection settings, which were approved by NRLDC on August 8 and 9, 2024. IndiGrid promptly restored the DTPC system on August 9, 2024, and submitted a detailed support test report (loop testing/software testing) to JPL, Haryana SLDC, and NRLDC.

A.19.4 Despite the DTPC being in a healthy state as of August 9, 2024, JPL did not give consent for the normalization of the Zone 2 settings without further testing, insisting on a DT signal test involving physical line opening. Due to the lack of consent from JPL, both lines tripped on August 11, 2024. Further, he added that if JPL had provided consent earlier, this tripping could have been avoided. This tripping was attributable to IndiGrid.

A.19.5 IndiGrid representative submitted that as part of prudent utility practices, line shutdowns can be avoided when simulations are feasible. He confirmed that IndiGrid will maintain spare card and also plan to conduct maintenance on the FOTE at JPL's end during the scheduled line maintenance.

A.19.6 LPGCL representative stated that one end being generation plant, it is accurate to do physical testing of breaker for DT testing. But the outage of line may be avoided by taking out the trip signal wiring from breaker. IndiGrid representative replied that DTPC healthiness may be ensured by carrier communication in live condition.

A.19.7 RVUNL representative mentioned that generally agencies maintaining PLCC equipment and relay breaker system, are different. Therefore, both can take care of its part.

A.19.8 MS, NRPC highlighted that utilities should try to avoid the shutdown if possible by simulation testing, as it is being done in case of SPS mock testing.

Decision taken by Forum:

Forum guided Apraava Energy Private Limited and IndiGrid to co-operate each other for proper operation of the transmission assets and try to avoid unnecessary system shutdown by adopting simulation testing if possible. Forum also directed IndiGrid to resolve the PLCC issues at both ends, ensure effective spare management and regular maintenance to prevent any future operational disruptions. HVPN may ensure the same in future also.

A.20. Approval of protection settings in compliance of IEGC 2023 (agenda by Adani Green Energy Limited)

A.20.1 AGEL representative apprised that Adani Green Energy Twenty-Five Limited (AGE25L) has commissioned the 400kV Solar PSS on 07-09-2024 for 500 MWSolar Power Project at Badisid, Phalodi, Rajasthan.

A.20.2 Further, he mentioned that NRLDC has given the consent to the protection settings of 400kV Solar PSS. These settings are attached as **Annexure-XXII**.

A.20.3 NRLDC representative conveyed that these settings were found in order and may be considered for final approval.

A.20.4 MS, NRPC emphasized that all utilities may send the protection settings approval agenda timely.

Decision taken by Forum:

Forum accorded final approval to the protection settings (attached as Annexure-XXII) of newly commissioned 400 kV Solar PSS for 500 MW Solar Power Project at Badisid, Phalodi, Rajasthan.

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

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

Annexure-P

Attendance of 52nd Protection Sub-Committee Meeting held on 20.09.2024				
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Annexure-I

Status of perfomance indices report of June 2024		
S. No.	**Utility**	**Status of Protection Performance indices**
1	PGCIL	Received (NR-1,2,3)
2	NTPC	Received (Unchahar, Tanda, Dadri, Koldam)
3	BBMB	Received (Transmission)
4	THDC	Received (Tehri, Koteshwar HEP)
5	SJVN	Received
6	NHPC	Received
7	NPCIL	Received (RAP- 1-2, 5-6), NAP (1-2)
8	DTL	Received
9	HVPNL	Received
10	RRVPNL	Received
11	UPPTCL	Received
12	PTCUL	Received
13	PSTCL	Received
14	HPPTCL	Received
15	IPGCL	Receivied (PPCL)
16	HPGCL	Not Recevied
17	RRVUNL	Received
18	UPRVUNL	Not Received
19	UJVNL	Received (Dharashu, Uttrakashi, Khodri, chibro, vyasi)
20	HPPCL	Not Recevied
21	PSPCL	Not Recevied
22	HPSEBL	Not Recevied
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 Recevied
27	Nabha Power Limited	Received
28	MEIL Anpara Energy Ltd	Not Recevied
29	Rosa Power Supply Company Ltd	Received
30	Lalitpur Power Generation Company Ltd	Received
31	MEJA Urja Nigam Ltd.	Not Recevied
32	Adani Power Rajasthan Limited	Received (Kawai)
33	JSW Energy Ltd. (KWHEP)	Not Recevied
34	AESL	Received (ATIL, MTSCL, GTL)
35	Tata Power Renewable Energy Ltd.	Received
36	UT of J&K	Not Recevied
37	UT of Ladakh	Not Recevied
38	UT of Chandigarh	Not Recevied
39	ATIL, BKTL, FBTL	Received
40	INDIGRID	Received
41	POWERLINK	Not Recevied
42	ADHPL	Received
43	Sekura Energy Limited	Not Recevied
44	WUPPTCL	Received
45	SEUPPTCL	Not Recevied
46	Vishnuprayag Hydro Electric Plant (J.P.)	Not Recevied
47	Alaknanda Hydro Electric Plant (GVK)	Not Recevied

Status of perfomance indices report of July 2024		
S. No.	**Utility**	**Status of Protection Performance indices**
1	PGCIL	Received (NR-1, 2)
2	NTPC	Received (Dadri, Koldam)
3	BBMB	Received (Transmission)
4	THDC	Received (Tehri, Koteshwar HEP)
5	SJVN	Received
6	NHPC	Received
7	NPCIL	Received (RAP- 1-6)
8	DTL	Received
9	HVPNL	Received
10	RRVPNL	Received
11	UPPTCL	Received
12	PTCUL	Received
13	PSTCL	Received
14	HPPTCL	Received
15	IPGCL	Received (PPCL)
16	HPGCL	Not Recevied
17	RRVUNL	Received
18	UPRVUNL	Received (DTPS-Anpara)
19	UJVNL	Received (Dharashu, Uttrakashi)
20	HPPCL	Not Recevied
21	PSPCL	Not Recevied
22	HPSEBL	Not Recevied
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.	Received
27	Nabha Power Limited	Received
28	MEIL Anpara Energy Ltd	Not Recevied
29	Rosa Power Supply Company Ltd	Received
30	Lalitpur Power Generation Company Ltd	Received
31	MEJA Urja Nigam Ltd.	Not Recevied
32	Adani Power Rajasthan Limited	Received (Kawai)
33	JSW Energy Ltd. (KWHEP)	Not Recevied
34	AESL	Received (ATIL, OCBTL)
35	Tata Power Renewable Energy Ltd.	Received (Sourya, TPGEL, TPREL)
36	UT of J&K	Not Recevied
37	UT of Ladakh	Not Recevied
38	UT of Chandigarh	Not Recevied
39	ATIL, BKTL, FBTL	Received
40	INDIGRID	Received
41	POWERLINK	Not Recevied
42	ADHPL	Received
43	Sekura Energy Limited	Not Recevied
44	WUPPTCL	Received
45	SEUPPTCL	Not Recevied
46	Vishnuprayag Hydro Electric Plant (J.P.)	Not Recevied
47	Alaknanda Hydro Electric Plant (GVK)	Not Recevied

Status of perfomance indices report of August 2024		
S. No.	**Utility**	**Status of Protection Performance indices**
1	PGCIL	Received (NR-1,2)
2	NTPC	Received (Dadri, Unchahar, Tanda, Anta)
3	BBMB	Not Recevied
4	THDC	Received
5	SJVN	Received
6	NHPC	Received
7	NPCIL	Received (RAP- 1-6), NAP-(1-2)
8	DTL	Received
9	HVPNL	Received
10	RRVPNL	Received
11	UPPTCL	Received
12	PTCUL	Received
13	PSTCL	Not Recevied
14	HPPTCL	Received
15	IPGCL	Received (PPCL)
16	HPGCL	Not Recevied
17	RRVUNL	Received
18	UPRVUNL	Received (DTPS-Anpara)
19	UJVNL	Received (Dharashu, Uttrakashi)
20	HPPCL	Not Recevied
21	PSPCL	Received (GGSSTPS, 220kV GATPL, 220kV GHTP)
22	HPSEBL	Not Recevied
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.	Received
27	Nabha Power Limited	Received
28	MEIL Anpara Energy Ltd	Not Recevied
29	Rosa Power Supply Company Ltd	Received
30	Lalitpur Power Generation Company Ltd	Received
31	MEJA Urja Nigam Ltd.	Not Recevied
32	Adani Power Rajasthan Limited	Received (Kawai)
33	JSW Energy Ltd. (KWHEP)	Not Recevied
34	AESL	Received(ATSCL, MTSCL, OCBTL, HPTSL)
35	Tata Power Renewable Energy Ltd.	Received (Sourya, TPGEL, TPREL)
36	UT of J&K	Not Recevied
37	UT of Ladakh	Not Recevied
38	UT of Chandigarh	Not Recevied
39	ATIL, BKTL, FBTL	Received (ATIL, BKTL, FBTL)
40	INDIGRID	Received
41	POWERLINK	Not Recevied
42	ADHPL	Received
43	Sekura Energy Limited	Not Recevied
44	WUPPTCL	Received
45	SEUPPTCL	Not Recevied
46	Vishnuprayag Hydro Electric Plant (J.P.)	Not Recevied
47	Alaknanda Hydro Electric Plant (GVK)	Not Recevied

Reasons for Performance Indices less than Unity- June 2024

ATIL

Case-1 500kV Mundra - Mohindergarh HVDC Pole-2 tripped on 14.6.2024

No. of unwanted operation -1

No. of correct operation -1

Reason for indices less than unity - Malfunction of Pole-2 Current converter to C&P measuring system at Mahendragarh end

Corrective action taken- Current converter replaced.

NTPC (Unchahar)

Case-1 Tripping of line

No. of unwanted operation -1

No. of correct operation -6

No. of failures to operate-0

Reason for indices less than unity - Auto reclose block issued.

Corrective action taken- Distance protection relay shall be tested in next shutdown for the actual cause

Case-2 Tripping of GT

No. of unwanted operation -1

No. of correct operation -5

No. of failures to operate-0

Reason for indices less than unity - Rain water ingress inside GCB panel leading to pre synch earth fault protection.

Corrective action taken- Root cause was found and eliminated by Civil and EMD.

POWERGRID (NR-2)

Case-1 Tripping of SAMBA 315MVA ICT-III on 8.6.2024

No. of unwanted operation -1

No. of correct operation -0

No. of failures to operate-0

Reason for indices less than unity - Due to maloperation of Sukrut make PRV caused by failure of microswitch make Jai Balaji

Corrective action taken- Defective microswitch replaced with spare**.**

Case-2 Tripping of LUDHIANA -400/+600 MVAR SVC

No. of unwanted operation -1

No. of correct operation -0

No. of failures to operate-0

Reason for indices less than unity – Tripping due to flashover in TSC branch caused by entry of CAT

Corrective action taken- Proper sealing of SVC yard done.

Case-3 Tripping of LUDHIANA -400/+600 MVAR SVC

No. of unwanted operation -1

No. of correct operation -0

No. of failures to operate-0

Reason for indices less than unity – SVC tripped on operation of TSC (Thyristor Switched Capacitor) current supervision protection caused by cable nsulation failure at gland point.

Corrective action taken- IR measurement for all and other cables done. Proper glanding of cable done.

PPGCL

Case-1 Tripping of 765kV 1500MVA ICT-1 at BARA

No. of unwanted operation -1

No. of correct operation -1

No. of failures to operate-0

Reason for indices less than unity- Tripped due to mall operation of master relay. New future FGD bay work is going on. At fault time, some interruption came in dc circuit.

Corrective action taken- Isolated the FGD dc circuit from running 765kV and 400kV switchyard.

RVPN

Case-1 400/220 Kv 500 MVA ICT-II AT 400 KV GSS KANKANI on 16.06.2024

No. of Unwanted operation – 1

Reason for indices less than unity – DC fault due to control wiring damaged, wiring replaced with DC change over relay

Corrective Action taken – Control wiring replaced. Damaged DC change over relay also replaced.

Case-2 220 KV Sakatpura- Dahara Line on 21.06.2024

No. of Unwanted operation – 1

Reason for indices less than unity - Due to VT selection relay problem

Corrective Action taken – VT selection relay problem rectified**.**

Case-3 220 KV JHALAWAR-AKLERA Line on 24.06.2024

No. of Unwanted operation – 1

Reason for indices less than unity – CB tripped without any relay signal.

Corrective Action taken – CB problem rectified.

Case-4 220 KV Saurya Urja Line-I at 400KV GSS Bhadla on 30.06.2024

No. of Unwanted operation – 1

Reason for indices less than unity – Relay panel caught fire following relay are burnt Dist Prot. M1, 195 A, 295 A, 86 A. No reason of fire eruption established.

Corrective Action taken – New panel arranged and will soon be commissioning.

Case-5 220/132 KV, 100 MVA TRF BHEL MAKE at 220 KV GSS BHAWAD on 02.06.2024 and 24.06.2024

No. of Unwanted operation – 2

Reason for indices less than unity – LBB relay automatically went to default setting values.

Corrective Action taken – Relay settings revised on dated 24.06.2024.

Case-6 220 /132 KV, 160MVA BHEL Make, 220 KV GSS HINDAUN on 06.06.2024 and

220/132 KV 100MVA, Tr. No. 1 at 220KV GSS SAWA on dated 07.06.2024

No. of Unwanted operation – 2

Reason for indices less than unity – Water logging in relay terminal box during heavy rain.

Corrective Action taken – Reay terminal box cleaned, dried and sealed.

Case-7 220/132 kV, 100 MVA transformer-II at 220 KV GSS RVPNL Lalsot on 10.06.2024

No. of Unwanted operation – 1

Reason for indices less than unity – High impedance differential protection relay defective

Corrective Action taken – High Impedance differential protection relay replaced.

SJVN

Case-1 Tripping of Generating unit-2 at Rampur HPS on 30.6.2024

No. of unwanted operation -1

No. of correct operation -0

No. of failures to operate-0

Reason for indices less than unity- Temperature measuring instrument mal-operated.

Corrective Action taken- The temperature measuring instrument replaced with the new one.

TATA POWER SOURYA LIMITED, BANDERWALA

Case-1 Tripping of 220/33KV 125MVA ICT-3 AT BTPSL_SL_BIK2_PG

No. of unwanted operation -1

No. of correct operation -0

No. of failures to operate-0

Reason for indices less than unity- Tripped due to inadvertent setting of Definite time earth fault remain at lower side.

Corrective Action taken- Not received from utility.

NHPC

Case-1 Tripping of Chamera-I-Chamera-II Line

No. of unwanted operation -1

No. of correct operation -1

No. of failures to operate-0

Reason for indices less than unity- Over Current Protection Operated.

Corrective Action taken- Over current was disabled as it was mistakenly present in the relay at the time of relay checking.

DTL

Case-1 Tripping of 400kV Mundka-Bawana-1,2

No. of unwanted operation -1

No. of correct operation -0

No. of failures to operate-0

Reason for indices less than unity- Tripped due to Main-2 relay seen the fault of other line in its zone-1.

Corrective Action taken- The issue was communicated to GE and the corrective action taken as per the recommendation of OEM. PSL has also been rectified.

UPPTCL

Case-1 Tripping of 315MVA ICT-2,3 at 400kV S/s Bareilly, 220kV feeders from Bareilly to Dohana-I, Pilibhit-2, C B Ganj-I and 220kV Bus coupler (Lucknow Zone)

No. of unwanted operation -0

No. of incorrect operation -1 for each element

No. of failures to operate-0

Reason for indices less than unity- Tripping due to mal operation of LBB protection of Pilibhit-2 feeder.

Corrective Action taken- Fault has been corrected.

Case-2 Tripping of 220kV Khurja-Dadri line on 19.06.2024 (Meerut Zone)

No. of unwanted operation -1

No. of correct operation -0

No. of failures to operate-0

Reason for indices less than unity- Line was mistakenly tripped at Khurja end by firm engineer during checking of main -2 relay.

Corrective action taken- More sincerity will be taken to avoid such event in future.

Case-3 Tripping of 220kV Khurja NAP line on 14.06.2024 (Meerut Zone)

No. of unwanted operation -1

No. of correct operation -0

No. of failures to operate-0

Reason for indices less than unity- Line tripped at Khurja end due to erratic force 3 phase trip generated on distance protection (due to wrong PSL).

Corrective action taken- Problem in the PSL has been rectified.

Case-4 Tripping pf 160MVA 220/132kV ICT-III at 220kV Baraut Substation (Meerut Zone)

No. of unwanted operation -1

No. of correct operation -0

No. of failures to operate-0

Reason for indices less than unity- Erratic tripping due to settings of REF relay was wrongly programmed as 2 winding Transformer instead of Auto Transformer.

Corrective action taken- Settings have been corrected as Auto transformer on 14.06.2024.

Case-5 Tripping of 500MVA ICT-II at 400kV Substation Motiram Adda (Gorakhpur Zone)

No. of unwanted operation -1

No. of correct operation -0

No. of failures to operate-0

Reason for indices less than unity- Tripping due to cable fault and polarity issue in NCT.

Corrective action taken- Fault removed.

Case-6 Tripping of 160MVA ICT- I at 220kV Substation Maharajganj (Gorakhpur Zone)

No. of unwanted operation -1

No. of correct operation -0

No. of failures to operate-0

Reason for indices less than unity- Tripping due to wiring problem in relay panel.

Corrective action taken- Fault rectified.

Case-7 Tripping of 220kV Kirawali-Sikandra line (Agra Zone)

No. of unwanted operation -1

No. of correct operation -1

No. of failures to operate-0

Reason for indices less than unity- Tripping due to malfunctioning of PLCC panel.

Corrective action taken- Fault rectified.

Case-8 Tripping of 220kV Kirawali-PGCIL line (Agra Zone)

No. of unwanted operation -2

No. of correct operation -3

No. of failures to operate-0

Reason for indices less than unity- Tripping due to malfunctioning of PLCC panel.

Corrective action taken- Fault rectified.

Case-9 Several trippings at 400kV Sarnath Substation -400/220 KV 315 MVA ICT-III, 220 KV Beerapatti TSS Feeder, 220/132 KV 160 MVA TF-I, 220/132 KV 200 MVA TF-I, 220/132 KV 160 MVA TF-III (Prayagraj Zone)

No. of unwanted operation -1 for each element

No. of correct operation -0 for each element

No. of failures to operate-0 for each element

Reason for indices less than unity- Due to wrong operation of PRV of 500 MVA ICT-II because of cable damage Protection

Corrective action taken- Fault rectified.

PSTCL

Case-1 Tripping of 220 kV Bassi Pathana-G-1 ckt

No. of unwanted operation -2

No. of correct operation -0

No. of failures to operate-0

Reason for indices less than unity- Maloperation of relay.

Corrective action taken- Direction set right on standalone E/F relay at Bassi Pathana and also settings revised at Gobindgarh end.

Case-2 Tripping of 220 kV Sandhwan-Muktsar(220) ckt.

No. of unwanted operation -1

No. of correct operation -0

No. of failures to operate-0

Reason for indices less than unity- Maloperation of relay (tripped at Sandhawan end on zone-4 while no tripping at Muktsar end).

Corrective action taken- Relay will be tested after paddy season.

Case-3 Tripping of 100 MVA, 220/66 kV Power Transformer-6 at 220kV /s Badal

No. of unwanted operation -1

No. of correct operation -0

No. of failures to operate-0

Reason for indices less than unity- Due to storm & wind- Rain water ingress in CT Marshalling box.

Corrective action taken- It has been covered now.

Case-4 Tripping of 220 kV Dhandari-Jamalpur ckt.I at Dhandari end only

No. of unwanted operation -1

No. of correct operation -0

No. of failures to operate-0

Reason for indices less than unity- DT received from Jamalpur BBMB end. Mal-operation.

Corrective action taken- To be investigated by Communication wing.

Case-5 Tripping of 220 kV Pakhowal-PGCIL ckt

No. of unwanted operation -0

No. of correct operation -0

No. of failures to operate-0

No. of incorrect operation-1

Reason for indices less than unity- Carrier not healthy at PGCIL end.

Corrective action taken- Carrier equipment are owned by PSTCL. End to end testing will be done based on shutdown.

Case-6 Tripping of 315 MVA, 400/220 kV ICT-2 at 400kV S/s Makhu

No. of unwanted operation -1

No. of correct operation -0

No. of failures to operate-0

Reason for indices less than unity- Due to cut on Control cable entering the Bucchholz relay- maloperation.

Corrective action taken- Defective part of control cable removed.

Case-7 Tripping of 220 kV Dasuya-Alawalpur ckt in zone -1 at Alawalpur and zone-2 at Dasuya

No. of unwanted operation -0

No. of correct operation -2

No. of failures to operate-0

O. of incorrect operation-1

Reason for indices less than unity- In spite of CR relay issued Z-2 trip.

Corrective action taken- Issue of relay configuration has been set right.

Case-8 Tripping of 100 MVA, 220/66 kV Power Transformer-3 at 220kV S/s Nabha

No. of unwanted operation -1

No. of correct operation -0

No. of failures to operate-0

Reason for indices less than unity- WTI tripping. Maloperation- no reason found.

Case-9 Tripping of 160 MVA, 220/66 kV Power Transformer-4 at 220kV S/s Nabha

No. of unwanted operation -1

No. of correct operation -0

No. of failures to operate-0

Reason for indices less than unity- Mal-operation, Due to ingress of moisture in OLTC Buchholz.

Corrective action taken- Relay has been covered.

Case-10 Tripping of 100 MVA, 220/66 kV Power Transformer-3 at 220kV S/s Udhoke

No. of unwanted operation -3

No. of correct operation -0

No. of failures to operate-0

Reason for indices less than unity- Control cable damaged and NCT connections found loose.

Corrective action taken- Control cable changed and NCT connections tightened.

Case-11 Tripping of 220/66 kV, 160 MVA Power Transformer-4 at 220kV S/s Chogawan

No. of unwanted operation -1

No. of correct operation -0

No. of failures to operate-0

Reason for indices less than unity- CTs were replaced and accordingly differential protection settings were not updated.

Corrective action taken- Settings have been changed.

Case-12 Tripping of 220 kV Butari-Railway ckt, 220 kV Butari-Verpal ckt, 220 kV Butari-BBMB ckt, 100 MVA,220/66 kV P.T/F T-1, 100 MVA,220/132 kV P.T/F T-5, 100 MVA,220/66 kV P.T/F T-4

No. of unwanted operation -1 for each element

No. of correct operation -0

No. of failures to operate-0

Reason for indices less than unity- Mal-operation of BBPS Relay.

Corrective action taken- Due to breaker contact issue. The issue will be resolved after 30.09.2024.

Case-13 Incorrect operations due to unhealthiness of carrier

Lines subjected- 220 kV Ferozepur Road - Ladhowal ckt, 220 kV Patti-Verpal ckt, 220 kV Numehal-Nakodar ckt, 220 kV Mahilpur-Bhakra ckt.II, 220 kV G-1-RTP ckt.II, 220 kV Sahnewal-PGCIL ckt, 220 kV Ablowal-Passiana ckt, 220 kV Malerkotla-Sandaur ckt.II, 220 kV Dhuri-Dhuri(400) ckt, 220 kV Doraha-PGCIL ckt, 220 kV Ghulal-Sahnewal ckt, 220 kV Badhni-PGCIL ckt

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

Corrective action taken- Matter is being taken up to resolve. It involves a huge procurement.

Reasons for Performance Indices less than Unity- July 2024

RVPN

Case-1 220 KV Dausa - Mandawar Line AT 220 KV GSS DAUSA on 03.07.2024

No. of unwanted operation -1

Reason for indices less than unity - VT supply failed due to problem in VT selection relay.

Corrective action taken- VT selection relay repaired and problem rectified.

Case-2 220 KV KUCHAMAN-MAKRANA LINE at 220 KV GSS Kuchaman on 06.07.2024

No. of unwanted operation -1

Reason for indices less than unity – Tripping due to DC problem at 220 KV GSS Kuchaman.

Corrective action taken- DC problem rectified.

Case-3 Multiple trippings of 220 KV lines at Ratangarh on 08.07.2024

220kV Sri Dungargarh-Ratangarh Line - No. of unwanted operation -2

220 KV RATANGARH- KHETRI-I- No. of unwanted operation -2

220 KV RATANGARH- KHETRI-II- No. of unwanted operation -2

Reason for indices less than unity – Tripping due to DC problem due to heavy rain at 400/220 KV GSS Ratangarh.

Corrective action taken- DC problem rectified.

Case-4 220KV Dausa - PGCIL Bassi Ckt-I Line at 220KV GSS Dausa on 24.07.2024

No. of unwanted operation -1

Reason for indices less than unity – CB tripped at Dausa end due to heavy air leakage from Pneumatic Drive of Y-Ph CB pole

Corrective action taken- CB repaired.

Case-5 220Kv Bikaner-Gajner-I line at 400 KV GSS Bikaner on 26.07.2024

No. of unwanted operation -1

Reason for indices less than unity – May be a DC fault, exact reason could not be identified.

Corrective action taken- Under observation.

Case-6 400 kV Bikaner-Merta Line at 400 KV GSS Bikaner on 22.07.2024

No. of unwanted operation -1

Reason for indices less than unity – May be a DC fault, exact reason could not be identified.

Corrective action taken- Under observation.

Case-7 220/132 KV 160 MVA Transformer-I at 220 KV GSS Bhiwadi on 04.07.2024

No. of unwanted operation -1

Reason for indices less than unity – Water logging in relay terminal box during heavy rain.

Corrective action taken- Reay terminal box cleaned, dried and sealed.

Case-8 220/132 KV, 160 MVA Transformer at 220 KV GSS RAWATSAR on 14.07.2024
No. of unwanted operation -1

Reason for indices less than unity – Water logging in relay terminal box during heavy rain.

Corrective action taken- Reay terminal box cleaned, dried and sealed.

Case-9 220/132KV 100 MVA ICT-I AT 220 KV GSS IG NAGAR on dated 25.07.2024

No. of unwanted operation -1

Reason for indices less than unity – Water logging in relay terminal box during heavy rain.

Corrective action taken- Reay terminal box cleaned, dried and sealed.

Case-10 220/132 KV, 100 MVA Transformer-I at 220KV GSS DECHU on 02.07.2024

No. of unwanted operation -1

Reason for indices less than unity – High impedance differential protection relay defective.

Corrective action taken- High Impedance differential protection relay replaced.

Case-11 220/132KV, 100 MVA Transformer-II AREVA at 220kV GSS GULABPURA on 16.07.2024

No. of unwanted operation -1

Reason for indices less than unity – High impedance differential protection relay defective.

Corrective action taken- High Impedance differential protection relay shall be replaced soon.

Case-12 220kV 160MVA Transformer-II at 220KV GSS GAJNER on 26.07.2024

No. of unwanted operation -1

Reason for indices less than unity – DC Fault due to heavy rain.

Corrective action taken- DC fault rectified.

RRVUNL

Case-1 Tripping of GT-1 at 220kV KSTPS kota on 19.7.2024

No. of unwanted operation -1

No. of correct operation-3

No. of failure to operate-0

Reason for indices less than unity – tripped due to malfunctioning of UAT Protection Relay RET650.

Corrective action taken- The faulty Relay has been taken out of circuit and is being sent to the OEM, M/s. HIEL (Formerly M/s. ABB India Ltd.) for analysis of the same.

SJVN

Case-1 Tripping of 68.67 MW generating unit no. 6 of Rampur HPS on 07.07.2024.

Number of unwanted operations = 1

Reason for indices less than unity – High TGB vibration above permissible limit. High TGB vibration occurred due to labyrinth seal damaged at runner.

Corrective action taken– The same was replaced.

UPPTCL

Case-1 Tripping of 220kV Kanduni-PG 2 line on 25.7.2024 (Lucknow zone)

No. of unwanted operation -1

No. of correct operation-1

No. of failure to operate-0

Reason for indices less than unity – DT received at Kanduni end.

Corrective action taken–Fault at 400kV Substation Khuri road (POWERGRID) removed.

Case-2 Tripping of 400/220kV 500MVA ICT-1 at 400kV Substation Azamgarh (Gorakhpur Zone)

No. of unwanted operation -1

No. of correct operation-1

No. of failure to operate-0

Reason for indices less than unity- Tripped on PRV due to DC cable fault.

Corrective action taken- Rectified on 14.7.2024.

Case-3 Tripping of 220kV Khurja NAPP line (Meerut Zone)

No. of unwanted operation -2

No. of correct operation-1

No. of failure to operate-0

Reason for indices less than unity- At Khurja Substation Damaged cable carrying signals to trip circuit and has operated due to water logging in trenches during severe rain.

Corrective action taken- Control cables of both trip circuits were replaced on 31.7.2024.

Case-4 Tripping of 220kV Debai NAPP line (Meerut Zone)

No. of unwanted operation -2

No. of correct operation-1

No. of failure to operate-0

Reason for indices less than unity- Line tripped at Debai end due to SOTF/TOR when distance protection picked in Zone-3**.**

Corrective action taken- Protection settings have been checked and revised.

PSTCL

Case-1 Tripping of 500 MVA, 400/220 kV ICT-1 at 400 kV S/S Dhanansu

No. of unwanted operation -1

No. of correct operation-0

No. of failure to operate-0

Reason for indices less than unity- Ingress of moisture due to Rain.

Corrective action taken- Officials have been asked to cover it properly.

Case-2 Tripping of 100 MVA, 220/132 kV Power Transformer-2 at 220 kV S/S Science City

No. of unwanted operation -2

No. of correct operation-0

No. of failure to operate-0

Reason for indices less than unity- Control cable of NCT damaged.

Corrective action taken- Replaced.

Case-3 Tripping of 500 MVA, 400/220 kV ICT-1 at 400 kV S/S Dhuri

No. of unwanted operation -1

No. of correct operation-0

No. of failure to operate-0

Reason for indices less than unity- Due to ingress of moisture in PRD & OSR.

Corrective action taken- Officials have been asked to cover it properly.

Case-4 Tripping of 100 MVA, 220/66 kV Power Transformer-4 at 220kV S/s Patran

No. of unwanted operation -1

No. of correct operation-0

No. of failure to operate-0

Reason for indices less than unity- Due to rain & bird's dropping resulting in flashover at LA jumper HV side.

Case-5 Tripping of 220 kV Muktsar-Ghubaya ckt

No. of unwanted operation -1

No. of correct operation-1

No. of failure to operate-0

Reason for indices less than unity- Mal-operation of PDR of CB.

Corrective action taken- Connections tightened in CB marshallaing box.

Case-6 Tripping of 220 kV Muktsar-Sandhwan ckt, 220 kV Muktsar-Sadiq ckt, 220 kV Muktsar-Katorewala ckt, 220 kV Muktsar-Bathinda ckt.I, 220 kV Muktsar-Bathinda ckt.II

No. of unwanted operation -0

No. of correct operation-0

No. of failure to operate-0

No. of incorrect operation- 1 on each element

Reason for indices less than unity- Bus fault developed subsequent to tripping of 220 kV Muktsar-Ghubaya circuit. BBPS failed to operate.

Corrective action taken- Due to issue in bus bar operation all feeders were tripped in zone-4 and Bus bar was out due to patch cord issue. The matter will be resolved after installation of new patch cord.

Case-7 Tripping of 220 kV Butari-BBMB Jalandhar ckt in Zone-1 from BBMB end and E/F at Butari end

No. of unwanted operation -1

No. of correct operation-0

No. of failure to operate-0

Reason for indices less than unity- Protection coordination issues of E/F relay.

Corrective action taken- Issue is being resolved.

Case-8 Tripping of 100 MVA, 220/66 kV Power Transformer-3 at 220kV S/s Rehana Jattan

No. of unwanted operation -2

No. of correct operation-0

No. of failure to operate-0

Reason for indices less than unity- Bucchholz Trip Stage-II, Master operated, due to DC leakage.

Corrective action taken- Partially attended.

Case-9 Tripping of 100 MVA, 220/66 kV, P.T/F T-3 at 220kV S/s Dera Bassi

No. of unwanted operation -1

No. of correct operation-0

No. of failure to operate-0

Reason for indices less than unity- Bucchholz Trip Stage-II, Master operated, due to Control cable punctured.

Corrective action taken- Control cable replaced.

Case-10 Tripping of 220kV Bhateri-Faggan Majra ckt. I

No. of unwanted operation -0

No. of correct operation-0

No. of failure to operate-0

No. of incorrect operation- 1

Reason for indices less than unity- Operation of O/C on adjacent circuit due to snapping of conductor.

Corrective action taken- Relays are old. Over current casing may be placed out.

Case-11 Tripping of 220 kV Passiana-Ablowal ckt and 220 kV Passiana-Rajla ckt from Passiana end only

No. of unwanted operation -1 for each element.

No. of correct operation-0

No. of failure to operate-0

Reason for indices less than unity- DC leakage.

Corrective action taken- Partially attended.

Case-12 Tripping of 100 MVA, 220/66 kV Power Transformer-2 at 220kV S/s Sarna

No. of unwanted operation -1

No. of correct operation-0

No. of failure to operate-0

Reason for indices less than unity- Control cable damaged by reptiles.

Corrective action taken- Control cable replaced.

Case-13 Tripping of 220 kV Verpal-Udhoke ckt and 220 kV Verpal-Wadala Granthian ckt

No. of unwanted operation -1 for each element.

No. of correct operation-0

No. of failure to operate-0

Reason for indices less than unity- Maloperation of DPRs due to damaging of bush of ICT at Wadala granthian.

Corrective action taken- PSL and settings of distance protection relay have been revised.

Case-14 Tripping of 160 MVA, 220/66kV Power Transformer-2 at 220kV S/s Malerkotla

No. of unwanted operation -1

No. of correct operation-0

No. of failure to operate-0

Reason for indices less than unity- Earth stick comes in induction during attending hot point at 66 kV Naudhrani.

Corrective action taken- Directed concerned officials to take care in future.

Case-15 Tripping of 220 kV Bhawanigarh-Nabha ckt at Bhawanigarh end only

No. of unwanted operation -0

No. of correct operation-0

No. of failure to operate-1

Reason for indices less than unity- failed to trip from Nabha end.

Corrective action taken- Will be taken up.

Case-16 Incorrect operations due to unhealthiness of carrier

Lines subjected- 220 kV Kotla Janga-Kartarpur ckt.II, 220 kV Bathinda-GHTP ckt.I

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

Corrective action taken- Matter is being taken up to resolve. It involves a huge procurement.

POWERGRID – NR-2

Case-1 Tripping of PATIALA 315MVA ICT-I & 500MVA ICT- III

No. of unwanted operation -1 for each element

Reason for indices less than unity- ICTs tripped on operation of 220KV Bus-1 Protection caused by operation of LBB protection of 220KV Nabha-1 due to problem in B-pole CB Patiala (PG).

Case-2 Tripping of DEHAR 315 MVA ICT-I at 220kV side only

No. of unwanted operation -1

Reason for indices less than unity- Tripped due to maloperation of Micom P743 Breaker failure relay owned by BBMB Dehar.

Corrective action taken- BBMB will email settings to POWERGRID for review.

Reasons for Performance Indices less than Unity- August 2024

POWERGRID- NR-2

Case-1 Tripping of 220KV SALAL-JAMMU-II at Jammu end on 07.08.2024

No. of unwanted operation -1

Reason for indices less than unity - Line tripped from Jammu end only due to maloperation of Trip supervision contactor. Dead earth fault was persisting at that time (JKPTCL Station)

Corrective action taken- earth fault at the substation could not ne figured out at Jammu.

Case-2 Tripping of 220KV SARNA-DASUYA-I on 16.08.2024

No. of incorrect operation -1

Reason for indices less than unity – Line successfully Auto Reclosed on B-N fault from Dasuya (PSTCL) but tripped from Sarna (PSTCL) due to maloperation of A/R scheme at Sarna (PSTCL). DTPC cable issue.

Corrective action taken- DTPC issue resolved.

Case-3 Tripping of 400KV BHIWANI (BBMB) - RAJPURA (PSTCL) LILO PORTION on 31.08.2024

No. of unwanted operation -1

Reason for indices less than unity – Line tripped from Rajpura (PS) end only due to DT received at Rajpura (PS) PSTCL end caused by maloperation of PLCC at BBMB Bhiwani. PLCC maloperation. PLCC and bay at Bhiwani are owned by BBMB.

Corrective action taken- Wrong PSL in distance protection of the line has been rectified by BBMB at Bhiwani end.

Case-4 Tripping of PATIALA 315MVA ICT-II & 500MVA ICT-IV on 24.07.2024

No. of unwanted operation -1 for each element.

Reason for indices less than unity – ICT-4 TBCB bay wiring issue. During shifting of ICT-4 (214) bay to TBC, +ive voltage extended to trip bus of 220kV Bus-2, resulting in operation of 220KV Bus-2.

Corrective action taken- Rectified.

CCGT Bawana, IPGCL

Case-1 Tripping of Generator Transformer GT – 4 on 18.8.2024 & 25.8.2024

No. of unwanted operation -2

No. of correct operation-2

No. of failure to operate-0

Reason for indices less than unity – On differential tripped due to CT Secondary wire of R – Phase Yard CT (Core 4 & Core 5) from CT Junction Box to CT MK found grounded.

Corrective action taken- New cable laid from R – Phase CT Junction Box to CT MK for Core 4 as well as Core 5

PSPCL (GGSSTPS)

Case-1 the following feeders tripped in Zone-2

1. 220 kV feeder Jadla-1 on 24.08.2024
2. 220 kV feeder Jadla-2 on 24.08.2024
3. 220 kV feeder Gobindgarh-2 on 27.08.2024

Reason for indices less than unity –Due to the unhealthiness of Carrier Communication.

Corrective action taken- In earlier testing, there was no discrepancy found. However, PSTCL will do testing again after taking planned shutdown.

RVPNL

Case-1 Tripping of 400 KV Merta - Bikaner Bay at 400 KV GSS MERTA on 09.08.2024

No. of Unwanted operation – 1

Reason of unwanted operation – DC cable problem initiated the breaker tripping.

Corrective Action taken – DC cable replace and problem rectified.

Case-2 Tripping of 400/220KV 315 MVA ILT-2ND AT 400 KV GSS RATANGARH on 02.08.2024

No. of Unwanted operation – 1

Reason of unwanted operation – Due to DC mixing of source 1 and source 2 at 400KV GSS Ratangarh in 400/220KV 315MVA ILT-2 panel.

Corrective Action taken – DC problem rectified.

Case-3 Tripping of 220 KV Manoharpur - Kukas line at Manoharpur on 01.08.2024

No. of Unwanted operation – 1

Reason of unwanted operation – DC problem due to damage of DC cable at 220 KV GSS Manoharpur.

Corrective Action taken – DC problem rectified.

Case-4 Tripping of 220kV Sri Dungargarh - Ratangarh line at 220KV GSS Ratangarh on 06.08.2024

No. of Unwanted operation – 1

Reason of unwanted operation – CB tripped at Ratangarh end without any indication due to DC problem.

Corrective Action taken – DC problem rectified.

Case-5 Tripping of 220kV Bhilwara Kankroli (PG) line at Bhilwara end on 08.08.2024

No. of Unwanted operation – 1

Reason of unwanted operation – PSL of relay was found wrong, the relay tripped with Carrier healthy signal.

Corrective Action taken – PSL corrected.

Case-6 Tripping of 220 kV Kankroli- Bamantukda Line at 220 KV GSS Bamantukda on 11.08.2024

No. of Unwanted operation – 1

Reason of unwanted operation – LBB relay setting found incorrect.

Corrective Action taken – LBB relay setting corrected.

Case-7 Tripping of 220KV Khetri- Ratangarh Ckt-II line at 220 KV GSS Khetri on dated 21.08.2024

No. of Unwanted operation – 1

Reason of unwanted operation – VT selection relay operation defective, VT output became near to zero.

Corrective Action taken – Problem of VT selection relay rectified.

Case-8 Tripping of 220/132 KV 160 MVA Transformer at 220 KV GSS VATIKA on 30.08.2024

No. of Unwanted operation – 2

Reason of unwanted operation – Main 2 differential relay was installed at the panel with incomplete CT wiring and was put out of ckt by removing DC supply. Workmen unknowingly put on the DC supply fuses.

Corrective Action taken – Main 2 differential relay again put out of circuit.

DTL

Case-1 400kV Mundaka- Bawana Ckt-1 and Ckt-2

No. of unwanted operation -2

No. of correct operation-0

No. of failure to operate-0

Reason of unwanted operation – Fault was in 400kV Bawana-Maharani Bagh Ckt.-1. Main-1 relay (P442) has correctly seen the fault in Zone-2. However, Main 2 Relay (GE make D-60) has seen the fault in Zone-1 and tripped accordingly. Main-2 Relay again saw the fault in Zone-1 even after revision of settings as per OEM recommendation in the month of June-2024.

Corrective Action taken- The issue was again raised with OEM and after further analysis by OEM they have recommended for change in Flex logic of GE make relay. Necessary recommendations were implemented and kept under observations.

PTCUL

Case-1 Tripping of 315 MVA ICT -II (400/220 KV) at 400 KV S/S Kashipur

No. of unwanted operation -1

No. of correct operation-0

No. of failure to operate-0

Reason of unwanted operation – transformer tripped without flags due to DC Earth fault.

Corrective Action taken- will look into issue after taking the shutdown.

UPPTCL

Case-1 220kV Parichha to Moth line (Jhansi Zone)

No. of unwanted operation -0

No. of correct operation-1

No. of failure to operate-1

Reason for indices less than unity – At 220kV S/s Moth Bus coupler breaker trip on E/F high set, while line CB did not trip.

Corrective Action taken- Fault got rectified**.**

Case-2 220kV Debai to Khurja line (Meerut Zone)

No. of unwanted operation -0

No. of correct operation-0

No. of failure to operate-1

Reason for indices less than unity – CB at 220kV Debai end failed to trip as trip signal was transferred to TBC breaker due to mal functioning of BCU.

Corrective Action taken- Trip transfer scheme is permanently shifted to main CB till the time BCU trouble is rectified.

Case-3 Tripping of 500MVA ICT-1 at 400kV Substation Azamgarh (Gorakhpur Zone)

No. of unwanted operation -1

No. of correct operation-0

No. of failure to operate-0

Reason for indices less than unity –ICT tripped on PRV due to mal functioning of PRV contact due to accumulation of water vapour.

Corrective Action taken- Gasket placedand proper sealing of PRV micro switch has been done.

Case-4 Tripping of 160MVA ICT (220/132kV) -1 at 400kV Substation Agra (Agra Zone)

No. of unwanted operation -1

No. of correct operation-0

No. of failure to operate-0

Reason for indices less than unity – Due to control cable fault.

Corrective Action taken- Fault rectified.

Case-5 Tripping of 400kV Aligarh Panki line (Agra Zone)

No. of unwanted operation -1

No. of correct operation-0

No. of failure to operate-0

Reason for indices less than unity – Due to DC Earth fault.

Corrective Action taken- Rectified after finding out cable fault.

Case-6 Tripping of 500MVA ICT-1 (LV side) at 400kV Substation Panki (Agra Zone)

No. of unwanted operation -3

No. of correct operation-0

No. of failure to operate-0

Reason for indices less than unity – Due to DC Earth fault.

Corrective Action taken- Rectified after finding out cable fault.

Case-7 Tripping of 500MVA ICT-I (HV side) at 400kV Substation Panki (Agra Zone)

No. of unwanted operation -1

No. of correct operation-0

No. of failure to operate-0

Reason for indices less than unity – Due to DC Earth fault.

Corrective Action taken- Rectified after finding out cable fault.

Status of Internal Protection Audit Plan for FY 2024 -25

S. No.	NRPC Member	Category	Status
1	PGCIL	Central Government owned Transmission Company	Received
2	NTPC	Central Generating Company	Received
3	BBMB		Received
4	THDC		Received
5	SJVN		Received (Rampur)
6	NHPC		Received
7	NPCIL		
8	DTL	State Transmission Utility	Received
9	HVPNL		Received
10	RRVPNL		Received
11	UPPTCL		Received for Jhansi, Lucknow, Meerut, Gorakhpur, Prayagraj, Agra zone)
12	PTCUL		Received
13	PSTCL		Received
14	HPPTCL		Received
15	IPGCL	State Generating Company	Received (PPCL)
16	HPGCL		
17	RRVUNL		Received
18	UPRVUNL		Received (obra -B, Anpara-B switch yard, Harduganj-C,D,E))
19	UJVNL		Received (Khodri, Chibro, Vyasi)
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	MEIL Anpara Energy Ltd		
29	Rosa Power Supply Company Ltd		Received
30	Lalitpur Power Generation Company Ltd		Received
31	MEJA Urja Nigam Ltd.		
32	Adani Power Rajasthan Limited		Received
33	JSW Energy Ltd. (KWHEP)		Received
34	AESL	Other transmission licensee	Received (ATIL -400kV Mohindergarh S/s, OBTL, FBTL, MTSCL, ATSCL, HPTSL, BKTL, GTL)
35	Tata Power Renewable Energy Ltd.		Recevied (TPGEL, BTPSL)
36	UT of J&K	UT of Northern Region	
37	UT of Ladakh		
38	UT of Chandigarh		
39	INDIGRID		Received
40	POWERLINK		
41	ADHPL		Received
42	Sekura Energy Limited		
43	WUPPTCl	Other transmission licensee in UP	
44	SEUPPTCL	Other transmission licensee in UP	
45	Vishnuprayag Hydro Electric Plant (J.P.)	Other Generating Units in UP	Received
46	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 utililty	Present Status Comlpleted (yes/no)
1	PGCIL	Central Government owned Transmission Company			
2	NTPC	Central Generating Company	Received (Tanda)	By 17.07.2025	
3	BBMB				
4	THDC		Received (Tehri)	March 2026	
5	SJVN		Received	FY-2025-26 for RHPS, Nov 24- March 25 for NJHPS	
6	NHPC		Received	FY-2025-26	
7	NPCIL				
8	DTL	State Transmission Utility			
9	HVPNL				
10	RRVPNL				
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	Revised schedule will be submitted
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	Dec-24	
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	MEIL Anpara Energy Ltd				
29	Rosa Power Supply Company Ltd		Received	By 30.09.2024	
30	Lalitpur Power Generation Company Ltd		Conducted	26.03.2024	
31	MEJA Urja Nigam Ltd.				
32	Adani Power Rajasthan Limited		Received (Kawai)	September, 2024	
33	JSW Energy Ltd. (KWHEP)		Received	December 2024 to March 2025	
34	AESL	Other Transmission Licensee	Received (ATIL -400kV Mohindergarh S/s.)	400kV Mohindergarh SS- Q2 , FY 2025-26	
			Received (OBTL)	OBTL-Q1 , FY 2025-26	
			Received (FBTL)	FBTL-Q3 , FY 2025-26	
			Received (MTSCL)	MTSCL-Q4 , FY 2025-26	
			Received (ATSCL)	ATSCL-Q1 , FY 2026-27	
			Received (HPTSL)	HPTSL- Q2 , FY 2026-27	
			Received (BKTL)	BKTL-Q3 , FY 2026-27	
			Received (GTL)	GTL- Q3 & Q4, FY 2026-27	
35	Tata Power Renewable Energy Ltd.	IPP having less than 1000 MW installed capacity (alphabetical rotaional basis)			
36	UT of J&K	UT of Northern Region			
37	UT of Ladakh				
38	UT of Chandigarh				
39	INDIGRID				
40	POWERLINK				
41	ADHPL		Received	30.09.2024	
42	Sekura Energy Limited				
43	WUPPTCl	Other transmission licensee in UP	Received	*2024-25	
44	SEUPPTCL	Other transmission licensee in UP			
45	Vishnuprayag Hydro Electric Plant (J.P.)	Other Generating Units in UP			
46	Alaknanda Hydro Electric Plant (GVK)	Other Generating Units in UP			

* Revised Schedule

Protection Audit report – 400/220 KV GIS Chamba Substation

Observations during Protection Audit carried out on 28th June -29th June 2024

1. Settings for protection relays to be implemented as per Latest Template & COE observations. All the protection templates need to be upgraded with the latest version and new fault current level. PSL/ Application configuration/CFC also needs to be modified as per the new templates wherever applicable.

2. Preventive maintenance record of protection system for not available with site except 400kV Bus Reactor-2, 400kV Chamba-Lahal ckt-1&2 & 207 bay (Majra line).

3. Tap position of ICT-1 R-phase is showing erroneous value i.e. -28 in SAS and same needs to be rectified.

4. ICT-2 WTI HV Y-Phase & WTI LV R-Phase are showing erroneous value in SAS. WTI HV Y-Phase: 76°& WTI LV R-Phase: -8.21°. same needs to be rectified.

5. BR-1 WTI is reporting erroneous value i.e 70° in SAS whereas 32° in WTI, same needs to be rectified.

6. In BR-1, Group-B Protection DC fail alarm persisting in DIFF relay but not showing SAS, on fail of actual DC-2, no change in alarm, same needs to be rectified.

7. In BR-1, on switch off Power supply of REF, Diff & BUI relay, no event/alarm of relays unhealthy in SAS, needs to be rectified.

8. ABB make CSD of BR-1 is not reporting to SAS.

9. Mutual Compensation wiring of Main-1 Relay (REL670) of 400kV Chamba-Lahal Ckt-1&2 not connected properly, same needs to be corrected.

10. Goose IED absent alarm is persisting in Main-2(P444) of 220kV Chamba-Karian, 220kV Chamba- Majra Line but not reporting to SAS, needs to be rectified.

11. Goose receives fail alarm persisting in Main-1 relay of 400kV Chamba-Lahal Ckt-2, same needs to be rectified.

12. CN-1 Carrier fail alarm persisting in 220 KV Chamba-Karian line (Bay-206).

13. 220KV Chamba- Majra Line PLCC counters are not reporting in SAS.

14. Most of indication lamps for CB/Isolators status are not working.

15. LT system (Tertiary & HPPCL supply) Voltage is not reporting in SAS-1 but reporting in SAS-2, needs to be rectified.

16. DG is working in Manual Mode. However, ACDB B/C is not working in Auto Mode, therefore DG unable to operate on Auto Mode. Same needs to be rectified.

17. Battery Room Temp is not reporting in SAS.

18. 50V Battery Charger-1 & 2 current and voltage are not reporting correctly needs to be rectified. SAS Value: Charger-1: -18V & 600A, & Charger-2: -18V & -4.5A.

19. 220V Battery Charger-1 & 2 current is not reporting correctly needs to be rectified. SAS Value: Charger-1: -0A, & Charger-2: -0A.

20. In 220V Battery Charger-1, Ammeter found defective, same needs to be replaced.

21. Firefighting pressure showing Zero in SAS, needs to be rectified.

22. Fire diesel engine is not functional in auto mode, same needs to be made functional in auto mode.

23. Out of 8 cameras, 7 are working and 1 (Camera No.-08) is not functional, same needs to be made functional.

24. DC voltage measured during audit, no DC earth fault present. Setting for E/F relay kept as 0.3 mA.
    a. 220V Source 1: +123.4V, -123.2V 48V Source 1: +0.5V, -51.5V
    b. 220V Source 2: +122.6V, -124.2V 48V Source 2: +0.7V, -52.0V

25. DC earth fault is simulated in 220 V DC Source-2. No Voltage deflection detected in DC source-1. No mixing found.

26. Logic for PRD trip with NO/NC & OTI/WTI trip with time delay 20ms and Buch Alarm/Trip with time delay 200ms is implemented in ICT-1,2 & BR-1,2.

27. 02 nos. Carrier switch out signals simulated. Found ok and reported to SAS.

28. Smoke detectors simulated from 3 no. zones (Zone-2, Zone-3 & Zone-5). Found ok and reported to SAS.

Rectification during Audit-

1. ICT-1 RY phase voltage is showing 93kV in SAS, rectified during audit.
2. In BR-2, REF relay found out of time sync, rectified during audit.
3. In BR-2, REF Stabilizing Resister found defective, replaced and value set as per Template i.e. 219 Ω during audit.

AUDITEE	AUDITOR
VIKENDER SINGH, DM	NARESH KUMAR, AM
ABHISHEK KUMAR, JE	

Protection Check-List

Name:- 400/220KV GIS CHAMBA Month and Year of Commissioning:- December 2011 Date of audit:- 28TH to 29th JUNE-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	To be updated as per Latest template and COE observation
	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		OK	
	Check that the VT fail shall block the tripping		OK	
	Check the current, voltage and angle in the relay		OK	
	Check for mutual compensation wiring (if applicable) and Check setting and configuration according to wiring.		OK	400kV Lahal-1&2 Main-1, wiring found not ok.
	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	Ch-1 fail of 220 KV Karian line (Bay-206)
	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	
	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	

Protection Check-List

LBB relay/PU relay	Check the relay settings (particularly, pick-up, retrip time and back-trip time)		OK	TEMPLATE NOT AVAILABLE.
	Check that single phase initiation is wired and configured correctly for lines		OK	
	Check the logic that re-trip trips the same breaker		NA	
	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)		OK	
	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		NA	
	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	TO BE UPDATED AS PER COE OBSERVATIONS & LATEST TEMPLATE
	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	TO BE UPDATED AS PER COE OBSERVATIONS & LATEST TEMPLATE
	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	
Back-up	Check the current and voltage in the relay		OK	

Protection Check-List

impedance				
	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	TO BE UPDATED AS PER COE OBSERVATIONS & LATEST TEMPLATE
	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)		OK	BR-1 CSD IS NOT Reporting to SAS.
	Check provision of bypassing of CSD is provided		OK	
	Check DR trigging of other relay on Manual operation of CB in case CSD is not having the provision of extraction of DR/graph.		OK	
General	Check that the two trippings of PRD, Buchholz etc are wired to two separate relays		OK	
	Check that the relays powered by DC-1 are supervised by relays powered by DC-2 and Vice-versa		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	TO BE UPDATED AS PER LATEST CIRCULAR.
	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		NOT OK	TO BE IMPLEMENTED.
	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	
	Back up of important data of sub-station		OK	
Bus Bar Protection	Whether duplicate bus bar protection provided in 400 & 765 kV Bus bar		OK	

Protection Check-List

	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		NA	
	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	
SAS	As per Annexure-I (SAS Checklist)		OK	
Alarms	Simulate the alarms as per Annex-II for at least 20% bays, Minimum 6 bays.		OK	
DC System	Check DC voltage at the farthest point in the switchyard (+ to Earth, - to earth)		OK	
AC system	Check auto operation of DG set		OK	
FFPH	Check auto operation of HVW and Diesel driven pump		OK	Diesel Engine Not working on Auto Mode.
Smoke detection system	Simulate smoke detection in any kiosk and check for alarm		OK	

AUDITEE	AUDITOR
VIKENDER SINGH, DM	NARESH KUMAR, AM
ABHISHEK KUMAR, JE	

Rajasthan Rajya Vidhyut Prasaran Nigam

Report of the Protection Audit-M/O-MAY 2024 , Date of Audit - 22.5.2024.

A. General Information

(i) Name of Utility:- 220 KV GSS HAMIRGARH

(ii) Name of Voltage Level of Sub Station:- 220/132 KV

(iii) Date of Commissioning:-20.03.1996

(iv) Type of Bus Switching Scheme:- Two Main Bus and Aux. Bus

(v) Name and Organization of Audit Team:- AEN (MPT&S) RVPNL BHILWARA

(vi)Name of representative from utility whose audit being carried out:- XEN 220KV GSS RVPNL HAMIRGARH

B. Check List for Protection Audit

S. No	Check		Functional/NonFunctional/Enabled/Disabled	Type of Relay (Numerical/Static/Electromechanical)	Setting as found in field	Compliance Status w.r.t regulatory provisions
	Transformer Protection Panel:					
(1)	**Name of Transformer (Rating/Capacity)**	**220/132,160MVA Transformer-I (ALSTOM Make)**				
	Tripping by Buchholz relay (Alarm)	Yes	Functional	Conventional		
	Differential Protection	Yes	Functional	Numerical	pickup- 0.2 pu,slope 1 - 0.3,slope 2-0.7	
	2nd Harmonic Block (Setting)	Yes	Enabled		15%	
	Event logger Operation	No	(No Event logger Installed)			
	Restricted Earth Fault Protection (HV Side)	Yes	Functional	Numerical	20%	
	Event logger Operation	No	(No Event logger Installed)			
	Restricted Earth Fault Protection (LV Side)	Yes	Functional	Numerical	20%	
	Event logger Operation	No	(No Event logger Installed)			
	Backup Over Current	Yes	Functional	Numerical	54%, CTR-800/1	
	Event logger Operation	No	(No Event logger Installed)			
	Earth Fault Protection	Yes	Functional	Numerical	20%	
	Event logger Operation	No	(No Event logger Installed)			
	Over Flux Protection	Yes	Enabled	Numerical	alarm -110%,5 sec ,Trip- As per inverse curve characteristics	
	Event logger Operation	No	(No Event logger Installed)			
	Local Breaker Back Up	YES	Feature enabled in Bus bar scheme,no separate LBB Relay	**Numerical**		
	Retrip		enabled		100 msec	
	Current and Time Setting	yes			120% Inormal,100 msec	
	Separate Single and three Phase Initiation	no			three phase initiation	
	Earth Fault	no	DISABLED			
	Event logger Operation	no				

ASSISTANT ENGINEER (MPT&S)
RRVPNL, BHILWARA

Dt. of Audit – 22.05.2024.

Name of Transformer (Rating/Capacity)	**220/132,100MVA Transformer-I (BHEL Make)**				
Tripping by Buchholz relay (Alarm)	Yes	Functional	Conventional		
Differential Protection	Yes	Functional	Static	pickup- 0.2 pu,slope 1 - 0.2,slope 2-0.7	
2nd Harmonic Block (Setting)	Yes			15% (Inbuilt)	
Event logger Operation	No	(No Event logger Installed)			
Restricted Earth Fault Protection (HV Side)	No			20%	
Event logger Operation	No	(No Event logger Installed)			
Restricted Earth Fault Protection (LV Side)	No			20%	
Event logger Operation	No	(No Event logger Installed)			
Backup Over Current	Yes	Functional	numerical	57% CTR-400,1 A	
Event logger Operation	No	(No Event logger Installed)			
Earth Fault Protection	Yes	Functional	numerical	20%	
Event logger Operation	No	(No Event logger Installed)			
Over Flux Protection	Yes	Enabled	numerical	alarm -110%,5 sec Trip-As per inverse curve characteristics	
Event logger Operation	No	(No Event logger Installed)			
Local Breaker Back Up	YES	Feature enabled in Bus bar scheme,no separate LBB Relay	**Numerical**		
Retrip	No	Enabled		100 msec	
Current and Time Setting	No			120% Inormal,100 msec	
Separate Single and three Phase Initiation	No			three phase initiation	
Earth Fault	No	DISABLED			
Event logger Operation	No	(No Event logger Installed)			

ASSISTANT ENGINEER (MPT&S)
RRVPNL, BHILWARA

Date of Audit - 22.05.2024.

Rajasthan Rajya Vidhyut Prasaran Nigam

Report of the Protection Audit

A. General Information

(i) Name of Utility - 220 KV GSS HAMIRGARH

(ii) Name of Voltage Level of Sub Station - 220/132 KV

(iii) Date of Commissioning - 20.03.1996

(iv) Type of Bus Switching Scheme - Two Main Bus and Aux. Bus

(v) Name and Organization of Audit Team:- AEN (MPT&S) RVPNL BHILWARA

(vi) Name of representative from utility whose audit being carried out - XEN 220KV GSS RVPNL HAMIRGARH

B. Check List for Protection Audit

S No	Check		Functional/NonFunctional/Enabled/Disabled	Type of Relay (Numerical/Static/Electromechanical)	Setting as found in field	Compliance Status w r t regulatory provisions
	Distance Protection Panel:M-I/II					
(i)	**Name of Line**	**220KV Hamirgarh-Bhilwara line**				
	Pole Discrepancy Relay	YES	Functional	ELECTROMECHANICAL	1 sec	
	PLCC Panel	Yes	Functional			
	Zone-1 2 3 4 5 (Settings)	Yes	Enabled	Numerical	As per latest Code of Configuration	
	Time Check-Z-1/2/3/4/5(Settings)	Yes	Enabled			
	SOTF	YES	Disabled			
	Aided Scheme	YES	Enabled			
	Fault Locator	YES	enabled			
	Power Swing (Setting R & X)	Yes	Enabled			
	All Zone Block	Yes	Enabled			
	DR	Yes	Enabled			
	Binary Inputs	Yes	ENABLED			
	Breaker Contacts	Yes	ENABLED			
	Carrier Receive	YES	ENABLED			
	Time Synchronization	YES				

(I)	**Name of Line**	**220KV Hamirgarh-Bhilwara line**				
	Pole Discrepancy Relay	YES	Functional	ELECTROMECHANICAL	1 sec	
	PLCC Panel	Yes	Functional			
	Zone-1 2 3 4 5 (Settings)	Yes	Enabled	Numerical	As per latest Code of Configuration	
	Time Check-Z-1/2/3/4/5(Settings)	Yes	Enabled			
	SOTF	YES	Disabled			
	Aided Scheme	YES	Enabled			
	Fault Locator	YES	enabled			
	Power Swing (Setting R & X)	Yes	Enabled			
	All Zone Block	Yes	Enabled			
	DR	Yes	Enabled			
	Binary Inputs	Yes	ENABLED			
	Breaker Contacts	Yes	ENABLED			
	Carrier Receive	YES	ENABLED			
	Time Synchronization	YES				

ASSISTANT ENGINEER (MPT&S)
RRVPNL, BHILWARA

Date of Audit - 22.05.2024.

Rajasthan Rajya Vidhyut Prasaran Nigam

Report of the Protection Audit

A. General Information

(i) Name of Utility - 220 KV GSS HAMIRGARH (ii) Name of Voltage Level of Sub Station - 220/132 KV

(iii) Date of Commissioning -20.03.1996 (iv) Type of Bus Switching Scheme - Two Main Bus and Aux. Bus

(v) Name and Organization of Audit Team - AEN (MPT&S) RVPNL BHILWARA

(vi) Name of representative from utility whose audit being carried out - XEN 220KV GSS RVPNL HAMIRGARH

B. Check List for Protection Audit

S No	Check		Functional/NonFunctional/Enabled/Disabled	Type of Relay (Numerical/Static/Electromechanical)	Setting as found in field	Compliance Status w.r.t regulatory provisions
1	**DC System**		Functional	Electromechanical	20%	
	No. Of Independent DC Source	1				
	Potential Between +ve & Earth (Source-I)	116 V				
	Potential Between -ve & Earth (Source-I)	118 V				
2	**Event Logger Panel**	No				
3	**Event Logger Time Synchronised**	No				
	Disturbance Recorder	No				
	DR Time Synchronised	No				
4	**Bus Bar Protection**	yes				
	Stability Check	yes				
	FL Output for this Event	yes				
	DR if Available	yes				
5	**DG Set**	No				
6	**Mock Testing of Sample Protection Associated with Transmission line**	yes				
7	**LBB/BFR**	No				
	Retrip	No				
	Current and Time Setting	No				
	Separate Single and Three Phase initiation	No				
	Earth Fault	No				
	Event Logger Operation	No				

ASSISTANT ENGINEER (MPT&S)
RRVPNL, BHILWARA

Date of Audit – 22.05.2024.

Rajasthan Rajya Vidhyut Prasaran Nigam

Report of the Protection Audit

A. General Information

(i) Name of Utility - 220 KV GSS HAMIRGARH

(ii) Name of Voltage Level of Sub Station - 220/132 KV

(iii) Date of Commissioning -20.03.1996

(iv) Type of Bus Switching Scheme - Two Main Bus and Aux. Bus

(v) Name and Organization of Audit Team - AEN (MPT&S) RVPNL BHILWARA

(vi)Name of representative from utility whose audit being carried out - XEN 220KV GSS RVPNL HAMIRGARH

B. Check List for Protection Audit

S No	Check		Functional/NonFunctional/Enabled/Disabled	Type of Relay (Numerical/Static/Electromechanical)	Setting as found in field	Compliance Status w.r.t regulatory provisions
	Reactor Protection Panel:	NA	No reactor Installed			
	Tripping by Buchholz relay (Alarm)	No				
	Differential Protection	No				
	2nd Harmonic Block (Setting)	No				
	Event logger Operation	No				
	Restricted Earth Fault Protection (HV Side)	No				
	Event logger Operation	No				
	Restricted Earth Fault Protection (LV Side)	No				
	Event logger Operation	No				
	Backup Over Current	No				
	Event logger Operation	No				
	Earth Fault Protection	No				
	Event logger Operation	No				
	Over Flux Protection	No				
	Event logger Operation	No				

ASSISTANT ENGINEER (MPT&S)
RRVPNL, BHILWARA

Rajasthan Rajya Vidhyut Prasaran Nigam Limited

Report of the Protection Audit

A. General Information

i)	Name of utility:	Rajasthan Rajya Vidhyut Prasaran Nigam Limited
ii)	Name of Voltage level of Substation:	220 kV GSS Indira Gandhi Nagar
iii)	Date of Commissioning:	25.02.2011
iv)	Type of Bus Switching Scheme	Two Main Bus (One & Half scheme)
v)	Name and Organization of Audit Team	Sh. Mukul Yadav, AEN-III (MPT&S), RVPN, Jaipur
		Sh. Munesh Kumar Meena , JEN-I O/o AEN-III (MPT&S), RVPN, Jaipur
vi)	Name of representative from utility whose audit being carried out	Sh. D.K. Jain, SE (Prot. Engg.) RVPNL Jaipur

B. Checklist for Protection Audit

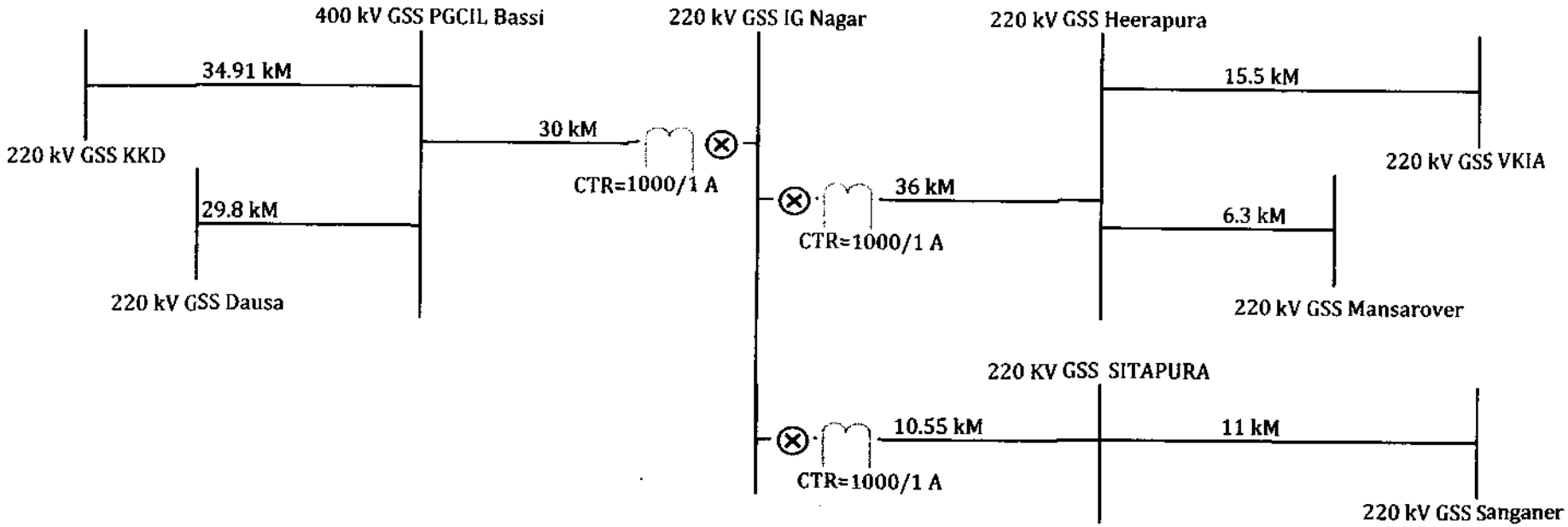
S.No.	Check		Functional/ Non-Functional/ Enabled/Disabled	Type of Relay*(Numerical/Static/Electromechanical)	Setting as found in field*/**	Compliance status w.r.t. regulatory provisions
Distance protection Panel:M-I/II						
(i)	**Name of Line**	**220 kV PGCIL Bassi Line**				
	Pole discrepancy relay	Yes	Functional(On CB)	Electromechanical	2 sec.	
	PLCC panel	Yes	Functional			
	Zone-1/2/3/4/5(settings)	Yes	Functional	Numerical Distance Protection Relays	Z1=4.897 Ohm, T1=0 ms Z2=9.162 Ohm, T2=350 ms Z3=13.958 Ohm, T3=1000 ms Z4(Rev.)=408 mOhm, T4=160 ms	Complying
	Time check-Zone-1/2/3/4/5(settings)	Yes	Functional			
	SOTF	No	Disabled	-	-	Complying
	Aided schemes	Yes	Functional	In built feature of Numerical Distance Protection Relays	Permissive Under Reach, 1 Phase Z1 Z2+CR	Complying
	Fault locator	Yes	Functional	In built feature of Numerical Distance Protection Relays	-	Complying

S.No.	Check		Functional/ Non-Functional/ Enabled/Disabled	Type of Relay*(Numerical/Static/Electromechanical)	Setting as found in field*/**	Compliance status w.r.t. regulatory provisions
	Power swing(S(settings R and X)				R=5 Ohm, X=5 Ohm	Complying
	All Zone block	Yes	Enabled	In built feature of Numerical Distance Protection Relays	-	Complying
	DR	Yes	Enabled		-	Complying
	Binary Input					
	Breaker Contacts	Yes	Functional	-	-	Complying
	Carrier Receive	Yes	Functional	-	-	Complying
	Time Synchronization	Yes	Functional	-	-	Complying
(ii)	**Name of Line**	**220 kV Heerapura Line**				
	Pole discrepancy relay	Yes	Functional(On CB)	Electromechanical	2 Sec.	
	PLCC panel	Yes	Functional			
	Zone-1/2/3/4/5(settings)	Yes	Functional	Numerical Distance Protection Relays	Z1=5.877 Ohm, T1=0 ms Z2= 7.989 Ohm, T2=350 ms Z3=10.825 Ohm, T3=1000 ms Z4(Rev.)=408 mOhm, T4=160 ms	Complying
	Time check-Zone-1/2/3/4/5(settings)	Yes	Functional			
	SOTF	No	Disabled	-	-	Complying
	Aided schemes	Yes	Functional	In built feature of Numerical Distance Protection Relays	Permissive Under Reach, 1 Phase Z1 Z2+CR	Complying
	Fault locator	Yes	Functional	In built feature of Numerical Distance Protection Relays	-	Complying
	Power swing(S(settings R and X)				R=5 Ohm, X=5 Ohm	Complying
	All Zone block	Yes	Enabled	In built feature of Numerical Distance	-	Complying
	DR	Yes	Enabled		-	Complying
	Binary Input					
	Breaker Contacts	Yes	Functional	-	-	Complying
	Carrier Receive	Yes	Functional	-	-	Complying
	Time Synchronization	Yes	Functional	-	-	Complying
Distance protection Panel:M-I/II						
(iii)	**Name of Line**	**220 KV Sitapura Line**				
	Pole discrepancy relay	Yes	Functional(On CB)	Electromechanical	2 sec.	
	PLCC panel	Yes	Functional			
	Zone-1/2/3/4/5(settings)	Yes	Functional	Numerical Distance Protection Relays	Z1=1.722 Ohm, T1=0 ms Z2=3.275 Ohm, T2=350 ms Z3=4.622 Ohm, T3=1000 ms Z4(Rev.)=408 mOhm, T4=160 ms	Complying
	Time check-Zone-1/2/3/4/5(settings)	Yes	Functional			

S.No.	Check		Functional/ Non-Functional/ Enabled/Disabled	Type of Relay*(Numerical/Static/Electromechanical)	Setting as found in field*/**	Compliance status w.r.t. regulatory provisions
	SOTF	No	Disabled	-	-	Complying
	Aided schemes	Yes	Functional	In built feature of Numerical Distance Protection Relays	Permissive Under Reach, 1 Phase Z1 Z2+CR	Complying
	Fault locator	Yes	Functional	In built feature of Numerical Distance Protection Relays	-	Complying
	Power swing(S(settings R and X)				R=5 Ohm, X=5 Ohm	Complying
	All Zone block	Yes	Enabled	In built feature of Numerical Distance	-	Complying
	DR	Yes	Enabled		-	Complying
	Binary Input					
	Breaker Contacts	Yes	Functional	-	-	Complying
	Carrier Receive	Yes	Functional	-	-	Complying
	Time Synchronization	Yes	Functional	-	-	Complying

Name. Signature & Contact No. of team Carrying out Protection audit:	1. Mukul Yadav, AEN-III (MPT&S), Jaipur 9413382334	
	2. Munesh Kr. Meena, JEN-I O/o AEN-III (MPT&S), Jaipur 9413383124	
Name. Signature & Contact No. of representative of utility whose Protection audit is being carried out:	1. Dinesh Kumar Jain, SE (Prot.Engg.), RVPN, Jaipur, 9413393540	

Distance relay calculation for 220 KV IG Nagar-PGCIL Bassi Line



EARTH FAULT COMPENSATION

RE/RL=1/3((Ro/R1)-1)

XE/XL=1/3((Xo/X1)-1)

kZ0 Res. Comp.= kZ0 = (Z0 – Z1) / 3Z1

Principle line Length	:	30 KM.
Shortest Line Length considered on Remote Bus		29.8 KM.
Longest line length Considered on Remote Bus		34.91 KM.

kZ0	**kZ0 angle**
0.734	**-1.83**

Conductor Used : **Zebra**

Conductor Parameters :	**R**	**X**	**Z**	**Angle**
Positive Sequence(Z1):	0.081	0.4	0.408	78.55
Zero Sequence(Z0):	0.2875	1.275	1.307	77.29
CTR:	1000/1 Amp= 1000			
PTR:	220000/110 V= 2000			
CTR/PTR:	0.5			

Zone 1(Forward) Reach:	80	% of the Line to be Protected
Zone 2(Forward) Reach:	50	% of the Shortest Line on remote Bus+100 % of the Protected Line

Zone 3(Forward) Reach:	110	% Longest line length on Remote Bus+100 % of the Protected Line
Zone 4(Reverse) Reach:	2	Km

Zone 1 forward Reach= 80% of line length (IG Nagar to PGCIL)* +ve Sequence impedance of conductor/km*(CTR/PTR)

= 4.897 **Ohm** **T1= Instt.**

Zone 2 forward Reach= 100% of line length (IG Nagar to PGCIL)+50 % of the Shortest Line on remote Bus(PGCIL-Dausa)*+ve Sequence impedance of conductor/km*(CTR/PTR)

= 9.162 **Ohm** **T2=350 ms**

Zone 3 forward Reach=100% of line length (IG nagar to PGCIL)+110 % Longest line length on Remote Bus(PGCIL-KKD)*+ve Sequence impedance of conductor/km*(CTR/PTR)

= 13.958 **Ohm** **T3=1000 ms**

Zone 4 reverse Reach=2 km*+ve Sequence impedance of conductor/km*(CTR/PTR)

= 0.408 **Ohm** **T4=160 ms**

Directional O/C & E/F relay calculation for 220 kV IG Nagar-PGCIL Bassi Line

Fault MVA of 220 kV BUS	:	8555	MVA
3 Phase Short Circuit Current	:	15891	Amp
Phase-Phase Short Circuit Current	:	13762	Amp
Phase to Earth Short Circuit Current	:	8581	Amp

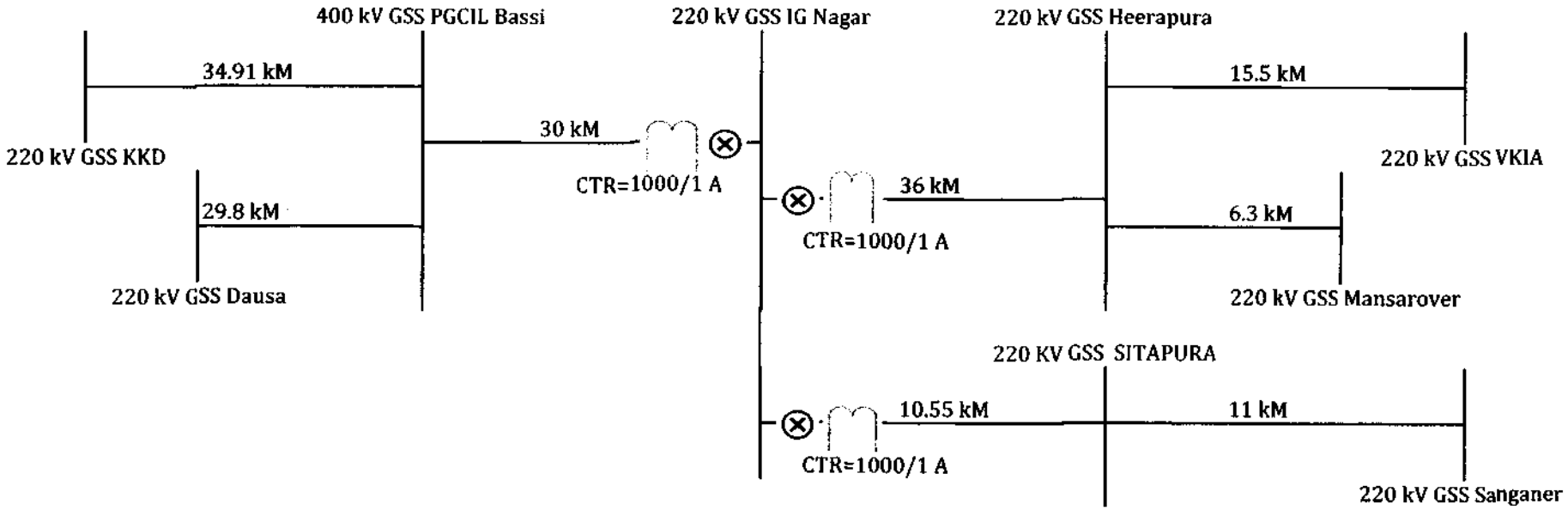
Directional Overcurrent Element Setting

CT Ratio	1000/1		
Plug Setting	100% i.e.	1000	Amp
Plug Setting Multiplier	13.762		
Time of Operation	0.5	Seconds	
TMS	**0.192**		

Directional Earthfault Element Setting

CT Ratio	1000/1		
Plug Setting	20 % i.e.	200	Amp
Plug Setting Multiplier	42.905		
Time of Operation	0.5	Seconds	
TMS	**0.227**		

Distance relay calculation for 220KV IG NAGAR -Heerapura Line



Principle line Length	:	36 KM.
Shortest Line Length considered on Remote Bus		6.3 KM.
Longest line length Considered on Remote Bus		15.5 KM.

EARTH FAULT COMPENSATION

	kZ0	kZ0 angle
RE/RL=1/3((Ro/R1)-1)		
XE/XL=1/3((Xo/X1)-1)		
kZ0 Res. Comp.= kZ0 = (Z0 – Z1) / 3Z1	**0.734**	**-1.83**

Conductor Used : **Zebra**

Conductor Parameters :

	R	X	Z	Angle
Positive Sequence(Z1):	0.081	0.4	0.408	78.55
Zero Sequence(Z0):	0.2875	1.275	1.307	77.29

CTR: 1000/1 Amp= 1000

PTR: 220000/110 V= 2000

CTR/PTR: 0.5

Zone 1(Forward) Reach:	80	% of the Line to be Protected
Zone 2(Forward) Reach:	50	% of the Shortest Line on remote Bus+100 % of the Protected Line
Zone 3(Forward) Reach:	110	% Longest line length on Remote Bus+100 % of the Protected Line
Zone 4(Reverse) Reach:	2	Km

Zone 1 forward Reach= 80% of line length (IG Nagar to Heerapura)* +ve Sequence impedance of conductor/km*(CTR/PTR)

= 5.877 Ohm T1= Instt.

Zone 2 forward Reach= 100% of line length (IG Nagar to Heerapura)+50 % of the Shortest Line on remote Bus(Heerapura-Mansarover)*+ve Sequence impedance of conductor/km*(CTR/PTR)

= 7.989 Ohm T2=350 ms

Zone 3 forward Reach=100% of line length (IG Nagar to Heerapura)+110 % Longest line length on Remote Bus(Heerapura-VKIA)*+ve Sequence impedance of conductor/km*(CTR/PTR)

= 10.825 Ohm T3=1000 ms

Zone 4 reverse Reach=2 km*+ve Sequence impedance of conductor/km*(CTR/PTR)

= 0.408 Ohm T4=160 ms

Directional O/C & E/F relay calculation for 220 kV IG Nagar-Heerapura Line

Fault MVA of 220 kV BUS	:	8555	MVA
3 Phase Short Circuit Current	:	15891	Amp
Phase-Phase Short Circuit Current	:	13762	Amp
Phase to Earth Short Circuit Current	:	8581	Amp

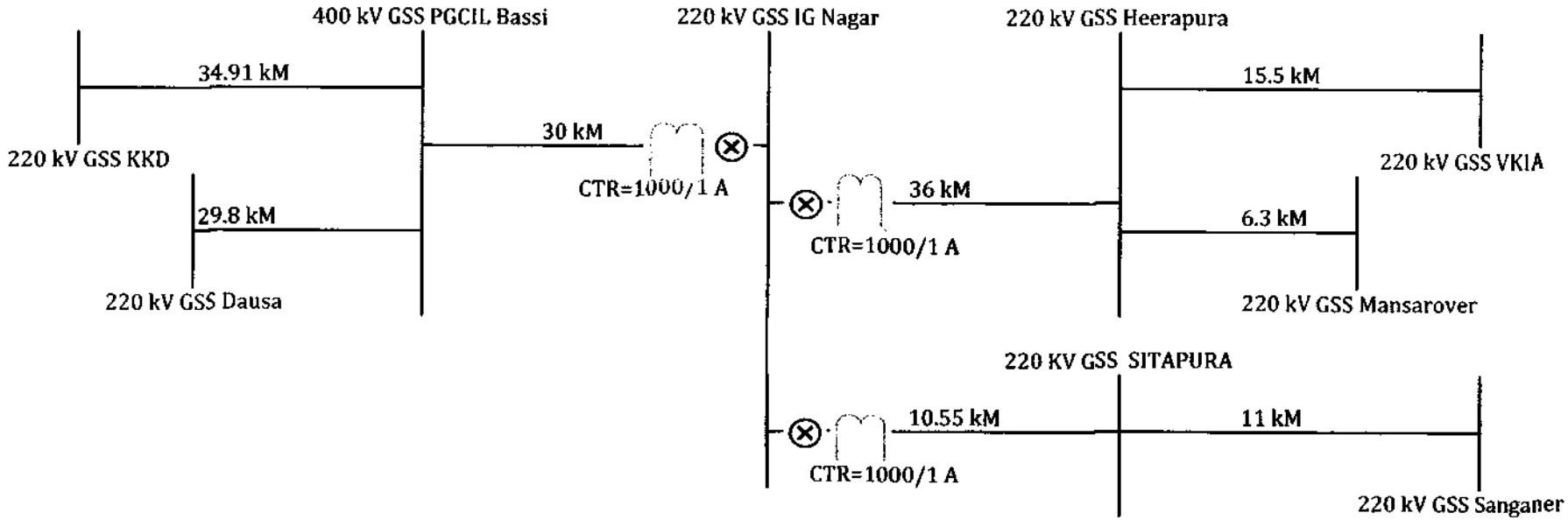
Directional Overcurrent Element Setting

CT Ratio	1000/1		
Plug Setting	100 % i.e.	1000	Amp
Plug Setting Multiplier	13.762		
Time of Operation	0.5	Seconds	
TMS	0.192		

Directional Earthfault Element Setting

CT Ratio	1000/1		
Plug Setting	20 % i.e.	200	Amp
Plug Setting Multiplier	42.905		
Time of Operation	0.5	Seconds	
TMS	0.227		

Distance relay calculation for 220 KV IG Nagar -Sitapura Line



Principle line Length	10.55 KM.
Shortest Line Length considered on Remote Bus	11 KM.
Longest line length Considered on Remote Bus	11 KM.

Conductor Used : **Zebra**

Conductor Parameters :

	R	X	Z	Angle
Positive Sequence(Z1):	0.081	0.4	0.408	78.55
Zero Sequence(Z0):	0.2875	1.275	1.307	77.29

CTR: 1000/1 Amp= 1000

PTR: 220000/110 V= 2000

CTR/PTR: 0.5

EARTH FAULT COMPENSATION

RE/RL=1/3((Ro/R1)-1)

XE/XL=1/3((Xo/X1)-1)

kZ0 Res. Comp.= kZ0 = (Z0 – Z1) / 3Z1

kZ0	**kZ0 angle**
0.734	**-1.83**

Zone 1(Forward) Reach:	80	% of the Line to be Protected
Zone 2(Forward) Reach:	50	% of the Shortest Line on remote Bus+100 % of the Protected Line
Zone 3(Forward) Reach:	110	% Longest line length on Remote Bus+100 % of the Protected Line
Zone 4(Reverse) Reach:	2	Km

Zone 1 forward Reach= 80% of line length (IG Nagar to Sitapura)* +ve Sequence impedance of conductor/km*(CTR/PTR)

= 1.722 Ohm T1= Instt.

Zone 2 forward Reach= 100% of line length (Ig Nagar to Sitpura)+50 % of the Shortest Line on remote Bus(Sitapura-Sanganer)*+ve Sequence impedance of conductor/km*(CTR/PTR)

= 3.275 Ohm T2=350 ms

Zone 3 forward Reach=100% of line length (I G Nagar to Sitapura)+110 % Longest line length on Remote Bus(Sitapura-Sanganer)*+ve Sequence impedance of conductor/km*(CTR/PTR)

= 4.622 Ohm T3=1000 ms

Zone 4 reverse Reach=2 km*+ve Sequence impedance of conductor/km*(CTR/PTR)

= 0.408 Ohm T4=160 ms

Directional O/C & E/F relay calculation for 220 kV IG Nagar -Sitapura Line

Fault MVA of 220 kV BUS	:	8555	MVA
3 Phase Short Circuit Current	:	15891	Amp
Phase-Phase Short Circuit Current	:	13762	Amp
Phase to Earth Short Circuit Current	:	8581	Amp

Directional Overcurrent Element Setting

CT Ratio	1000/1		
Plug Setting	100% i.e.	1000	Amp
Plug Setting Multiplier	13.762		
Time of Operation	0.5	Seconds	
TMS	**0.192**		

Directional Earthfault Element Setting

CT Ratio	1000/1		
Plug Setting	20 % i.e.	200	Amp
Plug Setting Multiplier	42.905		
Time of Operation	0.5	Seconds	
TMS	**0.227**		

Rajasthan Rajya Vidhyut Prasaran Nigam Limited

Report of the Protection Audit

A. General Information

i)	Name of utility:	Rajasthan Rajya Vidhyut Prasaran Nigam Limited
ii)	Name of Voltage level of Substation:	220 kV GSS Indira Gandhi Nagar
iii)	Date of Commissioning:	25.02.2011
iv)	Type of Bus Switching Scheme	Two Main Bus (One & Half scheme)
v)	Name and Organization of Audit Team	Sh. Mukul Yadav, AEN-III (MPT&S), RVPN, Jaipur
		Sh. Munesh Kumar Meena , JEN-I O/o AEN-III (MPT&S), RVPN, Jaipur
vi)	Name of representative from utility whose audit being carried out	Sh. D.K. Jain, SE (Prot. Engg.) RVPNL Jaipur

B. Checklist for Protection Audit

S.No.	Check		Functional/ Non-Functional/Enabled /Disabled	Type of Relay*(Numerical /Static/Electromechanical)	Setting as found in field*/**	Compliance status w.r.t. regulatory provisions
Transformer Protection Panel						
(i)	**Name of Transformer (Rating/Capacity)**	**220/132 kV, 100 MVA Areva make Transformer-I**				
	Tripping by Buchholz Relay (Alarm)	Yes	Enabled	Electromechanical		Complying
	Differential Protection	Yes	Enabled	Numerical		Complying
	2nd Harmonic Block (Setting)		Enabled		15%	Complying
	Event Logger Operation	Yes	In built feature of numerical differential relay			
	Restricted Earth Fault Protection (HV Side)(Auto X-mer)	Yes	Functional	Numerical	41.9 V	Complying
	Event Logger Operation	Yes	In built feature of numerical REF relay			
	REF Protection (LV Side)	NA				
	Event Logger Operation	NA				
	Backup Over Current	Yes	Enabled	Numerical	0.3/0.197	Complying
	Event Logger Operation	Yes	In built feature of numerical O/C & E/F relay			
	Earth Fault Protection	Yes	Enabled	Numerical	0.1/0.254	Complying
	Event Logger Operation	Yes	In built feature of numerical O/C & E/F relay			
	Over Flux Protection	Yes	Enabled			Complying
	Event Logger Operation	Yes	In built feature of numerical differential relay			
	Local Breaker Back Up	Yes				
	Retrip	Yes	Enabled			Complying
	Current and Time Setting				120%/100 ms+100 ms External timer	Complying
	Separate Single and three phase initiation	No (3 phase only)				Complying
	Earth Fault	No				Complying
	Event logger	Yes	In built feature of numerical LBB relay			
(i)	**Name of Transformer (Rating/Capacity)**	**220/132 kV, 100 MVA Areva make Transformer-II**				
	Tripping by Buchholz Relay (Alarm)	Yes	Enabled	Electromechanical		Complying
	Differential Protection	Yes	Enabled	Numerical		Complying
	2nd Harmonic Block (Setting)		Enabled		15%	Complying

S.No.	Check		Functional/ Non-Functional/Enabled /Disabled	Type of Relay*(Numerical /Static/Electromechanical)	Setting as found in field*/**	Compliance status w.r.t. regulatory provisions
	Event Logger Operation	Yes	In built feature of numerical differential relay			
	Restricted Earth Fault Protection (HV Side)(Auto X-mer)	Yes	Functional	Numerical	41.8 V	Complying
	Event Logger Operation	Yes	In built feature of numerical REF relay			
	REF Protection (LV Side)	NA				
	Event Logger Operation	NA				
	Backup Over Current	Yes	Enabled	Numerical	0.3/0.197	Complying
	Event Logger Operation	Yes	In built feature of numerical O/C & E/F relay			
	Earth Fault Protection	Yes	Enabled	Numerical	0.1/0.253	Complying
	Event Logger Operation	Yes	In built feature of numerical O/C & E/F relay			
	Over Flux Protection	Yes	Enabled			Complying
	Event Logger Operation	Yes	In built feature of numerical differential relay			
	Local Breaker Back Up	Yes				
	Retrip	Yes	Enabled			Complying
	Current and Time Setting				120%/100 ms+100 ms External timer	Complying
	Separate Single and three phase initiation	No(3 phase only)				Complying
	Earth Fault	No				Complying
	Event logger	Yes	In built feature of numerical LBB relay			

Name. Signature & Contact No. of team Carrying out Protection audit:	1. Mukul Yadav, AEN-III (MPT&S), Jaipur 9413382334	
	2. Munesh Kr. Meena, JEN-I O/o AEN-III (MPT&S), Jaipur 9413383124	
Name. Signature & Contact No. of representative of utility whose Protection audit is being carried out:	1. Dinesh Kumar Jain, SE (Prot.Engg.), RVPN, Jaipur, 9413393540	

Non Directional O/C & E/F relay calculation for 220/132 kV, 100 MVA Transformer-I

Fault MVA of 220 kV BUS	:	8555 MVA
P.U. Impedance of 220 kV BUS		0.0117
% Imepdance of transformer at Normal Tap		12.17 %
Transformer HV Voltage rating		220000 Volts
Transformer LV Voltage rating		132000 Volts
Transformer MVA Capacity		100 MVA
P.U. Impedance of Transformer		0.1217
Total P.U. Impedance		0.1334
Fault MVA of 132 kV BUS	:	750 MVA
3 Phase through fault Short Circuit Current		3280 Amp
Phase-Phase through fault Short Circuit Current		2840 Amp
Phase to Earth through fault Short Circuit Current		1771 Amp

Non Directional Overcurrent Element Setting

CT Ratio	1000/1		
Plug Setting	30 % i.e.	300	Amp
Plug Setting Multiplier	9.466667		
Time of Operation	0.6	Seconds	
TMS	0.197		

Non Directional Earthfault Element Setting

CT Ratio	1000/1		
Plug Setting	10 % i.e.	100	Amp
Plug Setting Multiplier	17.71		
Time of Operation	0.6	Seconds	
TMS	0.254		

Stablizing Resistor calculation for Restricted Earth fault relay

Transformer Full load current HV	262	Amp
Transformer Full load current LV	437	Amp
Maximum fault current on through fault (If)	3591	Amp
Bushing CT Ratio	600	
Lead resistance	1	Ohm
Rct	5	Ohm
Vk=	If*(Rct+2Rl)	
Vk=	41.9	Volts
REF Operating Current	0.1	Amp
Stablizing Resistor	419	Ohm

Non Directional O/C & E/F relay calculation for 220/132 kV, 100 MVA Transformer-II

Fault MVA of 220 kV BUS	:	8555	MVA
P.U. Impedance of 220 kV BUS		0.0117	
% Imepdance of transformer at Normal Tap		12.21	%
Transformer HV Voltage rating		220000	Volts
Transformer LV Voltage rating		132000	Volts
Transformer MVA Capacity		100	MVA
P.U. Impedance of Transformer		0.1221	
Total P.U. Impedance		0.1338	
Fault MVA of 132 kV BUS	:	747	MVA
3 Phase through fault Short Circuit Current		3267	Amp
Phase-Phase through fault Short Circuit Current		2829	Amp
Phase to Earth through fault Short Circuit Current		1764	Amp

Non Directional Overcurrent Element Setting

CT Ratio	1000/1		
Plug Setting	30 % i.e.	300	Amp
Plug Setting Multiplier	9.43		
Time of Operation	0.6	Seconds	
TMS	0.197		

Non Directional Earthfault Element Setting

CT Ratio	1000/1		
Plug Setting	10 % i.e.	100	Amp
Plug Setting Multiplier	17.64		
Time of Operation	0.6	Seconds	
TMS	0.253		

Stablizing Resistor calculation for Restricted Earth fault relay

Transformer Full load current HV	262	Amp
Transformer Full load current LV	437	Amp
Maximum fault current on through fault (If)	3579	Amp
Bushing CT Ratio	600	
Lead resistance	1	Ohm
Rct	5	Ohm
Vk=	If*(Rct+2Rl)	
Vk=	41.8	Volts
REF Operating Current	0.1	Amp
Stablizing Resistor	418	Ohm

Rajasthan Rajya Vidhyut Prasaran Nigam Limited

Report of the Protection Audit

A. General Information

i)	Name of utility:	Rajasthan Rajya Vidhyut Prasaran Nigam Limited
ii)	Name of Voltage level of Substation:	220 kV GSS Indira Gandhi Nagar
iii)	Date of Commissioning:	25.02.2011
iv)	Type of Bus Switching Scheme	Two Main Bus (One & Half scheme)
v)	Name and Organization of Audit Team	Sh. Mukul Yadav, AEN-III (MPT&S), RVPN, Jaipur
		Sh. Munesh Kumar Meena , JEN-I O/o AEN-III (MPT&S), RVPN, Jaipur
vi)	Name of representative from utility whose audit being carried out	Sh. D.K. Jain, SE (Prot. Engg.) RVPNL Jaipur

B. Checklist for Protection Audit

S.No.	Check		Functional/ Non-Functional/Enabled/ Disabled	Type of Relay*(Numerical /Static/Electromechanical)	Setting as found in field*/**	Compliance status w.r.t. regulatory provisions
1	**DC system**					
	No. of independent DC Sources	2 nos. 220 VDC	Functional			
	Potential between +ive & earth (Source-1)	64.3 V	-	-	-	-
	Potential between -ive & earth (Source-1)	186 V	-	-	-	-
	Potential between +ive & earth (Source-2)	118 V	-	-	-	-
	Potential between -ive & earth (Source-2)	110 V	-	-	-	-
2	Event Logger panel	No	-	-	-	-
3	Event Logger Time Synchronised	NA	-	-	-	-
	Disturbance Recorder	NA	-	-	-	-
	DR Time Synchronised	NA	-	-	-	-
4	Bus bar Protection	Yes	Functional	Numerical	120 % Pickup	Complying
	Stability Check	Yes(On Running load)	-	-	-	-
	EL output for this event	No	-	-	-	-
	DR if available	No	-	-	-	-
5	DG Set	No	-	-	-	-
	Mock testing of a sample protection associated with transmission line* **	Yes/ No	i. If Yes then observation..... ii. If no, the reason for the same.....			
6	**Local Breaker Back Up(For Line)**		-	Numerical	-	-
	Retrip	Yes	Enabled	-	-	Complying
	Current and Time Setting	Yes	-	-	PU-120%/100 ms+100 ms External timer	Complying
	Separate Single and three phase initiation	Yes	Functional	-	-	Complying
	Earth Fault	No	Disabled	-	-	Complying
	Event logger operation	Yes	In built feature of numerical LBB relay			

Name. Signature & Contact No. of team Carrying out Protection audit:	1. Mukul Yadav, AEN-III (MPT&S), Jaipur 9413382334	
	2. Munesh Kr. Meena, JEN-I O/o AEN-III (MPT&S), Jaipur 9413383124	
Name. Signature & Contact No. of representative of utility whose Protection audit is being carried out:	1. Dinesh Kumar Jain, SE (Prot.Engg.), RVPN, Jaipur, 9413393540	

Rajasthan Rajya Vidhyut Prasaran Nigam

Report of the Protection Audit dt 28.6.24

A. General Information

(i) Name of Utility:- 220 KV GSS Madri

(ii) Name of Voltage Level of Sub Station:- 220/132 KV

(iii) Date of Commission ng:-19.02.1977

(iv) Type of Bus Switching Scheme:- Main Bus and Aux. Bus

(v) Name and Organization of Audit Team:- XEN / AEN (MPT&S) RVPNL , Udaipur

(vi)Name of representative from utility whose audit being carried out:-XEN / AEN(MPT&S) RVPNL , Madri

B. Check List for Protection Audit

S.No	Check		Functional/NonFunctional/ Enabled/Disabled	Type of Relay (Numerical/Static/Electromechanical)	Setting as found in field	Compliance Status w.r.t regulatory provisions
	Transformer Protection Panel:					
(i)	**Name of Transformer (Rating/Capacity)**	**220/132KV , 100MVA TELK T/F**				
	Tripping by Buchholz relay (Alarm)	YES	Functional	Conventional		
	Differential Protection	YES	Functional	Numerical	As per code of configuration .	
	2nd Harmonic Block (Setting)	YES	Enable			
	Event logger Operation	NO				
	Restricted Earth Fault Protection (HV Side)	YES	Enable		20%	
	Event logger Operation	Yes/No				
	Restricted Earth Fault Protection (LV Side)	YES	Enable		20%	
	Event logger Operation	Yes/No				
	Backup Over Current	YES	Enable		65% , .16	
	Event logger Operation	NO				
	Earth Fault Protection	YES	Enable		20% , 0.16	
	Event logger Operation	NO				
	Over Flux Protection	YES	Enable		110% , 5Sec.	
	Event logger Operation	NO			120% , 1Sec.	
	Local Breaker Back Up	Yes	Disable		10%	
	Retrip	YES			250m	
	Current and Time Setting	Yes/No			500m	
	Separate Single and three Phase Initiation	NO				
	Earth Fault	Yes/No				
	Event logger Operation	NO				
(ii)	**Name of Transformer (Rating/Capacity)**	**220/132KV , 160MVA TELK T/F**				
	Tripping by Buchholz relay (Alarm)	YES	Functional	Conventional		
	Differential Protection	YES	Functional	Numerical	As per code of configuration .	
	2nd Harmonic Block (Setting)	YES	Enable			
	Event logger Operation	No				
	Restricted Earth Fault Protection (HV Side)	YES	Enable			
	Event logger Operation	Yes/No				
	Restricted Earth Fault Protection (LV Side)	YES	Enable			
	Event logger Operation	Yes/No				
	Backup Over Current	YES	Enable			
	Event logger Operation	Yes/No				
	Earth Fault Protection	YES	Enable			
	Event logger Operation	Yes/No				
	Over Flux Protection	Yes	Enabled			

Executive Engineer (MPT&S)
R.R.V.P.N.L., Udaipur

Assistant Engineer (MPT&S)
RRVPNL, UDAIPUR

	Event logger Operation	No				
	Local Breaker Back Up	Yes	Disable			
	Retrip	Yes				
	Current and Time Setting					
	Separate Single and three Phase Initiation	No				
	Earth Fault	No				
	Event logger Operation	No				
(iii)	**Name of Transformer (Rating/Capacity)**	**132/33KV , 20/25 MVA T/F - 1**				
	Tripping by Buchholz relay (Alarm)	YES	Functional	Conventional		
	Differential Protection	YES/NO	Functional	EM- DTH31	30% bias	
	2nd Harmonic Block (Setting)	NO			20% P/U	
	Event logger Operation	NO				
	Restricted Earth Fault Protection (HV Side)	NO				
	Event logger Operation	Yes/No				
	Restricted Earth Fault Protection (LV Side)	NO				
	Event logger Operation	Yes/No				
	Backup Over Current	YES			2.5A , 0.18	
	Event logger Operation	NO				
	Earth Fault Protection	YES			1A , 0.2	
	Event logger Operation	NO				
	Over Flux Protection	NO				
	Event logger Operation	Yes/No				
	Local Breaker Back Up	NO				
	Retrip	NO				
	Current and Time Setting					
	Separate Single and three Phase Initiation	NO				
	Earth Fault	NO				
	Event logger Operation	NO				

(iv)	**Name of Transformer (Rating/Capacity)**	**132/33KV , 20/25 MVA T/F - 2**				
	Tripping by Buchholz relay (Alarm)	YES	Functional	Conventional		
	Differential Protection	YES		EM-DTH 32	20% , P/U	
	2nd Harmonic Block (Setting)	NO			30% , P/U	
	Event logger Operation	NO				
	Restricted Earth Fault Protection (HV Side)	NO				
	Event logger Operation	NO				
	Restricted Earth Fault Protection (LV Side)	NO				
	Event logger Operation	NO				
	Backup Over Current	YES			5A , 0.18%	
	Event logger Operation	NO				
	Earth Fault Protection	YES			1A , 0.2	
	Event logger Operation	NO				
	Over Flux Protection	YES			105%	
	Event logger Operation	NO			120%	
	Local Breaker Back Up	NO				
	Retrip	NO				
	Current and Time Setting					
	Separate Single and three Phase Initiation	NO				
	Earth Fault	NO				
	Event logger Operation	NO				

Executive Engineer (MPT&S)
R.R.V.P.N.L., Udaipur

(iv)	**Name of Transformer (Rating/Capacity)**	**132/33KV , 40/50 MVA T/F - 3**				
	Tripping by Buchholz relay (Alarm)	YES	Functional	Conventional		
	Differential Protection	YES	Functional	ABB RADSB	20% , P/U	
	2nd Harmonic Block (Setting)	NO				
	Event logger Operation	NO				
	Restricted Earth Fault Protection (HV Side)	NO				
	Event logger Operation	NO				
	Restricted Earth Fault Protection (LV Side)	NO				
	Event logger Operation	NO				
	Backup Over Current	YES			90% , 0.2	
	Event logger Operation	NO				
	Earth Fault Protection	YES			20% , 0.23	
	Event logger Operation	NO				
	Over Flux Protection	YES			110% , 0.5Sec	
	Event logger Operation	NO			115% , 1Sec	
	Local Breaker Back Up	NO				
	Retrip	NO				
	Current and Time Setting	NO				
	Separate Single and three Phase Initiation	NO				
	Earth Fault	NO				
	Event logger Operation	NO				

Rajasthan Rajya Vidhyut Prasaran Nigam

Report of the Protection Audit

A. **General Information**

(i) Name of Utility:- 220 KV GSS Madri (ii) Name of Voltage Level of Sub Station:- 220/132 KV

(iii) Date of Commissioning:-19.02.1977 (iv) Type of Bus Switching Scheme:- Main Bus and Aux. Bus

(v) Name and Organization of Audit Team:- XEN / AEN (MPT&S) RVPNL , Udaipur

(vi)Name of representative from utility whose audit being carried out:-XEN / AEN(MPT&S) RVPNL , Madri

B. Check List for Protection Audit

S.No	Check		Functional/NonFunctional/ Enabled/Disabled	Type of Relay (Numerical/Static/Electromechanical)	Setting as found in field	Compliance Status w.r.t regulatory provisions
	Distance Protection Panel:M-I/II		Functional	Numerical		
(V)	**Name of Line**		220KV Debari-M-I/M-II		As per code of configuration .	
	Pole Discrepancy Relay	Yes				
	PLCC Panel	Yes				
	Zone-1/2/3/4/5 (Settings)	Yes				
	Time Check-Z-1/2/3/4/5(Settings)	Yes				
	SOTF	Yes/No				
	Aided Scheme	Yes				
	Fault Locator	Yes				
	Power Swing (Setting R & X)					
	All Zone Block	Yes				
	DR	Yes				
	Binary Inputs					
	Breaker Contacts	Yes				
	Carrier Receive	Yes				
	Time Synchronization	NO				
(VI)	**Name of Line**		220KV Banswara-M-I/M-II		As per code of configuration .	
	Pole Discrepancy Relay	Yes	Functional	Numerical		
	PLCC Panel	Yes				
	Zone-1/2/3/4/5 (Settings)	Yes				
	Time Check-Z-1/2/3/4/5(Settings)	Yes				
	SOTF	Yes/No				
	Aided Scheme	Yes				
	Fault Locator	Yes				
	Power Swing (Setting R & X)					
	All Zone Block	Yes				
	DR	Yes				
	Binary Inputs					
	Breaker Contacts	Yes				
	Carrier Receive	Yes				
	Time Synchronization	Yes/No				

Executive Engineer (MPT&S)
R.R.V.P.N.L. Udaipur

Assistant Engineer (MPT&S)
RRVPNL, UDAIPUR

	Distance Protection Panel:M-I/II					
(VII)	Name of Line		132KV Debari			
	Pole Discrepancy Relay	NO	Functional	Numerical	As per code of configuration .	
	PLCC Panel	Yes/No				
	Zone-1/2/3/4/5 (Settings)	Yes/No				
	Time Check-Z-1/2/3/4/5(Settings)	Yes/No				
	SOTF	Yes/No				
	Aided Scheme	Yes				
	Fault Locator	Yes				
	Power Swing (Setting R & X)					
	All Zone Block	Yes				
	DR	Yes				
	Binary Inputs	Yes/No				
	Breaker Contacts	Yes				
	Carrier Receive	Yes				
	Time Synchronization	Yes/No				
(VIII)	Name of Line		132KV Balicha			
	Pole Discrepancy Relay	NO	Functional	Numerical	As per code of configuration .	
	PLCC Panel	Yes				
	Zone-1/2/3/4/5 (Settings)	Yes				
	Time Check-Z-1/2/3/4/5(Settings)	Yes				
	SOTF	No				
	Aided Scheme	Yes				
	Fault Locator	Yes				
	Power Swing (Setting R & X)					
	All Zone Block	Yes				
	DR	Yes				
	Binary Inputs					
	Breaker Contacts	Yes				
	Carrier Receive	Yes				
	Time Synchronization	Yes/No				
(V)	Name of Line		132KV Pratap nagar			
	Pole Discrepancy Relay	NO	Functional	ABB RAZOA	As per code of configuration .	
	PLCC Panel	Yes				
	Zone-1/2/3/4/5 (Settings)	Yes				
	Time Check-Z-1/2/3/4/5(Settings)	Yes				
	SOTF	Yes/No				
	Aided Scheme	NO				
	Fault Locator	NO				
	Power Swing (Setting R & X)	NO				
	All Zone Block	Yes/No				
	DR	NO				
	Binary Inputs	NO				
	Breaker Contacts	NO				
	Carrier Receive	NO				
	Time Synchronization	NO				
(VI)	Name of Line		132KV Reliance Chem-TOSHIBA			
	Pole Discrepancy Relay	NO	Non-Functional	ABB RAZOA	As per code of configuration .	
	PLCC Panel	NO				
	Zone-1/2/3/4/5 (Settings)	NO				
	Time Check-Z-1/2/3/4/5(Settings)	NO				
	SOTF	NO				
	Aided Scheme	NO				
	Fault Locator	NO				
	Power Swing (Setting R & X)	NO				
	All Zone Block	NO				
	DR	NO				
	Binary Inputs	NO				
	Breaker Contacts	NO				
	Carrier Receive	NO				
	Time Synchronization	NO				

Executive Engineer (MPT&S)
R.R.V.P.N.L., Udaipur

Assistant Engineer (MPT&S)
RRVPNL, UDAIPUR

	Distance Protection Panel:M-I/II					
(VII)	**Name of Line**		132KV RSMM			
	Pole Discrepancy Relay	NO	Functional	Numerical	As per code of configuration .	
	PLCC Panel	Yes				
	Zone-1/2/3/4/5 (Settings)	Yes				
	Time Check-Z-1/2/3/4/5(Settings)	Yes				
	SOTF	NO				
	Aided Scheme	NO				
	Fault Locator	Yes				
	Power Swing (Setting R & X)	Yes				
	All Zone Block	Yes				
	DR	Yes				
	Binary Inputs	NO				
	Breaker Contacts	NO				
	Carrier Receive	NO				
	Time Synchronization	NO				
(VIII)	**Name of Line**		132KV Dakan Kotda			
	Pole Discrepancy Relay	NO	Functional	Numerical	As per code of configuration .	
	PLCC Panel	Yes				
	Zone-1/2/3/4/5 (Settings)	Yes				
	Time Check-Z-1/2/3/4/5(Settings)	Yes				
	SOTF	Yes				
	Aided Scheme	NO				
	Fault Locator	Yes				
	Power Swing (Setting R & X)	Yes				
	All Zone Block	Yes				
	DR	Yes				
	Binary Inputs	Yes/No				
	Breaker Contacts	No				
	Carrier Receive	No				
	Time Synchronization	No				

Executive Engineer (MPT&S)
R.R.V.P.N. Udaipur

Assistant Engineer (MPT&S)
RRVPNL UDAIPUR

Rajasthan Rajya Vidhyut Prasaran Nigam

Report of the Protection Audit

A. General Information

(i) Name of Utility:- 220 KV GSS Madri

(ii) Name of Voltage Level of Sub Station:- 220/132 KV

(iii) Date of Commissioning:-19.02.1977

(iv) Type of Bus Switching Scheme:- Main Bus and Aux. Bus

(v) Name and Organization of Audit Team:- XEN / AEN (MPT&S) RVPNL , Udaipur

(vi)Name of representative from utility whose audit being carried out:-XEN / AEN(MPT&S) RVPNL , Madri

B. Check List for Protection Audit

S.No	Check		Functional/NonFunctional/ Enabled/Disabled	Type of Relay (Numerical/Static/Electromechanical)	Setting as found in field	Compliance Status w.r.t regulatory provisions
1	**DC System**		Functional	117V		
	No. Of Independent DC Source	2				
	Potential Between +ve & Earth (Source-I)	115 V				
	Potential Between -ve & Earth (Source-I)	002 V				
	Potential Between +ve & Earth (Source-II)	116V	Functional	226V		
	Potential Between -ve & Earth (Source-II)	110V				
2	**Event Logger Panel**	No				
3	**Event Logger Time Synchronised**	No				
	Disturbance Recorder	No				
	DR Time Synchronised	No				
4	**Bus Bar Protection**	No				
	Stability Check					
	EL Output for this Event	No				
	DR if Available	No				
5	**DG Set**	No				
6	**Mock Testing of Sample Protection Associated with Transmission line**	No				
7	**LBB/BFR**	No				
	Retrip	No				
	Current and Time Setting	No				
	Separate Single and Three Phase initiation	No				
	Earth Fault	No				
	Event Logger Operation	No				

Rajasthan Rajya Vidhyut Prasaran Nigam

Report of the Protection Audit

A. General Information

(i) Name of Utility:- 220 KV GSS Madri

(ii) Name of Voltage Level of Sub Station:- 220/132 KV

(iii) Date of Commissioning:-19.02.1977

(iv) Type of Bus Switching Scheme:- Main Bus and Aux. Bus

(v) Name and Organization of Audit Team:- XEN / AEN (MPT&S) RVPNL , Udaipur

(vi)Name of representative from utility whose audit being carried out:-XEN / AEN(MPT&S) RVPNL , Madri

B. Check List for Protection Audit

S.No	Check		Functional/NonFunctional/ Enabled/Disabled	Type of Relay (Numerical/Static/Electromechanical)	Setting as found in field	Compliance Status w.r.t regulatory provisions
	Reactor Protection Panel:	NA	No Reactor Installed			
	Tripping by Buchholz relay (Alarm)	No				
	Differential Protection	No				
	2nd Harmonic Block (Setting)	No				
	Event logger Operation	No				
	Restricted Earth Fault Protection (HV Side)	No				
	Event logger Operation	No				
	Restricted Earth Fault Protection (LV Side)	No				
	Event logger Operation	No				
	Backup Over Current	No				
	Event logger Operation	No				
	Earth Fault Protection	No				
	Event logger Operation	No				
	Over Flux Protection	No				
	Event logger Operation	No				

Executive Engineer (MPT&S)
R.R.V.P.N.L., Udaipur

Rajasthan Rajya Vidhyut Prasaran Nigam Limited

Report of the Protection Audit

A. General Information

i)	Name of utility:	Rajasthan Rajya Vidhyut Prasaran Nigam Limited
ii)	Name of Voltage level of Substation:	220 kV GSS Niwana
iii)	Date of Commissioning:	29.03.2016
iv)	Type of Bus Switching Scheme	Two main One Auxillary Bus
v)	Name and Organization of Audit Team	Avdesh Gupta, AEN-II(MPT&S), RVPN, Jaipur
		Kamal Singh Gurjar,JEN-I(O/o AEN-II(MPT&S) RVPN,Jaipur
vi)	Name of representative from utility whose audit being carried out	Sh.D.K.Jain,SE(PROT.ENGG.) ,RVPN, Jaipur

B. Checklist for Protection Audit

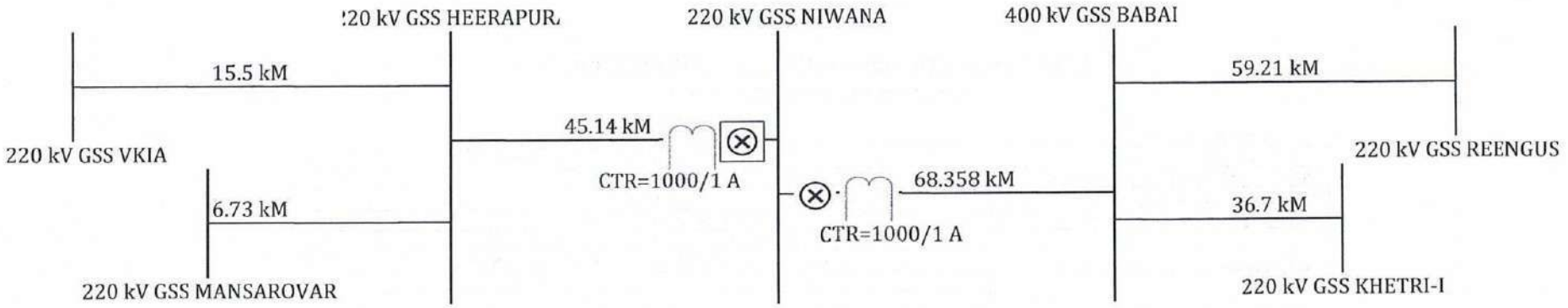
S.No.	Check		Functional / Non-Functional /Enabled/ Disabled	Type of Relay*(Numerical/Static/Electromechanical)	Setting as found in field*/**	Compliance status w.r.t. regulatory provisions
Distance protection Panel:M-I/II						
(i)	**Name of Line**	**220 kV HEERAPURA Line**				
	Pole discrepancy relay	Yes	Functional(On CB)	Electromechanical	2 sec.	
	PLCC panel	Yes	Functional			
	Zone-1/2/3/4/5(settings)	Yes	Functional	Numerical Distance Protection Relays	Z1=7.369 Ohm, T1=0 ms Z2=9.898 Ohm, T2=350 ms Z3=12.690 Ohm, T3=1000 ms Z4(Rev.)=408 mOhm, T4=160 ms	Complying
	Time check-Zone-1/2/3/4/5(settings)	Yes	Functional			
	SOTF	No	Disabled	-	-	Complying
	Aided schemes	Yes	Functional	In built feature of Numerical Distance Protection Relays	Permissive Under Reach, Phase Z1 Z2+CR 1	Complying
	Fault locator	Yes	Functional	In built feature of Numerical Distance Protection Relays	-	Complying

	Power swing(S(settings R and X)				R=5 Ohm, X=5 Ohm	Complying
	All Zone block	Yes	Enabled	In built feature of Numerical Distance Protection Relays	-	Complying
	DR	Yes	Enabled		-	Complying
	Binary Input					
	Breaker Contacts	Yes	Functional	-	-	Complying
	Carrier Receive	Yes	Functional	-	-	Complying
	Time Synchronization	Yes	Functional	-	-	Complying
(ii)	**Name of Line**	**220 kV BABAI Line**				
	Pole discrepancy relay	Yes	Functional(On CB)	Electromechanical	2 Sec.	
	PLCC panel	Yes	Functional			
	Zone-1/2/3/4/5(settings)	Yes	Functional	Numerical Distance Protection Relays	Z1=11.159 Ohm, T1=0 ms Z2=17.694 Ohm, T2=350 ms Z3=27.240 Ohm, T3=1000 ms Z4(Rev.)=408 mOhm, T4=160 ms	Complying
	Time check-Zone-1/2/3/4/5(settings)	Yes	Functional			
	SOTF	No	Disabled	-	-	Complying
	Aided schemes	Yes	Functional	In built feature of Numerical Distance Protection Relays	Permissive Under Reach, 1 Phase Z1 Z2+CR	Complying
	Fault locator	Yes	Functional	In built feature of Numerical Distance Protection Relays	-	Complying
	Power swing(S(settings R and X)				R=5 Ohm, X=5 Ohm	Complying
	All Zone block	Yes	Enabled	In built feature of Numerical Distance	-	Complying
	DR	Yes	Enabled		-	Complying
	Binary Input					
	Breaker Contacts	Yes	Functional	-	-	Complying
	Carrier Receive	Yes	Functional	-	-	Complying
	Time Synchronization	Yes	Functional	-	-	Complying

* Complying with the Code of Configuration issued by the CE(MPT&S), RVPN, Jaipur by Letter no. RVPN/CE/MPT&S/JPR/Tech./F./ Rajkaj ref No. 5221696/D.166 Dated 21.12.2023

Name. Signature & Contact No. of team Carrying out Protection audit:	1. Avdesh Gupta AEN-II(MPT&S), RVPNL,Jaipur 94143346180	
	2. Kamal Singh Gurjar, JEN O/o AEN-II(MPT&S), RVPNL,Jaipur 9413393612	
Name. Signature & Contact No. of representative of utility whose Protection audit is being carried out:	1. Dinesh Kumar Jain, SE(Prot.Engg.), RVPN, Jaipur, 9413393540	

Distance relay calculation for 220 kV NIWANA-HEERAPURA Line



Principle line Length : 45.14 KM.
Shortest Line Length considered on Remote Bus : 6.73 KM.
Longest line length Considered on Remote Bus : 15.5 KM.

EARTH FAULT COMPENSATION

RE/RL=1/3((Ro/R1)-1)
XE/XL=1/3((Xo/X1)-1)
kZ0 Res. Comp.= kZ0 = (Z0 – Z1) / 3Z1

kZ0	kZ0 angle
0.734	-1.83

Conductor Used : **Zebra**

Conductor Parameters :

	R	X	Z	Angle
Positive Sequence(Z1):	0.081	0.4	0.408	78.55
Zero Sequence(Z0):	0.2875	1.275	1.307	77.29

CTR: 1000/1 Amp= 1000
PTR: 220000/110 V= 2000
CTR/PTR: 0.5

Zone 1(Forward) Reach:	80	% of the Line to be Protected
Zone 2(Forward) Reach:	50	% of the Shortest Line on remote Bus+100 % of the Protected Line
Zone 3(Forward) Reach:	110	% Longest line length on Remote Bus+100 % of the Protected Line
Zone 4(Reverse) Reach:	2	Km

Zone 1 forward Reach= 80% of line length (SEZ to PGCIL)* +ve Sequence impedance of conductor/km*(CTR/PTR)

= **7.369** Ohm T1= Instt.

Zone 2 forward Reach= 100% of line length (SEZ to PGCIL)+50 % of the Shortest Line on remote Bus(PGCIL-Chaksu)*+ve Sequence impedance of conductor/km*(CTR/PTR)

= **9.898** Ohm T2=350 ms

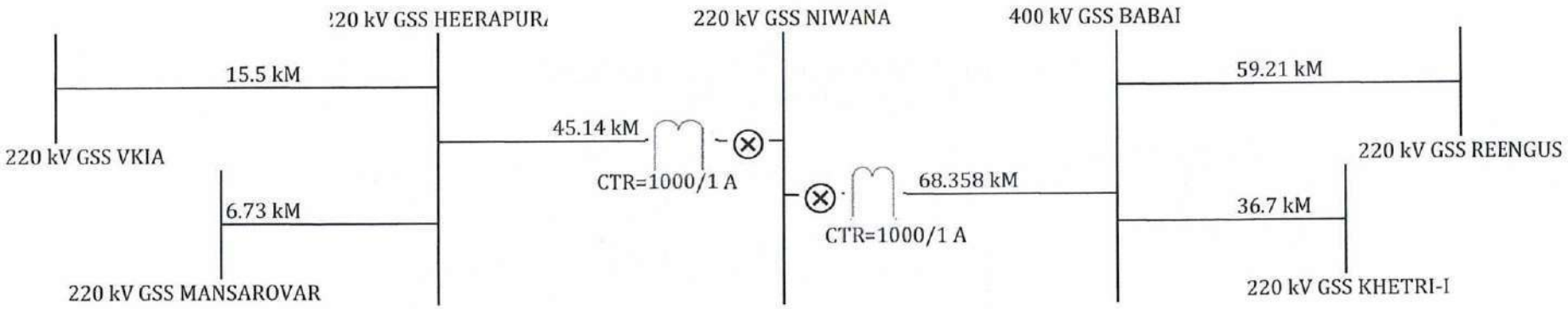
Zone 3 forward Reach=100% of line length (SEZ to PGCIL)+110 % Longest line length on Remote Bus(PGCIL-Vatika)*+ve Sequence impedance of conductor/km*(CTR/PTR)

= **12.690** Ohm T3=1000 ms

Zone 4 reverse Reach=2 km*+ve Sequence impedance of conductor/km*(CTR/PTR)

= **0.408** Ohm T4=160 ms

Distance relay calculation for 220 kV SEZ-Heerapura Line



Principle line Length : 68.358 KM.
Shortest Line Length considered on Remote Bus : 36.7 KM.
Longest line length Considered on Remote Bus : 59.21 KM.

EARTH FAULT COMPENSATION

RE/RL=1/3((Ro/R1)-1)
XE/XL=1/3((Xo/X1)-1)
kZ0 Res. Comp.= kZ0 = (Z0 – Z1) / 3Z1

kZ0	kZ0 angle
0.734	-1.83

Conductor Used : Zebra

Conductor Parameters :

	R	X	Z	Angle
Positive Sequence(Z1):	0.081	0.4	0.408	78.55
Zero Sequence(Z0):	0.2875	1.275	1.307	77.29

CTR: 1000/1 Amp= 1000
PTR: 220000/110 V= 2000
CTR/PTR: 0.5

Zone 1(Forward) Reach:	80	% of the Line to be Protected
Zone 2(Forward) Reach:	50	% of the Shortest Line on remote Bus+100 % of the Protected Line
Zone 3(Forward) Reach:	110	% Longest line length on Remote Bus+100 % of the Protected Line
Zone 4(Reverse) Reach:	2	Km

Zone 1 forward Reach= 80% of line length (SEZ to Heerapura)* +ve Sequence impedance of conductor/km*(CTR/PTR)

= **11.159** Ohm T1= Instt.

Zone 2 forward Reach= 100% of line length (SEZ to Heerapura)+50 % of the Shortest Line on remote Bus(Heerapura-NPH)*+ve Sequence impedance of conductor/km*(CTR/PTR)

= **17.694** Ohm T2=350 ms

Zone 3 forward Reach=100% of line length (SEZ to Heerapura)+110 % Longest line length on Remote Bus(Heerapura-Sanganer)*+ve Sequence impedance of conductor/km*(CTR/PTR)

= **27.240** Ohm T3=1000 ms

Zone 4 reverse Reach=2 km*+ve Sequence impedance of conductor/km*(CTR/PTR)

= **0.408** Ohm T4=160 ms

Rajasthan Rajya Vidhyut Prasaran Nigam Limited

Report of the Protection Audit

A. General Information

i)	Name of utility:	Rajasthan Rajya Vidhyut Prasaran Nigam Limited
ii)	Name of Voltage level of Substation:	220 kV GSS Niwana
iii)	Date of Commissioning:	29.03.2016
iv)	Type of Bus Switching Scheme	Two main One Auxillary Bus
v)	Name and Organization of Audit Team	Avdesh Gupta, AEN-II(MPT&S), RVPN, Jaipur
		Kamal Singh Gurjar,JEN-I(O/o AEN-II(MPT&S) RVPN,Jaipur
vi)	Name of representative from utility whose audit being carried out	Sh.D.K.Jain,SE(PROT.ENGG.) ,RVPN, Jaipur

B. Checklist for Protection Audit

S.No.	Check		Functional/ Non-Functional/Enabled /Disabled	Type of Relay*(Numerical /Static/Electromechanical)	Setting as found in field*/**	Compliance status w.r.t. regulatory provisions
Transformer Protection Panel						
(i)	**Name of Transformer (Rating/Capacity)**	**220/132 kV, 160 MVA BBL make Transformer**				
	Tripping by Buchholz Relay (Alarm)	Yes	Enabled	Electromechanical		Complying
	Differential Protection	Yes	Enabled	Numerical		Complying
	2nd Harmonic Block (Setting)		Enabled		15%	Complying
	Event Logger Operation	Yes	In built feature of numerical differential relay			
	Restricted Earth Fault Protection (HV Side)(Auto X-mer)	Yes	Functional	Numerical	42.3 V	Complying
	Event Logger Operation	Yes	In built feature of numerical REF relay			
	REF Protection (LV Side)	NA				
	Event Logger Operation	NA				
	Backup Over Current	Yes	Enabled	Numerical	0.42/0.200	Complying
	Event Logger Operation	Yes	In built feature of numerical O/C & E/F relay			
	Earth Fault Protection	Yes	Enabled	Numerical	0.2/0.220	Complying
	Event Logger Operation	Yes	In built feature of numerical O/C & E/F relay			
	Over Flux Protection	Yes	Enabled			Complying
	Event Logger Operation	Yes	In built feature of numerical differential relay			
	Local Breaker Back Up	Yes				
	Retrip	Yes	Enabled			Complying
	Current and Time Setting				120%/100 ms+100 ms External timer	Complying
	Separate Single and three phase initiation	No(3 phase only)				Complying

Non Directional O/C & E/F relay calculation for 220/132 kV, 160 MVA Transformer-1

Fault MVA of 220 kV BUS	:	4725	MVA
P.U. Impedance of 220 kV BUS		0.0212	
% Imepdance of transformer at Normal Tap		11.59	%
Transformer HV Voltage rating		220000	Volts
Transformer LV Voltage rating		132000	Volts
Transformer MVA Capacity		160	MVA
P.U. Impedance of Transformer		0.072438	
Total P.U. Impedance		0.0936	
Fault MVA of 132 kV BUS	:	1068	MVA
3 Phase through fault Short Circuit Current		4671	Amp
Phase-Phase through fault Short Circuit Current		4045	Amp
Phase to Earth through fault Short Circuit Current		2522	Amp

Non Directional Overcurrent Element Setting

CT Ratio	1000/1		
Plug Setting	42 % i.e.	420	Amp
Plug Setting Multiplier	9.630952		
Time of Operation	0.6	Seconds	
TMS	0.199		

Non Directional Earthfault Element Setting

CT Ratio	1000/1		
Plug Setting	20 % i.e.	200	Amp
Plug Setting Multiplier	12.61		
Time of Operation	0.6	Seconds	
TMS	**0.223**		

Stablizing Resistor calculation for Restricted Earth fault relay

Transformer Full load current HV	420	Amp
Transformer Full load current LV	700	Amp
Maximum fault current on through fault (If)	6040	Amp
Bushing CT Ratio	1000	
Lead resistance	1	Ohm
Rct	5	Ohm
Vk=	If*(Rct+2Rl)	
Vk=	42.3	Volts
REF Operating Current	0.1	Amp
Stablizing Resistor	423	Ohm

Non Directional O/C & E/F relay calculation for 220/132 kV, 160 MVA Transformer2

Fault MVA of 220 kV BUS	:	4725	MVA
P.U. Impedance of 220 kV BUS		0.0212	
% Imepdance of transformer at Normal Tap		11.59	%
Transformer HV Voltage rating		220000	Volts
Transformer LV Voltage rating		132000	Volts
Transformer MVA Capacity		160	MVA
P.U. Impedance of Transformer		0.072438	
Total P.U. Impedance		0.0936	
Fault MVA of 132 kV BUS	:	1068	MVA
3 Phase through fault Short Circuit Current		4671	Amp
Phase-Phase through fault Short Circuit Current		4045	Amp
Phase to Earth through fault Short Circuit Current		2522	Amp

Non Directional Overcurrent Element Setting

CT Ratio	1000/1		
Plug Setting	42 % i.e.	420	Amp
Plug Setting Multiplier	9.630952		
Time of Operation	0.6	Seconds	
TMS	0.199		

Non Directional Earthfault Element Setting

CT Ratio	1000/1		
Plug Setting	20 % i.e.	200	Amp
Plug Setting Multiplier	12.61		
Time of Operation	0.6	Seconds	
TMS	**0.223**		

Stablizing Resistor calculation for Restricted Earth fault relay

Transformer Full load current HV	420	Amp
Transformer Full load current LV	700	Amp
Maximum fault current on through fault (If)	6040	Amp
Bushing CT Ratio	1000	
Lead resistance	1	Ohm
Rct	5	Ohm
Vk=	If*(Rct+2Rl)	
Vk=	42.3	Volts
REF Operating Current	0.1	Amp
Stablizing Resistor	423	Ohm

Rajasthan Rajya Vidhyut Prasaran Nigam Limited

Report of the Protection Audit

A. General Information

i)	Name of utility:	Rajasthan Rajya Vidhyut Prasaran Nigam Limited
ii)	Name of Voltage level of Substation:	220 kV GSS Niwana
iii)	Date of Commissioning:	29.03.2016
iv)	Type of Bus Switching Scheme	Two main One Auxillary Bus
v)	Name and Organization of Audit Team	Avdesh Gupta, AEN-II(MPT&S), RVPN, Jaipur Kamal Singh Gurjar,JEN-I(O/o AEN-II(MPT&S) RVPN,Jaipur
vi)	Name of representative from utility whose audit being carried out	Sh.D.K.Jain,SE(PROT.ENGG.) ,RVPN, Jaipur

B. Checklist for Protection Audit

S.No.	Check		Functional/ Non-Functional/Enabled/ Disabled	Type of Relay*(Numerical /Static/Electromechanical)	Setting as found in field*/**	Compliance status w.r.t. regulatory provisions
1	**DC system**					
	No. of independent DC Sources	1 nos. 220 VDC	Functional			
	Potential between +ive & earth (Source-1)	118 V	-	-	-	-
	Potential between -ive & earth (Source-1)	115 V	-	-	-	-
	Potential between +ive & earth (Source-2)	-	-	-	-	-
	Potential between -ive & earth (Source-2)	-	-	-	-	-
2	Event Logger panel	No	-	-	-	-
3	Event Logger Time Synchronised	NA	-	-	-	-
	Disturbance Recorder	NA	-	-	-	-
	DR Time Synchronised	NA	-	-	-	-
4	Bus bar Protection	NA	-	-	-	-
	Stability Check	-	-	-	-	-
	EL output for this event	-	-	-	-	-
	DR if available	-	-	-	-	-
5	DG Set	NA	-	-	-	-
	Mock testing of a sample protection associated with transmission line* **	Yes/ No	i. If Yes then observation..... ii. If no, the reason for the same.....			
6	**Local Breaker Back Up(For Line)**		-	Numerical	-	-
	Retrip	Yes	Enabled	-	-	Complying
	Current and Time Setting	Yes	-	-	PU-120%/100 ms+100 ms External timer	Complying
	Separate Single and three phase initiation	Yes	Functional	-	-	Complying
	Earth Fault	No	Disabled	-	-	Complying
	Event logger operation	Yes	In built feature of numerical LBB relay			

Name. Signature & Contact No. of team Carrying out Protection audit:	1. Avdesh Gupta AEN-II(MPT&S), RVPNL,Jaipur 94143346180	
	2. Kamal Singh Gurjar, JEN O/o AEN-II(MPT&S), RVPNL,Jaipur 9413393612	
Name. Signature & Contact No. of representative of utility whose Protection audit is being carried out:	1. Dinesh Kumar Jain, SE(Prot.Engg.), RVPN, Jaipur, 9413393540	

	Earth Fault	No				Complying
	Event logger	Yes	In built feature of numerical LBB relay			
(ii)	**Name of Transformer (Rating/Capacity)**	**220/132 kV, 160 MVA BBL make Transformer**				
	Tripping by Buchholz Relay (Alarm)	Yes	Enabled	Electromechanical		Complying
	Differential Protection	Yes	Enabled	Numerical		Complying
	2nd Harmonic Block (Setting)		Enabled		15%	Complying
	Event Logger Operation	Yes	In built feature of numerical differential relay			
	Restricted Earth Fault Protection (HV Side)(Auto X-mer)	Yes	Functional	Numerical	42.3 V	Complying
	Event Logger Operation	Yes	In built feature of numerical REF relay			
	REF Protection (LV Side)	NA				
	Event Logger Operation	NA				
	Backup Over Current	Yes	Enabled	Numerical	0.42/0.200	Complying
	Event Logger Operation	Yes	In built feature of numerical O/C & E/F relay			
	Earth Fault Protection	Yes	Enabled	Numerical	0.2/0.220	Complying
	Event Logger Operation	Yes	In built feature of numerical O/C & E/F relay			
	Over Flux Protection	Yes	Enabled			Complying
	Event Logger Operation	Yes	In built feature of numerical differential relay			
	Local Breaker Back Up	Yes				
	Retrip	Yes	Enabled			Complying
	Current and Time Setting				120%/100 ms+100 ms External timer	Complying
	Separate Single and three phase initiation	No(3 phase only)				Complying
	Earth Fault	No				Complying
	Event logger	Yes	In built feature of numerical LBB relay			

Name. Signature & Contact No. of team Carrying out Protection audit:	1. Avdesh Gupta AEN-II(MPT&S), RVPNL,Jaipur 94143346180	
	2. Kamal Singh Gurjar, JEN O/o AEN-II(MPT&S), RVPNL,Jaipur 9413393612	
Name. Signature & Contact No. of representative of utility whose Protection audit is being carried out:	1. Dinesh Kumar Jain, SE(Prot.Engg.), RVPN, Jaipur, 9413393540	

RAJASTHAN RAJYA VIDYUT PRASARAN NIGAM LIMITED
Corporate Identity Number (CIN):U40109RJ2000SGCO16485
Regd. Office: Vidyut Bhawan, Janpath, Jyoti Nagar, Jaipur-302005

RVPN
AN ISO: 9001:2015
Certified Company

OFFICE OF THE SUPERINTENDING ENGINEER (PROT.-ENGG),
Room No.317, Vidyut Bhawan, Jaipur Tel. No.0141-2740381(Ext.1350)
E-mail: se.prot.engg@rvpn.co.in , Website:www.http://energy.rajasthan.gov.in/rvpnl

No. RVPN/SE/JPR/ (Prot.-Engg)/Tech./F./D.- 33 Jaipur, Dated: 31.05.2024

The Chief Engineer (LD/MPT&S)
RVPN, Jaipur.

Sub:- Regarding internal Protection Audit plan.

Ref:- 1. No. 4/MTGS/SG/NPC/CEA/2023/353 dated 18.09.2023
2. NO.RVPN/SE(Prot.Engg)/JPR/Tech./F./ Raj Kaj No. 6987851 dated 07.05.2024.

Kindly find attach the Internal Protection Audit report of 220 kV GSS MIA, Alwar. The Incharge of the concern GSS was informed to rectify the observations raised during audit with Protection wing, Alwar.

Submitted for further needful action and to appraise NRPC.

Copy forwarded:

1. Superintending Engineer (MPT&S), Jaipur
2. Executive Engineer, 220 kV GSS, MIA, Alwar

RajKaj Ref
7766661

Signature valid
Digitally signed by Dinesh Kumar Jain
Designation : Superintending Engineer
Date: 2024.06.04 17:46:35 IST
Reason: Approved

Northern Regional Power Committee
Report of the Protection Audit

A. General Information:

i. Name of utility :- Rajasthan Rajya Vidyut Prasaran Nigam Ltd.
ii. Name of Voltage level of sub-station :- 220 kV GSS MIA Alwar
iii. Date of commissioning :-08.02.2011
iv. Type of bus-switching scheme :- 220 kV Main Bus
v. Name and Organization of Audit Team :- Rajasthan Rajya Vidyut Prasaran Nigam Ltd.
vi. Name of representative from utility whose audit is being carried out :- Sh. R.R Gupta & Sh. A.K. Meena

B. Check List for Protection Audit

S.No	Check		Functional/ Nonfunctional/ Enabled/Disa bled	Type of relay * (Numerical/Static/ Electromechanical)	Setting as found in field*/**	Compliance status w.r.t. regulatory provisions
1.	DCsystem					
	No.ofindependentDCSources	1/2/3/4	1&2			01 No DC battery set Required . Purchase case under process
	Potentialbetween+ive& earth(Source-1)	-----V	Nonfunctional			
	Potentialbetween-ive&earth(Source-1)	-----V	Nonfunctional			
	Potentialbetween+ive& earth(Source-2)	-----V	Functional		125 V	Complied
	Potentialbetween-ive&earth (Source-2)	-----V	Functional		100 V	
	Potentialbetween+ive& earth(Source-3)	-----V	-			
	Potentialbetween-ive&earth (Source-3)	-----V	-			
	Potentialbetween+ive& earth(Source-4)	-----V	-			
	Potentialbetween-ive&earth (Source-4)	-----V	-			
2.	EventLogger panel	Yes/No	No			
3.	EventLoggerTime Synchronised	Yes/No	NO			
	DisturbanceRecorder	Yes/No	No			
	DRTimeSynchronised	Yes/No	NO			
4.1	TransformerProtectionPanel:		220/132 KV, 100 MVA ,BHEL TR 01			Complied
	TrippingbyBuchholz relay(Alarm)	Yes/No	Yes			
	DifferentialProtection	Yes/No	Yes	Numerical Relay	0.20 , 8.0	
	2nd HarmonicBlock(Setting)				15%	
	EventLoggeroperation	Yes/No	Yes	In Relay		
	RestrictedEarthFaultProtection(HVside)	Yes/No	Yes	MIT	0.10 In Instt.	
	EventLoggeroperation	Yes/No	No			
	REF Protection(LVside)	Yes/No	-			
	EventLoggeroperation	Yes/No	-			
	Backupovercurrent	Yes/No	Yes	Numerical Relay	0.7 In, 0.20	
	EventLoggeroperation	Yes/No	Yes	In Relay		
	Earth Faultprotection	Yes/No	Yes	Numerical Relay	0.20 In, 0.26	
	EventLoggeroperation	Yes/No	Yes	In Relay		
	Over Flux Protection	Yes/No	Yes	Numerical Relay	110 % 5s ,120 %1s	
	EventLoggeroperation	Yes/No	Yes	In Relay		
	LocalBreaker Back up	Yes/No	Yes	In Bus Bar Relay		
	Retrip	Yes/No	Yes		100 ms	
	Current and Time setting				1.2 In , 100+100ms	
	Seperatesingleandthree phaseinitiation	Yes/No	Yes		Single phase	
	Earthfault	Yes/No	No			
	EventLogger	Yes/No	Yes	In Relay		

4.2	TransformerProtectionPanel:	220/132 KV, 100 MVA ,TELK TR 02				Complied
	TrippingbyBuchholz relay(Alarm)	Yes/No	Yes			
	DifferentialProtection	Yes/No	Yes	Numerical Relay	0.20 , 8.0	
	2nd HarmonicBlock(Setting)				15%	
	EventLoggeroperation	Yes/No	Yes	In Relay		
	RestrictedEarthFaultProtection(HVside)	Yes/No	Yes	Numerical	0.10 In Instt.	
	EventLoggeroperation	Yes/No	Yes	In relay		
	REF Protection(LVside)	Yes/No	-			
	EventLoggeroperation	Yes/No	-			
	Backupovercurrent	Yes/No	Yes	Numerical Relay	0.7 In, 0.20	
	EventLoggeroperation	Yes/No	Yes	In Relay		
	Earth Faultprotection	Yes/No	Yes	Numerical Relay	0.20 In, 0.26	
	EventLoggeroperation	Yes/No	Yes	In Relay		
	Over Flux Protection	Yes/No	Yes	Numerical Relay	110 % 5s ,120 %1s	
	EventLoggeroperation	Yes/No	Yes	In Relay		
	LocalBreaker Back up	Yes/No	Yes	In Bus Bar Relay		
	Retrip	Yes/No	Yes		100 ms	
	Current and Time setting				1.2 In , 100+100ms	
	Seperatesingleandthree phaseinitiation	Yes/No	Yes		Single phase	
	Earthfault	Yes/No	No			
	EventLogger	Yes/No	Yes			
5	ReactorProtectionPanel:		Not available			
	TrippingbyBuchholz relay(Alarm)	Yes/No				
	DifferentialProtection	Yes/No				
	2nd HarmonicBlock(Setting)					
	EventLoggeroperation	Yes/No				
	REFProtection(HVside)	Yes/No				
	EventLoggeroperation	Yes/No				
	REF Protection(LVside)	Yes/No				
	EventLoggeroperation	Yes/No				
	Backupovercurrent	Yes/No				
	EventLoggeroperation	Yes/No				
	E/Fprotection	Yes/No				
	EventLoggeroperation	Yes/No				
	Over Flux Protection	Yes/No				
	EventLoggeroperation	Yes/No				
	LBB/BFR	Yes/No				
	Retrip	Yes/No				
	Current and Time setting					
	Seperatesingleandthree phaseinitiation	Yes/No				
	Earthfault	Yes/No				
	EventLoggeroperation	Yes/No				
6.1	DistanceProtectionPanel: M-I/II	220 kV MIA – Adani (400 kV) Line				Complied
	Polediscrepancyrelay	Yes/No	Yes		1.5 Sec	
	PLCCpanel	Yes/No	Yes			
	Zone-1/2/3/4/5 (Settings)	Yes/No	1,2,3,4 Enable	Numerical Relay	As per Line Length	
	Timecheck-Z-1/2/3/4/5(Settings)	Yes/No	Yes		0,350,1000,160 s	
	SOTF	Yes/No	Disable			
	Aidedschemes	Yes/No	Yes			
	FaultLocator	Yes/No	Yes	In relay		
	Powerswing (SettingsRandX)					
	All Zone block	Yes/No	Enable			
	DR	Yes/No	Yes			
	Binary Inputs				Available	
	Breaker Contacts	Yes/No	Yes		Available	
	CarrierReceive	Yes/No	Yes			
	TimeSynchronization	Yes/No	Yes			

6.2	**DistanceProtectionPanel: M-I/II**	**220 KV MIA – BADARPUR Line**				Complied
	Polediscrepancyrelay	Yes/No	Yes		1.5 Sec	
	PLCCpanel	Yes/No	Yes			
	Zone-1/2/3/4/5 (Settings)	Yes/No	1,2,3,4 Enable	Numerical Relay	As per Line Length	
	Timecheck-Z-1/2/3/4/5(Settings)	Yes/No	Yes		0,350,1000,160 s	
	SOTF	Yes/No	Disable			
	Aidedschemes	Yes/No	Yes			
	FaultLocator	Yes/No	Yes	In relay		
	Powerswing (SettingsRandX)					
	All Zone block	Yes/No	Enable			
	DR	Yes/No	Yes			
	Binary Inputs				Available	
	Breaker Contacts	Yes/No	Yes		Available	
	CarrierReceive	Yes/No	Yes			
	TimeSynchronization	Yes/No	Yes			
6.3	**DistanceProtectionPanel: M-I/II**	**220 kV MIA – ALWAR Line**				Complied
	Polediscrepancyrelay	Yes/No	Yes		1.5 Sec	
	PLCCpanel	Yes/No	Yes			
	Zone-1/2/3/4/5 (Settings)	Yes/No	1,2,3,4 Enable	Numerical Relay	As per Line Length	
	Timecheck-Z-1/2/3/4/5(Settings)	Yes/No	Yes		0,350,1000,160 s	
	SOTF	Yes/No	Disable			
	Aidedschemes	Yes/No	Yes			
	FaultLocator	Yes/No	Yes	In relay		
	Powerswing (SettingsRandX)					
	All Zone block	Yes/No	Enable			
	DR	Yes/No	Yes			
	Binary Inputs				Available	
	Breaker Contacts	Yes/No	Yes		Available	
	CarrierReceive	Yes/No	Yes			
	TimeSynchronization	Yes/No	Yes			
7.	**Bus Bar Protection**	Yes/No	Yes	Numerical		
	StabilityCheck		Yes			
	EL output for this event	Yes/No	Yes			
	DR if available	Yes/No	Yes	Available		
8.	**Single Phase Auto Re-closer Scheme**	Yes/No	Yes	AR feature enable in numerical DPS relays		Complied
9.	**CT**					
	Suitable as perfaultlevel		Yes			
10.	**DG Set**	Yes/No	No			
11.	**MockTestingofasampleprotectionassociated with transmission line*****	Yes/No	i. If Yes then observation .....Yes operated properly ii. If no, the reason for the same	**Line tripped on dated 03.05.2024 on 220 KV MIA Adani Line with adopted parameters.**		

* This column is applicable for relays only

** Method and Calculation to arrive at this setting has to be submitted by the utility to NRPC secretariat within 07 days of the protection audit.

** Purpose is to check whether the operation of that protection relay energises the breaker Trip coil.

C. Observation w.r.t. compliance to NRPC protection philosophy

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

(Name, Signature and Contact Number of Members of team comprising for carrying out protection audit and the representative of the utility whose audit is being carried out)

7.5.2024

R. R. Gupta
AEn (Prot. Engg.) RVPN Jaipur
9413393611

A. K. Meena
AEn (Prot. Engg.) RVPN Jaipur
9413393550

Copy to: (i) Station In-charge where audit has been carried out
(ii) Representative of the utility present with the protection audit team
(iii) SE (O), NRPC

RAJASTHAN RAJYA VIDYUT PRASARAN NIGAM

Report of the Protection Audit

Date : 09/07/24

A.General Information:

I. Name of Utility:- RVPNL

II. Name of Voltage Level of sub-station: 220kV

III. Date of Commissioning 28.06.1991

IV. Type of bus-switching scheme:- Main and Aux Bus

V. Name of Organization of Audit Team :- AEN (MPT&S) RVPNL Chittorgarh

VI.Name of Representative from utility whose audit being carrier out :- XEN 220kV GSS Chittorgarh

B. Check list for Protection Audit

S.NO.	Check		Fuctional/ Non-fuctional/ Enabeled/ Disabled	Type of Relay* (Numerical/Static/ Electo-mechanical)	Setting as Found in Field*/**	Compliance status w.r.t. regulatory provisions
	Transformer Protection Panel:					
1	**Name of Transformer(Rating/Capacity)**	220/132kV 100 MVA Tr-1 TELK Make				
	Tripping by Buchholz relay(Alarm)	YES/NO	YES			
	Diffrential Protection	YES/NO	YES	Static	Bias: 20% (CTR: 300/1) Instt: 8A	
	2nd Harmonic Block(Setting)		Internal			
	Event Logger operation	YES/NO	NO			
	Restricted Earth Fault Protection(HV side)	YES/NO	NO			
	Event Logger operation	YES/NO	NO			
	REF Protection(LV side)	YES/NO	NO			
	Event Logger operation	YES/NO	NO			
	Backup over current	YES/NO	YES	Electro-mechanical	Ps: 1A (CTR: 300/1) TMS: 0.35	
	Event Logger operation	YES/NO	NO			
	Earth Fault Protection	YES/NO	YES	Electro-mechanical	Ps: 0.2A (CTR: 300/1) TMS: 0.40	
	Event Logger operation	YES/NO	NO			
	Over flux Protection	YES/NO	YES	Electro-mechanical	K:1.2, t:12s	
	Event Logger operation	YES/NO	NO			
	Local Breaker Back up	YES/NO	NO			
	Retrip	YES/NO	NO			
	Current and Time Setting					
	Separate single and three phase initiation	YES/NO	NO			
	Earth Fault	YES/NO	NO			
	Event Logger	YES/NO	NO			

Assistant Engineer (MPT&S)
RVPNL CHITTORGARH

Date : 09/07/24

RAJASTHAN RAJYA VIDYUT PRASARAN NIGAM

Report of the Protection Audit

A.General Information:

I. Name of Utility:- RVPNL

II. Name of Voltage Level of sub-station: 220kV

III. Date of Commissioning 28.06.1991

IV. Type of bus-switching scheme:- Main and Aux Bus

V. Name of Organization of Audit Team :- AEN (MPT&S) RVPNL Chittorgarh

VI.Name of Representative from utility whose audit being carrier out :- XEN 220kV GSS Chittorgarh

B. Check list for Protection Audit

2	**Name of Transformer(Rating/Capacity)**	220/132kV 100 MVA Tr-2 BHEL Make				
	Tripping by Buchholz relay(Alarm)	YES/NO	YES			
	Diffrential Protection	YES/NO	YES	Static	Bias: 35% (CTR: 600/1) Instt: 8A	
	2nd Harmonic Block(Setting)		Internal			
	Event Logger operation	YES/NO	NO			
	Restricted Earth Fault Protection(HV side)	YES/NO	NO			
	Event Logger operation	YES/NO	NO			
	REF Protection(LV side)	YES/NO	NO			
	Event Logger operation	YES/NO	NO			
	Backup over current	YES/NO	YES	Electro-mechanical	Ps: 0.5A (CTR: 600/1) TMS: 0.35	
	Event Logger operation	YES/NO	NO			
	Earth Fault Protection	YES/NO	YES	Electro-mechanical	Ps: 0.2A (CTR: 600/1) TMS: 0.40	
	Event Logger operation	YES/NO	NO			
	Over flux Protection	YES/NO	NO			
	Event Logger operation	YES/NO	NO			
	Local Breaker Back up	YES/NO	NO			
	Retrip	YES/NO	NO			
	Current and Time Setting					
	Separate single and three phase initiation	YES/NO	NO			
	Earth Fault	YES/NO	NO			
	Event Logger	YES/NO	NO			

Assistant Engineer (MPT)
RVPNL, CHITTORGARH

Date: 09/07/24

RAJASTHAN RAJYA VIDYUT PRASARAN NIGAM

Report of the Protection Audit

A.General Information:

I. Name of Utility:- RVPNL

II. Name of Voltage Level of sub-station: 220kV

III. Date of Commissioning 28.06.1991

IV. Type of bus-switching scheme:- Main and Aux Bus

V. Name of Organization of Audit Team :- AEN (MPT&S) RVPNL Chittorgarh

VI.Name of Representative from utility whose audit being carrier out :- XEN 220kV GSS Chittorgarh

B. Check list for Protection Audit

3	**Name of Transformer(Rating/Capacity)**	220/132kV 100 MVA Tr-3 TELK Make				
	Tripping by Buchholz relay(Alarm)	YES/NO	YES			
	Diffrential Protection	YES/NO	YES	Numerical	CTR:400/1 Instt: 5A Per Diff. ID: 0.200 A Diff. IR1: 0.656 A Diff IR2: 3A Diff Slop S1: 0.00 Diff Slop S2: 0.200	
	2nd Harmonic Block(Setting)		Internal		Diff. 2nd HAR Ratio: 0.150 Diff. 5th HAR Ratio: 0.350	
	Event Logger operation	YES/NO	YES			
	Restricted Earth Fault Protection(HV side)	YES/NO	YES	Static	Ps: 5%, Time: 0.2s	
	Event Logger operation	YES/NO	YES			
	REF Protection(LV side)	YES/NO				
	Event Logger operation	YES/NO				
	Backup over current	YES/NO	YES	Numerical	Ps: 1A (CTR: 400/1) TMS: 0.35	
	Event Logger operation	YES/NO	YES			
	Earth Fault Protection	YES/NO	YES	Numerical	Ps: 20% (CTR: 400/1) TMS: 0.40	
	Event Logger operation	YES/NO	YES			
	Over flux Protection	YES/NO	YES	Numerical	Alarm: 110%, Time: 5s Trip: 120%, Time: 1s	
	Event Logger operation	YES/NO	YES			
	Local Breaker Back up	YES/NO	NO			
	Retrip	YES/NO	NO			
	Current and Time Setting		NO			
	Separate single and three phase initiation	YES/NO	NO			
	Earth Fault	YES/NO	NO			
	Event Logger	YES/NO	NO			

Assistant Engineer (MPT&S)
RVPNL, CHITTORGARH

Date: 09/07/24

RAJASTHAN RAJYA VIDYUT PRASARAN NIGAM
Report of the protection Audit

A. General Information:
I. Name of Utility:- RVPNL
II. Name of Voltage Level of sub-station: 220kV
III. Date of Commissioning 28.06.1991
IV. Type of bus-switching scheme:- 2 Main Bus and Aux. Bus
V. Name of Organization of Audit Team :- R\
VI. Name of Representative from utility whose audit being carrier out :- XEN 220kV GSS Chittorgarh

B. Check list for Protection Audit

S.NO.	Check		Fuctional/ Non-fuctional/ Enabeled/ Disabled	Type of Relay* (Numerical/ Static/ Electo-mechanical)	Setting as Found in Field*/**	Compliance status w.r.t. regulatory provisions
	Distance Protection Panel: M-I			**Numerical**		
1	**Name of Line**	220kV Chittorgarh -RAPPB-I				
	Pole discrepancy relay	YES/NO	YES		YES	
	PLCC panel	YES/NO	YES		YES	
	Zone-1/2/3/4(Setting)	YES/NO	ENABLED		Z1-16.2 Ω/ Z2-31.15Ω/ Z3-69.59 Ω/ Z4-0.326 Ω(reverse)	
	Time check-Z-1/2/3/4/5(Setting)	YES/NO	ENABLED		0,0.35,1,0.160 sec.	
	SOTF	YES/NO	DISABLED		DISABLED	
	Aided schemes	YES/NO	ENABLED		ENABLED	
	Fault locator	YES/NO	FUNCTIONAL		FUNCTIONAL	
	Power swing (Settings R and X)				4.10/4.10	
	All Zone Block	YES/NO	YES		YES	
	DR	YES/NO	YES		DR	
	Binary Inputs					
	Breaker Contacts	YES/NO	YES		YES	
	Carrier Receive	YES/NO	YES		YES	
	time Synchronization	YES/NO	NO		NO	
	Distance Protection Panel: M-II			**Numerical**		
	Pole discrepancy relay	YES/NO	YES		YES	
	PLCC panel	YES/NO	YES		YES	
	Zone-1/2/3/4/5(Setting)	YES/NO	ENABLED		R1-15.92Ω,X1-16.370Ω/ R2-15.92Ω, X2-30.690Ω/ R3-15.92Ω,X3-68.550Ω/ R4-15.92Ω,X4-0.830Ω	
	Time check-Z-1/2/3/4/5(Setting)	YES/NO	ENABLED		0,0.35,1,0.160 sec.	
	SOTF	YES/NO	DISABLED		DISABLED	
	Aided schemes	YES/NO	ENABLED		ENABLED	
	Fault locator	YES/NO	FUNCTIONAL		FUNCTIONAL	
	Power swing (Settings R and X)				4.10/4.10	
	All Zone Block	YES/NO	YES		YES	
	DR	YES/NO	YES		DR	
	Binary Inputs					
	Breaker Contacts	YES/NO	YES		YES	
	Carrier Receive	YES/NO	YES		YES	
	time Synchronization	YES/NO	N O		NO	

Assistant Engineer (MPT&S)
RVPNL, CHITTORGARH

Date : 09/07/24

RAJASTHAN RAJYA VIDYUT PRASARAN NIGAM
Report of the protection Audit

A.General Information:
I. Name of Utility:- RVPNL
II. Name of Voltage Level of sub-station: 220kV
III. Date of Commissioning 28.06.1991
IV. Type of bus-switching scheme:- 2 Main Bus and Aux. Bus
V. Name of Organization of Audit Team :- R\
VI.Name of Representative from utility whose audit being carrier out :- XEN 220kV GSS Chittorgarh

B. Check list for Protection Audit

	Distance Protection Panel: M-I			**Numerical**		
1	**Name of Line**	220kV Chittorgarh -RAPPB-II				
	Pole discrepancy relay	YES/NO	YES		YES	
	PLCC panel	YES/NO	YES		YES	
	Zone-1/2/3/4/5(Setting)	YES/NO	ENABLED		Z1-16.2 Ω/ Z2-31.15Ω/ Z3-69.59 Ω/ Z4-0.326 Ω(reverse)	
	Time check-Z-1/2/3/4/5(Setting)	YES/NO	ENABLED		0,0.35,1,0.160 sec.	
	SOTF	YES/NO	DISABLED		DISABLED	
	Aided schemes	YES/NO	ENABLED		ENABLED	
	Fault locator	YES/NO	FUNCTIONAL		FUNCTIONAL	
	Power swing (Settings R and X)				4.10/4.10	
	All Zone Block	YES/NO	YES		YES	
	DR	YES/NO	YES		DR	
	Binary Inputs					
	Breaker Contacts	YES/NO	YES		YES	
	Carrier Receive	YES/NO	YES		YES	
	time Synchronization	YES/NO	NO		NO	
	Distance Protection Panel: M-II			**Numerical**		
	Pole discrepancy relay	YES/NO	YES		YES	
	PLCC panel	YES/NO	YES		YES	
	Zone-1/2/3/4/5(Setting)	YES/NO	ENABLED		R1-15.92Ω,X1-16.370Ω/ R2-15.92Ω, X2-30.690Ω/ R3-15.92Ω,X3-68.550Ω/ R4-15.92Ω,X4-0.830Ω	
	Time check-Z-1/2/3/4/5(Setting)	YES/NO	ENABLED		0,0.35,1,0.160 sec.	
	SOTF	YES/NO	DISABLED		DISABLED	
	Aided schemes	YES/NO	ENABLED		ENABLED	
	Fault locator	YES/NO	FUNCTIONAL		FUNCTIONAL	
	Power swing (Settings R and X)				1/ 1	
	All Zone Block	YES/NO	YES		YES	
	DR	YES/NO	YES		DR	
	Binary Inputs					
	Breaker Contacts	YES/NO	YES		YES	
	Carrier Receive	YES/NO	YES		YES	
	time Synchronization	YES/NO	N O		NO	

Assistant Engineer (MPT&S
RVPNL, CHITTORGARH

Date: 09/01/24

RAJASTHAN RAJYA VIDYUT PRASARAN NIGAM
Report of the protection Audit

A.General Information:
I. Name of Utility:- RVPNL
II. Name of Voltage Level of sub-station: 220kV
III. Date of Commissioning 28.06.1991
IV. Type of bus-switching scheme:- 2 Main Bus and Aux. Bus
V. Name of Organization of Audit Team :- R\
VI.Name of Representative from utility whose audit being carrier out :- XEN 220kV GSS Chittorgarh

B. Check list for Protection Audit

	Distance Protection Panel: M-I			**Numerical**		
	Name of Line	220kV Chittorgarh -Hamirgarh				
	Pole discrepancy relay	YES/NO	YES		YES	
	PLCC panel	YES/NO	YES		YES	
	Zone-1/2/3/4/5(Setting)	YES/NO	ENABLED		Z1-6.149Ω/ Z2-9.213Ω/ Z3-10.74 Ω/ Z4-0 .326Ω(reverse)	
	Time check-Z-1/2/3/4/5(Setting)	YES/NO	ENABLED		0,0.35,1,0.160 sec.	
	SOTF	YES/NO	DISABLED		DISABLED	
	Aided schemes	YES/NO	ENABLED		ENABLED	
	Fault locator	YES/NO	FUNCTIONAL		FUNCTIONAL	
	Power swing (Settings R and X)				1/ 1	
	All Zone Block	YES/NO	YES		YES	
	DR	YES/NO	YES		DR	
	Binary Inputs					
	Breaker Contacts	YES/NO	YES		YES	
	Carrier Receive	YES/NO	YES		YES	
	time Synchronization	YES/NO	NO		NO	
	Distance Protection Panel: M-II			**Numerical**		
	Pole discrepancy relay	YES/NO	YES		YES	
	PLCC panel	YES/NO	YES		YES	
	Zone-1/2/3/4/5(Setting)	YES/NO	ENABLED		R1-30Ω, X1-6.029 Ω/ R2-30Ω ,X2-9.213Ω/ R3-30Ω,X3-10.528Ω/ R4-30Ω, X4-0.320Ω	
	Time check-Z-1/2/3/4/5(Setting)	YES/NO	ENABLED		0,0.35,1,0.160 sec.	
	SOTF	YES/NO	DISABLED		DISABLED	
	Aided schemes	YES/NO	ENABLED		ENABLED	
	Fault locator	YES/NO	FUNCTIONAL		FUNCTIONAL	
	Power swing (Settings R and X)				1/ 1	
	All Zone Block	YES/NO	YES		YES	
	DR	YES/NO	YES		DR	
	Binary Inputs					
	Breaker Contacts	YES/NO	YES		YES	
	Carrier Receive	YES/NO	YES		YES	
	time Synchronization	YES/NO	N O		NO	

Assistant Engineer (MPT&S)
RVPNL, CHITTORGARH

Date: 09/07/24

RAJASTHAN RAJYA VIDYUT PRASARAN NIGAM
Report of the protection Audit

A.General Information:
I. Name of Utility:- RVPNL
II. Name of Voltage Level of sub-station: 220kV
III. Date of Commissioning 28.06.1991
IV. Type of bus-switching scheme:- 2 Main Bus and Aux. Bus
V. Name of Organization of Audit Team :- R\
VI.Name of Representative from utility whose audit being carrier out :- XEN 220kV GSS Chittorgarh

B. Check list for Protection Audit

	Distance Protection Panel: M-I			**Numerical**		
4	**Name of Line**	220kV Chittorgarh - Chittorgarh (400kV GSS)				
	Pole discrepancy relay	YES/NO	YES		YES	
	PLCC panel	YES/NO	YES		YES	
	Zone-1/2/3/4/5(Setting)	YES/NO	ENABLED		Z1-0.266mΩ/ Z2-0.762mΩ/ Z3-4.080 Ω/ Z4-0 .065Ω(reverse)	
	Time check-Z-1/2/3/4/5(Setting)	YES/NO	ENABLED		0,0.35,1,0.160 sec.	
	SOTF	YES/NO	DISABLED		DISABLED	
	Aided schemes	YES/NO	ENABLED		ENABLED	
	Fault locator	YES/NO	FUNCTIONAL		FUNCTIONAL	
	Power swing (Settings R and X)				1/ 1	
	All Zone Block	YES/NO	YES		YES	
	DR	YES/NO	YES		DR	
	Binary Inputs					
	Breaker Contacts	YES/NO	YES		YES	
	Carrier Receive	YES/NO	YES		YES	
	time Synchronization	YES/NO	NO		NO	
	Distance Protection Panel: M-II			**Numerical**		
	Pole discrepancy relay	YES/NO	YES		YES	
	PLCC panel	YES/NO	YES		YES	
	Zone-1/2/3/4/5(Setting)	YES/NO	ENABLED		R1 6Ω, X1 0.260 Ω/ R2 6Ω ,X2 0.748Ω/ R3 6Ω,X3 4.0100Ω/ R4 6Ω, X4 0.650Ω(Rev.)	
	Time check-Z-1/2/3/4/5(Setting)	YES/NO	ENABLED		0,0.35,1,0.160 sec.	
	SOTF	YES/NO	DISABLED		DISABLED	
	Aided schemes	YES/NO	ENABLED		ENABLED	
	Fault locator	YES/NO	FUNCTIONAL		FUNCTIONAL	
	Power swing (Settings R and X)				1/ 1	
	All Zone Block	YES/NO	YES		YES	
	DR	YES/NO	YES		DR	
	Binary Inputs					
	Breaker Contacts	YES/NO	YES		YES	
	Carrier Receive	YES/NO	YES		YES	
	time Synchronization	YES/NO	N O		NO	

Assistant Engineer (MPT&S)
RVPNL, CHITTORGARH

Date: 09/07/24

RAJASTHAN RAJYA VIDYUT PRASARAN NIGAM
Report of the protection Audit

A.General Information:
I. Name of Utility:- RVPNL
II. Name of Voltage Level of sub-station: 220kV
III. Date of Commissioning 28.06.1991
IV. Type of bus-switching scheme:- 2 Main Bus and Aux. Bus
V. Name of Organization of Audit Team :- R\
VI.Name of Representative from utility whose audit being carrier out :- XEN 220kV GSS Chittorgarh

B. Check list for Protection Audit

	Distance Protection Panel: M-I			**Numerical**		
	Name of Line	220kV Chittorgarh -Sawa				
	Pole discrepancy relay	YES/NO	YES		YES	
	PLCC panel	YES/NO	YES		YES	
	Zone-1/2/3/4/5(Setting)	YES/NO	ENABLED		Z1-3.347Ω/ Z2-5.949Ω / Z3-8.480 Ω/ Z4-0 .326Ω(reverse)	
	Time check-Z-1/2/3/4/5(Setting)	YES/NO	ENABLED		0,0.35,1,0.160 sec.	
	SOTF	YES/NO	DISABLED		DISABLED	
	Aided schemes	YES/NO	ENABLED		ENABLED	
	Fault locator	YES/NO	FUNCTIONAL		FUNCTIONAL	
	Power swing (Settings R and X)				1/ 1	
	All Zone Block	YES/NO	YES		YES	
	DR	YES/NO	YES		DR	
	Binary Inputs					
	Breaker Contacts	YES/NO	YES		YES	
	Carrier Receive	YES/NO	YES		YES	
	time Synchronization	YES/NO	NO		NO	
	Distance Protection Panel: M-II			**Numerical**		
	Pole discrepancy relay	YES/NO	YES		YES	
	PLCC panel	YES/NO	YES		YES	
	Zone-1/2/3/4/5(Setting)	YES/NO	ENABLED		R1-30Ω, X1- 3.280Ω/ R2- 30Ω ,X2-5.836Ω/ R3- 30Ω,X3-8.320Ω/ R4-30Ω, X4-0.320Ω	
	Time check-Z-1/2/3/4/5(Setting)	YES/NO	ENABLED		0,0.35,1,0.160 sec.	
	SOTF	YES/NO	DISABLED		DISABLED	
	Aided schemes	YES/NO	ENABLED		ENABLED	
	Fault locator	YES/NO	FUNCTIONAL		FUNCTIONAL	
	Power swing (Settings R and X)				1/ 1	
	All Zone Block	YES/NO	YES		YES	
	DR	YES/NO	YES		DR	
	Binary Inputs					
	Breaker Contacts	YES/NO	YES		YES	
	Carrier Receive	YES/NO	YES		YES	
	time Synchronization	YES/NO	N O		NO	

Assistant Engineer (MPT&S)
RVPNL, CHITTORGARH

Date: 09/07/24

RAJASTHAN RAJYA VIDYUT PRASARAN NIGAM

Report of the protection Audit

A.General Information:

I. Name of Utility:- RVPNL

II. Name of Voltage Level of sub-station: 220kV

III. Date of Commissioning 28.06.1991

IV. Type of bus-switching scheme:- Main and Aux Bus

V. Name of Organization of Audit Team :- AEN (MPT&S) RVPNL Chittorgarh

VI.Name of Representative from utility whose audit being carrier out :- XEN 220kV GSS Chittorgarh

B. Check list for Protection Audit

S.NO.	Check		Fuctional/ Non-fuctional/ Enabeled/ Disabled	Type of Yearly* (Numerical/Static/ Electo-mechanical)	Setting as Found in Field*/**	Compliance status w.r.t. regulatory provisions
1	**DC System 220V DC system**					
	No. of independent DC Sources	1/2/3/4			2	
	Potential between +ive &earth (Source-1)	V	Functional		100 V	
	Potential between -ive &earth (Source-1)	V			120 V	
	Potential between +ive &earth (Source-2)	V	Defective		Defective	
	Potential between -ive &earth (Source-2)	V			Defective	
	Potential between +ive &earth (Source-3)	V			NA	
	Potential between -ive &earth (Source-3)	V			NA	
	Potential between +ive &earth (Source-4)	V			NA	
	Potential between -ive &earth (Source-4)	V			NA	
2	**Event Logger panel**	YES/NO	NO			
3	**Event Logger Time Synchronised**	YES/NO	NO			
	Distance Recorder	YES/NO	NO			
	DR Tme Synchronised	YES/NO	NO			
4	**Bus Bar Protection**	YES/NO	NO			
	Stability Check					
	EL output for this event	YES/NO				
	DR if available	YES/NO				
5	**DG Set**	YES/NO	NO			
6	**Mock Testing for a sample protection associated with transmission line*** **	YES/NO	I. If yes than observation .... ii. If no, the reason for the same			
	LBB/BFR	YES/NO	NO			
	Retrip	YES/NO	NO			
	Current and Time Setting					
	Separate single and three phase initiation	YES/NO	NO			
	Earth Fault	YES/NO	NO			
	Event Logger operation	YES/NO	NO			

Assistant Engineer (MPT&S)
RVPNL, CHITTORGARH

Rajasthan Rajya Vidhyut Prasaran Nigam Limited

RRVPN 220kV Sitapura S/s

Report of the Protection Audit

A. General Information

i)	Name of utility:	Rajasthan Rajya Vidhyut Prasaran Nigam Limited
ii)	Name of Voltage level of Substation:	220 kV GSS Sitapura
iii)	Date of Commissioning:	31.03.2015
iv)	Type of Bus Switching Scheme	One and Half Breaker Scheme
v)	Name and Organization of Audit Team	Kapish Sharma, AEN(MPT&S), RVPN, Jaipur
		Seema Choudhary, JEN o/o AEN(MPT&S), RVPN, Jaipur
vi)	Name of representative from utility whose audit being carried out	Sh. D.K.Jain, SE (Prot. Engg.), RVPN , Jaipur

B. Checklist for Protection Audit

S.No.	Check		Functional/ Non-Functional/Enabled/ Disabled	Type of Relay*(Numerical /Static/Electromechanical)	Setting as found in field*/**	Compliance status w.r.t. regulatory provisions
1	**DC system**					
	No. of independent DC Sources	1 nos. 220 VDC	Functional			
	Potential between +ive & earth (Source-1)	122.2 V	-	-	-	-
	Potential between -ive & earth (Source-1)	123.0 V	-	-	-	-
2	Event Logger panel	No	-	-	-	-
3	Event Logger Time Synchronised	NA	-	-	-	-
	Disturbance Recorder	NA	-	-	-	-
	DR Time Synchronised	NA	-	-	-	-
4	Bus bar Protection	Yes	Functional	Numerical	120 % Pickup	Complying
	Stability Check	Yes(On Running load)	-	-	-	-
	EL output for this event	No	-	-	-	-
	DR if available	No	-	-	-	-
5	DG Set	No	-	-	-	-
	Mock testing of a sample protection associated with transmission line* **	Yes/ No	i. If Yes then observation..... ii. If no, the reason for the same.....			
6	**Local Breaker Back Up(For Line)**		-	Numerical	-	-
	Retrip	Yes	Enabled	-	-	Complying
	Current and Time Setting	Yes	-	-	PU-120%/100 ms+100 ms External timer	Complying
	Separate Single and three phase initiation	Yes	Functional	-	-	Complying
	Earth Fault	No	Disabled	-	-	Complying
	Event logger operation	Yes	In built feature of numerical LBB relay			

*complying with the code of configuration issued by The CE (MPT&S) RVPN, Jaipur by letter no. RVPN/SE/MPT&S/JPR/Tech./F./ Rajkaj ref. No. 5221696/D.166 dated 21.12.2023

Name. Signature & Contact No. of team carriying out	Kapish Sharma, AEN(MPT&S), RVPN, Jaipur	
	Seema Choudhary, JEN o/o AEN(MPT&S), RVPN, Jaipur	
Name. Signature & Contact No. of representative of Utility	Sh. D.K.Jain, SE (Prot. Engg.), RVPN , Jaipur	

Rajasthan Rajya Vidhyut Prasaran Nigam Limited

Report of the Protection Audit

A. General Information

i)	Name of utility:	Rajasthan Rajya Vidhyut Prasaran Nigam Limited
ii)	Name of Voltage level of Substation:	220 kV GSS Sitapura
iii)	Date of Commissioning:	31.03.2015
iv)	Type of Bus Switching Scheme	One and Half Breaker Scheme
v)	Name and Organization of Audit Team	Kapish Sharma, AEN(MPT&S), RVPN, Jaipur Seema Choudhary, JEN o/o AEN(MPT&S), RVPN, Jaipur
vi)	Name of representative from utility whose audit being carried out	Sh. D.K.Jain, SE (Prot. Engg.), RVPN , Jaipur

B. Checklist for Protection Audit

S.No.	Check		Functional/ Non-Functional/Enabled /Disabled	Type of Relay*(Numerical /Static/Electromechanical)	Setting as found in field*/**	Compliance status w.r.t. regulatory provisions
Transformer Protection Panel						
(i)	**Name of Transformer (Rating/Capacity)**	**220/132 kV, 100 MVA IMP make Transformer**				
	Tripping by Buchholz Relay (Alarm)	Yes	Enabled	Electromechanical		Complying
	Differential Protection	Yes	Enabled	Numerical		Complying
	2nd Harmonic Block (Setting)		Enabled		15%	Complying
	Event Logger Operation	Yes	In built feature of numerical differential relay			
	Restricted Earth Fault Protection (HV Side)(Auto X-mer)	Yes	Functional	Numerical	42.28	Complying
	Event Logger Operation	Yes	In built feature of numerical REF relay			
	REF Protection (LV Side)	NA				
	Event Logger Operation	NA				
	Backup Over Current	Yes	Enabled	Numerical	0.42/0.208	Complying
	Event Logger Operation	Yes	In built feature of numerical O/C & E/F relay			
	Earth Fault Protection	Yes	Enabled	Numerical	0.2/0.232	Complying
	Event Logger Operation	Yes	In built feature of numerical O/C & E/F relay			
	Over Flux Protection	Yes	Enabled			Complying
	Event Logger Operation	Yes	In built feature of numerical differential relay			
	Local Breaker Back Up	Yes				
	Retrip	Yes	Enabled			Complying
	Current and Time Setting				120%/100 ms+100 ms External timer	Complying
	Separate Single and three phase initiation	No(3 phase only)				Complying
	Earth Fault	No				Complying
	Event logger	Yes	In built feature of numerical LBB relay			

*complying with the code of configuration issued by The CE (MPT&S) RVPN, Jaipur by letter no. RVPN/SE/MPT&S/JPR/Tech./F./ Rajkaj ref. No. 5221696/D.166 dated 21.12.2023

Name. Signature & Contact No. of team carriying out	Kapish Sharma, AEN(MPT&S), RVPN, Jaipur Seema Choudhary, JEN o/o AEN(MPT&S), RVPN, Jaipur	
Name. Signature & Contact No. of representative of Utility	Sh. D.K.Jain, SE (Prot. Engg.), RVPN , Jaipur	

Non Directional O/C & E/F relay calculation for 220/132 kV, 100 MVA Transformer

Fault MVA of 220 kV BUS	:	8519	MVA
P.U. Impedance of 220 kV BUS		0.0117	
% Imepdance of transformer at Normal Tap		11.59	%
Transformer HV Voltage rating		220000	Volts
Transformer LV Voltage rating		132000	Volts
Transformer MVA Capacity		160	MVA
P.U. Impedance of Transformer		0.072438	
Total P.U. Impedance		0.0842	
Fault MVA of 132 kV BUS	:	1188	MVA
3 Phase through fault Short Circuit Current		5196	Amp
Phase-Phase through fault Short Circuit Current		4500	Amp
Phase to Earth through fault Short Circuit Current		2806	Amp

Non Directional Overcurrent Element Setting

CT Ratio	1000/1		
Plug Setting	420 % i.e.	420	Amp
Plug Setting Multiplier	10.71429		
Time of Operation	0.6	Seconds	
TMS	0.208		

Non Directional Earthfault Element Setting

CT Ratio	1000/1		
Plug Setting	20 % i.e.	200	Amp
Plug Setting Multiplier	14.03		
Time of Operation	0.6	Seconds	
TMS	0.232		

Stablizing Resistor calculation for Restricted Earth fault relay

Transformer Full load current HV	420	Amp
Transformer Full load current LV	700	Amp
Maximum fault current on through fault (If)	6040	Amp
Bushing CT Ratio	1000	
Lead resistance	1	Ohm
Rct	5	Ohm
Vk=	If*(Rct+2Rl)	
Vk=	42.3	Volts
REF Operating Current	0.1	Amp
Stablizing Resistor	423	Ohm

Rajasthan Rajya Vidhyut Prasaran Nigam Limited

Report of the Protection Audit

A. General Information

i)	Name of utility:	Rajasthan Rajya Vidhyut Prasaran Nigam Limited
ii)	Name of Voltage level of Substation:	220 kV GSS Sitapura
iii)	Date of Commissioning:	31.03.2015
iv)	Type of Bus Switching Scheme	One and Half Breaker Scheme
v)	Name and Organization of Audit Team	Kapish Sharma, AEN(MPT&S), RVPN, Jaipur Seema Choudhary, JEN o/o AEN(MPT&S), RVPN, Jaipur
vi)	Name of representative from utility whose audit being carried out	Sh. D.K.Jain, SE (Prot. Engg.), RVPN , Jaipur

B. Checklist for Protection Audit

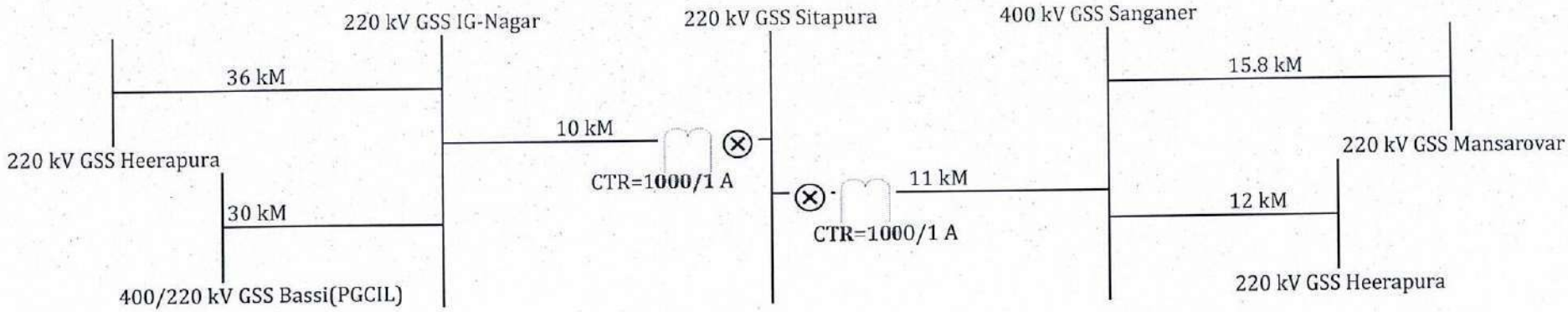
S.No.	Check		Functional / Non-Functional /Enabled/ Disabled	Type of Relay*(Numerical/Static/Electromechanical)	Setting as found in field*/**	Compliance status w.r.t. regulatory provisions
Distance protection Panel:M-I/II						
(i)	**Name of Line**	**220 kV IG Nagar Line**				
	Pole discrepancy relay	Yes	Functional(On CB)	Electromechanical	2 sec.	
	PLCC panel	Yes	Functional			
	Zone-1/2/3/4/5(settings)	Yes	Functional	Numerical Distance Protection Relays	Z1=1.632 Ohm, T1=0 ms Z2=5.101 Ohm, T2=350 ms Z3=10.121 Ohm, T3=1000 ms Z4(Rev.)=408 mOhm, T4=160 ms	Complying
	Time check-Zone-1/2/3/4/5(settings)	Yes	Functional			
	SOTF	No	Disabled	-	-	Complying
	Aided schemes	Yes	Functional	In built feature of Numerical Distance Protection Relays	Permissive Under Reach, Phase Z1 Z2+CR 1	Complying
	Fault locator	Yes	Functional	In built feature of Numerical Distance Protection Relays	-	Complying

S.No.	Check		Functional / Non-Functional /Enabled/ Disabled	Type of Relay*(Numerical/Static/Electromechanical)	Setting as found in field*/**	Compliance status w.r.t. regulatory provisions
	Power swing(S(settings R and X)				R=5 Ohm, X=5 Ohm	Complying
	All Zone block	Yes	Enabled	In built feature of Numerical Distance Protection Relays	-	Complying
	DR	Yes	Enabled		-	Complying
	Binary Input					
	Breaker Contacts	Yes	Functional	-	-	Complying
	Carrier Receive	Yes	Functional	-	-	Complying
	Time Synchronization	Yes	Functional	-	-	Complying
(ii)	**Name of Line**	**220 kV Sanganer Line**				
	Pole discrepancy relay	Yes	Functional(On CB)	Electromechanical	2 Sec.	
	PLCC panel	Yes	Functional			
	Zone-1/2/3/4/5(settings)	Yes	Functional	Numerical Distance Protection Relays	Z1=1.796 Ohm, T1=0 ms Z2=3.469 Ohm, T2=350 ms Z3=5.791 Ohm, T3=1000 ms Z4(Rev.)=408 mOhm, T4=160 ms	Complying
	Time check-Zone-1/2/3/4/5(settings)	Yes	Functional			
	SOTF	No	Disabled	-	-	Complying
	Aided schemes	Yes	Functional	In built feature of Numerical Distance Protection Relays	Permissive Under Reach, 1 Phase Z1 Z2+CR	Complying
	Fault locator	Yes	Functional	In built feature of Numerical Distance Protection Relays	-	Complying
	Power swing(S(settings R and X)				R=5 Ohm, X=5 Ohm	Complying
	All Zone block	Yes	Enabled	In built feature of Numerical Distance	-	Complying
	DR	Yes	Enabled		-	Complying
	Binary Input					
	Breaker Contacts	Yes	Functional	-	-	Complying
	Carrier Receive	Yes	Functional	-	-	Complying
	Time Synchronization	Yes	Functional	-	-	Complying

*complying with the code of configuration issued by The CE (MPT&S) RVPN, Jaipur by letter no. RVPN/SE/MPT&S/JPR/Tech./F./ Rajkaj ref. No. 5221696/D.166 dated 21.12.2023

Name. Signature & Contact No. of team carriying out	Kapish Sharma, AEN(MPT&S), RVPN, Jaipur Seema Choudhary, JEN o/o AEN(MPT&S), RVPN, Jaipur	
Name. Signature & Contact No. of representative of Utility	Sh. D.K.Jain, SE (Prot. Engg.), RVPN , Jaipur	

Distance relay calculation for 220 kV Sitapura-IG Nagar Line



Principle line Length : 10 KM.
Shortest Line Length considered on Remote Bus 30 KM.
Longest line length Considered on Remote Bus 36 KM.

EARTH FAULT COMPENSATION

RE/RL=1/3((Ro/R1)-1)
XE/XL=1/3((Xo/X1)-1)

	kZ0	kZ0 angle
kZ0 Res. Comp.= kZ0 = (Z0 – Z1) / 3Z1	0.734	-1.83

Conductor Used : Zebra

Conductor Parameters :

	R	X	Z	Angle
Positive Sequence(Z1):	0.081	0.4	0.408	78.55
Zero Sequence(Z0):	0.2875	1.275	1.307	77.29

CTR: 1000/1 Amp= 1000
PTR: 220000/110 V= 2000
CTR/PTR: 0.5

Zone 1(Forward) Reach:	80	% of the Line to be Protected
Zone 2(Forward) Reach:	50	% of the Shortest Line on remote Bus+100 % of the Protected Line
Zone 3(Forward) Reach:	110	% Longest line length on Remote Bus+100 % of the Protected Line
Zone 4(Reverse) Reach:	2	Km

Zone 1 forward Reach= 80% of line length (SEZ to PGCIL)* +ve Sequence impedance of conductor/km*(CTR/PTR)

= 1.632 **Ohm** **T1= Instt.**

Zone 2 forward Reach= 100% of line length (SEZ to PGCIL)+50 % of the Shortest Line on remote Bus(PGCIL-Chaksu)*+ve Sequence impedance of conductor/km*(CTR/PTR)

= 5.101 **Ohm** **T2=350 ms**

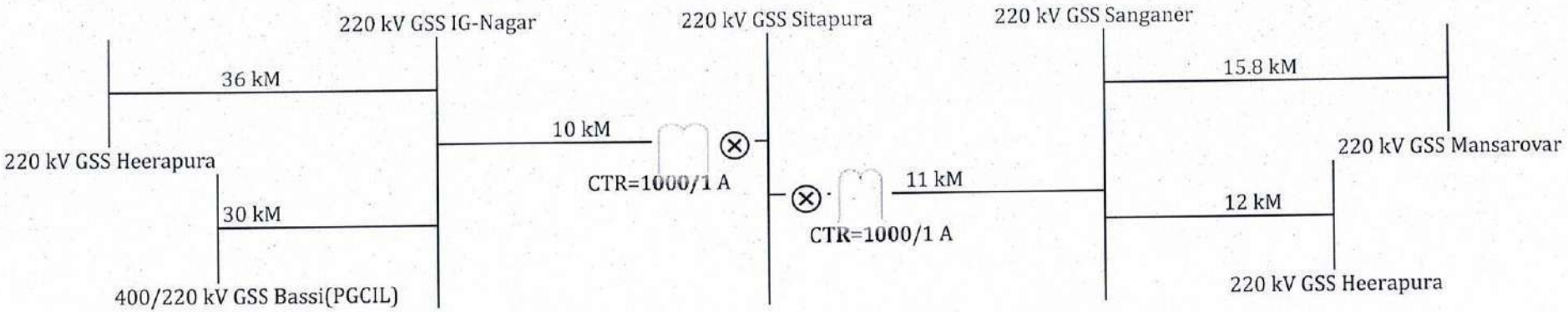
Zone 3 forward Reach=100% of line length (SEZ to PGCIL)+110 % Longest line length on Remote Bus(PGCIL-Vatika)*+ve Sequence impedance of conductor/km*(CTR/PTR)

= 10.121 **Ohm** **T3=1000 ms**

Zone 4 reverse Reach=2 km*+ve Sequence impedance of conductor/km*(CTR/PTR)

= 0.408 **Ohm** **T4=160 ms**

Distance relay calculation for 220 kV Sitapura-Heerapura Line



Principle line Length : 11 KM.
Shortest Line Length considered on Remote Bus 12 KM.
Longest line length Considered on Remote Bus 15.8 KM.

EARTH FAULT COMPENSATION

RE/RL=1/3((Ro/R1)-1)
XE/XL=1/3((Xo/X1)-1)
kZ0 Res. Comp.= kZ0 = (Z0 – Z1) / 3Z1

kZ0	kZ0 angle
0.734	-1.83

Conductor Used : Zebra

Conductor Parameters :

	R	X	Z	Angle
Positive Sequence(Z1):	0.081	0.4	0.408	78.55
Zero Sequence(Z0):	0.2875	1.275	1.307	77.29

CTR: 1000/1 Amp= 1000
PTR: 220000/110 V= 2000
CTR/PTR: 0.5

Zone 1(Forward) Reach:	80	% of the Line to be Protected
Zone 2(Forward) Reach:	50	% of the Shortest Line on remote Bus+100 % of the Protected Line
Zone 3(Forward) Reach:	110	% Longest line length on Remote Bus+100 % of the Protected Line
Zone 4(Reverse) Reach:	2	Km

Zone 1 forward Reach= 80% of line length (Sitapura to Sanganer)* +ve Sequence impedance of conductor/km*(CTR/PTR)

= **1.796** Ohm T1= Instt.

Zone 2 forward Reach= 100% of line length (Sitapura to Sanganer)+50 % of the Shortest Line on remote Bus(Sanganer to Heerapura)*+ve Sequence impedance of conductor/km*(CTR/PTR)

= **3.469** Ohm T2=350 ms

Zone 3 forward Reach=100% of line length (Sitapura to Sanganer)+110 % Longest line length on Remote Bus(Sanganer to Mansarovar)*+ve Sequence impedance of conductor/km*(CTR/PTR)

= **5.791** Ohm T3=1000 ms

Zone 4 reverse Reach=2 km*+ve Sequence impedance of conductor/km*(CTR/PTR)

= **0.408** Ohm T4=160 ms

Rajasthan Rajya Vidhyut Prasaran Nigam

Report of the Protection Audit on dated 14.06.2024

A. General Information

(i) Name of Utility - 400KV GSS BHILWARA
(ii) Name of Voltage Level of Sub Station - 400/220 kV
(iii) Date of Commissioning - 30 03 2010
(iv) Type of Bus Switching Scheme - 400KV Main Bus I & II
(v) Name and Organization of Audit Team - XEN (MPT&S) RVPNL BHILWARA
(vi)Name of representative from utility whose audit being carried out - XEN 400KV GSS RVPNL BHILWARA

B. Check List for Protection Audit

S No	Check		Functional/NonFunctional /Enabled/Disabled	Type of Relay (Numerical/Static/Electromechanical)	Setting as found in field	Compliance Status w r t regulatory provisions
	Transformer Protection Panel:					
(i)	**Name of Transformer/ICT (Rating/Capacity)**	**400/220/33KV, 500 MVA Transformer-I (SIEMENSEMake)**				
	Tripping by Buchholz relay (Alarm)	Yes/ No	Functional	Conventional		
	Differential Protection	Yes/ No	Functional	Numerical	0.20, 8.0	
	2nd Harmonic Block (Setting)	Yes/ No	Enabled		15%	
	Event logger Operation	Yes/ No	SAS Installed			
	Restricted Earth Fault Protection (HV Side)	Yes/ No	Functional	Numerical	20% inst	
	Event logger Operation	Yes/ No	SAS Installed			
	Restricted Earth Fault Protection (LV Side)	Yes/ No	Functional	Numerical	20% inst	
	Event logger Operation	Yes/ No	SAS Installed			
	Backup Over Current	Yes/ No	Functional	Numerical	0.81, 0.230	
	Event logger Operation	Yes/ No	SAS Installed			
	Earth Fault Protection	Yes/ No	Functional	Numerical	0.2, 0.350	
	Event logger Operation	Yes/ No	SAS Installed			
	Over Flux Protection	Yes/ No	Enabled	Numerical	Alarm 110%, 5 Sec and Trip	
	Event logger Operation	Yes/ No	SAS Installed			
	Local Breaker Back Up	Yes/ No	Functional	Numerical		
	Retrip	Yes/ No	Enabled		100 mSec	
	Current and Time Setting	Yes/ No	Enabled		120%, 100+100 mSec	
	Separate Single and three Phase Initiation	Yes/ No	Enabled		Single phase initiation	
	Earth Fault	Yes/ No	Disable			
	Event logger Operation	Yes/ No	SAS Installed			
(ii)	**Name of Transformer (Rating/Capacity)**	**400/220/33 KV 315 MVA make AREVA**				
	Tripping by Buchholz relay (Alarm)	Yes/ No	Functional	Conventional		
	Differential Protection	Yes/ No	Functional	Numerical	0.2, 8.0	
	2nd Harmonic Block (Setting)	Yes/ No	Enabled		15%	
	Event logger Operation	Yes/ No	SAS Installed			
	Restricted Earth Fault Protection (HV Side)	Yes/ No	Functional	Numerical	0.2 Inst	
	Event logger Operation	Yes/ No	SAS Installed			
	Restricted Earth Fault Protection (LV Side)	Yes/ No	Functional	Numerical	0.2, Inst	
	Event logger Operation	Yes/ No	SAS Installed			
	Backup Over Current	Yes/ No	Functional	Numerical	0.51, 0.230	
	Event logger Operation	Yes/ No	SAS Installed			
	Earth Fault Protection	Yes/ No	Functional	Numerical	0.2, 0.310	
	Event logger Operation	Yes/ No	SAS Installed			
	Over Flux Protection	Yes/ No	Enabled	Numerical	Alarm 110%, 5 Sec and Trip	
	Event logger Operation	Yes/ No	SAS Installed			
	Local Breaker Back Up	Yes/ No	Functional	Numerical		
	Retrip	Yes/ No	Enabled		100 mSec	
	Current and Time Setting	Yes/ No	Enabled		120%, 100 +100 mSec	
	Separate Single and three Phase Initiation	Yes/ No	Enabled		Single phase initiation	
	Earth Fault	Yes/ No	Disable			
	Event logger Operation	Yes/ No	SAS Installed			

Rajasthan Rajya Vidhyut Prasaran Nigam

Report of the Protection Audit

A. General Information

(i) Name of Utility - 400KV GSS BHILWARA

(ii) Name of Voltage Level of Sub Station - 400/220 kv

(iii) Date of Commissioning - 30.03.2010

(iv) Type of Bus Switching Scheme - 400KV Main Bus I & II

(v) Name and Organization of Audit Team - XEN (MPI&S) RVPNL BHILWARA

(vi)Name of representative from utility whose audit being carried out - XEN 400KV GSS RVPNL BHILWARA

B. Check List for Protection Audit

S No.	Check		Functional/NonFunctional/Enabled/Disabled	Type of Relay (Numerical/Static/Electromechanical)	Setting as found in field	Compliance Status w r t regulatory provisions
	Distance Protection Panel:M-I/II					
(I)	**Name of Line**	**400KV Bhilwara Chhabra**				
	Pole Discrepancy Relay	Yes/ No	Functional	Electromechanical	1.5s	
	PLCC Panel	Yes/ No	Functional			
	Zone-1/2/3/4/5 (Settings)	Yes/ No	Enabled	Numerical	As per Line length 0, 0.350 , 1.00 ,0.160 s	
	Time Check-Z-1/2/3/4/5(Settings)	Yes/ No	Enabled			
	SOTF	Yes/ No	Disabled			
	Aided Scheme	Yes/ No	Enabled			
	Fault Locator	Yes/ No	Enabled			
	Power Swing (Setting R & X)	Yes/ No	Enabled			
	All Zone Block	Yes/ No	Enabled			
	DR	Yes/ No	Enabled			
	Binary Inputs	Yes/ No	Enabled			
	Breaker Contacts	Yes/ No	Enabled			
	Carrier Receive	Yes/ No	Enabled			
	Time Synchronization	Yes/ No	Enabled	Through SAS		
	Distance Protection Panel:M-I/II					
(II)	**Name of Line**	**400KV Bhilwara- Chittorgarh-I**				
	Pole Discrepancy Relay	Yes/ No	Functional	Electromechenical	1.5s	
	PLCC Panel	Yes/ No	Functional			
	Zone-1/2/3/4/5 (Settings)	Yes/ No	Enabled	Numerical	As per Line length 0, 0.350 , 1.00 ,0.160 s	
	Time Check-Z-1/2/3/4/5(Settings)	Yes/ No	Enabled			
	SOTF	Yes/ No	Disabled			
	Aided Scheme	Yes/ No	Enabled			
	Fault Locator	Yes/ No	Enabled			
	Power Swing (Setting R & X)	Yes/ No	Enabled			
	All Zone Block	Yes/ No	Enabled			
	DR	Yes/ No	Enabled			
	Binary Inputs	Yes/ No	Enabled			
	Breaker Contacts	Yes/ No	Enabled			
	Carrier Receive	Yes/ No	Enabled			
	Time Synchronization	Yes/ No	Enabled	Through SAS		
	Distance Protection Panel:M-I/II					
(I)	**Name of Line**	**400KV Bhilwara- Chittorgarh-II**				
	Pole Discrepancy Relay	Yes/ No	Functional	Electromechanical	1.5s	
	PLCC Panel	Yes/ No	Functional			
	Zone-1/2/3/4/5 (Settings)	Yes/ No	Enabled	Numerical	As per Line length 0, 0.350 , 1.00 ,0.160 s	
	Time Check-Z-1/2/3/4/5(Settings)	Yes/ No	Enabled			
	SOTF	Yes/ No	Disabled			
	Aided Scheme	Yes/ No	Enabled			
	Fault Locator	Yes/ No	Enabled			
	Power Swing (Setting R & X)	Yes/ No	Enabled			
	All Zone Block	Yes/ No	Enabled			
	DR	Yes/ No	Enabled			
	Binary Inputs	Yes/ No	Enabled			
	Breaker Contacts	Yes/ No	Enabled			
	Carrier Receive	Yes/ No	Enabled			
	Time Synchronization	Yes/ No	Enabled	Through SAS		

(I)	Name of Line	400KV Bhilwara-Ajmer -I				
	Pole Discrepancy Relay	Yes/ No	Functional	Electromechanical	1.5s	
	PLCC Panel	Yes/ No	Functional			
	Zone-1/2/3/4/5 (Settings)	Yes/ No	Enabled	Numerical	As per Line length 0, 0.350 , 1.00 ,0.160 s	
	Time Check-Z-1/2/3/4/5(Settings)	Yes/ No	Enabled			
	SOTF	Yes/ No	Disabled			
	Aided Scheme	Yes/ No	Enabled			
	Fault Locator	Yes/ No	Enabled			
	Power Swing (Setting R & X)	Yes/ No	Enabled			
	All Zone Block	Yes/ No	Enabled			
	DR	Yes/ No	Enabled			
	Binary Inputs	Yes/ No	Enabled			
	Breaker Contacts	Yes/ No	Enabled			
	Carrier Receive	Yes/ No	Enabled			
	Time Synchronization	Yes/ No	Enabled	Through SAS		

(I)	Name of Line	400KV Bhilwara-Ajmer -II				
	Pole Discrepancy Relay	Yes/ No	Functional	Electromechanical	1.5s	
	PLCC Panel	Yes/ No	Functional			
	Zone-1/2/3/4/5 (Settings)	Yes/ No	Enabled	Numerical	As per Line length 0, 0.350 , 1.00 ,0.160 s	
	Time Check-Z-1/2/3/4/5(Settings)	Yes/ No	Enabled			
	SOTF	Yes/ No	Disabled			
	Aided Scheme	Yes/ No	Enabled			
	Fault Locator	Yes/ No	Enabled			
	Power Swing (Setting R & X)	Yes/ No	Enabled			
	All Zone Block	Yes/ No	Enabled			
	DR	Yes/ No	Enabled			
	Binary Inputs	Yes/ No	Enabled			
	Breaker Contacts	Yes/ No	Enabled			
	Carrier Receive	Yes/ No	Enabled			
	Time Synchronization	Yes/ No	Enabled	Through SAS		

220 kv feeders

(I)	Name of Line	220KV Bhilwara- Inter connector -I				
	Pole Discrepancy Relay	Yes/ No	Functional	Electromechanical	1.5s	
	PLCC Panel	Yes/ No	Functional			
	Zone-1/2/3/4/5 (Settings)	Yes/ No	Enabled	Numerical	As per Line length 0, 0.350 , 1.00 ,0.160 s	
	Time Check-Z-1/2/3/4/5(Settings)	Yes/ No	Enabled			
	SOTF	Yes/ No	Disabled			
	Aided Scheme	Yes/ No	Enabled			
	Fault Locator	Yes/ No	Enabled			
	Power Swing (Setting R & X)	Yes/ No	Enabled			
	All Zone Block	Yes/ No	Enabled			
	DR	Yes/ No	Enabled			
	Binary Inputs	Yes/ No	Enabled			
	Breaker Contacts	Yes/ No	Enabled			
	Carrier Receive	Yes/ No	Enabled			
	Time Synchronization	Yes/ No	Enabled	Through SAS		

(I)	Name of Line	220KV Bhilwara- Inter connector -II				
	Pole Discrepancy Relay	Yes/ No	Functional	Electromechanical	1.5s	
	PLCC Panel	Yes/ No	Functional			
	Zone-1/2/3/4/5 (Settings)	Yes/ No	Enabled	Numerical	As per Line length 0, 0.350 , 1.00 ,0.160 s	
	Time Check-Z-1/2/3/4/5(Settings)	Yes/ No	Enabled			
	SOTF	Yes/ No	Disabled			
	Aided Scheme	Yes/ No	Enabled			
	Fault Locator	Yes/ No	Enabled			
	Power Swing (Setting R & X)	Yes/ No	Enabled			
	All Zone Block	Yes/ No	Enabled			
	DR	Yes/ No	Enabled			
	Binary Inputs	Yes/ No	Enabled			
	Breaker Contacts	Yes/ No	Enabled			
	Carrier Receive	Yes/ No	Enabled			
	Time Synchronization	Yes/ No	Enabled	Through SAS		

(I)	Name of Line	220KV Bhilwara- Baman Tukada				
	Pole Discrepancy Relay	Yes/ No	Functional	Electromechanical	1.5s	
	PLCC Panel	Yes/ No	Functional			
	Zone-1/2/3/4/5 (Settings)	Yes/ No	Enabled	Numerical	As per Line length 0, 0.350 , 1.00 ,0.160 s	
	Time Check-Z-1/2/3/4/5(Settings)	Yes/ No	Enabled			
	SOTF	Yes/ No	Disabled			
	Aided Scheme	Yes/ No	Enabled			
	Fault Locator	Yes/ No	Enabled			
	Power Swing (Setting R & X)	Yes/ No	Enabled			
	All Zone Block	Yes/ No	Enabled			
	DR	Yes/ No	Enabled			
	Binary Inputs	Yes/ No	Enabled			
	Breaker Contacts	Yes/ No	Enabled			
	Carrier Receive	Yes/ No	Enabled			
	Time Synchronization	Yes/ No	Enabled	Through SAS		

(I)	**Name of Line**	**220KV Bhilwara- Pali**		Electromechanical	1 5s	
	Pole Discrepancy Relay	Yes/ No	Functional			
	PLCC Panel	Yes/ No	Functional	Numerical	As per Line length 0, 0 350 , 1 00 ,0 160 s	
	Zone-1/2/3/4/5 (Settings)	Yes/ No	Enabled			
	Time Check-Z-1/2/3/4/5(Settings)	Yes/ No	Enabled			
	SOTF	Yes/ No	Disabled			
	Aided Scheme	Yes/ No	Enabled			
	Fault Locator	Yes/ No	Enabled			
	Power Swing (Setting R & X)	Yes/ No	Enabled			
	All Zone Block	Yes/ No	Enabled			
	DR	Yes/ No	Enabled			
	Binary Inputs	Yes/ No	Enabled			
	Breaker Contacts	Yes/ No	Enabled			
	Carrier Receive	Yes/ No	Enabled			
	Time Synchronization	Yes/ No	Enabled	Through SAS		

(I)	**Name of Line**	**220KV Bhilwara- JSW**		Electromechanical	1 5s	
	Pole Discrepancy Relay	Yes/ No	Functional			
	PLCC Panel	Yes/ No	Functional	Numerical	As per Line length 0, 0 350 , 1 00 ,0 160 s	
	Zone-1/2/3/4/5 (Settings)	Yes/ No	Enabled			
	Time Check-Z-1/2/3/4/5(Settings)	Yes/ No	Enabled			
	SOTF	Yes/ No	Disabled			
	Aided Scheme	Yes/ No	Enabled			
	Fault Locator	Yes/ No	Enabled			
	Power Swing (Setting R & X)	Yes/ No	Enabled			
	All Zone Block	Yes/ No	Enabled			
	DR	Yes/ No	Enabled			
	Binary Inputs	Yes/ No	Enabled			
	Breaker Contacts	Yes/ No	Enabled			
	Carrier Receive	Yes/ No	Enabled			
	Time Synchronization	Yes/ No	Enabled	Through SAS		

Rajasthan Rajya Vidhyut Prasaran Nigam

Report of the Protection Audit

A. General Information

(i) Name of Utility - 400KV GSS BHILWARA

(ii) Name of Voltage Level of Sub Station - 400/220 kv

(iii) Date of Commissioning - 30 03 2010

(iv) Type of Bus Switching Scheme - 400KV Main Bus I & II

(v) Name and Organization of Audit Team - XEN (MPT&S) RVPNL BHILWARA

(vi)Name of representative from utility whose audit being carried out - XEN 400KV GSS RVPNL BHILWARA

B. Check List for Protection Audit

S.No	Check		Functional/NonFunctional /Enabled/Disabled	Type of Relay (Numerical/Static/Electromechanical)	Setting as found in field	Compliance Status w r t regulatory provisions
1	**DC System**		Functional			
	No Of Independent DC Source	2	1 & 2			
	Potential Between +ve & Earth (Source-I)	V	Fuctional		140 V	
	Potential Between -ve & Earth (Source-I)	V	Fuctional		80 V	
	Potential Between +ve & Earth (Source-II)	V	Fuctional		130 V	
	Potential Between -ve & Earth (Source-II)	V	Fuctional		100 V	
2	**Event Logger Panel**	Yes/ No	No			
3	**Event Logger Time Synchronised**	Yes/ No	No			
	Disturbance Recorder	Yes/ No	No			
	DR Time Synchronised	Yes/ No	No			
4	**Bus Bar Protection**	Yes/ No	Yes, Fuctional			
	Stability Check	Yes/ No	Yes, Fuctional			
	EL Output for this Event	Yes/ No	Yes, Fuctional			
	DR if Available	Yes/ No	Yes, Fuctional			
5	**DG Set**	Yes/ No	Manual			
6	**Mock Testing of Sample Protection Associated with Transmission line**	Yes/ No	Satisfactory			
	LBB/BFR	Yes/ No	Functional	Numerical		
	Retrip	Yes/ No	Enabled		100 mSec	
	Current and Time Setting	Yes/ No	Enabled		120% , 100 mSec	
	Separate Single and Three Phase initiation	Yes/ No	Enabled		Three phase initiation	
	Earth Fault	Yes/ No	Disable			
	Event Logger Operation	Yes/ No	SAS Installed			

Rajasthan Rajya Vidhyut Prasaran Nigam

Report of the Protection Audit

A. General Information

(i) Name of Utility - 400KV GSS BHILWARA

(ii) Name of Voltage Level of Sub Station - 400/220 kV

(iii) Date of Commissioning - 30.03.2010

(iv) Type of Bus Switching Scheme - 400KV Main Bus I & II

(v) Name and Organization of Audit Team - XEN (MPT&S) RVPNL BHILWARA

(vi)Name of representative from utility whose audit being carried out - XEN 400KV GSS RVPNL BHILWARA

B. Check List for Protection Audit: Bus Reactor

S No	Check		Functional/NonFunctional/Enabled/Disabled	Type of Relay (Numerical/Static/Electromechanical)	Setting as found in field	Compliance Status w r t regulatory provisions
	Reactor Protection Panel:	Yes/No	Yes	Numerical		
	Tripping by Buchholz relay (Alarm)	Yes/No	Functional			
	Differential Protection	Yes/No	Yes	Numerical	0.2 & 8.0	
	2nd Harmonic Block (Setting)	Yes/No	Yes		15%	
	Event logger Operation	Yes/No	SAS Installed			
	Restricted Earth Fault Protection (HV Side)	Yes/No	Yes	Numerical	0.2 Inst	
	Event logger Operation	Yes/No	SAS Installed			
	Restricted Earth Fault Protection (LV Side)	Yes/No	No			
	Event logger Operation	Yes/No				
	Backup Over Current	Yes/No	Yes	Numerical	0.5, 0.350ms	
	Event logger Operation	Yes/No	SAS Installed			
	Earth Fault Protection	Yes/No	Yes	Numerical	0.2, 0.350ms	
	Event logger Operation	Yes/No	SAS Installed			
	Over Flux Protection	Yes/No	No			
	Event logger Operation	Yes/No	No			

A. General Information

(i) Name of Utility - 400KV GSS BHILWARA

(ii) Name of Voltage Level of Sub Station - 400/220 kV

(iii) Date of Commissioning - 30.03.2010

(iv) Type of Bus Switching Scheme - 400KV Main Bus I & II

(v) Name and Organization of Audit Team - XEN (MPT&S) RVPNL BHILWARA

(vi)Name of representative from utility whose audit being carried out:- XEN 400KV GSS RVPNL BHILWARA

B. Check List for Protection Audit: - Line Reactor

S No	Check		Functional/NonFunctional/Enabled/Disabled	Type of Relay (Numerical/Static/Electromechanical)	Setting as found in field	Compliance Status w r t regulatory provisions
	Reactor Protection Panel:	Yes/No	Yes	Numerical		
	Tripping by Buchholz relay (Alarm)	Yes/No	Functional			
	Differential Protection	Yes/No	Yes	Numerical	0.2 & 8.0	
	2nd Harmonic Block (Setting)	Yes/No	Yes		15%	
	Event logger Operation	Yes/No	SAS Installed			
	Restricted Earth Fault Protection (HV Side)	Yes/No	Yes	Numerical	0.2, Inst	
	Event logger Operation	Yes/No	SAS Installed			
	Restricted Earth Fault Protection (LV Side)	Yes/No	No			
	Event logger Operation	Yes/No				
	Backup Over Current	Yes/No	No			
	Event logger Operation	Yes/No				
	Earth Fault Protection	Yes/No	No			
	Event logger Operation	Yes/No				
	Over Flux Protection	Yes/No	No			
	Event logger Operation	Yes/No	No			

Executive Engineer (MPT&S)
RVPNL, Bhilwara

Rajasthan Rajya Vidhyut Prasaran Nigam

Report of the Protection Audit dt 23.08.24

A. General Information

(i) Name of Utility:- 220 KV GSS Amberi
(ii) Name of Voltage Level of Sub Station:- 220/132 KV
(iii) Date of Commissioning:- 08.09.2017
(iv) Type of Bus Switching Scheme:- Main Bus and Aux. Bus
(v) Name and Organization of Audit Team:- XEN (MPT&S) RVPNL , Udaipur
(vi)Name of representative from utility whose audit being carried out:-XEN 220KV GSS Amberi

B. Check List for Protection Audit

S.No	Check		Functional NonFunctional Enabled Disabled	Type of Relay (Numerical Static Electromechanical)	Setting as found in field	Compliance Status w.r.t regulatory provisions
	Transformer Protection Panel:					
(i)	**Name of Transformer (Rating/Capacity)**	**220/132KV , 160MVA BHEL**				
	Tripping by Buchholz relay (Alarm)	YES	Enable			
	Differential Protection	YES	Enable	Numerical	As per code of configuration20 %	
	2nd Harmonic Block (Setting)	YES	Enable			
	Event logger Operation	NO				
	Restricted Earth Fault Protection (HV Side)	YES	Enable		20%	
	Event logger Operation	Yes No				
	Restricted Earth Fault Protection (LV Side)	YES	Enable		20%	
	Event logger Operation	Yes No				
	Backup Over Current	YES	Enable		.42% 0.25%	
	Event logger Operation	NO				
	Earth Fault Protection	YES	Enable		20% , 0.30	
	Event logger Operation	NO				
	Over Flux Protection	YES	Enable		110% , 5Sec.120% , 1Sec.	
	Event logger Operation	NO				
	Local Breaker Back Up in bus bar	YES	Enable			
	Retrip	YES	Enable			
	Current and Time Setting	Yes No			1200A	
	Separate Single and three Phase Initiation	NO				
	Earth Fault	Yes No				
	Event logger Operation	NO				
(ii)	**Name of Transformer (Rating/Capacity)**	**132/33KV ,20/25MVA TR**				
	Tripping by Buchholz relay (Alarm)	YES	Enable			
	Differential Protection	YES	Enable	Numerical	As per code of configuration .15%	
	2nd Harmonic Block (Setting)	YES	Enable			
	Event logger Operation	No				
	Restricted Earth Fault Protection (HV Side)	YES	Enable		20%	
	Event logger Operation	Yes No				
	Restricted Earth Fault Protection (LV Side)	YES	Enable		20%	
	Event logger Operation	Yes No				
	Backup Over Current	YES	Enable		.42% 0.18%	
	Event logger Operation	Yes No				
	Earth Fault Protection	YES	Enable		20% , 0.25	
	Event logger Operation	Yes No				
	Over Flux Protection	Yes	Enabled		110% , 5Sec.120% , 1Sec.	
	Event logger Operation	No				
	Local Breaker Back Up	YES				
	Retrip	Yes				
	Current and Time Setting					
	Separate Single and three Phase Initiation	No				
	Earth Fault	No				
	Event logger Operation	No				
	Earth Fault	NO				
	Event logger Operation	NO				

XEN (MPT & S)
RRVPNL, Udaipur

Assistant Engineer (MPT&S)
RRVPNL, UDAIPUR

Rajasthan Rajya Vidhyut Prasaran Nigam

Report of the Protection Audit

A. General Information

(i) Name of Utility:- 220 KV GSS Amberi

(ii) Name of Voltage Level of Sub Station:- 220/132 KV

(iii) Date of Commissioning:-08.09.2017

(iv) Type of Bus Switching Scheme:- Main Bus and Aux. Bus

(v) Name and Organization of Audit Team:- XEN (MPT&S) RVPNL Udaipur

(vi)Name of representative from utility whose audit being carried out:- XEN , 220KV GSS RVPNL Amberi

B. Check List for Protection Audit

S.No	Check		Functional NonFunctional Enabled Disabled	Type of Relay (Numerical Static El ectromechanical)	Setting as found in field	Compliance Status w.r.t regulatory provisions
	Distance Protection Panel:M-I/II					
III	**Name of Line : 220KV Debari-M-I/M-II**		Functional	Numerical	As per code of configuration .	
	Pole Discrepancy Relay	Yes	Enabled			
	PLCC Panel	Yes	Enabled			
	Zone-1 2 3 4 5 (Settings)	Yes	Enabled			
	Time Check-Z-1 2 3 4 5(Settings)	Yes	Enabled			
	SOTF	NO				
	Aided Scheme	Yes	Enabled			
	Fault Locator	Yes	Enabled			
	Power Swing (Setting R & X)					
	All Zone Block	Yes	Enabled			
	DR	Yes	Enabled			
	Binary Inputs					
	Breaker Contacts	Yes	Enabled			
	Carrier Receive	Yes	Enabled			
	Time Synchronization	NO	Enabled			
	Distance Protection Panel:M-I/II					
IV	**Name of Line : 220KV PGCIL-M-I/M-II**		Functional	Numerical	As per code of configuration .	
	Pole Discrepancy Relay	Yes	Enabled			
	PLCC Panel	Yes	Enabled			
	Zone-1 2 3 4 5 (Settings)	Yes	Enabled			
	Time Check-Z-1 2 3 4 5(Settings)	Yes	Enabled			
	SOTF	NO				
	Aided Scheme	Yes	Enabled			
	Fault Locator	Yes	Enabled			
	Power Swing (Setting R & X)					
	All Zone Block	Yes	Enabled			
	DR	Yes	Enabled			
	Binary Inputs					
	Breaker Contacts	Yes	Enabled			
	Carrier Receive	Yes	Enabled			
	Time Synchronization	Yes No	Enabled			
V	**Name of Line : 132KV Sukher -I**		Functional	Numerical	As per code of configuration .	
	Pole Discrepancy Relay	NO				
	PLCC Panel	NO				
	Zone-1 2 3 4 5 (Settings)	Yes No	Enabled			
	Time Check-Z-1 2 3 4 5(Settings)	Yes No	Enabled			
	SOTF	NO				
	Aided Scheme	NO				
	Fault Locator	Yes	Enabled			
	Power Swing (Setting R & X)					
	All Zone Block	Yes	Enabled			
	DR	Yes	Enabled			
	Binary Inputs					
	Breaker Contacts	Yes	Enabled			
	Carrier Receive	NO				
	Time Synchronization	Yes No	Enabled			

XEN (MPT & S)
RRVPNL, Udaipur

Assistant Engineer (MPT&S)
RRVPNL UDAIPUR

VI	**Name of Line : 132KV Sukher -II**		Functional	Numerical	As per code of configuration .	
	Pole Discrepancy Relay	NO				
	PLCC Panel	NO				
	Zone-1 2 3 4 5 (Settings)	Yes	Enabled			
	Time Check-Z-1 2 3 4 5(Settings)	Yes	Enabled			
	SOTF	No				
	Aided Scheme	NO				
	Fault Locator	Yes	Enabled			
	Power Swing (Setting R & X)					
	All Zone Block	Yes	Enabled			
	DR	Yes	Enabled			
	Binary Inputs					
	Breaker Contacts	Yes	Enabled			
	Carrier Receive	NO				
	Time Synchronization	Yes No	Enabled			
VII	**Name of Line : 132KV Sisarama**		Functional	Numerical	As per code of configuration .	
	Pole Discrepancy Relay	NO				
	PLCC Panel	NO				
	Zone-1 2 3 4 5 (Settings)	Yes	Enabled			
	Time Check-Z-1 2 3 4 5(Settings)	Yes	Enabled			
	SOTF	No				
	Aided Scheme	NO				
	Fault Locator	Yes	Enabled			
	Power Swing (Setting R & X)					
	All Zone Block	Yes	Enabled			
	DR	Yes	Enabled			
	Binary Inputs					
	Breaker Contacts	Yes	Enabled			
	Carrier Receive	NO				
	Time Synchronization	Yes No	Enabled			
VIII	**Name of Line : 132KV Debari**		Functional	Numerical	As per code of configuration .	
	Pole Discrepancy Relay	NO				
	PLCC Panel	NO				
	Zone-1 2 3 4 5 (Settings)	Yes	Enabled			
	Time Check-Z-1 2 3 4 5(Settings)	Yes	Enabled			
	SOTF	No				
	Aided Scheme	NO				
	Fault Locator	Yes	Enabled			
	Power Swing (Setting R & X)					
	All Zone Block	Yes	Enabled			
	DR	Yes	Enabled			
	Binary Inputs					
	Breaker Contacts	Yes	Enabled			
	Carrier Receive	NO				
	Time Synchronization	Yes No	Enabled			

XEN (MPT & S)
RRVPNL, Udaipur

Assistant Engineer (MPT&S)
RRVPNL, UDAIPUR

Rajasthan Rajya Vidhyut Prasaran Nigam

Report of the Protection Audit

A. General Information

(i) Name of Utility:- 220 KV GSS Amberi

(ii) Name of Voltage Level of Sub Station:- 220/132 KV

(iii) Date of Commissioning:- 08.9.2017

(iv) Type of Bus Switching Scheme:- Main Bus and Aux. Bus

(v) Name and Organization of Audit Team:- XEN (MPT&S) RVPNL Udaipur

(vi)Name of representative from utility whose audit being carried out:- XEN , 220KV GSS RVPNL,Amberi

B. Check List for Protection Audit

S.No	Check		Functional NonFunctional Enabled Disabled	Type of Relay (Numerical Static El ectromechanical)	Setting as found in field	Compliance Status w.r.t regulatory provisions
1	**DC System**		Functional			
	No. Of Independent DC Source	1				
	Potential Between +ve & Earth (Source-I)	117 V				
	Potential Between -ve & Earth (Source-I)	116V				
	Potential Between +ve & Earth (Source-II)					
	Potential Between -ve & Earth (Source-II)					
2	**Event Logger Panel**	No				
3	**Event Logger Time Synchronised**	No				
	Disturbance Recorder	No				
	DR Time Synchronised	No				
4	**Bus Bar Protection**	Yes	Functional			
	Stability Check					
	FL Output for this Event	No				
	DR if Available	Yes	Enable			
5	**DG Set**	No				
6	**Mock Testing of Sample Protection Associated with Transmission line**	No				
7	**LBB/BFR**	Yes	Enable			
	Retrip	Yes	Enable			
	Current and Time Setting	Yes	Enable		1200A	
	Separate Single and Three Phase initiation	Yes	Enable			
	Earth Fault	No				
	Event Logger Operation	No				

Rajasthan Rajya Vidhyut Prasaran Nigam

Report of the Protection Audit

A. General Information

(i) Name of Utility:- 220 KV GSS Madri

(ii) Name of Voltage Level of Sub Station:- 220/132 KV

(iii) Date of Commissioning:-

(iv) Type of Bus Switching Scheme:- Main Bus and Aux. Bus

(v) Name and Organization of Audit Team:- XEN (MPT&S) RVPNL Udaipur

(vi)Name of representative from utility whose audit being carried out:- XEN , 220KV GSS RVPNL Madri

B. Check List for Protection Audit

S.No	Check		Functional NonFunctional Enabled Disabled	Type of Relay (Numerical Static El ectromechanical)	Setting as found in field	Compliance Status w.r.t regulatory provisions
	Reactor Protection Panel:	NA	No Reactor Installed			
	Tripping by Buchholz relay (Alarm)	No				
	Differential Protection	No				
	2nd Harmonic Block (Setting)	No				
	Event logger Operation	No				
	Restricted Earth Fault Protection (HV Side)	No				
	Event logger Operation	No				
	Restricted Earth Fault Protection (LV Side)	No				
	Event logger Operation	No				
	Backup Over Current	No				
	Event logger Operation	No				
	Earth Fault Protection	No				
	Event logger Operation	No				
	Over Flux Protection	No				
	Event logger Operation	No				

XEN (MPT & S)
RVPNL, Udaipur

Assistant Engineer (MPT&S)
RRVPNL, UDAIPUR

RRVPN 220kV Kota (Sakatpura) S/s

RAJASTHAN RAJYA VIDYUT PRASARAN NIGAM LIMITED
Corporate Identity Number (CIN):U40109RJ2000SGC016485
Regd. Office: Vidyut Bhawan, Janpath, Jyoti Nagar, Jaipur-302005

RVPN
AN ISO: 9001:2015
Certified Company

OFFICE OF THE SUPERINTENDING ENGINEER (PROT.-ENGG),
Room No.317, Vidyut Bhawan, Jaipur Tel. No.0141-2740381(Ext.1350)
E-mail: se.prot.engg@rvpn.co.in , Website:www.http://energy.rajasthan.gov.in/rvpnl

No. RVPN/SE/JPR/ (Prot.-Engg)/Tech./F./D.- 42 Jaipur, Dated: 12.06.2024

The Chief Engineer (LD/MPT&S)
RVPN, Jaipur.

Sub:- Regarding internal Protection Audit plan.

Ref:- 1. No. 4/MTGS/SG/NPC/CEA/2023/353 dated 18.09.2023
2. NO.RVPN/SE(Prot.Engg)/JPR/Tech./F./ Raj Kaj No. 6987851 dated 07.05.2024.

Kindly find attach the Internal Protection Audit report of 220 kV GSS Sakatpura, Kota. The Incharge of the concern GSS was informed to rectify the observations raised during audit with Protection wing, Kota.

Submitted for further needful action and to appraise NRPC.

Copy forwarded:

1. Superintending Engineer (MPT&S), Kota
2. Executive Engineer, 220 kV GSS, Sakatpura, Kota

RajKaj Ref
7999582

Signature valid
Digitally signed by Dinesh Kumar Jain
Designation : Superintending Engineer
Date: 2024.06.12 15:02:55 IST
Reason: Approved

Report of the Protection Audit

A. General Information:

i. Name of utility :- Rajasthan Rajya Vidyut Prasaran Nigam Ltd.
ii. Name of Voltage level of sub-station :- 220 kV GSS RVPN, Sakatpura, Kota
iii. Date of commissioning :-11.07.1971
iv. Type of bus-switching scheme :- A to B, A to D, B to C
v. Name and Organization of Audit Team :- Rajasthan Rajya Vidyut Prasaran Nigam Ltd.
vi. Name of representative from utility whose audit is being carried out :- Sh. R.R Gupta & Sh. A.K. Meena

B. Check List for Protection Audit

S.No	Check		Functional/ Nonfunctional/ Enabled/ Disabled	Type of relay * (Numerical/ Static/ Electro mechanical)	Setting as found in field*/**	Compliance status w.r.t. regulatory provisions
1.	**DC system**					complied
	No. of independent DC Sources	1/2/3/4	2			
	Potential between +ive & earth (Source-1)	---- V	Functional		148.9	To be replaced
	Potential between -ive & earth (Source-1)	---- V	Functional		85.2	
	Potential between +ive & earth (Source-2)	---- V	Functional		123.7	
	Potential between -ive & earth (Source-2)	---- V	Functional		118.2	
	Potential between +ive & earth (Source-3)	---- V	-			
	Potential between -ive & earth (Source-3)	---- V	-			
	Potential between +ive & earth (Source-4)	---- V	-			
	Potential between -ive & earth (Source-4)	---- V	-			
2.	**Event Logger panel**	Yes/No	Nonfunctional			
3.	**Event Logger Time Synchronised**	Yes/No	-			
	Disturbance Recorder	Yes/No	Nonfunctional			
	DR Time Synchronised	Yes/No	Nonfunctional			
4.1	**Transformer Protection Panel:**		220/132 kV 160 MVA BHEL TR-01			complied
	Tripping by Buchholz relay(Alarm)	Yes/No	Yes			
	Differential Protection	Yes/No	Yes	Numerical Relay	0.20 , 8.0	
	2nd Harmonic Block(Setting)		Enabled		15%	
	Event Logger operation	Yes/No	Yes	In Relay		
	Restricted Earth Fault Protection (HV side)	Yes/No	No			
	Event Logger operation	Yes/No	-			
	REF Protection (LV side)	Yes/No	-			
	Event Logger operation	Yes/No	-			
	Backup over current	Yes/No	Yes	Numerical Relay	0.9 In, 0.20	
	Event Logger operation	Yes/No	Yes	In Relay		
	Earth Fault protection	Yes/No	-	Numerical Relay	0.20 In, 0.26	
	Event Logger operation	Yes/No	Yes	In Relay		
	Over Flux Protection	Yes/No	Yes	Numerical Relay	110 % 5s , 120 %1s	
	Event Logger operation	Yes/No	Yes	In Relay		

	Local Breaker Back up	Yes/No	No			
	Retrip	Yes/No	-			
	Current and Time setting		-			
	Seperate single and three phase initiation	Yes/No	-			
	Earth fault	Yes/No	-			
	Event Logger	Yes/No	-	In Relay		
42	Transformer Protection Panel:		220/132 kV 100 MVA CGL TR-02			complied
	Tripping by Buchholz relay(Alarm)	Yes/No	Yes			
	Differential Protection	Yes/No	Yes	Numerical Relay	0.20 , 8.0	
	2nd Harmonic Block(Setting)		Enabled		15%	
	Event Logger operation	Yes/No	Yes	In Relay		
	Restricted Earth Fault Protection (HV side)	Yes/No	Yes	JVS	0.10 In Instt.	
	Event Logger operation	Yes/No	NO			
	REF Protection (LV side)	Yes/No	-			
	Event Logger operation	Yes/No	-			
	Backup over current	Yes/No	Yes	Numerical Relay	0.7 In, 0.20	
	Event Logger operation	Yes/No	Yes	In Relay		
	Earth Fault protection	Yes/No	-	Numerical Relay	0.20 In, 0.26	
	Event Logger operation	Yes/No	Yes	In Relay		
	Over Flux Protection	Yes/No	Yes	Numerical Relay	110 % 5s , 120 %1s	
	Event Logger operation	Yes/No	Yes	In Relay		
	Local Breaker Back up	Yes/No	No			
	Retrip	Yes/No	-			
	Current and Time setting		-			
	Seperate single and three phase initiation	Yes/No	-			
	Earth fault	Yes/No	-			
	Event Logger	Yes/No	-	In Relay		
43	Transformer Protection Panel:		220/132 kV 100 MVA BHEL TR-03			complied
	Tripping by Buchholz relay(Alarm)	Yes/No	Yes			
	Differential Protection	Yes/No	Yes	Static Relay	0.20 , 8.0	
	2nd Harmonic Block(Setting)		Enabled		15%	
	Event Logger operation	Yes/No	No			
	Restricted Earth Fault Protection (HV side)	Yes/No	No			
	Event Logger operation	Yes/No	-			
	REF Protection (LV side)	Yes/No	-			
	Event Logger operation	Yes/No	-			
	Backup over current	Yes/No	Yes	Electro mechanical	0.7 In, 0.20	
	Event Logger operation	Yes/No	Yes			
	Earth Fault protection	Yes/No	-	Electro mechanical	0.20 In, 0.26	
	Event Logger operation	Yes/No	Yes			
	Over Flux Protection	Yes/No	No			
	Event Logger operation	Yes/No	No			
	Local Breaker Back up	Yes/No	No			
	Retrip	Yes/No	-			
	Current and Time setting		-			
	Seperate single and three phase initiation	Yes/No	-			
	Earth fault	Yes/No	-			
	Event Logger	Yes/No	-	In Relay		
44	Transformer Protection Panel:		220/132 kV 100 MVA BHEL TR-04			complied

	Tripping by Buchholz relay(Alarm)	Yes/No	Yes			
	Differential Protection	Yes/No	Yes	Numerical Relay	0.20 , 8.0	
	2nd Harmonic Block(Setting)		Enabled		15%	
	Event Logger operation	Yes/No	Yes	In Relay		
	Restricted Earth Fault Protection (HV side)	Yes/No	No	MIT	0.10 In Instt.	
	Event Logger operation	Yes/No	-			
	REF Protection (LV side)	Yes/No	-			
	Event Logger operation	Yes/No	-			
	Backup over current	Yes/No	Yes	Numerical Relay	0.7 In, 0.20	
	Event Logger operation	Yes/No	Yes	In Relay		
	Earth Fault protection	Yes/No	-	Numerical Relay	0.20 In, 0.26	
	Event Logger operation	Yes/No	Yes	In Relay		
	Over Flux Protection	Yes/No	Yes	Electro mechanical	110 % 5s ,120%1s	
	Event Logger operation	Yes/No	No			
	Local Breaker Back up	Yes/No	No			
	Retrip	Yes/No	-			
	Current and Time setting		-			
	Seperate single and three phase initiation	Yes/No	-			
	Earth fault	Yes/No	-			
	Event Logger	Yes/No	-	In Relay		
5.	Reactor Protection Panel:		No			
	Tripping by Buchholz relay(Alarm)	Yes/No				
	Differential Protection	Yes/No				
	2nd Harmonic Block (Setting)					
	Event Logger operation	Yes/No				
	REF Protection (HV side)	Yes/No				
	Event Logger operation	Yes/No				
	REF Protection (LV side)	Yes/No				
	Event Logger operation	Yes/No				
	Backup over current	Yes/No				
	Event Logger operation	Yes/No				
	E/F protection	Yes/No				
	Event Logger operation	Yes/No				
	Over Flux Protection	Yes/No				
	Event Logger operation	Yes/No				
	LBB/BFR	Yes/No				
	Retrip	Yes/No				
	Current and Time setting					
	Seperate single and three phase initiation	Yes/No				
	Earth fault	Yes/No				
	Event Logger operation	Yes/No				
6.1	Distance Protection Panel: M-I/II		220 kV Sakatpura-Dahra			complied
	Pole discrepancy relay	Yes/No	Yes		1.5 Sec	
	PLCC panel	Yes/No	Yes			
	Zone-1/2/3/4/5 (Settings)	Yes/No	1,2,3,4 Enable	Numerical Relay	As per Line Length	
	Time check-Z-1/2/3/4/5 (Settings)	Yes/No	1,2,3,4 Enable		0,350,1000,160 s	
	SOTF	Yes/No	No			
	Aided schemes	Yes/No	Yes			
	Fault Locator	Yes/No	Yes	In relay		
	Power swing (Settings R and X)					

	All Zone block	Yes/No	Yes			
	DR	Yes/No	Yes			
	Binary Inputs		Yes		Available	
	Breaker Contacts	Yes/No	Yes		Available	
	Carrier Receive	Yes/No	Yes			
	Time Synchronization	Yes/No	No		GPS not available	
6.2	**Distance Protection Panel: M-I/II**		220 kV SAKATPURA-RAPP A CKT-1			complied
	Pole discrepancy relay	Yes/No	Yes		0.6 Sec	Revised 1.0 to 0.6s
	PLCC panel	Yes/No	Yes			
	Zone-1/2/3/4/5 (Settings)	Yes/No	1,2,3,4 Enable	Numerical Relay	As per Line Length	
	Time check-Z-1/2/3/4/5 (Settings)	Yes/No	1,2,3,4 Enable		0,350,1000,160 s	
	SOTF	Yes/No	No			
	Aided schemes	Yes/No	Yes			
	Fault Locator	Yes/No	Yes	In relay		
	Power swing (Settings R and X)					
	All Zone block	Yes/No	Yes			
	DR	Yes/No	Yes			
	Binary Inputs		Yes		Available	
	Breaker Contacts	Yes/No	Yes		Available	
	Carrier Receive	Yes/No	Yes			
	Time Synchronization	Yes/No	No		GPS not available	
6.3	**Distance Protection Panel: M-I/II**		220 kV SAKATPURA-RAPP A CKT-2			complied
	Pole discrepancy relay	Yes/No	Yes		0.6 Sec	Revised 1.0 to 0.6s
	PLCC panel	Yes/No	Yes			
	Zone-1/2/3/4/5 (Settings)	Yes/No	1,2,3,4 Enable	Numerical Relay	As per Line Length	
	Time check-Z-1/2/3/4/5 (Settings)	Yes/No	1,2,3,4 Enable		0,350,1000,160 s	
	SOTF	Yes/No	No			
	Aided schemes	Yes/No	Yes			
	Fault Locator	Yes/No	Yes	In relay		
	Power swing (Settings R and X)					
	All Zone block	Yes/No	Yes			
	DR	Yes/No	Yes			
	Binary Inputs		Yes		Available	
	Breaker Contacts	Yes/No	Yes		Available	
	Carrier Receive	Yes/No	Yes			
	Time Synchronization	Yes/No	No		GPS not available	
6.4	**Distance Protection Panel: M-I/II**		220 kV SAKATPURA-RAPP A CKT-3			complied
	Pole discrepancy relay	Yes/No	Yes		0.6 Sec	Revised 1.0 to 0.6s
	PLCC panel	Yes/No	Yes			
	Zone-1/2/3/4/5 (Settings)	Yes/No	1,2,3,4 Enable	Numerical Relay	As per Line Length	

	Time check-Z-1/2/3/4/5 (Settings)	Yes/No	1,2,3,4 Enable		0,350,1000,160 s	
	SOTF	Yes/No	No			
	Aided schemes	Yes/No	Yes			
	Fault Locator	Yes/No	Yes	In relay		
	Power swing (Settings R and X)					
	All Zone block	Yes/No	Yes			
	DR	Yes/No	Yes			
	Binary Inputs		Yes		Available	
	Breaker Contacts	Yes/No	Yes		Available	
	Carrier Receive	Yes/No	Yes			
	Time Synchronization	Yes/No	No		GPS not available	
6.5	**Distance Protection Panel: M-I/II**		**220 kV Sakatpura-Mandalgarh**			**complied**
	Pole discrepancy relay	Yes/No	Yes		1.5 Sec	
	PLCC panel	Yes/No	Yes			
	Zone-1/2/3/4/5 (Settings)	Yes/No	1,2,3,4 Enable	Numerical Relay	As per Line Length	
	Time check-Z-1/2/3/4/5 (Settings)	Yes/No	1,2,3,4 Enable		0,350,1000,160 s	
	SOTF	Yes/No	No			
	Aided schemes	Yes/No	Yes			
	Fault Locator	Yes/No	Yes	In relay		
	Power swing (Settings R and X)					
	All Zone block	Yes/No	Yes			
	DR	Yes/No	Yes			
	Binary Inputs		Yes		Available	
	Breaker Contacts	Yes/No	Yes		Available	
	Carrier Receive	Yes/No	Yes			
	Time Synchronization	Yes/No	No		GPS not available	
6.6	**Distance Protection Panel: M-I/II**		**220 kV Sakatpura-Ranpur**			**complied**
	Pole discrepancy relay	Yes/No	Yes		1.5 Sec	
	PLCC panel	Yes/No	Yes			
	Zone-1/2/3/4/5 (Settings)	Yes/No	1,2,3,4 Enable	Numerical Relay	As per Line Length	
	Time check-Z-1/2/3/4/5 (Settings)	Yes/No	1,2,3,4 Enable		0,350,1000,160 s	
	SOTF	Yes/No	No			
	Aided schemes	Yes/No	Yes			
	Fault Locator	Yes/No	Yes	In relay		
	Power swing (Settings R and X)					
	All Zone block	Yes/No	Yes			
	DR	Yes/No	Yes			
	Binary Inputs		Yes		Available	
	Breaker Contacts	Yes/No	Yes		Available	
	Carrier Receive	Yes/No	Yes			
	Time Synchronization	Yes/No	No		GPS not available	
6.7	**Distance Protection Panel: M-I/II**		**220 kV Sakatpura- Anta**			**complied**
	Pole discrepancy relay	Yes/No	Yes		1.5 Sec	
	PLCC panel	Yes/No	Yes			

	Zone-1/2/3/4/5 (Settings)	Yes/No	1,2,3,4 Enable	Numerical Relay	As per Line Length	
	Time check-Z-1/2/3/4/5 (Settings)	Yes/No	1,2,3,4 Enable		0,350,1000,160 s	
	SOTF	Yes/No	No			
	Aided schemes	Yes/No	Yes			
	Fault Locator	Yes/No	Yes	In relay		
	Power swing (Settings R and X)					
	All Zone block	Yes/No	Yes			
	DR	Yes/No	Yes			
	Binary Inputs		Yes		Available	
	Breaker Contacts	Yes/No	Yes		Available	
	Carrier Receive	Yes/No	Yes			
	Time Synchronization	Yes/No	No		GPS not available	
6.8	Distance Protection Panel: M-I/II		220 kV SAKATPURA-KTPS-1			complied
	Pole discrepancy relay	Yes/No	Yes		0.5 Sec	
	PLCC panel	Yes/No	Yes			
	Zone-1/2/3/4/5 (Settings)	Yes/No	1,4 Enable	Numerical Relay	As per Line Length	Line differential relay in used
	Time check-Z-1/2/3/4/5 (Settings)	Yes/No	1,4 Enable		0,160 s	
	SOTF	Yes/No	No			
	Aided schemes	Yes/No	Yes			
	Fault Locator	Yes/No	Yes	In relay		
	Power swing (Settings R and X)					
	All Zone block	Yes/No	Yes			
	DR	Yes/No	Yes			
	Binary Inputs		Yes		Available	
	Breaker Contacts	Yes/No	Yes		Available	
	Carrier Receive	Yes/No	Yes			
	Time Synchronization	Yes/No	No		GPS not available	
6.9	Distance Protection Panel: M-I/II		220 kV SAKATPURA- KTPS-II			complied
	Pole discrepancy relay	Yes/No	Yes		0.5 Sec	
	PLCC panel	Yes/No	Yes			
	Zone-1/2/3/4/5 (Settings)	Yes/No	1,4 Enable	Numerical Relay	As per Line Length	Line differential relay in used
	Time check-Z-1/2/3/4/5 (Settings)	Yes/No	1,4 Enable		0,160 s	
	SOTF	Yes/No	No			
	Aided schemes	Yes/No	Yes			
	Fault Locator	Yes/No	Yes	In relay		
	Power swing (Settings R and X)					
	All Zone block	Yes/No	Yes			
	DR	Yes/No	Yes			
	Binary Inputs		Yes		Available	
	Breaker Contacts	Yes/No	Yes		Available	
	Carrier Receive	Yes/No	Yes			
	Time Synchronization	Yes/No	No		GPS not available	
6.10	Distance Protection Panel: M-I/II		220 kV SAKATPURA- KTPS- II			complied

	Pole discrepancy relay	Yes/No	Yes		0.5 Sec	
	PLCC panel	Yes/No	Yes			
	Zone-1/2/3/4/5 (Settings)	Yes/No	1,4 Enable	Numerical Relay	As per Line Length	Line differential relay in used
	Time check-Z-1/2/3/4/5 (Settings)	Yes/No	1,4 Enable		0,160 s	
	SOTF	Yes/No	No			
	Aided schemes	Yes/No	Yes			
	Fault Locator	Yes/No	Yes	In relay		
	Power swing (Settings R and X)					
	All Zone block	Yes/No	Yes			
	DR	Yes/No	Yes			
	Binary Inputs		Yes		Available	
	Breaker Contacts	Yes/No	Yes		Available	
	Carrier Receive	Yes/No	Yes			
	Time Synchronization	Yes/No	No		GPS not available	
6.11	**Distance Protection Panel: M-I/II**		**220 kV SAKATPURA-KTPS -III**			**complied**
	Pole discrepancy relay	Yes/No	Yes		0.5 Sec	
	PLCC panel	Yes/No	Yes			
	Zone-1/2/3/4/5 (Settings)	Yes/No	1,4 Enable	Numerical Relay	As per Line Length	Line differential relay in used
	Time check-Z-1/2/3/4/5 (Settings)	Yes/No	1,4 Enable		0,160 s	
	SOTF	Yes/No	No			
	Aided schemes	Yes/No	Yes			
	Fault Locator	Yes/No	Yes	In relay		
	Power swing (Settings R and X)					
	All Zone block	Yes/No	Yes			
	DR	Yes/No	Yes			
	Binary Inputs		Yes		Available	
	Breaker Contacts	Yes/No	Yes		Available	
	Carrier Receive	Yes/No	Yes			
	Time Synchronization	Yes/No	No		GPS not available	
7.	**Bus Bar Protection**	Yes/No	No			To be installed
	Stability Check					
	EL output for this event	Yes/No				
	DR if available	Yes/No				
8.	**Single Phase Auto Recloser Scheme**	Yes/No	No			
9.	CT		Yes			
	Suitable as per fault level		No			
10.	**DG Set**	Yes/No	No			
11.	**Mock Testing of a sample protection associated with transmission line*** **	Yes/No	i. If Yes then observation ..... ii. If no, the reason for the same	**220 kV Sakatpura RAPP-B Ckt-I AR lockout C-G trip time 59 ms Distance 36.1 km**		

* This column is applicable for relays only

** Method and Calculation to arrive at this setting has to be submitted by the utility to NRPC secretariat within 07 days of the protection audit.

** Purpose is to check whether the operation of that protection relay energises the breaker Trip coil.

C. Observation w.r.t. compliance to NRPC protection philosophy

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

(Name, Signature and Contact Number of Members of team comprising for carrying out protection audit and the representative of the utility whose audit is being carried out)

R. R. Gupta
AEn (Prot. Engg.) RVPN Jaipur
9413393611

A. K. Meena
AEn (Prot. Engg.) RVPN Jaipur
9413393550

Copy to: (i) Station In-charge where audit has been carried out
(ii) Representative of the utility present with the protection audit team
(iii) SE (O), NRPC

Rajasthan Rajya Vidhyut Prasaran Nigam

Report of the Protection Audit

Protection Audit for the Month July 2024 (Date of audit 09.07.2024)

A. General Information

(i) Name of Utility:- 220 KV GSS BANSWARA **(ii) Name of Voltage Level of Sub Station:- 220/132 KV**

(iii) Date of Commissioning:-24.03.2004 **(iv) Type of Bus Switching Scheme:- Two Main Bus and Aux. Bus**

(v) Name and Organization of Audit Team:- AEN (MPT&S) RVPNL BANSWARA

(vi)Name of representative from utility whose audit being carried out:- XEN 220KV GSS RVPNL BANSWARA

B. Check List for Protection Audit

S.No.	Check		Functional/NonFunctional/Enabled/Disabled	Type of Relay (Numerical/Static/Electromechanical)	Setting as found in field	Compliance Status w.r.t regulatory provisions
	Transformer Protection Panel:					
(1)	**Name of Transformer (Rating/Capacity)**	**220/132, 100MVA Transformer-I (BHEL Make)**				
	Tripping by Buchholz relay (Alarm)	Yes	Functional	Conventional		
	Differential Protection	Yes	Functional	Numerical	Pickup- 0.2 pu, Slope 1 - 0.3, Slope 2- 0.7	
	2nd Harmonic Block (Setting)	Yes	Enabled		15%	
	Event logger Operation	No	(No Event logger Installed)			
	Restricted Earth Fault Protection (HV Side)	Yes	Functional	Numerical	20%	
	Event logger Operation	No	(No Event logger Installed)			
	Restricted Earth Fault Protection (LV Side)	Yes	Functional	Numerical	20%	
	Event logger Operation	No	(No Event logger Installed)			
	Backup Over Current	Yes	Functional	Numerical	88%, CTR-300/1	
	Event logger Operation	No	(No Event logger Installed)			
	Earth Fault Protection	Yes	Functional	Numerical	20%	
	Event logger Operation	No	(No Event logger Installed)			
	Over Flux Protection	Yes	Enabled	Numerical	Alarm -110%, 5 sec , Trip- As per inverse curve characteristics	
	Event logger Operation	No	(No Event logger Installed)			
	Local Breaker Back Up	YES	Functional	**Static**		
	Retrip		Enabled		100 msec	
	Current and Time Setting	yes			120% Inormal,100 msec	
	Separate Single and three Phase Initiation	no			three phase initiation	
	Earth Fault	no	DISABLED			
	Event logger Operation	no				

Assistant Engineer (MPT&S)
RVPNL, Banswara

(ii)	**Name of Transformer (Rating/Capacity)**	**220/132, 100MVA Transformer-I (TELK Make)**				
	Tripping by Buchholz relay (Alarm)	Yes	Functional	Conventional		
	Differential Protection	Yes	Functional	Static	Pickup- 0.2 pu, Slope 1- 0.2, Slope 2- 0.7	
	2nd Harmonic Block (Setting)	Yes			15% (Inbuilt)	
	Event logger Operation	No	(No Event logger Installed)			
	Restricted Earth Fault Protection (HV Side)	No			20%	
	Event logger Operation	No	(No Event logger Installed)			
	Restricted Earth Fault Protection (LV Side)	No			20%	
	Event logger Operation	No	(No Event logger Installed)			
	Backup Over Current	Yes	Functional	numerical	66% CTR-400, 1 A	
	Event logger Operation	No	(No Event logger Installed)			
	Earth Fault Protection	Yes	Functional	numerical	20%	
	Event logger Operation	No	(No Event logger Installed)			
	Over Flux Protection	Yes	Enabled	numerical	Alarm -110%,5 sec Trip- As per inverse curve characteristics	
	Event logger Operation	No	(No Event logger Installed)			
	Local Breaker Back Up	YES	Functional	**Numerical**		
	Retrip	No	Enabled		100 msec	
	Current and Time Setting	No			120% Inormal,100 msec	
	Separate Single and three Phase Initiation	No			three phase initiation	
	Earth Fault	No	DISABLED			
	Event logger Operation	No	(No Event logger Installed)			

Assistant Engineer (MPT&S)
RVPNL, Banswara

Rajasthan Rajya Vidhyut Prasaran Nigam

Report of the Protection Audit

A. General Information

(i) Name of Utility:- 220 KV GSS BANSWARA

(ii) Name of Voltage Level of Sub Station:- 220/132 KV

(iii) Date of Commissioning:- 24.03.2004

(iv) Type of Bus Switching Scheme:- Two Main Bus and Aux. Bus

(v) Name and Organization of Audit Team:- AEN (MPT&S) RVPNL BANSWARA

(vi)Name of representative from utility whose audit being carried out:- XEN 220KV GSS RVPNL BANSWARA

B. Check List for Protection Audit

S.No.	Check		Functional/NonFunctional/Enabled/Disabled	Type of Relay (Numerical/Static/Electromechanical)	Setting as found in field	Compliance Status w.r.t regulatory provisions
	Distance Protection Panel:M-I/II					
(I)	**Name of Line**	**220KV BANSWARA-ASPUR LINE**				
	Pole Discrepancy Relay	YES	Functional	ELECTROMECHANICAL	1.5 sec	
	PLCC Panel	Yes	Functional			
	Zone-1/2/3/4/5 (Settings)	Yes	Enabled	Numerical	As per latest Code of Configuration	
	Time Check-Z-1/2/3/4/5(Settings)	Yes	Enabled			
	SOTF	YES	Disabled			
	Aided Scheme	YES	Enabled			
	Fault Locator	YES	Enabled			
	Power Swing (Setting R & X)	Yes	Enabled			
	All Zone Block	Yes	Enabled			
	DR	Yes	Enabled			
	Binary Inputs	Yes	ENABLED			
	Breaker Contacts	Yes	ENABLED			
	Carrier Receive	YES	ENABLED			
	Time Synchronization	YES				

Assistant Engineer (MPT&S)
RVPNL, Banswara

(II)	**Name of Line**	**220KV BANSWARA-MADRI LINE**				
	Pole Discrepancy Relay	YES	Functional	ELECTROMECHANICAL	1.5 sec	
	PLCC Panel	Yes	Functional			
	Zone-1/2/3/4/5 (Settings)	Yes	Enabled	Numerical	As per latest Code of Configuration	
	Time Check-Z-1/2/3/4/5(Settings)	Yes	Enabled			
	SOTF	YES	Disabled			
	Aided Scheme	YES	Enabled			
	Fault Locator	YES	Enabled			
	Power Swing (Setting R & X)	Yes	Enabled			
	All Zone Block	Yes	Enabled			
	DR	Yes	Enabled			
	Binary Inputs	Yes	ENABLED			
	Breaker Contacts	Yes	ENABLED			
	Carrier Receive	YES	ENABLED			
	Time Synchronization	YES				

Assistant Engineer (MPT&S)
RVPNL, Banswara

Rajasthan Rajya Vidhyut Prasaran Nigam

Report of the Protection Audit

A. General Information

(i) Name of Utility:- 220 KV GSS BANSWARA

(ii) Name of Voltage Level of Sub Station:- 220/132 KV

(iii) Date of Commissioning:-24.03.2004

(iv) Type of Bus Switching Scheme:- Two Main Bus and Aux. Bus

(v) Name and Organization of Audit Team:- AEN (MPT&S) RVPNL BANSWARA

(vi)Name of representative from utility whose audit being carried out:- XEN 220KV GSS RVPNL BANSWARA

B. Check List for Protection Audit

S.No.	Check		Functional/NonFunctional/Enabled/Disabled	Type of Relay (Numerical/Static/Electromechanical)	Setting as found in field	Compliance Status w.r.t regulatory provisions
1	**DC System (220V DC)**		Functional	Static	20%	
	No. Of Independent DC Source	1				
	Potential Between +ve & Earth (Source-I)	190 V				
	Potential Between -ve & Earth (Source-I)	50 V				
2	**Event Logger Panel**	No				
3	**Event Logger Time Synchronised**	No				
	Disturbance Recorder	No				
	DR Time Synchronised	No				
4	**Bus Bar Protection**	yes				
	Stability Check	yes				
	EL Output for this Event	yes				
	DR if Available	yes				
5	**DG Set**	No				
6	**Mock Testing of Sample Protection Associated with Transmission line**	yes				
7	**LBB/BFR**	No				
	Retrip	No				
	Current and Time Setting	No				
	Separate Single and Three Phase initiation	No				
	Earth Fault	No				
	Event Logger Operation	No				

Assistant Engineer (MPT&S)
RVPNL, Banswara

Rajasthan Rajya Vidhyut Prasaran Nigam

Report of the Protection Audit

A. General Information

(i) Name of Utility :- 220 KV GSS BANSWARA

(ii) Name of Voltage Level of Sub Station:- 220/132 KV

(iii) Date of Commissioning:-24.03.2004

(iv) Type of Bus Switching Scheme:- Two Main Bus and Aux. Bus

(v) Name and Organization of Audit Team:- AEN (MPT&S) RVPNL BANSWARA

(vi)Name of representative from utility whose audit being carried out:- XEN 220KV GSS RVPNL BANSWARA

B. Check List for Protection Audit

S.No.	Check		Functional/NonFunctional/Enabled/Disabled	Type of Relay (Numerical/Static/Electromechanical)	Setting as found in field	Compliance Status w.r.t regulatory provisions
	Reactor Protection Panel:	NA	No reactor Installed			
	Tripping by Buchholz relay (Alarm)	No				
	Differential Protection	No				
	2nd Harmonic Block (Setting)	No				
	Event logger Operation	No				
	Restricted Earth Fault Protection (HV Side)	No				
	Event logger Operation	No				
	Restricted Earth Fault Protection (LV Side)	No				
	Event logger Operation	No				
	Backup Over Current	No				
	Event logger Operation	No				
	Earth Fault Protection	No				
	Event logger Operation	No				
	Over Flux Protection	No				
	Event logger Operation	No				

Assistant Engineer (MPT&S)
RVPNL, Banswara

Rajasthan Rajya Vidhyut Prasaran Nigam

Report of the Protection Audit dt 01.08.2024

A. General Information

(i) Name of Utility:- 220 KV GSS Reengus

(ii) Name of Voltage Level of Sub Station:- 220 KV

(iii) Date of Commissioning:-12.01.1984

(iv) Type of Bus Switching Scheme:- 02 NO's Main Bus and Aux. Bus

(v) Name and Organization of Audit Team:- AEN O/O SE (Prot. Engg.) RVPNL ,Jaipur

(vi)Name of representative from utility whose audit being carried out:-SE (Prot. Engg.) RVPNL ,Jaipur

B. Check List for Protection Audit

S.No.	Check		Functional/ NonFunctional/Enabled/ Disabled	Type of Relay (Numerical/Static/Electromechanical)	Setting as found in field	Compliance Status w.r.t regulatory provisions
	Transformer Protection Panel:					
(i)	**Name of Transformer (Rating/Capacity)**	**220/132KV , 160MVA BBL Make T/F-1**				
	Tripping by Buchholz relay (Alarm)	YES	Enable	Conventional		Complying
	Differential Protection	YES	Enable	Numerical	As per code of configuration	Complying
	2nd Harmonic Block (Setting)	YES	Enable	In built feature in Diff. Relay	15.00%	Complying
	Event logger Operation	YES	Enable			
	Restricted Earth Fault Protection (HV Side)	YES	Functional	STATIC	20%	Complying
	Event logger Operation	YES				
	Restricted Earth Fault Protection (LV Side)	NA				
	Event logger Operation	NA				
	Backup Over Current	YES	Enable	Numerical	2.5/ 0.21	Complying
	Event logger Operation	YES				
	Earth Fault Protection	YES	Enable	Numerical	2.5/ 0.23	Complying
	Event logger Operation	YES				
	Over Flux Protection	YES	Enable	In built feature in Diff. Relay		Complying
	Event logger Operation	YES				
	Local Breaker Back Up	YES	Functional	Numerical		Complying
	Retrip	YES	Enable			
	Current and Time Setting	YES	Functional	Numerical	120% for 100 ms+External timer 100 ms	Complying
	Separate Single and three Phase Initiation	No (3 Phase only)				
	Earth Fault	No				
	Event logger Operation	No				
(ii)	**Name of Transformer (Rating/Capacity)**	**220/132KV , 160MVA , IMP Make T/F-2**				
	Tripping by Buchholz relay (Alarm)	YES	Enable	Conventional		Complying
	Differential Protection	YES	Enable	Numerical	As per code of configuration	Complying
	2nd Harmonic Block (Setting)	YES	Enable	In built feature in Diff. Relay	15.00%	Complying
	Event logger Operation	YES	Enable			
	Restricted Earth Fault Protection (HV Side)	YES	Functional	Numerical	20%	Complying
	Event logger Operation	YES				
	Restricted Earth Fault Protection (LV Side)	NA				

	Event logger Operation	NA				
	Backup Over Current	YES	Enable	Numerical	1.0/ 0.22	Complying
	Event logger Operation	YES				
	Earth Fault Protection	YES	Enable	Numerical	1.0/ 0.26	Complying
	Event logger Operation	YES				
	Over Flux Protection	YES	Enable	In built feature in Diff. Relay		Complying
	Event logger Operation	YES				
	Local Breaker Back Up	YES	Functional	Numerical		Complying
	Retrip	YES	Enable			
	Current and Time Setting	YES	Functional	Numerical	120% for 100 ms+External timer 100 ms	Complying
	Separate Single and three Phase Initiation	No (3 Phase only)				
	Earth Fault	No				
	Event logger Operation	No				

* Complying with the code of configuration issued by the CE(MPT&S) ,RVPN. Jaipur by letter No. RVPN/CE/MPT&S/JPR/Tech./F./Rajkaj ref No.5221696/D.166 Dated 21.12.2023

Name: Signature & Contact no. Team carrying out Protection audit:	Sh. R.R.Gupta, AEN O/O SE (Prot. Engg.) RVPNL ,Jaipur	
	A .K. Lamoria ,AEN(MPT&S) ,RVPN , Jhunjhunu	
	Pragya Pandey ,AEN(MPT&S) ,RVPN , Sikar	
	Ramawatar Dhaka ,JEN(MPT&S) RVPN ,Sikar	
Name: Signature & Contact no. Representative of utility whose protection audit is being carried out:Team carrying out Protection audit:	Sh. D.K. Jain ,SE(Prot. Engg.) RVPN , Jaipur	

Rajasthan Rajya Vidhyut Prasaran Nigam

Report of the Protection Audit

A. General Information

(i) Name of Utility:- 220 KV GSS Reengus
(ii) Name of Voltage Level of Sub Station:- 220 KV
(iii) Date of Commissioning:-12.01.1984
(iv) Type of Bus Switching Scheme:- 02 NO's Main Bus and Aux. Bus
(v) Name and Organization of Audit Team:- AEN O/O SE (Prot. Engg.) RVPNL ,Jaipur
(vi)Name of representative from utility whose audit being carried out:-SE (Prot. Engg.) RVPNL ,Jaipur

B. Check List for Protection Audit

S.No.	Check		Functional/ NonFunctional/Enabled/ Disabled	Type of Relay (Numerical/Static/Electromechanical)	Setting as found in field	Compliance Status w.r.t regulatory provisions
	Distance Protection Panel:M-I		DIST. M-I SIEMENS			
(V)	**Name of Line**	**220 KV REENGUS-SIKAR 1**				
	Pole Discrepancy Relay	YES	Functional			Complying
	PLCC Panel	YES	Functional			
	Zone-1/2/3/4/5 (Settings)	YES	Functional	Numerical	X1=1.48 Ω T1=0.00 ms , X2=2.03 Ω T2=350 ms, X3=2.26 Ω T3=1000 ms, X4(rev.) = 65 mΩ T4=160 ms	
	Time Check-Z-1/2/3/4/5(Settings)	YES	Functional			
	SOTF	YES	Disable			
	Aided Scheme	YES	Functional	In built feature in Dist. Relay	permissive under reach phase, Z1 Z2+CR	Complying
	Fault Locator	YES	Enable			
	Power Swing (Setting R & X)	YES	Enable		R=1 Ω and X=1 Ω	
	All Zone Block	YES	Enable			
	DR	YES	Enable			
	Binary Inputs	YES	Enable			
	Breaker Contacts	YES	Enable			
	Carrier Receive	YES	Enable			
	Time Synchronization	YES	Enable			
	Distance Protection Panel:M-II		DIST M II- MICOM P442			
(VI)	**Name of Line**	**220 KV REENGUS-SIKAR 1**				
	Pole Discrepancy Relay	YES	Functional			Complying
	PLCC Panel	YES	Functional			
	Zone-1/2/3/4/5 (Settings)	YES	Functional	Numerical	Z1=1.514 Ω T1=0.00 ms Z2=2.07 Ω T2=350 ms Z3=2.30 Ω T3=1000 ms Z4(rev.) = 65 mΩ T4=160 ms	
	Time Check-Z-1/2/3/4/5(Settings)	YES	Functional			
	SOTF	YES	Disable			

Pradyut Lamniwala

	Aided Scheme	YES	Functional	In built feature in Dist. Relay	permissive under reach phase, Z1 Z2+CR	Complying
	Fault Locator	YES	Enable			
	Power Swing (Setting R & X)	YES	Enable		R=1 Ω and X=1 Ω	
	All Zone Block	YES	Enable			
	DR	YES	Enable			
	Binary Inputs	YES	Enable			
	Breaker Contacts	YES	Enable			
	Carrier Receive	YES	Enable			
	Time Synchronization	YES	Enable			
	Distance Protection Panel:M-I		DIST M I – MICOM P442			
(VII)	**Name of Line**	**220 KV REENGUS-SIKAR II**				
	Pole Discrepancy Relay	YES	Functional			
	PLCC Panel	YES	Functional			
	Zone-1/2/3/4/5 (Settings)	YES	Functional	Numerical	Z1=7.57 Ω T1=0.00 ms Z2=10.36 Ω T2=350 ms Z3=11.53 Ω T3=1000 ms Z4(rev.) = 326mΩ T4=160 ms	
	Time Check-Z-1/2/3/4/5(Settings)	YES	Functional			
	SOTF	YES	Disable			
	Aided Scheme	YES	Functional	In built feature in Dist. Relay	permissive under reach phase, Z1 Z2+CR	
	Fault Locator	YES	Enable			
	Power Swing (Setting R & X)	YES	Enable		R=5 Ω and X=5 Ω	
	All Zone Block	YES	Enable			
	DR	YES	Enable			
	Binary Inputs	YES	Enable			
	Breaker Contacts	YES	Enable			
	Carrier Receive	YES	Enable			
	Time Synchronization	YES	Enable			
	Distance Protection Panel:M-I		DIST M II – GE D 60			
(VIII)	**Name of Line**	**220 KV REENGUS-SIKAR II**				
	Pole Discrepancy Relay	YES	Functional			
	PLCC Panel	YES	Functional			
	Zone-1/2/3/4/5 (Settings)	YES	Functional	Numerical	Z1=7.57 Ω T1=0.00 ms Z2=10.36 Ω T2=350 ms Z3=11.53 Ω T3=1000 ms Z4(rev.) = 326mΩ T4=160 ms	
	Time Check-Z-1/2/3/4/5(Settings)	YES	Functional			
	SOTF	YES	Disable			
	Aided Scheme	YES	Functional	In built feature in Dist. Relay	permissive under reach phase, Z1 Z2+CR	
	Fault Locator	YES	Enable			
	Power Swing (Setting R & X)	YES	Enable		R=5 Ω and X=5 Ω	

	All Zone Block	YES	Enable	In built feature in Dist. Relay		
	DR	YES	Enable			
	Binary Inputs	YES	Enable			
	Breaker Contacts	YES	Enable			
	Carrier Receive	YES	Enable			
	Time Synchronization	YES	Enable			
	Distance Protection Panel:M-I		DIST. M-I SIEMENS			
(V)	**Name of Line**		**220 KV REENGUS-LAXMANGARH**			
	Pole Discrepancy Relay	YES	Functional			Complying
	PLCC Panel	YES	Functional			
	Zone-1/2/3/4/5 (Settings)	YES	Functional	Numerical	X1=8.88 Ω T1=0.00 ms X2=18.08 Ω T2=350 ms X3=23.45 Ω T3=1000 ms X4(rev.) = 326 mΩ T4=160 ms	
	Time Check-Z-1/2/3/4/5(Settings)	YES	Functional			
	SOTF	YES	Disable			
	Aided Scheme	YES	Functional	In built feature in Dist. Relay	permissive under reach phase, Z1 Z2+CR	Complying
	Fault Locator	YES	Enable			
	Power Swing (Setting R & X)	YES	Enable		R=5 Ω and X=5 Ω	
	All Zone Block	YES	Enable			
	DR	YES	Enable			
	Binary Inputs	YES	Enable			
	Breaker Contacts	YES	Enable			
	Carrier Receive	YES	Enable			
	Time Synchronization	YES	Enable			
	Distance Protection Panel:M-I		DIST. M-II Q-MHO			
(VI)	**Name of Line**		**220 KV REENGUS-LAXMANGARH**			
	Pole Discrepancy Relay	YES	Functional			Complying
	PLCC Panel	YES	Functional			
	Zone-1/2/3/4/5 (Settings)	YES	Functional	STATIC	Z1=4.32 Ω T1=0.00 ms Z2=9.56 Ω T2=350 ms Z3=15.21 Ω T3=1000 ms Z4(rev.) = 326mΩ T4=160 ms	
	Time Check-Z-1/2/3/4/5(Settings)	YES	Functional			
	SOTF	NO	NA			
	Aided Scheme	YES	Functional	In built feature in Dist. Relay	permissive under reach phase, Z1 Z2+CR	Complying
	Fault Locator	NO	NA			
	Power Swing (Setting R & X)	YES	Enable	In built feature in Dist. Relay	R=5 Ω and X=5 Ω	
	All Zone Block	YES	Enable			
	DR	NO	NA			
	Binary Inputs	YES	Enable	In built feature in Dist. Relay		Complying
	Breaker Contacts	NO	NA			
	Carrier Receive	YES	Enable	In built feature in Dist. Relay		Complying

	Time Synchronization	NO	NA			
	Distance Protection Panel:M-I		DIST. M-I SIEMENS			
(VII)	**Name of Line**		**220 KV REENGUS-RENWAL**			
	Pole Discrepancy Relay	YES	Functional			Complying
	PLCC Panel	YES	Functional			
	Zone-1/2/3/4/5 (Settings)	YES	Functional	Numerical	X1=1.48 Ω T1=0.00 ms X2=2.03 Ω T2=350 ms X3=4.01 Ω T3=1000 ms X4(rev.) = 65 mΩ T4=160 ms	
	Time Check-Z-1/2/3/4/5(Settings)	YES	Functional			
	SOTF	YES	Disable			
	Aided Scheme	YES	Functional	In built feature in Dist. Relay	permissive under reach phase, Z1 Z2+CR	Complying
	Fault Locator	YES	Enable			
	Power Swing (Setting R & X)	YES	Enable		R=1 Ω and X=1 Ω	
	All Zone Block	YES	Enable			
	DR	YES	Enable			
	Binary Inputs	YES	Enable			
	Breaker Contacts	YES	Enable			
	Carrier Receive	YES	Enable			
	Time Synchronization	YES	Enable			
(VIII)	**Distance Protection Panel:M-II**		DIST M II- MICOM P442			
	Name of Line		**220 KV REENGUS-RENWAL**			
	Pole Discrepancy Relay	YES	Functional			Complying
	PLCC Panel	YES	Functional			
	Zone-1/2/3/4/5 (Settings)	YES	Functional	Numerical	Z1=1.35 Ω T1=0.00 ms Z2=2.22 Ω T2=350 ms Z3=4.09 Ω T3=1000 ms Z4(rev.) = 65 mΩ T4=160 ms	
	Time Check-Z-1/2/3/4/5(Settings)	YES	Functional			
	SOTF	YES	Disable			
	Aided Scheme	YES	Functional	In built feature in Dist. Relay	permissive under reach phase, Z1 Z2+CR	Complying
	Fault Locator	YES	Enable			
	Power Swing (Setting R & X)	YES	Enable		R=1 Ω and X=1 Ω	
	All Zone Block	YES	Enable			
	DR	YES	Enable			
	Binary Inputs	YES	Enable			
	Breaker Contacts	YES	Enable			
	Carrier Receive	YES	Enable			
	Time Synchronization	YES	Enable			

	Distance Protection Panel:M-I		DIST. M-I SIEMENS			
	Name of Line		**220 KV REENGUS-CHOMU**			
	Pole Discrepancy Relay	YES	Functional			Complying
	PLCC Panel	YES	Functional			
	Zone-1/2/3/4/5 (Settings)	YES	Functional	Numerical	X1=0.97 Ω T1=0.00 ms X2=1.6 Ω T2=350 ms X3=2.06 Ω T3=1000 ms X4(rev.) = 65 mΩ T4=160 ms	
	Time Check-Z-1/2/3/4/5(Settings)	YES	Functional			
	SOTF	YES	Disable			
	Aided Scheme	YES	Functional	In built feature in Dist. Relay	permissive under reach phase, Z1 Z2+CR	Complying
	Fault Locator	YES	Enable			
	Power Swing (Setting R & X)	YES	Enable		R=1 Ω and X=1 Ω	
	All Zone Block	YES	Enable			
	DR	YES	Enable			
	Binary Inputs	YES	Enable			
	Breaker Contacts	YES	Enable			
	Carrier Receive	YES	Enable			
	Time Synchronization	YES	Enable			
(X)	**Distance Protection Panel:M-II**		DIST M II- MICOM P442			
	Name of Line		**220 KV REENGUS-CHOMU**			
	Pole Discrepancy Relay	YES	Functional			Complying
	PLCC Panel	YES	Functional			
	Zone-1/2/3/4/5 (Settings)	YES	Functional	Numerical	Z1=0.99 Ω T1=0.00 ms Z2=1.63 Ω T2=350 ms Z3=2.10 Ω T3=1000 ms Z4(rev.) = 65 mΩ T4=160 ms	
	Time Check-Z-1/2/3/4/5(Settings)	YES	Functional			
	SOTF	YES	Disable			
	Aided Scheme	YES	Functional	In built feature in Dist. Relay	permissive under reach phase, Z1 Z2+CR	Complying
	Fault Locator	YES	Enable			
	Power Swing (Setting R & X)	YES	Enable		R=1 Ω and X=1 Ω	
	All Zone Block	YES	Enable			
	DR	YES	Enable			
	Binary Inputs	YES	Enable			
	Breaker Contacts	YES	Enable			
	Carrier Receive	YES	Enable			
	Time Synchronization	YES	Enable			
	Distance Protection Panel:M-I		DIST. M-I SIEMENS			
(XI)	**Name of Line**		**220 KV REENGUS-BABAI**			
	Pole Discrepancy Relay	YES	Functional			Complying
	PLCC Panel	YES	Functional			
	Zone-1/2/3/4/5 (Settings)	YES	Functional	Numerical	X1=1.48 Ω T1=0.00 ms X2=2.0 Ω T2=350 ms X3=3.14 Ω T3=1000 ms X4(rev.) = 65 mΩ T4=160 ms	
	Time Check-Z-1/2/3/4/5(Settings)	YES	Functional			

	SOTF	YES	Disable			
	Aided Scheme	YES	Functional	In built feature in Dist. Relay	permissive under reach phase, Z1 Z2+CR	Complying
	Fault Locator	YES	Enable			
	Power Swing (Setting R & X)	YES	Enable		R=1 Ω and X=1 Ω	
	All Zone Block	YES	Enable			
	DR	YES	Enable			
	Binary Inputs	YES	Enable			
	Breaker Contacts	YES	Enable			
	Carrier Receive	YES	Enable			
	Time Synchronization	YES	Enable			
	Distance Protection Panel:M-II		DIST M II- MICOM P442			
(XII)	**Name of Line**		**220 KV REENGUS-BABAI**			
	Pole Discrepancy Relay	YES	Functional			Complying
	PLCC Panel	YES	Functional			
	Zone-1/2/3/4/5 (Settings)	YES	Functional	Numerical	Z1=1.51 Ω T1=0.00 ms Z2=2.04 Ω T2=350 ms Z3=3.21 Ω T3=1000 ms Z4(rev.) = 65 mΩ T4=160 ms	
	Time Check-Z-1/2/3/4/5(Settings)	YES	Functional			
	SOTF	YES	Disable			
	Aided Scheme	YES	Functional	In built feature in Dist. Relay	permissive under reach phase, Z1 Z2+CR	Complying
	Fault Locator	YES	Enable			
	Power Swing (Setting R & X)	YES	Enable		R=1 Ω and X=1 Ω	
	All Zone Block	YES	Enable			
	DR	YES	Enable			
	Binary Inputs	YES	Enable			
	Breaker Contacts	YES	Enable			
	Carrier Receive	YES	Enable			
	Time Synchronization	YES	Enable			
	Distance Protection Panel:M-I		DIST. M-I SIEMENS			
(XIII)	**Name of Line**		**220 KV REENGUS-DFCC-I**			
	Pole Discrepancy Relay	YES	Functional			Complying
	PLCC Panel	YES	Functional			
	Zone-1/2/3/4/5 (Settings)	YES	Functional	Numerical	X1=1.48 Ω T1=0.00 ms X2=2.03 Ω T2=350 ms X3=2.26 Ω T3=1000 ms X4(rev.) = 326mΩ T4=160 ms	
	Time Check-Z-1/2/3/4/5(Settings)	YES	Functional			
	SOTF	YES	Disable			
	Aided Scheme	YES	Functional	In built feature in Dist. Relay	permissive under reach phase, Z1 Z2+CR	Complying
	Fault Locator	YES	Enable			
	Power Swing (Setting R & X)	YES	Enable		R=5 Ω and X=5 Ω	
	All Zone Block	YES	Enable			
		YES	Enable			

	Inputs	YES	Enable	In built feature in Dist. Relay		
	aker Contacts	YES	Enable			
	Carrier Receive	YES	Enable			
	Time Synchronization	YES	Enable			
	Distance Protection Panel:M-II		DIST M II- MICOM P442			
(XIV)	**Name of Line**	**220 KV REENGUS-DFCC-I**				
	Pole Discrepancy Relay	YES	Functional			Complying
	PLCC Panel	YES	Functional			
	Zone-1/2/3/4/5 (Settings)	YES	Functional	Numerical	Z1=4.32 Ω T1=0.00 ms Z2=9.56 Ω T2=350 ms Z3=15.21 Ω T3=1000 ms Z4(rev.) = 326mΩ T4=160 ms	
	Time Check-Z-1/2/3/4/5(Settings)	YES	Functional			
	SOTF	YES	Disable			
	Aided Scheme	YES	Functional	In built feature in Dist. Relay	permissive under reach phase, Z1 Z2+CR	Complying
	Fault Locator	YES	Enable			
	Power Swing (Setting R & X)	YES	Enable		R=5 Ω and X=5 Ω	
	All Zone Block	YES	Enable			
	DR	YES	Enable			
	Binary Inputs	YES	Enable			
	Breaker Contacts	YES	Enable			
	Carrier Receive	YES	Enable			
	Time Synchronization	YES	Enable			
	Distance Protection Panel:M-I		DIST. M-I SIEMENS			
(XV)	**Name of Line**	**220 KV REENGUS-DFCC-II**				
	Pole Discrepancy Relay	YES	Functional			Complying
	PLCC Panel	YES	Functional			
	Zone-1/2/3/4/5 (Settings)	YES	Functional	Numerical	X1=1.48 Ω T1=0.00 ms X2=2.03 Ω T2=350 ms X3=2.26 Ω T3=1000 ms X4(rev.) = 326mΩ T4=160 ms	
	Time Check-Z-1/2/3/4/5(Settings)	YES	Functional			
	SOTF	YES	Disable			
	Aided Scheme	YES	Functional	In built feature in Dist. Relay	permissive under reach phase, Z1 Z2+CR	Complying
	Fault Locator	YES	Enable			
	Power Swing (Setting R & X)	YES	Enable		R=5 Ω and X=5 Ω	
	All Zone Block	YES	Enable			
	DR	YES	Enable			
	Binary Inputs	YES	Enable			
	Breaker Contacts	YES	Enable			
	Carrier Receive	YES	Enable			
	Time Synchronization	YES	Enable			
	Distance Protection Panel:M-II		DIST M II- MICOM P442			
(XVI)	**Name of Line**	**220 KV REENGUS-DFCC II**				

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	Pole Discrepancy Relay	YES	Functional			Complying
	PLCC Panel	YES	Functional			
	Zone-1/2/3/4/5 (Settings)	YES	Functional	Numerical	Z1=4.32 Ω T1=0.00 ms Z2=9.56 Ω T2=350 ms Z3=15.21 Ω T3=1000 ms Z4(rev.) = 326mΩ T4=160 ms	
	Time Check-Z-1/2/3/4/5(Settings)	YES	Functional			
	SOTF	YES	Disable			
	Aided Scheme	YES	Functional	In built feature in Dist. Relay	permissive under reach phase, Z1 Z2+CR	Complying
	Fault Locator	YES	Enable			
	Power Swing (Setting R & X)	YES	Enable		R=5 Ω and X=5 Ω	
	All Zone Block	YES	Enable			
	DR	YES	Enable			
	Binary Inputs	YES	Enable			
	Breaker Contacts	YES	Enable			
	Carrier Receive	YES	Enable			
	Time Synchronization	YES	Enable			

* Complying with the code of configuration issued by the CE(MPT&S) ,RVPN. Jaipur by letter No. RVPN/CE/MPT&S/JPR/Tech./F./Rajkaj ref No.5221696/D.166 Dated 21.12.2023

Name: Signature & Contact no. Team carrying out Protection audit:	Sh. R.R.Gupta, AEN O/O SE (Prot. Engg.) RVPNL ,Jaipur	
	A .K. Lamoria ,AEN(MPT&S) ,RVPN , Jhunjhunu	
	Pragya Pandey ,AEN(MPT&S) ,RVPN , Sikar	
	Ramawatar Dhaka ,JEN(MPT&S) RVPN ,Sikar	
Name: Signature & Contact no. Representative of utility whose protection audit is being carried out:Team carrying out Protection audit:	Sh. D.K. Jain ,SE(Prot. Engg.) RVPN , Jaipur	

Rajasthan Rajya Vidhyut Prasaran Nigam

Report of the Protection Audit

General Information

(i) Name of Utility:- 220 KV GSS Reengus
(ii) Name of Voltage Level of Sub Station:- 220 KV
(iii) Date of Commissioning:-12.01.1984
(iv) Type of Bus Switching Scheme:- 02 NO's Main Bus and Aux. Bus
(v) Name and Organization of Audit Team:- AEN O/O SE (Prot. Engg.) RVPNL ,Jaipur
(vi)Name of representative from utility whose audit being carried out:-SE (Prot. Engg.) RVPNL ,Jaipur

B. Check List for Protection Audit						
S.No.	Check		Functional/ NonFunctional/Enabled/ Disabled	Type of Relay (Numerical/Static/Electromechanical)	Setting as found in field	Compliance Status w.r.t regulatory provisions
1	**DC System**	2 nos (220 V DC)	Functional			Complying
	No. Of Independent DC Source	119 V				
	Potential Between +ve & Earth (Source-I)	112 V				
	Potential Between -ve & Earth (Source-I)	114 V				
	Potential Between +ve & Earth (Source-II)	110V				
	Potential Between -ve & Earth (Source-II)					
2	**Event Logger Panel**	No				
3	**Event Logger Time Synchronised**	No				
	Disturbance Recorder	No				
	DR Time Synchronised	No				
4	**Bus Bar Protection**	yes	Functional	Numerical		Complying
	Stability Check					
	EL Output for this Event					
	DR if Available					
5	**DG Set**	No				
6	**Mock Testing of Sample Protection Associated with Transmission line**	No				
7	**LBB/BFR**	YES	Functional	Numerical		Complying
	Retrip	YES	Enable			Complying
	Current and Time Setting	YES	Enable		PU =120%/100ms +100ms External timer	Complying
	Separate Single and Three Phase initiation	YES	Enable			Complying
	Earth Fault	YES	Disable			
	Event Logger Operation	YES	Enable			Complying

* Complying with the code of configuration issued by the CE(MPT&S) ,RVPN. Jaipur by letter No. RVPN/CE/MPT&S/JPR/Tech./F./Rajkaj ref No.5221696/D.166 Dated 21.12.2023

Name: Signature & Contact no. Team carrying out Protection audit:	Sh. R.R.Gupta, AEN O/O SE (Prot. Engg.) RVPNL ,Jaipur	
	A .K. Lamoria ,AEN(MPT&S) ,RVPN , Jhunjhunu	
	Pragya Pandey ,AEN(MPT&S) ,RVPN , Sikar	
	Ramawatar Dhaka ,JEN(MPT&S) RVPN ,Sikar	
Name: Signature & Contact no. Representative of utility whose protection audit is being carried out:Team carrying out Protection audit:	Sh. D.K. Jain ,SE(Prot. Engg.) RVPN , Jaipur	

Assistant Engineer (MPT&S)
R.R.V.P.N.L., SIKAR

Assistant Engineer (MPT &
RVPNL, Jhunjhunu

Rajasthan Rajya Vidhyut Prasaran Nigam

Report of the Protection Audit carried out 3.09.2024

A. General Information

(i) Name of Utility:- 220 KV GSS Kankroli (ii) Name of Voltage Level of Sub Station:- 220/132 KV

(iii) Date of Commissioning:- 31.03.1997 (iv) Type of Bus Switching Scheme:- Double Main Bus and Single Aux. Bus

(v) Name and Organization of Audit Team:- XEN (MPT&S) RVPNL Udaipur

(vi)Name of representative from utility whose audit being carried out:- XEN 220K V GSS RVPNL Kankroli

B. Check List for Protection Audit

S.No.	Check		Functional/NonFunctional/Enabled/Disabled	Type of Relay (Numerical/Static/Electromechanical)	Setting as found in field	Compliance Status w.r.t regulatory provisions
	Transformer Protection Panel:					
(i)	**Name of Transformer (Rating/Capacity)**	**220/132,100MVA Transformer-I (BHEL Make)**				
	Tripping by Buchholz relay (Alarm)	Yes	Functional	Conventional		
	Differential Protection	Yes	Functional	Static	PickUp 20%	
	2nd Harmonic Block (Setting)	No	Feature Not Available			
	Event logger Operation	No	(No Event logger Installed)			
	Restricted Earth Fault Protection (HV Side)	Yes	Functional	Electromechanical	20%	
	Event logger Operation	No	(No Event logger Installed)			
	Restricted Earth Fault Protection (LV Side)	No	Not Required			
	Event logger Operation	No	(No Event logger Installed)			
	Backup Over Current	Yes	Functional	Electromechanical	75%	
	Event logger Operation	No	(No Event logger Installed)			
	Earth Fault Protection	Yes	Functional	Electromechanical	20%	
	Event logger Operation	No	(No Event logger Installed)			
	Over Flux Protection	Yes	Enabled	Electromechanical	As per Code of Configuration	
	Event logger Operation	No	(No Event logger Installed)			
	Local Breaker Back Up					
	Retrip					

Executive Engineer (MPT&S)
RVPNL Udaipur

AEN (MPT&S)
RVPNL KANKROLI

(2)

	Current and Time Setting					
	Separate Single and three Phase Initiation					
	Earth Fault					
	Event logger Operation					
(ii)	**Name of Transformer (Rating/Capacity)**	**220/132,100MVA Transformer-II (TELK Make)**				
	Tripping by Buchholz relay (Alarm)	Yes	Functional	Conventional		
	Differential Protection	Yes	Functional	Numerical	As per Code of Configuration	
	2nd Harmonic Block (Setting)	Yes				
	Event logger Operation	NA	(No Event logger Installed)			
	Restricted Earth Fault Protection (HV Side	Yes		Numerical	20%	
	Event logger Operation	NA	(No Event logger Installed)			
	Restricted Earth Fault Protection (LV Side)	No	Not required			
	Event logger Operation	NA	(No Event logger Installed)			
	Backup Over Current	Yes	Functional	Numerical	65.6%	
	Event logger Operation	NA	(No Event logger Installed)			
	Earth Fault Protection	Yes	Functional	Numerical	20%	
	Event logger Operation	NA	(No Event logger Installed)			
	Over Flux Protection	Yes	Enabled	Numerical	As per Code of Configuration	
	Event logger Operation	NA	(No Event logger Installed)			
	Local Breaker Back Up					
	Retrip					
	Current and Time Setting					
	Separate Single and three Phase Initiation					
	Earth Fault					
	Event logger Operation					

AEM (MPT&S)
ERVPNL, PANKROLI

Rajasthan Rajya Vidhyut Prasaran Nigam

Report of the Protection Audit carried out on 03.09.2024

A. General Information

(i) Name of Utility:- 220 KV GSS Kankroli

(ii) Name of Voltage Level of Sub Station:- 220/132 KV

(iii) Date of Commissioning:- 31.03.1997

(iv) Type of Bus Switching Scheme:- Double Main Bus and Single Aux. Bus

(v) Name and Organization of Audit Team:- XEN (MPT&S) RVPNL Udaipur

(vi)Name of representative from utility whose audit being carried out:- XEN 220KV GSS RVPNL Kankroli

B. Check List for Protection Audit

S.No.	Check		Functional/NonFunctional/Enabled/Disabled	Type of Relay (Numerical/Static/Electromechanical)	Setting as found in field	Compliance Status w.r.t regulatory provisions
	Distance Protection Panel:M-I/II					
(I)	**Name of Line**	**220KV PGCIL-I**				
	Pole Discrepancy Relay	Yes	Functional			
	PLCC Panel	Yes	Functional			
	Zone-1/2/3/4/5 (Settings)	Yes	Enabled	Numerical(M-I) Static (M-II)	As per Code of Configuration	
	Time Check-Z-1/2/3/4/5(Settings)	Yes	Enabled			
	SOTF	No	Disabled			
	Aided Scheme	Yes	Enabled			
	Fault Locator	No				
	Power Swing (Setting R & X)	Yes	Enabled			
	All Zone Block	Yes	Enabled			
	DR	Yes	Enabled			
	Binary Inputs	Yes				
	Breaker Contacts	Yes				
	Carrier Receive	Yes	Enabled			
	Time Synchronization	No				

AEN (MPT&S)
RVPNL KANKROLI

(4)

(2)	**Name of Line**	**220KV PGCIL-II**				
	Pole Discrepancy Relay	Yes	Functional			
	PLCC Panel	Yes	Functional			
	Zone-1/2/3/4/5 (Settings)	Yes	Enabled	Numerical	As per Code of Configuration	
	Time Check-Z-1/2/3/4/5(Settings)	Yes	Enabled			
	SOTF	No	Disabled			
	Aided Scheme	Yes	Enabled			
	Fault Locator	No				
	Power Swing (Setting R & X)	Yes	Enabled			
	All Zone Block	Yes	Enabled			
	DR	Yes	Enabled			
	Binary Inputs	Yes				
	Breaker Contacts	Yes				
	Carrier Receive	Yes	Enabled			
	Time Synchronization	No				

(3)	**Name of Line**	**220KV HZL-I**				
	Pole Discrepancy Relay	Yes	Functional			
	PLCC Panel	Yes	Functional			
	Zone-1/2/3/4/5 (Settings)	Yes	Enabled	Numerical	As per Code of Configuration	
	Time Check-Z-1/2/3/4/5(Settings)	Yes	Enabled			
	SOTF	No	Disabled			
	Aided Scheme	Yes	Enabled			
	Fault Locator	No				
	Power Swing (Setting R & X)	Yes	Enabled			
	All Zone Block	Yes	Enabled			
	DR	Yes	Enabled			
	Binary Inputs	Yes				
	Breaker Contacts	Yes				
	Carrier Receive	Yes	Enabled			
	Time Synchronization	No				

Executive Engineer (MPT&S)
R.R.V.P.N.L., Udaipur

AEN (MPT&S)
RVPNL, KANKROLI

(4)	**Name of Line**	**220KV HZL-II**				
	Pole Discrepancy Relay	Yes	Functional			
	PLCC Panel	Yes	Functional			
	Zone-1/2/3/4/5 (Settings)	Yes	Enabled	Numerical	As per Code of Configuration	
	Time Check-Z-1/2/3/4/5(Settings)	Yes	Enabled			
	SOTF	No	Disabled			
	Aided Scheme	Yes	Enabled			
	Fault Locator	No				
	Power Swing (Setting R & X)	Yes	Enabled			
	All Zone Block	Yes	Enabled			
	DR	Yes	Enabled			
	Binary Inputs	Yes				
	Breaker Contacts	Yes				
	Carrier Receive	Yes	Enabled			
	Time Synchronization	No				
(5)	**Name of Line**	**220KV Bamantukda**				
	Pole Discrepancy Relay	Yes	Functional			
	PLCC Panel	Yes	Functional			
	Zone-1/2/3/4/5 (Settings)	Yes	Enabled	Numerical	As per Code of Configuration	
	Time Check-Z-1/2/3/4/5(Settings)	Yes	Enabled			
	SOTF	No	Disabled			
	Aided Scheme	Yes	Enabled			
	Fault Locator	No				
	Power Swing (Setting R & X)	Yes	Enabled			
	All Zone Block	Yes	Enabled			
	DR	Yes	Enabled			
	Binary Inputs	Yes				
	Breaker Contacts	Yes				
	Carrier Receive	Yes	Enabled			
	Time Synchronization	No				

Executive Engineer (Maintenance)
R.R.V.P.N.L. Udaipur

AEN (MPT&S)
RRVPNL, KANKROLI

(6)

Rajasthan Rajya Vidhyut Prasaran Nigam

Report of the Protection Audit

A. General Information

(i) Name of Utility:- 220 KV GSS Kankroli (ii) Name of Voltage Level of Sub Station:- 220/132 KV

(iii) Date of Commissioning:- 31.03.1997 (iv) Type of Bus Switching Scheme:- Double Main Bus and Single Aux. Bus

(v) Name and Organization of Audit Team:- XEN (MPT&S) RVPNL Udaipur

(vi)Name of representative from utility whose audit being carried out:- XEN 220KV GSS RVPNL Kankroli

B. Check List for Protection Audit

S.No.	Check		Functional/NonFunctional/Enabled/Disabled	Type of Relay (Numerical/Static/Electromechanical)	Setting as found in field	Compliance Status w.r.t regulatory provisions
1	**DC System**		Functional	Electromechanical	20%	
	No. Of Independent DC Source	1				
	Potential Between +ve & Earth (Source-I)	118 V				
	Potential Between -ve & Earth (Source-I)	118 V				
2	**Event Logger Panel**	No				
3	**Event Logger Time Synchronised**	No				
	Disturbance Recorder	No				
	DR Time Synchronised	No				
4	**Bus Bar Protection**	Yes	Functional	Numerical	As per Code of Configuration	
	Stability Check					
	EL Output for this Event	No				
	DR if Available	No				
5	**DG Set**	No				

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RRVPNL KAN...

6	**Mock Testing of Sample Protection Associated with Transmission line**	No				
	LBB/BFR					
	Retrip					
	Current and Time Setting					
	Separate Single and Three Phase initiation					
	Earth Fault					
	Event Logger Operation					

Rajasthan Rajya Vidhyut Prasaran Nigam

Report of the Protection Audit carried out on 3.09.2024

A. General Information

(i) Name of Utility:- 220 KV GSS Kankroli (ii) Name of Voltage Level of Sub Station:- 220/132 KV

(iii) Date of Commissioning:- 31.03.1997 (iv) Type of Bus Switching Scheme:- Double Main Bus and Single Aux. Bus

(v) Name and Organization of Audit Team:- XEN (MPT&S) RVPNL Udaipur

(vi)Name of representative from utility whose audit being carried out:- XEN 220KV GSS RVPNL Kankroli

B. Check List for Protection Audit

S.No.	Check		Functional/NonFunctional/Enabled/Disabled	Type of Relay (Numerical/Static/Electromechanical)	Setting as found in field	Compliance Status w.r.t regulatory provisions
	Reactor Protection Panel:	NA	No reactor Installed			
	Tripping by Buchholz relay (Alarm)	No				
	Differential Protection	No				
	2nd Harmonic Block (Setting)	No				
	Event logger Operation	No				
	Restricted Earth Fault Protection (HV Side)	No				
	Event logger Operation	No				
	Restricted Earth Fault Protection (LV Side)	No				
	Event logger Operation	No				

Executive Engineer (MPT&S) RVPNL Udaipur

AEN (MPT&S) KANKROLI

(8)

	Backup Over Current	No				
	Event logger Operation	No				
	Earth Fault Protection	No				
	Event logger Operation	No				
	Over Flux Protection	No				
	Event logger Operation	No				

Executive Engineer (MPT&S)
R.R.V.P.N.L., Udaipur

AEN (MPT&S)
R.R.V.P.N.L., KANKROLI

Rajasthan Rajya Vidhyut Prasaran Nigam Limited

Report of the Protection Audit

A. General Information

i)	Name of utility:	Rajasthan Rajya Vidhyut Prasaran Nigam Limited
ii)	Name of Voltage level of Substation:	220 kV GSS Kukas
iii)	Date of Commissioning:	13.10.1999
iv)	Type of Bus Switching Scheme	Two Main Bus
v)	Name and Organization of Audit Team	Sh. Mukul Yadav, AEN-III (MPT&S), RVPN, Jaipur Sh. Munesh Kumar Meena , JEN-I O/o AEN-III (MPT&S), RVPN, Jaipur
vi)	Name of representative from utility whose audit being carried out	Sh. D.K. Jain, SE (Prot. Engg.) RVPNL Jaipur

B. Checklist for Protection Audit

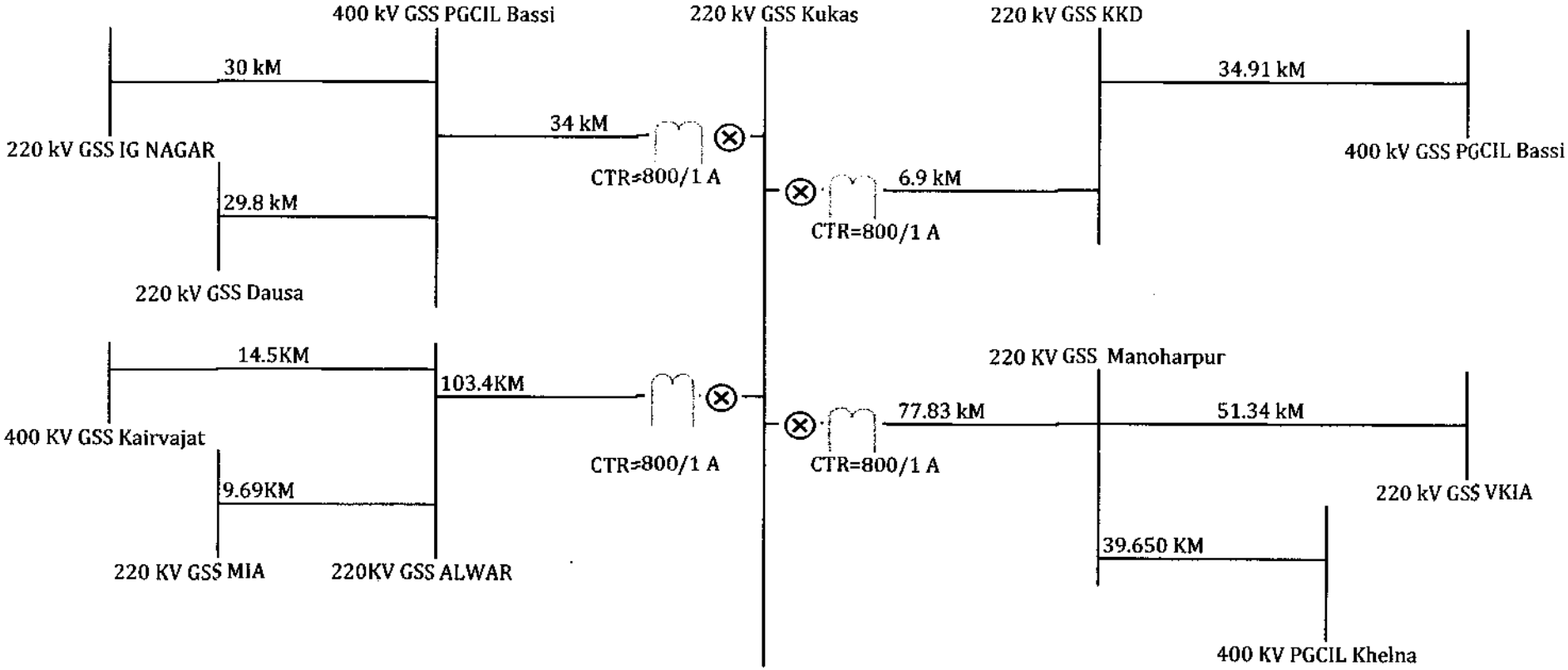
S.No.	Check		Functional / Non-Functional /Enabled/ Disabled	Type of Relay*(Numerical/Static/Electromechanical)	Setting as found in field*/**	Compliance status w.r.t. regulatory provisions
Distance protection Panel:M-I/II						
(i)	**Name of Line**	**220 kV PGCIL Bassi Line**				
	Pole discrepancy relay	Yes	Functional(On CB)	Electromechanical	2 sec.	
	PLCC panel	Yes	Functional			
	Zone-1/2/3/4/5(settings)	Yes	Functional	Numerical Distance Protection Relays	Z1=4.44 Ohm, T1=0 ms Z2=7.983 Ohm, T2=350 ms Z3=10.938 Ohm, T3=1000 ms Z4(Rev.)=326 mOhm, T4=160 ms	Complying
	Time check-Zone-1/2/3/4/5(settings)	Yes	Functional			
	SOTF	No	Disabled	-	-	Complying
	Aided schemes	Yes	Functional	In built feature of Numerical Distance Protection Relays	Permissive Under Reach, 1 Phase Z1 Z2+CR	Complying
	Fault locator	Yes	Functional	In built feature of Numerical Distance Protection Relays	-	Complying

S.No.	Check		Functional / Non-Functional /Enabled/ Disabled	Type of Relay*(Numerical/Static/Electromechanical)	Setting as found in field*/**	Compliance status w.r.t. regulatory provisions
	Power swing(S(settings R and X)				R=5 Ohm, X=5 Ohm	Complying
	All Zone block	Yes	Enabled	In built feature of Numerical Distance Protection Relays	-	Complying
	DR	Yes	Enabled		-	Complying
	Binary Input					
	Breaker Contacts	Yes	Functional	-	-	Complying
	Carrier Receive	Yes	Functional	-	-	Complying
	Time Synchronization	Yes	Functional	-	-	Complying
(ii)	**Name of Line**	**220 kV KKD Line**				
	Pole discrepancy relay	Yes	Functional(On CB)	Electromechanical	2 Sec.	
	PLCC panel	Yes	Functional			
	Zone-1/2/3/4/5(settings)	Yes	Functional	Numerical Distance Protection Relays	Z1=901 mOhm, T1=0 ms Z2= 3.976 Ohm, T2=350 ms Z3=7.395 Ohm, T3=1000 ms Z4(Rev.)=326 mOhm, T4=160 ms	Complying
	Time check-Zone-1/2/3/4/5(settings)	Yes	Functional			
	SOTF	No	Disabled	-	-	Complying
	Aided schemes	Yes	Functional	In built feature of Numerical Distance Protection Relays	Permissive Under Reach, 1 Phase Z1 Z2+CR	Complying
	Fault locator	Yes	Functional	In built feature of Numerical Distance Protection Relays	-	Complying
	Power swing(S(settings R and X)				R=5 Ohm, X=5 Ohm	Complying
	All Zone block	Yes	Enabled	In built feature of Numerical Distance Protection Relays	-	Complying
	DR	Yes	Enabled		-	Complying
	Binary Input					
	Breaker Contacts	Yes	Functional	-	-	Complying
	Carrier Receive	Yes	Functional	-	-	Complying
	Time Synchronization	Yes	Functional	-	-	Complying
Distance protection Panel:M-I/II						
(iii)	**Name of Line**	**220 KV Manoharpur Line**				
	Pole discrepancy relay	Yes	Functional(On CB)	Electromechanical	2 sec.	
	PLCC panel	Yes	Functional			
	Zone-1/2/3/4/5(settings)	Yes	Functional	M1-Numerical Distance	Z1=10.164 Ohm, T1=0 ms	

S.No.	Check		Functional / Non-Functional /Enabled/ Disabled	Type of Relay*(Numerical/Static/Electromechanical)	Setting as found in field*/**	Compliance status w.r.t. regulatory provisions
	Time check-Zone-1/2/3/4/5(settings)	Yes	Functional	Protection Relay M2-Electrostatic Distance Protection Relay	Z2=15.942 Ohm, T2=350 ms Z3=21.925 Ohm, T3=1000 ms Z4(Rev.)=326 mOhm, T4=160 ms	Complying
	SOTF	No	Disabled	-	-	Complying
	Aided schemes	Yes	Functional	In built feature of Numerical Distance Protection Relay	Permissive Under Reach, 1 Phase Z1 Z2+CR	Complying
	Fault locator	Yes	Functional	In built feature of Numerical Distance Protection Relay	-	Complying
	Power swing(S(settings R and X)				R=5 Ohm, X=5 Ohm	Complying
	All Zone block	Yes	Enabled	In built feature of Numerical Distance Protection Relay	-	Complying
	DR	Yes	Enabled		-	Complying
	Binary Input					
	Breaker Contacts	Yes	Functional	-	-	Complying
	Carrier Receive	Yes	Functional	-	-	Complying
	Time Synchronization	Yes	Functional	-	-	Complying
Distance protection Panel:M-I/II						
(iv)	**Name of Line**	**220 KV Alwar Line**				
	Pole discrepancy relay	Yes	Functional(On CB)	Electromechanical	2 sec.	
	PLCC panel	Yes	Functional			
	Zone-1/2/3/4/5(settings)	Yes	Functional	Numerical Distance Protection Relays	Z1=13.504 Ohm, T1=0 ms Z2=17.671 Ohm, T2=350 ms Z3=19.484 Ohm, T3=1000 ms Z4(Rev.)=326 mOhm, T4=160 ms	Complying
	Time check-Zone-1/2/3/4/5(settings)	Yes	Functional			
	SOTF	No	Disabled	-	-	Complying
	Aided schemes	Yes	Functional	In built feature of Numerical Distance Protection Relays	Permissive Under Reach, 1 Phase Z1 Z2+CR	Complying
	Fault locator	Yes	Functional	In built feature of Numerical Distance Protection Relays	-	Complying
	Power swing(S(settings R and X)				R=5 Ohm, X=5 Ohm	Complying
	All Zone block	Yes	Enabled	In built feature of Numerical Distance Protection Relays	-	Complying
	DR	Yes	Enabled		-	Complying
	Binary Input					

S.No.	Check		Functional / Non-Functional /Enabled/ Disabled	Type of Relay*(Numerical/Static/Electromechanical)	Setting as found in field*/**	Compliance status w.r.t. regulatory provisions
	Breaker Contacts	Yes	Functional	-	-	Complying
	Carrier Receive	Yes	Functional	-	-	Complying
	Time Synchronization	Yes	Functional	-	-	Complying
Name. Signature & Contact No. of team Carrying out Protection audit:			1. Mukul Yadav, AEN-III (MPT&S), Jaipur 9413382334			
			2. Munesh Kr. Meena, JEN-I O/o AEN-III (MPT&S), Jaipur 9413383124			
Name. Signature & Contact No. of representative of utility whose Protection audit is being carried out:			1. Dinesh Kumar Jain, SE (Prot.Engg.), RVPN, Jaipur, 9413393540			

Distance relay calculation for 220 KV Kukas-PGCIL Bassi Line



EARTH FAULT COMPENSATION

RE/RL=1/3((Ro/R1)-1)

XE/XL=1/3((Xo/X1)-1)

kZ0 Res. Comp.= kZ0 = (Z0 – Z1) / 3Z1

Principle line Length	:	34 KM.
Shortest Line Length considered on Remote Bus		29.8 KM.
Longest line length Considered on Remote Bus		30 KM.

kZ0	**kZ0 angle**
0.734	**-1.83**

Conductor Used : **Zebra**

Conductor Parameters :	**R**	**X**	**Z**	**Angle**
Positive Sequence(Z1):	0.081	0.4	0.408	78.55

Zero Sequence(Z0):	0.2875	1.275	1.307	77.29
CTR:	800/1 Amp=	800		
PTR:	220000/110 V=	2000		
CTR/PTR:	0.4			

Zone 1(Forward) Reach:	80	% of the Line to be Protected
Zone 2(Forward) Reach:	50	% of the Shortest Line on remote Bus+100 % of the Protected Line
Zone 3(Forward) Reach:	110	% Longest line length on Remote Bus+100 % of the Protected Line
Zone 4(Reverse) Reach:	2	Km

Zone 1 forward Reach= 80% of line length (Kukas to PGCIL Bassi)* +ve Sequence impedance of conductor/km*(CTR/PTR)

= 4.440 Ohm T1= Instt.

Zone 2 forward Reach= 100% of line length (Kukas to PGCIL Bassi)+50 % of the Shortest Line on remote Bus(PGCIL-Dausa)*+ve Sequence impedance of conductor/km*(CTR/PTR)

= 7.983 Ohm T2=350 ms

Zone 3 forward Reach=100% of line length (Kukas to PGCIL Bassi)+110 % Longest line length on Remote Bus(PGCIL-IG NAGAR)*+ve Sequence impedance of conductor/km*(CTR/PTR)

= 10.938 Ohm T3=1000 ms

Zone 4 reverse Reach=2 km*+ve Sequence impedance of conductor/km*(CTR/PTR)

= 0.326 Ohm T4=160 ms

Directional O/C & E/F relay calculation for 220 kV Kukas-PGCIL Bassi Line

Fault MVA of 220 kV BUS	:	6885	MVA
3 Phase Short Circuit Current	:	15891	Amp
Phase-Phase Short Circuit Current	:	13762	Amp
Phase to Earth Short Circuit Current	:	8581	Amp

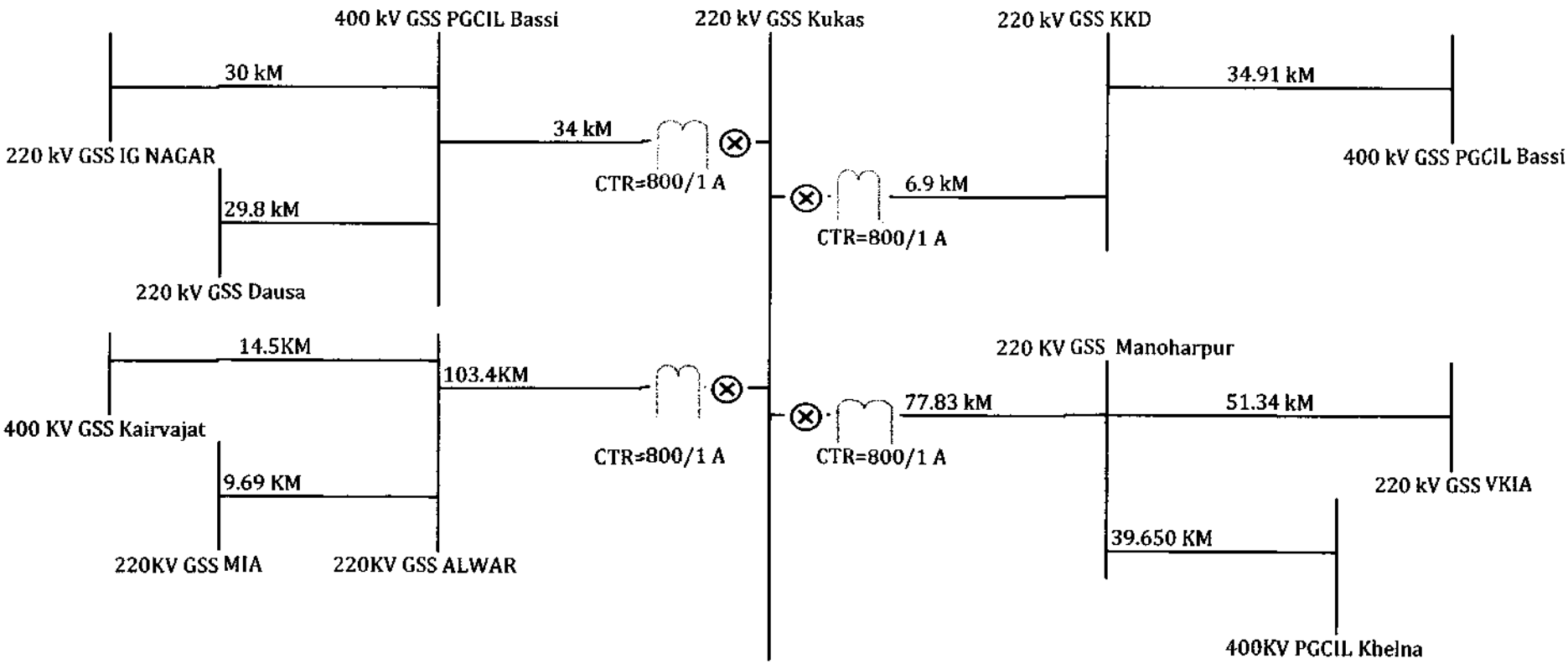
Directional Overcurrent Element Setting

CT Ratio	800/1		
Plug Setting	100% i.e.	800	Amp
Plug Setting Multiplier	17.2025		
Time of Operation	0.5	Seconds	
TMS	**0.209**		

Directional Earthfault Element Setting

CT Ratio	800/1		
Plug Setting	20 % i.e.	160	Amp
Plug Setting Multiplier	53.6313		
Time of Operation	0.5	Seconds	
TMS	**0.227**		

Distance relay calculation for 220KV Kukas - KKD Line



Principle line Length	:	6.9 KM.
Shortest Line Length considered on Remote Bus		34.91 KM.
Longest line length Considered on Remote Bus		34.91 KM.

Conductor Used	:	**Zebra**			
Conductor Parameters	:	**R**	**X**	**Z**	**Angle**
Positive Sequence(Z1):		0.081	0.4	0.408	78.55
Zero Sequence(Z0):		0.2875	1.275	1.307	77.29
CTR:		800/1 Amp= 800			
PTR:		220000/110 V= 2000			
CTR/PTR:		0.4			

EARTH FAULT COMPENSATION

	kZ0	**kZ0 angle**
RE/RL=1/3((Ro/R1)-1)		
XE/XL=1/3((Xo/X1)-1)		
kZ0 Res. Comp.= kZ0 = (Z0 – Z1) / 3Z1	**0.734**	**-1.83**

Zone 1(Forward) Reach:	80	% of the Line to be Protected
Zone 2(Forward) Reach:	50	% of the Shortest Line on remote Bus+100 % of the Protected Line
Zone 3(Forward) Reach:	110	% Longest line length on Remote Bus+100 % of the Protected Line
Zone 4(Reverse) Reach:	2	Km

Zone 1 forward Reach= 80% of line length (Kukas to KKD)* +ve Sequence impedance of conductor/km*(CTR/PTR)

= 0.901 Ohm T1= Instt.

Zone 2 forward Reach= 100% of line length (Kukas to KKD)+50 % of the Shortest Line on remote Bus (KKD to PGCIL Bassi)*+ve Sequence impedance of conductor/km*(CTR/PTR)

= 3.976 Ohm T2=350 ms

Zone 3 forward Reach=100% of line length (Kukas to KKD)+110 % Longest line length on Remote Bus(KKD to PGCIL Bassi)*+ve Sequence impedance of conductor/km*(CTR/PTR)

= 7.395 Ohm T3=1000 ms

Zone 4 reverse Reach=2 km*+ve Sequence impedance of conductor/km*(CTR/PTR)

= 0.326 Ohm T4=160 ms

Directional O/C & E/F relay calculation for 220 kV Kukas-KKD Line

Fault MVA of 220 kV BUS	:	6885	MVA
3 Phase Short Circuit Current	:	15891	Amp
Phase-Phase Short Circuit Current	:	13762	Amp
Phase to Earth Short Circuit Current	:	8581	Amp

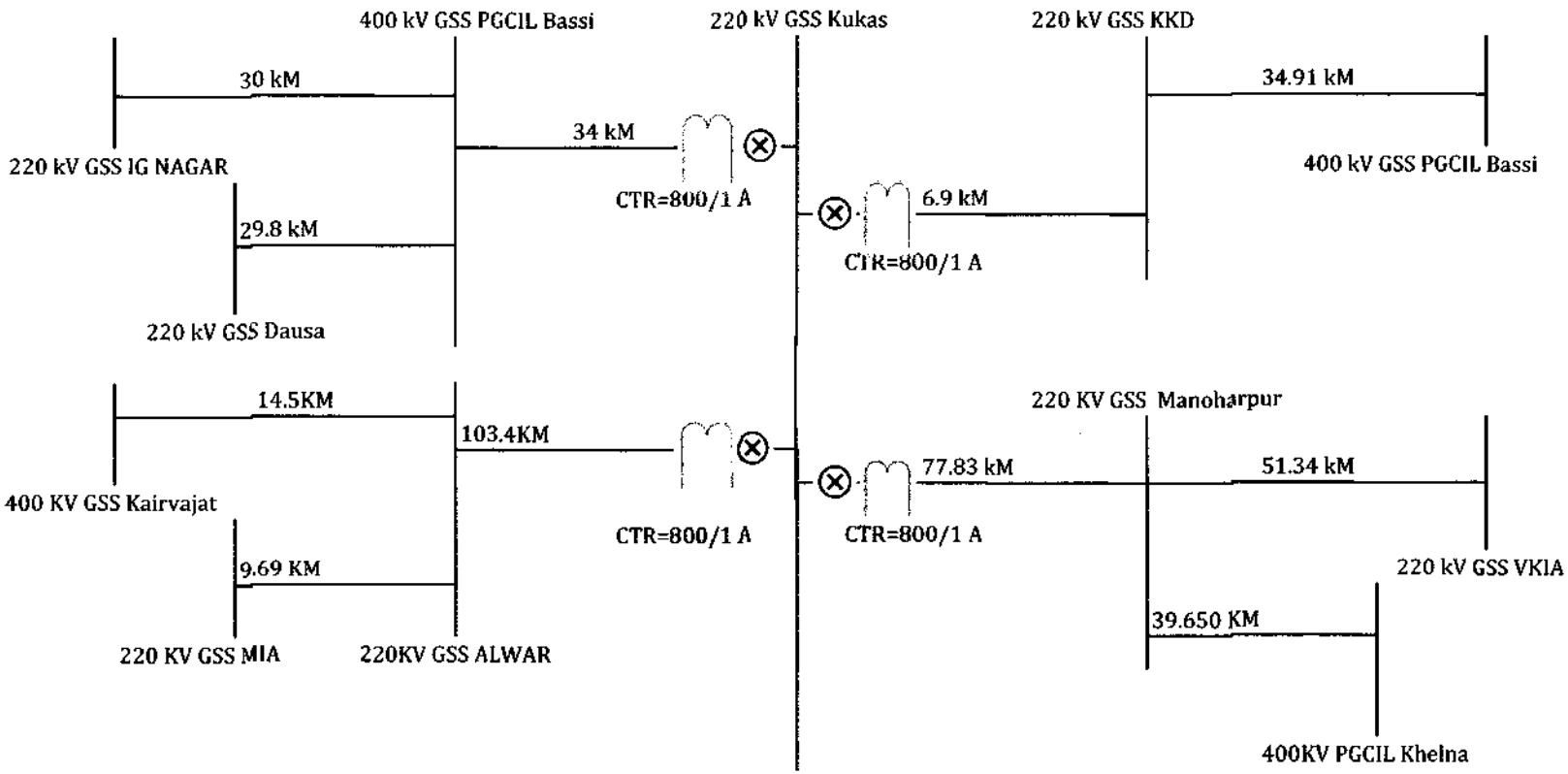
Directional Overcurrent Element Setting

CT Ratio	800/1		
Plug Setting	100 % i.e.	800	Amp
Plug Setting Multiplier	17.2025		
Time of Operation	0.5	Seconds	
TMS	**0.209**		

Directional Earthfault Element Setting

CT Ratio	800/1		
Plug Setting	20 % i.e.	160	Amp
Plug Setting Multiplier	53.6313		
Time of Operation	0.5	Seconds	
TMS	**0.227**		

Distance relay calculation for 220 KV Kukas -Manoharpur Line



Principle line Length	77.83 KM.
Shortest Line Length considered on Remote Bus	39.65 KM.
Longest line length Considered on Remote Bus	51.34 KM.

Conductor Used : Zebra

Conductor Parameters :

	R	X	Z	Angle
Positive Sequence(Z1):	0.081	0.4	0.408	78.55
Zero Sequence(Z0):	0.2875	1.275	1.307	77.29

CTR: 800/1 Amp= 800

PTR: 220000/110 V= 2000

CTR/PTR: 0.4

EARTH FAULT COMPENSATION

RE/RL=1/3((Ro/R1)-1)

XE/XL=1/3((Xo/X1)-1)

	kZ0	kZ0 angle
kZ0 Res. Comp.= kZ0 = (Z0 - Z1) / 3Z1	**0.734**	**-1.83**

Zone 1(Forward) Reach:	80	% of the Line to be Protected
Zone 2(Forward) Reach:	50	% of the Shortest Line on remote Bus+100 % of the Protected Line
Zone 3(Forward) Reach:	110	% Longest line length on Remote Bus+100 % of the Protected Line
Zone 4(Reverse) Reach:	2	Km

Zone 1 forward Reach= 80% of line length (Kukas to Manoharpur)* +ve Sequence impedance of conductor/km*(CTR/PTR)

= **10.164** **Ohm** **T1= Instt.**

Zone 2 forward Reach= 100% of line length (Kukas to Manoharpur)+50 % of the Shortest Line on remote Bus(Manoharpur-PGCIL Khelna)*+ve Sequence impedance of conductor/km*(CTR/PTR)

= **15.942** **Ohm** **T2=350 ms**

Zone 3 forward Reach=100% of line length(Kukas to Manoharpur)+110 % Longest line length on Remote Bus(Manoharpur-VKIA)*+ve Sequence impedance of conductor/km*(CTR/PTR)

= **21.925** **Ohm** **T3=1000 ms**

Zone 4 reverse Reach=2 km*+ve Sequence impedance of conductor/km*(CTR/PTR)

= **0.326** **Ohm** **T4=160 ms**

Directional O/C & E/F relay calculation for 220 kV Kukas-Manoharpur Line

Fault MVA of 220 kV BUS	:	6885	MVA
3 Phase Short Circuit Current	:	15891	Amp
Phase-Phase Short Circuit Current	:	13762	Amp
Phase to Earth Short Circuit Current	:	8581	Amp

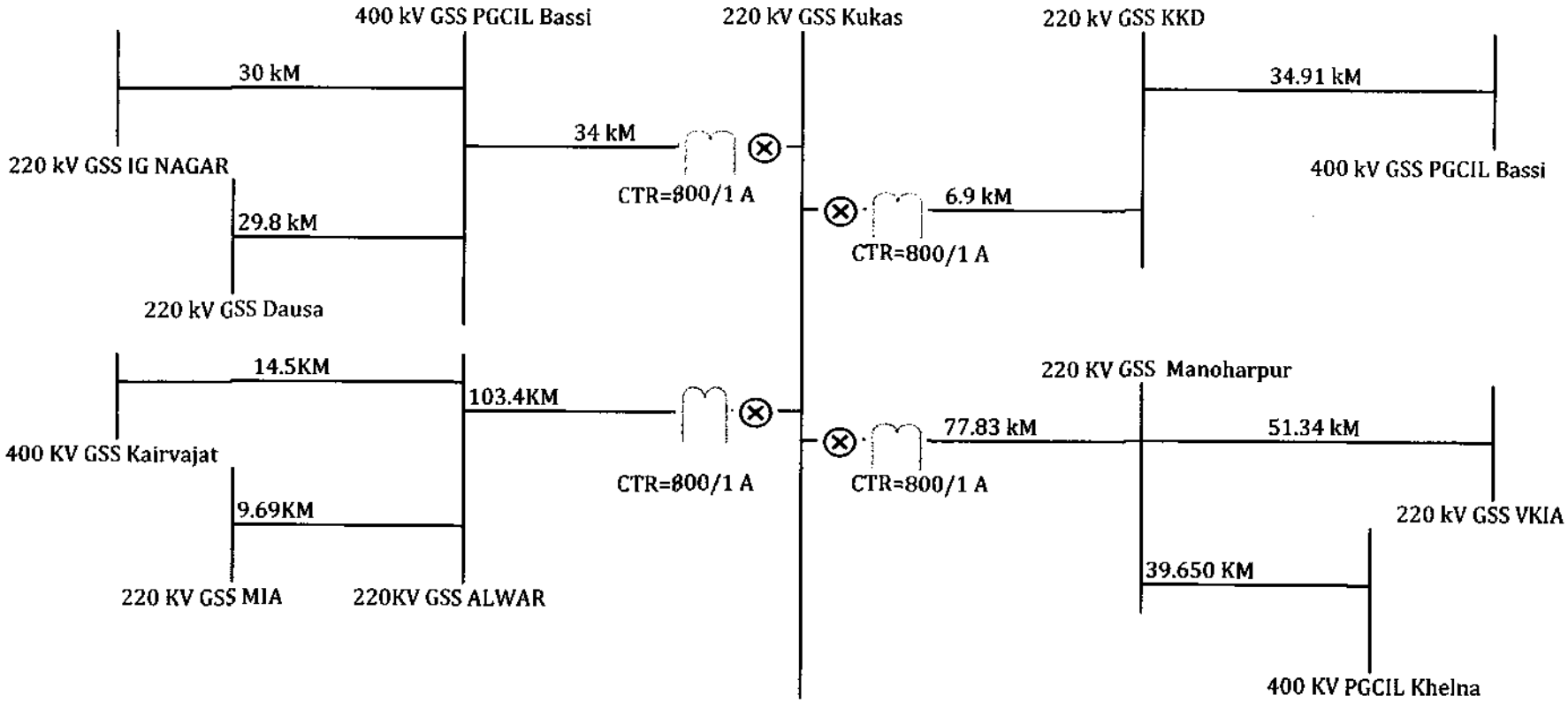
Directional Overcurrent Element Setting

CT Ratio	800/1		
Plug Setting	100% i.e.	800	Amp
Plug Setting Multiplier	17.2025		
Time of Operation	0.5	Seconds	
TMS	0.209		

Directional Earthfault Element Setting

CT Ratio	800/1		
Plug Setting	20 % i.e.	160	Amp
Plug Setting Multiplier	53.6313		
Time of Operation	0.5	Seconds	
TMS	0.227		

Distance relay calculation for 220 KV Kukas -Alwar Line



Principle line Length	:	103.4 KM.
Shortest Line Length considered on Remote Bus		9.69 KM.
Longest line length Considered on Remote Bus		14.5 KM.

Conductor Used : **Zebra**

Conductor Parameters :	**R**	**X**	**Z**	**Angle**
Positive Sequence(Z1):	0.081	0.4	0.408	78.55
Zero Sequence(Z0):	0.2875	1.275	1.307	77.29
CTR:	800/1 Amp= 800			
PTR:	220000/110 V= 2000			
CTR/PTR:	0.4			

EARTH FAULT COMPENSATION

RE/RL=1/3((Ro/R1)-1)

XE/XL=1/3((Xo/X1)-1)

kZ0 Res. Comp.= kZ0 = (Z0 - Z1) / 3Z1

kZ0	**kZ0 angle**
0.734	**-1.83**

Zone 1(Forward) Reach:	80	% of the Line to be Protected
Zone 2(Forward) Reach:	50	% of the Shortest Line on remote Bus+100 % of the Protected Line
Zone 3(Forward) Reach:	110	% Longest line length on Remote Bus+100 % of the Protected Line
Zone 4(Reverse) Reach:	2	Km

Zone 1 forward Reach= 80% of line length (Kukas to Alwar)* +ve Sequence impedance of conductor/km*(CTR/PTR)

= 13.504 Ohm T1= Instt.

Zone 2 forward Reach= 100% of line length (Kukas to Alwar)+50 % of the Shortest Line on remote Bus(Alwar-MIA)*+ve Sequence impedance of conductor/km*(CTR/PTR)

= 17.671 Ohm T2=350 ms

Zone 3 forward Reach=100% of line length (Kukas to Alwar)+110 % Longest line length on Remote Bus(Alwar-Kairvajat)*+ve Sequence impedance of conductor/km*(CTR/PTR)

= 19.484 Ohm T3=1000 ms

Zone 4 reverse Reach=2 km*+ve Sequence impedance of conductor/km*(CTR/PTR)

= 0.326 Ohm T4=160 ms

Directional O/C & E/F relay calculation for 220 kV Kukas-Alwar Line

Fault MVA of 220 kV BUS	:	6885	MVA
3 Phase Short Circuit Current	:	15891	Amp
Phase-Phase Short Circuit Current	:	13762	Amp
Phase to Earth Short Circuit Current	:	8581	Amp

Directional Overcurrent Element Setting

CT Ratio	800/1		
Plug Setting	100% i.e.	800	Amp
Plug Setting Multiplier	17.2025		
Time of Operation	0.5	Seconds	
TMS	**0.209**		

Directional Earthfault Element Setting

CT Ratio	800/1		
Plug Setting	20 % i.e.	160	Amp
Plug Setting Multiplier	53.6313	.	
Time of Operation	0.5	Seconds	
TMS	**0.227**		

Rajasthan Rajya Vidhyut Prasaran Nigam Limited

Report of the Protection Audit

A. General Information

i)	Name of utility:	Rajasthan Rajya Vidhyut Prasaran Nigam Limited
ii)	Name of Voltage level of Substation:	220 kV GSS Kukas
iii)	Date of Commissioning:	13.10.1999
iv)	Type of Bus Switching Scheme	Two Main Bus
v)	Name and Organization of Audit Team	Sh. Mukul Yadav, AEN-III (MPT&S), RVPN, Jaipur
		Sh. Munesh Kumar Meena , JEN-I O/o AEN-III (MPT&S), RVPN, Jaipur
vi)	Name of representative from utility whose audit being carried out	Sh. D.K. Jain, SE (Prot. Engg.) RVPNL Jaipur

B. Checklist for Protection Audit

S.No.	Check		Functional/ Non-Functional/Enabled /Disabled	Type of Relay*(Numerical/ Static/Electromechanical)	Setting as found in field*/**	Compliance status w.r.t. regulatory provisions
Transformer Protection Panel						
(i)	**Name of Transformer (Rating/Capacity)**	**220/132 kV, 100 MVA CGL make Transformer-I**				
	Tripping by Buchholz Relay (Alarm)	Yes	Enabled	Electromechanical		Complying
	Differential Protection	Yes	Enabled	Electrostatic		Complying
	2nd Harmonic Block (Setting)		Enabled		15%	Complying
	Event Logger Operation	No				
	Restricted Earth Fault Protection (HV Side)(Auto X-mer)	No				
	Event Logger Operation	No				
	REF Protection (LV Side)	NA				
	Event Logger Operation	NA				
	Backup Over Current	Yes	Enabled	Electromechanical	1/0.215	Complying
	Event Logger Operation	No				
	Earth Fault Protection	Yes	Enabled	Electromechanical	0.2/0.273	Complying
	Event Logger Operation	No				
	Over Flux Protection	Yes	Enabled			Complying
	Event Logger Operation	No				
	Local Breaker Back Up	Yes				
	Retrip	Yes	Enabled			Complying
	Current and Time Setting				120%/100 ms+100 ms External timer	Complying
	Separate Single and three phase initiation	No(3 phase only)				Complying
	Earth Fault	No				Complying
	Event logger	No				
(i)	**Name of Transformer (Rating/Capacity)**	**220/132 kV, 100 MVA CGL make Transformer-III**				
	Tripping by Buchholz Relay (Alarm)	Yes	Enabled	Electromechanical		Complying
	Differential Protection	Yes	Enabled	Numerical		Complying
	2nd Harmonic Block (Setting)		Enabled		15%	Complying

S.No.	Check		Functional/ Non-Functional/Enabled /Disabled	Type of Relay*(Numerical/ Static/Electromechanical)	Setting as found in field*/**	Compliance status w.r.t. regulatory provisions
	Event Logger Operation	Yes	In built feature of numerical differential relay			
	Restricted Earth Fault Protection (HV Side)(Auto X-mer)	Yes	Functional	Numerical	40.1 V	Complying
	Event Logger Operation	Yes	In built feature of numerical REF relay			
	REF Protection (LV Side)	NA				
	Event Logger Operation	NA				
	Backup Over Current	Yes	Enabled	Numerical	0.66/0.203	Complying
	Event Logger Operation	Yes	In built feature of numerical O/C & E/F relay			
	Earth Fault Protection	Yes	Enabled	Numerical	0.2/0.273	Complying
	Event Logger Operation	Yes	In built feature of numerical O/C & E/F relay			
	Over Flux Protection	Yes	Enabled			Complying
	Event Logger Operation	Yes	In built feature of numerical differential relay			
	Local Breaker Back Up	Yes				
	Retrip	Yes	Enabled			Complying
	Current and Time Setting				120%/100 ms+100 ms External timer	Complying
	Separate Single and three phase initiation	No(3 phase only)				Complying
	Earth Fault	No				Complying
	Event logger	Yes	In built feature of numerical LBB relay			
Name. Signature & Contact No. of team Carrying out Protection audit:			1. Mukul Yadav, AEN-III (MPT&S), Jaipur 9413382334			
			2. Munesh Kr. Meena, JEN-I O/o AEN-III (MPT&S), Jaipur 9413383124			
Name. Signature & Contact No. of representative of utility whose Protection audit is being carried out:			1. Dinesh Kumar Jain, SE (Prot.Engg.), RVPN, Jaipur, 9413393540			

Non Directional O/C & E/F relay calculation for 220/132 kV, 100 MVA Transformer-I

Fault MVA of 220 kV BUS	:	6885	MVA
P.U. Impedance of 220 kV BUS		0.0145	
% Imepdance of transformer at Normal Tap		9.47	%
Transformer HV Voltage rating		220000	Volts
Transformer LV Voltage rating		132000	Volts
Transformer MVA Capacity		100	MVA
P.U. Impedance of Transformer		0.0947	
Total P.U. Impedance		0.1092	
Fault MVA of 132 kV BUS	:	916	MVA
3 Phase through fault Short Circuit Current		4007	Amp
Phase-Phase through fault Short Circuit Current		3470	Amp
Phase to Earth through fault Short Circuit Current		2164	Amp

Non Directional Overcurrent Element Setting

CT Ratio	300/1		
Plug Setting	100 % i.e.	300	Amp
Plug Setting Multiplier	11.56667		
Time of Operation	0.6	Seconds	
TMS	0.215		

Non Directional Earthfault Element Setting

CT Ratio	300/1		
Plug Setting	20 % i.e.	60	Amp
Plug Setting Multiplier	36.06667		
Time of Operation	0.6	Seconds	
TMS	0.273		

Stablizing Resistor calculation for Restricted Earth fault relay

Transformer Full load current HV	262	Amp
Transformer Full load current LV	437	Amp
Maximum fault current on through fault (If)	4615	Amp
Bushing CT Ratio	600	
Lead resistance	1	Ohm
Rct	5	Ohm
Vk=	If*(Rct+2Rl)	
Vk=	53.8	Volts
REF Operating Current	0.1	Amp
Stablizing Resistor	538	Ohm

Non Directional O/C & E/F relay calculation for 220/132 kV, 100 MVA Transformer-III

Fault MVA of 220 kV BUS	:	6885	MVA
P.U. Impedance of 220 kV BUS		0.0145	
% Imepdance of transformer at Normal Tap		12.71	%
Transformer HV Voltage rating		220000	Volts
Transformer LV Voltage rating		132000	Volts
Transformer MVA Capacity		100	MVA
P.U. Impedance of Transformer		0.1271	
Total P.U. Impedance		0.1416	
Fault MVA of 132 kV BUS	:	706	MVA
3 Phase through fault Short Circuit Current		3088	Amp
Phase-Phase through fault Short Circuit Current		2674	Amp
Phase to Earth through fault Short Circuit Current		1668	Amp

Non Directional Overcurrent Element Setting

CT Ratio	400/1		
Plug Setting	66 % i.e.	264	Amp
Plug Setting Multiplier	10.12879		
Time of Operation	0.6	Seconds	
TMS	0.203		

Non Directional Earthfault Element Setting

CT Ratio	400/1		
Plug Setting	20 % i.e.	80	Amp
Plug Setting Multiplier	20.85		
Time of Operation	0.6	Seconds	
TMS	0.273		

Stablizing Resistor calculation for Restricted Earth fault relay

Transformer Full load current HV	262	Amp
Transformer Full load current LV	437	Amp
Maximum fault current on through fault (If)	3438	Amp
Bushing CT Ratio	600	
Lead resistance	1	Ohm
Rct	5	Ohm
Vk=	If*(Rct+2Rl)	
Vk=	40.1	Volts
REF Operating Current	0.1	Amp
Stablizing Resistor	401	Ohm

Rajasthan Rajya Vidhyut Prasaran Nigam Limited

Report of the Protection Audit

A. General Information

i)	Name of utility:	Rajasthan Rajya Vidhyut Prasaran Nigam Limited
ii)	Name of Voltage level of Substation:	220 kV GSS Kukas
iii)	Date of Commissioning:	13.10.1999
iv)	Type of Bus Switching Scheme	Two Main Bus
v)	Name and Organization of Audit Team	Sh. Mukul Yadav, AEN-III (MPT&S), RVPN, Jaipur Sh. Munesh Kumar Meena , JEN-I O/o AEN-III (MPT&S), RVPN, Jaipur
vi)	Name of representative from utility whose audit being carried out	Sh. D.K. Jain, SE (Prot. Engg.) RVPNL Jaipur

B. Checklist for Protection Audit

S.No.	Check		Functional/ Non-Functional/Enabled/Disabled	Type of Relay*(Numerical /Static/Electromechanical)	Setting as found in field*/**	Compliance status w.r.t. regulatory provisions
1	**DC system**					
	No. of independent DC Sources	2 nos. 220 VDC	01 Nos. Functional & 01 Nos. Non-functional			
	Potential between +ive & earth (Source-1)	114.2 V	-	-	-	-
	Potential between -ive & earth (Source-1)	115.7 V	-	-	-	-
	Potential between +ive & earth (Source-2)	–	-	-	-	-
	Potential between -ive & earth (Source-2)	-	-	-	-	-
2	Event Logger panel	No	-	-	-	-
3	Event Logger Time Synchronised	NA	-	-	-	-
	Disturbance Recorder	NA	-	-	-	-
	DR Time Synchronised	NA	-	-	-	-
4	Bus bar Protection	Yes	Functional	Numerical	120 % Pickup	Complying
	Stability Check	Yes(On Running load)	-	-	-	-
	EL output for this event	No	-	-	-	-
	DR if available	No	-	-	-	-
5	DG Set	No	-	-	-	-
	Mock testing of a sample protection associated with transmission line* **	Yes/ No	i. If Yes then observation..... ii. If no, the reason for the same.....			
6	**Local Breaker Back Up(For Line)**		-	Electrostatic	-	-
	Retrip	Yes	Enabled	-	-	Complying
	Current and Time Setting	Yes	-	-	PU-120%/100 ms+100 ms External timer	Complying

S.No.	Check		Functional/ Non-Functional/Enabled/Disabled	Type of Relay*(Numerical /Static/Electromechanical)	Setting as found in field*/**	Compliance status w.r.t. regulatory provisions
	Separate Single and three phase initiation	Yes	Functional	-	-	Complying
	Earth Fault	No	Disabled	-	-	Complying
	Event logger operation	No				
Name. Signature & Contact No. of team Carrying out Protection audit:			1. Mukul Yadav, AEN-III (MPT&S), Jaipur 9413382334			
			2. Munesh Kr. Meena, JEN-I O/o AEN-III (MPT&S), Jaipur 9413383124			
Name. Signature & Contact No. of representative of utility whose Protection audit is being carried out:			1. Dinesh Kumar Jain, SE (Prot.Engg.), RVPN, Jaipur, 9413393540			

Internal Protection Audit Report

Jaypee Vishnuprayag Hydro Electric Plant, Vishnuprayag

Date : 27.07.2024

(a)	General Information	
(i)	Name of the project	Jaypee Vishnuprayag Hydro-Electric Project (4x100 MW)
(ii)	Name of Owner Utility	Jaiprakash Power Ventures Ltd.
(iii)	Voltage Level (s) or highest voltage level	400 KV
(iv)	Short circuit current rating of all equipment (for all voltage level)	40 KA(rms) for 1 second (Value of AC component)
(v)	Date of commissioning of the substation	2006
(vi)	Checking and validation date	24-Jul-24
(vii)	Record of previous tripping"s (in last one year) and details of protection operation	Annexure-V
(viii)	Previous Relay Test Reports	Annexure-VI
(ix)	Overall single line diagram (SLD)	Annexure-I
(x)	AC aux SLD	Annexure-II (415V & 11 KV)
(xi)	DC aux SLD	Annexure-III
(xii)	SAS architecture diagram	Annexure-IV
(xiii)	SPS scheme implemented (if any)	NA

(b)	Plant details			
	Date of commissioning	Unit 1	13.09.2006	
		Unit 2	22.09.2006	
		Unit 3	01.10.2006	
		Unit 4	01.11.2006	
	Type of bus-switching scheme:	Double Bus Bar Scheme		
	Wheather SLD connected or Not:	Connected		
	Name and Organization of Audit Team	Mr. Rakesh Malviya		Internal Audit
		Mr. Ajay Parashar		Internal Audit
		Mr. Manish Rana		Internal Audit

(c)	The relay configuration checklist for available power system elements at station:	
(i)	Transmission Line	Refer (c - i)
(ii)	Bus Reactor/Line Reactor	Refer (c - ii)
(iii)	Inter-connecting Transformer	NA
(iv)	Busbar Protection Relay	Refer (c - iv)
(v)	AC auxiliary system	Refer (c - v)
(vi)	DC auxiliary system	Refer (c - vi)
(vii)	Communication system	Refer (c - vii)
(viii)	Circuit Breaker Details	Refer (c - viii)
(ix)	Current Transformer Details	Refer (c - ix)

(x)	Capacitive Voltage Transformers Details	Refer (c - x)		
(xi)	Any other equipment/system relevant for protection system operation			

(c - i)	**Transmission Line Distance Protection/Differential Protection**			
a.	Name and Length of Line	Line-1:- 283.1 KM (Vishnuprayag - Muzzaffarnagar 400 KV Line) Line-2:- 106 KM (Vishnuprayag - Alaknanda 400 KV Line)		
b.	Whether series compensated or not	Not Applicable		
c.	Mode of communication used (PLCC/OPGW)	PLCC		
d.	Relay Make and Model for Main-I and Main-II	Main-I:- ABB (REL 670) Main-II Siemens (Siprotec 7SA522)		
e.	List of all active protections & settings	Refer B Check List for Protection Audit		
f.	Carrier aided scheme if any	Yes		
g.	Status of Power Swing/Out of Step/SOTF/Breaker Failure/Broken Conductor/STUB/Fault Locator/DR/VT fuse fail/Overvoltage Protection/Trip Circuit supervision/Auto reclose/Load encroachment etc.	Refer B Check List for Protection Audit		
h.	Relay connected to Trip Coil-1 or 2 or both	Both		
i.	CT ratio and PT ratio	Line-1 & 2:- 1000/1A	400 kV / √3 / 110 V / √3	
j.	Feed from DC supply-1 or 2	Both		
k.	Connected to dedicated CT core (mention name)	CT L101 & CT L201	CORE-1	PS
			CORE-2	PS
			CORE-3	0.1
			CORE-4	0.2
			CORE-5	PS
			CORE-6	PS
		CT R101 (for Shunt Reactors)	CORE-1	PS
			CORE-2	PS
			CORE-3	5P20
			CORE-4	PS
		CT R102 (for Shunt Reactors)	CORE-1	PS
		CT R103 (for Shunt Reactors)	CORE-1	PS
l.	Other requirements for protection checking and validation	Nil		

(c - ii)	**Shunt Reactor Protection**			
a.	Relay Make and Model	ABB & RET 670		
b.	List of all active protections along with settings	Attached		
c.	Status of Oil Temperature Indicator/Winding Temperature Indicator/Bucholz/Pressure Release Device etc.	All OK		
d.	Relay connected to Trip Coil-1 or 2 or both	Both		
e.	CT ratio and PT ratio	250/1A	400 kV / √3 / 110 V / √3	
f.	Feed from DC supply-1 or 2	Both		
g.	Connected to dedicated CT core (mention name) *CTs mounted on Reactors	Line Bushing	Neutral End	WTI CT
		Core-1 - PS	Core-1 - PS	5 (7.5 VA)
		Core-2 - PS		

	CTs mounted on Reactors	Core-3 - PS		
		Core-4 - 5P20 (10VA)		
h.	Other requirements for protection checking and validation	Nil		

(c - iii)	**NA**	
(c - iv)	**Busbar Protection Relay**	
a.	Busbar and redundant relay make and model	ABB & REB 670
b.	Type of Busbar arrangement	Double Bus Bar
c.	Zones	Zone 1 to 4
d.	Dedicated CT core for each busbar protection (Yes/No)	Bus-I:- B101-1(spare), B101-2(Protection) Bus-II;- B102-1(BB prot.), B102-2(Metering)
e.	Breaker Failure relay included (Yes/No), if additional then furnish make and model	Yes
f.	Trip issued to both Busbar protection in case of enabling	Yes
g.	Isolator indication and check relays	Yes
h.	Other requirements for protection checking and validation	Nil

(c - v)	**AC Auxiliary system**	
a.	Source of AC auxiliary system	SSB & UAB
b.	Supply changeover between sources (Auto/Manual)	Auto & Manual both
c.	Diesel generator (DG) details	2*1010 KVA
d.	Maintenance plan and supply changeover periodicity in DG	Annually & Quaterly
e.	Single Line Diagram	Attached
f.	Other requirements for protection checking and validation	Nil

(c - vi)	**DC Auxiliary system**	
a.	Type of Batteries (Make, vintage, model)	Lead acid, Make: Exide, Vintage: TH1000H
b.	Status of battery Charger	Working
c.	Measured voltage (positive to earth and negative to earth)	Positive to earth Source -1/Source-2: Unearthed system Negative to earthSource -1/Source-2: Unearthed system
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	Nil

(c - vii)	**Communication system**	
(i)	Mode of communication for Main-1 and Main-2 protection	PLCC
(ii)	Mode of communication for data and speech communication	PLCC
(iii)	Status of PLCC channels	Working
(iv)	Time synchronization equipment details	GPS Receiver, interconnecting cable with matching connector.

(v)	OPGW on geographically diversified paths for Main-1 and main-2 relay	Not available
(vi)	Other requirements for protection checking and validation	Nil

(c - viii)	**Circuit Breaker Details**	
a.	Details and Status	Make: GE T&D Type: T155-2&3 compact CB, Single break Rated voltage: 420 KV
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	Density monitor for SF6 Pressure
f.	Other requirements for protection checking and validation	Nil

(c - ix)	**Current Transformer (CT) Details**								
a.	CT core connection details								
	Core	CT U101 (1000-500-250/1A)	CT G101 (6000/5A)	CT G102 (6000/5A)	CT G103 (6000/5A)	CT G104 (6000/5A)	CT G105 (500-250/1A)	CT G106 (1500/1A)	CT G107 (1500/1A)
	1	PS	PS	0.5 cl, 30 VA	PS	PS	PS	PS	PS
	2	PS	PS	0.5 cl, 30 VA	5P20, 10VA (200/5A)	5P20, 10VA (100/1A)	5P20, 10 VA	0.1, 15 VA (Metering)	-
	3	5P20, 30 VA	PS (Spare)	PS	-	-	-	5P20, 5 VA	-
	4	PS	Metering, 30VA	-	-	-	-	-	-
	5	PS	PS	-	-	-	-	-	-
	Adoted Ratio	1000/1A	6000/5A	6000/5A	6000/5A	6000/5A	500/1A	1500/1A	1500/1A
	Make	GE T&D (Earlier Areva)	Prayog Electricals	Prayog Electricals	Prayog Electricals	Prayog Electricals	Prayog Electricals	Prayog Electricals	Prayog Electricals
	Type	T155-CT	Cast Resin Ring Type	Cast Resin Ring Type	Cast Resin Ring Type	Cast Resin Ring Type	Cast Resin Ring Type	Cast Resin Ring Type	Cast Resin Ring Type
	Voltage level	420 KV	13.8 Kv	13.8 Kv	13.8 Kv	13.8 Kv	13.8 Kv	13.8 Kv	415 V
	Location	GIS	Generator Neutral side	Generator Phase side	Excitatin transformer CT	GT primary CT	GT Neutral CT	UAT CT	UAT LT side CT

(c - x)	**Capacitive Voltage Transformer (CVT) Details**	
	CVT name and voltage level	Line CVT - 400 KV
	CVT core connection details	Core 1/2/3
	Wdg-I	100 VA
	Wdg-II	0.2 Cl./300 VA

	Wdg-III	3P	
c.	Accuracy Class	CT - 0.5 cl	CVT - 0.2 cl
d.	Whether Protection/Metering	Both	
e.	CVT ratio available and ratio adopted	400 kV / √3 / 110 V / √3	
f.	Details of last checking and validation of CVT healthiness	Feb-24	
g.	Other requirements for protection checking and validation	Nil	

B. Check List for Protection Audit

S.No	Check		Functional / Non-functional / Enabled / Disabled	Type of relay * (Numerical / Static / Electro mechanical)	Setting as found in field*/**	Remarks
1.	**DC system**					
	No. of independent DC Sources	2	NA	NA	NA	220 V DC System
	Potential between +ive & earth (Source-1)	-	NA	NA	NA	Unearthed system (220 V DC System)
	Potential between -ive & earth (Source-1)	-	NA	NA	NA	Unearthed system (220 V DC System)
	Potential between +ive & earth (Source-2)	-	NA	NA	NA	Unearthed system (220 V DC System)
	Potential between -ive & earth (Source-2)	-	NA	NA	NA	Unearthed system (220 V DC System)
	Earth Fault / Over voltage Protection relay	-	Functional	Static	IE>0.7IN OV-110%Un	
2.	**Event Logger panel**	Yes	Functional	NA	NA	Inbuilt function of SCADA / protection system
3.	**Event Logger Time Synchronised**	Yes	Functional	NA	NA	Inbuilt function of SCADA / protection system
	Disturbance Recorder	Yes	Functional	NA	NA	Inbuilt function of SCADA / protection system
	DR Time Synchronised	Yes	Functional	NA	NA	Inbuilt function of SCADA / protection system
4.	**Transformer Protection Panel:**					
	Tripping by Buchholz relay (Alarm)	Yes	Functional	Numerical	NA	
	Differential Protection	Yes	Functional			
	2nd Harmonic Block(Setting)		Functional	Numerical	Attached	
	Event Logger operation	Yes	Functional	Numerical	Attached	

	Restricted Earth Fault Protection (LV side)	No				Primary winding is in Delta Connection
	Event Logger operation	No		NA	NA	
	REF Protection (HV side)	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
	Over current	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
	Earth Fault protection	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
	Over Flux Protection	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
5.	**Reactor Protection Panel:**					
	Tripping by Buchholz relay(Alarm)	**Yes**	Functional	Numerical	NA	
	Differential Protection	**Yes**	Functional	Numerical	Attached	
	2^{nd} Harmonic Block (Setting)	**Yes**	Functional	Numerical	Attached	
	5^{th} Harmonic Block (Setting)	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
	REF Protection (LV side)	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
	Backup Impedance	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
6.	**Line Protection Panel: M-I/II**					
	Pole discrepancy relay	**Yes**	Functional	Through Schematic	1 seconds	
	PLCC panel	**Yes**	Functional	NA	NA	
	Distanace Protection	**Yes**	Functional	Numerical	Attached	
	Zone-1/2/3/4/5 (Settings)	**Yes**	Functional	Numerical	Attached	
	Time check-Z-1/2/3/4/5 (Settings)	**Yes**	Functional	Numerical	Attached	
	SOTF	**Yes**	Functional	Numerical	Attached	
	Fault Locator	**Yes**	Functional	Numerical	Attached	
	Power swing(Settings R and X)	**Yes**	Functional	Numerical	Attached	
	All Zone block	**Yes**	Functional	NA	NA	
	DR	**Yes**	Functional	in built in numerical relay also	NA	
	Breaker Contacts	**Yes**	Functional	NA	NA	
	Carrier Receive	**Yes**	Functional	NA	NA	
	Time Synchronization	**Yes**	Functional	NA	NA	

7.	**Single Phase Auto Recloser Scheme**	**Yes**	Functional	Numerical	Attached	
8.	**Bus Bar Protection**	**Yes**	Functional	Numerical		
	Stability Check	**Yes**	Functional	Numerical		
	Slope check	**Yes**	Functional	Numerical	Attached	
	EL output for this event	**Yes**	Functional	Numerical		
	DR if available	**Yes**	Functional	Numerical		
	Local Breaker Back up	**Yes**	Functional	Numerical	Attached	
	Retrip	**Yes**	Functional			
	Current and Time setting	**Yes**	Functional		Attached	
	Seperate single and three phase initiation	**Yes**	Functional	Numerical	Attached	
	Earth fault	**Yes**	Functional	Numerical	Attached	
	Event Logger	**Yes**	Functional	Numerical	Attached	
9.	**Bus Coupler Protection**	**Yes**	Functional	Numerical		
	Over Current	**Yes**	Functional	Numerical		
	Earth Fault protection	**Yes**	Functional	Numerical	Attached	
	EL output for this event	**Yes**	Functional	Numerical		
	DR if available	**Yes**	Functional	Numerical		
10.	**Generator & Generator Transformer Protection Panel:**					
	Main 1 Protection					
10-A1	Generator Differential Protection	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
10-A2	Generator Backup Protection	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
10-A3	Gen. Loss of Excitation (U/V)	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
10-A4	Gen AC Inst Over Current	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
10-A5	Gen AC Time delayed Over	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
10-A6	Gen O/V protection Stage 1	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
10-A7	Gen O/V protection Stage 2	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
10-A8	Gen Reverse Power Protection	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
10-A9	Gen Neg Phase Seq Protection	**Yes**	Functional	Numerical	Attached	

	Event Logger operation	**Yes**	Functional	NA	NA	
10-A10	Generator Thermal Protection	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
10-A11	Gen Volt Balance Protection	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
10-A12	GT Restricted Earth Fault	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
10-A13	UAT O/c & E/F Protection	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
10-A14	Gen Stator 100% Earth Fault	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
	Main 2 Protection					
10-B1	Over Voltage Stage-1 (59)	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
10-B2	Over Voltage Stage-2 (59)	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
10-B3	Under Voltage Stage-1 (27)	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
10-B4	Under Voltage Stage-2 (27)	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
10-B5	Over Frequency Stage-1 (81)	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
10-B6	Over Frequency Stage-2 (81)	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
10-B7	Under Frequency Stage-1 (81)	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
10-B8	Under Frequency Stage-2 (81)	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
10-B9	Over Fluxing Stage-1 (24)	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
10-B10	Over Fluxing Stage-2 (24)	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
10-B11	UAT Restricted E/F Protn. (64R)	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
10-B12	GT/F Time Delayed O/C (51GT)	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
10-B13	Gen. Trans. Neu. O/C (51NGT)	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
10-B14	95% Stator E/F(59/27)	**Yes**	Functional	Numerical	Attached	
	Event Logger operation	**Yes**	Functional	NA	NA	
10-B15	Overall Differential (87T)	**Yes**	Functional	Numerical	Attached	

	Event Logger operation	**Yes**	Functional	NA	NA	
11.	**DG Set**	**Yes**	Functional	Auto/Manual		In built in DG sets function of DG set controller

	System	Time Synchronising	Availablity (In service or
i)	400 kV System	Masibus	In service

A) Transmission Line Protection-I

	Name of Line	Main-I Protection (Make & Model)	Availablity (In service or
i)	400 kV Vishnuprayag-Muzaffarnagar Line-1	ABB; REL-670	In service
ii)	400 kV Vishnuprayag-Alaknanda Line-2	ABB; REL-670	In service

Transmission Line Protection-II

	Name of Line	PLCC/Protection coupler (Make and Model)
i)	400 kV Vishnuprayag-Muzaffarnagar Line-1	ABB; ETI41/NSD41
ii)	400 kV Vishnuprayag-Muzaffarnagar Line-2	ABB; ETI41/NSD41

B) Reactor Protection

	Name of Reactor	Differential Protection (Make and Model)	REF Protection (Make and Model)
i)	Line-1 Reactor	Hitachi; RET-670	Hitachi; RET-670
ii)	Line-2 Reactor	Hitachi; RET-670	Hitachi; RET-670
iii)	Bus Reactor-1		
iv)	Bus Reactor-2		

C) Geneator & Generator Transformer Protection

	Name of Reactor	Main 1
i)	Unit 1 (100 MW)	Hitachi - REG 670
i)	Unit 2 (100 MW)	Hitachi - REG 670
i)	Unit 3 (100 MW)	Hitachi - REG 670

i)	Unit 4 (100 MW)	Hitachi - REG 670

Summary of Protection system
uprayag Hydro Electric Plant, Vishnuprayag

Date of Installation	Event Logger (Make)	Availablity (In service or not)	Synchronising Facility Available or
Jan. 2024	Hitachi and ABB	In service	Available

Date of Testing	Main-II Protection (Make & Model)	Availablity (In service or not)	Date of Testing	LBB (Mak
Feb. 2024	Siemens, 7SA522	In service	Feb. 2024	ABI
Feb. 2024	Siemens, 7SA522	In service	Feb. 2024	ABI

Availablity (In service or not)	Disturbance Recorder(DR)	Details of O/V Protection
In service	Provided in line Main-1&2 Protections	Provided in line Main-1&2 Protections
In service		

Back-up Impedance Protection (Make and Model)	OTI/WTI Indication working or not	Buchholz/ PRD	Any other Protection	Date of Testing
Hitachi; RET-670	working	working	--	Feb-24
Hitachi; RET-670	working	working	--	Feb-24

Bus Reactors Not Installed

Main 2	OTI/WTI Indication working or not	Buchholz/ PRD	Any other Protection	Date of Testing
Hitachi - REG 670	working	working	--	Feb-24
Hitachi - REG 670	working	working	--	Feb-24
Hitachi - REG 670	working	working	--	Feb-24

Hitachi - REG 670	working	working	--	Feb-24

Synchro Check Relay	Remarks
SKD 11	

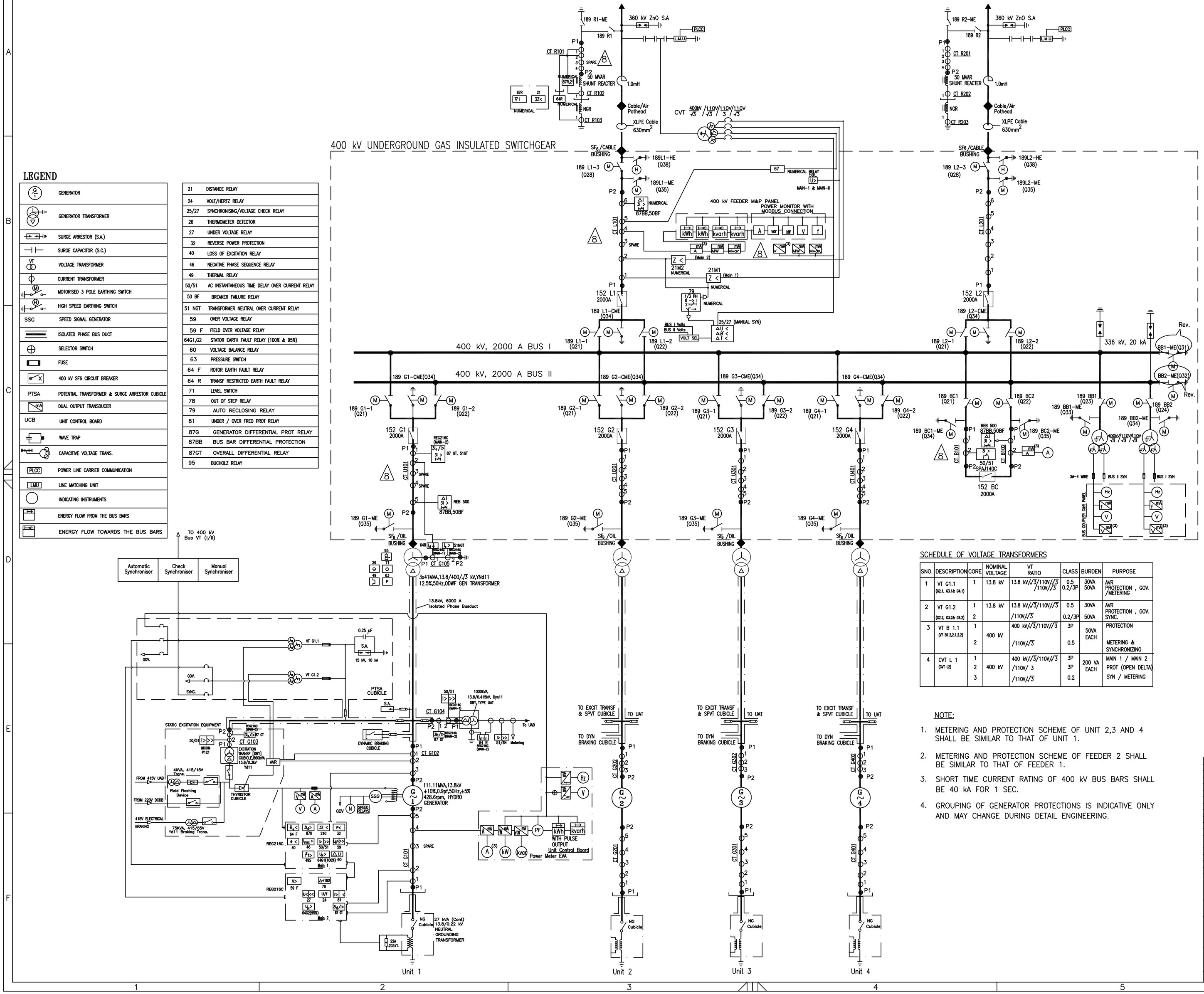
; Protection ‹e & Model)	Availablity (In service	Date of Testing
B; REB-670	In service	Jan. 2024
B; REB-670	In service	Jan. 2024

Availablity (In service or not)
In service
In service

LA Rating HV side
360kV,20kA, Class IV
360kV,20kA, Class IV

Remarks

Annexure-I



LEGEND

G	GENERATOR
	GENERATOR TRANSFORMER
	SURGE ARRESTOR (S.A.)
	SURGE CAPACITOR (S.C.)
VT	VOLTAGE TRANSFORMER
CT	CURRENT TRANSFORMER
M	MOTORISED 3 POLE EARTHING SWITCH
H	HIGH SPEED EARTHING SWITCH
SSG	SPEED SIGNAL GENERATOR
	ISOLATED PHASE BUS DUCT
	SELECTOR SWITCH
	FUSE
X	400 kV SF6 CIRCUIT BREAKER
PTSA	POTENTIAL TRANSFORMER & SURGE ARRESTOR CUBICLE
mA	DUAL OUTPUT TRANSDUCER
UCB	UNIT CONTROL BOARD
	WAVE TRAP
	CAPACITIVE VOLTAGE TRANS.
PLCC	POWER LINE CARRIER COMMUNICATION
LMU	LINE MATCHING UNIT
	INDICATING INSTRUMENTS
	ENERGY FLOW FROM THE BUS BARS
	ENERGY FLOW TOWARDS THE BUS BARS

21	DISTANCE RELAY
24	VOLT/HERTZ RELAY
25/27	SYNCHRONISING/VOLTAGE CHECK RELAY
26	THERMOMETER DETECTOR
27	UNDER VOLTAGE RELAY
32	REVERSE POWER PROTECTION
40	LOSS OF EXCITATION RELAY
46	NEGATIVE PHASE SEQUENCE RELAY
49	THERMAL RELAY
50/51	AC INSTANTANEOUS TIME DELAY OVER CURRENT RELAY
50 BF	BREAKER FAILURE RELAY
51 NGT	TRANSFORMER NEUTRAL OVER CURRENT RELAY
59	OVER VOLTAGE RELAY
59 F	FIELD OVER VOLTAGE RELAY
64G1,G2	STATOR EARTH FAULT RELAY (100% & 95%)
60	VOLTAGE BALANCE RELAY
63	PRESSURE SWITCH
64 F	ROTOR EARTH FAULT RELAY
64 R	TRANSF RESTRICTED EARTH FAULT RELAY
71	LEVEL SWITCH
78	OUT OF STEP RELAY
79	AUTO RECLOSING RELAY
81	UNDER / OVER FREQ PROT RELAY
87G	GENERATOR DIFFERENTIAL PROT RELAY
87BB	BUS BAR DIFFERENTIAL PROTECTION
87GT	OVERALL DIFFERENTIAL RELAY
95	BUCHOLZ RELAY

SCHEDULE OF CURRENT TRANSFORMERS

sno	Description	Core	Nominal Voltage	CT Ratio	Class	App Sec. Res (Ohm)	Knee Point Voltage, volt	Burden VA	Purpose
1	CT G101 (CT G201,G301, G401)	1	13.8 kV	6000/5A	PS	≤1.5	>415	–	OVERALL DIFF PROT
		2			PS	≤1.5	>477	–	PROT MAIN 2
		3			PS	≤1.5	>477	–	SPARE
		4			0.5	–	–	30	METERING
		5			PS	≤1.5	>477	–	PROT MAIN 1
2	CT G102 (CT G202,G302, G402)	1	13.8 kV	6000/5A	0.5	–	–	30	AVR 1
		2			0.5	–	–	30	AVR 2
		3			PS	≤1.5	>477	–	GEN DIFF PROT
3	CT G103 (CT G203,G303, G403)	1	13.8 kV	6000/5A 100/1A	PS 5P20	≤1.5 –	>415	– 10	OVERALL DIFF PROT PROT
4	CT G104 (CT G204,G304, G404)	1	13.8 kV	6000/5A 100/1A	PS 5P20	≤1.5	>415	– 10	OVERALL DIFF PROT PROT
5	CT G105 (CT G205,G305, G405)	1	400 kV	500–250 /1A	PS 5P20	≤1.5 –	>250	– 10	REF NEUTRAL O/C PROT
6	CT U101 (CT U201,U301, U401)	1	400kV	1000–500/ 250/1A	X	≤5.0	>1000	–	OVERALL DIFF PROT
		2			X 5P20	≤5.0 –	>1000	–	PROTECTION
		3				–	–	30	SPARE
		4			X	≤5.0	>1000	–	SPARE
		5			X	≤5.0	>1000	–	BUS BAR PROT
7	CT B101	1	400kV	1000–500/ 250/1A	X 5P20	≤5.0 –	>1000	– 30	SPARE PROT
		2							
8	CT B102	1	400kV	1000–500/ 250/1A	X 0.5	≤5.0 –	>1000 –	– 30	BUS BAR PROT METERING
		2							
9	CT L101 (CT L201)	1	400kV	1000–500 / 1A	X	≤5.0	>1000	–	LINE PROT MAIN 1
		2			X	≤5.0	>1000	–	LINE PROT MAIN 2
		3			0.1/0.2*	–	–	50	SPARE
		4			0.1/0.2*	–	–	50	METERING & SYN
		5			X	≤5.0	>1000	–	OVERCURRENT PROT
		6			X	≤5.0	>1000	–	BUS BAR PROT
10	CT R101 (CT R201)	1	400kV	250/1A	X	≤4.0	>400	–	REACTOR DIFF PROT
		2			X	≤4.0	>400	–	PROTECTION (REF)
		3			5P20	–		30	SPARE
		4			X	≤4.0	–	–	SPARE
11	CT R102 (CT R202)	1	400kV	250/1A	X	≤4.0	>400	–	REACTOR DIFF PROT.
12	CT R103 (CT R203)	1	400kV	250/1A	X	≤4.0	>400	–	PROTECTION (REF)

(* The CT cores for line metering and spare shall have accuracy of 0.1 at 1000/1A and 0.2 at 500/1A tap)

SCHEDULE OF VOLTAGE TRANSFORMERS

SNO.	DESCRIPTION	CORE	NOMINAL VOLTAGE	VT RATIO	CLASS	BURDEN	PURPOSE
1	VT G1.1 (G2.1, G3.1& G4.1)	1	13.8 kV	13.8 kV/√3/110V/√3 /110V/√3	0.5 0.2/3P	30VA 50VA	AVR PROTECTION , GOV. /METERING
2	VT G1.2 (G2.2, G3.2& G4.2)	1	13.8 kV	13.8 kV/√3/110V/√3 /110V/√3	0.5 0.2/3P	30VA 50VA	AVR PROTECTION , GOV. SYNC.
3	VT B 1.1 (VT B1.2,2.1,2.2)	1	400 kV	400 kV/√3/110V/√3 /110V/√3	3P 0.5	50VA EACH	PROTECTION & SYNCHRONIZING
		2					
4	CVT L 1 (CVT L2)	1	400 kV	400 kV/√3/110V/√3 /110V/ 3 /110V/√3	3P 3P 0.2	200 VA EACH	MAIN 1 / MAIN 2 PROT (OPEN DELTA) SYN / METERING
		2					
		3					

NOTE:

1. METERING AND PROTECTION SCHEME OF UNIT 2,3 AND 4 SHALL BE SIMILAR TO THAT OF UNIT 1.
2. METERING AND PROTECTION SCHEME OF FEEDER 2 SHALL BE SIMILAR TO THAT OF FEEDER 1.
3. SHORT TIME CURRENT RATING OF 400 kV BUS BARS SHALL BE 40 kA FOR 1 SEC.
4. GROUPING OF GENERATOR PROTECTIONS IS INDICATIVE ONLY AND MAY CHANGE DURING DETAIL ENGINEERING.

Rev.	Description	Grid Ref.	BY	Approved By:	Date
10	Drawing Updated	–	Amit Juahair		24/07/24
9	Drawing Updated	–	Tapan Singh	AKS/SC	02/08/05
8	Modif. in line CT for Prot. & Spare, Addition of identification code for Relays, CB, Disconnectors, Earthing Switches	–	Tapan Singh	AKS/SC	05/08/04
7	Location of CT U101, U201, U301, U401 400kV CT parameter Unit Aux.Transformer Rating, Earth switch, Reactor CT Detail modified	–	Tapan Singh	AKS/SC	15/07/04
6	Protection Module added, 13.8kV VT Config. Revised	–	Tapan Singh	AKS/SC	04/04/04
5	Knee point voltage and CT resistance for CTs added	–	S.Mathur	AKS/SC	12/12/03
4	Cable Diff Prot removed, Reactor rating & CT details changed	–	S.Mathur	AKS/SC	08/10/03
3	VT G1.1 revised, line & neutral grounding Reactors added	–	S.Mathur	AKS/SC	25/07/03
2			AC	SC	9/10/02

Print Issue Date	27/07/2003		
		DATE	25/07/03
Drawn	AMIT CHAUDHRY	Drawing Checked	A.K.SINHA (V.P.)
Designed	A.K SINHA	Recommended/App.	SURESH CHANDRA (Jt. P.)

Drawing issued for information only unless signed as approved

CLIENT

JAIPRAKASH POWER VENTURES LIMITED

PROJECT

VISHNUPRAYAG HYDROELECTRIC PROJECT (400 MW)

TITLE

SINGLE LINE PROTECTION AND METERING DIAGRAM

JAYPEE VENTURES LIMITED

PLOT 64/4, SITE-IV, INDUSTRIAL AREA, SAHIBABAD – 201 010, U.P.

SCALE : NTS	DRAWING NO: 1100 – 2132 – 0011	REV. 10

Annexure – II

LEGEND

- 11kV withdrawable type V.C.B/SF6 CB
- 415V MCCB with O/L & S/C release
- Withdrawable-Type, 415V Electrically Operated, 3P, ACB
- Fuse Disconnect switch
- Direction overcurrent / Earth fault relay
- Restricted earth fault
- Over Voltage
- Under Voltage Relay
- Data Acquisition And Control System
- Reverse Power Relay
- Ammeter
- Voltmeter
- Powerfactormeter
- Kilowattmeter
- Kilowatthourmeter
- 13.8kV Isolated Phase Bus Duct
- Ammeter Transducer
- Line Trap
- VoltageTransducer
- Kilowatt Transducer
- Frequency Transducer
- Pulse Output
- Ammeter Selector Switch
- Voltmeter Selector Switch
- Potential Transformer
- Curent Transformer
- Lightning Arrester
- Isolator with Earth Switch
- Diesel Generator
- 415V Bus Trunking
- Syn. Arrangement
- Coupling Device
- Line Matching Unit

111.1MVA 13.8kV GEN. (1)

01LKA001TA — 1500/1A PS, 1500/1A 5P10 — 1000 kVA, 13.8/0.415 kV, Dyn11 **UAT-1** [Dry-type]

12LKA001TB

64R — Ratio : 1500/1A; 5VA : 5P10; 15VA : Cl.1; 1500/1A ; PS

Power Monitor with Modbus Connection — kW, AS, A 0–1500 A., VS, V 0–500 V

415/110 V (√3 / √3) — kWh — PT — 27

52–1 — 1500A

UAB–1

Bus PT 415/110V (√3 / √3) — 27

52–7 — 1500A — Ratio : 1500/1A; 5VA : 5P10; 15VA : Cl.1 — AS, A 0–1500 A.

Ref Drg No. 1100–2132–0013

1500A — 52–5 — 1500A

111.1MVA 13.8kV GEN. (2)

002 — 02LKA001TA — 1500/1A PS, 1500/1A 5P10 — 1000 kVA, 13.8/0.415 kV, Dyn11 **UAT-2** [Dry-type]

64R — Ratio : 1500/1A; 5VA : 5P10; 15VA : Cl.1; 1500/1A ; PS

Power Monitor with Modbus Connection — kW, AS, A 0–1500 A., VS, V 0–500 V

415/110 V (√3 / √3) — kWh — PT — 27

52–2 — 1500A

UAB–2

Bus PT 415/110 V (√3 / √3) — 27

52–8 — 1500A — Ratio : 1500/1A; 5VA : 5P10; 15VA : Cl.1 — AS, A 0–1500 A.

Ref Drg No. 1100–2132–0013

415V, 3–Phase 4Wire,2000A,50kA for 1 Sec

111.1MVA 13.8kV GEN. (3)

003 — 03LKA001TA — 1500/1A PS, 1500/1A 5P10 — 1000 kVA, 13.8/0.415 kV, Dyn11 **UAT-3** [Dry-type]

64R — Ratio : 1500/1A; 5VA : 5P10; 15VA : Cl.1; 1500/1A ; PS

Power Monitor with Modbus Connection — kW, AS, A 0–1500 A., VS, V 0–500 V

415/110 V (√3 / √3) — kWh — PT — 27

52–3 — 1500A

UAB–3

Bus PT 415/110 V (√3 / √3) — 27

52–9 — 1500A — Ratio : 1500/1A; 5VA : 5P10; 15VA : Cl.1 — AS, A 0–1500 A.

Ref Drg No. 1100–2132–0013

1500A — 52–6 — 1500A

111.1MVA 13.8kV GEN. (4)

004 — 04LKA001TA — 1500/1A PS, 1500/1A 5P10 — 1000 kVA, 13.8/0.415 kV, Dyn11 **UAT-4** [Dry-type]

64R — Ratio : 1500/1A; 5VA : 5P10; 15VA : Cl.1; 1500/1A ; PS

Power Monitor with Modbus Connection — kW, AS, A 0–1500 A., VS, V 0–500 V

415/110 V (√3 / √3) — kWh — PT — 27

34LKA001TB — 002

52–4 — 1500A

UAB–4

Bus PT 415/110 V (√3 / √3) — 27

52–10 — 1500A — Ratio : 1500/1A; 5VA : 5P10; 15VA : Cl.1 — AS, A 0–1500 A.

Ref Drg No. 1100–2132–0013

415V, 3–Phase 4Wire,2000A,50kA for 1 Sec

20LKA001TB

1500A Isolator 89–1 — Bus PT 415/110 V (√3 / √3) — 27

SSB–A

1500A Isolator 89–2

1500A — 52–11 — 1500A — SSB–B

1500A Isolator 89–3 — Bus PT 415/110 V (√3 / √3) — 27

1500A Isolator 89–4

NOT FOUND IN EQUIPMENT LIST

415V, 3–Phase 4Wire,2000A,50kA for 1 Sec

1500A 52–12 — Ref Drg No. 1100–2132–0014 — 1500A 52–13

40LKA001TB

Bus PT 415/110V (√3 / √3) — VS, V 0–500 V

Butterfly Valve Chamber

415V Aux. Board

(For detail refer Drg. No. 1100–2132–0042)

40LKA001TA — 250kVA 11/0.415kV

152–B2 400A

40LGA001TB — 11000/110 V (√3 / √3) — PT — VS, V 0–15 kV

Ratio : 15/1A; 5VA : 5P10; 15VA : Cl.1 — AS, A 0–15 A.

4 Pole Structure

Isolator with Earth Switch — LA

11KV O.H Line

4 Pole Structure

Isolator with Earth Switch — LA

20LKA001TB

1500/1A ; PS — 415/110 V (√3 / √3) — 27 — Power Monitor with Modbus Connection — VS, V 0–500 V — PT

Ratio : 1500/1A; 15VA : Cl.1 — kW, AS, A 0–1500 A.

64R — 5VA : 5P10

20LKA001TA

51N — 1500/1A PS — 1500/1A 5P10 — 1000 kVA, 11/0.415 kV, Dyn11 **SST-1** [Dry-type]

11KV CABLE

20LKA002TB

001 — 1500/1A ; PS — 415/110 V (√3 / √3) — 27 — Power Monitor with Modbus Connection — VS, V 0–500 V — PT

Ratio : 1500/1A; 15VA : Cl.1 — kW, AS, A 0–1500 A.

64R — 5VA : 5P10

20LKA002TA

51N — 1500/1A PS — 1500/1A 5P10 — 1000 kVA, 11/0.415 kV, Dyn11 **SST-2** [Dry-type]

11KV CABLE

415V Potyard Aux. Board

(For detail refer Drg. No. 1100–2132–0044)

90LKA001TB

Bus PT 415/110V (√3 / √3) — 0–500 V, V, VS

90LKA001TA — 250kVA 11/0.415 kV, Dyn11 Station Transformer for Potyard

PLCC SYSTEM

4 Pole Structure

Isolator with Earth Switch — LA

Marwari

11KV O.H Line — Existing 33kV line to be used

4 Pole Structure

Isolator with Earth Switch — LA

PLCC SYSTEM

11KV O.H Line

50LGA001TB

0–30 A — VS, V 0–15kV — 11/0.11kV (√3 / √3)

30/1A, 30/1A 5P10 Cl.1 — 152–B1 400A

50LKA001TA

500kVA 11/0.415kV Dyn11 Near DG Room

50LKP001GE

320kVA 415V — DG

51N — 32 — 5VA : 5P10 — Power Monitor with Modbus Connection — 0–500A — A, AS, kW, kWh — Ratio–500/1A 15VA, Cl.1

27 — Hz, VS, V 0–500V — PF — 415/110 V (√3 / √3) — 81 — Bus PT 415/110 V (√3 / √3) — 59

630A — 52–B3

50LKP002GE

1/2 LOGIC

DG 320kVA 415V

5VA;5P10 — 32 — 51N — Ratio–500/1A 15VA, Cl.1

415V DG BOARD — 415V, 3 Phase, 4 Wire, 1000A, Al. Bus Bar

630A — 52–B4

IN THE SCOPE OF D.G. SET SUPPLIER

1000A 4 Pole Isolator — 89–B1

DG Room — 50LKA001TB

50LKA002TB

Ratio–800/1A; 5VA : 5P10; 15VA, Cl.1 — Power Monitor with Modbus Connection — 0–800 A. — kW, AS, A — PT — 0–500V — VS, V — 415/110 V (√3 / √3) — 27

800A — 52–B1

415V, 3–Phase 800A,20kA

800A — 52–B2 — Bus PT 415/110 V (√3 / √3)

Barrage Control Room

415V AC Barrage Power Dist. Board

(For detail refer Drg. No. 1100–2132–0043)

90LGA001TB

Ratio : 40/5A; 5VA : 5P10; 15VA : Cl.1 — AS, A 0–15 A.

630A — 152–8

Ratio : 100/5A; 5VA : 5P10; 15VA : Cl.1 — AS, A 0–100 A.

630A — 152–5

(Local synch. for DG sets)

Synch. Check Relay — 27

Bus PT 11000/110 V (√3 / √3)

Ratio : 100/5A; 5VA : 5P10; 15VA : Cl.1 — AS, A 0–100 A.

630A — 152–6

Ratio : 40/5A; 5VA : 5P10; 15VA : Cl.1 — AS, A 0–15 A

630A — 152–9

Ratio : 40/5A; 5VA : 5P10; 15VA : Cl.1 — AS, A 0–30 A.

630A — 152–7

11KV, 3–Phase 3Wire,400A,10kA for 1 Sec

11KV BUS

33KV O.H Line — For Colony Supply

4 Pole Structure — L.A. — Isolator with Earth Switch

400A — 11KV BUS — 400A

Ratio–150/1A; 5VA : 5P10; 15VA, Cl.0.5 — 0–150 A. — AS, kW, kWh — 0–15 KV — V, VS — 27, 59 — PT — 11000/110 V (√3 / √3)

2000kVA 33/11kV

33kV Breaker — 33kV BUS

Exixsting 66/33kV PPCL Sub–station

Marwary Colony (Near Diesel Sets)

11KV O.H Line

4 Pole Structure — Isolator with Earth Switch — LA

Incoming–1

152–1 630A — Power Monitor with Modbus Connection — 0–150 A. — AS, kW, PF, Hz — 0–15 KV — V, VS — kWh — PT — 27 — 11000/110 V (√3 / √3) — Ratio–150/5A; 5VA : 5P10; 15VA, Cl.0.5

152–3 630A — Power Monitor with Modbus Connection — 0–100 A. — AS, kW, PF, Hz — 0–15 KV — V, VS — 81, 59, 27 — kWh — PT — 11000/110 V (√3 / √3) — Ratio–100/5A; 15VA, Cl.0.5 — Ratio–100/5A; 5VA : 5P10 — 5P10, 32

2000 kVA 0.415/11 kV Ynd 11 TRANSFORMER

152–4 630A — Ratio–100/5A; 15VA, Cl.0.5 — Power Monitor with Modbus Connection — kW, PF, AS, A 0–100 A. — Hz — 0–15 KV — V, VS — 27, 59, 81 — PT — kWh — 11000/110 V (√3 / √3) — Ratio–100/5A; 5VA : 5P10 — 5P10, 32

SPARE

152–2 630A — Ratio–150/5A; 5VA : 5P10; 15VA, Cl.0.5 — Power Monitor with Modbus Connection — 0–150 A. — kW, AS, A — 0–15 KV — V, VS — kWh — PT — 11000/110 V (√3 / √3) — 27

R4:– Capacity of UAT,SST DG Set revised to 1000 kVA.

4 Pole Structure — Isolator with Earth Switch — LA

11KV O.H Line

Incoming–2 / Spare

D.G. COMPOSITE CONTROL PANEL

415V, 3 Phase, 4 Wire, 3200A, Al. Bus Bar

52–C3 3200A T.P. ACB

52–C1 1600A T.P. ACB — 52–C2 1600A T.P. ACB

90LKP001GE — DG 1010kVA 415 V D.G. SET–1

1/2 LOGIC

90LKP002GE — DG 1010kVA 415 V D.G. SET–2

IN THE SCOPE OF D.G. SET SUPPLIER

NOTE

1. Synchronising arrangement between DG Sets to be provided
2. Short circuit rating of Circuit Breakers :
   415 V Circuit Breakers – 50 kA, 1 Sec for Power House &
   20 kA, 1 Sec for Barrage Site
   11 kV Circuit Breakers – 10 kA, 1 Sec
3. All the transducers shall have 4–20 mA dual output.Power Monitor will have modbus connection.
4. The energy meters shall have provision of pulse output if facility does not exist in Power Monitor
5. The connection of UATs to respective UABs, SSTs to respective SSBs and interconnection between UABs & SSBs as shown in the SLD shall be through sandwich type LT bus trunking system
6. OFC Cables will be laid on 11kV line from Power House to BFV Chamber & 11kV line from Power House to Barrage Site
7. For details of PLCC System refer Drawing 1100–2163–0001

Rev.	Description	Grid Ref.	By	Approved By:	Date
R8	1010kVA D.G. Scheme Modified, 2MVA Trf. Added		AJ		24/07/24
R7	1010kVA D.G. Scheme Modified, 2MVA Trf. Added		GS/LDP	S. Chandra	22/08/05
R6	Protection of 415V D.G. Set Added		GS/LDP	S. Chandra	12/04/05
R5	11kV CTs ratio & Breaker rating revised		Rohit Gupta	S. Chandra	20/10/04
R4	Capacity of UAT, SST, DG Set revised to 1000kVA		T S / SM	S. Chandra	20/04/04
R3	PT, Power Monitor & equipment marking added		T S / SM	S. Chandra	16/03/04
R2	PLCC Sys & Alstom equipment marking added		S. Maiti	S. Chandra	02/02/04
R1	Ammeter Transducers added & CT rating modified		S. Maiti	S. Chandra	20/11/03

Z:\Vishnuprayag\Schematic\ACAD\1100–2132–0025_R6.dwg

DATE	16/09/03	Drawing Checked	A. K. Sinha Vice Pres.
Designed	S. MAITI Design Engr.	Recommended/App.	S. CHANDRA Joint Pres.

Drawing issued for information only unless signed as approved

CLIENT

JAIPRAKASH POWER VENTURES LIMITED

PROJECT: VISHNUPRAYAG HYDROELECTRIC PROJECT (400 MW)

TITLE: 11kV/415V AC POWER DISTRIBUTION SYSTEM – SINGLE LINE DIAGRAM

JAYPEE VENTURES LIMITED

PLOT 64/4, SITE–IV, INDUSTRIAL AREA, SAHIBABAD – 201 010, U.P.

SCALE NTS | DRAWING NO: 1100–2132–0025 | REV. R8

Annexure-III (DC System)

REFERENCE DRAWINGS

	TITLE	DRG. NO.
1.	SINGLE LINE DIAGRAM FOR BATTERY & CHARGER FOR 220 V DC SYSTEM	1100-2147-0002
2.	UPS DISTRIBUTION BOARD	1100-2147-0005

NOTES :-

1. CONNECTION FOR SDB-2A, FOR UNIT 2 IS SIMILAR TO SDB-1A. SIMILARLY, CONNECTION FOR SDB-2B, FOR UNIT 2 IS SIMILAR TO SDB-1B.
2. CONNECTION FOR SDB-4A, FOR UNIT 4 IS SIMILAR TO SDB-3A. SIMILARLY, CONNECTION FOR SDB-3B, FOR UNIT 4 IS SIMILAR TO SDB-3B.
3. DCDB-I & DCDB-II ARE PROTECTED WITH D.C. UNDERVOLTAGE, OVERTAGE RELAY AND EARTH FAULT RELAYS.
4. ALL THE MCCBs ARE PROVIDED WITH POTENTIAL FREE CONTACTS FOR 'ON' AND 'TRIP' STATES. SIMILARLY, ALL THE MCBs ARE PROVIDED WITH POTENTIAL FREE CONTACT FOR 'ON' STATE.

Rev.	Description	Grid Ref.	BY	Approved By:	Date
R7	MCCB ratings updated		Amit Jauhari	Suresh Chandra	13/09/05
R6	Revised as per present details		Amit Jauhari	Suresh Chandra	05/02/05
R5	MCBs changed to MCCBs		Gopal Sharma	Suresh Chandra	30/10/04
R4	100 A MCBs changed to 100 A MCCBs		Amit Jauhari	Suresh Chandra	10/09/04
R3	LTBoard supply from DCDB-II included		Amit Jauhari	Suresh Chandra	12/05/04
R2	SDB-5 A&B, DC HP pump supply modified.		Amit Jauhari	Suresh Chandra	16/03/04
R1	Feeders revised,equipment codes by Alstom added		S. Maiti	S. Chandra	30/01/04

D:\AMIT\Acad-2\VISHNU\DC SYSTEM\1100-2147-0004_R0

DATE	13/10/2003	Drawing Checked	AK Sinha V.P.
Designed	Amit Jauhari Sr. Engr.	Recommended/App.	S. CHANDRA Jt. President

Drawing Issued for Information only unless signed as approved

CLIENT

JAIPRAKASH POWER VENTURES LIMITED

PROJECT

VISHNUPRAYAG HYDROELECTRIC PROJECT (400 MW)

TITLE

DC SYSTEM – SINGLE LINE DIAGRAM

JAYPEE VENTURES LIMITED

PLOT 64/4, SITE-IV, INDUSTRIAL AREA, SAHIBABAD – 201 010, U.P.

SCALE N.T.S. | DRAWING NO: 1100-2147-0004 | REV. R7

COMMUNICATION CONNECTIVITY DIAGRAM
Refurbishment of Main Protection Relays at 400MW
Vishnuprayag Hydroelectric project

Annexure-IV

CONTROL ROOM

Central Monitoring and Parameterization

TO Plant Automation System

LAPTOP

Protocol : OPC-DA / IEC61850

Mounted in Wall Mounting Network Panel- Portyard

-KD1 (AA1KD1) GPS Receiver — SYNC — GPS Receiver

-P1 Event Printer

-P2 Hard Copy Printer

-KC1 (AA1KC1) Printer Server 18 — Printer Server 172.16.0.162 — TCP/IP — // 1 — // 2

-KA1 (AA1KA1) Monitoring and Parameterization 001
SYS500 / HMI / MMC 500
172.16.0.158 — 61850 — 172.16.0.173 — 61850 — 172.16.0.161 — 61850

11kV SWITCHGEAR

Mounted in Wall Mounting Network Panel- Portyard

LIU-1

1000 Mtr

-TJ4 (AA1TJ4) Mounted in Wall Mounting Network Panel- Portyard
ORing Backup / 38
Portyard Bay Ethernet Switch
172.16.201.0 — SNMP

Port Details	Used Ports	Spare Ports
16FX+4TX	12FX+1TX	4FX+3TX

PORTYARD

11KV GRID INCOMER-1
-K2Q01FN1 (AA1K2Q01FN1)
REF615 21 — Distance Protection Relay M1 — 172.16.201.3 — IEC61850

11KV BFV FEEDER
-K2Q02FN1 (AA1K2Q02FN1)
REF615 22 — Distnce Protection Relay M2 — 172.16.201.4 — IEC61850

11KV SST-01
-K2Q03FN1 (AA1K2Q03FN1)
REF615 23 — Distnce Protection Relay M2 — 172.16.201.5 — IEC61850

11KV DG-1 INCOMER
-K2Q04FN1 (AA1K2Q04FN1)
REF615 24 — Distnce Protection Relay M2 — 172.16.201.6 — IEC61850

11KV BUS PT
-K2Q05FN1 (AA1K2Q05FN1)
REF615 16 — Distnce Protection Relay M2 — 172.16.201.7 — IEC61850

11KV DG2 INCOMER
-K2Q06FN1 (AA1K2Q06FN1)
REF615 26 — Distnce Protection Relay M2 — 172.16.201.8 — IEC61850

Port Details	Used Ports	Spare Ports
9FX	6FX	9FX

PORTYARD

11KV SST-02
-K2Q07FN1 (AA1K2Q07FN1)
REF615 30 — IEC61850 — 172.16.201.9 — Distnce Protection Relay M2

11KV POTYARD
-K2Q08FN1 (AA1K2Q08FN1)
REF615 29 — IEC61850 — 172.16.201.10 — Distnce Protection Relay M2

11KV BARRAGE
-K2Q09FN1 (AA1K2Q09FN1)
REF615 28 — IEC61850 — 172.16.201.11 — Distnce Protection Relay M2

11KV INCOMER-2
-K2Q10FN1 (AA1K2Q10FN1)
REF615 27 — IEC61850 — 172.16.201.12 — Distnce Protection Relay M2

MECHINE HALL

1000 Mtr

Port Details	Used Ports	Spare Ports
16FX	8FX	8FX

LIU-4 Mounted in Unit-2 Panel

-TJ2 (AA1TJ2) Mounted in Unit-2 Panel
ORing Root / 1
UNIT-2 Bay Ethernet Switch-2
172.16.2.100 — SNMP

100 Mtr

Port Details	Used Ports	Spare Ports
16FX	8FX	8FX

LIU-7 Mounted in Unit-4 Panel

-TJ3 (AA1TJ3) Mounted in Unit-4 Panel
ORing Root / 6
UNIT-4 Bay Ethernet Switch-3
172.16.3.100 — SNMP

LIU-3 Mounted in Unit-2 Panel — 50 Mtr — 50 Mtr — **LIU-2** Mounted in Unit-1 Panel

LIU-6 Mounted in Unit-4 Panel — 50 Mtr — 50 Mtr — **LIU-5** Mounted in Unit-3 Panel

UNIT-2
-K1Q02FN1 (AA1K1Q02FN1) REG670 3 — Generator Protection Relay M1 — 172.16.2.3 — IEC61850
-K1Q02FN3 (AA1K1Q02FN3) 7UM6215 4 — Stator Protection Relay — 172.16.2.4 — IEC61850
-K1Q02FN2 (AA1K1Q02FN2) REG670 5 — Generator Protection Relay M2 — 172.16.2.5 — IEC61850

UNIT-1
-K1Q01FN1 (AA1K1Q01FN1) REG670 — IEC61850 — 172.16.2.0 — Generator Protection Relay M1
-K1Q01FN3 (AA1K1Q01FN3) 7UM6215 — IEC61850 — 172.16.2.1 — Stator Protection Relay
-K1Q01FN2 (AA1K1Q01FN2) REG670 — IEC61850 — 172.16.2.2 — Generator Protection Relay M2

UNIT-4
-K1Q04FN1 (AA1K1Q04FN1) REG670 8 — Generator Protection Relay M1 — 172.16.3.3 — IEC61850
-K1Q04FN3 (AA1K1Q04FN3) 7UM6215 9 — Stator Protection Relay — 172.16.3.4 — IEC61850
-K1Q04FN2 (AA1K1Q04FN2) REG670 7 — Generator Protection Relay M2 — 172.16.3.5 — IEC61850

UNIT-3
-K1Q03FN1 (AA1K1Q03FN1) REG670 — IEC61850 — 172.16.3.0 — Generator Protection Relay M1
-K1Q03FN3 (AA1K1Q03FN3) 7UM6215 — IEC61850 — 172.16.3.1 — Stator Protection Relay
-K1Q03FN2 (AA1K1Q03FN2) REG670 — IEC61850 — 172.16.3.2 — Generator Protection Relay M2

11kV SWITCHGEAR

50 Mtr

Mounted in Wall Mounting Network Panel-Back Feed

LIU-8

-TJ5 (AA1TJ5) Mounted in Wall Mounting Network Panel- Back Feed
ORing 31
Switch
172.16.6.100 — SNMP

Port Details	Used Ports	Spare Ports
9FX	7FX	2FX

11kV BACKFEED PANEL

UNIT-1 INCOMER
-K2Q11FN1 (AA1K2Q11FN1) REF615 34 — Distnce Protection Relay M2 — 172.16.6.3 — IEC61850

UNIT-2 INCOMER
-K2Q12FN1 (AA1K2Q12FN1) REF615 33 — Distnce Protection Relay M2 — 172.16.6.4 — IEC61850

UNIT-3 INCOMER
-K2Q13FN1 (AA1K2Q13FN1) REF615 16 — Distnce Protection Relay M2 — 172.16.6.5 — IEC61850

OUTGOING FEEDER TO POTYARD
-K2Q14FN1 (AA1K2Q14FN1) REF615 36 — Distnce Protection Relay M2 — 172.16.6.6 — IEC61850

UNIT-4 INCOMER
-K2Q15FN1 (AA1K2Q15FN1) REF615 37 — Distnce Protection Relay M2 — 172.16.6.7 — IEC61850

CONTROL ROOM

120 Mtr

Port Details	Used Ports	Spare Ports
12FX+8TX	10FX+6TX	2FX+2TX

LIU-9 Mounted in RLB Line-1 Panel

-TJ1 (AA1TJ1) ORing Root / 2
CR Bay Ethernet Switch
Mounted in RLB Line-1 Panel
172.16.1.100 — SNMP

400 kV Busbar
RBB
-C1QBB1FN1 (AA1C1QBB1FN1) REB670 10 — Bus bar Protection Protection Relay — 172.16.1.3 — IEC61850

400 kV Bus coupler
KBC
-C1Q03FN1 (AA1C1Q03FN1) REF615 11 — Bus coupler Protection Relay — 172.16.1.4 — IEC61850

400 kV Line-1
RLA
-C1Q01FN1 (AA1C1Q01FN1) REL670 12 — Distance Protection Relay M1 — 172.16.1.5 — IEC61850
-C1Q01FN2 (AA1C1Q01FN2) 7SA522 13 — Distnce Protection Relay M2 — 172.16.1.6 — IEC61850
-C1Q01FN4 (AA1C1Q01FN4) EM 19 — Energy Meter — 172.16.1.11 — IEC61850

400 kV Line-1 REACTOR
RLB
-C1Q01FN3 (AA1C1Q01FN3) RET670 14 — Reactor Protection Relay 87R — 172.16.1.7 — IEC61850

400 kV Line-2
RLA
-C1Q02FN1 (AA1C1Q02FN1) REL670 17 — IEC61850 — 172.16.1.11 — Distance Protection Relay M1
-C1Q02FN2 (AA1C1Q02FN2) 7SA522 16 — IEC61850 — 172.16.1.9 — Distnce Protection Relay M2
-C1Q02FN4 (AA1C1Q02FN4) EM 20 — IEC61850 — 172.16.1.12 — Energy Meter

400 kV Line-2 REACTOR
RLB
-C1Q02FN3 (AA1C1Q02FN3) RET670 15 — IEC61850 — 172.16.1.8 — Reactor Protection Relay 87R

LEGEND :

- ARMOURED FO CABLE
- DUPLEX FO PTCH CABLE
- LAN CABLE CAT-6

FX – MULTI MODE FIBER OPTIC PORT
TX – COPPER PORT (RJ45)
LIU – MULTI MODE LIGHT INTERFACE UNIT

Based on: SALE ORDER No:310013745		Title	VISHNUPRAYAG HYDROELECTRIC PROJECT (400 MW) COMMINICATION CONNECTIVITY DIAGRAM
Prepared: SMB			
Approved: PSK			
Project Vishnuprayag Hydroelectric project Jaiprakash Power Ventures Limited	Doc. des.: COMMUNICATION CONNECTIVITY DIAGRAM	Ref. des.:	
	Resp. dept.: PG-GAS	Rev. ind.: 02	Lang.: English:
HITACHI	Doc. No.: 1MNS801835-ZSA		Sheet: 01
			No. of sh.: 01

Rev | Rev

SHUT DOWN LOG (June 2023 - June 2024)						Annexure-V
Sl. No.	Unit/ Feeder	Date / Time		Duration during month	Type of Fault	Purpose / Reason
		From	To	(Hrs : Mts)		
1	400 kV VP – MZN Line	30.06.2023 02:28	30.06.2023 04:11	01 Hrs 43 Mts	Transmission line fault	400 kV VP-MZN line CB at VP end was tripped at 02:28 Hrs on 30.06.2023 on receipt of Direct trip command from MZN end. After receiving line charging codes, 400 kV VP-MZN line was charged from MZN end at 04:10 Hrs and CB at VP end was closed at 04:11 Hrs on 30.06.2023 respectively. (400 kV VP-ALK Line remained in service)
2	400 kV VP – MZN Line	05.07.2023 12:38	05.07.2023 15:07	02 Hrs 29 Mts	Transmission line fault	400 kV VP-MZN Line tripped on R-Y Fault (Dist. 92.0 km), from both ends at 1238 Hrs on 05.07.2023. 400 kV VP-MZN Line was charged from MZN end at 1506 Hrs and CB at VP end was tried to close at 1507 Hrs, but again tripped on Y-N Fault (Dist. 97.81 km) on 05.07.2023. 400 kV VP - MZN line shutdown availed by UPPTCL from 0905 Hrs on 06.07.2023. After attending the fault 400 kV VP-MZN Line was charged from MZN end at 15:12 Hrs and at VP end CB was Closed at 15:13 Hrs on 12.07.2023. (400 kV VP-ALK Line remained in service)
	400 kV VP – MZN Line	05.07.2023 15:07	12.07.2023 15:13	168 Hrs 06 Mts	Transmission line fault	
3	Unit - 2	14.07.2023 17:16	14.07.2023 21:48	04 Hrs 32 Mts	Governor	Unit-2 Tripped on Quick shutdown (QSD) due to Governor oil level too low at 17:16 Hrs on 14.07.2023. After attending the fault Unit-2 Synchronized with grid at 21:48 Hrs on 14.07.2023.
4	400 kV VP – ALK Line	04.08.2023 03:09	04.08.2023 04:42	01 Hrs 33 Mts	Transmission line fault	400 kV ALK-MZN line tripped, simultaneously CB of 400 kV VP - MZN line at VP end also tripped. As power evacuation system was not available; running unit 1, 2, 3 & 4 also tripped at 03:09 hrs on 04.08.2023. 400 kV VP – ALK line was charged at 04:42 hrs with restoration of 400kV ALK – MZN line. After receiving line charging codes VP-MZN line CB at VP end was closed at 05:03 hrs on 04.08.2023. Unit 1, 2, 3 & 4 were synchronized with grid at 05:54 hrs, 05:48 hrs, 05:22
	400 kV VP – MZN Line	04.08.2023 03:09	04.08.2023 05:03	01 Hrs 54 Mts	Transmission line fault	
	Unit - 1	04.08.2023 03:09	04.08.2023 05:54	02 Hrs 45 Mts	Transmission line fault	
	Unit - 2	04.08.2023 03:09	04.08.2023 05:48	02 Hrs 39 Mts	Transmission line fault	

	Unit - 3	04.08.2023 03:09	04.08.2023 05:22	02 Hrs 13 Mts	Transmission line fault	hrs & 05:40 hrs respectively.
	Unit - 4	04.08.2023 03:09	04.08.2023 05:40	02 Hrs 31 Mts	Transmission line fault	
5	400 kV VP – MZN Line	10.08.2023 03:50	10.08.2023 05:23	01 Hrs 33 Mts	Transmission line fault	400 kV VP - MZN line CB at VP End tripped on over current at 03:50 Hrs on 10.08.2023, due to tripping of 400 kV ALK - MZN line and excess power flow, resulting in tripping of running units 1, 2, 3 & 4 at 03:50 Hrs After receiving line charging codes, 400 kV VP-MZN line CB closed at VP end at 05:23 hrs on 10.08.2023. Units 1, 2, 3 & 4 were synchronized with grid at 06:06 hrs, 05:52 hrs, 05:40 hrs & 05:48 hrs respectively on 10.08.2023. After receiving opening codes, 400 kV VP-ALK Line was opened at 05:28 Hrs and on receipt of charging codes, 400 kV VP-ALK Line was charged from ALK End at 06:22 Hrs & CB at VP End was closed at 06:23 Hrs on 10.08.2023
	400 kV VP – ALK Line	10.08.2023 05:28	10.08.2023 06:23	00 Hrs 55 Mts	Transmission line fault	
	Unit - 1	10.08.2023 03:50	10.08.2023 06:06	02 Hrs 16 Mts	Transmission line fault	
	Unit - 2	10.08.2023 03:50	10.08.2023 05:52	02 Hrs 02 Mts	Transmission line fault	
	Unit - 3	10.08.2023 03:50	10.08.2023 05:40	01 Hrs 50 Mts	Transmission line fault	
	Unit - 4	10.08.2023 03:50	10.08.2023 05:48	01 Hrs 58 Mts	Transmission line fault	
6	400 kV VP – ALK Line	18.08.2023 16:37	19.08.2023 15:15	22 Hrs 38 Mts	Transmission line fault	400 kV VP-ALK Line tripped on Y-B Fault (Dist. 56.60 km) at 1637 Hrs on 18.08.2023, resulting in tripping of all running Units 1, 2, 3 & 4 at 1637 Hrs, due to non-availability of Power Evacuation. After Charging 400 kV VP-MZN Line at 1748 Hrs, Units 1, 2, 3 & 4 were synchronised with grid at 1820 Hrs,1804 Hrs, 1808 Hrs & 1753 Hrs respectively on 18.08.2023. also after receiving line charging codes of 400 kV VP - ALK line, 400 kV VP-ALK line was charged from ALK end at 15:14 hrs and CB of VP end was closed at 15:15 hrs on 19.08.2023. 400 kV VP-MZN Line Shutdown was availed by UPPTCL from 1612 Hrs to 1748 Hrs on 18.08.2023.
	Unit - 1	18.08.2023 16:37	18.08.2023 18:20	01 Hrs 43 Mts	Transmission line fault	
	Unit - 2	18.08.2023 16:37	18.08.2023 18:04	01 Hrs 27 Mts	Transmission line fault	
	Unit - 3	18.08.2023 16:37	18.08.2023 18:08	01 Hrs 31 Mts	Transmission line fault	
	Unit - 4	18.08.2023 16:37	18.08.2023 17:53	01 Hrs 16 Mts	Transmission line fault	
7	Unit - 3	20.08.2023 23:09	21.08.2023 00:45	01 Hrs 36 Mts	Governor	Unit – 3 tripped (QSD) due to TSLG major fault at 23:09 hrs on 20.09.2023. After attending the fault Unit - 3 was synchronized with grid at 00:45 hrs on 21.08.2023.
8	400 kV VP – MZN Line	22.08.2023 07:15	22.08.2023 07:53	00 Hrs 38 Mts	Transmission line fault	400 kV VP - MZN line CB at VP End tripped on Y-N fault and auto-reclosed at 07:15 Hrs at VP end but CB did not clos at MZN end on 22.08.2023,after receiving charging code 400 kV VP - MZN line CB at MZN end closed at 07:53 at MZN end.on 22.08.2023.

9	400 kV VP – MZN Line	22.08.2023 18:35	22.08.2023 19:05	00 Hrs 30 Mts	Transmission line fault	400kV VP-MZN line tripped at VP end on receipt of direct trip command from MZN end at 18:35 hrs on 22.08.2023. After receiving line charging codes, CB of VP-MZN line was closed at VP end at 19:05 hrs on 22.08.2023.
10	400 kV VP – MZN Line	23.08.2023 09:31	23.08.2023 10:40	01 Hrs 09 Mts	Transmission line fault	400 kV VP- MZN line CB tripped at VP end on receipt of Direct Trip Commond (DTR) at 09:59 Hrs on 23.08.2023. After receiving line charging codes, 400 kV VP - MZN line CB at VP end closed at 10:40 Hrs on 23.08.2023.
11	Unit - 1	15.03.2024 02:49	15.03.2024 05:29 (U#4)	02 Hrs 40 Mts	Transmission line fault	400 kV VP-MZN and 400 KV VP- ALK Lines tripped due to bus bar protection operated at 0249 Hrs resulting in tripping of running Units 1 & 3 on 15.03.2024. 400 KV VP -ALK Line was restored at 0519 Hrs & Plant Generation resumed at 0529 Hrs on 15.03.2024. Shutdown of 400 kV VP-MZN Line is availed by VPHEP, as foul smell was observed in the B phase compartment of Circuit Breaker, from 1238 Hrs on 15.03.2024 for inspection and attending the fault. A foul smell was observed in the B- phase compartment of Circuit Breaker at VPHEP end. After replacement of B – phase pole of circuit breaker 400 kV VP-MZN line
	Unit - 3	15.03.2024 02:49	15.03.2024 05:29 (U#4)	02 Hrs 40 Mts	Transmission line fault	
	400 kV VP – MZN Line	15.03.2024 02:49	19.03.2024 19:14	112 Hrs 25 Mts	Transmission line fault	
	400 kV VP – MZN Line	15.03.2024 02:49	15.03.2024 05:19	02 Hrs 30 Mts	Transmission line fault	
12	400 kV VP - MZN Line	29.04.2024 22:59	30.04.2024 00:46	01 Hrs 47 Mts	Transmission line fault	400 kV VP-MZN line tripped and Auto Reclosed at VP end but tripped at MZN end at 22:59 Hrs on 29-04-2024. After receiving S/D codes for 400 kV VP-MZN line, C.B was opened at VP end at 00:11 Hrs on 30.04.2024. 400 kV ALK-MZN line tripped as Bus Bar protection operated at MZN end at 00:16 Hrs on 30-04-2024. but C.B did not opened at VP end, resulting in tripping of running Unit-2 (QSD) due to non-availability of power evacuation system. 400 kV VP-MZN line was charged from MZN end at 00:45 Hrs and C.B at V.P end was closed at 00:46 Hrs on 30-04-2024. Unit-02 was synchronised with grid at 00:48 Hrs.
13	Unit - 2	30.04.2024 00:16	30.04.2024 00:48	00 Hrs 32 Mts	Transmission line fault	400 kV VP-MZN line tripped and Auto Reclosed at VP end but tripped at MZN end at 22:59 Hrs on 29-04-2024. After receiving S/D codes for 400 kV VP-MZN line, C.B was opened at VP end at 00:11 Hrs on 30.04.2024. 400 kV ALK-MZN line tripped as Bus Bar protection operated at MZN end at 00:16 Hrs on 30-04-2024. but C.B did not opened at VP end, resulting in tripping of running Unit-2 (QSD) due to non-availability of power evacuation system. 400 kV VP-MZN line was charged from MZN end at 00:45 Hrs and C.B at V.P end was closed at 00:46 Hrs on 30-04-2024. Unit-02 was synchronised with grid at 00:48 Hrs.

14	400 kV VP - MZN Line	02.05.2024 01:54	02.05.2024 20:02	18 Hrs 08 Mts	Transmission line fault	400 kV VP - MZN Line tripped on R→N fault (Dist-213.84 km) at 01:54 Hrs on 02.05.2024. After receiving charging codes 400 kV VP - MZN Line charged from MZN end at 20:01 Hrs and CB at VP end closed at 20:02 Hrs on 02.05.2024. (400 kV VP - ALK Line remained in service)
15	400 kV VP - MZN Line	04.05.2024 19:12	05.05.2024 11:28	16 Hrs 16 Mts	Transmission line fault	400 kV VP - MZN Line tripped on Y→B fault (Dist-39.71 km) at 19:12 Hrs on 04.05.2024. 400 KV VP-MZN Line was under shut down from 20:34 Hrs on 04.05.2024(Shut down availed by UPPTCL). 400KV VP-MZN Line was charged from MZN end at 11:27 Hrs. and CB at VP end was closed at 11:28 Hrs on 5.05.2024. (400 kV VP - ALK Line remained in service)
16	Unit-3	09.05.2024 16:44	09.05.2024 17:54	01 Hrs 10 Mts	Breakdown	Unit- 03 tripped (QSD) at 16:44 Hrs on 09.05.2024 due to TSLG Major Fault (Governor). After attending Fault Unit-03 Synchronized with Grid at 17:54 Hrs
17	400 kV VP - MZN Line	31.05.2024 16:03	31.05.2024 16:03	00 Hrs 00 Mts	Breakdown	400 kV VP-MZN line tripped and Auto Reclosed at 16:03 Hrs on 31.05.2024.
18	400 kV VP - MZN Line	01.06.2024 18:13	01.06.2024 19:03	00 Hrs 50 Mts	Breakdown	400 kV VP - MZN Line tripped on Y→N fault (Dist-160.90km) at 18:13 Hrs on 01.06.2024. After receiving charging codes 400 kV VP - MZN Line charged from MZN end at 19:03 Hrs and CB at VP end closed at 19:03 Hrs on 01.06.2024. (400 kV VP - ALK Line remained in service)
19	400 kV VP - MZN Line	05.06.2024 14:40	05.06.2024 20:02	05 Hrs 22 Mts	Breakdown	400 kV VP - MZN Line tripped on Y→B fault (Dist-93.21 km) at 14:40 Hrs on 05.06.2024. After receiving codes 400 kV VP - MZN Line charged from MZN end at 20:01 Hrs and CB at VP end closed at 20:02 Hrs on 05.06.2024. (400 kV VP - ALK Line remained in service)

Legends	
	For Transmission Lines
	For 1, 2, 3, 4 Units

Annexure-VI

ग्रिड-इंडिया GRID-INDIA

ग्रिड कंट्रोलर ऑफ इंडिया लिमिटेड
(भारत सरकार का उद्यम)
GRID CONTROLLER OF INDIA LIMITED
(A Government of India Enterprise)
[formerly Power System Operation Corporation Limited (POSOCO)]
राष्ट्रीय भार प्रेषण केन्द्र / National Load Despatch Centre

आज़ादी का अमृत महोत्सव

कार्यालय : बी-9, प्रथम एवं द्वितीय तल, कुतुब इंस्टीट्यूशनल एरिया, कटवारिया सराय, नई दिल्ली - 110016
Office : 1st and 2nd Floor, B-9, Qutab Institutional Area, Katwaria Sarai, New Delhi -110016
CIN : U40105DL2009GOI188682, Website : www.grid-india.in, E-mail : gridindiacc@grid-india.in, Tel.: 011- 42785855

संदर्भ: Grid-India/NLDC/2024/August/

दिनाँक: 21.08.2024

सेवा मे,

[1] Member Secretary, Northern Regional Power Committee,18-A, Qutab Institutional Area, Shaheed Jeet Singh Marg, Katwaria Sarai, New Delhi-110 016
[2] Member Secretary, Eastern Regional Power Committee, 14 Golf Club Road, Tollygunje, Kolkata-700033

महोदय/महोदया,

विषय/Subject: 220 केवी और उससे अधिक वोल्टेज वर्ग की अंतर-क्षेत्रीय लाइनों की ट्रिपिंग में सुरक्षा मानक के उल्लंघन की अधिसूचना

Notifying violation of protection standard in case of tripping of the Inter-Regional lines of voltage class 220 kV and above

220 केवी और उससे अधिक वोल्टेज वर्ग की अंतर क्षेत्रीय लाइनों की ट्रिपिंग के मामले में, केंद्रीय विद्युत प्राधिकरण, 2010 के ग्रिड मानक नियमन की धारा 3.ई के अनुसार फ़ाल्ट निम्नलिखित समय सीमा मे निर्बाधित किया जाना है:

This has reference to violation of protection standard in case of tripping of Inter Regional Lines of voltage class 220 kV and above. As per section 3.e of Grid Standards Regulation of CEA, 2010, fault is to be cleared within the following time:

क्र.स./ Sl. No.	मामूली प्रणाली वोल्टेज (केवी आरएमएस)/ Nominal System Voltage in kV rms	फ़ाल्ट निर्बाधन का अधिकतम समय (मिली सेकंड)/ Maximum time of fault clearing in msec
1	400	100
2	220	160

जुलाई 2024 माह के दौरान 220 केवी और उससे अधिक वोल्टेज वर्ग की अंतर-क्षेत्रीय लाइनों की ट्रिपिंग की सूची संलग्न है, जिनमें उल्लंघन पाए गए हैं। यह देखा गया है कि इन घटनाओं के दौरान निर्दिष्ट समय के भीतर फ़ाल्ट को निर्बाधित नहीं किया गया था। चूंकि, ये घटनाएं चिंता का विषय हैं, यह अनुरोध किया जाता है कि उल्लिखित लाइनों/सबस्टेशनों के संबंधित स्वामियों को उपयुक्त कार्रवाई करने की सलाह दी जाए।

The list of tripping of Inter Regional Lines of voltage class 220 kV and above, during the month of **July 2024** in which violations have been observed is enclosed. It has been observed that fault had not cleared within specified time during these incidents. Since, these events are matter of concern, it is requested that the corresponding owners of mentioned lines/substations may be advised to take suitable actions.

सधन्यवाद,

भवदीय,

(मानस रंजन चंद)
उप महाप्रबंधक, रा.भा.प्रे.कें.

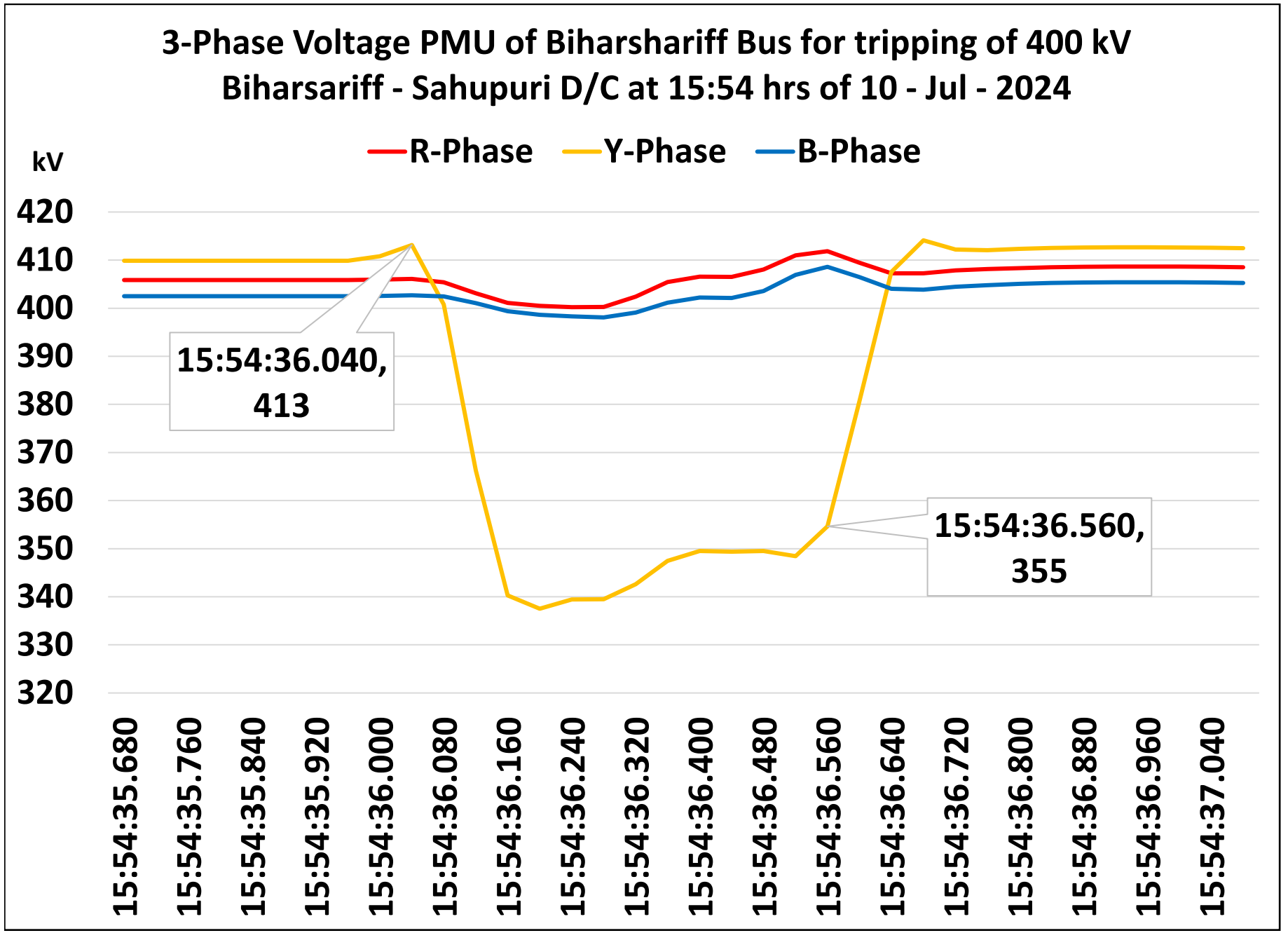
प्रतिलिपि सूचनार्थ :

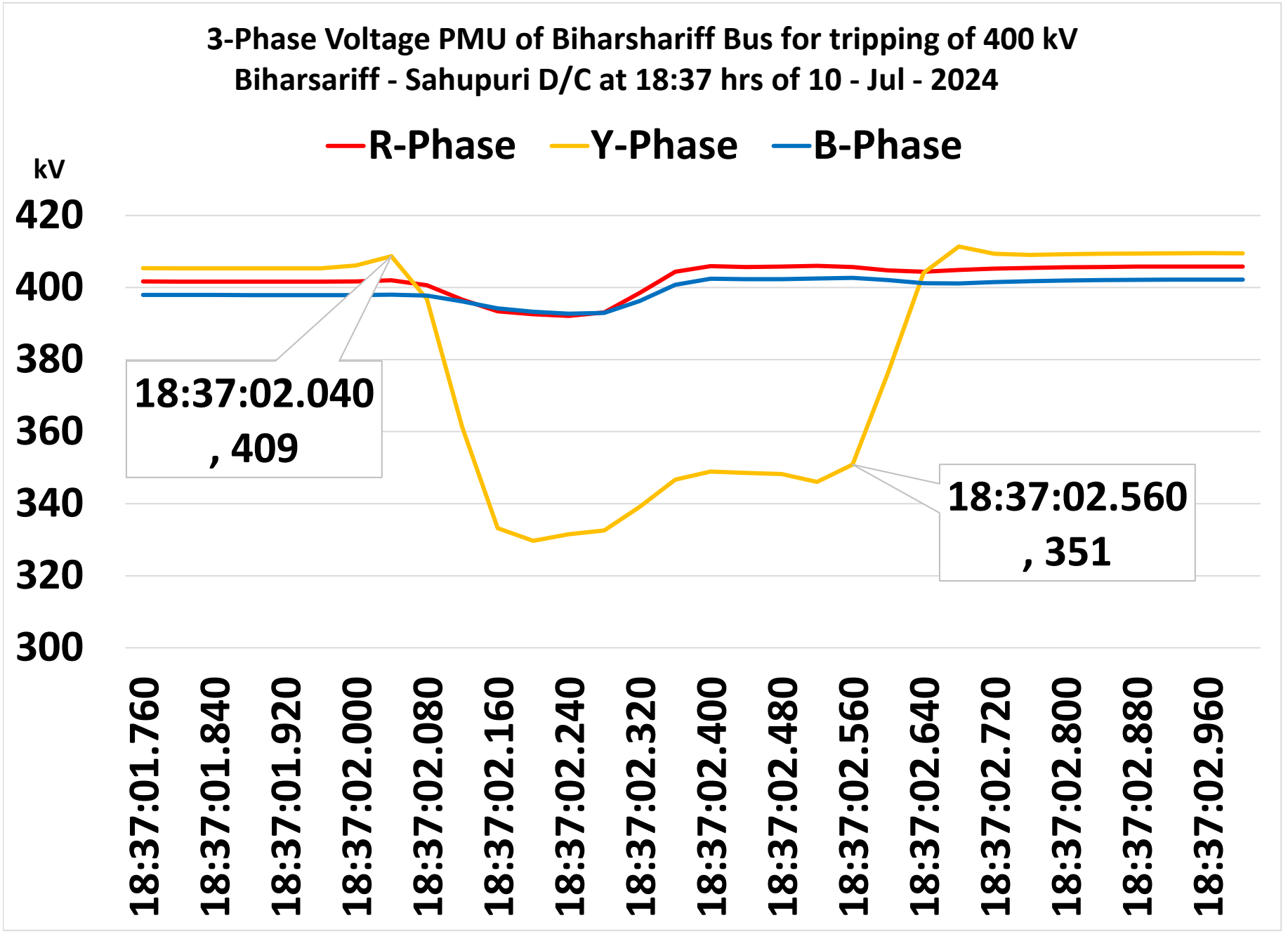
1. कार्यपालक निदेशक, ऊतरी क्षेत्रीय भार प्रेषण केंद्र / पूर्वी क्षेत्रीय भार प्रेषण केंद्र

Violation of Standards in case of tripping of Inter-Regional lines for July 2024

S.No.	Name of Transmission Line	Regions Involved	Tripping Date and Time	Brief Reason/ Relay Indication	Restoration Date and Time	Fault Clearing Time (in msec as per nearest PMU)
1	400 kV Biharsariff - Sahupuri I	ER/NR	10-Jul-2024 15:54	Y-N Phase	10-Jul-2024 17:53	520
2	400 kV Biharsariff - Sahupuri II	ER/NR	10-Jul-2024 15:54	Y-N Phase	10-Jul-2024 17:54	520
3	400 kV Biharsariff - Sahupuri I	ER/NR	10-Jul-2024 18:37	Y-N Phase	10-Jul-2024 23:03	520
4	400 kV Biharsariff - Sahupuri II	ER/NR	10-Jul-2024 18:37	Y-N Phase	10-Jul-2024 23:02	520

Note: Fault clearing time calculated as per nearest PMU voltage


3-Phase Voltage PMU of Biharshariff Bus for tripping of 400 kV Biharsariff - Sahupuri D/C at 15:54 hrs of 10 - Jul - 2024
R-Phase
Y-Phase
B-Phase
kV
420
410
400
390
380
370
360
350
340
330
320
15:54:36.040, 413
15:54:36.560, 355
15:54:35.680
15:54:35.760
15:54:35.840
15:54:35.920
15:54:36.000
15:54:36.080
15:54:36.160
15:54:36.240
15:54:36.320
15:54:36.400
15:54:36.480
15:54:36.560
15:54:36.640
15:54:36.720
15:54:36.800
15:54:36.880
15:54:36.960
15:54:37.040


3-Phase Voltage PMU of Biharshariff Bus for tripping of 400 kV
Biharsariff - Sahupuri D/C at 18:37 hrs of 10 - Jul - 2024
R-Phase
Y-Phase
B-Phase
kV
420
400
380
360
340
320
300
18:37:02.040
, 409
18:37:02.560
, 351
18:37:01.760
18:37:01.840
18:37:01.920
18:37:02.000
18:37:02.080
18:37:02.160
18:37:02.240
18:37:02.320
18:37:02.400
18:37:02.480
18:37:02.560
18:37:02.640
18:37:02.720
18:37:02.800
18:37:02.880
18:37:02.960

Annexure-VII

RAJASTHAN RAJYA VIDYUT PRASARAN NIGAM LIMITED
[Corporate Identity Number (CIN): U40109RJ2000SGC016485]
Regd. Office: Vidyut Bhawan, Janpath, Jyoti Nagar, Jaipur-302005

RVPN
An ISO 9001:2015 Certified Company

OFFICE OF THE CHIEF ENGINEER (LD)
New Prasaran Bhawan, TCC Building, Heerapura, Jaipur Tel. No. 0141-2948293
E-mail: ce.ld@rvpn.co.in website: www.http://energy.rajasthan.gov.in/rvpnl

No. RVPN/ CE (LD)/SE(SOLD)/XEN-III/ F. / D. 138 Jaipur, D.12/08/24

The Member Secretary
NRPC, New Delhi

Sub:- Agenda Item for inclusion in next Protection Sub-Committee (PSC) meeting-Regarding tripping of 400/220 kV, 315 MVA ICT at 2x600 MW Kalisindh Thermal Power Station, Jhalawar on Sensitive Earth Fault Relay.

On the above captioned subject, it is intimated that Sensitive Earth fault protection (SEF) is used on 400/220kV , 315 MVA ICT at Kalisindh with tripping mode, and recently few tripping occurred on 400/220 kV, 315 MVA ICT due to SEF Protection (details attached) causing a large area disturbance i.e. Jhalawar, Bhawanimandi & Aklera.

So, in view of above a Agenda Item is enclosed herewith for including the above issue in upcoming PSC Meeting Agenda.

Encl: As above

(Manish Athaiya)
Chief Engineer (LD)
RVPN, Jaipur

Copy to the following for information and necessary action :-

1. The Chief Engineer(MPT&S), RVPN, Jaipur.
2. The Chief Engineer, Kalisindh Thermal Power Station, RVUN, Jhalawar.
3. The Superintending Engineer(Prot.Engg.), RVPN, Jaipur
4. The Superintending Engineer(Elect./Operations), Kalisindh Thermal Power Station, RVUN, Jhalawar.

RajKaj Ref 9694644

Signature valid
Chief Engineer (LD)
RVPN, Jaipur
Digitally signed by Manish Athaiya
Designation: Chief Engineer
Date: 2024.08.12 17:42:45 IST
Reason: Approved

Agenda :-**Sensitive Earth Fault relay (to be kept on Alarm Mode only) of 440/220KV 315MVA ICT at 2X600MW Kalisindh Thermal Power Station, Jhalawar**

1. It is to inform that 220KV GSS Jhalawar, Bhawanimandi and Aklera supply is presently fed radially through(400/220 KV,315 MVA ICT)Kalisindh Generating Station (KSTPS).
2. SEF (Sensitive Earth Fault) protection is used in 440/220KV 315MVA ICT with tripping mode having time 1.5 Sec. (DT)
3. Recently few tripping occurred on 440/220KV, 315MVA ICT on SEF (Sensitive Earth Fault) Because of jumper snapping (Broken Conductor) in 220 KV lines. Due to this, supply of large area having 03 Nos. above 220 KV GSS & connected 132 KV GSS disturbed.
4. SEF Protection may operate because of unbalance current that due to broken conductor of 220 kV line.The RVPN has enabled broken conductor protection in 220 & 132 KV lines on alarm mode. In case any alarm observed, the line shall be manually tripped after checking current in all phases.
5. SEF relay is connected on neutral CT having CT ratio 500/1 and current plug setting is 0.1A (i.e. 45.4 Amp only), TMS – 1.5 Sec. DT mode.
6. At Kalisindh Thermal Power Station, Jhalawar the backup protection is also available on ICT which may take care of unbalance current in case of jumper snapping or actual phase to earth fault.
7. Such protection with tripping mode is **nowhere used in RVPN** Transmission system, this protection (SEF) is also **not included in the recent Protection Philosophy**.
8. Therefore Please arrange to disable tripping through SEF relay or increase the setting from existing value & keep it on alarm mode only for 440/220KV, 315MVA ICT at **Kalisindh Thermal Power Station, Jhalawar**.

EHV Trippng details on 220 KV GSS Jhalawar

S.NO.	NAME OF CIRCLE	NAME OF GSS	Name of Line	Tripping Date	Tripping Time	Closing Date	Closing Time	Relay Indication			Remarks
								JWR End	B.Mandi End	Katpp End	
1	SE (T&C) RVPN KOTA	220 KV GSS Jhalawar	220 KV JWR-KATPPI-Bhawanimandi Line	23.02.2024	8:50	23.02.2024	14:56	Supply Fail	Supply Fail	ICT Tripped on SEF	**Due to jumper open at 220 KV JWR-Aklera line, Supply affected at 220 KV GSS Jhalawar, 220 KV Bhawanimandi, Aklera GSS**
1	SE (T&C) RVPN KOTA	220 KV GSS Jhalawar	220 KV JWR-KATPPI-Bhawanimandi Line	07.07.2024	22:05	07.07.2024	23:11	Supply Fail	Supply Fail	ICT Tripped on SEF	**Due to jumper open at 220 KV Aklera-CTPS line at loc. No. 130, Supply affected at 220 KV GSS Jhalawar, 220 KV Bhawanimandi, Aklera, Kawai GSS**

Annexure-VIII

RAJASTHAN RAJYA VIDYUT PRASARAN NIGAM LIMITED

[Corporate Identity Number (CIN): U40109RJ2000SGC016485]
Regd. Office: Vidyut Bhawan, Janpath, Jyoti Nagar, Jaipur-302005

RVPN
An ISO 9001:2015 Certified Company

OFFICE OF THE CHIEF ENGINEER (LD)

New Prasaran Bhawan, TCC Building, Heerapura, Jaipur Tel. No. 0141-2948293
E-mail: ce.ld@rvpn.co.in website: www.http://energy.rajasthan.gov.in/rvpnl

No. RVPN/ CE (LD)/ F. / D.148 Jaipur, dt. 20/08/2024

The Member Secretary
NRPC, New Delhi

Sub: - Agenda Item for inclusion in next Protection Sub-Committee (PSC) meeting – regarding excessive trippings of SPS on 400/220kV 2X315 MVA ICT's at STPS Suratgarh

Ref:- MoM of 49th PSC meeting held on 25.1.2024

On the above captioned subject, it is submitted there was excessive trippings on SPS at 400/220kV 2X 315 MVA ICT's at STPS, Suratgarh causing a large area disturbance. SPS of 400/220kV 2x315 MVA ICT's at STPS Suratgarh was approved in the 49th PSC meeting held on 25.1.2024.

So, in view of above a Agenda item is enclosed herewith for including the above issue in upcoming PSC Meeting Agenda.

Encl: 1. Agenda item for upcoming PSC.
2. Detail of tripping on ICT's due to SPS.

(Manish Athaiya)
Chief Engineer (LD)
RVPN, Jaipur

Copy to the following for information and necessary action :-

1. The Chief Engineer(MPT&S), RVPN, Jaipur.
2. The Chief Engineer, STPS, RVUN, Suratgarh.
3. The Superintending Engineer(Prot.Engg.), RVPN, Jaipur
4. The Superintending Engineer(Elect. Operations), STPS, RVUN, Suratgarh
5. The Superintending Engineer(MPT &S),RVPN, Bikaner.

Chie Engineer (LD)
RVPN, Jaipur

RajKaj Ref
9818344

Signature valid
Digitally signed by M ish Athaiya
Designation: Chie gineer
Date: 2024.0 :46:46 IST
Reason: Appro

AGENDA NOTE FOR EXCESSIVE SPS TRIPPING OF 2X315 MVA, 400/220 KV ICT's AT STPS SURATGARH

Ref.:-(1) MoM of 49th PSC of NRPC held on dated 25.01.2024.

(1) Recently the SPS on 400/220 KV, 2X315 MVA ICT's at STPS Suratgarh has been commissioned on dated 06.05.2024 to meet out the N-1 contingency .

(2) Excessive interruptions (i.e. 39 Nos w.e.f. 18/5/24 to 22/7/24) has been observed due to operation of newly commissioned SPS at STPS Suratgarh since commissioning and a large load approx. 150 MW was affected due to same.

(3) After analysis of trippings it is observed that these trippings were due to operation of Over Current element of relay either by gradual overloading, poor power factor, poor voltage profile, Traction load etc. or some other reasons instead of "N-1 contingency".

(4) After analyzing fault records /DR & discussion with RVUN officials, It is found that the present settings of Over current protection element of numerical relay used for SPS initiation is "Any one Phase" on full Load current.

(5) It is recommended to update in the existing approved SPS scheme of STPS Suratgarh to avoid the power supply disturbance caused by gradual overloading instead of "N-1 Contingency".

   a. To update the settings of over current element used for SPS start on "ALL Phase" instead of "Any Phase". As in most of the trippings, there is very much unbalance between the phases and the same may cause undesired initiation of SPS.

   b. To update the Current Setting (I>) from full load to 125 % of load on each ICT as per thermal capability of each ICT's.

   c. To incorporate C.B. status in the tripping circuit of SPS on each 220 KV lines at both end to avoid unnecessary trippings.

   d. To Split the first stage of time delay of 1.0 sec (approx load relief of 150MW) at 220 KV GSS Bhadra by providing timer with 0.85 Sec (with load relief of 20 MW) and with 1.0 Sec (with load relief of rest 140 MW).

Raj Kumar Ref
318344

Signature valid
Digitally signed by Mukesh Athaiya
Designation: Chief Engineer
Date: 2024.07.[illegible]:46:46 IST
Reason: Approved

DATED-22.07.2024

Details of Phase Wise Loading of 400/220 KV,2X315 MVA ILT's of STPS Suratgarh at the time of trippings

SR.NO	ILT-I/ILT-II	TIMING		400/220 KV ILT-I/ILT-II(400 KV Side)						TIE CT						Summation of Main & TIE CT 400/220 KV ILT-I/ILT-II(400 KV Side)					
		DATE	FROM	R-PH	Angle (Deg)	Y-PH	Angle (Deg)	B-PH	Angle (Deg)	R-PH	Angle (Deg)	Y-PH	Angle (Deg)	B-PH	Angle (Deg)	R-PH	Angle (Deg)	Y-PH	Angle (Deg)	B-PH	Angle (Deg)
1	ILT-2	18.05.2024	1:34:19	500	47.9	495	289.3	477	168.1	58	240.9	41	139.7	30	8.3	444	37.83494156	511	19.948	450	89.858
2	ILT-2	21.05.2024	13:26:30	556	221.6	399	92.8	421	354.8	43	234.7	24	174.5	1.773	185.7	593	-81.14297438	423	-82.89	423	-11.33
				470	221.6	394	92.8	419	354.1	44	234.7	24	174.5	4.252	185.7	508	-80.73201164	418	-82.89	419	-51.4
3	ILT-2	30.05.2024	10:11:01	441	189	453	76.1	457	313.2	0.959	52.8	50	327.4	27	202.3	441	29.01411956	503	40.053	442	-52.12
			10:50:35	445	344	459	231	460	108	1.248	42.4	53	121.6	30	356.3	446	89.74701399	415	-88.54	430	67.489
4	ILT-1	31.05.2024	16:05:54	442	260	468	133.2	454	15.6	0.928	166.1	53	247.5	35	134.5	443	-43.05640942	490	77.595	485	-8.096
	ILT-2	31.05.2024	15:26:56	443	104.7	438	350.8	438	227.5	1.055	12.3	45	265.8	23	164.6	443	58.99944884	394	-59.49	461	74.595
5	ILT-2	01.06.2024	12:42:56	441	290.5	455	179.8	466	56.9	0.775	356.6	67	75.7	51	305.5	440	84.41121761	395	45.813	420	17.328
6	ILT-2	02.06.2024	10:10:59	412	74.7	511	323.7	517	197.4	1.015	343.1	85	188.7	57	38.4	412	-40.14350388	426	5.6345	500	-35.96
			12:47:31	452	295.6	495	180.6	497	54.6	0.926	269.8	57	34.4	40	214.8	453	16.55990178	492	81.005	457	68.456
7	ILT-2	03.06.2024	11:57:58	452	4.3	470	250.6	469	125.2	1.059	275.3	48	127.9	12	337.9	453	66.47012106	423	-40.53	476	-27.72
8	ILT-1	04.06.2024	14:01:14	452	189.7	488	66.6	489	310.3	0.77	28.1	39	208.6	38	135.3	452	69.10521639	457	33.024	513	-37.72
			15:04:53	456	256.8	496	134.9	493	80	0.784	229.3	35	293.1	41	12.6	455	-46.51278688	512	-7.272	489	88.424
			15:37:30	452	358.5	489	236.3	484	119.7	0.938	285.4	34	28.4	34	314.4	451	20.62588407	518	37.012	518	18.009
9	ILT-1	05.06.2024	11:19:47	450	80.7	484	316.9	482	200.4	0.706	119.7	39	88.5	33	23.5	450	-56.14399333	462	-26.87	501	-41.04
10	ILT-1	06.06.2024	16:18:22	455	265.2	498	143.3	489	26.5	0.776	200.4	37	312.8	44	222.1	455	74.75056303	535	-70.09	520	81.889
11	ILT-1	10.06.2024	14:56:14	453	248.3	501	127.8	506	9.6	0.999	182.2	40	301.2	55	202.4	452	6.558036086	469	-60.41	487	4.0866
12	ILT-1	11.06.2024	14:14:07	454	314	504	192.5	503	75.3	0.726	256.3	45	2.8	57	265.6	454	-9.208858114	522	44.819	493	0.8312

			16:15:00	454	7.4	506	246.4	507	128.1	0.894	303.3	46	52.6	53	312.6	455	64.05146432	533	81.787	474	-35.57
13	ILT-1	12.06.2024	1:00:44	455	298	464	146.3	464	59	0.973	213.5	16	284	11	273	454	-25.89667527	478	-78.6	474	-39.07
	ILT-2		1:31:13	456	69.6	452	311.8	452	189.8	1.154	33.2	17	223.2	10	228.3	456	27.92583905	466	43.583	459	75.635
14	ILT-1	13.06.2024	11:36:48	450	195.8	478	72.4	474	315.6	0.717	133.9	28	205.9	27	149.8	450	58.5868497	479	11.563	454	80.34
			11:54:49	450	171.1	478	47.5	473	290.7	1.379	115	28	180	26	121.3	451	83.38382537	502	23.228	498	-83.39
			12:34:26	440	183.3	486	60.3	482	300.9	0.617	99.8	30	191	25	128.4	440	62.23846775	496	31.651	458	-40.59
			14:59:39	450	351.2	486	227.8	480	110.6	0.903	263.6	33	15	33	295.2	451	-37.68131558	509	-85.28	457	39.75
			15:06:09	452	22.6	496	258.1	478	140.7	0.62	28.1	35	45.8	33	322.4	452	34.82922135	506	31.894	507	-40.31
			16:49:19	452	237.1	493	113.9	489	356.2	0.963	182.1	38	265.2	39	171.2	452	84.95135716	527	47.985	453	67.045
15	ILT-1	16.06.2024	12:47:52	450	272.6	470	151.4	469	32.5	0.669	187.1	17	280.8	15	219.1	449	-41.11708148	456	33.384	464	60.359
16	ILT-1	17.06.2024	13:55:07	458	317.5	470	194.3	472	77.5	0.82	288.1	23	288.2	15	278.2	458	11.50265258	492	-28.34	486	-60.2
17	ILT-1	18.06.2024	12:46:38	454	142.8	464	19.8	463	264.4	0.977	102.3	19	122.2	21	136.8	453	81.79603006	459	56.725	456	26.539
	ILT-1		13:42:12	454	148.1	471	24.7	471	268.8	0.848	92.1	30	135.5	14	105.6	455	25.56067315	452	-27.64	485	-78.63
18	ILT-1	19.06.2024	15:14:03	469	74.1	483	313.3	501	196.8	0.821	22.6	34	91.9	32	20.2	469	-74.4773637	487	-53.22	526	-66.36
	ILT-1		16:40:25	454	207.3	476	83.1	470	325.8	1.006	122.8	35	[illegible]	[illegible]	117.6	453	-2.625290522	503	83.908	484	-54.91
	ILT-1		16:44:01	464	305.5	485	178.7	464	63.1	0.789	224.9	37	[illegible]	21	209.9	464	43.94656408	467	-17.37	450	17.379
19	ILT-1	20.06.2024	11:46:09	451	319.2	490	198.3	497	80.7	1.024	245.1	30	11.5	48	277.7	451	-71.06196827	487	25.256	469	-51.56
20	ILT-1	05.07.2024	10:55:25	384.9	31.6	860.8	313.15	2881	148.7	45.752	326.1	30.68	26.3	154.14	327.7	418	5.998002923	844	-56.11	2727	60.111
21	ILT-2			428.1	43.9	885.2	339.4	2610	171.6	42.175	167.4	31.72	228.1	154.27	169.9	406	-9.657452906	879	8.2034	2594	-71.43
22	ILT-2	19.07.2024	13:33:34	490.4	[illegible]	418.5	35.1	429.6	276.5	26.868	353.3	25.07	318.2	15.254	282.3	497	-22.40212085	442	32.216	443	1.3667
23	ILT-1			436	284.4	440	161.7	457	49.7	27.148	306.2	24.82	273.6	15.492	235.3	411	-84.36192835	450	81.782	442	-32.89
24	ILT-1	20.07.2024	12:15:09	479	342.8	520	219.9	520	102.5	38.146	197.5	60.75	43.8	79.196	301.4	507	17.93738774	580	-1.678	480	-75.05
25	ILT-2	22.07.2024	15:54:48	461.1	263.4	445.5	144.3	434.5	22.4	19.807	198.2	37.61	90.8	35.239	2	447	-30.06507506	408	-11.73	437	18.797

SUB:Comments of RVUNL, STPS for the Agenda raised by RVPNL regarding SPS on 2x315MVA, 400/220KV ICTs at STPS, Suratgarh

Ref.:

(1) MOM of 49th PSC of NRPC held on 25.01.24

(2) Agenda submitted by RVPNL vide letter No. RVPN/CE (LD) /F. /D.148 dtd 20.08.24 (Enclosed)

On the above cited subject and references, pointvise reply of RVUNL, STPS on the agenda SPS on 2x315MVA, 400/220KV ICTs at STPS, Suratgarh submitted by RVPNL to NRPC are as under:

S. no.	RVPN proposal	RVUN Comments
1.	To update the settings of over current element used for SPS start on "All phase" instead of "Any phase". As in most of the trippings, there is very much unbalance between the phases and the same may cause undesired initiation of SPS	At Generating station the Tripping /alarms of over-current/overload protections on all the electrical equipment i.e. Generator, Transformer, HT Motors, feeders, LT Motors etc **always operates on any phase basis**. Being Generating station it is necessary to initiate alarm as well to isolate the faulty element at the first instance to protect the equipment and curb major damage so as to avoid its downtime and loss of generation. The proposal may be considered to be dropped.
2.	To Update the current setting (I>) from full load to 125% of load on each ICT as per thermal capability of each ICT's.	Presently, Over current setting for ILT is 110% i.e. 500A and setting of SPS is 100% FLC i.e 460A (approx). If SPS is to be operated at 125% of FLC then ILT shall trip first on overcurrent protection before the operation of SPS.
3.	To incorporate CB status in the tripping circuit of SPS on each 220 KV lines at both end to avoid unnecessary trippings.	Once the RVPNL suggestion at point no 4 is implemented then there will be no need to execute point no.3. Besides this, RVUNL also suggest to install underpower relay at the GSS end rather than to interlock of breaker contacts as the chances of malfunctioning of breaker contacts are more. However, this type of SPS scheme is already in function at various Generating Stations/GSS. So, RVUNL request to NRPC to provide guidance/ elaboration on this matter.
4	To Split the first stage of time delay of 1 sec (approx load relief of 150MW) at 220 KV GSS bhadra by providing timer with 0.85 sec (with load relief of 20 MW) and with 1 Sec (With load relief of rest 140 MW)	Agreed but RVUNL, STPS suggest to implement this bifurcation of load relief at each stage/GSS i.e. Bhadra, Halasar and Sriganganagar because lines are not always in service.

Dy. Chief Engineer (Elect.)
RVUN, SSTPS, SURATGARH

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	31.12.2024	Panel has been installed. Commissioning pending due to non- availability of shutdown.
	220kV S/Stn Sec-1 Manesar	**Installed and Operational**		**Commissioned on 26.02.2023**
	220kV S/Stn Panchgaon	**Installed and Operational**		**Commissioned on 05.01.2024**
	220kV S/Stn Rewari	Not Installed	31.03.2025	Material is not allocated so far. Installation will be carried out after allocation of material.
	220kV S/Stn Narnaul	Not Installed	31.10.2024	Panel has been installed. Work in progress on turnkey basis. Isolators of 220 kV TFs have to be replaced thereafter the work shall be completed.
	220kV S/Stn Mohinder Garh	**Installed and Operational**		**Commissioned on 28.10.2023**
	220 KV S/Stn Palwal	Not Installed	31.12.2024	Panel has been installed. Commissioning is pending.
	220 KV S/Stn Rangala Rajpur	**Installed and Operational**		**Commissioned on 22.06.2023**
	220 kV Unispur	Installed but Non-Operational	31.08.2024	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	31.08.2024	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	31.03.2025	Old & Obsolete, Allocation of New BBP and allied material awaited.
	220kV Kaithal	Not Installed	31.03.2025	Control Cable for Bus-Bar Protection Scheme has been drawn from DD Stores, 220kV Bus-Bar Protection panel is awaited.
	220 KV Sonepat	Not Installed	31.08.2024	220 KV Bus Bar Protection Scheme will be installed / commissioned within 45 days after the availability of the necessary material i.e 220kV Duplex, Directional, Bus Bar Cum Bus Coupler C and R Panel, Auxiliary Voltage 220V DC (without SAS) required for commissioning. It has been gathered from the P&M wing that the material is likely to be available in DD stores by April 2024.
	220 KV REGC, Sonepat	Not Installed	30.09.2024	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. Errection work under progress & the same will be completed 31.08.23.
	220 KV Bhuna	Installed but Non-Operational	31.12.2024	The Siemens make Bus Bar protection Scheme installed at the time of commissioning of the substation went out of order. The higher authority decided to replace with new one. M/s Schneider make new Scheme was then allocated and drawn from DDS Ballabgarh and installed at site, but while testing of same, three out of four relays of the Bus Bar Panel found faulty for which matter is under pursuance with firm.
	220 KV Sirsa	Not Installed		Not required being single source of supply
	220 KV Rania	Not Installed	31.03.2025	Estimate for Bus Bar Protection is sanctioned but C&R panel is not available in store.
	220 KV Bhiwani	Not Installed	31.03.2025	Bus Bar Protection scheme has been proposed in integrated planning meeting and requirement of material have been generated in PR.
	220kV Madanpur	Not Installed	31.08.2024	Material is not allocated so far. Installation will be carried out after allocation of material.
	220kV Tepla	Installed but Non-Operational	31.08.2024	material allocation is awaited.
	220kV Rajokheri	**Installed and Operational**	31.03.2024	**Made operational on dated 30.05.2024.**
BBMB	**220kV Charkhi Dadri**	**Installed and Operational**		**commissioned on 31.01.2023**
	220kV Samaypur	**Installed and Operational**		**made operational on 23.12.2023**
	220kV Dhulkote	Not Installed		Not feasible
	220kV Jagadhari	Not Installed		
	220kV Barnala	Not Installed		

	220kV Parichha	Installed but Non-Operational	30.06.2023	
	220kV Partapur	Installed but Non-Operational	Jan-23	
	220kV Bareilly (400/220kV	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 Amariya	**Installed and Operational**		**commissioned on 15th July 2023**
	220kV Sultanpur	**Installed and Operational**		**commissioned on 02.03.2024**
	220kV New Tanda	**Installed and Operational**		**commissioned on 20.04.2024**
	220kV Shahjhanpur	Installed but Non-Operational	30.06.2024	Cable partially received, work will start soon
	220kV Ajijpur	Installed but Non-Operational		1. HV side 220kV CT of 160MVA T/F-I & II has bot proper ratio for bus bar
	220kV Nirpura	Installed but Non-Operational	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 fefective 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, Botanicla Garden	Not Installed		Panel allotment pending
	220kV sec.-62, Noida	**Installed and Operational**		**made operational on 12.10.2023**
	220kV Dadri	**Installed and Operational**	Apr-24	**made operational on 23.04.2024**
	400kV S/S Agra	**Installed and Operational**		**commissioned on 13th September 2023**
UP	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 Gomti 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 Robertganj	partillay 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 Recived, construction of
	220kV Chamba	**Installed and Operational**		**commissioned in Jan-2024**
	220kV MattaSidh	Installed but Non-Operational		
HP	220kV kangoo	Installed but Non-Operational	31.12.2024	Work in under progress, issues are being taken up with ABB
	220kV Nangal	Installed but Non-Operational		
	220kV Katha Baddi	Installed but Non-Operational		
	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	Dec-24	Commissioning is in process. Material has arrived, commissioning shall be done as per shutdown availability.
Punjab	220 KV S/S Hoshiarpur	Not Installed		
	220 KV S/S Goraya	Not Installed		
	220 KV S/S Bhawanigarh	Not Installed		
	220 KV S/S Badhni kalan	**Installed and Operational**		**Commissioned**
	220 KV S/S Bhari	**Installed and Operational**		**Commissioned**
	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. Matter has been taken up with firm
	220 kV GSS Niwana	Not installed	Sep-24	To be commissioned shortly
	220 kV GSS Alwar	Not installed		To be commissioned shortly
	220 kV GSS Bansur	Not installed		To be commissioned shortly
	220 kV GSS Behror	Not installed		To be commissioned shortly
	220KV GSS Hindaun	Not installed		To be commissioned shortly
	220KV GSS Dooni	Not installed		**commissioned**
	220KV GSS Bhawanimandi	Not installed		**commissioned**
	220 KV GSS Sakatpura, Kota	Not installed		**commissioned on 09.07.2024**
	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 avaliable due to this 220 KV Main Bus-bar-II is out of ckt. work under progress
	220 kV GSS, Beawar	Not installed		**commissioned**
	220 KV GSS Jethana	Not installed		**commissioned**
	220 KV GSS Kuchaman City	Installed but non operational		Purchase has been taken up with the firm

Rajasthan	220 KV GSS Bherunda	Not installed		**commissioned**
	220 KV GSS Kuchera	Not installed		**commissioned**
	220 KV GSS Reengus	Installed but non operational		**commissioned**
	220 KV GSS Laxmangarh	Not installed		**Commissioned**
	220KV GSS Khetri Nagar	Installed but non operational		**commissioned**
	400 KV GSS, Babai	Installed but non operational		**commissioned**
	220 KV GSS Chittorgarh	Installed but non operational	20.08.2024	To be commissioned shortly
	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	31.08.2024	To be commissioned shortly
	220KV GSS Amberi	Not installed		**commissioned**
	220KV GSS Madri	Not installed	14.08.2024	To be commissioned shortly
	400 KV GSS Surpura (Jodhpur)	Installed but non operational	30.09.2024	To be commissioned shortly
	400 KV GSS Akal (Jaisalmer) 220	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		Case file moved
	220 KV GSS Badisid	Not installed		**commissioned**
	220 KV GSS Bhadla	Not installed	25.09.2024	Allotted & Panel Received. To be commissioned shortly
	220 KV GSS Pali	Installed but non operational		**commissioned**
	220 KV GSS Ramgarh	Not installed	05.09.2024	Allotted & Panel Received. To be commissioned shortly
	220 KV GSS Balotra	Installed but non operational		**commissioned**
	220 KV GSS Sayla	Not installed		**commissioned**
	400 KV GSS Bikaner 400 KV BUS	Installed but non operational		to be done with transformer work
	220 KV GSS Ratangarh	Not installed		**commissioned**
	220 KV GSS Sujangarh	Not installed	10.08.2024	Allotted & Panel Received. To be commissioned shortly
	220 KV GSS Halasar	Not installed	25.07.2024	Allotted & Panel Received. To be commissioned shortly
	220 KV GSS Tehandesar	Not installed	15.09.2024	Allotted & Panel Received. To be commissioned shortly
	220 KV GSS Rawatsar	Not installed		**commissioned**

Status of Bus bar protection				
Constituent Name	**Name of Station**	**Status of Bus bar protection(as reported)**	**Expected date of implementation (as reported in 51st PSC meeting)**	**Remarks**
Uttarakhand	220 KV Substation, Ramnagar, Roorkee	Blocked due to more elements added at 220 KV Voltage level.		
	220 KV Sub Station, SIDCUL, Haridwar			
	220kV Jhajhra, Dehradun	Not commissioned yet		
	400KV Kashipur (220kV side)	Available but Non operational	Revised date not received	Work is under process.
	220kv Haldwani	Not Available	31 December 2024	Budget for FY 2023-24.
	220kv Pantnagar	Available but Non operational	Revised date not received	Work is under process.
	220kV Rishikesh	Available but Non operational	31 December 2024	It has been Taken in Budget for FY 2023-24.
	220kV Chamba	Not commissioned yet	31 December 2024	It has been Taken in Budget for FY 2023-24.
Haryana	**220kV S/Stn Badshahpur**	**Installed and Operational**		**Commissioned on 20.02.2023**
	220kV S/Stn Sec-52A, Gurgaon	Not Installed	31.12.2024	Panel has been installed. Commissioning pending due to non- availability of shutdown.
	220kV S/Stn Sec-1 Manesar	**Installed and Operational**		**Commissioned on 26.02.2023**
	220kV S/Stn Panchgaon	**Installed and Operational**		**Commissioned on 05.01.2024**
	220kV S/Stn Rewari	Not Installed	31.03.2025	Material is not allocated so far. Installation will be carried out after allocation of material.
	220kV S/Stn Narnaul	Not Installed	31.12.2024	Panel has been installed. Work in progress on turnkey basis. Isolators of 220 kV TFs have to be replaced thereafter the work shall be completed.
	220kV S/Stn Mohinder Garh	**Installed and Operational**		**Commissioned on 28.10.2023**
	220 KV S/Stn Palwal	Not Installed	31.12.2024	Panel has been installed. Commissioning is pending.
	220 KV S/Stn Rangala Rajpur	**Installed and Operational**		**Commissioned on 22.06.2023**
	220 kV Unispur	Installed but Non-Operational	31.10.2024	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	31.10.2024	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	31.03.2025	Old & Obsolete, Allocation of New BBP and allied material awaited.
	220kV Kaithal	Not Installed	31.03.2025	Control Cable for Bus-Bar Protection Scheme has been drawn from DD Stores, 220kV Bus-Bar Protection panel is awaited.
	220 KV Sonepat	Not Installed	31.10.2024	220 KV Bus Bar Protection Scheme will be installed / commissioned within 45 days after the availability of the necessary material i.e 220kV Duplex, Directional, Bus Bar Cum Bus Coupler C and R Panel, Auxiliary Voltage 220V DC (without SAS) required for commissioning. It has been gathered from the P&M wing that the material is likely to be available in DD stores by April 2024.
	220 KV REGC, Sonepat	Not Installed	30.09.2024	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. Errection work under progress & the same will be completed 31.08.23.
	220 KV Bhuna	Installed but Non-Operational	31.12.2024	The Siemens make Bus Bar protection Scheme installed at the time of commissioning of the substation went out of order. The higher authority decided to replace with new one. M/s Schneider make new Scheme was then allocated and drawn from DDS Ballabgarh and installed at site, but while testing of same, three out of four relays of the Bus Bar Panel found faulty for which matter is under pursuance with firm.
	220 KV Sirsa	Not Installed		Not required being single source of supply
	220 KV Rania	Not Installed	31.03.2025	Estimate for Bus Bar Protection is sanctioned but C&R panel is not available in store.
	220 KV Bhiwani	Not Installed	31.03.2025	Bus Bar Protection scheme has been proposed in integrated planning meeting and requirement of material have been generated in PR.
	220kV Madanpur	Not Installed	30.11.2024	Material is not allocated so far. Installation will be carried out after allocation of material.
	220kV Tepla	Installed but Non-Operational	30.11.2024	material allocation is awaited.
	220kV Rajokheri	**Installed and Operational**		**Made operational on dated 30.05.2024.**
BBMB	**220kV Charkhi Dadri**	**Installed and Operational**		**commissioned on 31.01.2023**
	220kV Samaypur	**Installed and Operational**		**made operational on 23.12.2023**
	220kV Dhulkote	Not Installed		Not feasible
	220kV Jagadhari	Not Installed		
	220kV Barnala	Not Installed		
	220kV Parichha	Installed but Non-Operational	Revised date not received	
	220kV Partapur	**Installed and Operational**		**made operational on 06.01.2023**
	220kV Bareilly (400/220kV Bareilly)	Installed but Non-Operational	Revised date not received	Old panel capacity exhausted. New relay panel supplied & need to be
	220kV Pilibhit	**Installed and Operational**		**commissioned on 28.10.2023**
	220kV Amariya	**Installed and Operational**		**commissioned on 15th July 2023**
	220kV Sultanpur	**Installed and Operational**		**commissioned on 02.03.2024**

	220kV New Tanda	Installed and Operational		commissioned on 20.04.2024
	220kV Shahjhanpur	Installed but Non-Operational	Revised date not received	Cable partially received, work will start soon
	220kV Ajijpur	Installed but Non-Operational		1. HV side 220kV CT of 160MVA T/F-I & II has bot proper ratio for bus bar
	220kV Nirpura	Installed but Non-Operational	Revised date not received	
	220kV IITGNL	Installed and Operational		made operational on 19.02.2023
	220kV Rampur	Installed but Non-Operational	Revised date not received	
	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	31.10.2024	Central unit of bus bar protection faulty. Expected to revive by November-24.
	220kV Sec. - 148, Noida	Installed and Operational		made operational on 27.01.2024
	220kV sec. 38A, Botanicla Garden	Not Installed	31.11.2024	Bus Bar protection panel awaited
	220kV sec.-62, Noida	Installed and Operational		made operational on 12.10.2023
	220kV Dadri	Installed and Operational		made operational on 23.04.2024
	400kV S/S Agra	Installed and Operational		commissioned on 13th September 2023
	220kV S/S Bah	Not Installed		Requirement sent to design circle, awaited fro allotment.
UP	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	Revised date not received	New 160MVA transformer-3 is not configured with bus bar
	220kV Kidwainagar	Installed but Non-Operational		
	220kV Chhata	Installed but Non-Operational	Revised date not received	New 160MVA transformer-3 is not configured with bus bar
	220kV Harduaganj	Installed but Non-Operational	Revised date not received	
	220kV 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	Revised date not received	
	220kV Sirathu, Kaushambi	Not Installed	Revised date not received	
	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 Gomti 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	Revised date not received	Relay Defective, concern firm service engineer is awaited
	20kV S/S Harahua	Installed but Non-Operational	Revised date not received	NOT COMMISSIONED
	220kv Rewa Road	Installed but Non-Operational	Revised date not received	Due to Isolator & CB status not Proper. Informed to Transmission wing but
	220kV S/S Sahupuri	Installed but Non-Operational	Revised date not received	Defective, Requirement for New panel has been raised, not received from
	220kv Robertganj	partillay operational	Revised date not received	Line and bus coupler and T/F-I under cover but T/F-II not cover
	220kV S/S Mirzapur	Not Installed	Revised date not received	Bubar Protection Panel has been Recived, construction of Transfer bus is on progress
	220kV Chamba	Installed and Operational		commissioned in Jan-2024
	220kV MattaSidh	Installed but Non-Operational		
HP	220kV kangoo	Installed but Non-Operational	31.12.2024	Work in under progress, issues are being taken up with ABB
	220kV Nangal	Installed but Non-Operational		
	220kV Katha Baddi	Installed but Non-Operational		
	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	Dec-24	Commissioning is in process. Material has arrived, commissioning shall be done as per shutdown availability.
Punjab	220 KV S/S Hoshiarpur	Not Installed		
	220 KV S/S Goraya	Not Installed		
	220 KV S/S Bhawanigarh	Not Installed		
	220 KV S/S Badhni kalan	Installed and Operational		Commissioned
	220 KV S/S Bhari	Installed and Operational		Commissioned
	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. Matter has been taken up with firm
	220 kV GSS Niwana	Not installed	Sep-24	Commissioning work started, to be commissioned shortly
	220 kV GSS Alwar	Not installed		Commissioning work started, to be commissioned shortly
	220 kV GSS Bansur	Not installed		Commissioning work started, to be commissioned shortly
	220 kV GSS Behror	Not installed		Commissioning work started, to be commissioned shortly
	220KV GSS Hindaun	Not installed		Commissioning work started, to be commissioned shortly
	220KV GSS Dooni	Installed and Operational		commissioned
	220KV GSS Bhawanimandi	Installed and Operational		commissioned
	220 KV GSS Sakatpura, Kota	Installed and Operational		commissioned on 09.07.2024
	400 KV GSS Ajmer (220 KV BUS)	Installed but non operational	Revised date not received	One number of PU is defective. Isolator status is OK.
	220 kV GSS, Beawar	Installed and Operational		commissioned
	220 KV GSS Jethana	Installed and Operational		commissioned
	220 KV GSS Kuchaman City	Installed but non operational	Revised date not received	CU is defective. Purchase has been taken up with the firm
	220 KV GSS Bherunda	Installed and Operational		commissioned
	220 KV GSS Kuchera	Installed and Operational		commissioned
	220 KV GSS Reengus	Installed and Operational		commissioned
	220 KV GSS Laxmangarh	Installed and Operational		Commissioned
	220KV GSS Khetri Nagar	Installed and Operational		commissioned
Rajasthan	400 KV GSS, Babai	Installed and Operational		commissioned
	220 KV GSS Chittorgarh	Installed and Operational		commissioned
	400 KV GSS BHILWARA(220 KV BUS)	Installed and Operational		commissioned
	220 KV GSS MANDALGARH	Installed and Operational		commissioned
	220KV GSS Debari	Installed and Operational		commissioned
	220KV GSS Amberi	Installed and Operational		commissioned
	220KV GSS Madri	Installed and Operational		commissioned
	400 KV GSS Surpura (Jodhpur) 220 KV	Installed but non operational	30.09.2024	Commissioning work started, to be commissioned shortly

	400 KV GSS Akal (Jaisalmer) 220 KV	Installed but non operational	Revised date not received	One PU defective. Case has been taken up with firm
	220 KV GSS Jodhpur	Installed but non operational	Revised date not received	A&FS and TS issued. Case has been send for approval
	220 KV GSS NPH Jodhpur	Not installed	Revised date not received	Case file moved
	220 KV GSS Badisid	**Installed and Operational**		**commissioned**
	220 KV GSS Bhadla	Not installed	25.09.2024	Commissioning work started, to be commissioned shortly
	220 KV GSS Pali	**Installed and Operational**		**commissioned**
	220 KV GSS Ramgarh	Not installed	05.09.2024	Commissioning work started, to be commissioned shortly
	220 KV GSS Balotra	**Installed and Operational**		**commissioned**
	220 KV GSS Sayla	**Installed and Operational**		**commissioned**
	400 KV GSS Bikaner 400 KV BUS	Installed but non operational	Revised date not received	to be done with transformer work
	220 KV GSS Ratangarh	**Installed and Operational**		**commissioned**
	220 KV GSS Sujangarh	**Installed and Operational**		**commissioned**
	220 KV GSS Halasar	**Installed and Operational**		**commissioned**
	220 KV GSS Tehandesar	Not installed	15.09.2024	Commissioning work started, to be commissioned shortly
	220 KV GSS Rawatsar	**Installed and Operational**		**commissioned**

Status of protection relay type				
Constituent Name	**Name of Station**	**Element Name**	**Present Status**	**Remark**
Uttarakhand	220kV Rishikesh	SIDCUL line	Main-II is not installed	
		Chamba line		
		Dharasu line-2		
	220kV Chamba	Rishikesh line		
HP	220kV MattaSidh	220kV transformer bank-1 & 2	Static relay	
Rajasthan	220 kV GSS Sanganer	220 kV HEERAPURA	Static	
	220 kV GSS Phulera	220 KV HEERAPURA	Static	Replaced by numerical relay
		220 kV Makrana	Static	
	220 KV GSS CHOMU	220 kV Heerapura	Static	
		220 kV Reengus Line	Static	
	220 kV GSS Kukas	220 kV Manoharpur Line	Static	Replaced by numerical relay
		220 kV Alwar Line	Static	
	220kV GSS Dausa	220 kV SawaiMadhopur Line	Static	
		220 kV Bassi-I Line	Static	
		220 kV Bassi-II Line	Static	
		220 kV Alwar Line	Static	
		220 kV Mandawar Line	Static	
	220KV BHARATPUR GSS	220 KV DHOLPUR	Static	Replaced by numerical relay
	220 KV GSS SAKATPURA	220 kV ANTA(NTPC)	Static	
	220 KV DAHRA	220 kV BARAN	Static	
		220 kV SAKATPURA	Static	
	220KV GSS MODAK	220 kV RANPUR	Static	
		220 kV Jhalawar	Static	
	220 KV GSS JHALAWAR	220 kV Modak	Static	
	220KV GSS HINDAUN	220KV Sikrai Line	Static	relay defective
	220KV GSS DHOLPUR	220 kV DCPP	Static	
	220 KV GSS Reengus	220 KV Laxmangarh	Static	
	220 KV GSS Nagour	220KV NOKHA	Static	
		220KV KUCHERA	Static	
	220KV GSS Kankroli	220 KV PGCIL-I	Static	
	220 KV GSS SIROHI	220 KV (400) KV PGCIL Bhinmal	Static	
	220 KV GSS SIROHI	220 KV Jalore	Static	
	220 KV GSS BHINMAL	220 KV (400) KV PGCIL Bhinmal-I	Static	
	220 KV GSS BALI	220kV Sirohi	Static	Replaced by numerical relay
	220 KV GSS Suratgarh	220 KV STPS-I	Static	
		220 KV STPS-II	Static	
		220 KV Hanumangarh Line	Static	
	220 KV GSS Sri Ganganagar	220 KV Hanumangarh Line	Static	Replaced by numerical relay
	220 KV GSS Hanumangarh	220 KV Suratgarh	Static	
	220KV GSS Ratangarh	220KV Rawatsar	Static	
	220KV GSS Ratangarh	220KV Halasar	Static	
	220KV GSS Ratangarh	220KV InterConnector-I	Static	
	220KV GSS Ratangarh	220KV InterConnector-II	Static	
	220KV GSS Sujangarh	220KV Ratangarh	Static	
	220 KV GSS Bikaner	220 KV Badnu Line	Static	
	220 KV GSS Bikaner	220 KV Interconnector-I Line	Static	
	220 KV GSS Bikaner	220 KV Spare Line	Static	
	220kV Madanpur	220/66kV 100 MVA PTF T-1	Electromechanical	Working properly, need to be replace with numerical relay
		220/66kV 100 MVA PTF T-1 A	Electromechanical	Working properly, need to be replace with numerical relay
		220kV Bus-Coupler	Backup relay -Numerical all other relays are	Working properly, need to be replace with numerical relay
		220/66kV 100 MVA PTF T-1 A	Electromechanical Execept 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 Jorian -DCRTPP Ckt-1	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220KV Jorian -DCRTPP Ckt-2	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220KV Jorian -Shahbad Ckt-1	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay

Haryana	220KV S/Stn Jorian	220KV Jorian -Shahbad Ckt-2	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220KV Jorian -Abdullapur Ckt-1	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220KV Jorian -Abdullapur Ckt-2	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220/66, 160MVA T/F T-1	Defferntial Relay = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220/66, 100MVA T/F T-2	All Electromechanical	Working properly, need to be replace with numerical relay
		220/66, 100MVA T/F T-3	Defferntial & REF Relay = Numerical all other	Working properly, need to be replace with numerical relay
	220 kv Salempur	220 KV BAKANA–SALEMPUR CKT-I	All electromechanical type,except DPR relays	Working properly, need to be replace with numerical relay
		220 KV BAKANA–SALEMPUR CKT-II	All electromechanical type,except DPR relays	Working properly, need to be replace with numerical relay
		220 KV SALEMPUR-NISSING CKT-I	All electromechanical type,except DPR relays	Working properly, need to be replace with numerical relay
		220 KV SALEMPUR-NISSING CKT-II	All electromechanical type,except DPR relays	Working properly, need to be replace with numerical relay
		220 KV BUS-COUPLER	All electromechanical type	Working properly, need to be replace with numerical relay
		220/66 KV 100MVA T/F T-I	All electromechanical type,except Differential relays	Working properly, need to be replace with numerical relay
		220/66 KV 100MVA T/F T-2	All electromechanical type,except Differential relays	Working properly, need to be replace with numerical relay
	TS Division Karnal	220kV Nissing-PTPS Ckt-I	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 Electromechnical	
		100MVA 220/66kV T-2	REF & backup Electromechnical	
		100MVA 220/66kV T-7	Diff & Backup lectromechnical and REF static	
		220kV Palla - Sector 78	backup Electromechnical	
		220kV Palla - FGPP ckt-II	backup Electromechnical	
	220 kV S/Stn. Pali	100 MVA 220/66 kV T-1	REF & backup Electromechnical	
		100 MVA 220/66 kV T-3	REF & backup Electromechnical	
		220 kV Pali-BBMB Samaypur Ckt 1	backup Electromechnical	
		220 kV Pali-BBMB Samaypur Ckt 2	backup Electromechnical	
		220 kV Pali-Sector 46 Ckt 1	backup Electromechnical	
		220 kV Pali-Sector 46 Ckt 2	backup Electromechnical	
		220 kV Pali-Sector 65 Ckt 1	backup Electromechnical	
		220 kV Pali-Badshahpur Ckt 2	backup Electromechnical	
		220 kV Pali-Sector 56 Ckt 1	backup Electromechnical	
		220 kV Pali-Sector 56 Ckt 2	backup Electromechnical	
	220kV S/Stn Palwal	220/66kV 160MVA T-1 T/F	REF & backup Electromechnical	
		220/66kV 100MVA T-2 T/F	Diff, REF & Backup Electromechnical	
		220kV Prithala Palwal Ckt I	backup Electromechnical	
		220kV Prithala Palwal Ckt II	backup Electromechnical	
	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 , Electromechnical 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) Electromechnical Relays	

UP	400 KV S/S Moradabad	400 KV MORADABAD - RAMPUR LINE	LBB- ABB(RAICA) / STATIC	UNDER PGCIL
		400 KV MORADABAD - KASHIPUR LINE	LBB- English Electric(CTIG) / Electromechnical	
		400 KV, TRANSFER BUS	LBB- English Electric(CTIG) / Electromechnical	
		400 KV, BUS COUPLER	LBB- English Electric(CTIG) / Electromechnical	
	220kV S/S BARAUT	220/132kV 200MVA TRANSFORMER-1	REF Protection - Electromechanical	
	220kV S/S BAGHPAT	220/132kV 160MVA TRANSORMER-1	Backup (L.V. Side) - Electromechanical	
	220 kV KHURJA	220/132Kv 200MVA Transformer-I	REF-Static	
	220 kV DEBAI	220/132Kv 100MVA Transformer-I	Numerical	
	220 kV Jahangirabad	220/132Kv 160MVA Transformer-I	REF-Static	
	400KV S/S MURAD NAGAR	220KV LONI LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	Will be replaced by July24
		220KV FARID NAGAR LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV INTER CONNECTOR-I MURAD NAGAR LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV INTER CONNECTOR-II MURAD NAGAR LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV SAHIBABAD LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV PRATAP VIHAR LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV TBC	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		400KV TBC	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		400KV ALIGARH LINE	LBB RELAY IS ELECTROMECHANICAL.	
		400KV ATOUR LINE	LBB RELAY IS ELECTROMECHANICAL.	
	220KV S/S MURAD NAGAR	220KV BUS COUPLER	O/C RELAY IS ELECTROMECHANICAL	
	400KV S/S Gorakhpur	400KV TBC	Electromechanical	
		220KV TBC	Electromechanical	
	220KV S/S Barahua	220KV PGCIL	Back up relay electromechenical	
	220KV S/S Basti	220 KV Basti Tanda line	67N(2TJM12)(Electromechanical)	
		63MVA Transformer-II	HV Side directional o/c&e/f(Electromechanical)	
	400 KV SS Kasara,Mau	200MVA, 400/132KV ICT-1st	REF & Over flux relay Electromechanical	
		200MVA, 400/132KV ICT-2nd	REF & Over flux relay Electromechanical	
	220 KV SS Substation Hafizpur Azamgarh	160 MVA ICT -1	Electromechanical(EE Make)	Replaced with Siemens make numerical relay on 16.10.2023
	220kV Khara		Electromechanical	process of replacing electrochemical relay with numerical relay has been started, it will be completed within 2 3 months.
	220kV Gokul	160MVA ICT-1	Electromechanical (Diff and O/C)	
	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 RAPPC	220KV Anta line	Backup relay: Static relay(RAPDK3)	Completed
	220kV NAPP	NAPP-SAMBHAL		Completed
		NAPP-SIBHOLI		Completed
		NAPP-DIBAI		Completed
		NAPP-KHURJA		Completed
		NAPP-ATRAULI		Completed

Status of protection relay type				
Constituent Name	**Name of Station**	**Element Name**	**Present Status**	**Remark**
Uttarakhand	220kV Rishikesh	SIDCUL line	Main-II is not installed	
		Chamba line		
		Dharasu line-2		
	220kV Chamba	Rishikesh line		
HP	220kV MattaSidh	220kV transformer bank-1 & 2	Static relay	
Rajasthan	220 kV GSS Sanganer	220 kV HEERAPURA	Static	
	220 kV GSS Phulera	220 KV HEERAPURA	Static	Replaced by numerical relay
		220 kV Makrana	Static	
	220 KV GSS CHOMU	220 kV Heerapura	Static	
		220 kV Reengus Line	Static	
	220 kV GSS Kukas	**220 kV Manoharpur Line**	**Static**	**Replaced by numerical relay**
		220 kV Alwar Line	Static	
	220kV GSS Dausa	220 kV SawaiMadhopur Line	Static	
		220 kV Bassi-I Line	Static	
		220 kV Bassi-II Line	Static	
		220 kV Alwar Line	Static	
		220 kV Mandawar Line	Static	
	220KV BHARATPUR GSS	**220 KV DHOLPUR**	**Static**	**Replaced by numerical relay**
	220 KV GSS SAKATPURA	220 kV ANTA(NTPC)	Static	
	220 KV DAHRA	220 kV BARAN	Static	
		220 kV SAKATPURA	Static	
	220KV GSS MODAK	220 kV RANPUR	Static	
		220 kV Jhalawar	Static	
	220 KV GSS JHALAWAR	220 kV Modak	Static	
	220KV GSS HINDAUN	220KV Sikrai Line	Static	relay defective
	220KV GSS DHOLPUR	**220 kV DCPP**	**Static**	**Replaced by numerical relay**
	220 KV GSS Reengus	220 KV Laxmangarh	Static	
	220 KV GSS Nagour	220KV NOKHA	Static	
		220KV KUCHERA	Static	
	220KV GSS Kankroli	220 KV PGCIL-I	Static	
	220 KV GSS SIROHI	220 KV (400) KV PGCIL Bhinmal	Static	
	220 KV GSS SIROHI	220 KV Jalore	Static	
	220 KV GSS BHINMAL	220 KV (400) KV PGCIL Bhinmal-I	Static	
	220 KV GSS BALI	**220kV Sirohi**	**Static**	**Replaced by numerical relay**
	220 KV GSS Suratgarh	220 KV STPS-I	Static	
		220 KV STPS-II	Static	
		220 KV Hanumangarh Line	Static	
	220 KV GSS Sri Ganganagar	**220 KV Hanumangarh Line**	**Static**	**Replaced by numerical relay**
	220 KV GSS Hanumangarh	220 KV Suratgarh	Static	
	220KV GSS Ratangarh	220KV Rawatsar	Static	
	220KV GSS Ratangarh	220KV Halasar	Static	
	220KV GSS Ratangarh	220KV InterConnector-I	Static	
	220KV GSS Ratangarh	220KV InterConnector-II	Static	
	220KV GSS Sujangarh	220KV Ratangarh	Static	
	220 KV GSS Bikaner	220 KV Badnu Line	Static	
	220 KV GSS Bikaner	220 KV Interconnector-I Line	Static	
	220 KV GSS Bikaner	220 KV Spare Line	Static	
	220kV Madanpur	220/66kV 100 MVA PTF T-1	Electromechanical	Working properly, need to be replace with numerical relay
		220/66kV 100 MVA PTF T-1 A	Electromechanical Except Differential relay (Numerical)	Working properly, need to be replace with numerical relay
		220kV Bus-Coupler	All relays are Numerical	New 220 KV C&R panel replaced on dated 26.05.2022
		220/66kV 100 MVA PTF T-1 A	Electromechanical Except Differential relay (Numerical)	Working properly, need to be replace with numerical relay
	220 KV S/Stn Shahbad	100 MVA 220/66 KV T/F T-1	All relays are electromechical and static	New C&R panel laying at S/Stn.for commissioning
		220 KV Bus Coupler	Electromechanical	Working properly, need to be replace with numerical relay
	220 KV S/STnTepla	220KV Bus Coupler	Electromechanical	Working properly, need to be replace with numerical relay
		220KV Jorian -DCRTPP Ckt-1	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220KV Jorian -DCRTPP Ckt-2	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220KV Jorian -Shahbad Ckt-1	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay

Haryana	220KV S/Stn Jorian	220KV Jorian -Shahbad Ckt-2	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220KV Jorian -Abdullapur Ckt-1	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220KV Jorian -Abdullapur Ckt-2	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220/66, 160MVA T/F T-1	Defferntial Relay = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220/66, 100MVA T/F T-2	All Electromechanical	Working properly, need to be replace with numerical relay
		220/66, 100MVA T/F T-3	Defferntial & REF Relay = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
	220 kv Salempur	220 KV BAKANA–SALEMPUR CKT-I	All electromechanical type,except DPR relays	Working properly, need to be replace with numerical relay
		220 KV BAKANA–SALEMPUR CKT-II	All electromechanical type,except DPR relays	Working properly, need to be replace with numerical relay
		220 KV SALEMPUR-NISSING CKT-I	All electromechanical type,except DPR relays	Working properly, need to be replace with numerical relay
		220 KV SALEMPUR-NISSING CKT-II	All electromechanical type,except DPR relays	Working properly, need to be replace with numerical relay
		220 KV BUS-COUPLER	All electromechanical type	Working properly, need to be replace with numerical relay
		220/66 KV 100MVA T/F T-I	All electromechanical type,except Differential relays	Working properly, need to be replace with numerical relay
		220/66 KV 100MVA T/F T-2	All electromechanical type,except Differential relays	Working properly, need to be replace with numerical relay
	TS Division Karnal	220kV Nissing-PTPS Ckt-I	Main-1 & Main-2 = Numerical, other (O/C+E/F) Electromechanical	Only Backup relays are electromechenical
		100 MVA 220/132kV T-8	R.E.F & Differential relays are Numerical, other (O/C+E/F) Electromechanical	Working properly, need to be replace with numerical relay
		220 kV Bus-coupler	Bus bar protection and panel relay are Numerical	all relay are Numerical type
		220 KV DCRTPP–UNISPUR CKT-I	Main-1 & Main-2 = Numerical, other (O/C+E/F) Electromechanical	Only Backup relays are electromechenical relays need to be replaced with numerical
		220 KV DCRTPP–UNISPUR CKT-II	Main-1 & Main-2 = Numerical, other (O/C+E/F) Electromechanical	Only Backup relays are electromechenical
		220 KV KARNAL–UNISPUR LINE	Main-1 & Main-2 = Numerical, other (O/C+E/F) Electromechanical	Only Backup relays are electromechenical
		220/132 KV 100 MVA T/F T-1	R.E.F & Differential relays are Numerical, other (O/C) Electromechanical	Working properly, need to be replace with numerical relay
		220/132 KV 100 MVA T/F T-2	R.E.F & Differential relays are Numerical, other (O/C) Electromechanical	Working properly, need to be replace with numerical relay
		220/132 KV 160 MVA T/F T-4	R.E.F & Differential relays are Numerical, other (O/C) Electromechanical	Working properly, need to be replace with numerical relay
	220kV S/Stn Palla	100MVA 220/66kV T-1	differencial numerical, REF & Backup electromechanical	Working properly, need to be replace with numerical relay
		100MVA 220/66kV T-2	differencial numerical, REF & Backup electromechanical	Working properly, need to be replace with numerical relay
		100MVA 220/66kV T-7	differencial & Backup electromechanical, REF static	Working properly, need to be replace with numerical relay
		220kV Palla - Sector 78	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
		220kV Palla - FGPP ckt-II	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
	220 kV S/Stn. Pali	100 MVA 220/66 kV T-1	differencial numerical, REF & Backup electromechanical	Working properly, need to be replace with numerical relay
		100 MVA 220/66 kV T-3	differencial numerical, REF & Backup electromechanical	Working properly, need to be replace with numerical relay
		220 kV Pali-BBMB Samaypur Ckt 1	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
		220 kV Pali-BBMB Samaypur Ckt 2	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
		220 kV Pali-Sector 46 Ckt 1	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
		220 kV Pali-Sector 46 Ckt 2	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
		220 kV Pali-Sector 65 Ckt 1	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
		220 kV Pali-Badshahpur Ckt 2	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
		220 kV Pali-Sector 56 Ckt 1	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
		220 kV Pali-Sector 56 Ckt 2	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
	220kV S/Stn Palwal	220/66kV 160MVA T-1 T/F	differencial numerical, REF & Backup electromechanical	Working properly, need to be replace with numerical relay
		220/66kV 100MVA T-2 T/F	all electromechanical	Working properly, need to be replace with numerical relay
		220kV Prithala Palwal Ckt I	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
		220kV Prithala Palwal Ckt II	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
	220kv S/Stn. Sector 52A GGM	Sec 56-Sec 52A ckt 1	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
		Sec 56-Sec 52A ckt 2	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
		Sec 72-Sec 52A	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
		Sec 57-Sec 52A	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
	220kV Sonipat	220KV Barhi-Sonepat Line	DPR numerical, Backup electromechanical	Working properly and the respective C&R panels are to be changed with new C&R panels having all numerical /digital relays. The estimate 220/132KV 100MVA T-4 T/F is sanctioned and others is under preparation to replace the same.
		220/132KV 100MVA T-3 T/F	Differencial,REF and O/C ,E/F relays are Electromechanical	
		220/132KV 100MVA T-4 T/F	Differencial,REF and O/C ,E/F relays are Electromechanical	
		220/132KV 100MVA T-5 T/F	Differencial,REF and O/C ,E/F relays are Electromechanical	

	220kV Rohtak	220 KV Rohtak - Kabulpur line	DPR numerical but E/F are conventional	The Numerical O/c has been replaced.
		220 KV Rohtak - Sampla line	DPR numerical but E/F are conventional	
		220 KV Rohtak - PTPS Ckt-1	DPR numerical but E/F are conventional	
		220 KV Rohtak - PTPS Ckt-2	DPR numerical but E/F are conventional	
		100 MVA, 220/132 KV T-3 T/F,	Differential relay numerical but O/C conventional.	The relay has been replaced with the numerical relay.
		100 MVA, 220/132 KV T-4 T/F,	Differential relay numerical but O/C and REF conventional.	
		100 MVA, 220/132 KV T-6 T/F,	Differential relay numerical but O/C and REF conventional.	
		220kV Bus-Coupler	all relays are conventional	The Numerical O/c has been replaced.
	220kV Nuna Majra	220 Kv Nuna Majra-Sampla Ckt-1	DPR Numerical, Earth fault electromechanical	Working properly, need to be replace with numerical relay in Phased manner. The estimates is under sanction to replace the same.
		220 Kv Nuna Majra-Sampla Ckt-2	DPR Numerical, Earth fault electromechanical	
		220 Kv Nuna Majra-PGCIL Ckt-1	DPR Numerical, Earth fault electromechanical	
		220 Kv Nuna Majra-PGCIL Ckt-2	DPR Numerical, Earth fault electromechanical	
		220 Kv Nuna Majra-Sector-107	DPR Numerical, Earth fault electromechanical	
		220 Kv Nuna Majra-Daultabad	DPR Numerical, Earth fault electromechanical	
		100 MVA,220/132 KV T/F T-1	Differential and REF Numerical,Non directional Over Current Electromechanical	
		100 MVA,220/132 KV T/F T-2	Differential and REF Numerical,Non directional Over Current Electromechanical	
		100 MVA,220/132 KV T/F T-4	Differential and REF Numerical,Non directional Over Current Electromechanical	

UP	400 KV S/S Moradabad	400 KV MORADABAD - RAMPUR LINE	LBB- ABB(RAICA) / STATIC	UNDER PGCIL
		400 KV MORADABAD - KASHIPUR LINE	LBB- English Electric(CTIG) / Electromechnical	Will be replaced by July24
		400 KV, TRANSFER BUS	LBB- English Electric(CTIG) / Electromechnical	
		400 KV, BUS COUPLER	LBB- English Electric(CTIG) / Electromechnical	
	220kV S/S BARAUT	220/132kV 200MVA TRANSFORMER-1	REF Protection - Electromechanical	
	220kV S/S BAGHPAT	220/132kV 160MVA TRANSORMER-1	Backup (L.V. Side) - Electromechanical	
	220 kV KHURJA	220/132Kv 200MVA Transformer-I	REF-Static	
	220 kV DEBAI	220/132Kv 100MVA Transformer-I	Numerical	
	220 kV Jahangirabad	220/132Kv 160MVA Transformer-I	REF-Static	
	400KV S/S MURAD NAGAR	220KV LONI LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV FARID NAGAR LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV INTER CONNECTOR-I MURAD NAGAR LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV INTER CONNECTOR-II MURAD NAGAR LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV SAHIBABAD LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV PRATAP VIHAR LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV TBC	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		400KV TBC	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		400KV ALIGARH LINE	LBB RELAY IS ELECTROMECHANICAL.	
		400KV ATOUR LINE	LBB RELAY IS ELECTROMECHANICAL.	
	220KV S/S MURAD NAGAR	220KV BUS COUPLER	O/C RELAY IS ELECTROMECHANICAL	
	400KV S/S Gorakhpur	400KV TBC	Electromechanical	
		220KV TBC	Electromechanical	
	220KV S/S Barahua	220KV PGCIL	Back up relay electromechenical	
	220KV S/S Basti	220 KV Basti Tanda line	67N(2TJM12)(Electromechanical)	
		63MVA Transformer-II	HV Side directional o/c&e/f(Electromechanical)	
	400 KV SS Kasara,Mau	200MVA, 400/132KV ICT-1st	REF & Over flux relay Electromechanical	
		200MVA, 400/132KV ICT-2nd	REF & Over flux relay Electromechanical	
	220 KV SS Substation Hafizpur Azamgarh	160 MVA ICT -1	Electromechanical(EE Make)	Replaced with Siemens make numerical relay on 16.10.2023
	220kV Khara		Electromechanical	process of replacing electrochemical relay with numerical relay has been started, it will be completed within 2-3 months.
	220kV Gokul	160MVA ICT-1	Electromechanical (Diff and O/C)	New panels are available at S/s and replacement work is under process
	220kV Meetai	200MVA ICT-1	Electromechanical (E/F and O/C), Diff:Static	
		200MVA ICT-2	Electromechanical (E/F and O/C), Diff:Static	
	220kV Atrauli	160MVA ICT-1	Electromechanical + Numerical	Tender process is complete.
		160MVA ICT-2	Electromechanical + Numerical	
	220kV Mainpuri	160MVA ICT-1	Electromechanical(REF) + Numerical	New panels are available at S/s and replacement work is under process
		160MVA ICT-2	Electromechanical(REF) + Numerical	
	220kV Panki	220kV Bus coupler	Electromechanical	Under process
	400kV S/S Sultanpur	240 MVA ICT-II	Non Numerical	
		50 MVAR Obra Line Reactor	Non Numerical	
	220kV S/S Sultanpur	220kV B/C	Non Numerical	
		160 MVA T/F-I	Non Numerical	
NPCIL	**220kV RAPPC**	**220KV Anta line**	**Backup relay: Static relay(RAPDK3)**	**Completed**
	220kV NAPP	**NAPP-SAMBHAL**		**Completed**
		NAPP-SIBHOLI		**Completed**
		NAPP-DIBAI		**Completed**
		NAPP-KHURJA		**Completed**
		NAPP-ATRAULI		**Completed**

Details Of Protection Relay

S. No.	Name of Division	Name of Substation	Element Name	Voltage Level	Protection Relays type Static/Electromechnical	Status of Action being taken	
						Tenetative date for replacement of relay	Any other remarks
1	T&CD, Shahjahanpur	220KV S/S Shahjahanpur	220KV Gola line	220KV	Backup Relay Electromechanical	30.06.2024	
		220KV S/S Hardoi	220KV Shahjahanpur line	220KV	Backup Relay Electromechanical	31.07.2024	
2	T&CD, Gonda	132 KV Sub Station Balrampur	132 KV Balrampur-Utraula line	132 kV	Electromechnical	30.05.2024	
			132 KV Balrampur- Chini Mill line	132 kV	Electromechnical	30.05.2024	
		132 KV Sub Station Mankapur	132 kv MCM line	132 kV	Electromechnical	30.05.2024	Main Distance Protection is Numerical but Back Up relay is Electromechanical
		132 KV Sub Station Mankapur	5 MVA Ist(33 KV)	33 kV	Electromechnical	30.05.2024	
			5 MVA Iind(33 KV)	33 kV	Electromechnical	30.05.2024	
		132 KV Sub Station Utraula	132 KV Sub Station Utraula	132 kV	Electromechnical	30.05.2024	Main Distance Protection is Numerical but Back Up relay is Electromechanical
3	T&CD, Sarojini Nagar	400/220kV UNNAO	400 KV UNNAO MOHANLALGANJ LINE	400 KV	STATIC(ABB RXEG21)	31.09.2024	
			400 KV UNNAO BAREILLY 1 LINE	400 KV	STATIC(ABB RXEG21)	31.09.2024	
			400 KV UNNAO BAREILLY 2 LINE	400 KV	STATIC(ABB RXEG21)	31.09.2024	
			400kV UNNAO- PANKI LINE	400 KV	STATIC(ABB RXEG21)	31.09.2024	
			400 KV UNNAO AGRA LINE	400 KV	STATIC(ABB RXEG21)	31.09.2024	
			400/220 KV 315 MVA ICT -1	400/220kV	STATIC(ABB RADSB,RATUB,RADHD), Electromechnical(TJM12)	31.09.2024	
			50MVAR LINE REACTOR ON 400KV AGRA, BAREILLY-I,	400 KV	STATIC(ABB RADHA,RAKZB,RADHD)	31.09.2024	
			63MVAR BUS REACTOR	400 KV	STATIC(ABB RADHA,RAKZB,RADHD)	31.09.2024	
		220/132kV UNNAO	220 KV UNNAO-BITHOOR LINE	220KV	STATIC(ABB RXPE+RXIG)	31.09.2024	
			220 KV UNNAO-RPH LINE	220KV	STATIC(ABB RXPE+RXIG)	31.09.2024	
			220 KV UNNAO-GIS KANPUR ROAD LINE	220KV	STATIC(ABB RXPE+RXIG)	31.09.2024	
			220/132 KV 160 MVA ICT -1	220/132kV	STATIC(ABB RADSB,RATUB,RADHD), Electromechnical(TJM12)	31.09.2024	
			220/132 KV 160 MVA ICT -2	220/132kV	STATIC(ABB RADSB,RATUB,RADHD), Electromechnical(TJM12)	31.09.2024	
		220kV Sarojini Nagar	132kV TRT-1	132kV	Electro-Mechanical (EASUN REYROLLE (TJM12))	31.09.2024	
			132kV TRT-2	132kV	Electro-Mechanical (EASUN REYROLLE (TJM12))	31.09.2024	
			132kV RAHIMABAD	132kV	Electro-Mechanical (EASUN REYROLLE (2TJM12))	31.09.2024	
			132kV SGPGI-1	132kV	Electro-Mechanical (EASUN REYROLLE (2TJM12))	31.09.2024	
			132kV BIJNOUR	132kV	Electro-Mechanical (EASUN REYROLLE (2TJM12))	31.09.2024	
			200MVA T/F-2	132kV	Electro-Mechanical (AREVA (CAG14AF12A))	31.09.2024	
4	T&CD, Sultanpur	400kV S/S Sultanpur	400/220kV, 240MVA ICT-II	400/220kV	Diff.:- (English Electric- DTH32), O/C&E/F:- (English Electric type-CDD)	31.08.2024	
			50MVAR Obra line Reactor	400kV	Diff.:- (English Electric type-CAG), Backup:- (English Electric type-YTG33)	30.09.2024	
		220kV S/S Sultanpur	220kV Bus Coupler	220kV	English Electric type-CDG	31.07.2024	
			220/132kV, 160MVA T/F-I	220/132kV	Diff.:- (English Electric DMH3232DF1A5), O/C&E/F (HV):- (English Electric CDG 61EG8081BX), O/C&E/F (LV):- (English Electric CDG 31EG164A5), REF:- (English Electric CAG 14AF12A)	30.06.2024	
5	T&CD, Bareilly	400KV S/S Bareilly	315 MVA ICT-1	400/220KV	Diff/ REF/ Over flux,/ LBB/ HV & LV Backup Relay Electromechanical	Requisition of relay sent	
			80 MVAR Bus Reactor	400 KV	Diff/ REF/ Backup Impedance Relay Electromechanical	Requisition of relay sent	
			220 KV CB GANJ Ckt-1	220 KV	DIR E/F & LBB RELAY STATIC	Requisition of relay sent	
			220 KV PANTNAGAR	220 KV	DIR E/F & LBB RELAY STATIC	Requisition of relay sent	
			220 KV PILIBHIT CKT-2	220 KV	DIR E/F & LBB RELAY STATIC	Requisition of relay sent	
		220 KV S/S CB Ganj	200/132 KV 200 MVA T/F-II	220KV	Main Reyrolle Duo Bias M / Backup(ERL-Electro Mechanical)	Requisition of relay sent	
6	T&CD, Lucknow	220 KV CHINHAT	220/132 KV 200 MVA T/F-II ADITYA	220KV	ELECTROMECHENICAL (ESUN REYROLL, 2TJM12,2TJM12)REF,HV &LV BU		
		220 KV GOMTINAGAR	220/33 KV 60 MVA T/F -I	220KV	ELECROMECHENICAL AREVA MAKE HV & LV REF		
			220/33 KV 60 MVA T/F -II	220KV	ELECROMECHENICAL AREVA MAKE HV & LV REF		
			220/33 KV 60 MVA T/F -III	220KV	ELECROMECHENICAL AREVA MAKE HV & LV REF		

Annexure-XIV

~~Annex V~~

Status of Recording Instruments (220kV & above stations)						
Sr. No	Station Name	Voltage Level	Disturbance Recorder/Station Event logger healthy (Yes or No)	Standardisation (Yes or No)	Time Sync (Yes or No)	Remarks

Sr No	Element Name	Outage Date	Outage Time	Reason
1	220 KV Anta(NT)-Sakatpura(RS) (RS) Ckt-1	01-Aug-24	05:29	Phase to earth fault B-N. As per PMU and DR (Sakatpura), B-N fault occured, no auto-reclosing is observed. DR not recevied from Anta end.
		09-Aug-24	22:37	Phase to earth fault B-N. As per PMU and DR (Sakatpura), B-N fault occured, no auto-reclosing is observed. DR not recevied from Anta end.
		13-Aug-24	21:39	Phase to earth fault B-N. As per PMU and DR (Sakatpura), B-N fault occured, no auto-reclosing is observed. DR not recevied from Anta end.
		14-Aug-24	08:33	Phase to earth fault B-N. As per PMU and DR (Sakatpura), B-N fault occured, no auto-reclosing is observed. DR not recevied from Anta end.
2	220 KV DandhariKalanI(PS)-Ludhiana(PG) (PSTCL) Ckt-2	01-Aug-24	01:37	Phase to Phase Fault R-B. As per PMU & DR, R-N fault occured, no auto-reclosing is observed.
		06-Aug-24	14:23	Phase to earth fault B-N. As per PMU & DR, B-N fault occured, no auto-reclosing is observed.
		26-Aug-24	21:52	Phase to earth fault R-N. As per PMU & DR, R-N fault occured, no auto-reclosing is observed.
3	220 KV NAPP(NP)-Khurja(UP) (UP) Ckt-1	14-Aug-24	23:09	Phase to earth fault R-N. As per PMU and DR, R-N fault occurred with no A/R operation at Khurja end and successful A/R operation at NAPP end is observed. dat/cfg file of DR not received from NAPP end.
		17-Aug-24	10:16	Phase to earth fault R-N. As per PMU and DR, R-N fault occurred with no A/R operation at Khurja end and successful A/R operation at NAPP end is observed. dat/cfg file of DR not received from NAPP end.
		21-Aug-24	15:14	Phase to earth fault R-N. As per PMU, R-N fault occured, no auto-reclosing is observed. As per DR (Khurja end), R-N fault is observed in zone-3. As reported, line tripped on zone-3 distance protection from Khurja end only due to fault on 220kV Khurja-Debari line.
		24-Aug-24	08:54	Phase to earth fault R-N. As per PMU and DR (NAPP end), B-N fault with no A/R operation is observed. DR of Khurja end not received.
		24-Aug-24	20:54	Phase to earth fault R-N. As per PMU and DR, B-N fault with no A/R operation is observed. As reported, tripping time was 22:42hrs.
		28-Aug-24	05:16	Phase to earth fault B-N. As per PMU, no fault is observed. As per DR of NAPP end, B-N fault is observed. DR not received from Khurja end. Dat/cfg file of DR not received from NAPP end.
4	220 KV Saharanpur(PG)-Shamli(UP) (UP) Ckt-1	01-Aug-24	03:37	Phase to earth fault R-N. As per PMU and DR (Saharanpur end), R-N fault with no A/R operation at Saharanpur end and successful A/R operation at Shamli end. DR of Shamli end not received.
		11-Aug-24	22:09	Phase to earth fault R-N. As per PMU and DR, R-N fault with no A/R operation at Saharanpur end and successful A/R operation at Shamli end.
		13-Aug-24	05:13	Phase to earth fault Y-N. As per PMU and DR, Y-N fault with no A/R operation at Saharanpur end and successful A/R operation at Shamli end.
		17-Aug-24	23:58	Earth fault. As per PMU and DR (Shamli end), B-N fault with no A/R operation at Saharanpur end and successful A/R operation at Shamli end. DR of Saharanpur end not received.
5	400 KV Agra-Unnao (UP) Ckt-1	03-Aug-24	01:53	Phase to earth fault Y-N. As per PMU, Y-N fault occured, no auto-reclosing is observed.
		12-Aug-24	18:03	Phase to earth fault R-N. As per PMU and DR, R-N fault with unsuccessful A/R operation at Unnao end is observed.
		28-Aug-24	04:37	Phase to earth fault R-N. As per PMU and DR, R-N fault is observed with A/R operation started from both ends. Line succussfully closed from agra end and finally line tripped from Unnao end.
		28-Aug-24	08:05	Over Voltage. DR not received from both ends.
6	400 KV Bhadla-Merta (RS) Ckt-1	02-Aug-24	07:31	Phase to Phase Fault R-Y. As per PMU, R-Y fault is observed. DR of Bhadla end is not readable. DR not received from Merta end.
		02-Aug-24	18:06	Phase to Phase Fault R-Y. As per PMU and DR (Merta end), R-Y fault is observed. DR of Bhadla end is not readable. Time sync issue in DR of Merta end.
		04-Aug-24	15:37	Phase to Phase Fault Y-B. As per PMU, R-Y fault is observed. As per DR (Merta), Y-B fault is observed. DR of Bhadla end is not readable. Time sync issue in DR of Merta end.
		13-Aug-24	15:48	Phase to Phase Fault Y-B. As per PMU, R-Y fault is observed. As per DR (Merta), Y-B fault is observed. DR of Bhadla end is not received.
		27-Aug-24	17:44	DT received & 86 relay operated at Merta end. As per PMU, no fault is observed only fluctuation in voltage is observed. DR of Bhadla end is not readable. DR of Merta end is not received.
7	400 KV Dadri(NT)-Panipat(BB) (PG) Ckt-1	02-Aug-24	05:25	Phase to earth fault B-N. As per PMU and DR, Y-N fault with no A/R operation at Dadri end and successful A/R operation at Panipat end. Dat/cfg file of DR of Dadri end not received.
		18-Aug-24	03:24	Earth fault. As per PMU and DR (Panipat end), Y-N fault with no A/R operation at Dadri end and successful A/R operation at Panipat end. DR of Dadri end not received.
		20-Aug-24	10:51	Phase to earth fault R-N. As per PMU, B-N fault and unsuccessful auto-reclosing observed. As per DR of Dadri end, R-N fault is observed. As per DR of Panipat end, B-N fault with unsuccessful A/R operation at Panipat end is observed. Dat/cfg file of DR of Dadri end not received.

Sr No	Incident/tripping	Outage Date	Outage Time	Reason	Remedial actions
1	Frequent tripping of 220 KV Khara(UP)-Saharanpur(PG) (UP) Ckt-1 during July24	06-Jul-24	12:15	Phase to earth fault B-N. As per PMU, fluctuation in voltage is observed, no fault in the system. DR not received from both ends.	static/electromechanical relays at Khara(UP) will be replaced by numerical relay
		07-Jul-24	16:37	Phase to earth fault B-N. As per PMU and DR (of Saharanpur end), B-N fault with no A/R operation at Saharanpur end and successful A/R operation at Khara end is observed. DR not received from Khara end.	
		08-Jul-24	19:41	Phase to earth fault R-N. As per PMU and DR (of Saharanpur end), R-N fault with delayed fault clearance time of 560ms and no A/R operation at Saharanpur end is observed. DR not received from Khara end.	
		18-Jul-24	17:06	Phase to earth fault B-N. As per PMU and DR (of Saharanpur end), Y-N fault with no A/R operation at Saharanpur end and unsuccessful A/R operation at Khara end is observed. DR not received from Khara end.	
		28-Jul-24	11:02	Phase to earth fault R-N. As per PMU, R-N fault occured, no auto-reclosing is observed.. As per DR (of Saharanpur end), R-Y fault is observed. Time sync issue in DR of Saharanpur end and DR not received from Khara end.	
2	Frequent tripping of 400 KV Bikaner-Bhadla (RS) Ckt-1 during July24	04-Jul-24	14:18	Phase to earth fault Y-N. As per PMU, R-N fault occured, no auto-reclosing is observed.	a) issue in BCU at Bikaner end due to which command is not reaching to breaker. b) dead time setting in A/R, it seems that it is kept as 600msec which need to be ~1sec
		05-Jul-24	16:12	Phase to earth fault B-N. As per PMU, B-N fault and unsuccessful auto-reclosing observed. Auto-reclosing time is 600msec.	
		11-Jul-24	22:27	Transient fault. As per PMU, no fault is observed. As per DR of Bikaner end, Y-N fault is observed and line tripped on DT received from the remote end before completion of auto-reclosing action.	
3	Multiple elements tripping event at Baghpat(PG) & Baghpat(UP)	1-Jul-24	21:37	i)220kV Baghpat(UP) has main and transfer bus scheme at 220kV level. ii)During antecedent condition, incoming power at Baghpat(UP) was approx. 80 MW through 220 KV Baghpat(PG)-Baghpat(UP) (UP) Ckt-1 & 2. 220 KV Baghpat(PG)-Baghpat(UP) (UP) D/C, 220/132kV 160MVA ICT-1 and 220/132kV 100MVA ICT-2 were connected to 220kV main bus. 220 KV Baghpat(PG)-Baghpat(UP) (UP) D/C is on the same towers. iii)As per SCADA SOE, 220 KV Baghpat(PG)-Baghpat(UP) (UP) Ckt-2 tripped at 21:37:59.415hrs and 220 KV Baghpat(PG)-Baghpat(UP) (UP) Ckt-1 tripped at 21:37:59.535 hrs. iv)As reported, at 21:37 hrs, 220 KV Baghpat(PG)-Baghpat(UP) (UP) Ckt-2 tripped on Y-B-N double phase to earth fault and line tripped on zone-1 distance protection operation from both ends. As per Baghpat(UP) reporting, initially a B-ph fault occurred on 220 KV Baghpat(PG)-Baghpat(UP) (UP) Ckt-2 with fault current - 10.39kA in zone-1. At the same time, jumper at tower no 45 of 220 KV Baghpat(PG)-Baghpat(UP) (UP) Ckt-2 got broken which created line-line (Y-B) fault due to which line got tripped from both ends. v)Further 220 KV Baghpat(PG)-Baghpat(UP) (UP) Ckt-1 also tripped on B-N phase to earth fault with fault current of ~9.7kA and fault distance of 11.8km from Baghpat(PG) end. As per DR of Baghpat(PG) end, B-N phase to earth fault with no A/R operation is observed and line tripped on zone-1 distance protection operation. Since there was no source remaining at 220kV Baghpat(UP) hence 220 KV Baghpat(PG)-Baghpat(UP) (UP) Ckt-1 didn't trip from Baghpat(UP) end. vi)As per PMU at Meerut(PG), Y-B phase to phase fault with fault clearance time of 80ms is observed. vii)Due to tripping of 220 KV Baghpat(PG)-Baghpat(UP) (UP) Ckt-1 & 2, Baghpat(UP) lost its connectivity from the grid and 220kV Baghpat(UP) S/s became dead. viii) As per SCADA, change in demand of approx. 68 MW in UP control area. However, SLDC-UP reported 80MW load loss.	A/R operation ot observed in 220 KV Baghpat(PG)-Baghpat(UP) (UP) Ckt-1 tripped on B-N fault.
4	Multiple elements tripping event at Ziankote(J&K) & Amargarh(INDIGRID)	18-Jul-24	11:01	i)220/132kV Ziankote S/s have two bus at 220kV side i.e., main bus & reserve bus. 220kV Amargarh-Ziankote ckt-1&2 are on the same tower (D/C tower) and line length is ~21.4km. ii)During antecedent condition, 220kV Amargarh(INDIGRID) –Ziankote(JK) D/C was carrying 109 MW each and feeding Ziankote load.	Status of carrier communication and A/R scheme implementation at Ziankote end. Z-2 time delay setting at Amargarh end.
		26-Aug-24	13:53	i)220/132kV Ziankote S/s have two bus at 220kV side i.e., main bus & reserve bus. 220kV Amargarh-Ziankote ckt-1&2 are on the same tower (D/C tower) and line length is ~21.4km. ii)During antecedent condition, 220kV Amargarh(INDIGRID) –Ziankote(JK) D/C was carrying 104 MW each and feeding Ziankote load. iii)As reported, at 13:53 hrs, 220 KV Amargarh(INDIGRID)-Ziankote(JK) (PDD JK) Ckt-2 tripped from both ends on R-Y phase to phase fault with fault distance of 6.6km and fault current of Ir=~2.15kA & Iy=~2.37kA from Ziankote(JK) end. 220 KV Amargarh(INDIGRID)-Ziankote(JK) (PDD JK) Ckt-1 tripped only from Amargarh(INDIGRID) end on the same R-Y phase to phase fault (Exact reason of fault is yet to be received). iv)As per DR of Amargarh(INDIGRID) end of 220 KV Amargarh (INDIGRID)-Ziankote(JK) (PDD JK) Ckt-1, R-Y phase to phase fault is observed in zone-2 with fault current of Ir=~2.5kA & Iy=~2.1kA. v)As per DR of Amargarh(INDIGRID) end of 220 KV Amargarh (INDIGRID)-Ziankote(JK) (PDD JK) Ckt-2, R-Y phase to phase fault is observed in zone-1 with fault current of Ir=~5.2kA & Iy=~4.9kA. vi)As confirmed by Amargarh(INDIGRID), in view of non-availability of carrier communication and A/R scheme at Ziankote end, A/R has been kept disabled at Amargarh end and time delay of Z-2 also kept as instantaneous at Amargarh end. vii)As per PMU at Amargarh(PG), R-Y phase to phase fault which cleared within 120 msec is observed. viii)As per SCADA, change in demand of approx. 180MW is observed in J&K control area.	
5	Multiple elements tripping event at Patiala(PG)	19-Jul-24	18:50	i)400/220kV Patiala(PG) has one and half bus scheme at 400kV level and double main & transfer bus scheme at 220kV level. ii)During antecedent condition, 400/220kV 315 MVA ICT-1 & 500 MVA ICT-3, 220kV Bahadurgarh-I, Nabha-I, Ablowal-I were connected at 220kV Bus-1 and 400/220kV 315 MVA ICT-2 & 500 MVA ICT-4, 220kV Bahadurgarh-II, Nabha-II, Ablowal-II were connected at 220kV Bus-2. 400/220kV ICT-1,2,3 & 4 were carrying approx. 156MW, 153MW, 243MW & 238 MW respectively. 220kV D/C to Nabha, Bahadurgarh & Ablowal were carrying approx. 171MW, 98MW & 127MW respectively per circuit. iii)As reported at 18:50 hrs, B-N phase to earth fault occurred on 220 KV Patiala(PG)-Nabha(PS) (PSTCL) Ckt-1. Fault location was ~7.3km from Nabha end. Distance protection at Patiala end sensed fault in Z-2 and initiated tripping command however, breaker at Patiala end failed to open. This further led to the operation of LBB protection of Nabha-I bay at Patiala(PG). iv)On the result of LBB protection operation, 400/220kV 315 MVA ICT-1, Ablowal-I, bus coupler tripped however, 400/220kV 500 MVA ICT-3 & 220kV Bahadurgarh-I didn't trip. v)Further, 400/220kV 500 MVA ICT-3 tripped on over current earth fault protection operation and 220kV Bahadurgarh-I tripped from Bahadurgarh end only. vi)Further, at the same time, Nabha-II, Ablowal-II also tripped due to overloading. vii)At 18:50:33 hrs, 220 KV Bahadurgarh(PS)-Patiala(PG) (PSTCL) Ckt-2 tripped on another B-N fault. As reported, fault occurred due to conductor snapping at distance ~1.5km from Bahadurgarh end. viii)As per PMU at Patiala(PG), B-N phase to earth fault at 18:50:15 hrs & 18:50:33 hrs with fault clearance time of 2400 msec at 18:50:15 hrs and 120 msec at 18:50:33 hrs is observed. ix)As per SCADA, change in demand of approx. 245MW is observed in Punjab control area. x)As reported by POWERGRID(NR-2), CB operating mechanism problem of 220kV Nabha-I line has been rectified and reason of non-tripping of 400/220kV 500 MVA ICT-3 & 220kV Bahadurgarh-I at Patiala(PG) on LBB operation is under investigation.	Status of replacement of bus bar relay
6	Multiple elements tripping event at Mandaula(PG), Bawana(DTL) & Maharani Bagh(PG)	28-Jul-24	18:24	i)400 KV Mandaula(PG)-Maharani Bagh(PG) (DTL) D/C and 400 KV Bawana(DTL)-Maharani Bagh(PG) (DTL) D/C are on same towers. ii)During antecedent condition, incoming power at Maharani Bagh(PG) through 400 KV Mandaula(PG)-Maharani Bagh(PG) (DTL) D/C and 400 KV Bawana(DTL)-Maharani Bagh(PG) (DTL) Ckt-1 was approx. 295 MW and 292 MW respectively (as per SCADA). iii)As reported, at 18:24 hrs, 400 KV Bawana(DTL)-Maharani Bagh(PG) (DTL) Ckt-1 and 400 KV Mandaula(PG)-Maharani Bagh(PG) (DTL) Ckt-2 tripped on Y-B phase to phase fault and at the same time 400 KV Mandaula(PG)-Maharani Bagh(PG) (DTL) Ckt-1 also tripped from Mandaula(PG) end (reason of tripping is yet to be received). iv)During patrolling of Ckts, it was found that Y-B phase to phase fault occurred on 400 KV Bawana(DTL)-Maharani Bagh(PG) (DTL) Ckt-1 and 400 KV Mandaula(PG)-Maharani Bagh(PG) (DTL) Ckt-2 due to kite thread. v)As per PMU at Maharani Bagh(PG), Y-B followed by Y-B phase to phase fault with fault clearing time of 120msec & 120msec is observed. vi)As per DR of Bawana(DTL) end of 400 KV Bawana(DTL)-Maharani Bagh(PG) (DTL) Ckt-1, Y-B phase to phase fault (Iy=~9.8kA & Ib=~10.3kA) sensed in zone-2 with carrier signal received is observed. Fault distance was 39.58km from Bawana(DTL) end (as reported). vii)As per SCADA, change in demand of approx. 95 MW in Delhi control area.	Reason of tripping of 400 KV Mandaula(PG)-Maharani Bagh(PG) (DTL) Ckt-1
7	Multiple elements tripping event at Nara(UP)	11-Aug-24	18:25	i)220kV Nara(UP) has main and transfer bus scheme at 220kV level. ii)During antecedent condition, loading at Nara(UP) S/s was approx. 80 MW. Loading of 220/132kV 160 MVA ICT-1 & 220/132kV 200 MVA ICT-2 at Nara(UP) S/s were approx. 35 MW and 45 MW respectively. iii)As reported, at 18:25 hrs, 220 KV Meerut(PG)-Nara(UP) (PG) Ckt tripped from Meerut(PG) end on B-N phase to earth fault with fault distance of 10.5 km (33.02%) from Meerut(PG) end with fault current of Ib=14.05kA. iv)On this fault, B-phase pole of CB of 220 KV Meerut(PG)-Nara(UP) (PG) Ckt at Nara(UP) end got stuck and could not open properly. On this, LBB of Meerut bay at Nara(UP) S/s operated which led to tripping of 220kV line from Nara(UP) to Roorkee(UK), 200/132kV 160 MVA ICT-1 and 200 MVA ICT-2 at Nara(UP) S/s. v)As reported, during inspection (at Nara(UP) S/s) it was found that tripping command was issued to both 220kV Muzaffarnagar and 220kV Jansath bay also but their breakers were not tripped (cable found broken) hence both these lines were tripped from other end in zone -3. vi)As per PMU at Muzaffarnagar(UP), B-N phase to earth fault with delayed fault clearance time of 1240msec is observed. vii)As per DR of Meerut end of 220 KV Meerut(PG)-Nara(UP) (PG) Ckt, B-N phase to earth fault with fault current of Ib=~12.3kA with unsuccessful A/R operation is observed. Zone-1 distance protection operated from Meerut(PG) end. viii) Due to LBB operation at Nara(UP) S/s and tripping of 220 KV Nara-Jansath (UP) Ckt & 220 KV Nara-Muzaffarnagar (UP) Ckt from remote ends, Nara(UP) S/s lost its connectivity from Grid which led to blackout at 220kV Nara(UP) S/s. ix) As reported, no fault record found at Nara(UP) S/s. During inspection, it was found that DC main fuse of relay panel was blown off. x) As per SCADA, change in demand of approx. 70 MW & 40 MW in UP and Uttarakhand control area respectively. However, SLDC-UP has reported load loss of approx. 80 MW at Nara(UP) S/s.	Status of work related to relay communication cables replacement of Muzaffarnagar & Jansath Ckt bay at Nara(UP) S/s.

8	Multiple elements tripping event at Vishnuparyag HPS	25-Aug-24	04:25	i)During antecedent condition, 400 kV Muzaffarnagar(UP)-Vishnuprayag(UP) (UP) Ckt, 110 MW Unit-1 & 4 at Vishnuprayag(UP) were connected to 400kV Bus-1 at Vishnuprayag(UP) and 400 kV Alaknanda(UP)-Vishnuprayag(UP) (UP) Ckt, 110 MW Unit-2 & 3 at Vishnuprayag(UP) were connected to 400kV Bus-2 at Vishnuprayag(UP). 400 kV Vishnuprayag (UP)- Muzaffarnagar(UP) (UP) Ckt, 400kV Alaknanda-Muzaffarnagar ckt and 400kV Vishnuprayag-Alaknanda ckt were carrying ~343 MW, ~462 MW & 86 MW respectively. ii)As reported, at 04:25 hrs, 400 kV Muzaffarnagar(UP)-Vishnuprayag(UP) (UP) Ckt tripped on Y-B phase to phase fault. Fault occurred due to tree falling on the line between tower location no. 102 & 103, tower base at location no. 102 also got damaged due to land slide. Fault distance was ~225km (~79%) from Muzaffarnagar end. iii)Further after ~50msec, 400kV bus coupler at Vishnuprayag HEP tripped on over current stage-2 (DT) protection operation. iv)With the tripping of 400kV Bus coupler at Vishnuprayag HEP, 110 MW Unit-1 & 4 at Vishnuprayag HEP also tripped due to loss evacuation path. v)As per PMU at Muzaffarnagar(UP) and line DR files, Y-B phase to phase which cleared within 80msec is observed. Fault was in Z-1 from Vishnuprayag end. vi)As per SCADA, generation loss of ~220MW occurred at 110 MW Unit-1 & 4 at Vishnuprayag HEP due to tripping of 110 MW Unit-1 & 4. vii)As tower base at location no. 102 of 400 kV Muzaffarnagar(UP)-Vishnuprayag(UP) (UP) Ckt damaged during the event, line was taken under emergency shutdown after the event. Unit-1&4 were revived by 06:00 hrs and taken into service through 400kV Bus-2. Generation evacuated through 400kV Vishnuprayag-Alaknanda ckt & 400kV Alaknanda-Muzaffarnagar ckt path. viii)400 kV Muzaffarnagar(UP)-Vishnuprayag(UP) (UP) Ckt was revived at 17:33 hrs on 27.08.024. 400kV Bus-1 was also taken into service with the revival of 400 kV Muzaffarnagar(UP)-Vishnuprayag(UP) (UP) Ckt.	Status of remedial action taken for issue of O/C protection applied on bus coupler at Vishnuprayag.
9	Multiple elements tripping event at Bawana(DV), Mundka (DV) & Maharanibagh(PG)	31-Aug-24	16:40	i)400kV Bawana(DTL) S/s has one and half breaker bus arrangement at 400kV level. ii)During antecedent condition, incoming power at Bawana(DTL) through 400 KV Bawana-Mundka (DV) Ckt-1 & 2 were approx. 514MW & 503MW respectively and outgoing power from Bawana(DTL) to Maharani Bagh(PG) through 400 KV Bawana(DV)-Maharanibagh(PG) (DTL) Ckt-1 & 2 were approx. 294 MW & 294 MW. iii)As reported, at 16:40 hrs, 400 KV Bawana(DV)-Maharanibagh(PG) (DTL) Ckt-1 tripped on R-Y phase to phase fault with fault distance of 4.71km and with fault current of Ir=~31.38kA & Iy=~29.27kA from Bawana end (Reason of fault is yet to be received). 400 KV Bawana(DV)-Maharanibagh(PG) (DTL) Ckt-1 tripped on zone-1 distance protection from Bawana(DTL) end. iv)As per DR of Bawana(DTL) end of 400 KV Bawana(DV)-Maharanibagh(PG) (DTL) Ckt-1, R-Y phase to phase fault is observed with fault current of Ir=~31.3kA, Iy=~29.3kA and line tripped on zone-1 distance protection. v)As reported, the same fault sensed in zone-1 from Mundka(DTL) end and 400 KV Bawana-Mundka (DV) Ckt-1 & 2 tripped on zone-1 distance protection from Mundka(DTL) end. vi)As per PMU at Maharani Bagh(PG), R-Y phase to phase fault with fault clearing time of 120msec is observed. vii)As per SCADA, change in demand of approx. 105MW is observed in Delhi control area. viii)As reported by SLDC Delhi, the case of over reach of GE D60 relays at Mundka(DTL) S/s is already forwarded to GE company for analysis and necessary corrective recommendations.	Status of remedial action taken for issue of over reaching of distance relays at Mundka(DTL) end.

Annexure-XVII

Tripping events to be discussed in 52nd 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 Chinhat-Satrikh Road (UP) Ckt 2)220 KV Chinhat-Gomtinagar (UP) Ckt 3)220 KV Chinhat-Kursi Road (UP) Ckt 4)220 KV Chinhat(UP)-Lucknow_1(PG) (UP) Ckt	Uttar Pradesh	PGCIL, UPPTCL	1-Jul-24	00:15	i)220kV Chinhat(UP) has main and transfer bus scheme at 220kV level. ii)During antecedent condition, incoming power at Chinhat(UP) was through 220kV Satrikh ckt (~100MW), Kursi Road ckt (~30MW) and Lucknow(PG) ckt (~80MW) and outgoing power was through 220kV Gomatinagar ckt (~30MW) and load at Chinhat(UP) S/s (~90MW). All 220kV lines and ICTs connected to 220kV main bus at Chinhat(UP) S/s. 220kV Chinhat-LMRC D/C is radial line from Chinhat(UP) S/s. iii)As reported, at 00:15 hrs, LA of 220 KV Chinhat-Satrikh Road (UP) Ckt bay burst at Chinhat(UP) S/s which caused R-N phase to earth fault. iv)On this fault 220kV lines from Chinhat(UP) to Satrikh Road (UP), Gomtinagar (UP), Kursi Road (UP) & Lucknow_1(PG) tripped (Reason of tripping and type of protection operated for all elements yet to receive). v)Due to these trippings at Chinhat(UP) S/s, 220kV Chinhat-LMRC D/C, 220/132kV ICT-1 & 2 became dead and blackout occurred at 220kV Chinhat(UP) S/s. vi)As per PMU at Lucknow(PG), R-N phase to earth fault with delayed fault clearance of 440msec is observed (reason for delayed fault clearance yet to receive). vii)As per SCADA, change in demand of approx. 195 MW in UP control area.	0	195	440
2	GI-1	1)220 KV Akal-Akal(Suzlon) (RS) Ckt-2 2)220 KV Akal-Akal(Suzlon) (RS) Ckt-1 3)220 KV Akal-Mulana (RS) Ckt	Rajasthan	RVPNL, Mulana, Suzlon	6-Jul-24	05:26	i)400/220kV Akal(RS) has one and half breaker scheme at 400kV level and double main and transfer bus scheme at 220kV level. ii)During antecedent condition, incoming power at Akal(RS) S/s through 220 KV Akal-Akal(Suzlon) (RS) D/C and 220 KV Akal-Mulana (RS) Ckt were approx. 235 MW and 125 MW respectively. iii)As reported, at 05:26 hrs, R-phase conductor of 220 KV Akal-Akal(Suzlon) (RS) ckt-2 broke at a distance of approx. 160m from Akal(RS) S/s which caused R-N phase to earth fault and subsequently 220 KV Akal-Akal(Suzlon) (RS) ckt-2 tripped on zone-1 distance protection from Akal(RS) end. iv)As per PMU at ASPS1(IP), R-Y phase to phase fault followed by R-N phase to earth fault with fault clearance time of 80msec and 80msec respectively are observed. v)At the same time, 220 KV Akal-Akal(Suzlon) (RS) Ckt-1 and 220 KV Akal-Mulana (RS) Ckt also tripped from Akal(RS) end (Reason of tripping yet to be received). vi)During this event, dip in Rajasthan wind generation of approx. 1800 MW is observed out of which approx. 1150 MW recovered within 10 minutes. (As per SCADA). vii)As per SCADA, no change in demand is observed in Rajasthan control area. viii)As per SCADA, change in Rajasthan wind generation of approx. 168MW is observed.	650	0	80
3	GI-2	1)400 KV Azamgarh-Mau (UP) Ckt 2)400 KV Mau(UP)-Balia(PG) (PG) Ckt 3)400/132 kV 200 MVA ICT 3 at Mau(UP)	Uttar Pradesh	PGCIL, UPPTCL	7-Jul-24	11:44	i)220kV Mau(UP) has double main and transfer bus scheme at 400kV level. ii)During antecedent condition, 400 KV Azamgarh-Mau (UP) Ckt, 400 KV Mau(UP)-Balia(PG) (PG) Ckt & 400/132 kV 200 MVA ICT-3 connected to 400kV bus-1 and 400kV Mau-Rasra (UP) ckt, 400/132/33kV 200MVA ICT-1 & 2 connected to 400kV bus-2. 400 KV Anpara_B(UPUN)-Mau(UP) (UP) Ckt was not in service during the event. iii)As reported, at 11:44 hrs, B-phase CT of 400 KV Azamgarh-Mau (UP) Ckt burst which caused bus fault on 400kV bus-1 which led to bus bar protection operation on 400kV bus-1 at Mau(UP) S/s (Reason for delayed operation of bus bar protection yet to be received). iv)As per PMU at Azamgarh(UP), B-N phase to earth fault converted into Y-B phase to phase fault with delayed fault clearance time of 560ms is observed (Reason for delayed fault clearance is yet to receive). v)Due to bus bar protection operation, all elements connected to 400kV bus-1 (400kV Azamgarh(UP) ckt, Balia(PG) ckt and 400/132 kV 200 MVA ICT-3) tripped at 400kV Mau(UP) S/s. vi)As per SCADA, change in demand of approx. 60 MW in UP control area.	0	60	560
4	GI-2	1)400 KV Varanasi(PG)-Sahupuri(UP) (PG) Ckt-1 2)400 KV Varanasi(PG)-Sahupuri(UP) (PG) Ckt-2 3)400 KV Sahupuri(UP)-Biharshariff(PG) (PG) Ckt-1 4)400 KV Sahupuri(UP)-Biharshariff(PG) (PG) Ckt-2 5)400/220 kV 500 MVA ICT 2 at Sahupuri(UP) 6)132 KV Sahupuri(UP)-Karamnasa(BS) (UP) Ckt-1	Uttar Pradesh	PGCIL, UPPTCL	10-Jul-24	15:54	i)400/220kV Sahupuri(UP) has double main double scheme at 400kV and 220kV level. ii)During antecedent condition at 15:52 hrs, 400 KV Varanasi(PG)-Sahupuri(UP) (PG) Ckt-2, 400 KV Sahupuri(UP)-Biharshariff(PG) (PG) Ckt-1 and 400/220 kV 500 MVA ICT-2 were connected to 400kV bus-1 and 400 KV Varanasi(PG)-Sahupuri(UP) (PG) Ckt-1 and 400 KV Sahupuri(UP)-Biharshariff(PG) (PG) Ckt-2 were connected to 400kV bus-2 at 400kV Sahupuri(UP) S/s. 400/220 kV 500 MVA ICT-1 at Sahupuri(UP) is under installation (commissioning) process. iii)As reported, at 15:54 hrs, Y-N phase to earth fault occurred in GIS compartment at 400kV Sahupuri(UP) (exact location of fault is yet to be received). It is suspected that fault location was in the bay of 400 KV Varanasi(PG)-Sahupuri(UP) (PG) Ckt-2 in GIS compartment at 400kV Sahupuri(UP). iv)On this fault, 400 KV Sahupuri(UP)-Biharshariff(PG) (PG) Ckt-1 & 2 (fault current Iy=~1.1kA from Sahupuri end) tripped only from Sahupuri(UP) end on zone-4 distance protection. 400 KV Varanasi(PG)-Sahupuri(UP) (PG) Ckt-1 & 2 (fault current Iy=~3.3kA from Varanasi end, Iy=~3.6kA from Sahupuri end) tripped only from Varanasi(PG) end on zone-2 distance protection and fault sensed in zone-4 from Sahupuri(UP) end. 400/220 kV 500 MVA ICT 2 at Sahupuri(UP) and also tripped (details of protection operation is yet to receive). v)As reported, from 15:27 hrs to 17:49 hrs, multiple 220 & 132kV line also tripped at 220kV Sahupuri S/s i.e. 220kV Sahupuri-Churk ckt, 220kV Sahupuri-Raja Talab ckt, 220kV Sahupuri(400kV)-Sahupuri(200kV) interconnector, 132kV Sahupuri-Aliapur ckt, 132kV Sahupuri-Karamnasha ckt, 132kV Sahupuri-Chandauli ckt, 132kV Sahupuri-Sadat ckt and 132kV Sahupuri-Dhanapur ckt. Reason of tripping of these lines are yet to be received. vi)As per PMU at Varanasi(PG), at 15:54 hrs, Y-N phase to earth fault with delayed fault clearance time of 400msec is observed (Reason for delayed fault clearance is yet to receive). vii)As per SCADA, at 15:54 hrs, change in demand of approx. 100 MW in UP control area. viii)By 18:29 hrs, 400 KV Sahupuri(UP)-Biharshariff(PG) (PG) D/C and 400/220 kV 500 MVA ICT-2 were charged.	0	100	400
5	GI-2	1)400/220 kV 500 MVA ICT 1 at Lucknow(UP) 2)400/220 kV 500 MVA ICT 2 at Lucknow(UP) 3)220kV Lucknow-Hardoi Road (UP) ckt 4)220kV Lucknow-Unnao (UP) ckt 5)220/132 kV 200 MVA ICT 1 at Lucknow(UP) 6)220/132 kV 200 MVA ICT 2 at Lucknow(UP)	Uttar Pradesh	UPPTCL	14-Jul-24	15:53	i)220kV Lucknow(UP) has double main and transfer bus scheme at 220kV level. ii)During antecedent condition, 400/220kV 500 MVA ICT-1 & 2, 220/132kV 200 MVA ICT-1 & 2, 220kV Lucknow-Hardoi Road (UP) ckt & 220kV Lucknow-Unnao (UP) ckt were connected to 220kV bus-1 and 220kV lines from Lucknow(UP) to Bachrawan, Gomatinagar, Kanpur Road & 220/132kV 200MVA ICT-1 & 2 connected to 220kV bus-2 at 220kV Lucknow(UP) S/s. 220kV Lucknow-Kanpur Road (UP) ckt was not in service during the event. iii)As reported, at 15:53 hrs, R-N phase to earth fault occurred on 220kV bus-1 which led to tripping of all elements connected to 220kV bus-1 at 220kV Lucknow(UP). Bus bar protection failed to operate and 400/220 kV 500 MVA ICT-1 & 2 tripped on LBB protection (Type of protection operated in tripping of other elements is yet to receive) iv)As per PMU at Lucknow(PG), R-N phase to earth fault with delayed fault clearance time of 880ms is observed (Reason for delayed fault clearance is yet to receive). v)As per SCADA, change in demand of approx. 280 MW in UP control area. However, approx. 250 MW load loss in UP control area as per SLDC-UP.	0	250	880
6	GD-1	1) 220 KV Samaypur (BB)-Palli (HV) (HVPNL) Ckt-1 2) 220 KV Samaypur (BB)-Palli (HV) (HVPNL) Ckt-2 3) 220 KV Badshahpur (HV)-Palli (HV) (HVPNL) Ckt-1 4) 220 KV Badshahpur (HV)-Palli (HV) (HVPNL) Ckt-2 5) 220 KV Palla (HV) (Sec-46) -Palli (HV) (HVPNL) Ckt-1 6) 220 KV Palla (HV) (Sec-46) -Palli (HV) (HVPNL) Ckt-2 7) 220 KV Sector 52 (HV) (Sec-56 Gurgoan)-Palli (HV) (HVPNL) Ckt-1 8) 220 KV Sector 52 (HV) (Sec-56 Gurgoan)-Palli (HV) (HVPNL) Ckt-2	Haryana and Delhi	BBMB, HVPNL	16-Jul-24	22:10	i)During antecedent condition, 220 kV Palli S/S importing load from 220 KV Samaypur (BB)-Palli (HV) (HVPNL) Ckt-1 & Ckt-2, 220 KV Badshahpur (HV)-Palli (HV) (HVPNL) Ckt-1 & ckt-2 and 220 KV Sector-56 (Gurgaon) -Palli (HV) (HVPNL) Ckt-1 & Ckt-2 and feeding that load to 220 KV Palla (HV) (Sec-46) & 220 KV Palli (2*100MVA+1*160MVA) S/S. ii)As reported, to manage the line loading on sector-72 Gurgaon ckt, 220 KV Sector 52 (HV) (Sec-56 Gurgaon)-Palli (HV) (HVPNL) Ckt-1 was opened at 22:10 hrs on the instruction of SLDC-Haryana. This led to sparking on the 220 KV Sector 52 (HV) (Sec-56 Gurgaon)-Palli (HV) (HVPNL) Ckt-2 at Palli S/S end. iii)At the same time, busbar protection operated at 220kV Palli(HV) due to which all the elements connected to 220kV Bus-1 and 2 at Palli(HV) tripped and complete blackout occurred at Palli(HV) S/s. iv)As per PMU, R-Y phase to phase fault with delayed fault clearing time of 880 ms was observed. v)As per SCADA, change in demand of approx. 600 MW and 980 MW in Delhi and Haryana control area respectively were observed. However, as reported, approx. 400 MW load loss occurred at Palli & Sec-46 (Faridabad). Rest of the change in demand is suspected due to stalling of induction motor.	0	1580	880
7	GD-1	1) 220 KV Khodri(UK)-Majri(HP) (UK) Ckt-1 2) 220 KV Khodri(UK)-Majri(HP) (UK) Ckt-2 3) 220 KV Khodri(UK)-Sarsawan(UP) (UP) Ckt 4) 220 KV Khodri(UK)-Saharanpur(UP) (UP) Ckt 5) 220 KV Khodri-Chhibro (UK) Ckt-1 6) 220 KV Khodri-Chhibro (UK) Ckt-2 7) 30 MW Khodri Unit-1, 2, 3 & 4 8) 60 MW Chhibro Unit-1, 2, 3 & 4	Uttarakhand	PTCUL, HPPTCL, UPPTCL	19-Jul-24	21:31	i)During antecedent condition, all the four 30MW units of Khodri and 60 MW units of Chhibro were running and total active power generation of Khodri and Chhibro was approx. 89 MW and 196 MW (as per SCADA). Total generation of Chhibro was evacuating through 220 KV Khodri-Chhibro (UK) Ckt-1 & 2. ii)As reported, at 21:31 hrs, while taking out 30MW Khodri Unit-2, B-phase pole of CB of Unit-2 did not open. This led to LBB protection operation which further resulted in tripping of all the elements connected to both the buses at 220kV Khodri(UK) and complete blackout occurred at 220kV Khodri(UK) S/s. iii)Due to tripping of 220 KV Khodri-Chhibro (UK) Ckt-1 & 2, 60 MW Chhibro Unit-1, 2, 3 & 4 also tripped due to loss of evacuation path and complete blackout occurred at 220kV Chhibro(UK) S/s. iv)As per PMU, no fault was observed in the system. v)As per SCADA, change in demand and generation of approx. 30 MW and 300 MW respectively in Uttarakhand control area were observed. vi)As remedial action taken, over hauling & testing of generator CB has been performed and found satisfactory.	300	30	NA

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)	
8	GI-1	1) 220kV Bhadla(RS)-Saurya Urja Ckt-2 2) 220 kV Bus sectionalizer-I (Bay no. 09) 3) 220 kV Bus Coupler-I (Bay no. 13) 4) 220kV Bhadla(RS)-RSDCL I Ckt-2	Rajasthan	RVPNL	30-Jul-24	11:38	i)400/220kV Bhadla(RS) has double main and transfer bus arrangement at 220kV side. ii)During antecedent condition, 220 kV Bhadla(RS)-Saurya Urja-2 and 220kV Bhadla(RS)-RSDCL I Ckt-2 were carrying approx. 242 MW & 128 MW respectively (reported data). iii)As reported, at 11:38hrs, B-ph jumper of 220kV Bhadla(RS)-Saurya Urja Ckt-2 snapped from Main Bus at Bhadla(RS) which led to tripping of 220kV Bhadla(RS)-Saurya Urja Ckt-2. iv)During the same time, 220 kV Bus sectionalizer-I (Bay no. 09) and 220 kV Bus Coupler-I (Bay no. 13) at Bhadla(RS) also tripped due to B-N phase to ground fault (As per PMU, Y-N fault; phase sequence issue is observed). v)Further as reported, 220kV Bhadla(RS)-RSDCL I Ckt-2 also tripped from RSDCL I end only due to LBB operation at the same time (exact reason of LBB operation yet to be shared). vi)As per PMU at Bhadla(PG), Y-N phase to ground fault is observed with delayed fault clearing time of 160 ms. vii) As per SCADA, change in solar generation of approx. 905MW is observed in Rajasthan control area. viii)As reported by SLDC Rajasthan, approx. 370 MW of solar generation loss occurred in Rajasthan control area and there is total approx. 730 MW reduction in solar generation by RE plants connected at Bhadla(RS).	370	0	160
9	GI-1	1)220/132kV 160MVA ICT-1 at Barn (JK) 2)220/132kV 160MVA ICT-2 at Barn (JK) 3)220/132kV 160MVA ICT-3 at Barn (JK) 4)132kV Barn-Canal (JK) Ckt-1 5)132kV Barn-Canal (JK) Ckt-2	Jammu and Kashmir	JK PDD	2-Aug-24	15:03	i)As reported, at 15:03hrs, 220/132kV 160MVA ICT-1, 132kV Barn-Canal (JK) D/C tripped at Barn(JK) S/s on Y-B phase to phase fault which occurred on 132kV Barn-Canal (JK) D/C (exact reason, location of fault and type of protection operated is yet to be received). ii)As reported, due to tripping of ICT-1, the complete load shifted on 220/132kV 160MVA ICT-2 & 3 which led to tripping of 220/132kV 160MVA ICT-2 & 3 on overloading at Barn(JK) S/s. iii)As per PMU at Kishenpur(PG), Y-B phase to phase fault with fault clearing time of 120ms is observed. iv)As per SCADA, load loss of approx. 345MW occurred in J&K control area.	0	345	120
10	GI-2	1)400/220 kV 315 MVA ICT 1 at Muzaffarnagar(UP) 2)400/220 kV 315 MVA ICT 2 at Muzaffarnagar(UP) 3)400/220 kV 315 MVA ICT 3 at Muzaffarnagar(UP) 4)400/220 kV 500 MVA ICT 4 at Muzaffarnagar(UP) 5)220kV Muzaffarnagar-Charla (UP) Ckt 6)220kV Muzaffarnagar-Jansath (UP) Ckt 7)220kV Muzaffarnagar-Shamli (UP) Ckt 8)220kV Muzaffarnagar-Khatauli (UP) Ckt	Uttar Pradesh	UPPTCL	21-Aug-24	09:02	i)During antecedent condition, 400/220kV 315 MVA ICT-1, 400/220kV 500 MVA ICT-4, 220kV Muzaffarnagar-Shamli (UP) Ckt, 220kV Muzaffarnagar-Khatauli (UP) Ckt, 220kV Muzaffarnagar-Badhni kalan (UP) Ckt & 220/132kV 160MVA ICT-4 were connected to 220kV bus-1 and 400/220 kV 315 MVA ICT-2, 400/220 kV 315 MVA ICT-3, 220kV Muzaffarnagar-Charla (UP) Ckt, 220kV Muzaffarnagar-Jansath (UP) Ckt & 220/132kV 160MVA ICT-5 were connected to 220kV bus-2 at Muzaffarnagar(UP) S/s. Bus coupler of 220kV bus-1 and 220kV bus-2 was in ON condition and 220kV Muzaffarnagar-Nara (UP) Ckt was not in service (under shutdown) during the tripping event. ii)As reported, at 09:02 hrs, R-N phase to earth fault occurred on 220kV Muzaffarnagar-Badhni kalan (UP) Ckt with fault distance of 3.8km from Muzaffarnagar(UP) end and 20.4km from Badhni kalan(UP) end. Fault was sensed in zone-1 from both ends. iii)On this fault 220kV Muzaffarnagar-Badhni kalan (UP) Ckt tripped from Badhni kalan end on zone-1 distance protection on R-N fault. During fault clearing process at Muzaffarnagar(UP) end, R-phase CB interrupting chamber got damaged which resulted into continuation of sparking between R phase male contact and R phase dropper wire of breaker. The circuit breaker operated mechanically (auxiliary contacts operated properly) and thus breaker status reflected as OPEN. iv)As breaker didn't open completely (sparking between R phase male contact and R phase dropper wire of breaker was still there), fault was not cleared yet. Due to continuous fault feeding 400/220kV 315MVA ICT-1 & 2 and 400/220kV 500 MVA ICT-4 tripped on directional earth fault protection and 400/220kV 315 MVA ICT-3 tripped on back up impedance protection. 220 kV Charla line, 220 kV Jansath line and 220 kV shamli line tripped from remote ends on zone-3 distance protection (it is confirmed from respective DRs also). v)Ideally, this fault would have been cleared by LBB protection of Badhni kalan bay, but as CB status changed from ON to OFF due to proper operation of breaker auxiliary contacts, LBB initiation got reset. vi)Further, as reported, bus bar protection of 220kV bus-1 at Muzaffarnagar(UP) also operated after 1 second of fault starting time due to persisting differential current. vii)As per DR of bus bar protection at Muzaffarnagar(UP), busbar protection operated on 220kV bus-1 after 1.05 second of fault starting time. On this, all remaining elements also tripped which were connected to 220kV bus-1 i.e. 220kV Muzaffarnagar-Khatauli (UP) Ckt, 220/132kV 160MVA ICT-4 and bus coupler of 220kV bus-1 and bus-2. viii) As per PMU at Meerut(PG), R-N phase to earth fault with delayed fault clearing time of 1080 msec is observed. ix)As per SCADA, load loss of approx. 290 MW in UP control area. However, SLDC-UP reported load loss of 127 MW in UP control area.	0	127	1080
11	GD-1	1)220 KV Abdullapur(PG)-Rajokheri (HV) (HVPNL) Ckt-1 2)220 KV Abdullapur(PG)-Rajokheri (HV) (HVPNL) Ckt-2 3)220 KV Shahbad-Rajokheri(HV)(HVPNL) Ckt-1 4)220 KV Shahbad-Rajokheri(HV)(HVPNL) Ckt-2 5)220 KV Tepla-Rajokheri(HV)(HVPNL) Ckt-1 6)220 KV Tepla-Rajokheri(HV)(HVPNL) Ckt-2 7)220 KV Shahbad-Durla(HV)(HVPNL) Ckt-1 8)220 KV Shahbad-Durla(HV)(HVPNL) Ckt-2 9)220 KV Shahbad-Joria(HV)(HVPNL) Ckt-1 10)220 KV Shahbad-Joria(HV)(HVPNL) Ckt-2	Haryana	PGCIL, HVPNL	26-Aug-24	22:58	i)220kV Rajokheri(HV) & 220kV Shahbad(HV) S/s have double main bus arrangement at 220kV side. ii)During antecedent condition, incoming power at Rajokheri(HV) S/s through 220 KV Abdullapur(PG)-Rajokheri (HV) (HVPNL) D/C was approx. 115 MW and outgoing power from Rajokheri(HV) through 220 KV Shahbad-Rajokheri(HV)(HVPNL) D/C was approx. 90 MW. Loading of 220 KV Shahbad-Joria(HV)(HVPNL) D/C and 220 KV Shahbad-Durla(HV)(HVPNL) D/C were approx. 100 MW and 75 MW feeding to Shahbad(HV) and Durla(HV) respectively. iii)As reported, at 22:58 hrs, due to inclement weather conditions, Y-B phase to phase occurred on 220 KV Shahbad-Rajokheri(HV)(HVPNL) Ckt-1 & 220 KV Abdullapur(PG)-Rajokheri (HV) (HVPNL) Ckt-1. iv)As reported, 220 KV Abdullapur(PG)-Rajokheri (HV) (HVPNL) D/C tripped only from Abdullapur(PG) end not from Rajokheri(HV) end. 220 KV Shahbad-Rajokheri(HV)(HVPNL) Ckt-1 tripped on zone-1 distance protection on Y-B-G double phase to ground fault with fault distance of 29km and fault current of Iy=~5.79kA & Ib=~5.39kA from Rajokheri(HV) end. 220 KV Shahbad-Rajokheri(HV)(HVPNL) Ckt-2 & 220 KV Tepla-Rajokheri(HV)(HVPNL) Ckt-2 tripped on direction earth fault from Rajokheri(HV) end. 220 KV Tepla-Rajokheri(HV)(HVPNL) Ckt-1 tripped on zone-3 distance protection on Y-B phase to phase fault from Rajokheri(HV) end (details regarding trippings at Shahbad(HV) S/s is yet to be received). v)As per PMU at Abdullapur(PG), Y-B phase to phase fault converted into R-Y-B three phase fault with delayed fault clearing time of 2040msec is observed. vi)Due to tripping of all 220kV lines at Rajokheri(HV) & Shahbad(HV), both sub-stations lost their connectivity from Grid which led to blackout of 220kV Rajokheri(HV) S/s & 220kV Shahbad(HV) S/s. vii)As per SCADA, change in demand of approx. 350 MW in Haryana control area.	0	350	2040

Utilities are requested to prepare detailed analysis report and present the event details during 52nd PSC meeting. Events involving more than one utility may be jointly prepared and presented.

Multiple elements tripping at 400/220kV Akal(RS) 06th July 2024

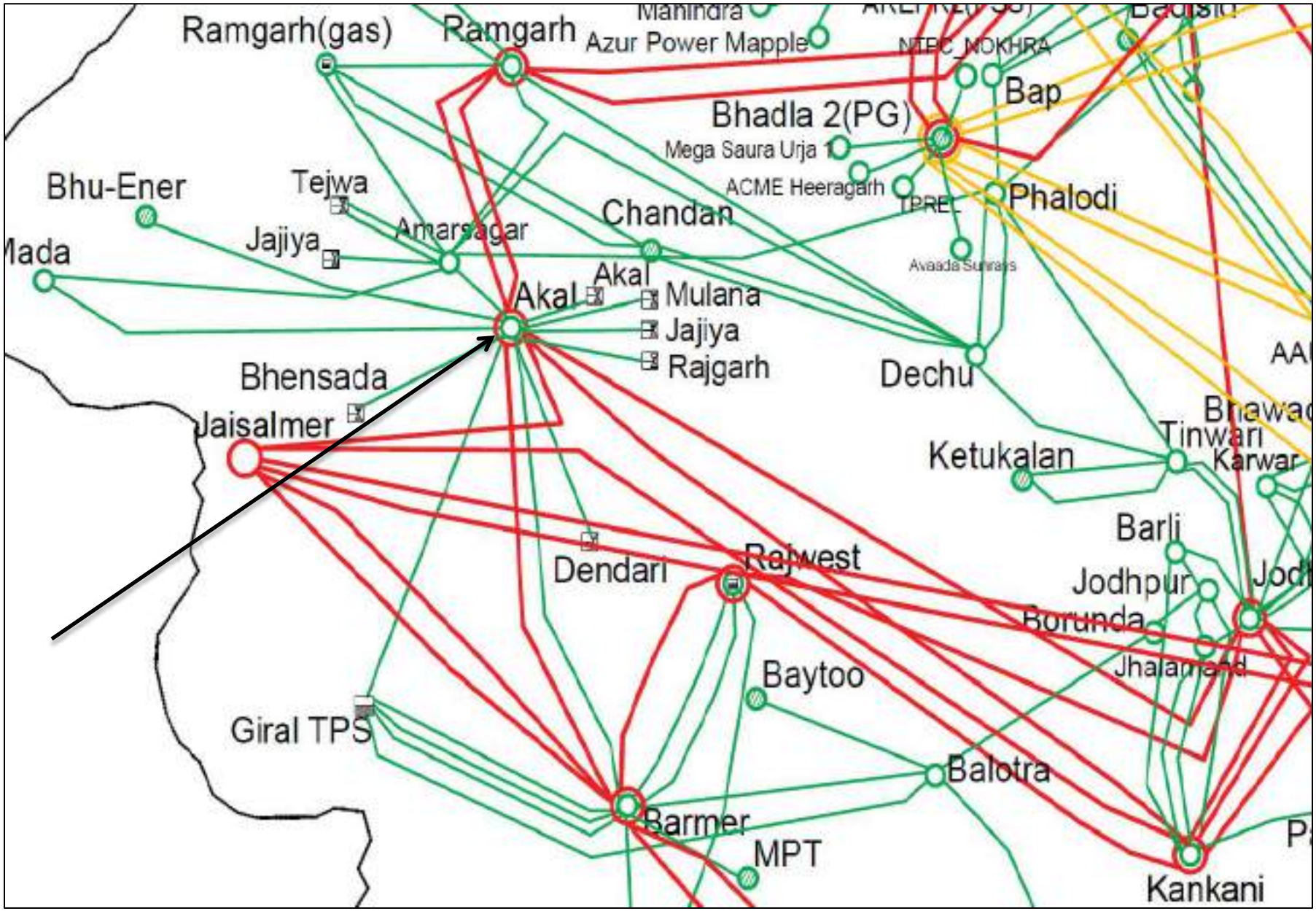
Brief of event:

i. 400/220kV Akal(RS) has one and half breaker scheme at 400kV level and double main and transfer bus scheme at 220kV level.
ii. During antecedent condition, incoming power at Akal(RS) S/s through 220 KV Akal-Akal(Suzlon) (RS) D/C and 220 KV Akal-Mulana (RS) Ckt were approx. 235 MW and 125 MW respectively.
iii. As reported, at 05:26 hrs, R-phase conductor of 220 KV Akal-Akal(Suzlon) (RS) ckt-2 broke at a distance of approx. 160m from Akal(RS) S/s which caused R-N phase to earth fault and subsequently 220 KV Akal-Akal(Suzlon) (RS) ckt-2 tripped on zone-1 distance protection from Akal(RS) end.
iv. As per PMU at ASPS1(IP), R-Y phase to phase fault followed by R-N phase to earth fault with fault clearance time of 80msec and 80msec respectively are observed.
v. At the same time, 220 KV Akal-Akal(Suzlon) (RS) Ckt-1 and 220 KV Akal-Mulana (RS) Ckt also tripped from Akal(RS) end (Reason of tripping yet to be received).
vi. During this event, dip in Rajasthan wind generation of approx. 1800 MW is observed out of which approx. 1150 MW recovered within 10 minutes. (As per SCADA).
vii. As per SCADA, no change in demand is observed in Rajasthan control area.
viii. As per SCADA, change in Rajasthan wind generation of approx. 168MW is observed.

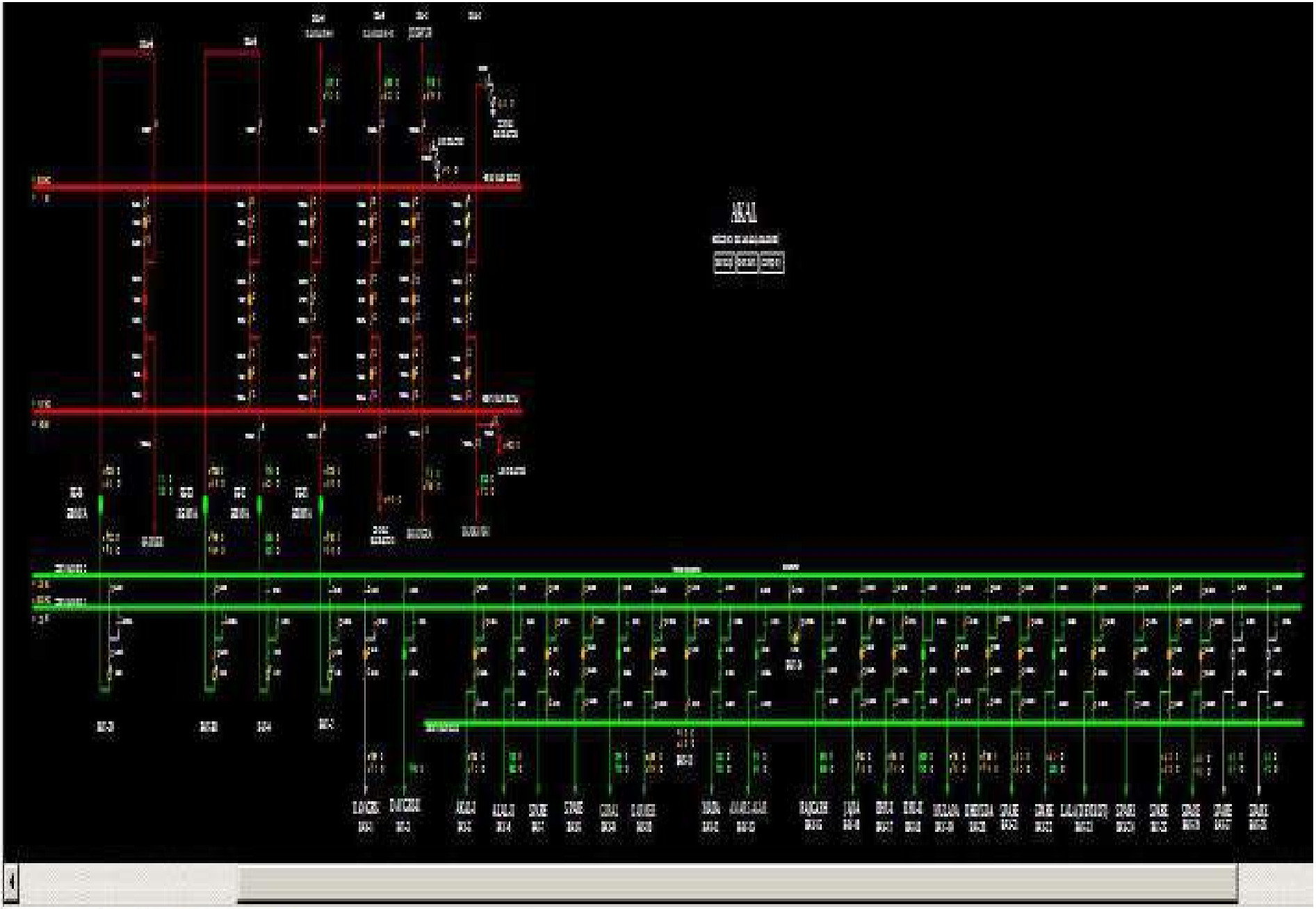
Elements tripped:

i. 220 KV Akal-Akal(Suzlon) (RS) Ckt-2
ii. 220 KV Akal-Akal(Suzlon) (RS) Ckt-1
iii. 220 KV Akal-Mulana (RS) Ckt

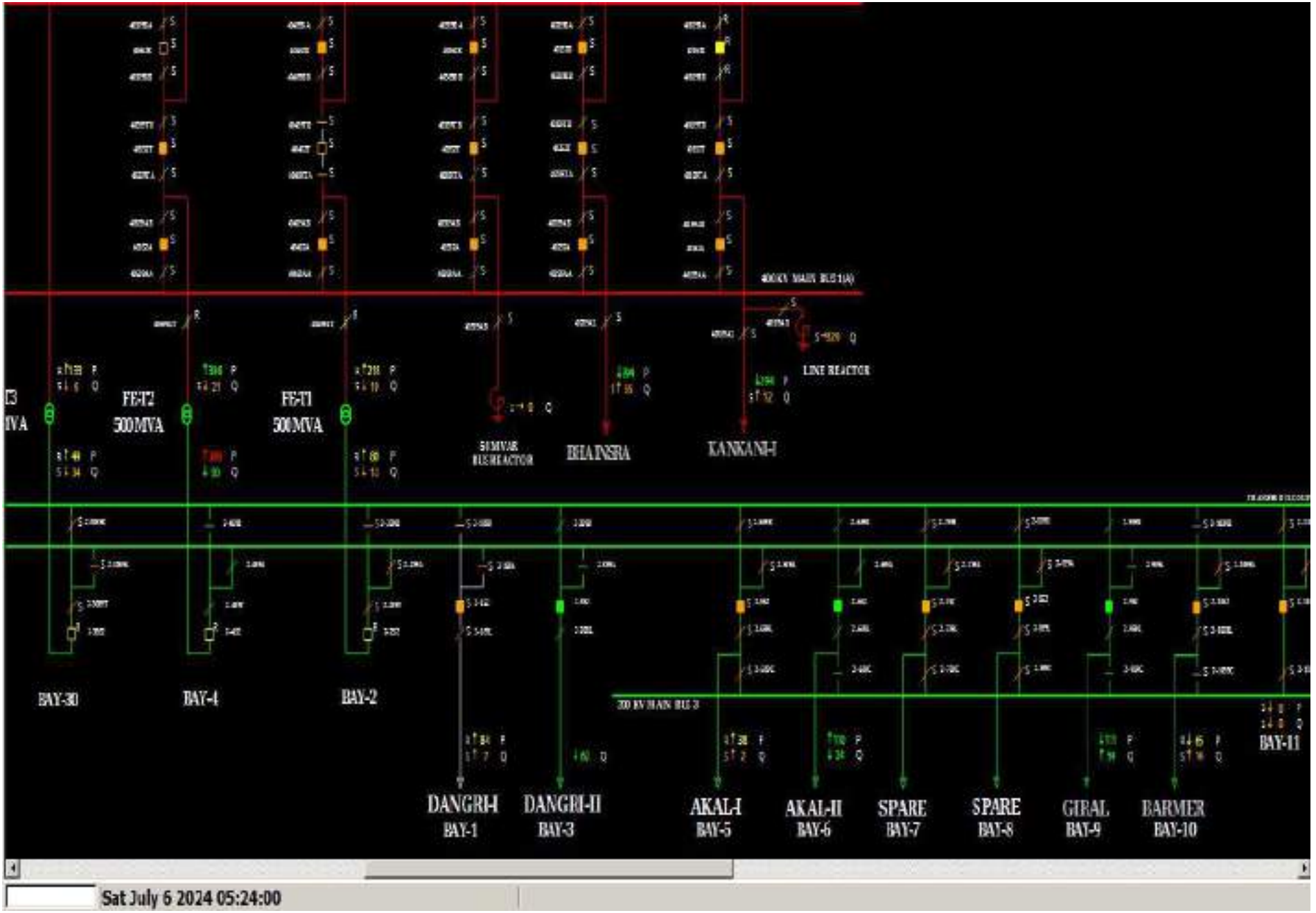
Network Diagram



SLD of 400/220kV Akal(RS) before the event

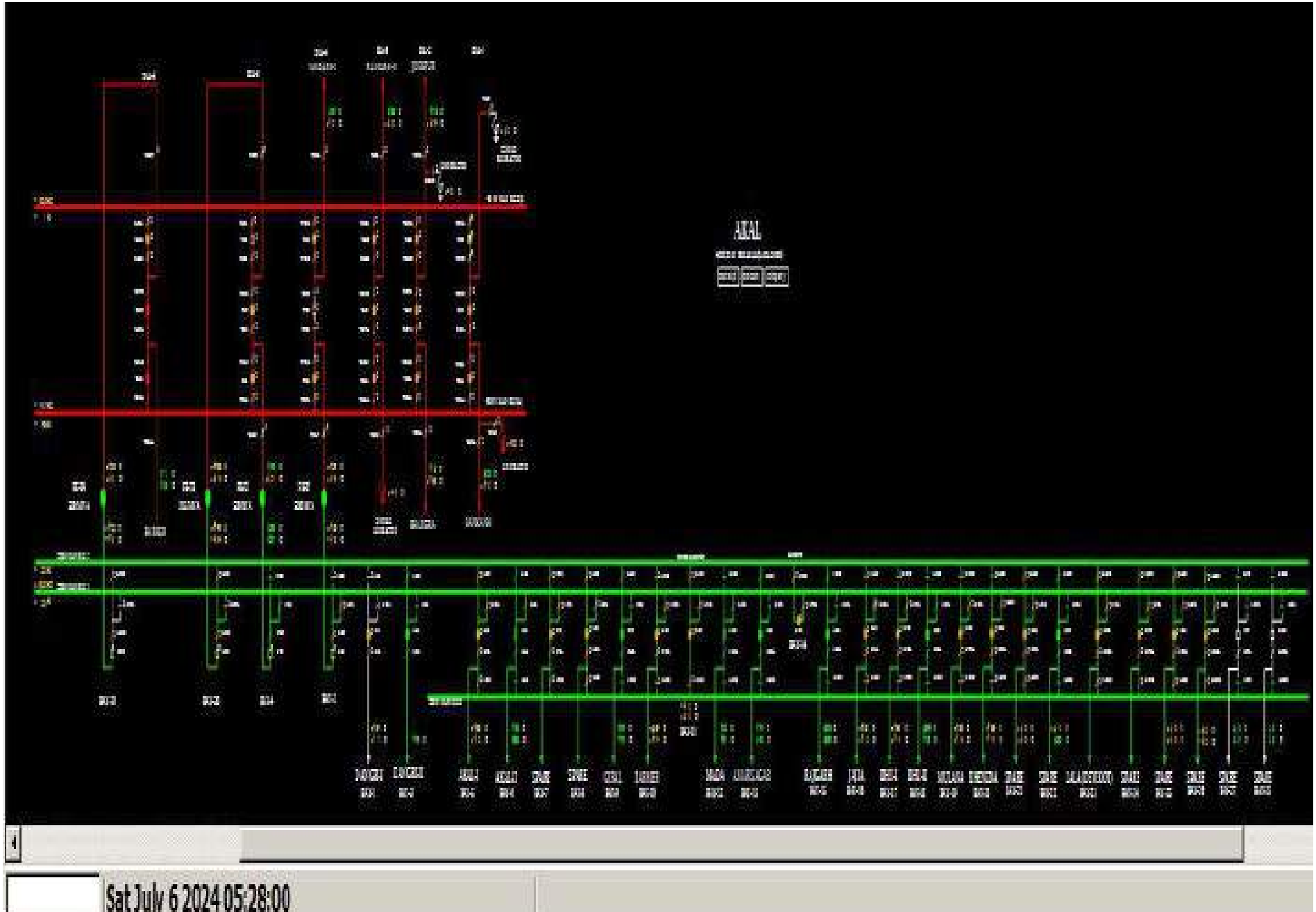


SLD of 400/220kV Akal(RS) before the event

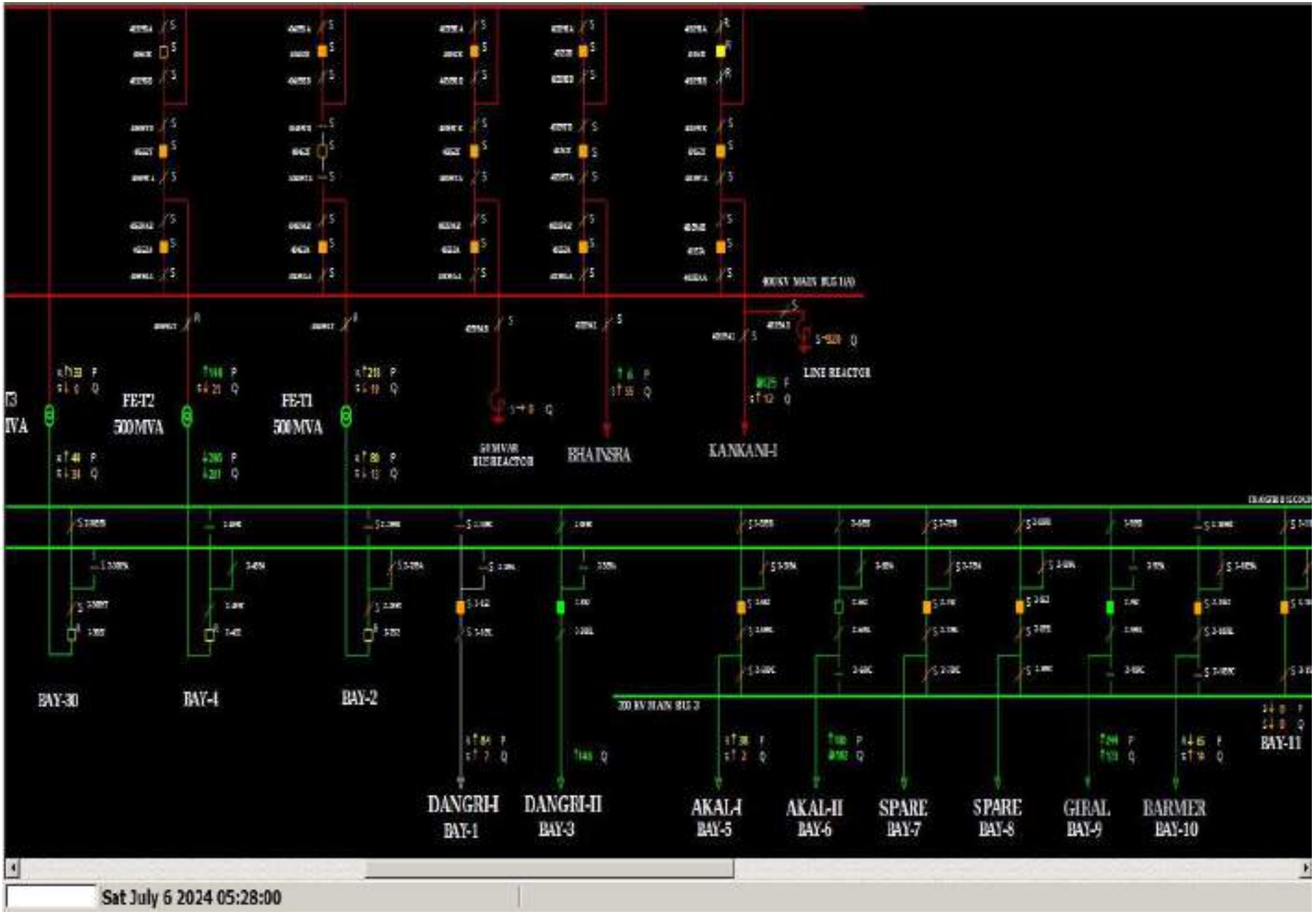


SLD of 400/220kV Akal(RS) before the event

SLD of 400/220kV Akal(RS) after the event

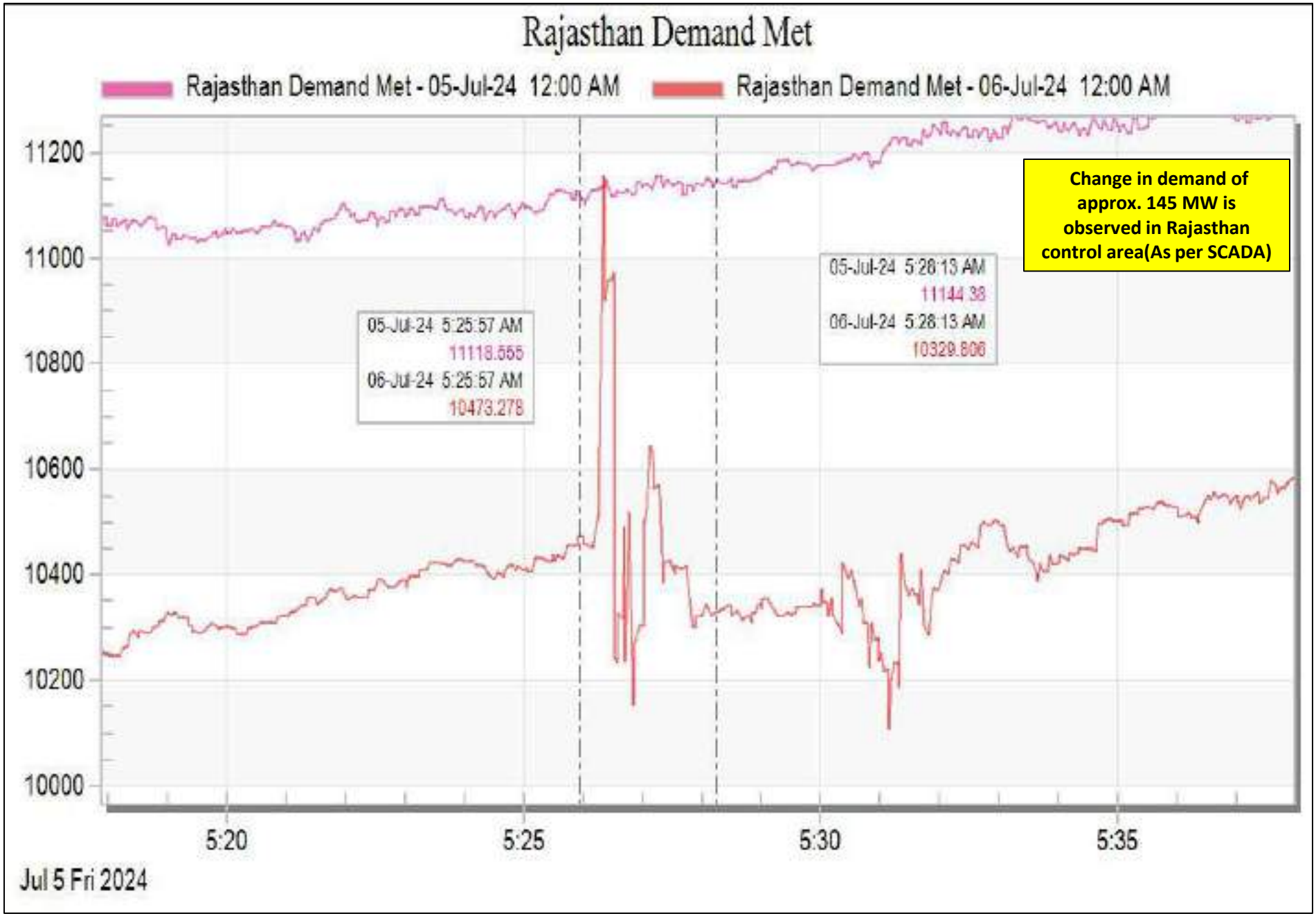


SLD of 400/220kV Akal(RS) after the event

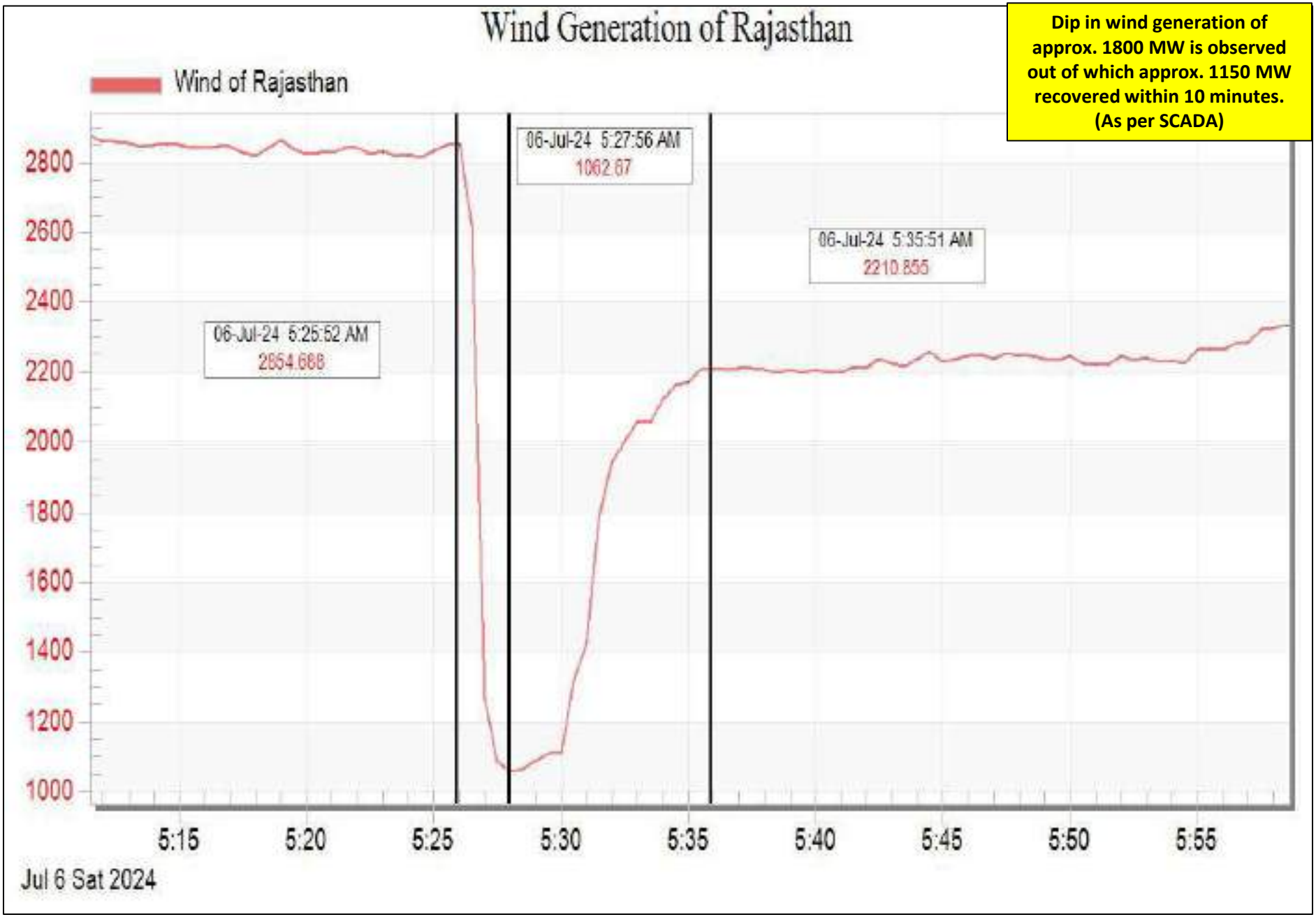


SLD of 400/220kV Akal(RS) after the event

Rajasthan Demand during the event

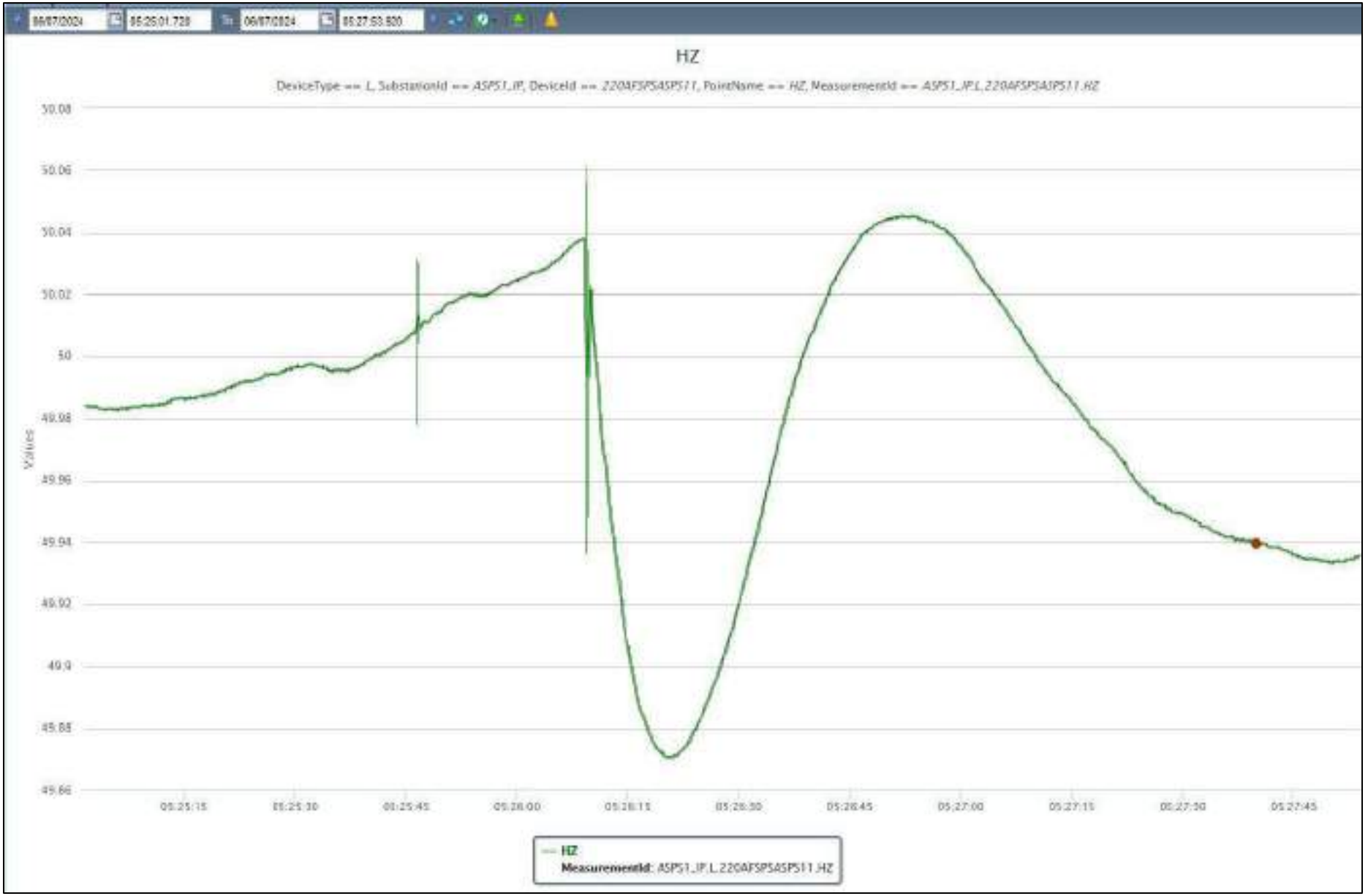


Rajasthan Wind Generation during the event



PMU Plot of frequency at ASPS1(IP)

05:26 hrs/06-July-24



PMU Plot of phase voltage magnitude at ASPS1(IP)

05:26 hrs/06-July-24

Point of discussion

i) Reason for tripping of 220 KV Akal-Akal(Suzlon) (RS) Ckt-1 and 220 KV Akal-Mulana (RS) Ckt need to be shared.

ii) SCADA data was freeze during the event. Availability and healthiness of SCADA data need to be ensured.

iii) DR/EL (.dat/.cfg file) of all tripped elements along with detailed tripping report and remedial action taken report need to be shared.

iv) Trippings at Akal(RS) S/s are not recorded in SCADA SOE. Availability of SCADA SOE data needs to be ensured.

Multiple elements tripping at 400/220kV Bhadla(RS) 30th July 2024

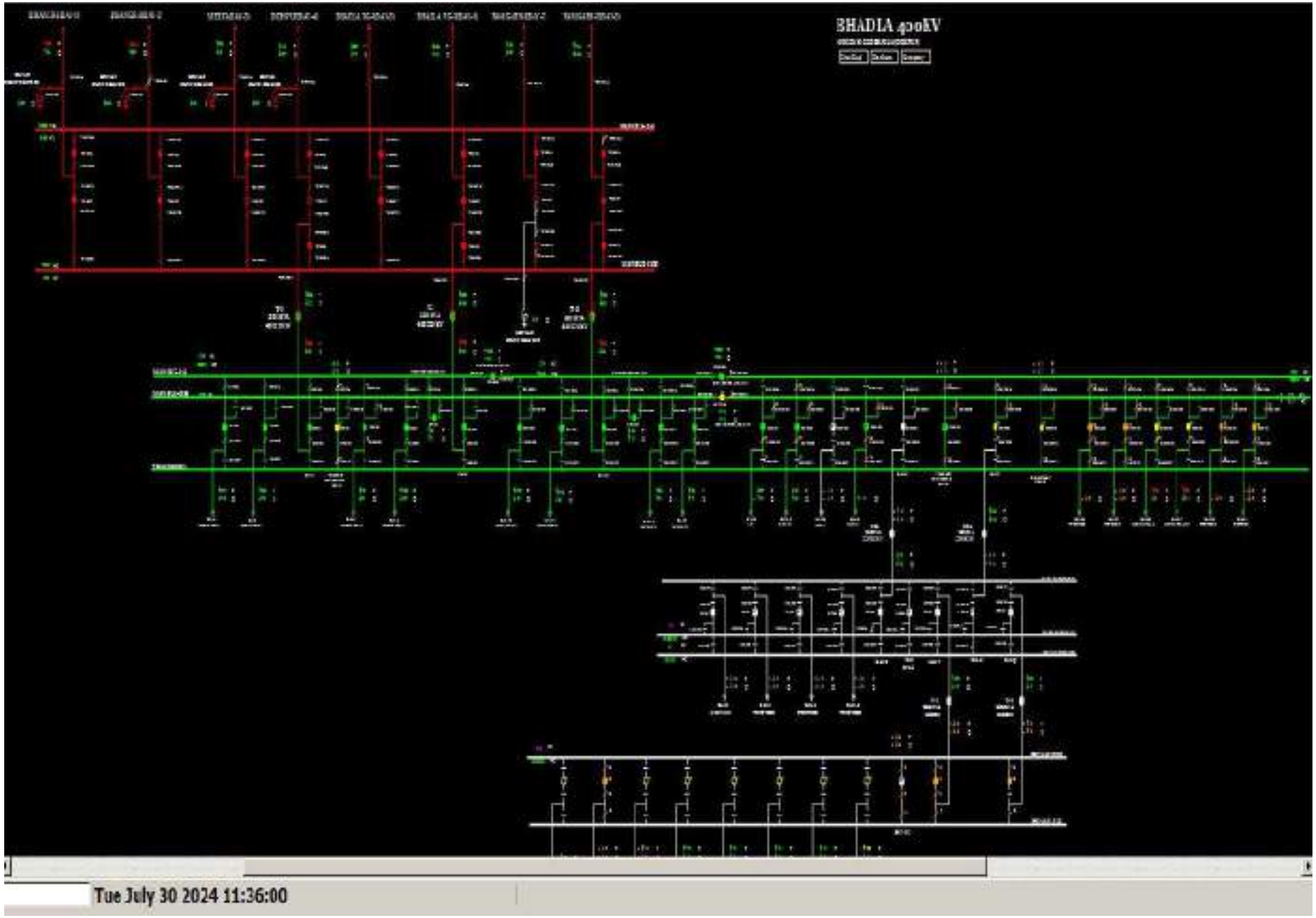
Brief of event:

i. 400/220kV Bhadla(RS) has double main and transfer bus arrangement at 220kV side.
ii. During antecedent condition, 220 kV Bhadla(RS)-Saurya Urja-2 and 220kV Bhadla(RS)-RSDCL I Ckt-2 were carrying approx. 242 MW & 128 MW respectively (reported data).
iii. As reported, at 11:38hrs, B-ph jumper of 220kV Bhadla(RS)-Saurya Urja Ckt-2 snapped from Main Bus at Bhadla(RS) which led to tripping of 220kV Bhadla(RS)-Saurya Urja Ckt-2.
iv. During the same time, 220 kV Bus sectionalizer-I (Bay no. 09) and 220 kV Bus Coupler-I (Bay no. 13) at Bhadla(RS) also tripped due to B-N phase to ground fault (As per PMU, Y-N fault; phase sequence issue is observed).
v. Further as reported, 220kV Bhadla(RS)-RSDCL I Ckt-2 also tripped from RSDCL I end only due to LBB operation at the same time (exact reason of LBB operation yet to be shared).
vi. As per PMU at Bhadla(PG), Y-N phase to ground fault is observed with delayed fault clearing time of 160 ms.
vii. As per SCADA, change in solar generation of approx. 905MW is observed in Rajasthan control area.
viii. As reported by SLDC Rajasthan, approx. 370 MW of solar generation loss occurred in Rajasthan control area and there is total approx. 730 MW reduction in solar generation by RE plants connected at Bhadla(RS).

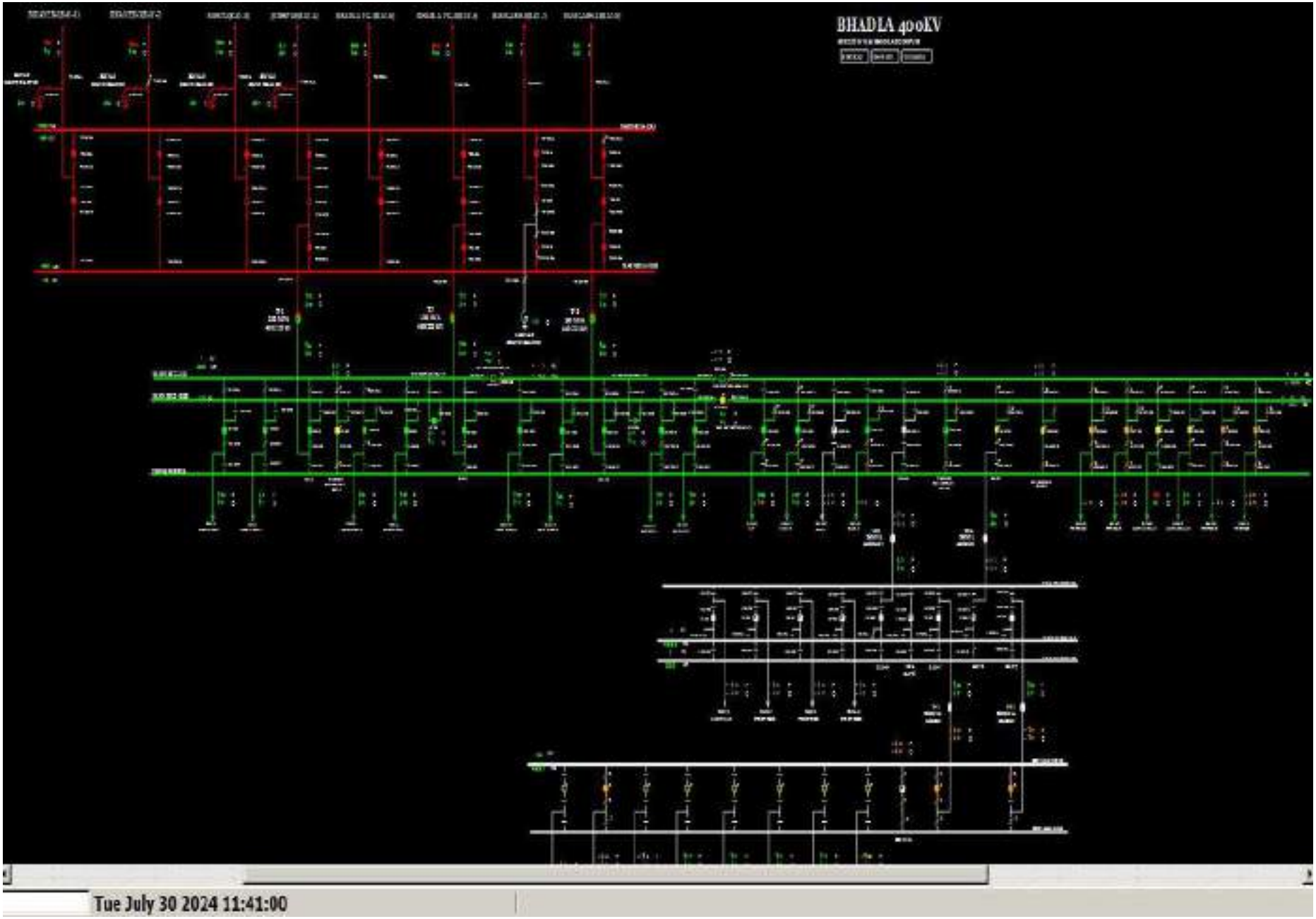
Elements tripped:

i. 220kV Bhadla(RS)-Saurya Urja Ckt-2
ii. 220 kV Bus sectionalizer-I (Bay no. 09)
iii. 220 kV Bus Coupler-I (Bay no. 13)
iv. 220kV Bhadla(RS)-RSDCL I Ckt-2

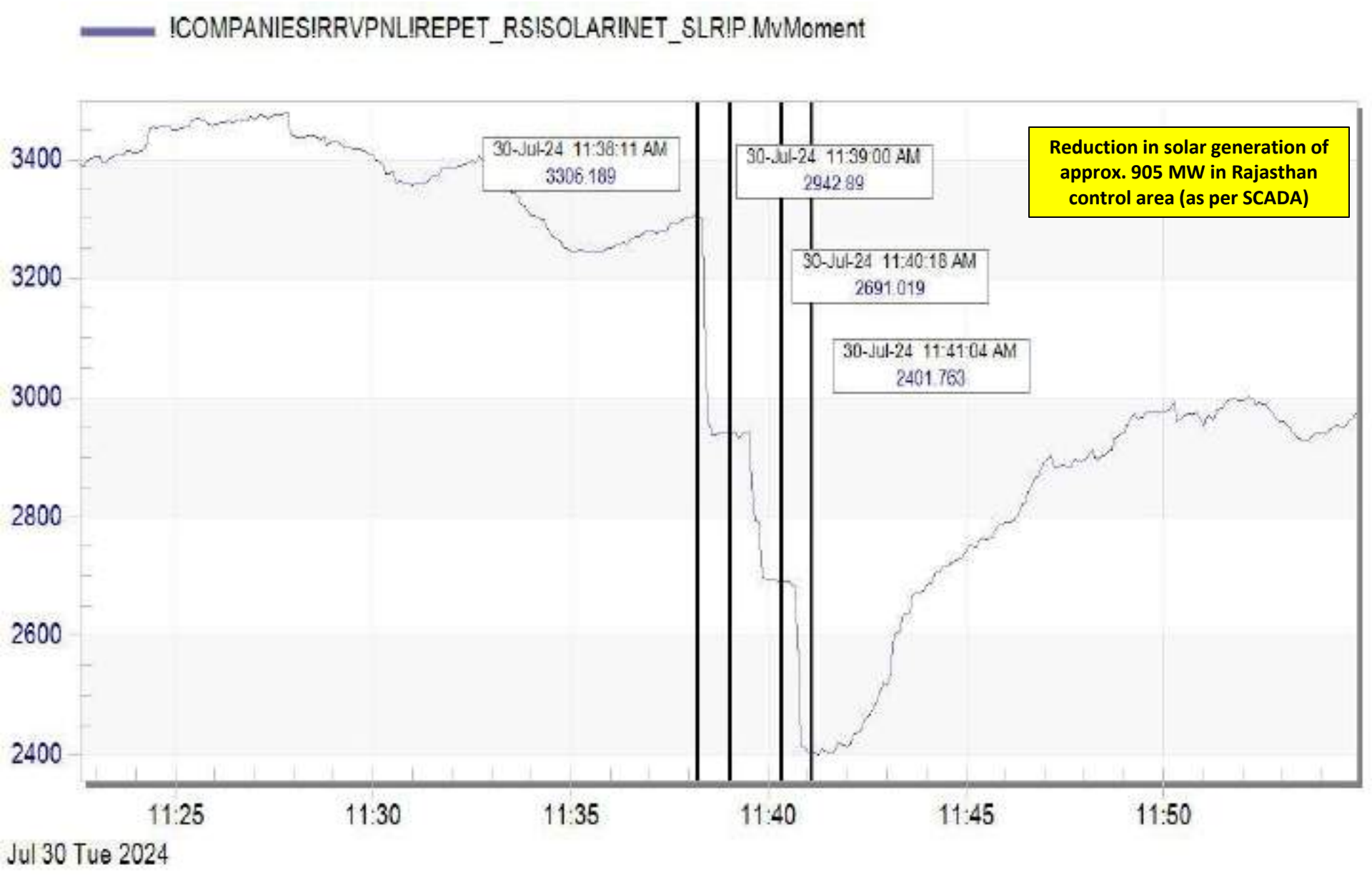
SLD of 400/220/132kV Bhadla(RS) before the event

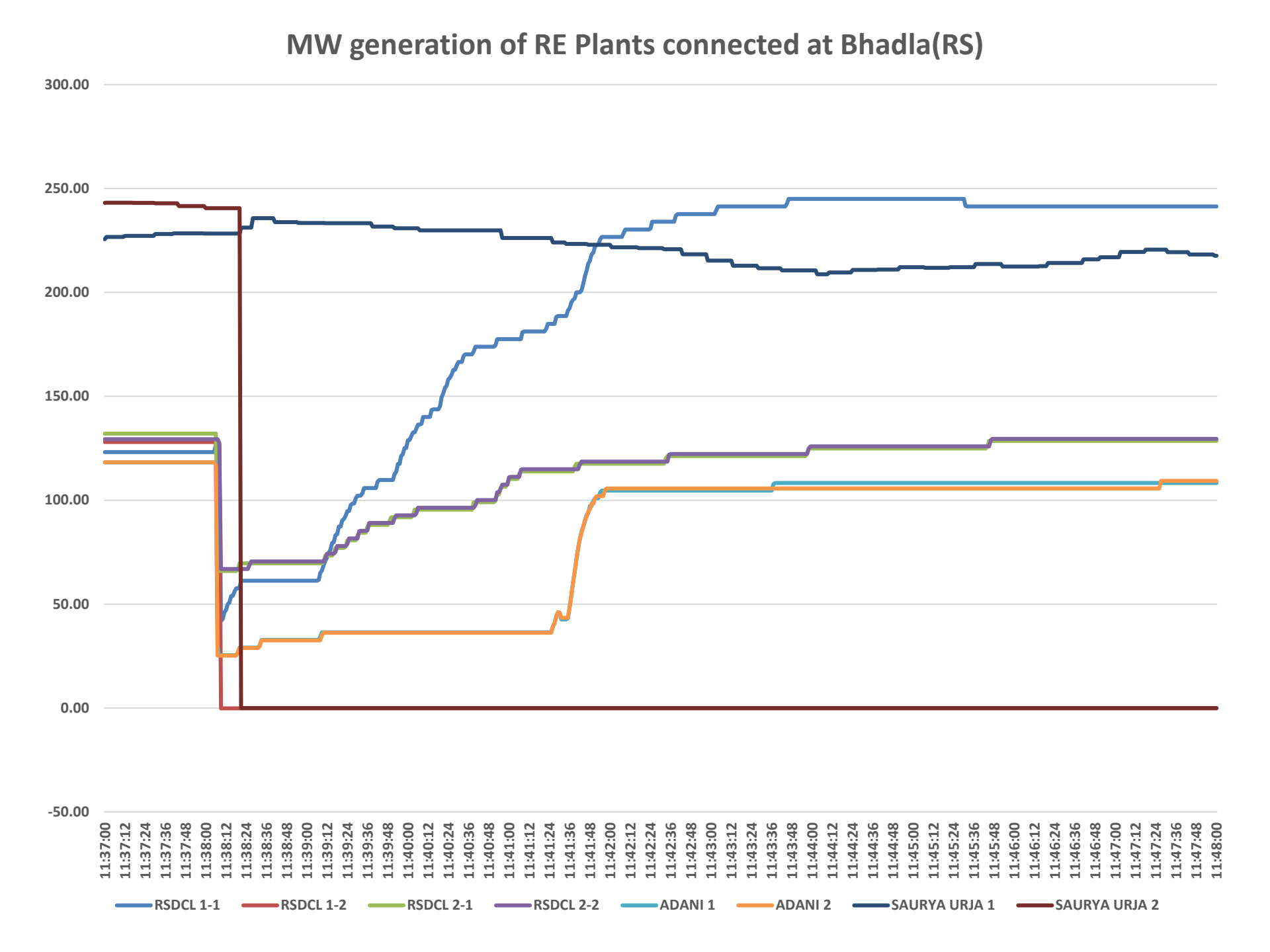


SLD of 400/220/132kV Bhadla(RS) after the event

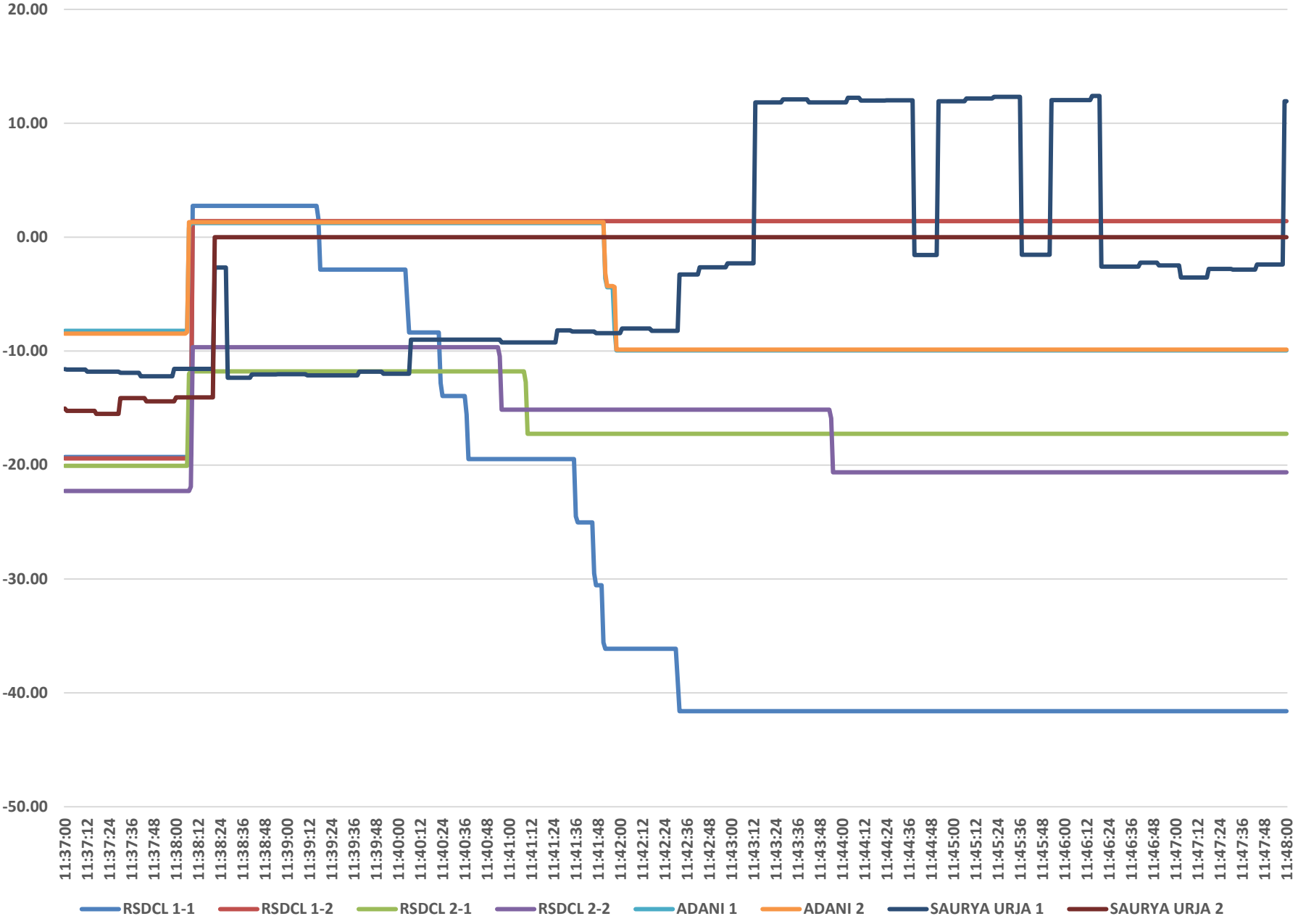


Rajasthan Solar Generation during the event



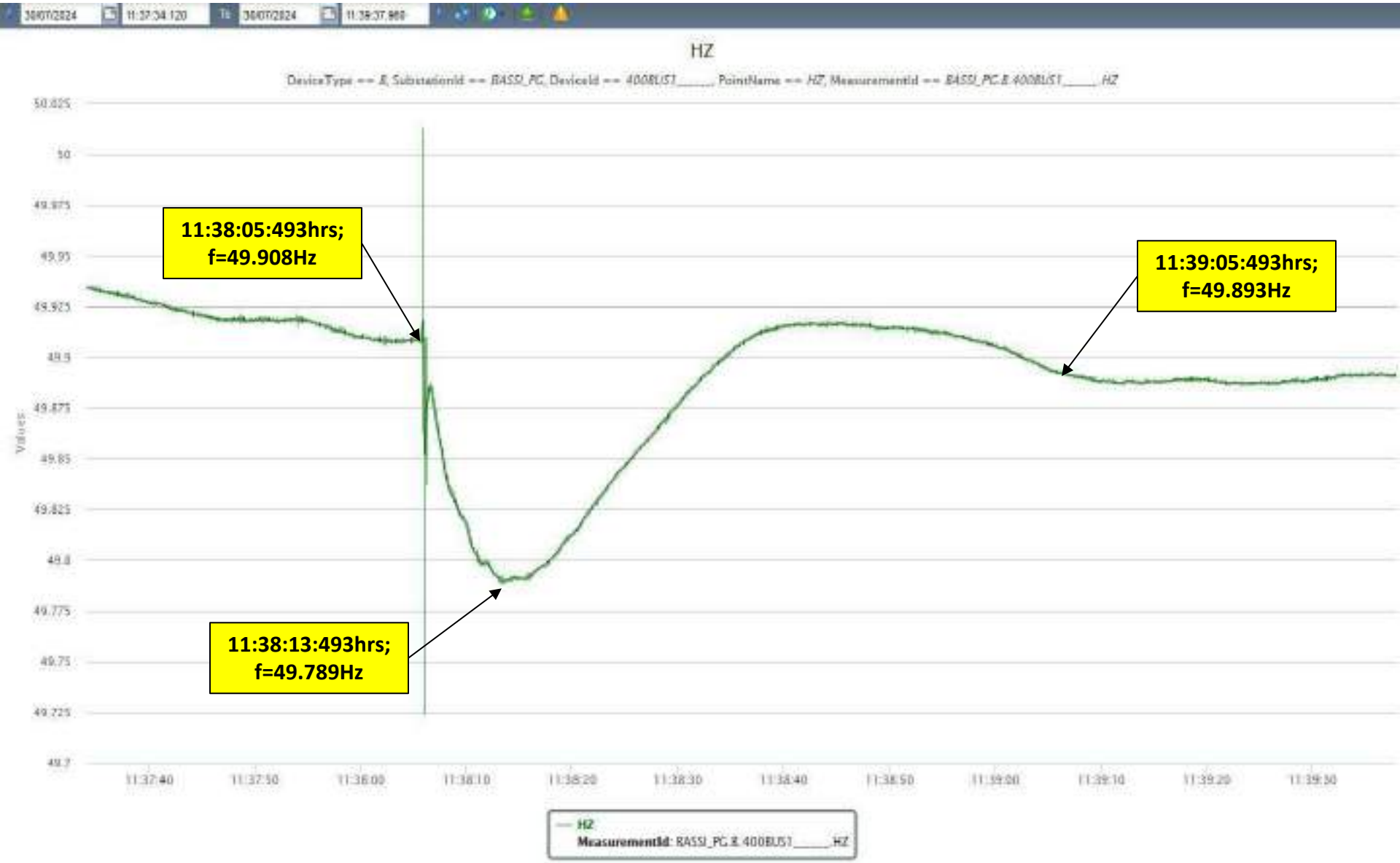

MW generation of RE Plants connected at Bhadla(RS)
300.00
250.00
200.00
150.00
100.00
50.00
0.00
-50.00
11:37:00
11:37:12
11:37:24
11:37:36
11:37:48
11:38:00
11:38:12
11:38:24
11:38:36
11:38:48
11:39:00
11:39:12
11:39:24
11:39:36
11:39:48
11:40:00
11:40:12
11:40:24
11:40:36
11:40:48
11:41:00
11:41:12
11:41:24
11:41:36
11:41:48
11:42:00
11:42:12
11:42:24
11:42:36
11:42:48
11:43:00
11:43:12
11:43:24
11:43:36
11:43:48
11:44:00
11:44:12
11:44:24
11:44:36
11:44:48
11:45:00
11:45:12
11:45:24
11:45:36
11:45:48
11:46:00
11:46:12
11:46:24
11:46:36
11:46:48
11:47:00
11:47:12
11:47:24
11:47:36
11:47:48
11:48:00
RSDCL 1-1
RSDCL 1-2
RSDCL 2-1
RSDCL 2-2
ADANI 1
ADANI 2
SAURYA URJA 1
SAURYA URJA 2

MVAr generation of RE Plants connected at Bhadla(RS)



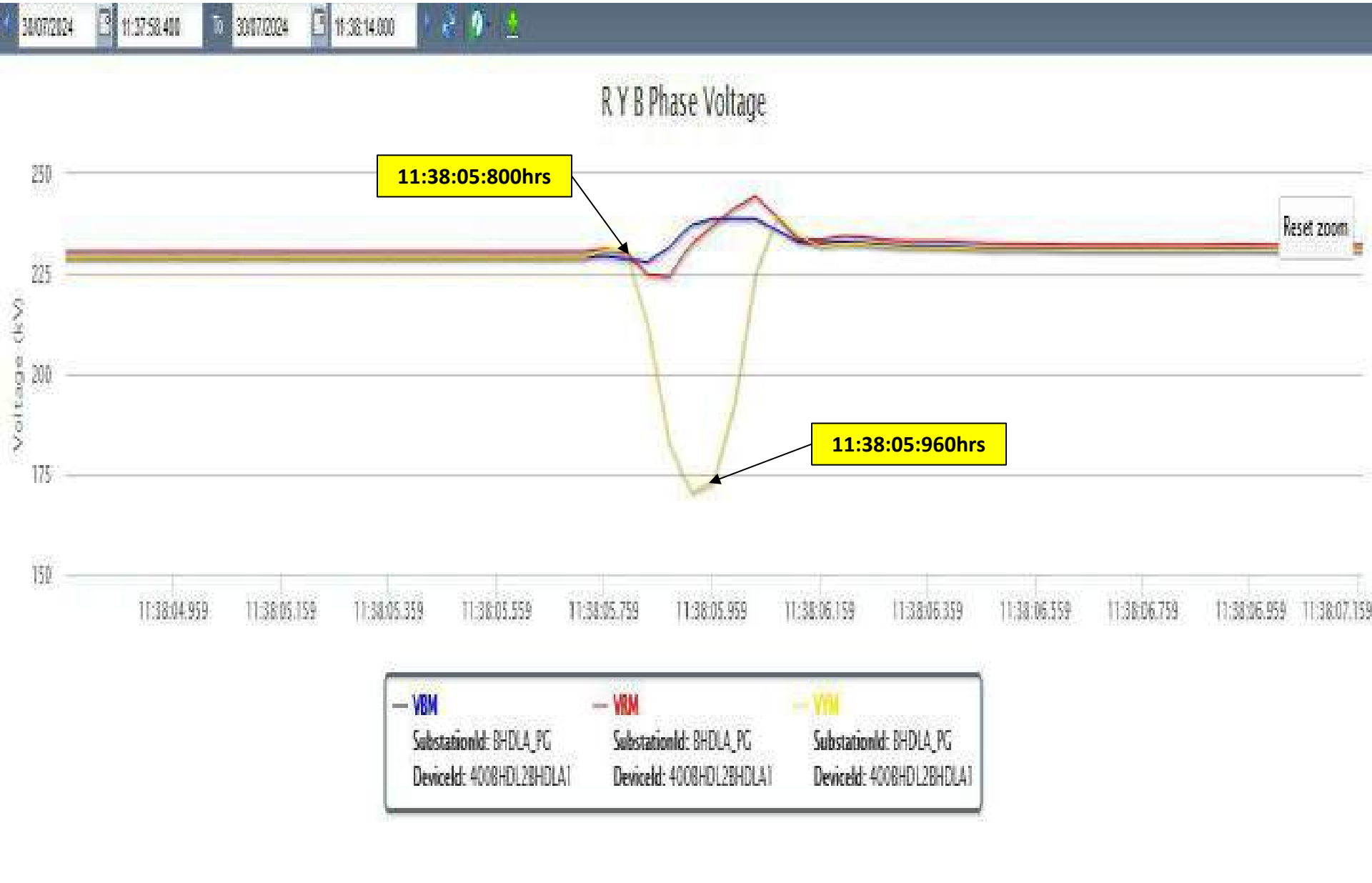
PMU Plot of frequency at Bassi(PG)

11:38 hrs/30-July-24



PMU Plot of Phase Voltage Magnitude at Bhadla(PG)

11:38 hrs/30-July-24



Point of discussion

i) Exact reason of LBB operation at RSDCL need to be shared.
ii) Phase sequence issue need to be resolved at the earliest.
iii) Tripping is not recorded in SCADA SOE. Availability of SCADA SOE data needs to be ensured.
iv) DR/EL (.dat/.cfg file) along with tripping report need to be shared for each element from both the ends.
v) Remedial action taken report to be shared.

220KV SUB –STATION CHINHAT LUCKNOW, UPPTCL

01.07.2024, 00:15 HRS

TRIPPING OF 220 KV LINE KURSI ROAD,

220 KV LINE PGCIL LKO & 220 KV LINE GOMTINAGAR DUE TO FAULT ON 220KV CHINHAT-SATRIKH ROAD LINE

AT 220 KV CHINHAT :TRIPPING OF 220 KV KURSI ROAD LINE,220 KV PGCIL LKO LINE & 220 KV GOMTI NAGAR LINE DUE TO FAULT ON 220 KV SATRIKH ROAD LINE ON DT. 01.07.2024, TIME - 00:15 HRS

- **Date & Time of event**: 01.07.2024 at 00:15 hrs
- **Sub-Station affected**: 220 KV CHINHAT ,LKO
- **Date & Time of restoration**:220 KV LINE KURSHI ROAD AT 00:28 HRS, 220KV LINE PGCIL LKO AT 03:55 HRS, 220 KV LINE GOMTINAGAR AT 04:11 HRS & 220 KV LINE SATRIKH ROAD LKO AT 05:12 HRS On SAME DAY.

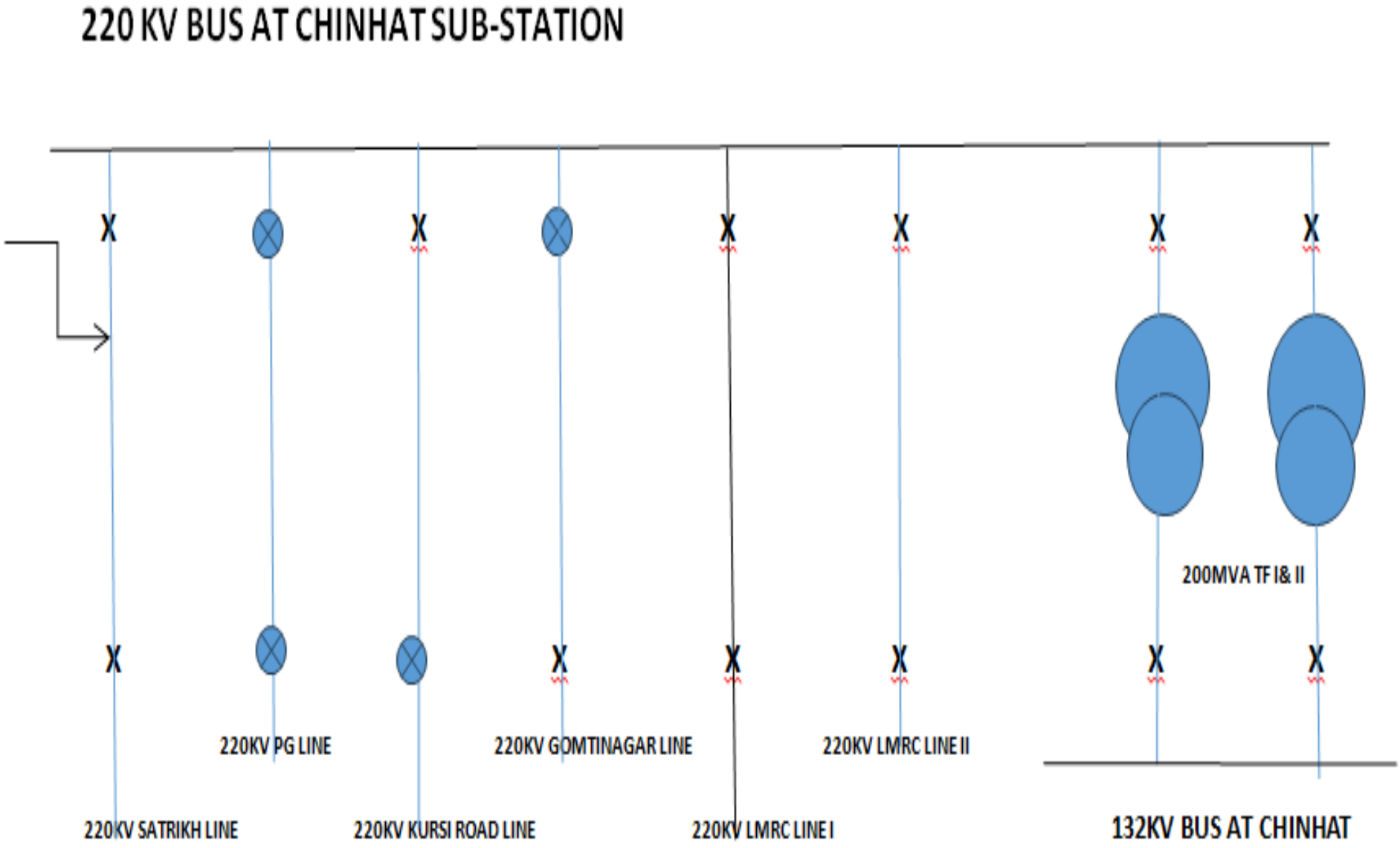
Antecedents condition

- 220 KV SUBSTATION CHINHAT HAS SINGLE MAIN AND TRANSFER BUS SCHEME.

- DURING ANTECEDENT CONDITION, **INCOMING POWER** AT CHINHAT WAS THROUGH 220KV SATRIKH ROAD LINE(~100MW),220 KV KURSI ROADLINE(~30 MW) AND 220 KV PGCIL LKO(~80 MW) & **OUTGOING POWER** WAS THROUGH 220 KV GOMTINAGAR LINE(~30 MW) AND LOAD AT CHINHAT SUB STATION(~90 MW).

- ALL 220 KV LINES AND ICTS CONNECTED TO 220 KV MAIN BUS AT CHINHAT S/S.220 KV LMRC D/C IS RADIAL LINE FROM CHINHAT S/S.

SLD

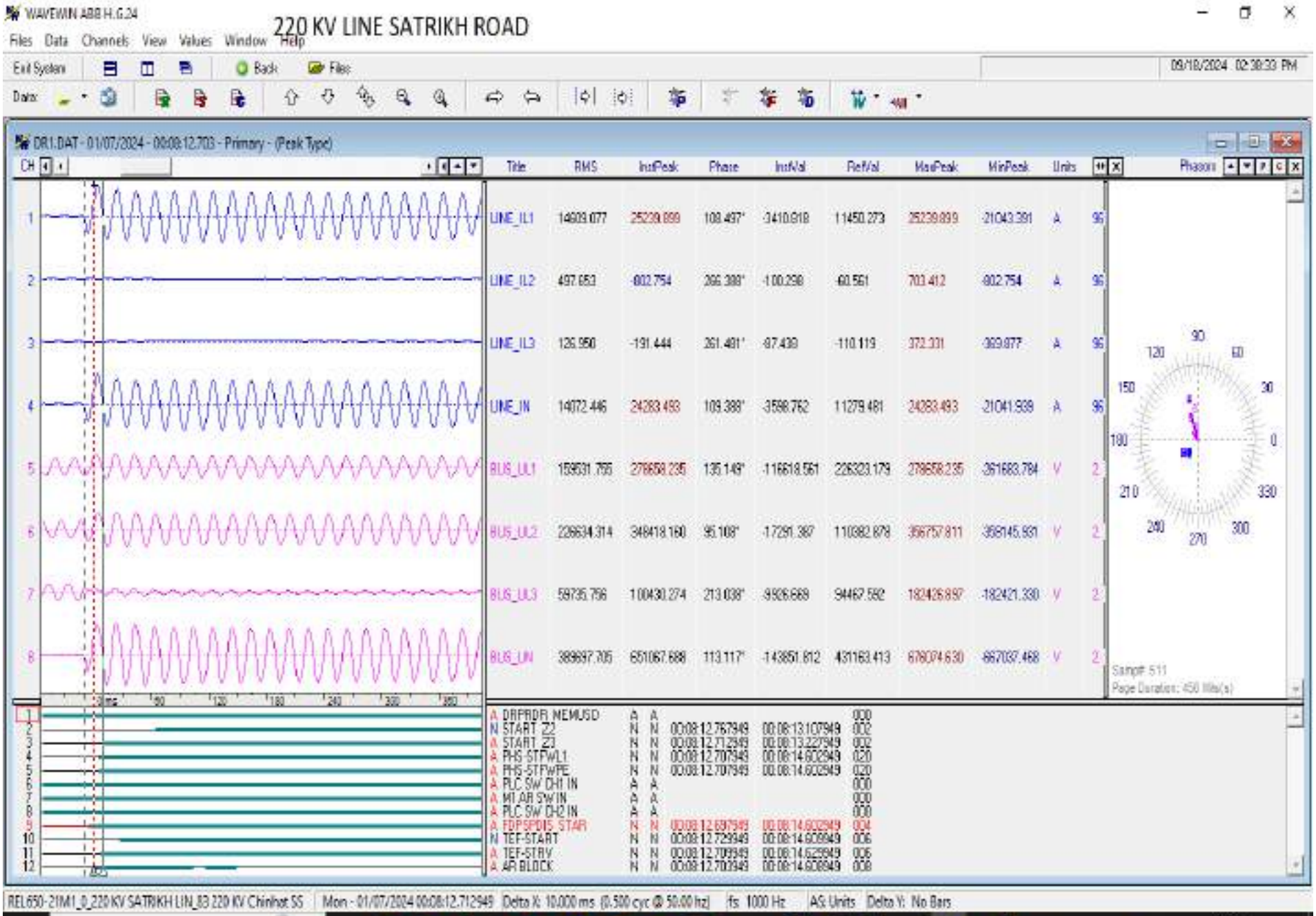

220 KV BUS AT CHINHAT SUB-STATION
220KV PG LINE
220KV GOMTINAGAR LINE
220KV LMRC LINE II
200MVA TF I& II
220KV SATRIKH LINE
220KV KURSI ROAD LINE
220KV LMRC LINE I
132KV BUS AT CHINHAT

Report

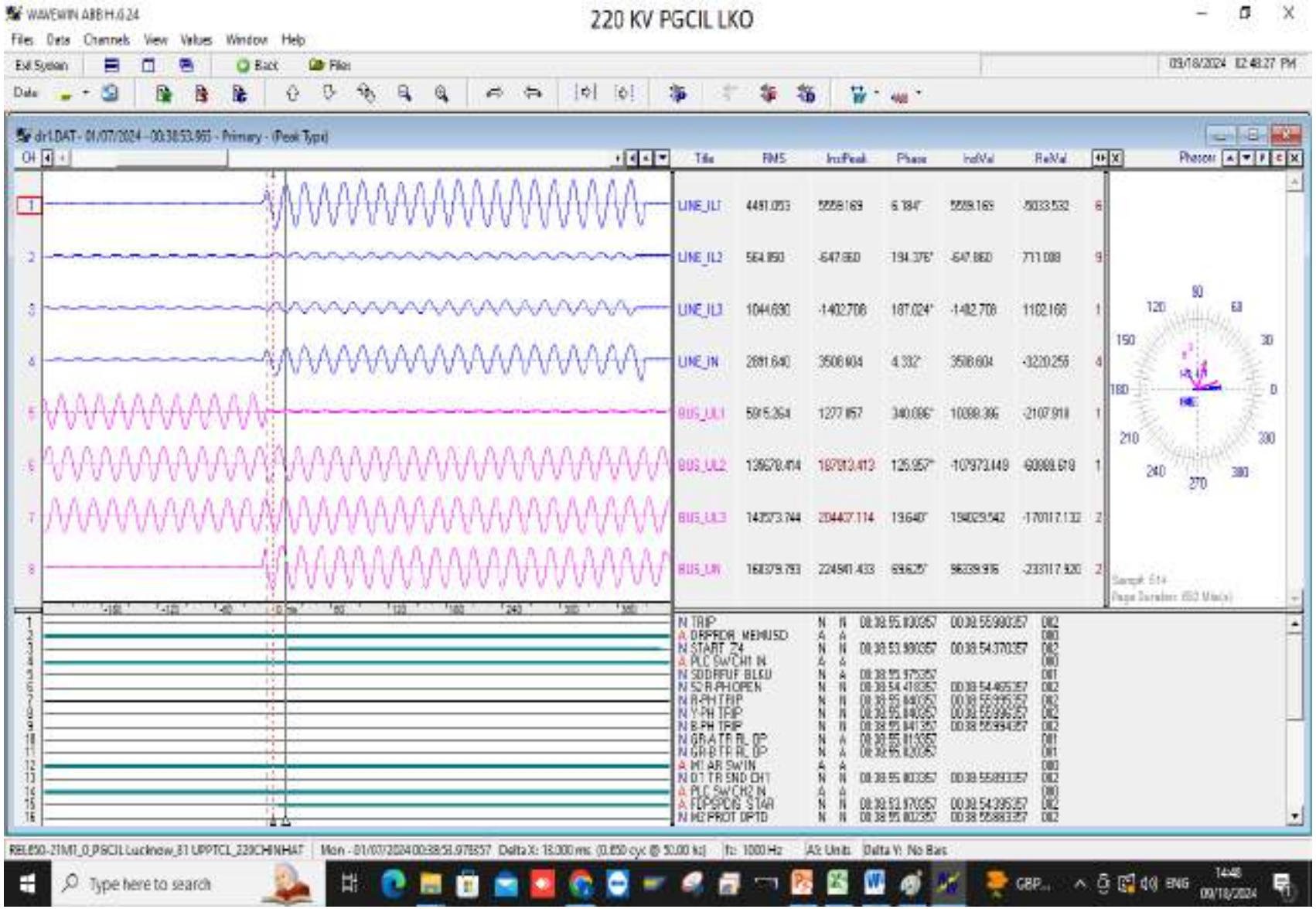
ELECTRICITY TEST AND COMMISSIONING DIVISION LUCKNOW

FALUT ANALYSIS SATATEMENT OF PROTECTION GEARS FOR THE MONTH OF JULY 2024

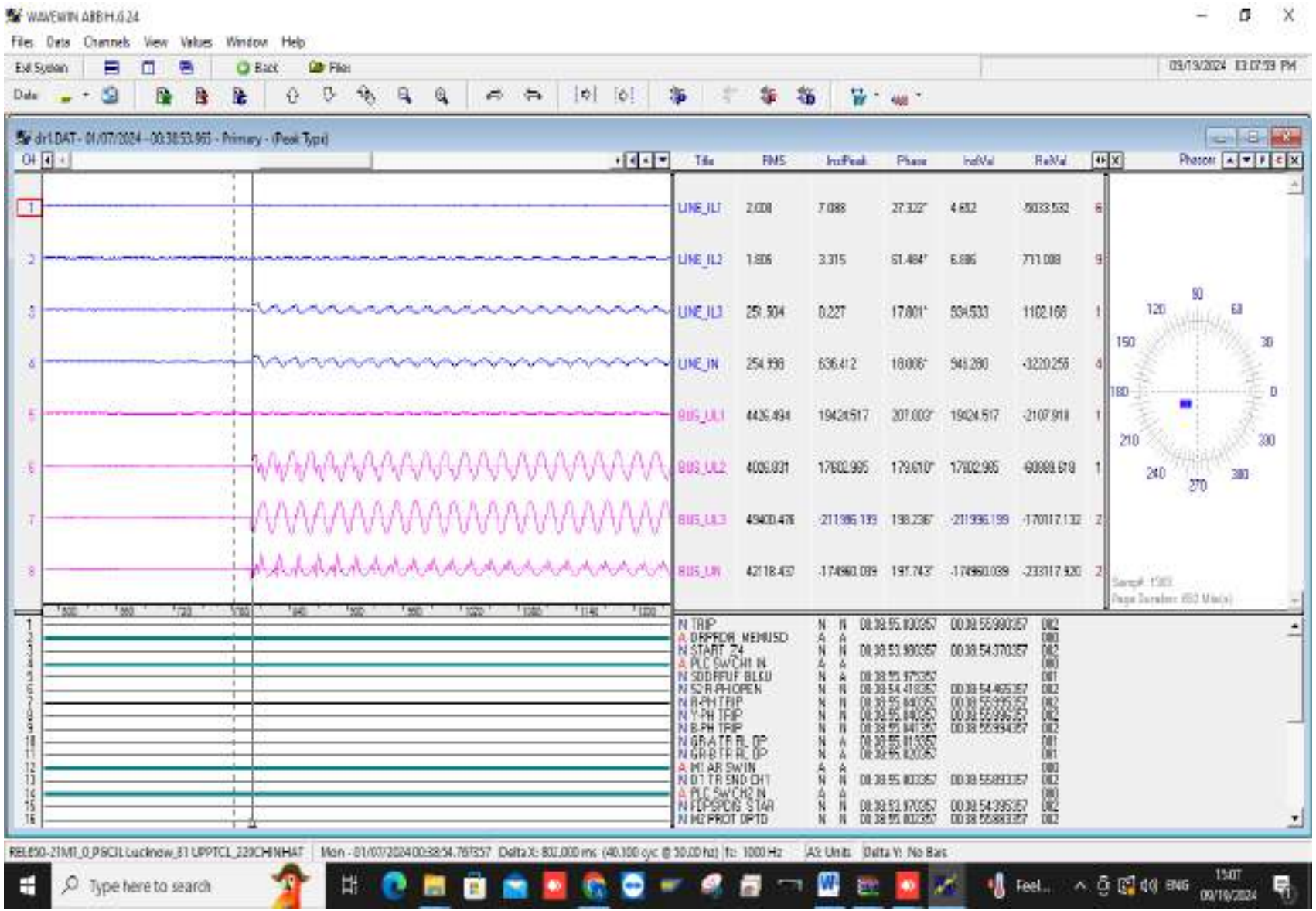
Closing Date/Time	Name of Sub station	CB No.with Direction (Code)	Type of Relay Scheme	Flags and Observation Observed	F/L,DIR, SIR,AIR, C/L	Analysis
01/07/2024 05:12 Hrs	220 kv Chinhat	CB No. 83, 220 kv Satrikh-chinhat	ABB(REL 650),GE(D60)	21M1-IL1=14.62KA,IL2=0.51KA,IL3=0.045KA,IN=14.12KA ,21M2-VT FUSE FAIL,FAULT TYPE AG,PSP	Dist-6.3KM	1. On dated 01.07.2024 at 00:15 hrs, Fault occurred at 220kv Chinhat Substation due to 220 Kv Chinhat-Satrikh line, R Phase LA was damaged at Chinhat end and its relay picked up with flags- 21M1- IL1= 14.62KA,IL2=0.51 KA,IL3=0.045KA,IN-14.12KA ,21M2-VT FUSE FAIL, FAULT TYPE AG, PSB. As per DR , fault didn't reflect in relay due to weak earthing(earthing at switch yard and neutral point of relay panel). Due to this secondary voltage increased and relay didn't issue tripping command at Chinhat end and CB didn't trip. At other end, 220kv Bus coupler tripped with delay time 120ms at Satrikh road end hence satrikh end CB didn't trip .
01/07/2024 00:28 Hrs		CB No. 84,220kv Kurshi road-chinhat	Siemens 7SA611,Siemens 7SJ8031	R phase,Z2,Dist=15.6 km IL1=4.39KA,IL2=0.30KA,IL3=0.58KA,86-1,86-2	Dist=15.6 km	220kv Chinhat- Kursi road line tripped from Kursi road end in zone 2 with fault current- 4.39KA, Distance 15.6 km.
01/07/2024 04:11 Hrs		CB N0. 82 220kv chinhat-Gomtinagar	Siemens 7SA611,Siemens 7SJ8031	Gen Trip,E/F trip,86A,86B		1. 220kv Chinhat- Gomtinagar line tripped on E/F IA-3.68KA, IB-0.393KA, IC-1.19KA IN-3.34KA with delay time 432 ms (AS PER DR) at Chinhat End. Relay Settings checked whether it is Non-Directional but current setting is found directional Earth Fault with PS=0.2 and TMS =0.2, its operation and star point re-checked. During testing of B/U relay through injection kit, it is also working in directional mode.Hence, it indicates that the back-up relay mal-operated during the fault, it should not have operated for reverse current but it operated .The setting and event record file has been shared
01/07/2024 03:55 Hrs		CB NO. 81,220kv PGCIL Lko-chinhat	ABB(REL 650),GE(D60)	Gen Trip,IL1=4.2KA,IL2=0.533KA ,IL3=1.07KA,IN=2.68KA,86-1,86-2,Z4 Pick up,Fault type AG **other end flag** :21M1-R phase F/I 4.68 KA,F/C=28.1km 21M2-Z2,F/L=27.96km,F/C 4.3KA	Dist= -2.1km	1. 220 kv Chinhat-PG Line tripped from PG end in zone 2 with fault curent-4.3KA, Dist.-27.96KM.At 00:15 hrs flags at Chinhat End, IL1- 4.2KA, I L20.533KA IL3-1.07KA, In 2.68KA, Z4 PU distt :- -2.1 KM,CB at chinhat end did not trip as CB of PG end tripped in Zone -2, after 850 ms of the occurrence of the fault as per DR- due to fault at PG end B Phase breaker pole got stuck (Also reported by operation wing) at PG end there appeared fault current in B phase. Fault gradually increased till 1900 ms then relay operated at earth-fault protection and the said fault was finally isolated from UPPTCL end.


WAVEWIN ABB H.G.24
220 KV LINE SATRIKH ROAD
Files Data Channels View Values Window Help
Exit System
Back
Files
09/18/2024 02:38:33 PM
DR1.DAT - 01/07/2024 - 00:08:12.703 - Primary - (Peak Type)
CH
Title RMS InstPeak Phase InstVal RefVal MaxPeak MinPeak Units
Phasors
LINE_IL1 14909.077 25239.899 109.497° -3410.918 11450.273 25239.899 -21043.391 A 96
LINE_IL2 497.653 -802.754 266.388° -100.259 -60.561 703.412 -802.754 A 96
LINE_IL3 126.950 -191.444 261.481° -97.439 -110.119 372.331 -369.877 A 96
LINE_IN 14072.446 24283.493 109.388° -3598.752 11279.481 24283.493 -21041.939 A 96
BUS_UL1 159631.795 278658.235 135.149° -116618.561 226323.179 278658.235 -361683.784 V 2
BUS_UL2 226634.314 348418.160 95.108° -17291.387 110382.878 356757.811 -358145.931 V 2
BUS_UL3 59735.756 100430.274 213.038° -9926.668 94467.582 182426.897 -182421.330 V 2
BUS_UN 389697.705 651067.688 113.117° -143851.812 431163.413 676074.630 -667037.468 V 2
Sample: 511
Page Duration: 450 Mile(s)
A DRPRDR_MEMUSD A A 000
N START_Z2 N N 00:08:12.767949 00:08:13.107949 002
A START_Z3 N N 00:08:12.712949 00:08:13.227949 002
A PHS-STFWL1 N N 00:08:12.707949 00:08:14.602949 020
A PHS-STFWPE N N 00:08:12.707949 00:08:14.602949 020
A PLC SW CH1 IN A A 000
A M1 AR SW IN A A 000
A PLC SW CH2 IN A A 000
A FDPSPDIS_STAR N N 00:08:12.697949 00:08:14.602949 004
N TEF-START N N 00:08:12.729949 00:08:14.609949 006
A TEF-STRV N N 00:08:12.709949 00:08:14.625949 006
A AR BLOCK N N 00:08:12.703949 00:08:14.609949 008
REL650-21M1_0_220 KV SATRIKH LIN_83 220 KV Chinhat SS
Mon - 01/07/2024 00:08:12.712949
Delta X: 10.000 ms (0.500 cyc @ 50.00 Hz)
fs: 1000 Hz
AG Units
Delta Y: No Bars
Type here to search
ENG
14:38
09/18/2024

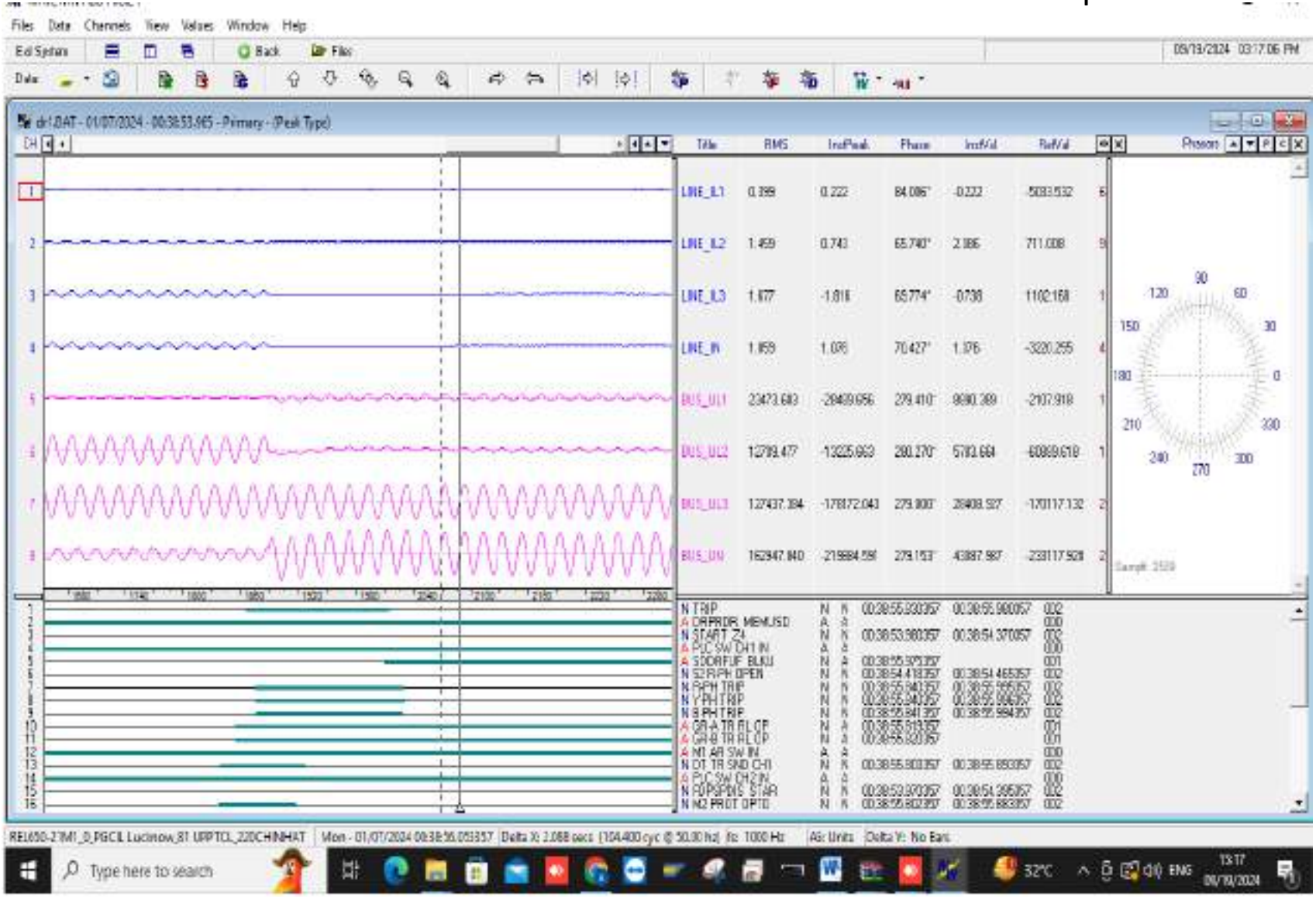
DR of PG line at Chinhat End. Snap-1



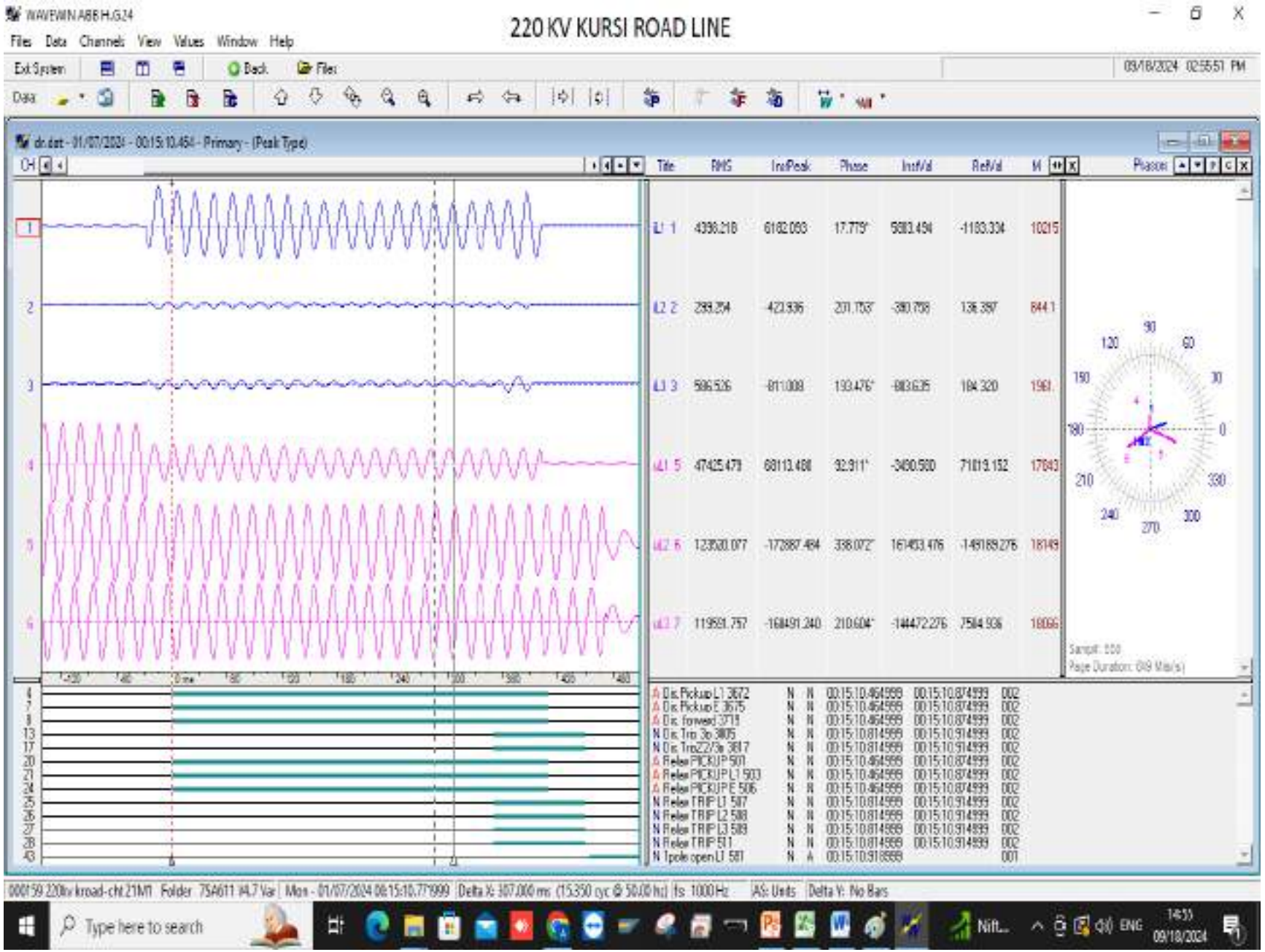
DR of PG line when current increase at Chinhat End. Snap-2

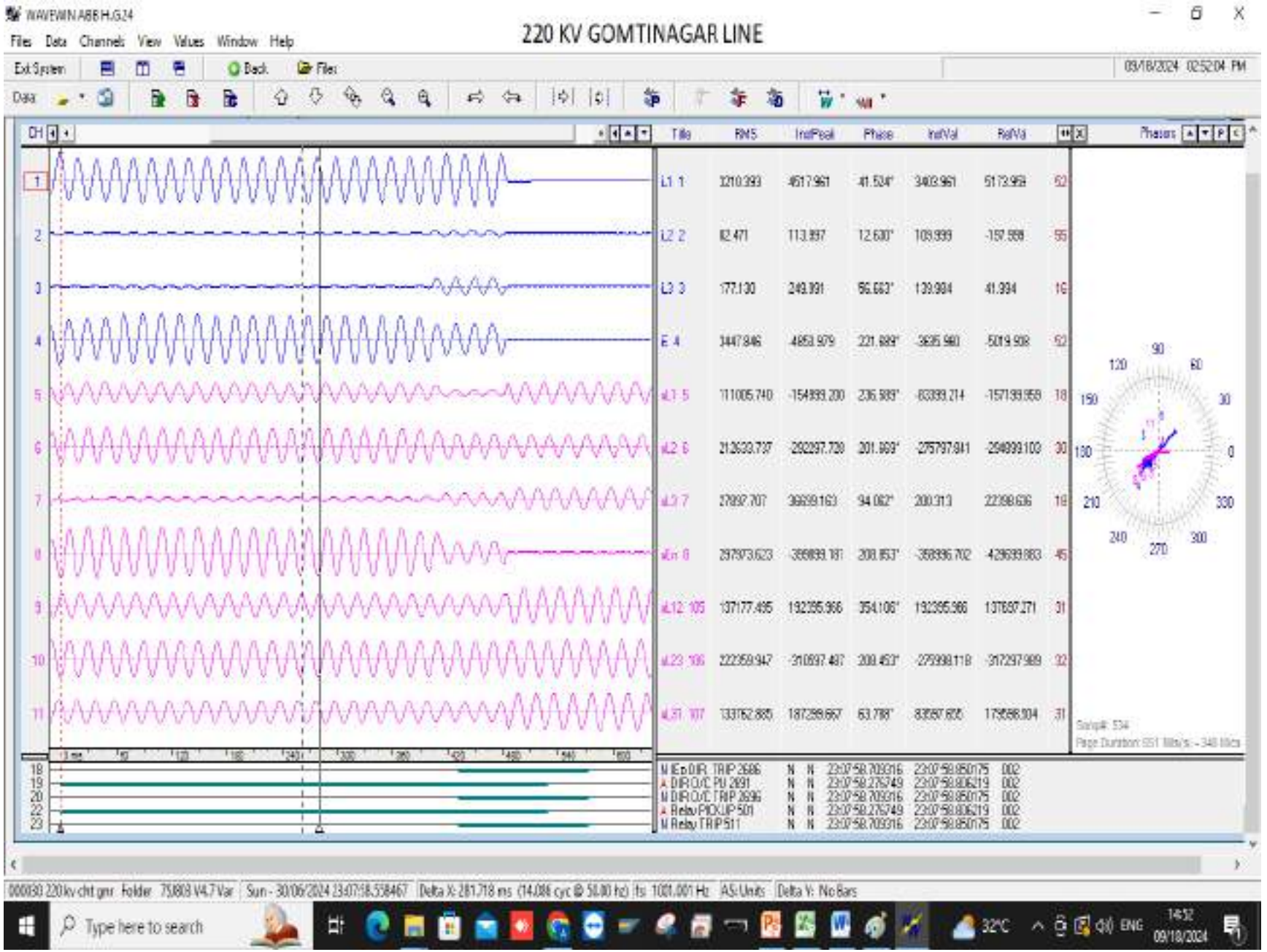


DR PG line after current reaches to zero at Chinhat End. Snap-3



220 KV KURSI ROAD LINE




WAVEWIN ABB H.G.24
220 KV GOMTINAGAR LINE
Files Data Channels View Values Window Help
Ext.System
Back
Files
09/18/2024 02:52:04 PM
Data
CH
Title
RMS
InstPeak
Phase
InstVal
RefVal
Phasors
L1 1
L2 2
L3 3
E 4
Trip
Pickup
Relay TRIP 511
Relay PICKUP 501
A DIR O/C TRIP 2696
A DIR O/C PU 2691
M IEp DIR TRIP 2686
Type here to search
32°C
ENG
14:52
09/18/2024

Events Description

- On dated 01.07.2024 at **00:15 hrs** at **220 kv CHINHAT Substation,** R Ph LA was damaged at chinhat end of 220 Kv Chinhat-Satrikh line. During fault, CB didn't open from Chinhat end and 220kv Bus coupler tripped at other (Satrikh road) end.
- At same time 220kv Chinhat-PG Line tripped from both end,220kv Chinhat- kursi Road line tripped from kursi Road end only and 220kv Chinhat-Gomtinagar line tripped from Chinhat end only.
- 220kv Chinhat- LMRC 1st &2nd line didn’t trip as it operates in radial mode at LMRC end.

Analysis Report :-

- On dated 01.07.2024 at 00:15 hrs, Fault occurred at 220kv Chinhat Substation on 220 Kv Chinhat-Satrikh line, R Phase LA was damaged at Chinhat end and its relay picked up with flags- 21M1- IL1= 14.62KA,IL2=0.51 KA,IL3=0.045KA,IN-14.12KA ,21M2-VT FUSE FAIL, FAULT TYPE AG, PSB. As per DR , fault didn't reflect in relay due to weak earthing (earthing at switch yard and neutral point of relay panel). Due to this secondary voltage increased and relay didn't issue tripping command at Chinhat end and CB didn't trip. At other end, 220kv Bus coupler tripped with delay time 120ms at Satrikh road end hence satrikh end CB didn't trip .
- 220 kv Chinhat-PG Line tripped from PG end in zone 2 with fault curent-4.3KA, Dist.-27.96KM. At 00:15 hrs flags at Chinhat End, IL1- 4.2KA, I L2-0.533KA, IL3-1.07KA, In- 2.68KA, Z4 PU, dist :- -2.1 KM, CB at Chinhat end did not trip as CB of PG end tripped in Zone -2, After 850 ms of the occurrence of the fault as per DR. Due to fault at PG end B Phase breaker pole got stuck (Also reported by operation wing) at PG end there appeared fault current in B phase. Fault gradually increased till 1900 ms then relay operated at earth-fault protection and the said fault was finally isolated from UPPTCL end.

- 220kv Chinhat- Kursi road line tripped from Kursi road end in zone 2 with fault current- 4.39KA, Distance 15.60 KM.

- 220kv Chinhat- Gomtinagar line tripped on E/F IA-3.68KA, IB-0.393KA, IC-1.19KA IN-3.34KA with delay time 432 ms (AS PER DR) at Chinhat End. (Relay Settings checked whether it is Non-Directional but current setting is found directional Earth Fault with PS=0.2 and TMS =0.2, its operation and star point re-checked. During testing of B/U relay through injection kit, it is also working in directional mode.) Hence, it indicates that the back-up relay mal-operated during the fault, it should not have operated for reverse current but it operated .

Remedial Measures Taken.

- On dated 01.07.2024, 220 kV Chinhat-Satrikh line protection testing was performed at 220 kV Chinhat Substation and it was found that distance protection relay tripped on given fault with 86 relay and CB were operating properly. Earthing was done in field junction box but as per approved drawing there was earthing in panel also. Due to double earthing the above mentioned problem occurred. During shutdown, problem pertaining to neutral earthing has been rectified at 220kv Satrikh line relay panel.

THANK YOU.

Multiple elements tripping at 400/132kV Mau(UP) 07th July 2024

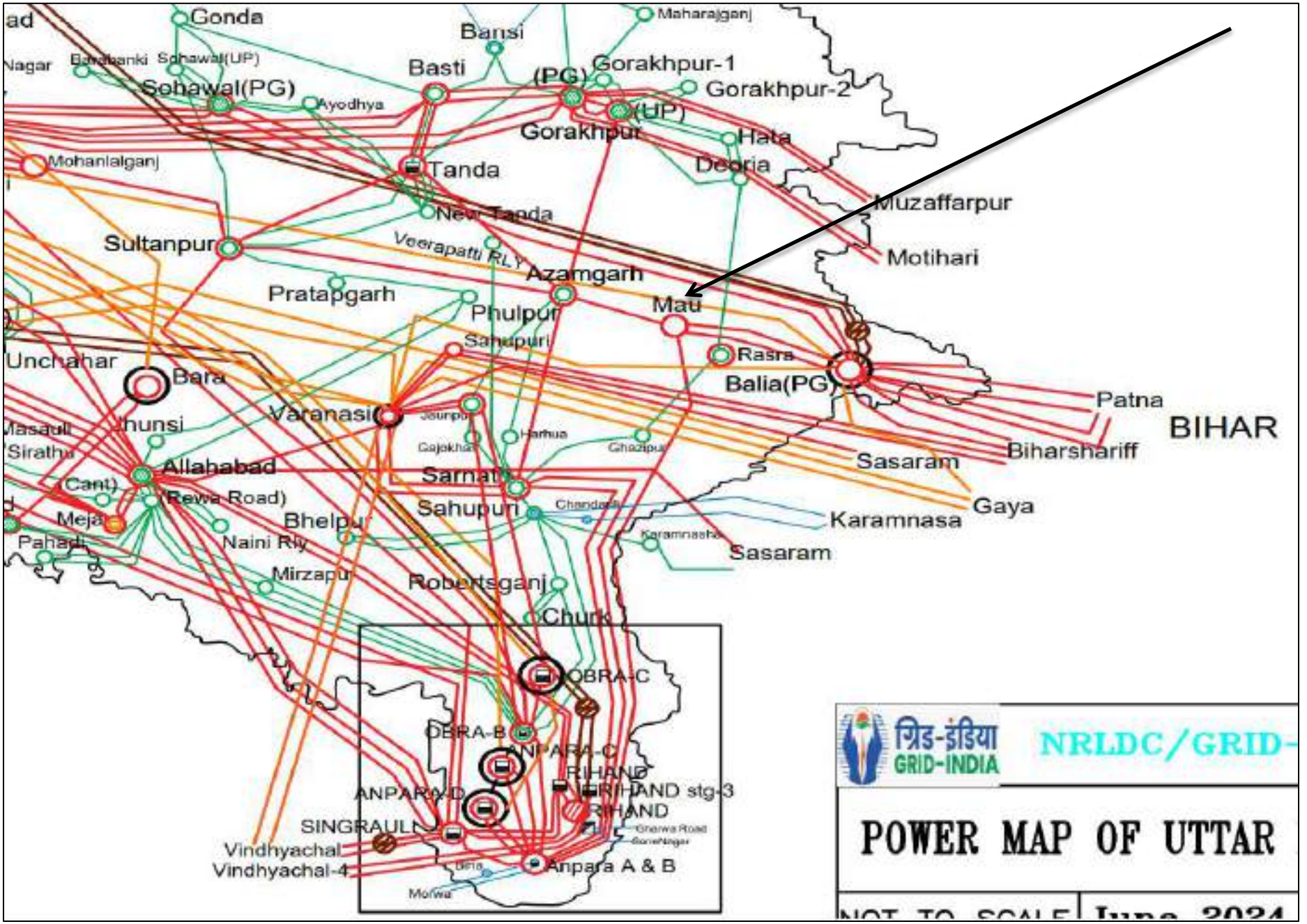
Brief of event:

i. 220kV Mau(UP) has double main and transfer bus scheme at 400kV level.
ii. During antecedent condition, 400 KV Azamgarh-Mau (UP) Ckt, 400 KV Mau(UP)-Balia(PG) (PG) Ckt & 400/132 kV 200 MVA ICT-3 connected to 400kV bus-1 and 400kV Mau-Rasra (UP) ckt, 400/132/33kV 200MVA ICT-1 & 2 connected to 400kV bus-2. 400 KV Anpara_B(UPUN)-Mau(UP) (UP) Ckt was not in service during the event.
iii. As reported, at 11:44 hrs, B-phase CT of 400 KV Azamgarh-Mau (UP) Ckt burst which caused bus fault on 400kV bus-1 which led to bus bar protection operation on 400kV bus-1 at Mau(UP) S/s (Reason for delayed operation of bus bar protection yet to be received).
iv. As per PMU at Azamgarh(UP), B-N phase to earth fault converted into Y-B phase to phase fault with delayed fault clearance time of 560ms is observed (Reason for delayed fault clearance is yet to receive).
v. Due to bus bar protection operation, all elements connected to 400kV bus-1 (400kV Azamgarh(UP) ckt, Balia(PG) ckt and 400/132 kV 200 MVA ICT-3) tripped at 400kV Mau(UP) S/s.
vi. As per SCADA, change in demand of approx. 60 MW in UP control area.

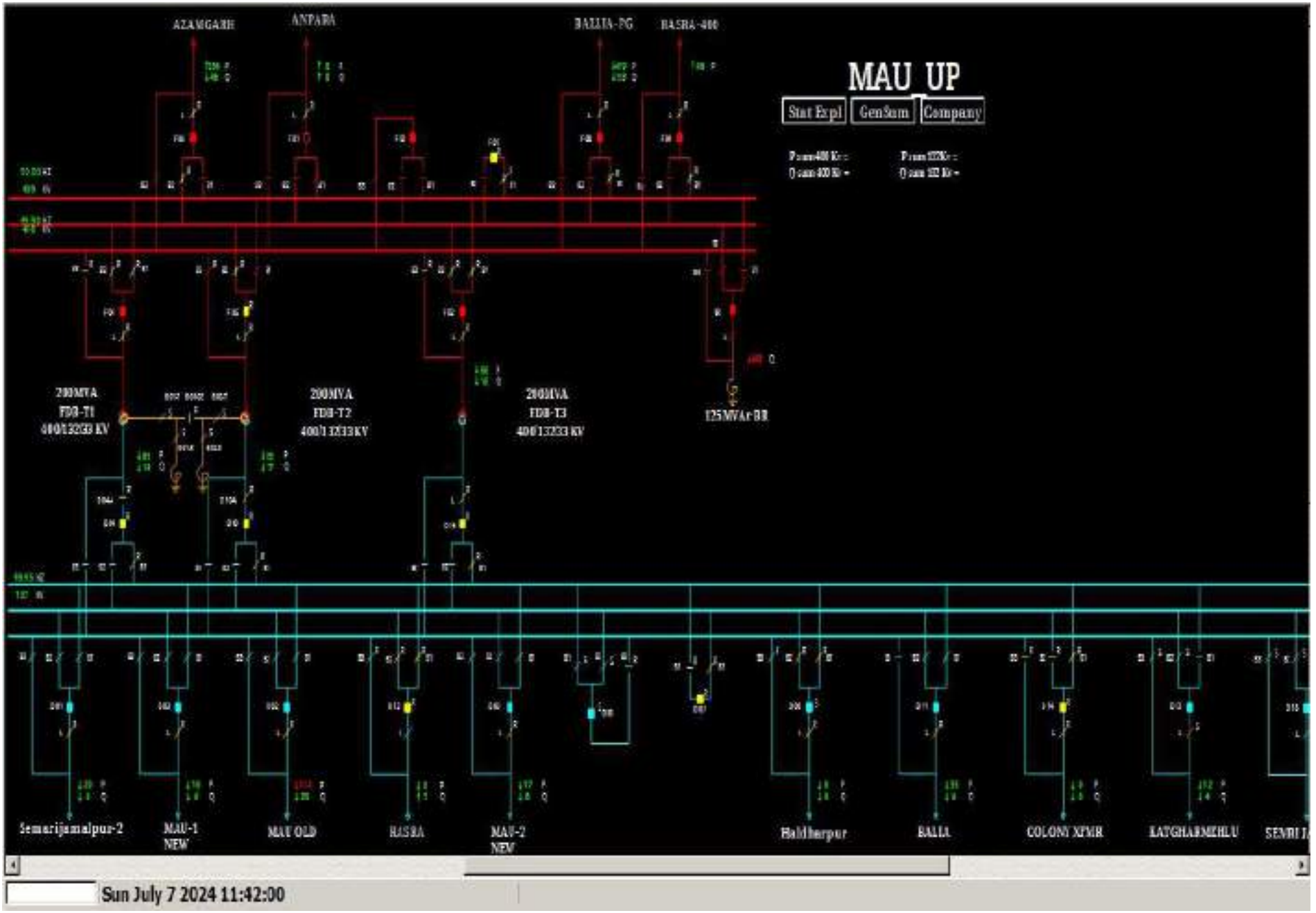
Elements tripped:

i. 400 KV Azamgarh-Mau (UP) Ckt
ii. 400 KV Mau(UP)-Balia(PG) (PG) Ckt
iii. 400/132 kV 200 MVA ICT 3 at Mau(UP)

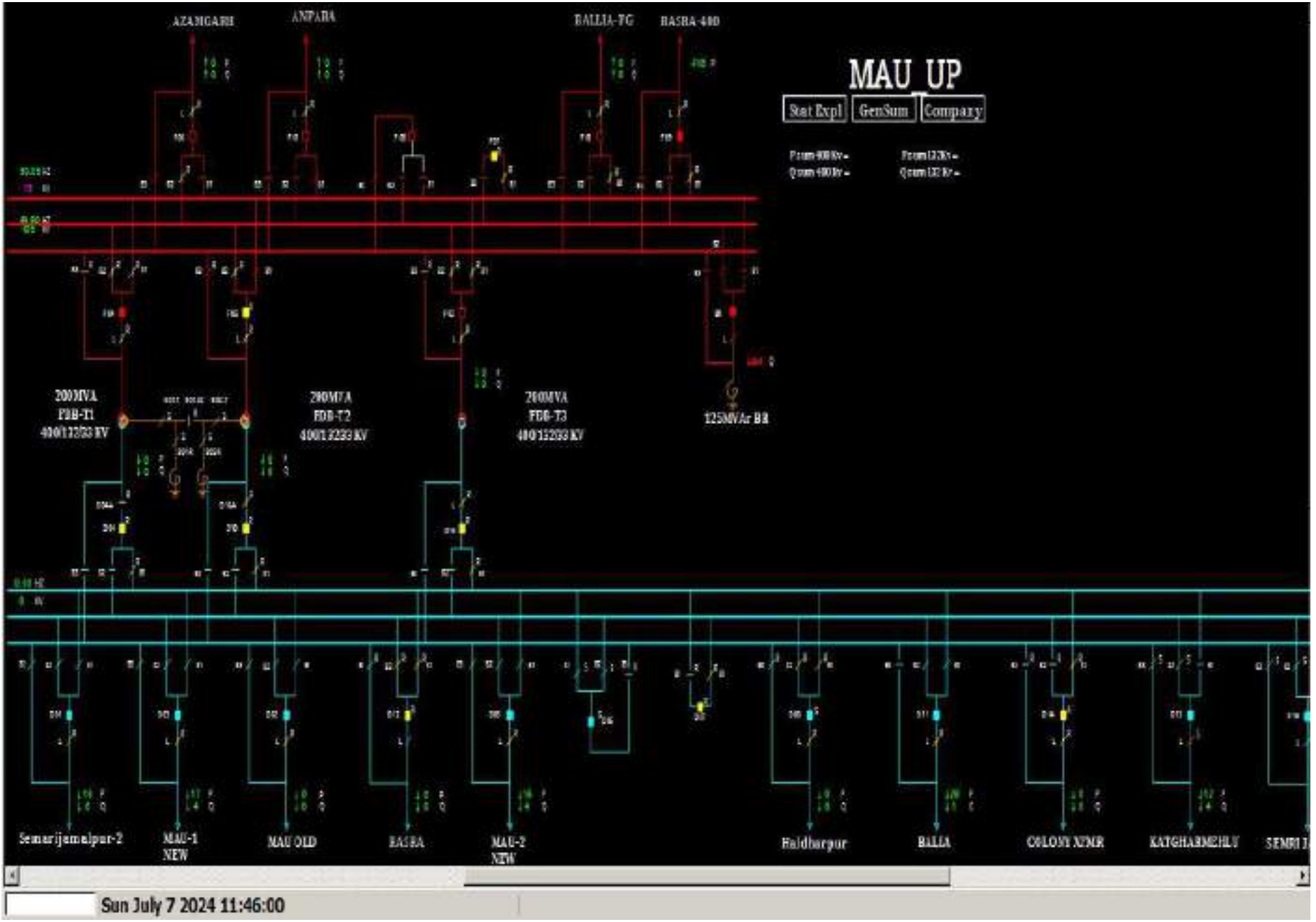
Network Diagram



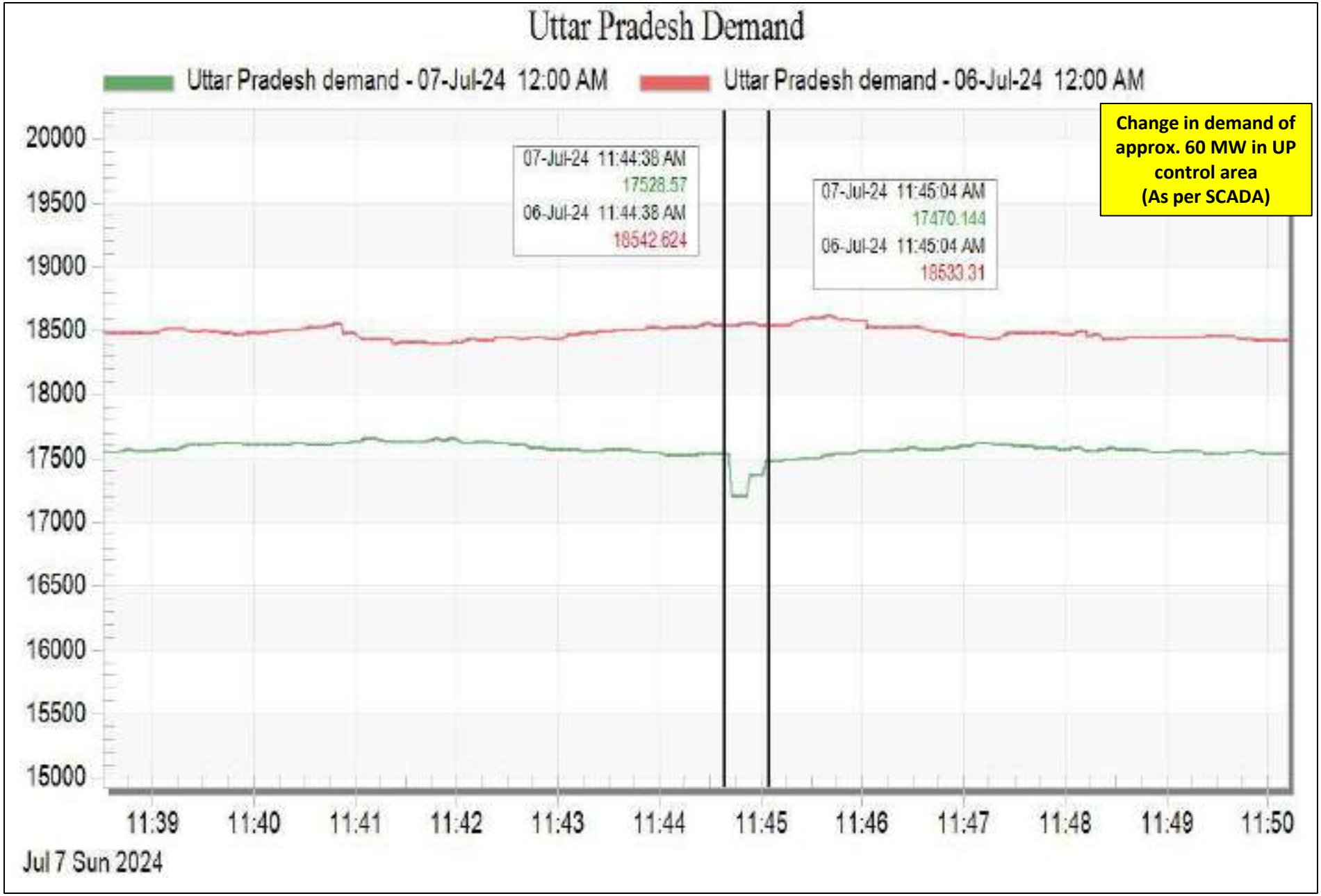
SLD of 400KV Mau(UP) before the event



SLD of 400KV Mau(UP) after the event

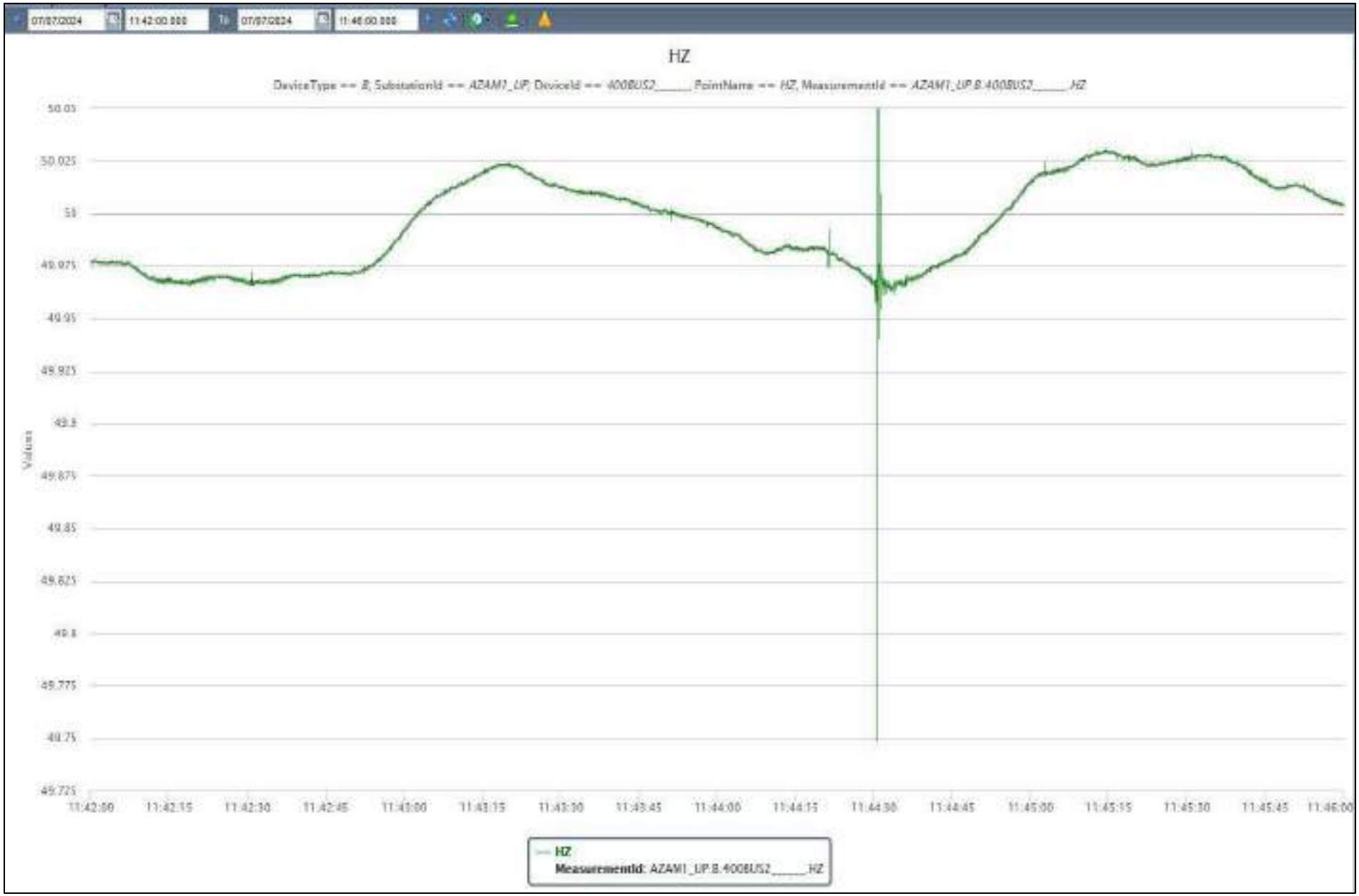


Uttar Pradesh Demand during the event



PMU Plot of frequency at Azamgarh(UP)

11:44 hrs/07-July-24



PMU Plot of phase voltage magnitude at Azamgarh(UP)

11:44 hrs/07-July-24

SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remarks
11:44:30,568	MAU___UP	400kV	03TBC	Circuit Breaker	Open	Transfer bus coupler at Mau(UP) end of 400kVbus-1,2 &transfer bus opened
11:44:30,571	MAU___UP	400kV	06AZAM1	Circuit Breaker	Open	Line CB at Mau(UP) end of 400 kV Mau-Azamgarh (UP) Ckt opened
11:44:30,571	MAU___UP	400kV	02T3	Circuit Breaker	Open	CB at Mau(UP) end of 400/132/33kV 200MVA ICT-3 opened
11:44:30,575	MAU___UP	400kV	08BALIA1	Circuit Breaker	Open	Line CB at Mau(UP) end of 400 KV Mau(UP)-Balia(PG) (PG) Ckt opened
11:44:30,584	RASDA_UP	400kV	01MAU	Circuit Breaker	disturbe	
11:44:31,190	MAU___UP	400kV	06AZAM1	Circuit Breaker	Close	Line CB at Mau(UP) end of 400 kV Mau-Azamgarh (UP) Ckt closed
11:44:31,239	MAU___UP	400kV	06AZAM1	Circuit Breaker	Open	Line CB at Mau(UP) end of 400 kV Mau-Azamgarh (UP) Ckt opened
11:45:02,341	AZAM1_UP	400kV	10MAU	Circuit Breaker	Open	Tie CB at Azamgarh(UP) end of 400 kV Mau-Azamgarh (UP) Ckt opened
11:45:06,123	AZAM1_UP	400kV	9MAU	Circuit Breaker	Open	Tie CB at Azamgarh(UP) end of 400 kV Mau-Azamgarh (UP) Ckt opened

Point of discussion

i) Nature of fault and reason for delayed fault clearance need to be shared.

ii) Reason for delayed operation of bus bar protection and protection settings at Mau(UP) S/s need to be shared.

iii) DR/EL (.dat/.cfg file) of all the tripped elements along with detailed tripping report need to shared.

iv) Remedial action taken report to be shared.

400 KV Sub-Station MAU, UPPTCL

07.07.2024, 11:44 Hrs

TRIPPING OF BUS BAR AND ELEMENTS CONNECTED ON BUS 1 (200 MVA ICT-3 & 400 KV MAU – BALLIA (PGCIL)LINE DUE TO THE FAULT ON 400 KV MAU – AZAMGARH LINE

400 KV MAU :TRIPPING OF BUS BAR AND ELEMENTS CONNECTED ON BUS-1 (200 MVA ICT-3,400 KV MAU-BALLIA PGCIL LINE) DUE TO FAULT ON 400 KV MAU – AZAMGARH LINE DATED-07.07.2024

- **Date & Time of event**: 07.07.2024 at 11:44 hrs
- **Sub-Station affected**: 400 KV Substation MAU
- **Date & Time of restoration**: 400 KV MAU-BALLIA PGCIL LINE, 200 MVA ICT-3 AT 14:01Hrs &14:02 Hrs RESPECTIVELY ON 07.07.2024. AND 400 KV MAU – AZAMGARH LINE AT 17:29 Hrs ON 09.07.2024.

Antecedents condition

- IN ANTECEDENTS CONDITION 400 /132KV 200 MVA ICT-3 & 400 KV MAU-AZAMGARH LINE , 400 KV MAU – BALLIA (PGCIL) LINE WERE CARRYING 66 MW,275MW & 509MW RESPECTIVELY.

- IN ANTECEDENTS CONDITION ELEMENTS CONNECTED ON BUS -2 : 400 /132KV 200 MVA ICT-1, ICT-2 & 400 KV MAU-RASRA LINE WERE CARRYING 63 MW,61MW & 47 MW RESPECTIVELY. 400 KV MAU-ANPARA LINE WAS IN SHUTDOWN.

Report 400 KV SS MAU

DETAILED ANALYSIS REPORT	
INTRODUCTION	
TIME AND DATE OF EVENT	**11:44, 07.07.2024**
SUBSTATION AFFECTED ALONG WITH VOLTAGE LEVEL	400kV S/S Mau
BRIEF SUMMARY	**Brief Analysis:** 1. B-phase CT of 400KV Mau- Azamgarh line got damaged. 2. Busbar differential protection optd. 3. B pole of CB lagged in opening causes LBB prot operation.
ANTECEDENT CONDITIONS	
WEATHER INFORMATION	Rainy
ADDITIONAL RELEVANT INFORMATION VIZ POWER FLOW AND SHUTDOWN	During antecedent condition 200 MVA ICT-3 and 400 kV lines to Azamgarh, Ballia (PGCIL), were carrying 66MW, 275MW.-509MW respectively.
EVENT DATA	
CHANGE IN FREQUENCY	
GENERATION LOSS	NIL
LOAD LOSS	60 MW (as per SCADA data)
ENERGY LOSS IN MU	
SINGLE LINE DIAGRAM(Detailing Bus arrangement and Tripped elements)	Attached
DR / EL	Attached

NAME AND TIME OF THE TRIPPED ELEMENT IN TIME CHRONOLOGY ALONG WITH RESTORATION TIME AND FLAG

NAME OF ELEMENT	RESTORATION DATE	RESTORATION TIME	FLAGS END 1	FLAGS END 2
400kV Mau-Azamgarh line	09.07.2024	17:29	**Control panel flag-** Dist trip,carrier send, CB pole discrepancy, DT receive, GR B dc fail. **M-1(REL670)-** ZONE-1, B-PHASE, IL3=2.74KA, DIST=0KM, Rxme-18 B phase, GR-A trip . **M-2(SIPROTEC)-** B-PHASE PICKUP **Flag on Other panel-** RAICA prot optd	**M1(SIPROTEC)-** Y, B Phase pickup,zone-2, A/R optd, fault current-6.58KA, dist-46.1km. **M2(ABB)-** Y, B Phase pickup, zone-2, fault current-6.59KA, dist-45.4km
200MVA ICT-3	07.07.2024	14:02	**BUSBAR OPERATION RELAY(SEL487B)-** TRIP, 87 DIFF. ZONE-1, LBB Optd,BKR Fail,96 OPTD.	--
400kv Mau-Ballia(PG) line	07.07.2024	14:01	-Do-	--

EVENT DESCRIPTION/ANALYSIS OF THE EVENT

1. On dated 07.07.2024 at 11:44Hrs, B phase CT of 400kv Mau- Azamgarh line got damaged As per the DR/EL zone-1 prot of main-1 relay and Busbar Differential protection operated (operating current 6pu) and elements connected through BUS-1 got tripped in 60ms(ict-3, pgcil) but due to delay/non opening of B pole CB of Mau- Azamgarh line as per DR at Mau end causes LBB Protection also (ABB Make RAICA static Relay) to operate in approx 500ms. CB of Mau- Azamgarh line opened on Pole discrepancy prot. As per DR of Main -2 relay of Mau- Azamgarh line, At the time of fault B phase current of core-2 (used for main-2 and LBB protection as per scheme) is negligible and B phase current of core-1 (used for main-1 protection) is about 30KA. After 280ms Y phase fault (6KA) created and LBB prot optd in (280ms+200ms)=480ms.

DR 400 KV MAU-AZAMGARH LINE

ABB

Disturbance Short Report

Disturbance Recordings Information

Device Information

Recorder ID	1
IED type	REL670
IED version	1.2.3.18
Station name	UPPTCL KASARA MAU
Object name	AZAMGARH LINE-M1
IED name	REL670 1.2.3

Fault Information

Trig date and time	07-07-2024 11:44:30.511
Trigger signal name	PHS-STFWL3
Recording number	735
Total recording time	3009 ms
Pre-trig recording time	500 ms
Post trig recording time	2499 ms
Max. recording time	3000 ms

General Recordings Information

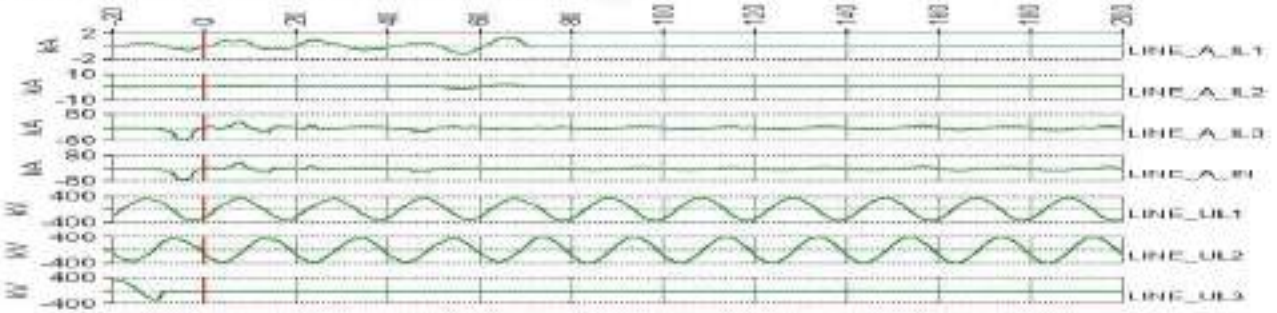
Disturbance recorder	Installed
Event recorder	Installed
System frequency	50 Hz
Sampling frequency	1 kHz
Active setting group during recording	1

Fault Location Information

Fault loop type	L3-N
Fault location	0.0 (0.0 %)
Status of fault calculation	Ok
Fault direction	Not valid

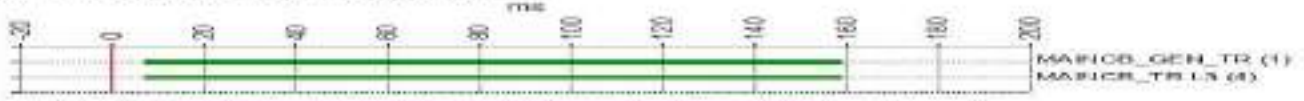
Analog Time Diagram

Trig Date Time: 07-07-2024 11:44:30.511

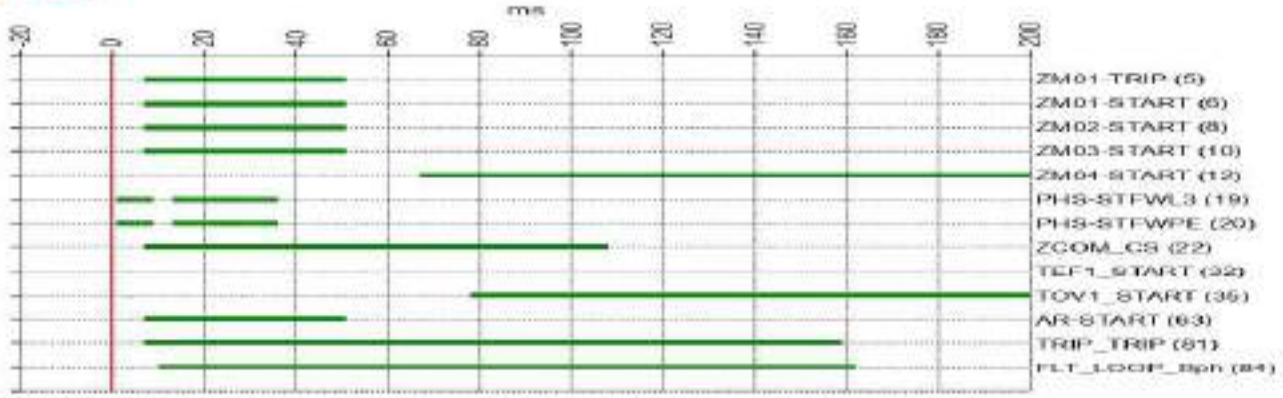


Binary Time Diagram

Trig Date Time: 07-07-2024 11:44:30.511



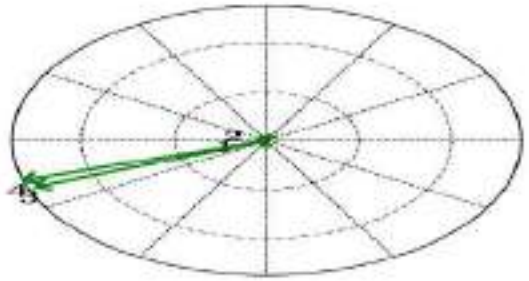
Recording File Name: C:\PCM\Data\Database\Disturbance\Recordings\Vipin 7 Jul 24\IED GRID\REL670_AA1C1G01A1\AA1C1G01A1\20240707\20



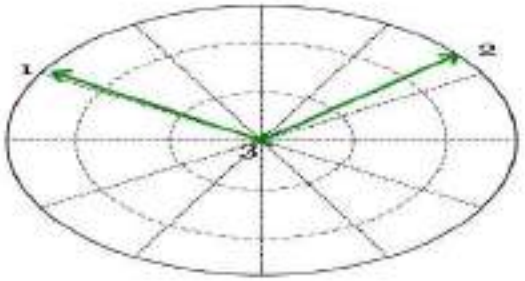
Vector Diagrams

Calculation Time Period : 1 ms to 20 ms

Currents



Voltages



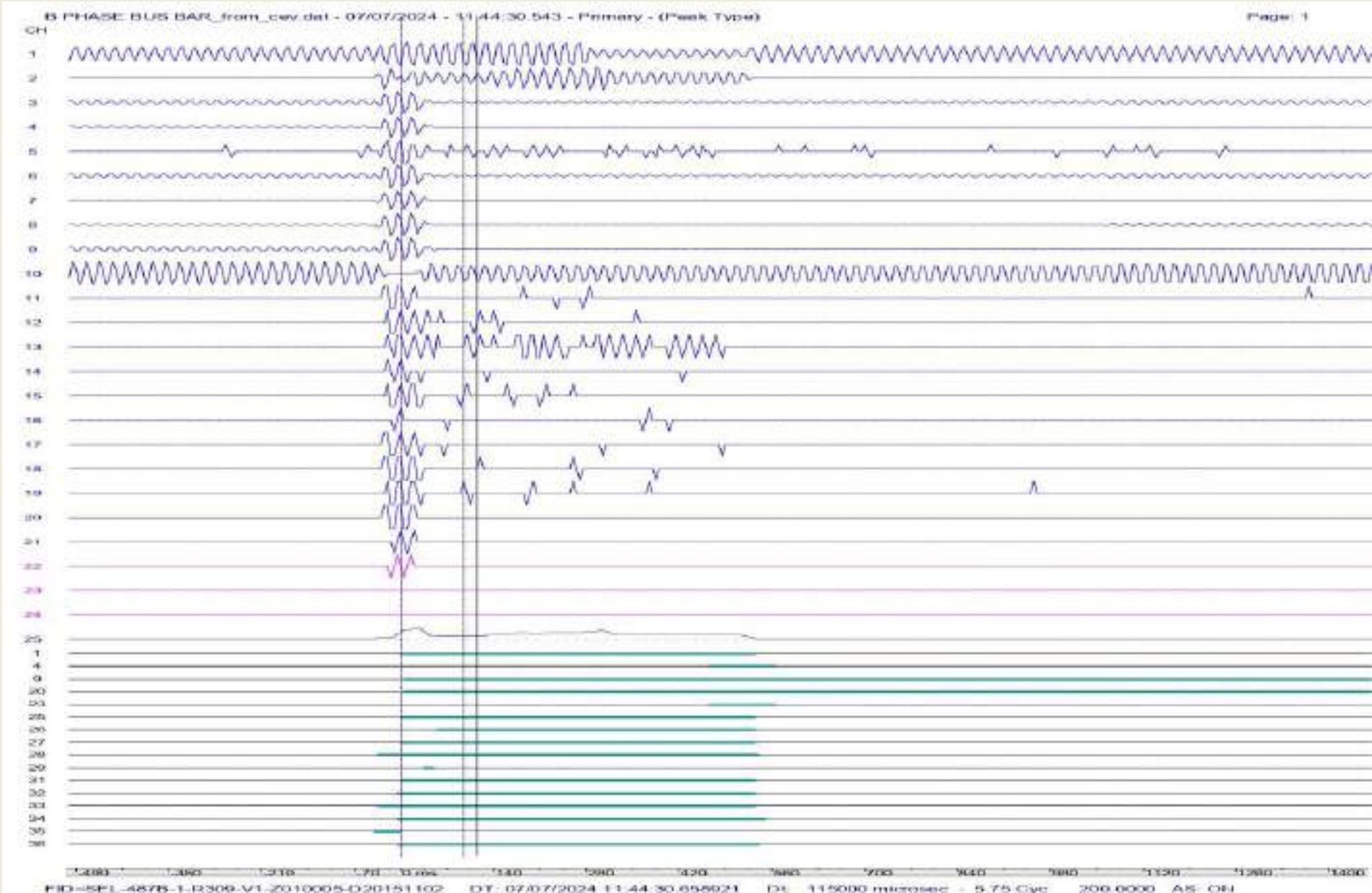
No.	Name	RMS	Angle	No.	Name	RMS	Angle
1	LINE_A_IL1	580.329(A)	178.9°	1	LINE_UL1	241021.469 (V)	148.1°
2	LINE_A_IL2	550.398(A)	151.7°	2	LINE_UL2	250097.719 (V)	39.8°
3	LINE_A_IL3	15650.207(A)	200.7°	3	LINE_UL3	5120.696(V)	194.4°
4	LINE_A_IN	16101.972(A)	197.2°				

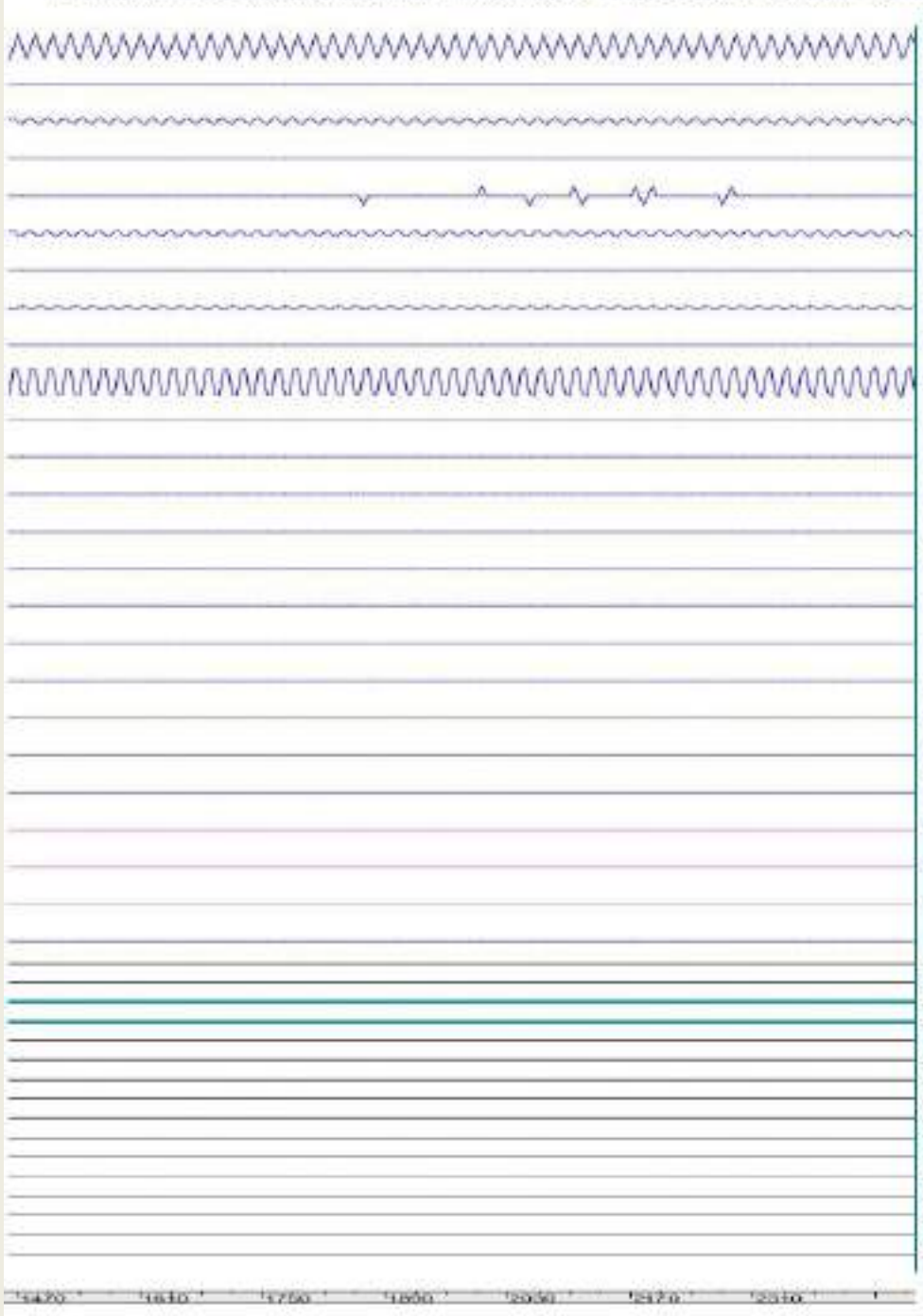
Events List

Channel Number	Name	Status	Time
19	PHS-STFWL3	On	07-07-2024 11:44:30.511
20	PHS-STFWPE	On	07-07-2024 11:44:30.511
1	MAINCB_GEN_TR	On	07-07-2024 11:44:30.517
4	MAINCB_TR L3	On	07-07-2024 11:44:30.517
5	ZM01-TRIP	On	07-07-2024 11:44:30.517
6	ZM01-START	On	07-07-2024 11:44:30.517
8	ZM02-START	On	07-07-2024 11:44:30.517
10	ZM03-START	On	07-07-2024 11:44:30.517
22	ZCOM_CS	On	07-07-2024 11:44:30.517

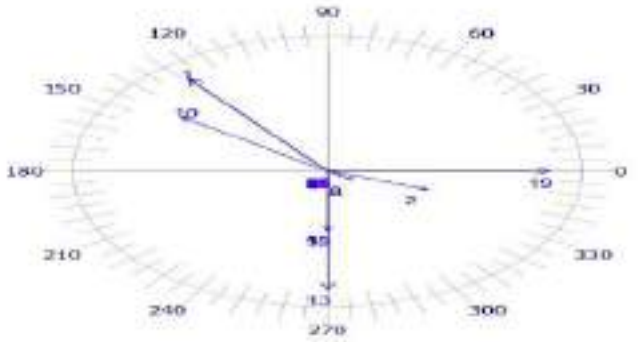
63	AR-START	On	07-07-2024 11:44:30.517
81	TRIP_TRIP	On	07-07-2024 11:44:30.517
19	PHS-STFWL3	Off	07-07-2024 11:44:30.520
20	PHS-STFWPE	Off	07-07-2024 11:44:30.520
84	FLT_LOOP_Bph	On	07-07-2024 11:44:30.520
19	PHS-STFWL3	On	07-07-2024 11:44:30.523
20	PHS-STFWPE	On	07-07-2024 11:44:30.523
19	PHS-STFWL3	Off	07-07-2024 11:44:30.547
20	PHS-STFWPE	Off	07-07-2024 11:44:30.547
5	ZM01-TRIP	Off	07-07-2024 11:44:30.562
6	ZM01-START	Off	07-07-2024 11:44:30.562
8	ZM02-START	Off	07-07-2024 11:44:30.562
10	ZM03-START	Off	07-07-2024 11:44:30.562
63	AR-START	Off	07-07-2024 11:44:30.562
12	ZM04-START	On	07-07-2024 11:44:30.577
35	TOV1_START	On	07-07-2024 11:44:30.588
22	ZCOM_CS	Off	07-07-2024 11:44:30.619
1	MAINCB_GEN_TR	Off	07-07-2024 11:44:30.670
4	MAINCB_TR L3	Off	07-07-2024 11:44:30.670
81	TRIP_TRIP	Off	07-07-2024 11:44:30.670
84	FLT_LOOP_Bph	Off	07-07-2024 11:44:30.673
19	PHS-STFWL3	On	07-07-2024 11:44:30.739
20	PHS-STFWPE	On	07-07-2024 11:44:30.739
12	ZM04-START	Off	07-07-2024 11:44:30.742
19	PHS-STFWL3	Off	07-07-2024 11:44:30.742
20	PHS-STFWPE	Off	07-07-2024 11:44:30.742
1	MAINCB_GEN_TR	On	07-07-2024 11:44:30.760
4	MAINCB_TR L3	On	07-07-2024 11:44:30.760
5	ZM01-TRIP	On	07-07-2024 11:44:30.760
6	ZM01-START	On	07-07-2024 11:44:30.760
8	ZM02-START	On	07-07-2024 11:44:30.760
10	ZM03-START	On	07-07-2024 11:44:30.760
19	PHS-STFWL3	On	07-07-2024 11:44:30.760
20	PHS-STFWPE	On	07-07-2024 11:44:30.760
22	ZCOM_CS	On	07-07-2024 11:44:30.760
63	AR-START	On	07-07-2024 11:44:30.760
81	TRIP_TRIP	On	07-07-2024 11:44:30.760
84	FLT_LOOP_Bph	On	07-07-2024 11:44:30.763
32	TEF1_START	On	07-07-2024 11:44:30.773
32	TEF1_START	Off	07-07-2024 11:44:30.780
19	PHS-STFWL3	Off	07-07-2024 11:44:30.781
20	PHS-STFWPE	Off	07-07-2024 11:44:30.781
5	ZM01-TRIP	Off	07-07-2024 11:44:30.799
6	ZM01-START	Off	07-07-2024 11:44:30.799
8	ZM02-START	Off	07-07-2024 11:44:30.799
10	ZM03-START	Off	07-07-2024 11:44:30.799
63	AR-START	Off	07-07-2024 11:44:30.799
12	ZM04-START	On	07-07-2024 11:44:30.811
22	ZCOM_CS	Off	07-07-2024 11:44:30.862
1	MAINCB_GEN_TR	Off	07-07-2024 11:44:30.910
4	MAINCB_TR L3	Off	07-07-2024 11:44:30.910
81	TRIP_TRIP	Off	07-07-2024 11:44:30.910
84	FLT_LOOP_Bph	Off	07-07-2024 11:44:30.913
35	TOV1_START	Off	07-07-2024 11:44:31.092
12	ZM04-START	Off	07-07-2024 11:44:31.094

DR 400 KV BUS BAR MAU



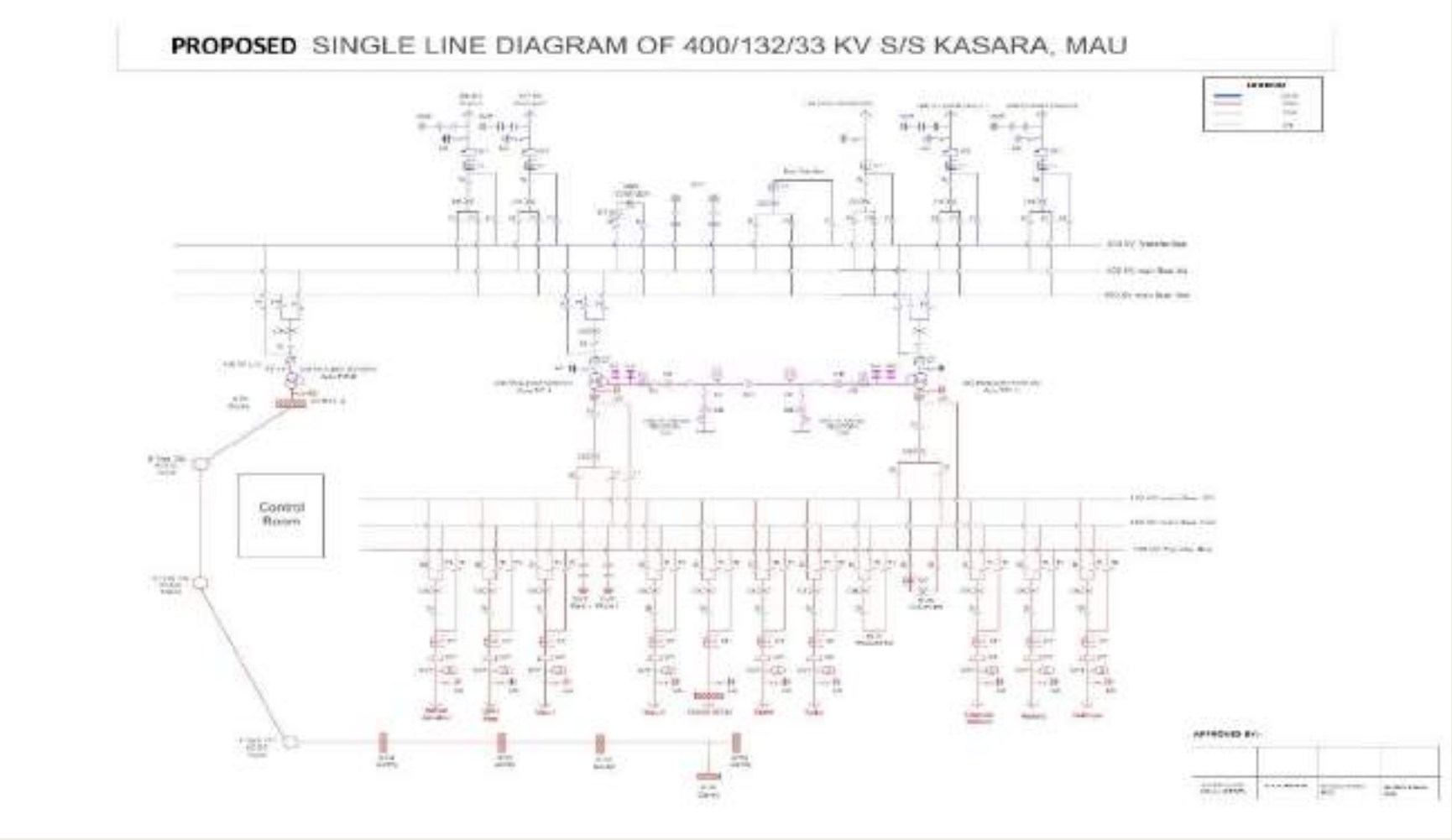


Title	NMS
I01(A)	27.168
I02(A)	7441.365
I03(A)	37.168
I04(A)	0.706
I05(A)	0.707
I06(A)	35.893
I07(A)	0.034
I08(A)	19.027
I09(A)	0.500
I10(A)	91.904
I11(A)	0.000
I12(A)	0.500
I13(A)	0.707
I14(A)	0.000
I15(A)	0.500
I16(A)	0.000
I17(A)	0.000
I18(A)	0.000
I19(A)	0.500
I20(A)	0.000
I21(A)	0.000
V01(kV)	0.000
V02(kV)	0.000
V03(kV)	0.000
IDIF1	5.244



A	Z1_TRIP	N	N	11:44:30.643921	11:44:31.078921	002
N	FBF02	N	N	11:44:31.008921	11:44:31.108921	002
A	FLT01	N	A	11:44:30.548921		001
A	OUT104	N	A	11:44:30.548921		001
N	OUT107	N	N	11:44:31.008921	11:44:31.108921	002
A	Z1S	N	N	11:44:30.643921	11:44:31.078921	002
A	Z2S	N	N	11:44:30.598921	11:44:31.078921	002
A	Z3S	N	N	11:44:30.643921	11:44:31.078921	002
A	87S1	N	N	11:44:30.598921	11:44:31.083921	002
N	87S2	N	N	11:44:30.678921	11:44:30.593921	002
A	87R1	N	N	11:44:30.643921	11:44:31.078921	002
A	FB7R1	N	N	11:44:30.638921	11:44:31.078921	002
A	87D1	N	N	11:44:30.598921	11:44:31.078921	002
A	FAULT1	N	N	11:44:30.638921	11:44:31.083921	002
N	CON1	N	N	11:44:30.600921	11:44:30.643921	002
A	FDIF1	N	N	11:44:30.638921	11:44:31.083921	002

SLD 400 KV SS MAU

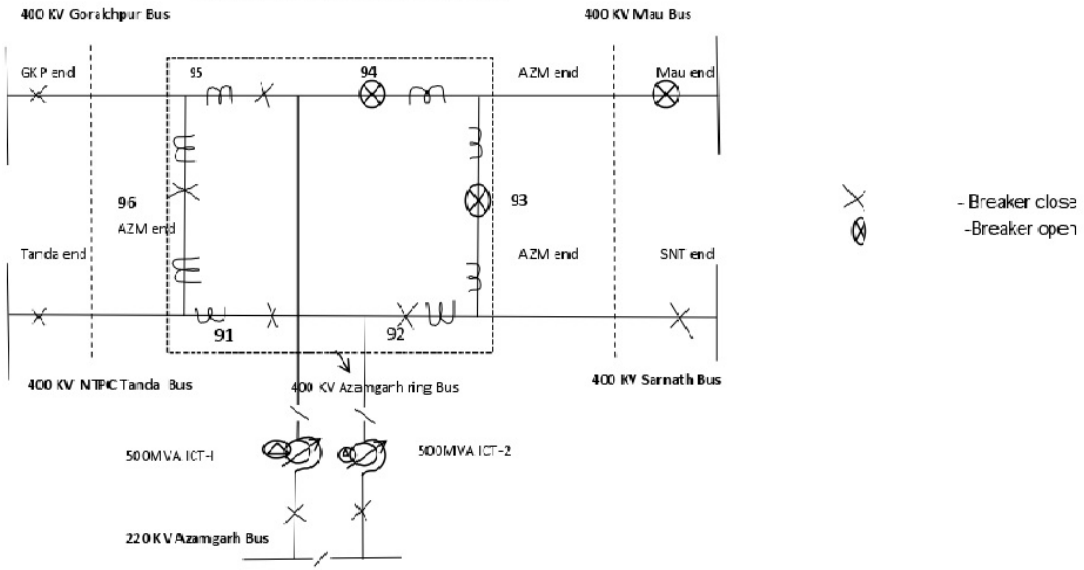


REPORT 400 KV AZAMGARH-MAU LINE

Electricity Test & Commissioning Circle,Gorakhpur
Division: Electricity Test & Commissioning Division, Azamgarh
Tripping Statement of 400 KV S/S Azamgarh — Jul-24

Sr. No.	Tripping Date/Time	Closing Date/Time	T/F /Feeder C.B. No.	Name of Sub-Station	Type of Protection	Flags Observed		Analysis	Remarks
						This End	Other End		
1	2	3	4	5	6	7	8	9	10
1	07/07/2024 11:44Hrs	09/07/2024 17:29Hrs	400 KV Azamgarh-Mau Line	400 KV S/S Azamgarh	Distance Protection - I	SIPROTEC Relay: Gen Trip ,Y Phasepickup ,B phase pick up, Z-2 ,A/Rpotd ,IL2= 6.58 Ka ,IL36.37kA Distance - 46.1 km %d = 95.3% RXME ,R, Y, B interconnection	REL 670 B phase Trip ,Z1 trip,IL3= 2742 A DT Receive, CB Pole Dicrepancy , Dis -0 Km	B Phase C T damage at Mau end.	
					Distance Protection - II	SIPROTEC Relay: Gen Trip ,Y phase pickup ,B phase pick up Z-2 ,IL2 = 6.59 kA ,IL3 = 6.40 kA Distance - 45.4 km ,%d = 93.8%	Flag On Bus Bar Pane l- 87 Differential Optd,Zone-1,LLB		

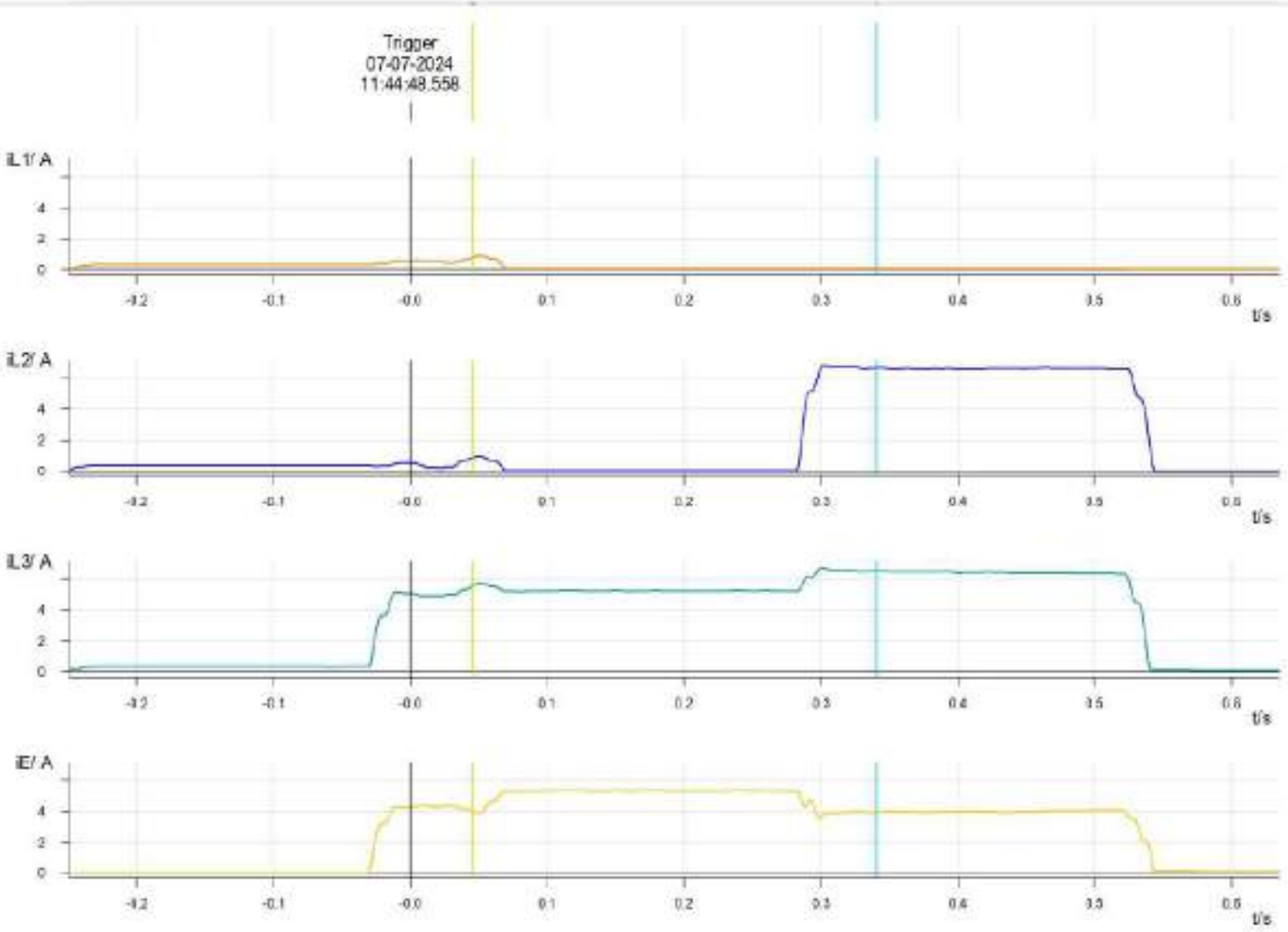
Fault on 400KV Azamgarh -Mau Line

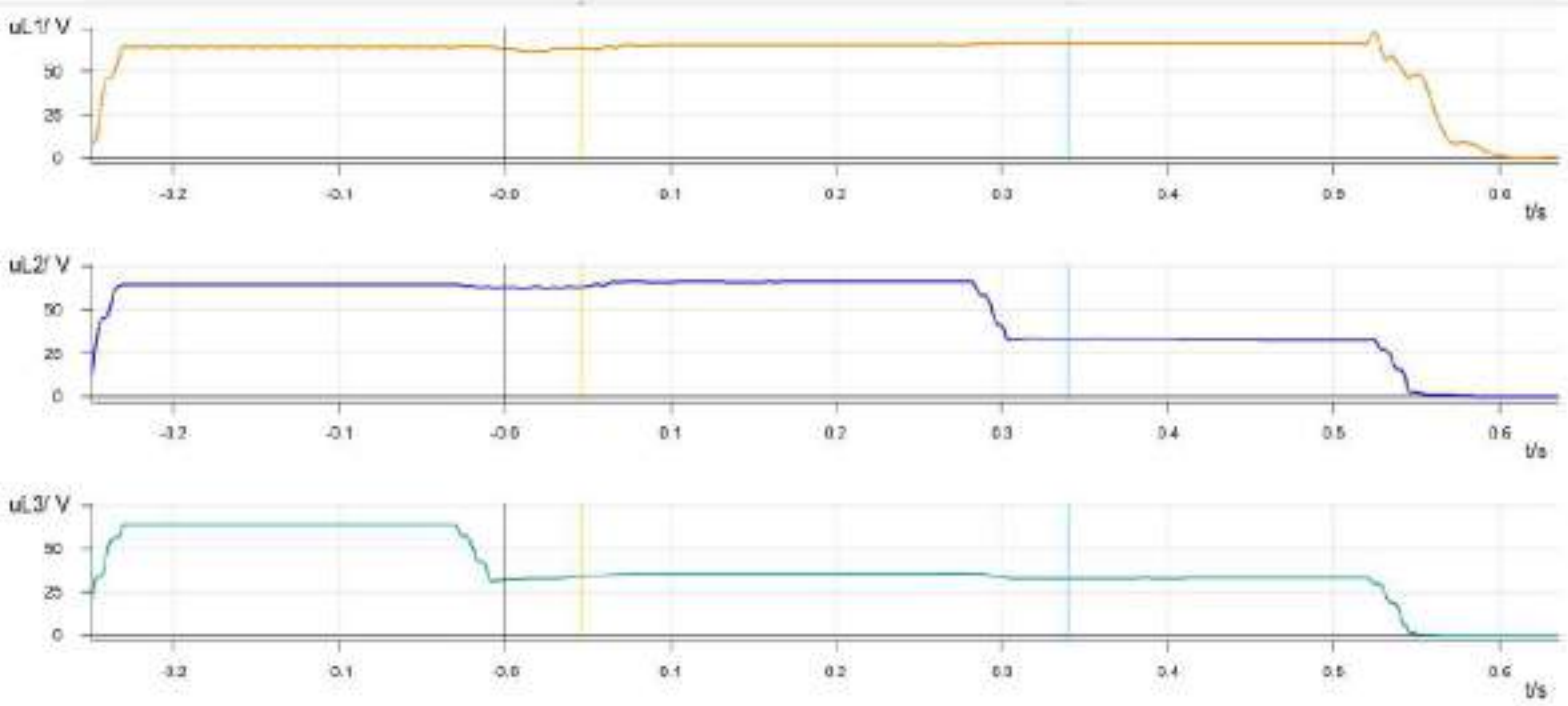


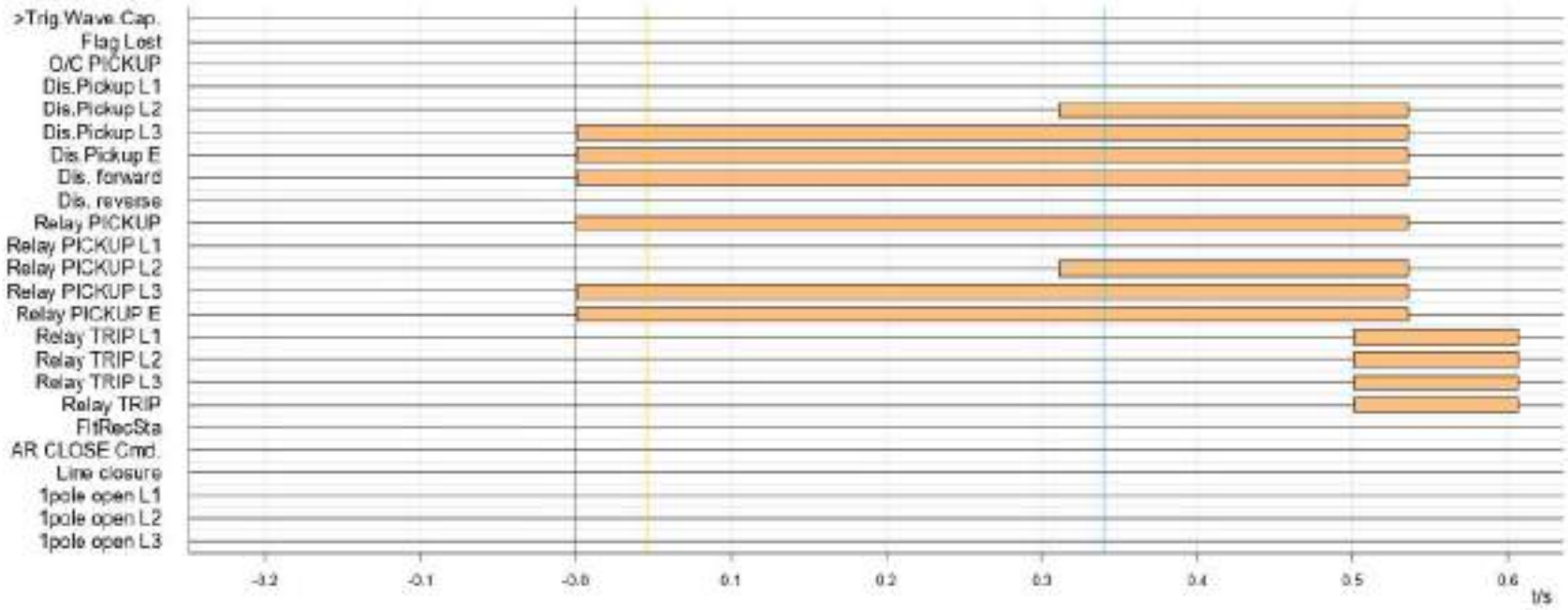
DR 400 KV AZMGARH – MAU LINE

400KVMAU 400 AMH 7SA611 V4.7 Var 10

File path: C:\USERS\ADMIN\DESKTOP\MAU07072024\M1 MAU 07072024.CFG
Start time: 07-07-2024 11:44:48.309
Sample rate: 1000 Hz
Value representation: secondary
Record type: COMTRADE


Trigger
07-07-2024
11:44:48.558
iL1/ A
iL2/ A
iL3/ A
iE/ A
4
2
0
-0.2
-0.1
-0.0
0.1
0.2
0.3
0.4
0.5
0.6
t/s


uL1/ V
50
25
0
-0.2
-0.1
-0.0
0.1
0.2
0.3
0.4
0.5
0.6
t/s
uL2/ V
50
25
0
-0.2
-0.1
-0.0
0.1
0.2
0.3
0.4
0.5
0.6
t/s
uL3/ V
50
25
0
-0.2
-0.1
-0.0
0.1
0.2
0.3
0.4
0.5
0.6
t/s


>Trig.Wave.Cap.
Flag Lost
O/C PICKUP
Dis.Pickup L1
Dis.Pickup L2
Dis.Pickup L3
Dis.Pickup E
Dis. forward
Dis. reverse
Relay PICKUP
Relay PICKUP L1
Relay PICKUP L2
Relay PICKUP L3
Relay PICKUP E
Relay TRIP L1
Relay TRIP L2
Relay TRIP L3
Relay TRIP
FltRecSta
AR CLOSE Cmd.
Line closure
1pole open L1
1pole open L2
1pole open L3
-0.2
-0.1
0.0
0.1
0.2
0.3
0.4
0.5
0.6
t/s

Events Description

ANALYSIS OF TRIPPING OF 400 KV MAU-AZAMGARH LINE OCCURRED ON 07.07.2024 AT 11:44 Hrs

- 400 KV Mau-Azamgarh Line tripped on 07.07.2024 at 11:44 Hrs, B -Ph CT of 400 Mau - Azamgarh Line got damaged at Mau end. As per the DR / EL zone -1 Prot. Of Main - 1 relay and Busbar Differential protection operated and elements connected through Bus - 1 got tripped in 60 ms (200 MVA ICT-3, 400 KV Mau-Ballia PGCIL Line) but DT was not sent to Azamgarh End because of the damage DT Cable. (DT Cable replaced and tested later). That is why at 400 KV Azamgarh Relay waited for 500 ms for Zone-2 and after 500 ms Line tripped in Zone-2 at Azamgarh end. Fault was cleared in 560 ms.
- Permissive Carrier not received at Azamgarh end due to defective LMU at Mau End (LMU replacement work is under process).
- C.B Status was not changed after Busbar operation of 400 KV Mau - Azamgarh Line at Mau end causes LBB operation due to defective CB status cable.(CB status cable has been changed)

THANK YOU.

Multiple elements tripping at 400/220kV Lucknow2(HR) 14th August 2024

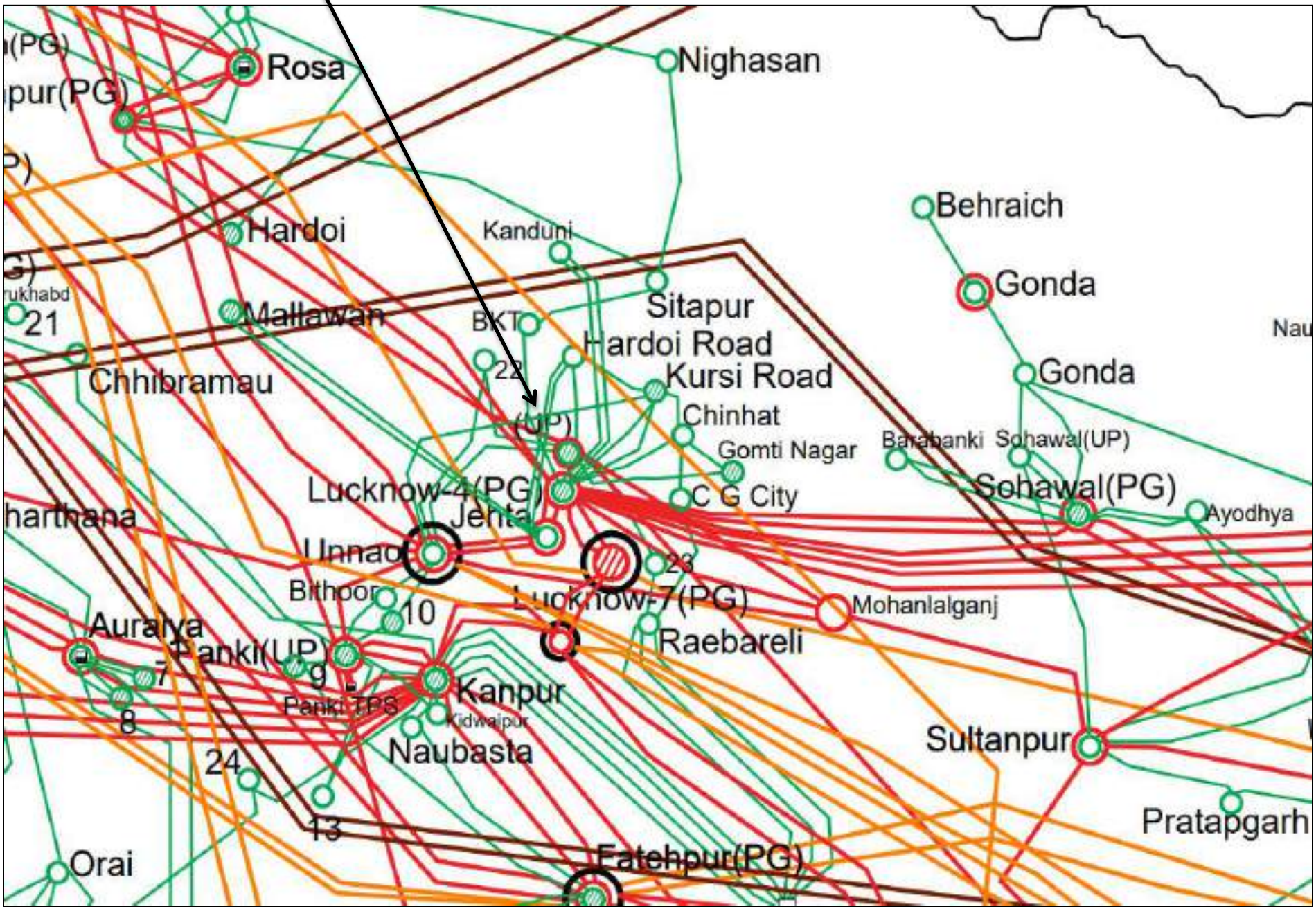
Brief of event:

i. 220kV Lucknow(UP) has double main and transfer bus scheme at 220kV level.
ii. During antecedent condition, 400/220kV 500 MVA ICT-1 & 2, 220/132kV 200 MVA ICT-1 & 2, 220kV Lucknow-Hardoi Road (UP) ckt & 220kV Lucknow-Unnao (UP) ckt were connected to 220kV bus-1 and 220kV lines from Lucknow(UP) to Bachrawan, Gomatinagar, Kanpur Road & 220/132kV 200MVA ICT-1 & 2 connected to 220kV bus-2 at 220kV Lucknow(UP) S/s. 220kV Lucknow-Kanpur Road (UP) ckt was not in service during the event.
iii. As reported, at 15:53 hrs, R-N phase to earth fault occurred on 220kV bus-1 which led to tripping of all elements connected to 220kV bus-1 at 220kV Lucknow(UP). Bus bar protection failed to operate and 400/220 kV 500 MVA ICT-1 & 2 tripped on LBB protection (Type of protection operated in tripping of other elements is yet to received)
iv. As per PMU at Lucknow(PG), R-N phase to earth fault with delayed fault clearance time of 880ms is observed (Reason for delayed fault clearance is yet to receive).
v. As per SCADA, change in demand of approx. 280 MW in UP control area. However, approx. 250 MW load loss in UP control area as per SLDC-UP.

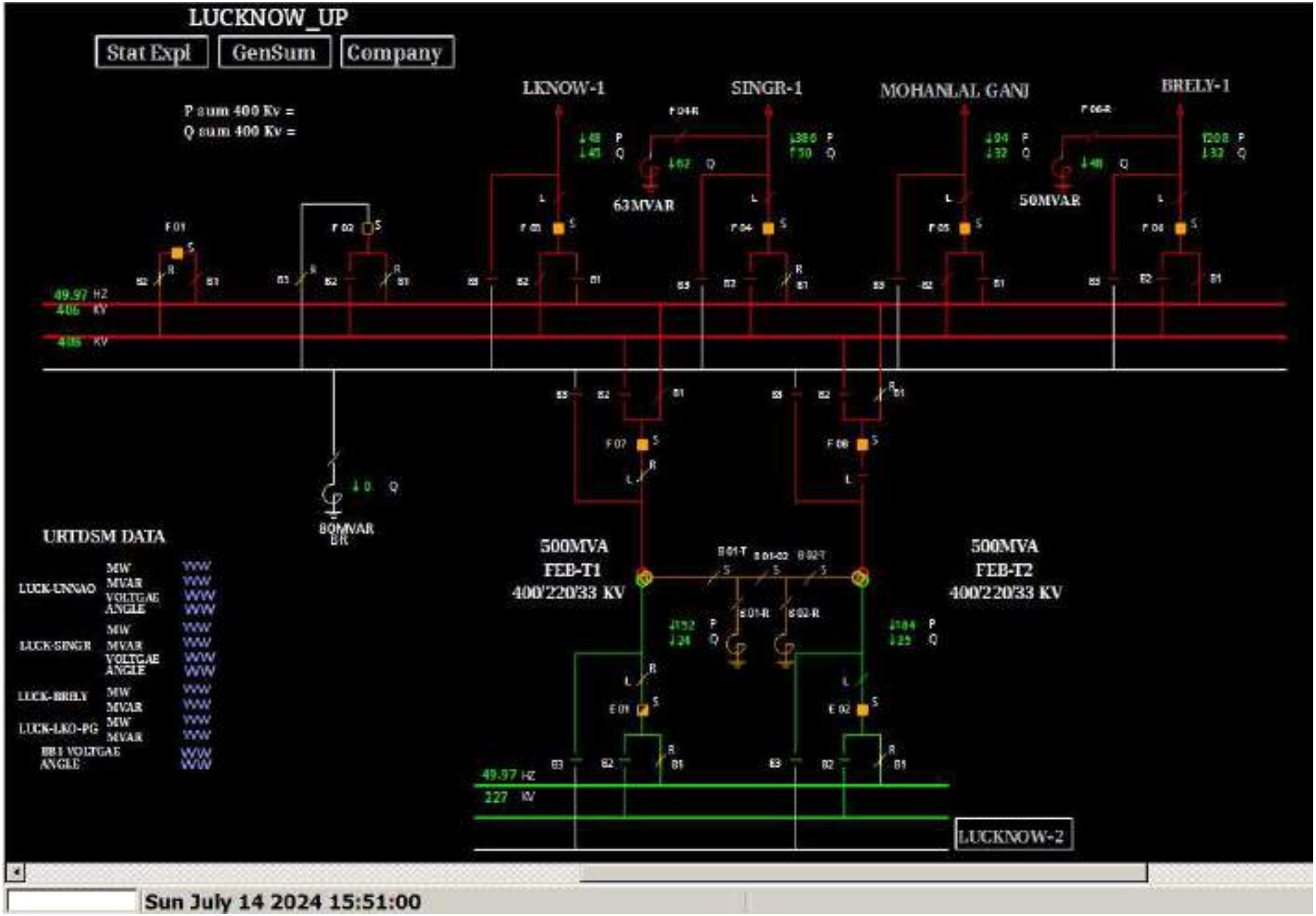
Elements tripped:

i. 400/220 kV 500 MVA ICT 1 at Lucknow(UP)
ii. 400/220 kV 500 MVA ICT 2 at Lucknow(UP)
iii. 220kV Lucknow-Hardoi Road (UP) ckt
iv. 220kV Lucknow-Unnao (UP) ckt
v. 220/132 kV 200 MVA ICT 1 at Lucknow(UP)
vi. 220/132 kV 200 MVA ICT 2 at Lucknow(UP)

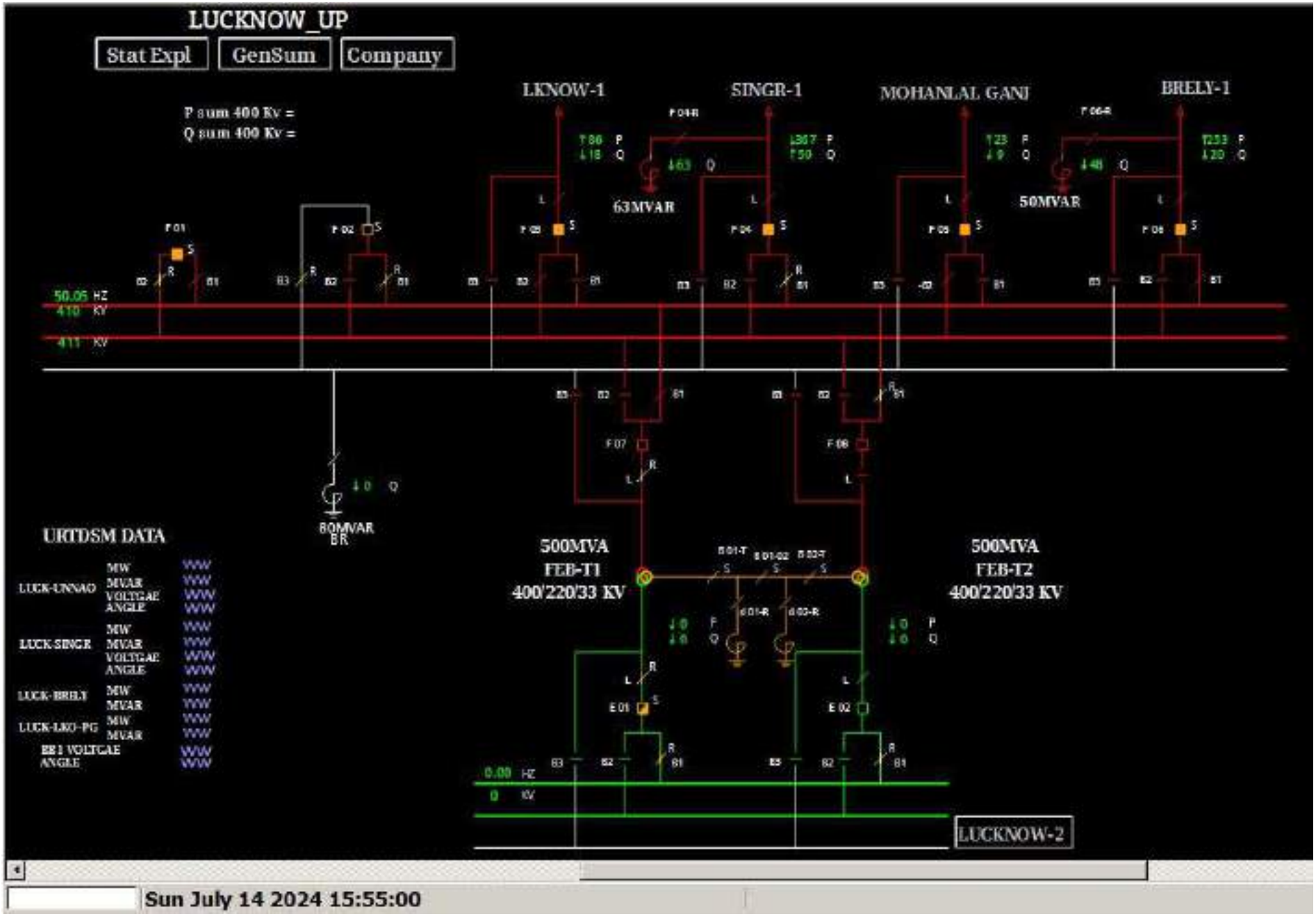
Network Diagram



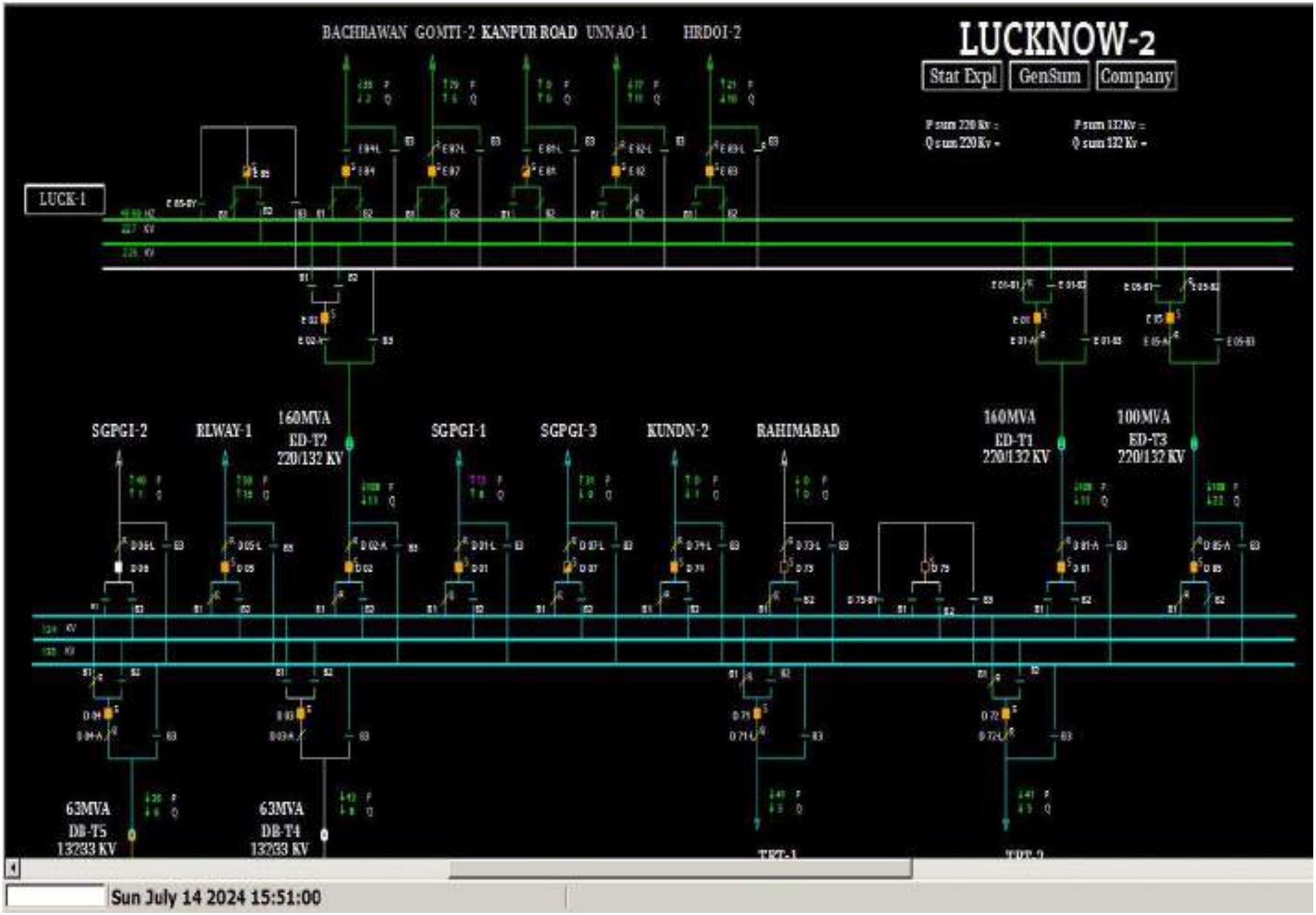
SLD of 400/220KV Lucknow(UP) before the event



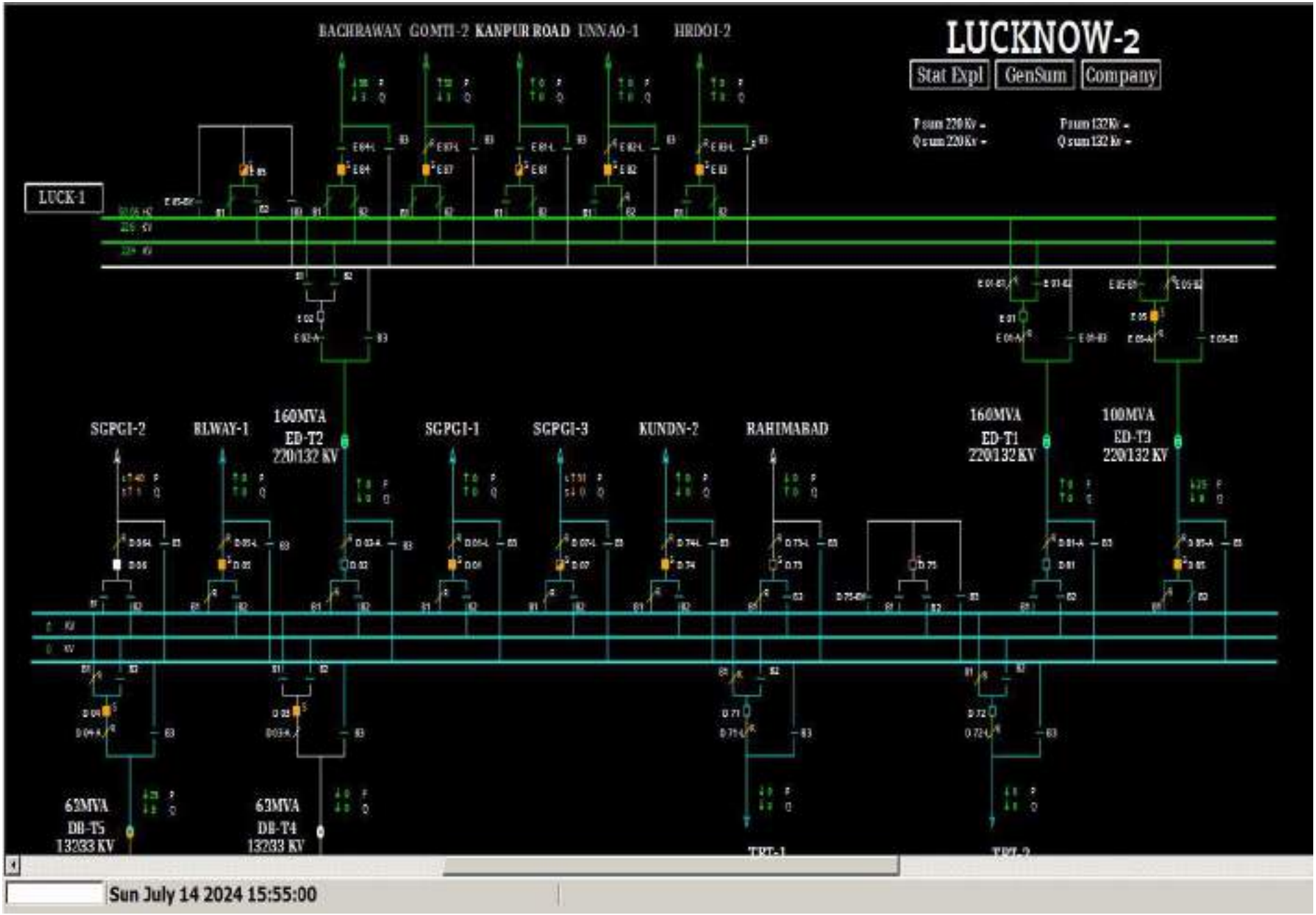
SLD of 400/220KV Lucknow(UP) after the event



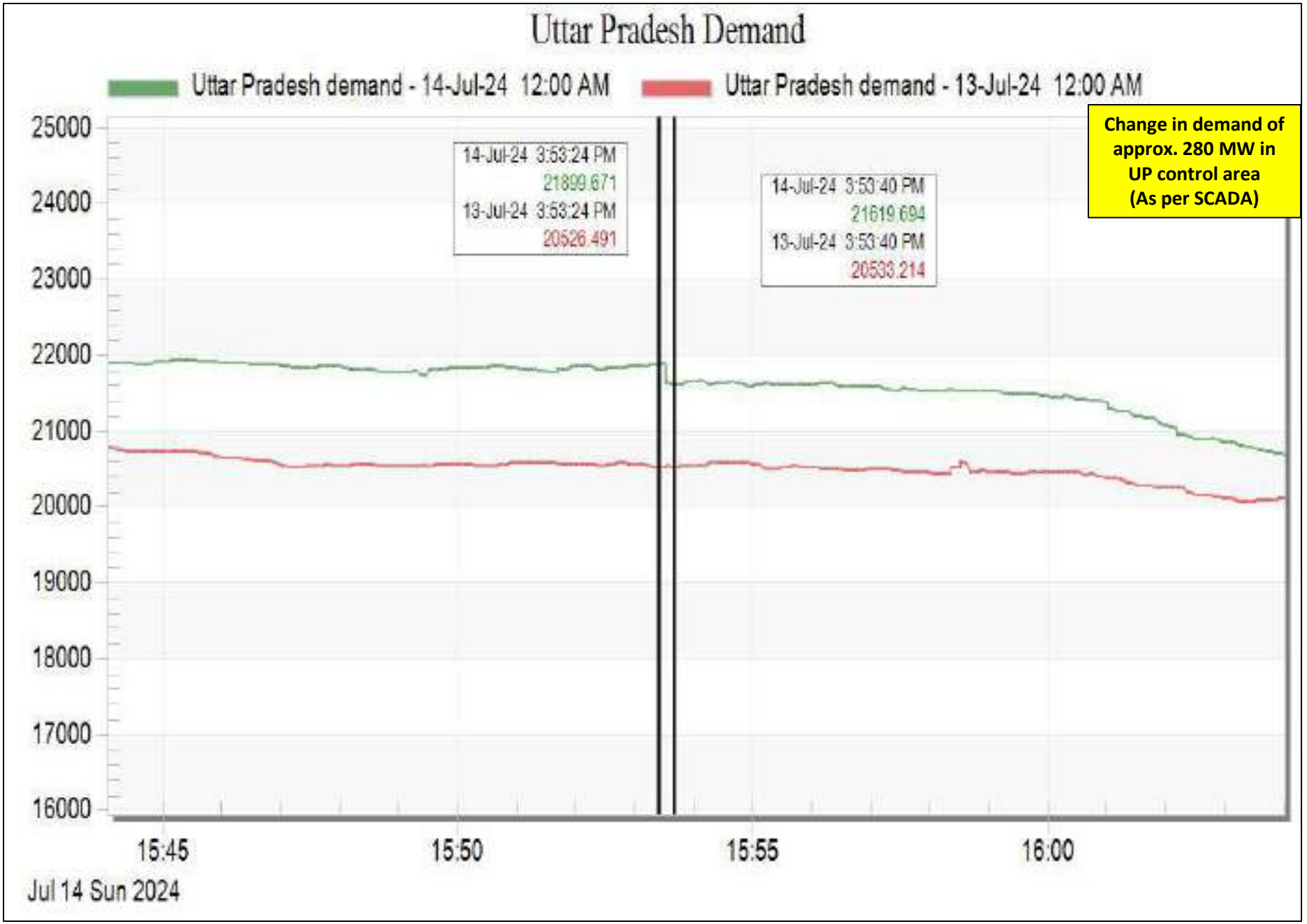
SLD of 220/132KV Lucknow(UP) before the event



SLD of 220/132KV Lucknow(UP) after the event



Uttar Pradesh Demand during the event

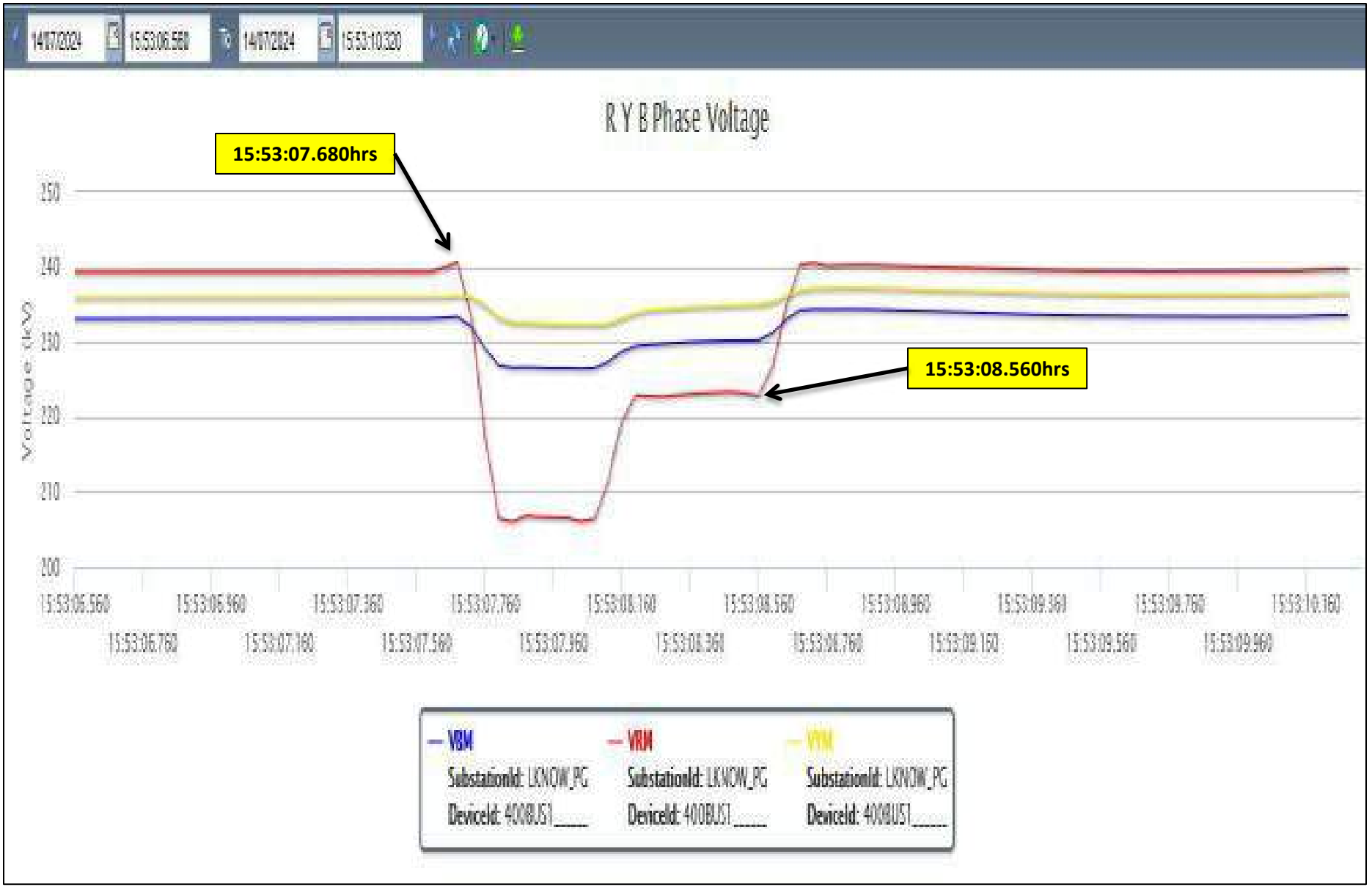


PMU Plot of frequency at Lucknow(PG)

15:53 hrs/14-July-24

PMU Plot of phase voltage magnitude at Lucknow(PG)

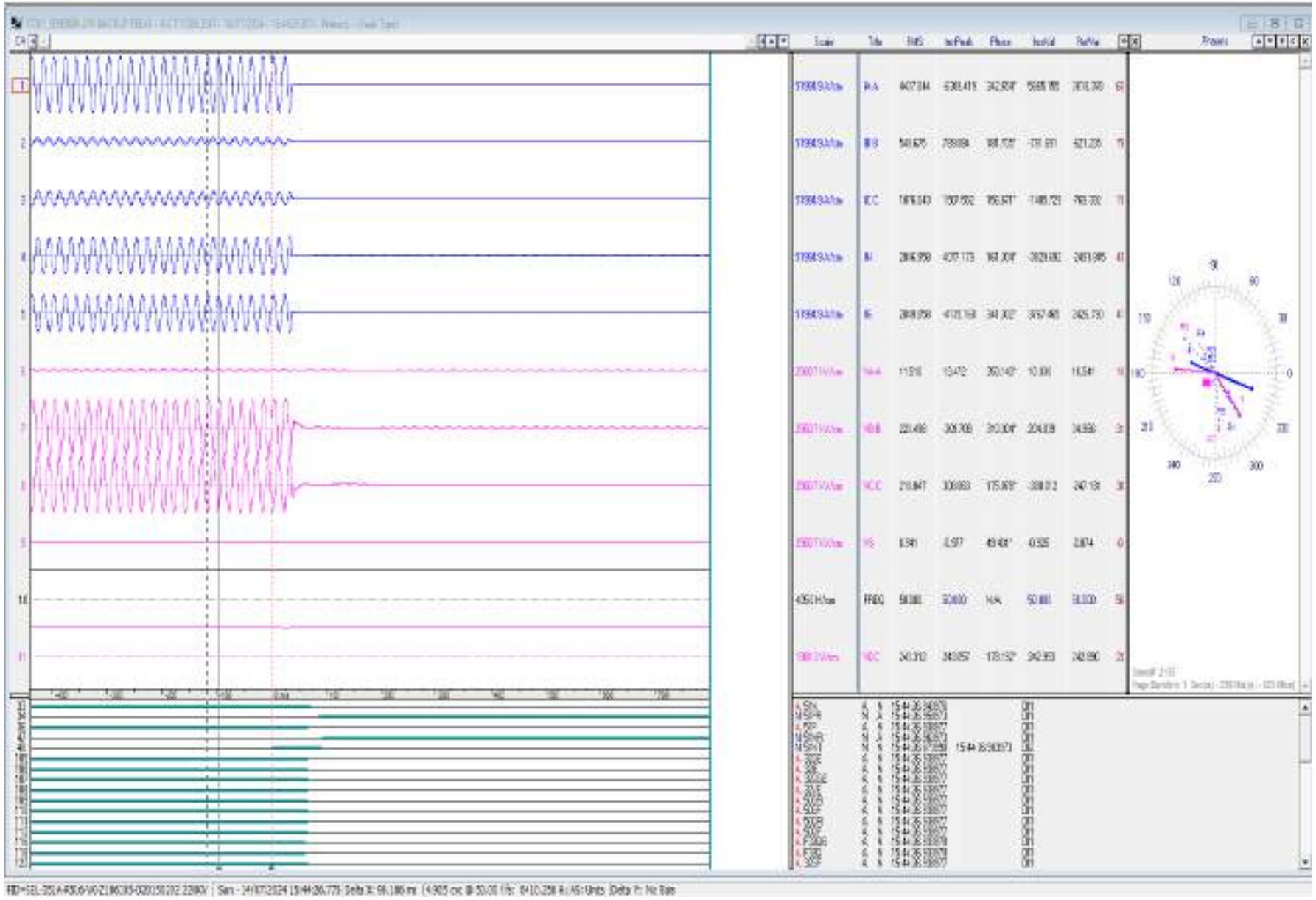
15:53 hrs/14-July-24



SCADA SOE

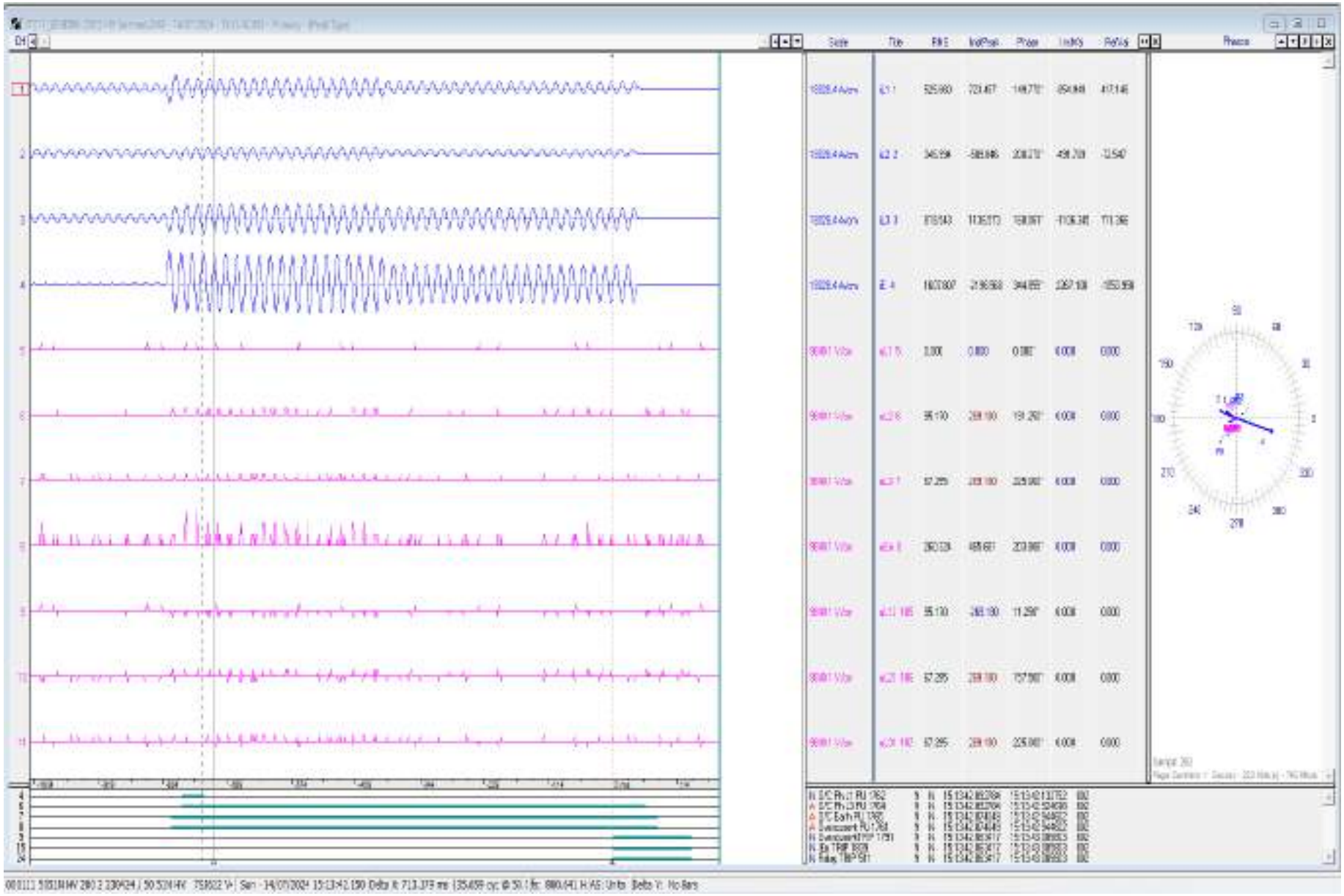
Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remarks
15:53:08,114	HRDOI_UP	220kV	01LUCK2	Circuit Breaker	Open	Line CB at Hardoi Road(UP) end, 220kV Hardoi-Lucknow (UP) ckt opened
15:53:08,496	LUCK2_UP	132kV	02T2	Circuit Breaker	Open	CB at Lucknow(UP) end of 220/132kV 160MVA ICT-2 opened from 132kV side
15:53:08,498	LUCK1_UP	400kV	08T2	Circuit Breaker	Open	CB at Lucknow(UP) end of 400/220kV 500MVA ICT-2 opened from 400kV side
15:53:08,501	LUCK2_UP	220kV	02T2	Circuit Breaker	Open	CB at Lucknow(UP) end of 220/132kV 160MVA ICT-2 opened from 220kV side
15:53:08,510	LUCK1_UP	220kV	02T2	Circuit Breaker	Open	CB at Lucknow(UP) end of 400/220kV 500MVA ICT-2 opened from 220kV side
15:53:08,523	LUCK2_UP	132kV	81T1	Circuit Breaker	Open	CB at Lucknow(UP) end of 220/132kV 160MVA ICT-1 opened from 132kV side
15:53:08,528	LUCK2_UP	220kV	01T1	Circuit Breaker	Open	CB at Lucknow(UP) end of 220/132kV 160MVA ICT-1 opened from 220kV side
15:53:08,736	LUCK1_UP	400kV	07T1	Circuit Breaker	Open	CB at Lucknow(UP) end of 400/220kV 500MVA ICT-1 opened from 400kV side

DR of 400/220kV 500MVA ICT-2 at Lucknow2(UP)



O/C E/F operated, DR time is not synced

DR of 220/132kV 200MVA ICT-2 at Lucknow2(UP)



O/C E/F operated, DR time is not synced

Point of discussion

i) Reason of fault and reason for delayed fault clearance at 220kV Lucknow(UP) S/s need to be shared.

ii) Reason for failed operation of bus bar protection at 220kV Lucknow(UP) S/s need to be shared.

iii) Relay flag details and type of protection operated for all tripped elements need to be shared.

iv) DR/EL (.dat/.cfg file) of all the tripped elements along with detailed tripping report need to shared.

v) Remedial action taken report to be shared.

400kV & 220kV Sarojini Nagar Sub-Station, UPPTCL, Lucknow

14.07.2024, 15:53

Tripping of 200MVA ICT-I, 200MVA ICT-II, 220kV Hardoi Road line, 220kV Dahi Chauki(Unnao) line, 500MVA ICT-I, 500MVA ICT-II, *due to fault on 220kV Bus-A at 220/132kV S/s Sarojini Nagar*

On 14.07.2024 at 15:53 hrs following elements trip at 400kV & 220kV S/s Sarojini Nagar

NAME OF ELEMENT	RESTORATION DATE	RESTORATION TIME	FLAGS END 1 (INCLUDING A/R)	FLAGS END 2 (INCLUDING A/R)
220/132kV 200MVA ICT-I	14.07.2024	16:08	*CP:* HV E/f, *RP:* HV Dir O/c & E/f, E/f trip relay, 86A, 86B	-
220/132kV 200MVA ICT-II	14.07.2024	16:08	*CP:* HV E/f, *RP:* HV O/c & E/f protection, General trip, R&B phase, E/f trip, 86A, 86B, 86LV, O/c & E/f protection relay	
220kV Sarojini Nagar (Lucknow)-Hardoi Road line	14.07.2024	16:27	No flag	Z-2, R-phase, 86 optd
220kV Sarojini Nagar (Lucknow)-Dahi Chauki(Unnao) line	14.07.2024	16:30	No flag	Z-2, R-phase, 86A, 86B
400/220kV 500MVA ICT-II	14.07.2024	19:30	*CP:* LBB optd, HV side O/C & E/f Relay: Trip, 51, A-N, HV-286, LV-286 HV side LBB Relay: Trip, 51, Breaker Failure	
400/220kV 500MVA ICT-I	14.07.2024	17:27	No flag	

Antecedents condition

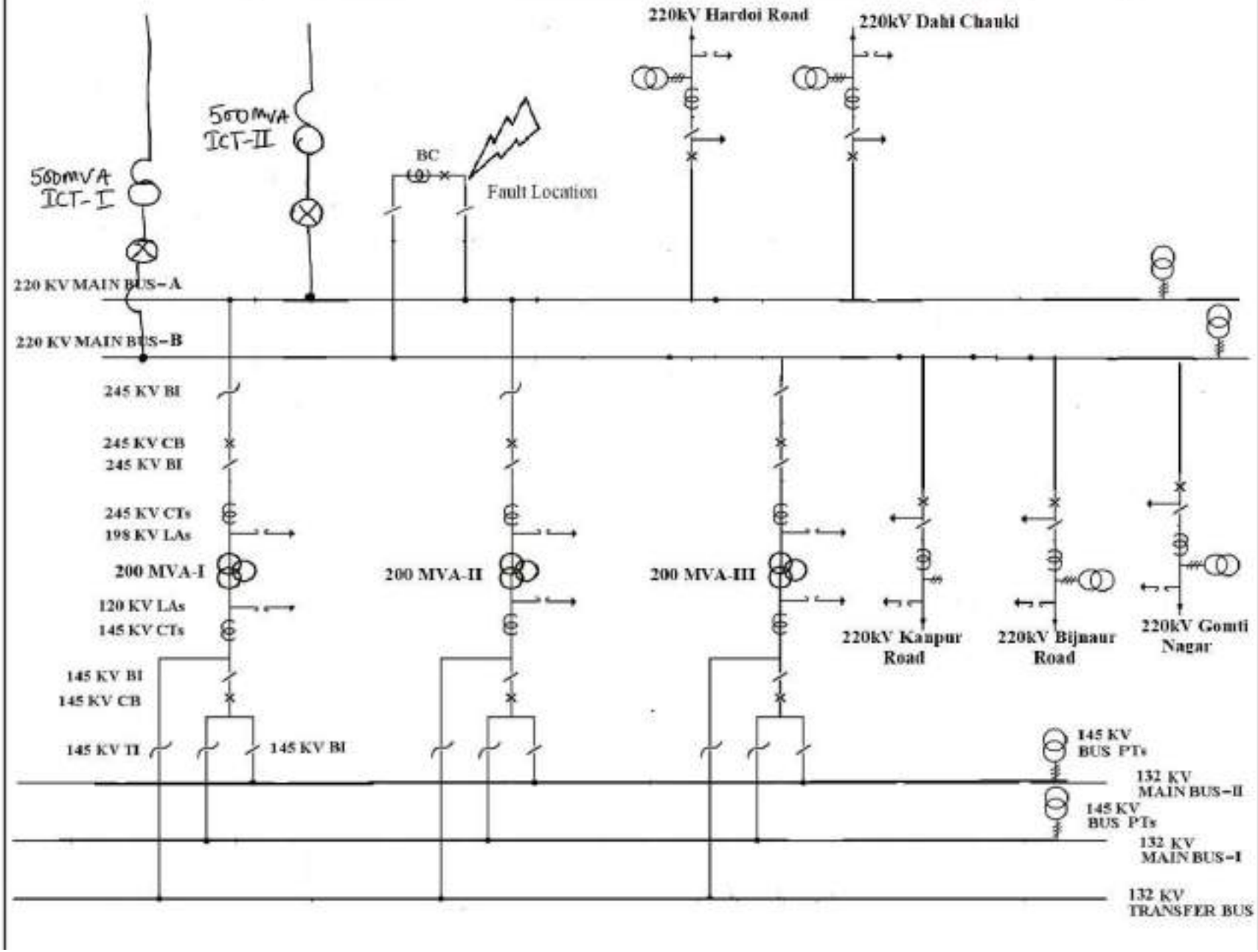
- 220kV Bus Coupler was open.

- On 220kV Bus-A, the following elements were connected :-
  - 220/132kV 200MVA ICT-I
  - 220/132kV 200MVA ICT-II
  - 220kV Sarojini Nagar(Lucknow)-Hardoi Road line
  - 220kV Sarojini Nagar(Lucknow)-Dahi Chauki(Unnao) line
  - 400/220kV 500MVA ICT-II

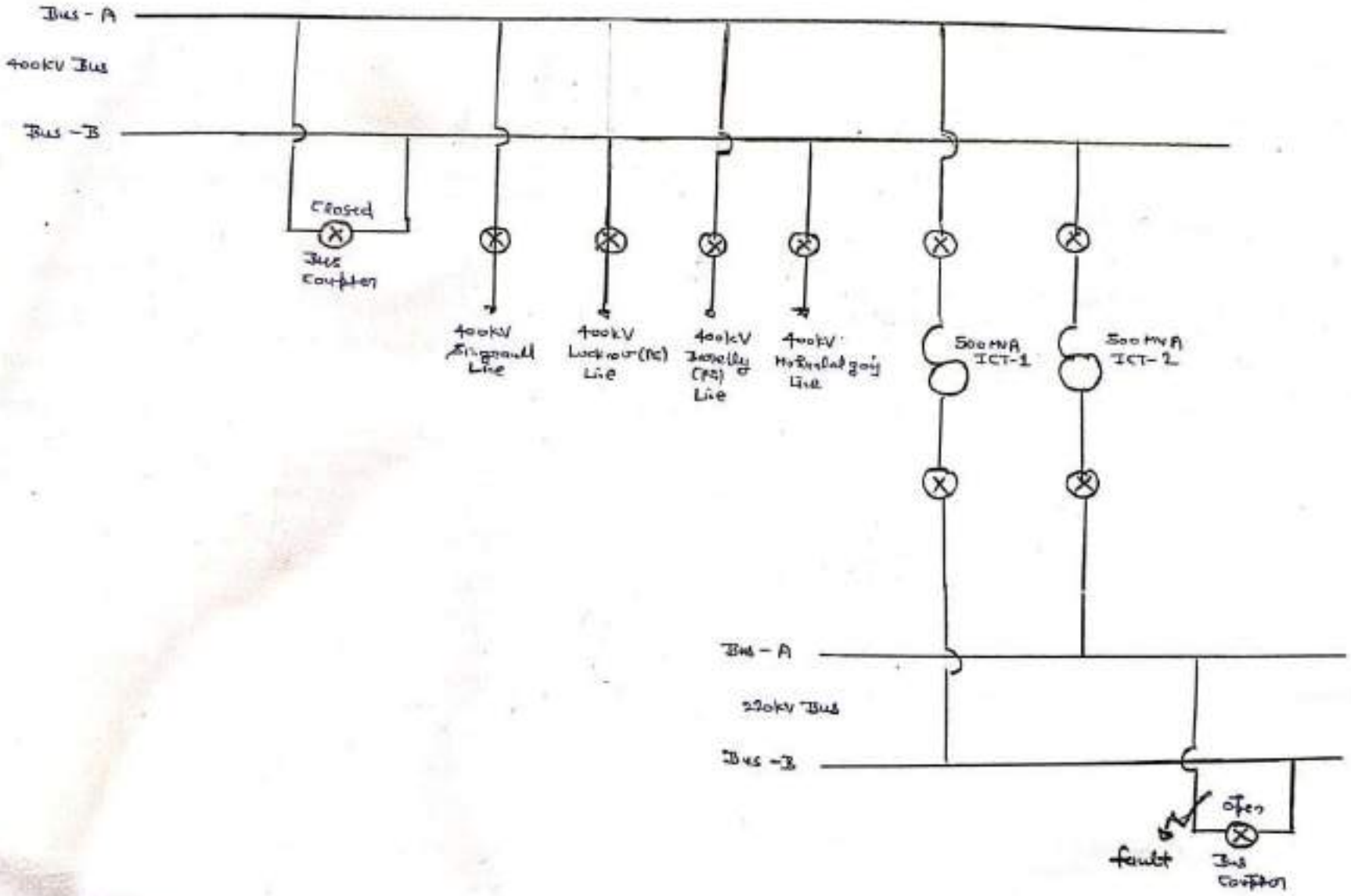
- On 220kV Bus-B, the following elements were connected :-
  - 220/132kV 200MVA ICT-III
  - 220kV Sarojini Nagar(Lucknow)-Bachhrawan line
  - 220kV Sarojini Nagar(Lucknow)-Gomti Nagar line
  - 400/220kV 500MVA ICT-I

- 220kV Sarojini Nagar(Lucknow)- Kanpur Road line was not in service.

SINGLE LINE DIAGRAM OF 220 KV S/S Sarojini Nagar



SLD of 400kV Sarojini Nagar S/S



Events Description

- On 14.07.2024 at 15:54hrs, 220/132kV S/s Sarojini Nagar, a fault occurred on 220kV Bus-A, due to a bird carrying string (wire) dropped near jumper at R-phase gantry of 220kV Bus Coupler Bay.

- 220kV Bus Coupler was already open before the occurrence of fault.

- 220kV Busbar protection not operated because of CT Fail alarm and mentioned elements tripped with following flags-

  - 200MVA ICT-1, *CP:* HV E/f, *RP:* HV Dir O/c & E/f, E/f trip relay, 86A, 86B.

  - 200MVA ICT-2, *CP:* HV E/f, *RP:* HV O/c & E/f protection, General trip, R&B phase, E/f trip, 86A, 86B, 86LV, O/c & E/f protection relay.

Events Description

- 220kV Sarojini Nagar(Lucknow)-Dahi Chauki(Unnao) line, tripped from other end (Z-2, R-phase, 86 optd).

- 220kV Sarojini Nagar(Lucknow)-Hardoi Road line, tripped from other end (Z-2, R-phase, 86A, 86B).

- 500MVA ICT-2, *CP:* LBB optd,

  HV side O/C & E/f Relay: Trip, 51, A-N, HV-286, LV-286

  HV side LBB Relay: Trip, 51, Breaker Failure

- 400 side Bus Coupler/Busbar panel: Busbar protection DC Fail, 80T DC No Volt Relay (B/B protection trip ckt).

- 500MVA ICT-1, *RP:* 86ITA, 86ITB, 86ITC, 86ITD, 86TX, 86AX, 86BX

Analysis Report

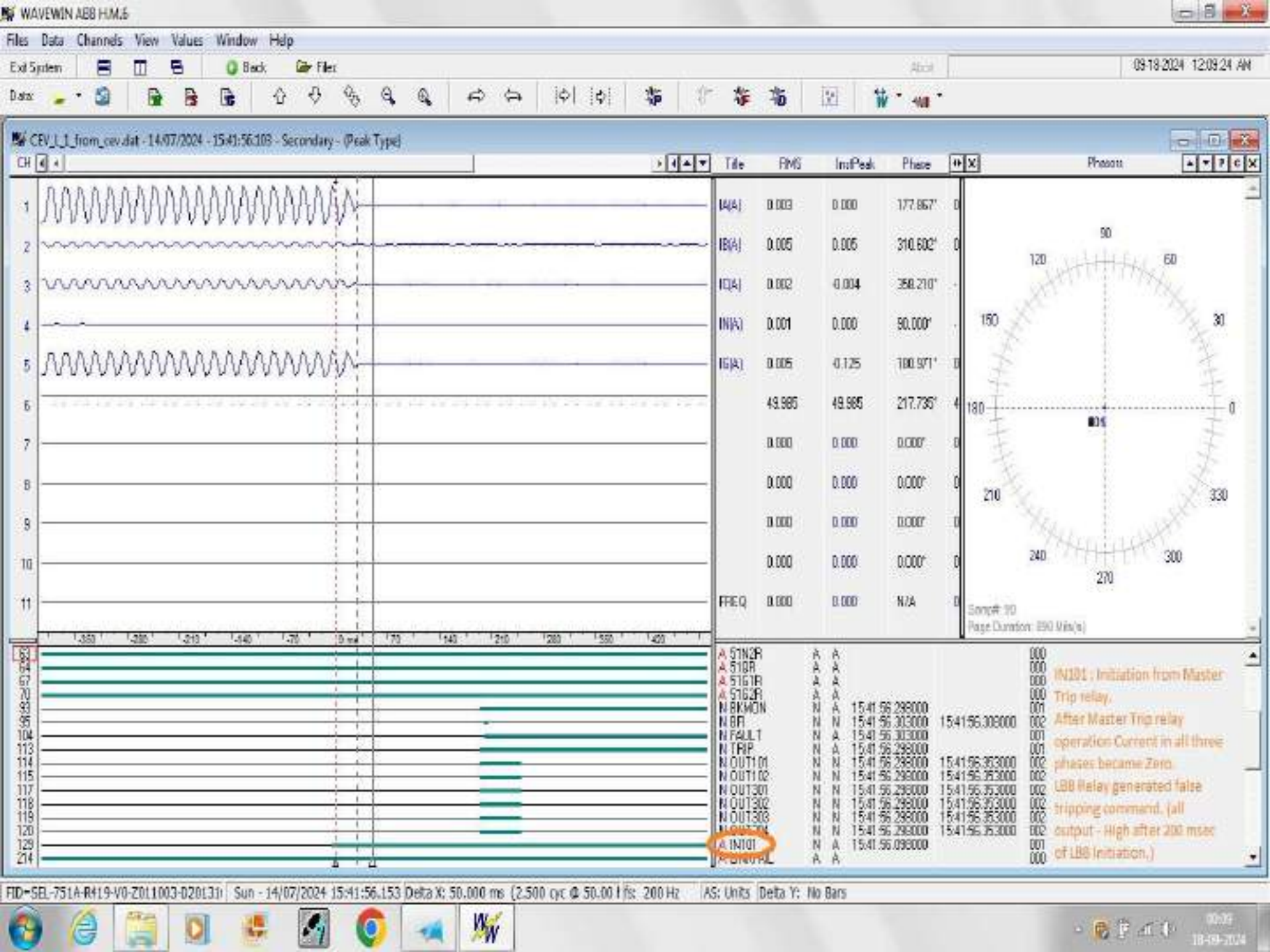
- At 220kV Sarojini Nagar S/s, on 14.07.2024 at 15:54hrs, a bird dropped a string near R-phase gantry of 220kV Bus causing bus-A fault. 220kV Busbar protection failed to operate because of CT Fail alarm which blocked busbar protection causing tripping of 200MVA ICT-1&2, 220kV Sarojini Nagar(Lucknow)-Hardoi Road line, 220kV Sarojini Nagar(Lucknow)-Dahi Chauki(Unnao) line and 500MVA ICT-2.

- On further analysis it was found that CT fail alarm was appearing in 220kV Busbar relay due to mismatch between connected CT ratio and CT ratio fed in the relay in two no bays (200MVA ICT I and II)

Analysis Report

- At 400kV Sarojini Nagar S/s, 500MVA ICT-2 tripped on R-phase IDMT O/C & E/f protection. As per DR, HV LBB relay got initiation from respective Master Trip relay and after approx 200msec of initiation HV side LBB relay generated trip command.
- After Master trip relay operation current in ICT-2 became zero in all phases before LBB trip command generation, thus indicating false command generation. At the same time in Busbar panel “80T DC No Volt Relay (B/B protection trip ckt)” operated which means 400kV Busbar tripping circuit DC failed with fluctuations, and for this reason other elements on 400kV Bus-A may not have tripped.

- As per DR, after tripping of 500MVA ICT-2, approx 240msec later 500MVA ICT-1 tripped without any flags on protective relays installed on this ICT. Only trip relays operated. Cause of this tripping is yet to be analysed.


WAVEWIN ABB H.M.6
Files Data Channels View Values Window Help
Exit System
Back
Files
09.18.2024 12:09:24 AM
CEV_1_1_from_cev.dat - 14/07/2024 - 15:41:56.103 - Secondary - (Peak Type)
Title
RMS
Int/Peak
Phase
Phasors
IA(A) 0.003 0.000 177.867°
IB(A) 0.005 0.005 310.602°
IC(A) 0.002 -0.004 358.210°
IN(A) 0.001 0.000 90.000°
IG(A) 0.005 -0.125 180.971°
49.985 49.985 217.735°
0.000 0.000 0.000°
FREQ 0.000 0.000 N/A
IN101 : Initiation from Master Trip relay.
After Master Trip relay operation Current in all three phases became Zero.
LBB Relay generated false tripping command. (all output - High after 200 msec of LBB Initiation.)
FID=SEL-751A-R419-V0-Z011003-D20131
Sun - 14/07/2024 15:41:56.153
Delta X: 50.000 ms (2.500 cyc @ 50.00 Hz)
fs: 200 Hz
AS: Units
Delta Y: No Bars

Analysis Report

Because of non-operation of 220kV Busbar protection each element were tripped timely at own protection settings. For example, 500MVA ICT-2 setting are as-

O/C (IDMT) = 0.80, TMS = 0.30

O/C (Highset) = 4.5 Amp, Time = 0.06

E/f (IDMT) = 0.20, TMS = 0.30

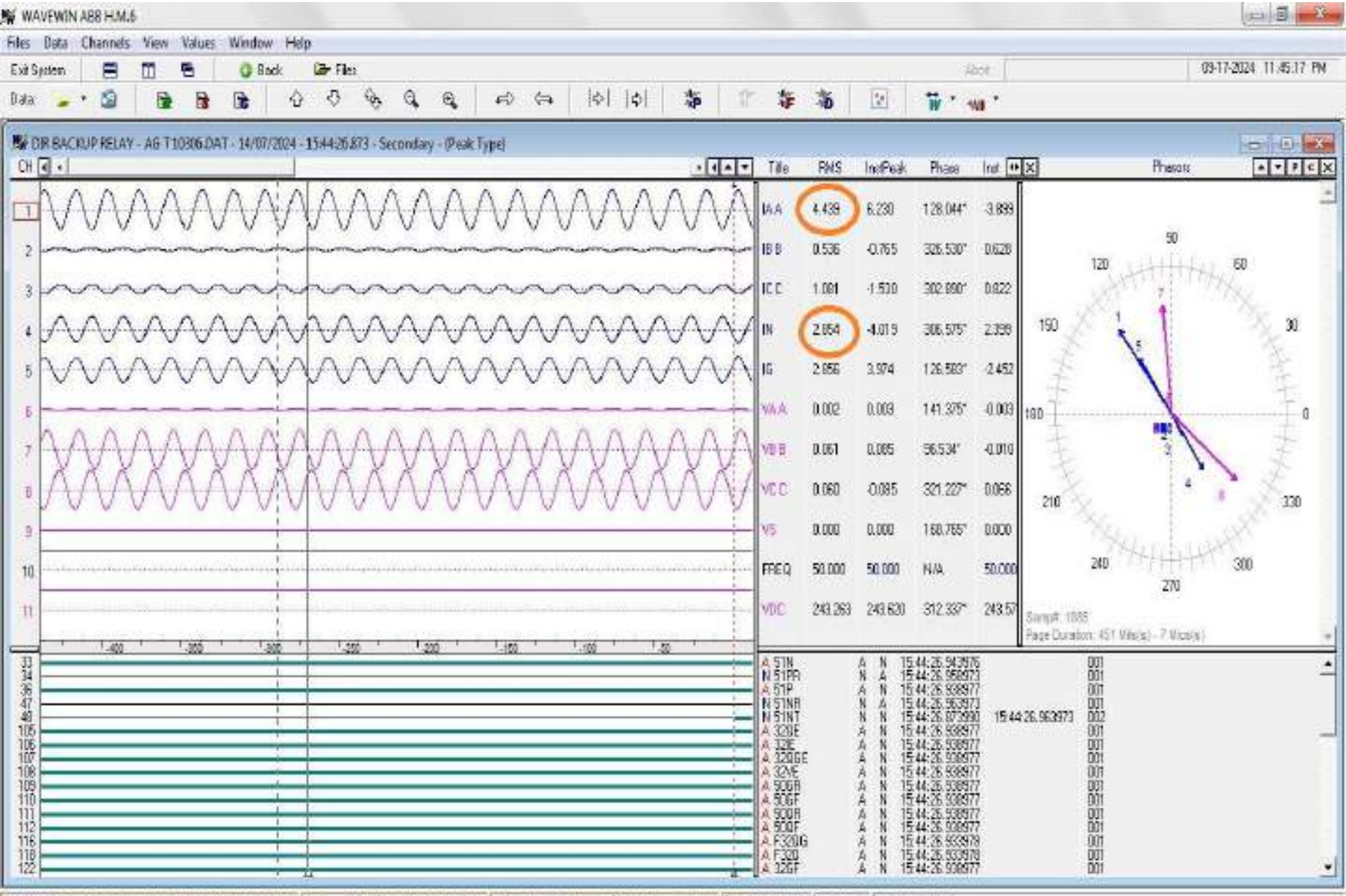
E/f (Highset) = 4.5 Amp, Time = 0.06

As seen in DR, Current in R-Phase & Neutral are below Highset value.

Current in Neutral = 2.854 Amp (approx. 14.27 times of setting (0.2))

Therefore, **the calculated time for tripping (according to IEC Standard Inv. Curve) = 771msec**

DR Of B/U Relay (500MVA ICT-2)



Remedial Actions

- At 220kV Sarojini Nagar S/s, CT Fail Alarm problem was resolved by correcting the connected CT ratio.

- At 400kV Sarojini Nagar S/s, a new Busbar protection is being retrofitted since 17.09.2024.

THANK YOU.

Multiple elements tripping at 400/220kV Muzaffarnagar(UP) 21st August 2024

Brief of event:

i. During antecedent condition, 400/220kV 315 MVA ICT-1, 400/220kV 500 MVA ICT-4, 220kV Muzaffarnagar-Shamli (UP) Ckt, 220kV Muzaffarnagar-Khatauli (UP) Ckt, 220kV Muzaffarnagar-Badhnikalan (UP) Ckt & 220/132kV 160MVA ICT-4 were connected to 220kV bus-1 and 400/220 kV 315 MVA ICT-2, 400/220 kV 315 MVA ICT-3, 220kV Muzaffarnagar-Charla (UP) Ckt, 220kV Muzaffarnagar-Jansath (UP) Ckt & 220/132kV 160MVA ICT-5 were connected to 220kV bus-2 at Muzaffarnagar(UP) S/s. Bus coupler of 220kV bus-1 and 220kV bus-2 was in ON condition and 220kV Muzaffarnagar-Nara (UP) Ckt was not in service (under shutdown) during the tripping event.

ii. As reported, at 09:02 hrs, **R-N phase to earth fault occurred on 220kV Muzaffarnagar-Badhni kalan (UP) Ckt with fault distance of 3.8km from Muzaffarnagar(UP) end and 20.4km from Badhni kalan(UP) end.** Fault was sensed in zone-1 from both ends.

iii. On this fault 220kV Muzaffarnagar-Badhni kalan (UP) Ckt tripped from Badhni kalan end on zone-1 distance protection on R-N fault. During fault clearing process at Muzaffarnagar(UP) end, R-phase CB interrupting chamber got damaged which resulted into continuation of sparking between R phase male contact and R phase dropper wire of breaker. The circuit breaker operated mechanically (auxiliary contacts operated properly) and thus breaker status reflected as OPEN.

iv. As breaker didn't open completely, fault was not cleared yet. Due to continuous fault feeding 400/220kV 315MVA ICT-1 & 2 and 400/220kV 500 MVA ICT-4 tripped on directional earth fault protection and 400/220kV 315 MVA ICT-3 tripped on back up impedance protection. 220 kV Charla line, 220 kV Jansath line and 220 kV shamli line tripped from remote ends on zone-3 distance protection (it is confirmed from respective DRs also).

Brief of event:

v. Ideally, this fault would have been cleared by LBB protection of Badhni kalan bay, but as CB status changed from ON to OFF due to proper operation of breaker auxiliary contacts, LBB initiation got reset.

vi. Further, as reported, bus bar protection of 220kV bus-1 at Muzaffarnagar(UP) also operated after 1 second of fault starting time due to persisting differential current.

vii. As per DR of bus bar protection at Muzaffarnagar(UP), busbar protection operated on 220kV bus-1 after 1.05 second of fault starting time. On this, all remaining elements also tripped which were connected to 220kV bus-1 i.e. 220kV Muzaffarnagar-Khatauli (UP) Ckt, 220/132kV 160MVA ICT-4 and bus coupler of 220kV bus-1 and bus-2.

viii. As per PMU at Meerut(PG), R-N phase to earth fault with delayed fault clearing time of 1080 msec is observed.

ix. As per SCADA, load loss of approx. 290 MW in UP control area. However, SLDC-UP reported load loss of 127 MW in UP control area.

Elements tripped:

i. 1) 400/220 kV 315 MVA ICT 1 at Muzaffarnagar(UP)

ii. 2) 400/220 kV 315 MVA ICT 2 at Muzaffarnagar(UP)

iii. 3) 400/220 kV 315 MVA ICT 3 at Muzaffarnagar(UP)

iv. 4) 400/220 kV 500 MVA ICT 4 at Muzaffarnagar(UP)

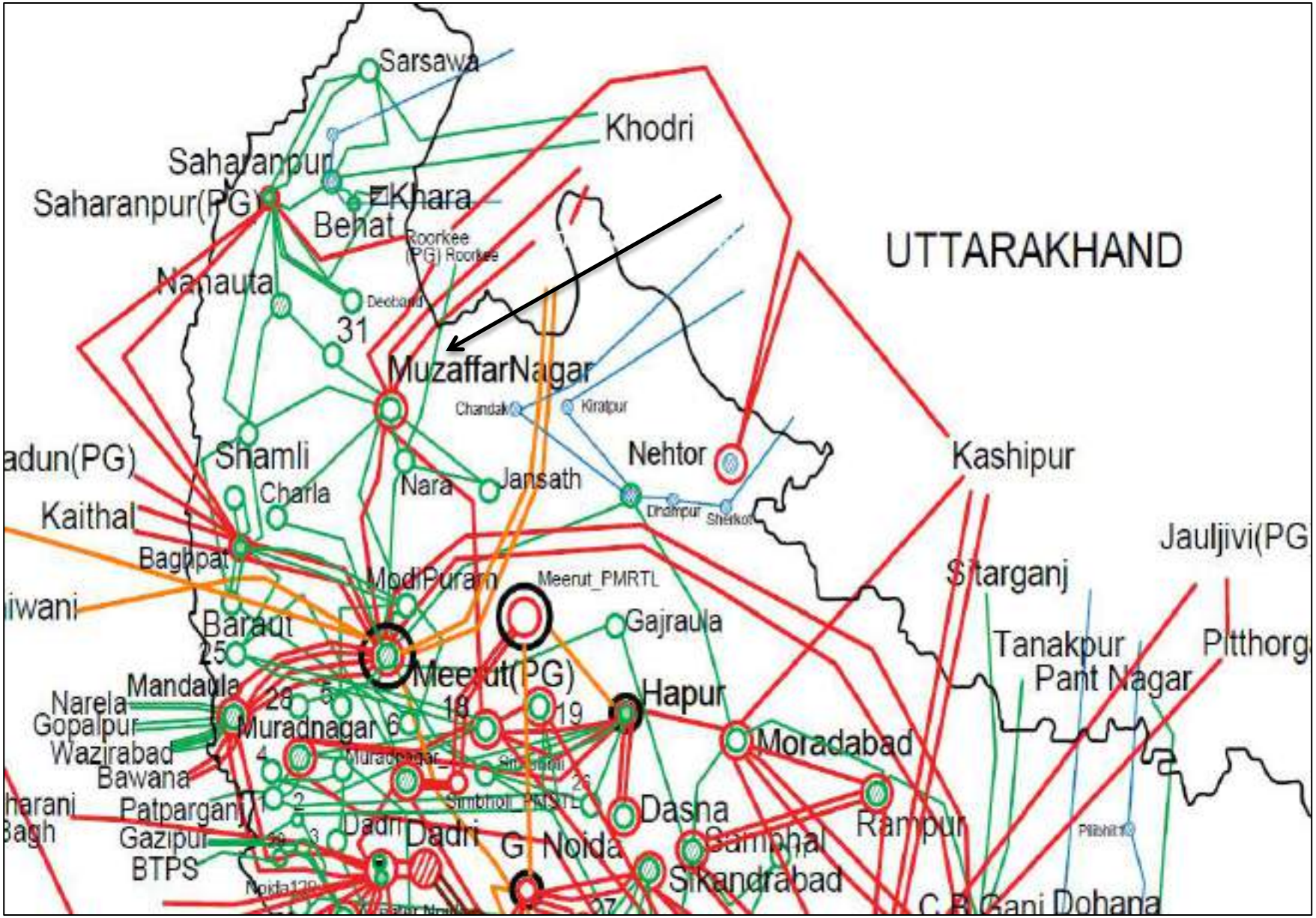
v. 5) 220kV Muzaffarnagar-Charla (UP) Ckt

vi. 6) 220kV Muzaffarnagar-Jansath (UP) Ckt

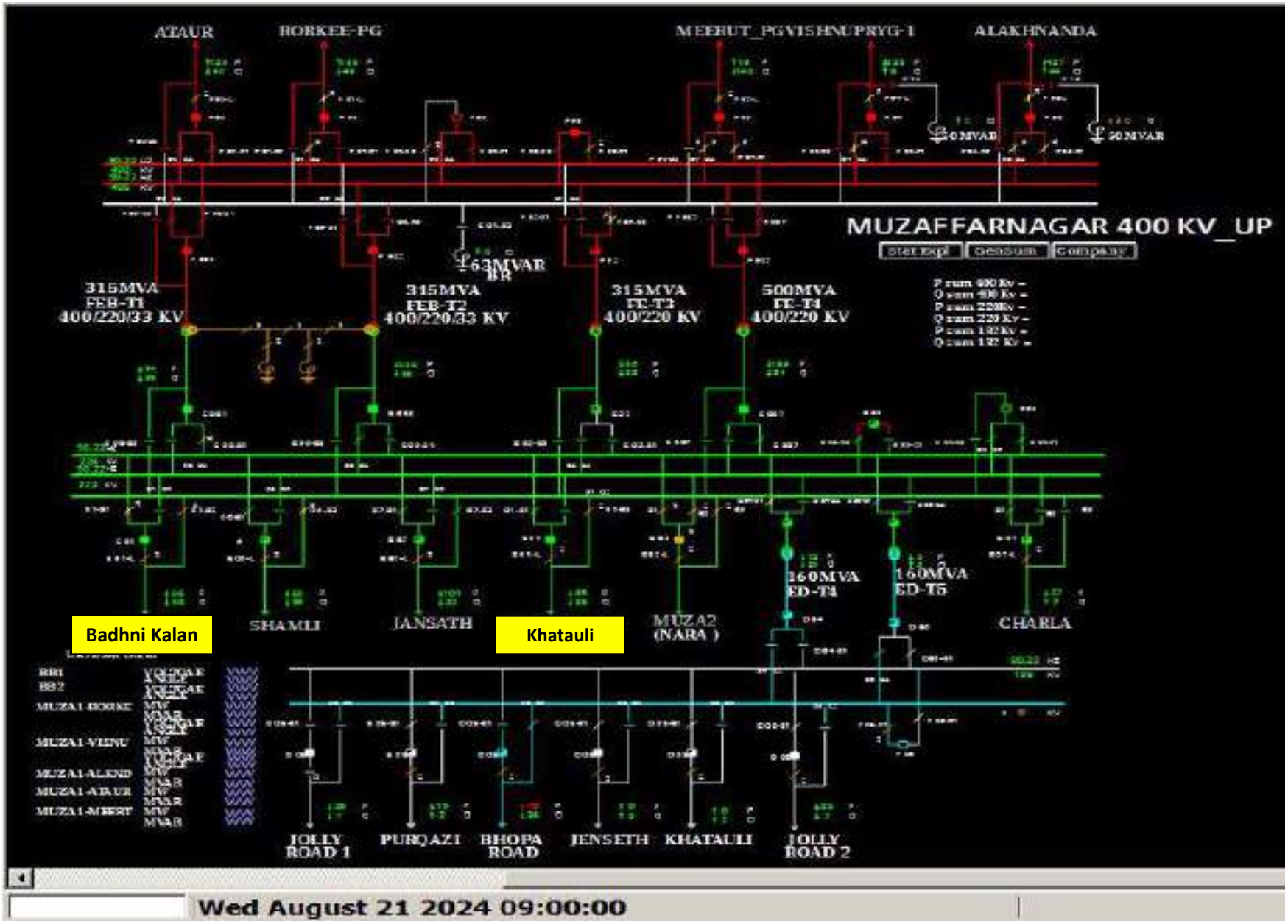
vii. 7) 220kV Muzaffarnagar-Shamli (UP) Ckt

viii. 8) 220kV Muzaffarnagar-Khatauli (UP) Ckt

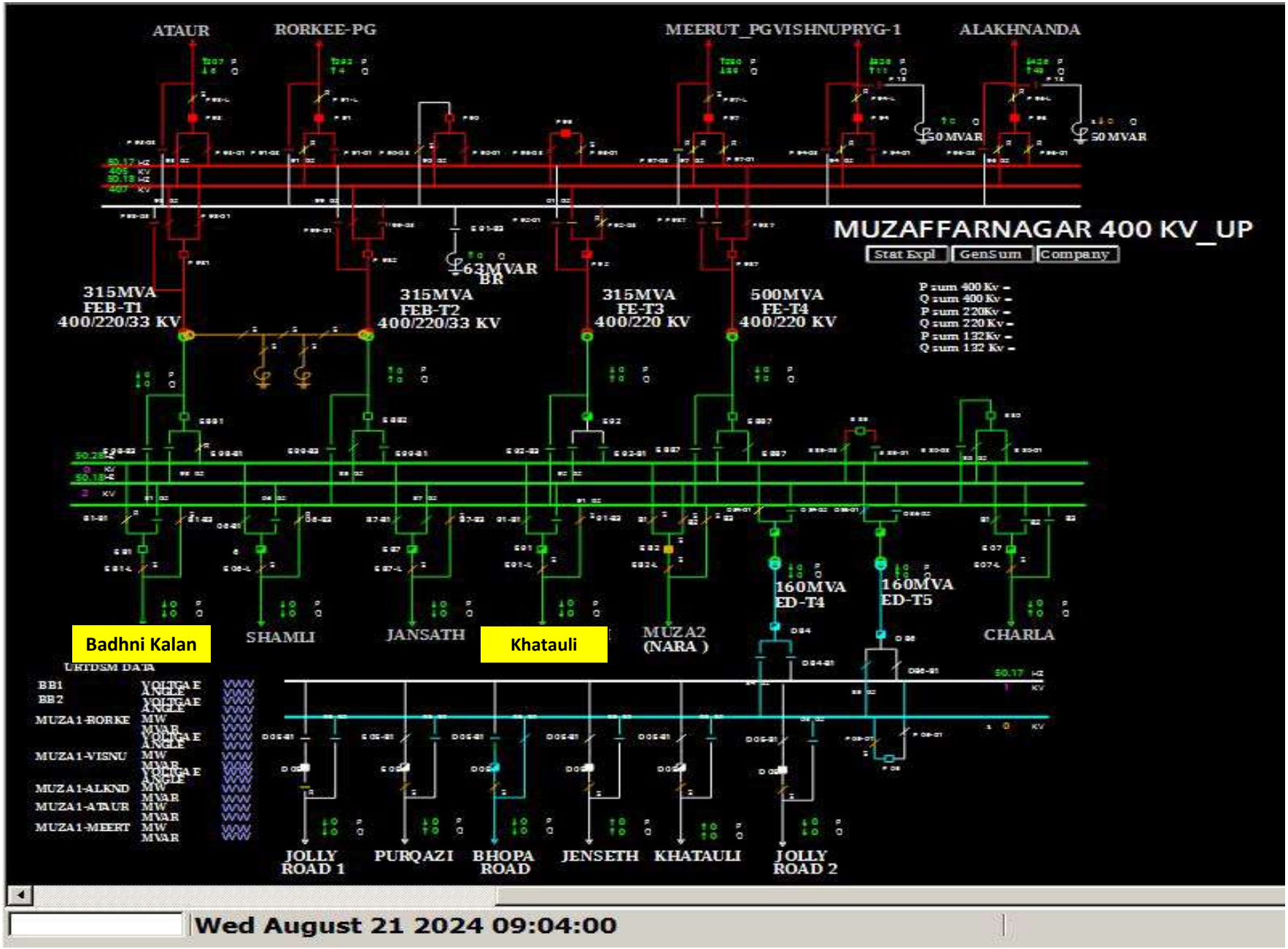
Network Diagram



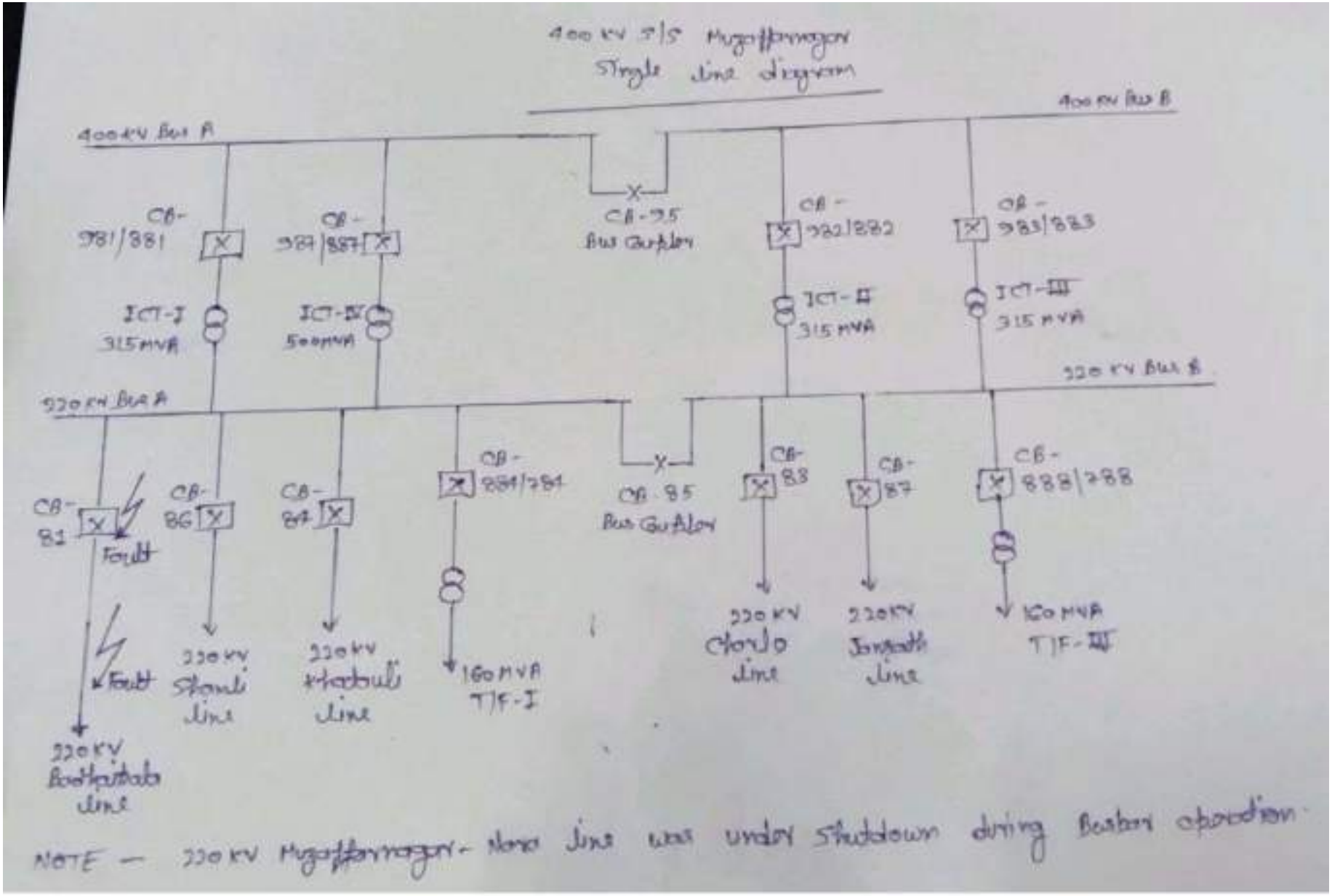
SLD of 400/220 KV Muzaffarnagar(UP) before the event



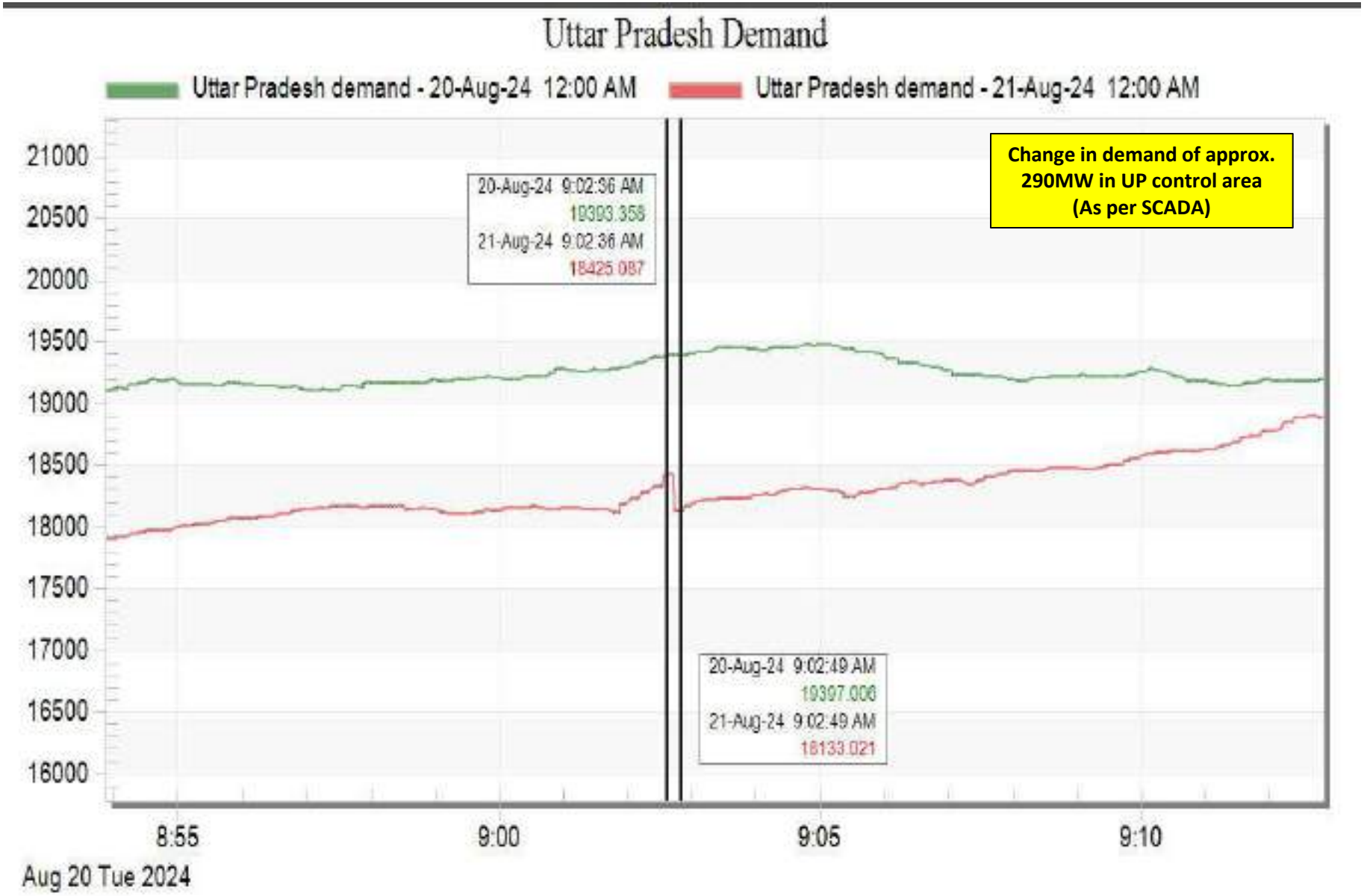
SLD of 400/220 KV Muzaffarnagar(UP) after the event



SLD of 400/220 KV Muzaffarnagar(UP) during the event (Bus wise arrangement)



Uttar Pradesh Demand during the event



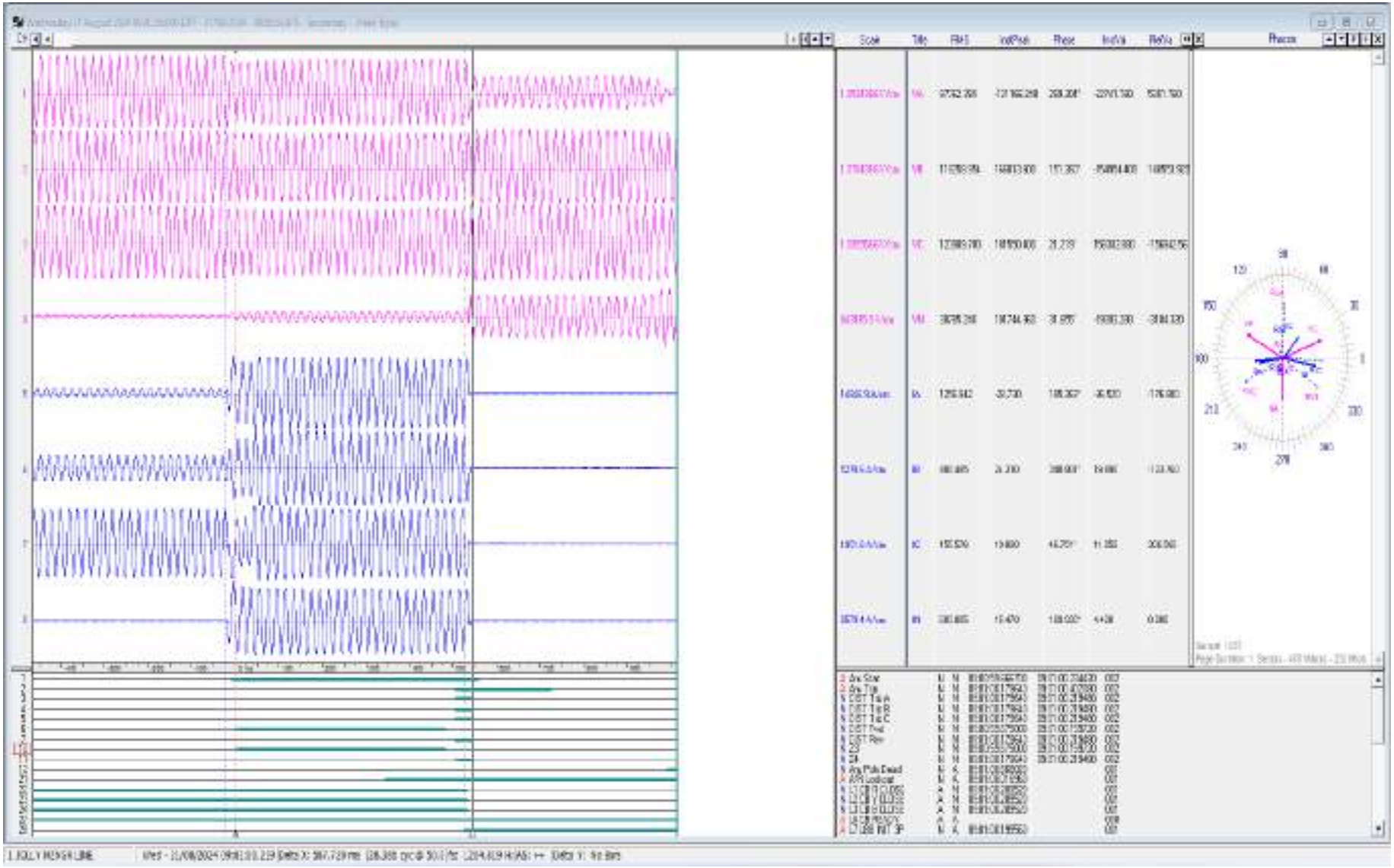
PMU Plot of frequency at Meerut(PG)

09:02 hrs/21-Aug-24

PMU Plot of phase voltage magnitude at Meerut(PG)

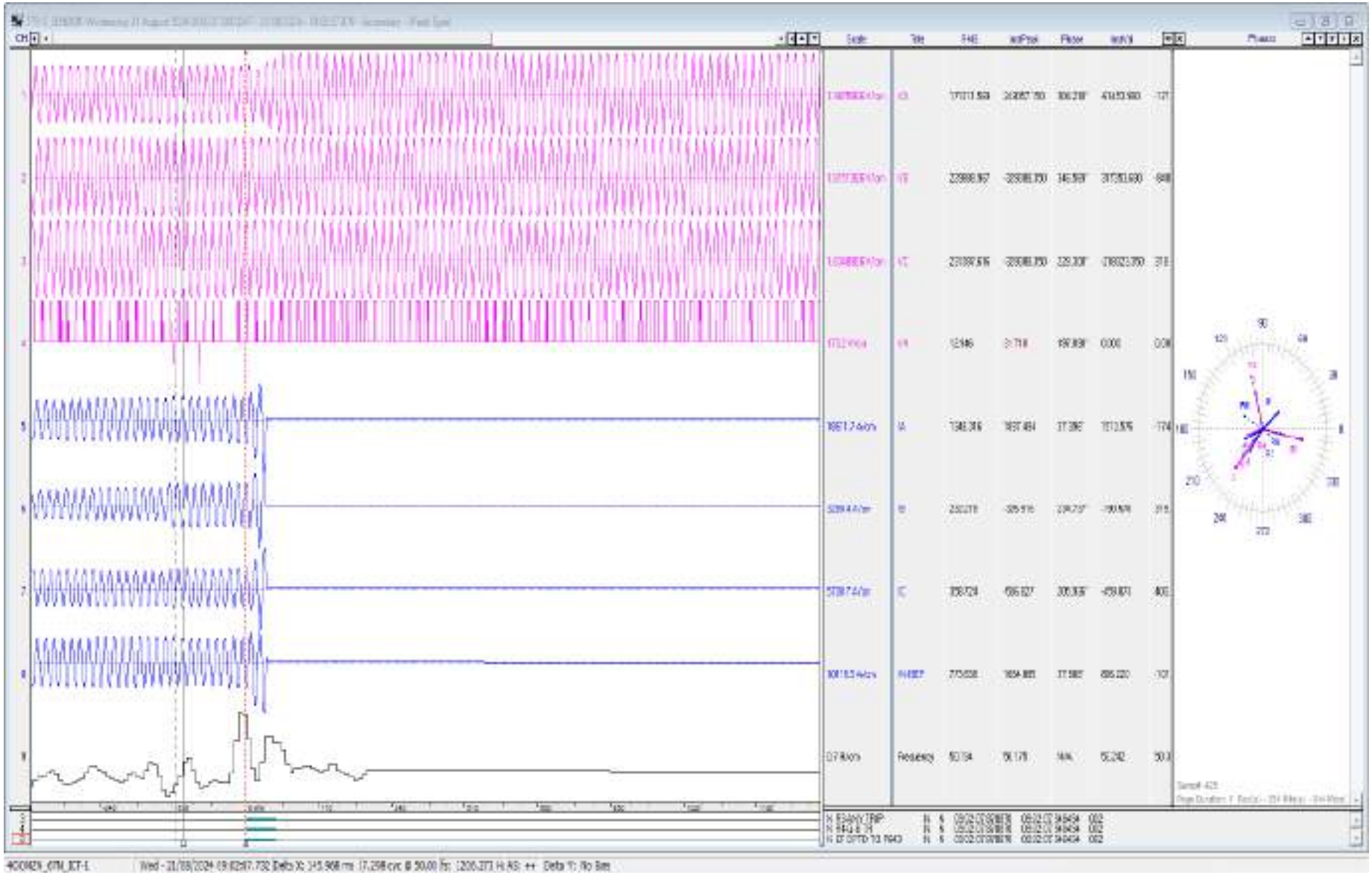
09:02 hrs/21-Aug-24

DR of 220kV Muzaffarnagar-Shamli(end) (UP) ckt



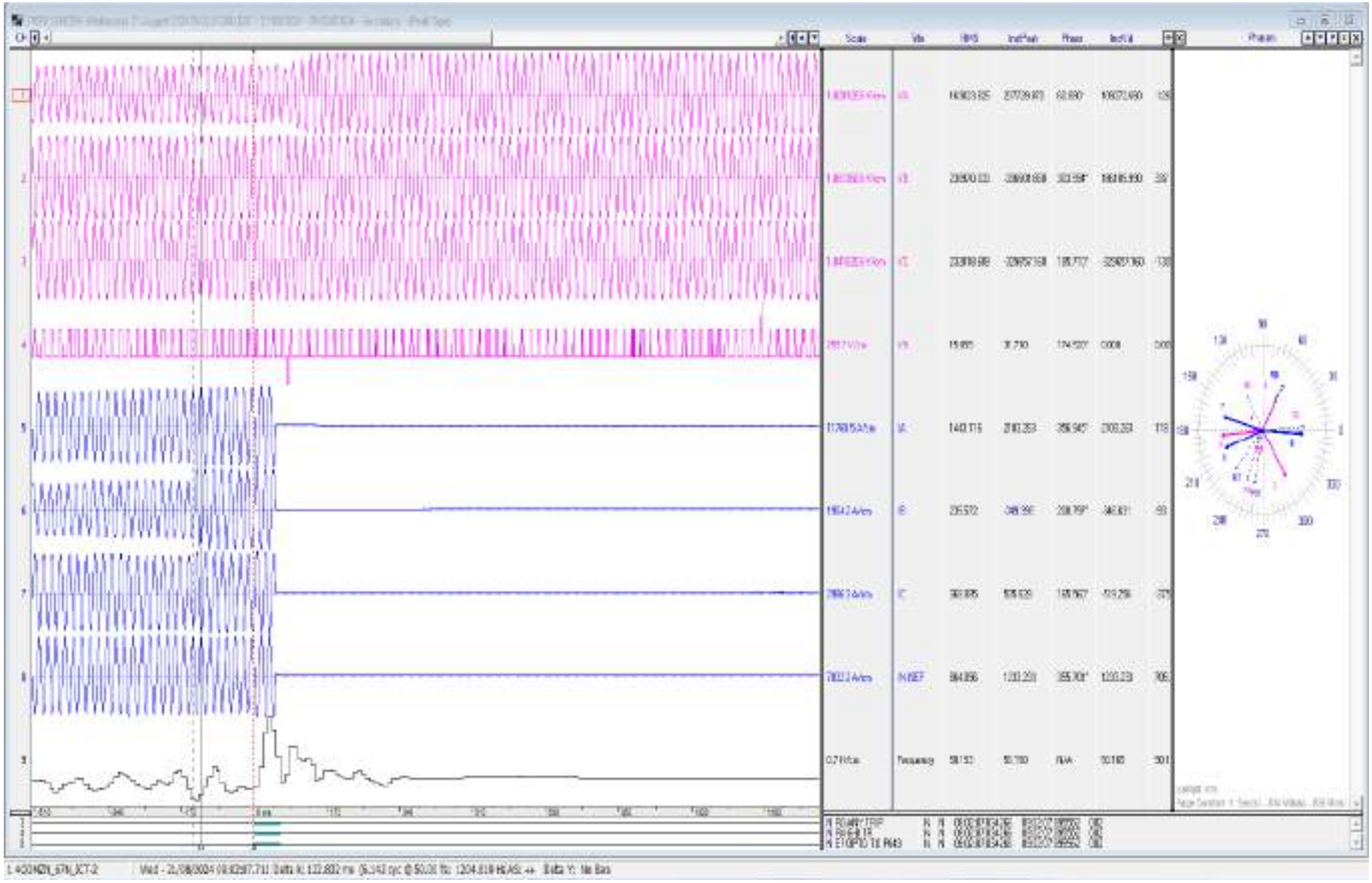
- ✓ R-N fault, Z-3, trip time: ~560msec

DR of 400/220kV 315 MVA ICT-1 at Muzaffarnagar(UP)



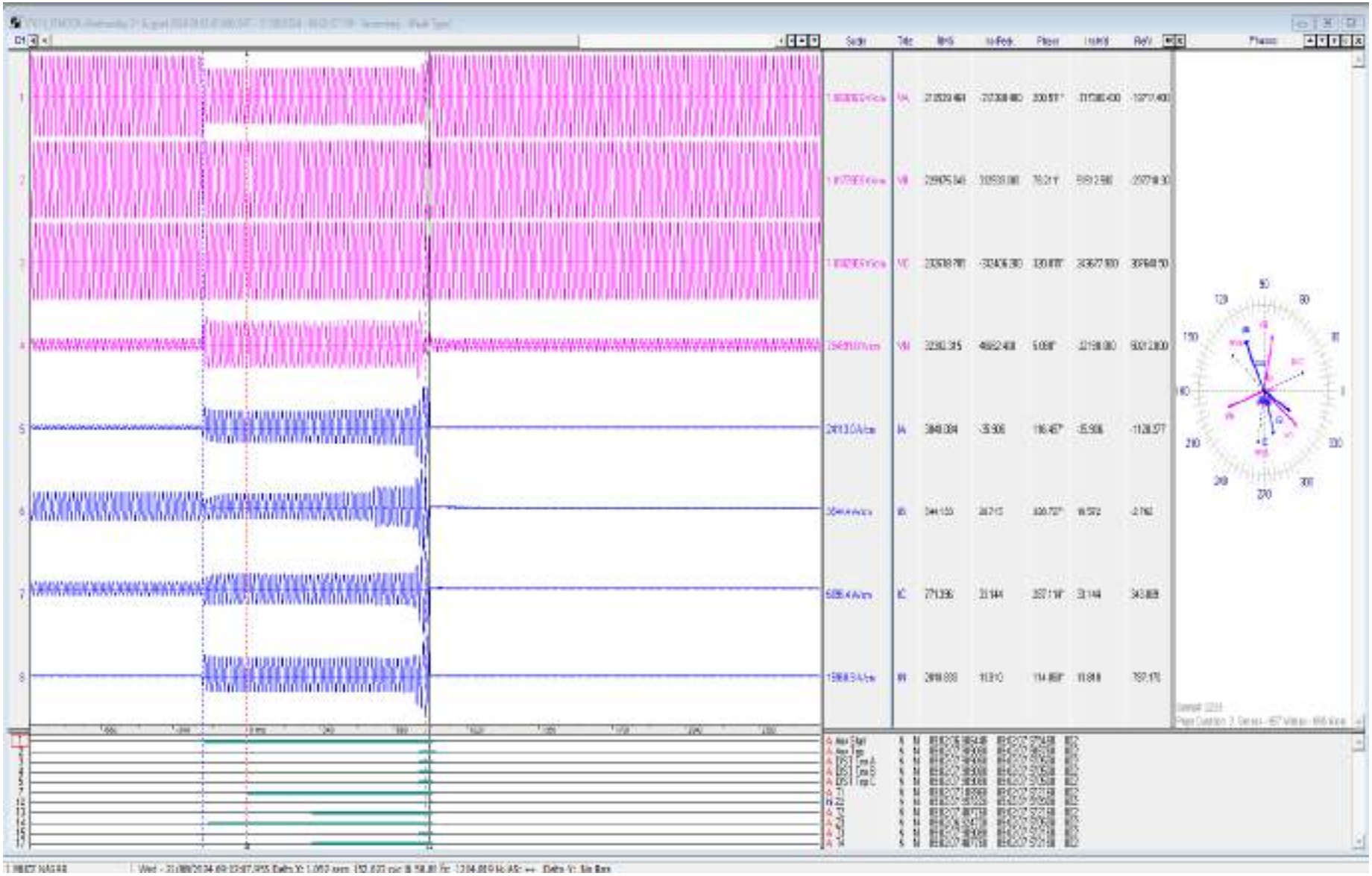
- ✓ DEF operated, Ir=~1350A, In=~750A

DR of 400/220kV 315 MVA ICT-2 at Muzaffarnagar(UP)



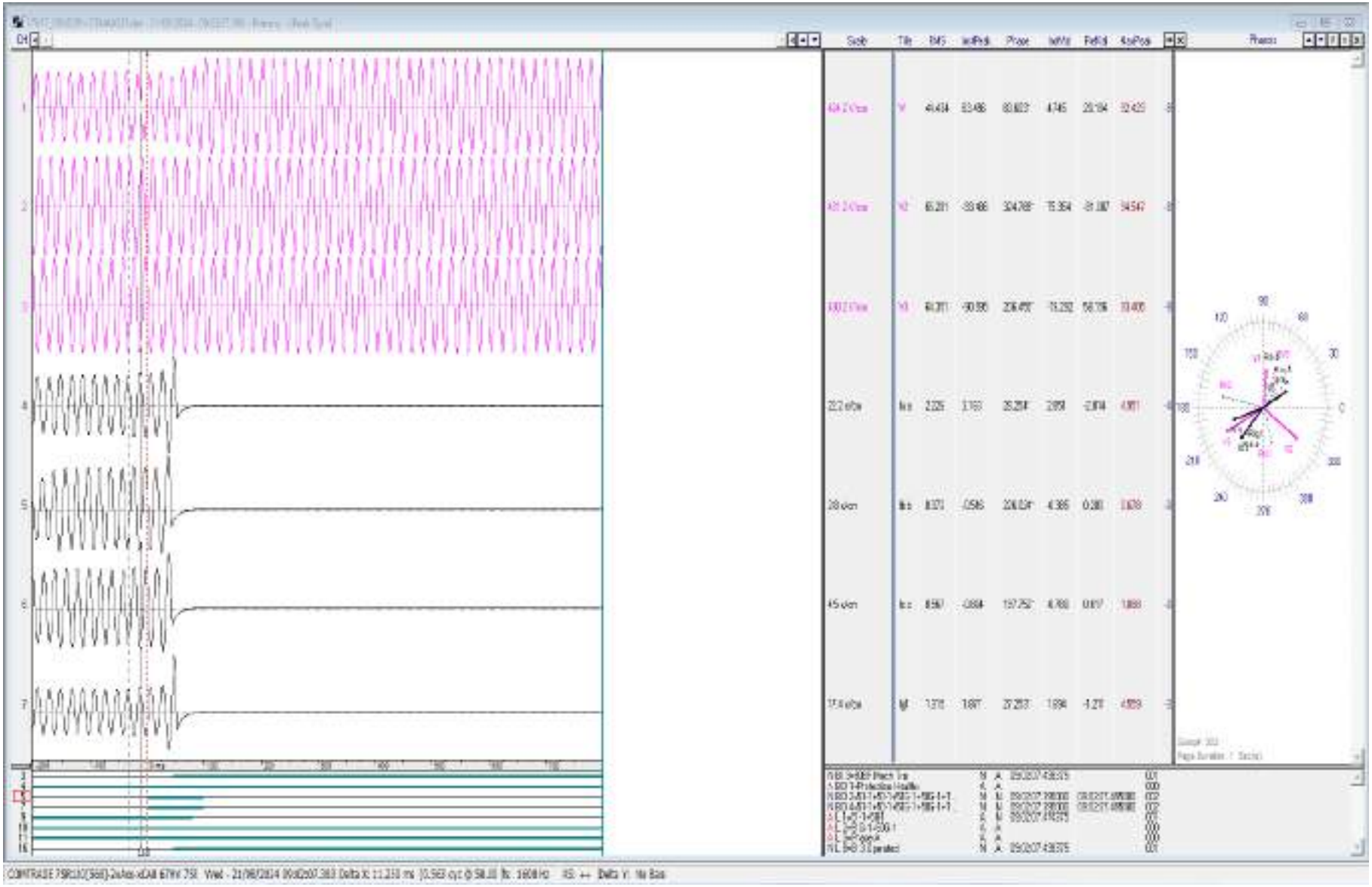
- ✓ DEF operated, Ir=~1440A, In=~860A

DR of 400/220kV 315 MVA ICT-3 at Muzaffarnagar(UP)



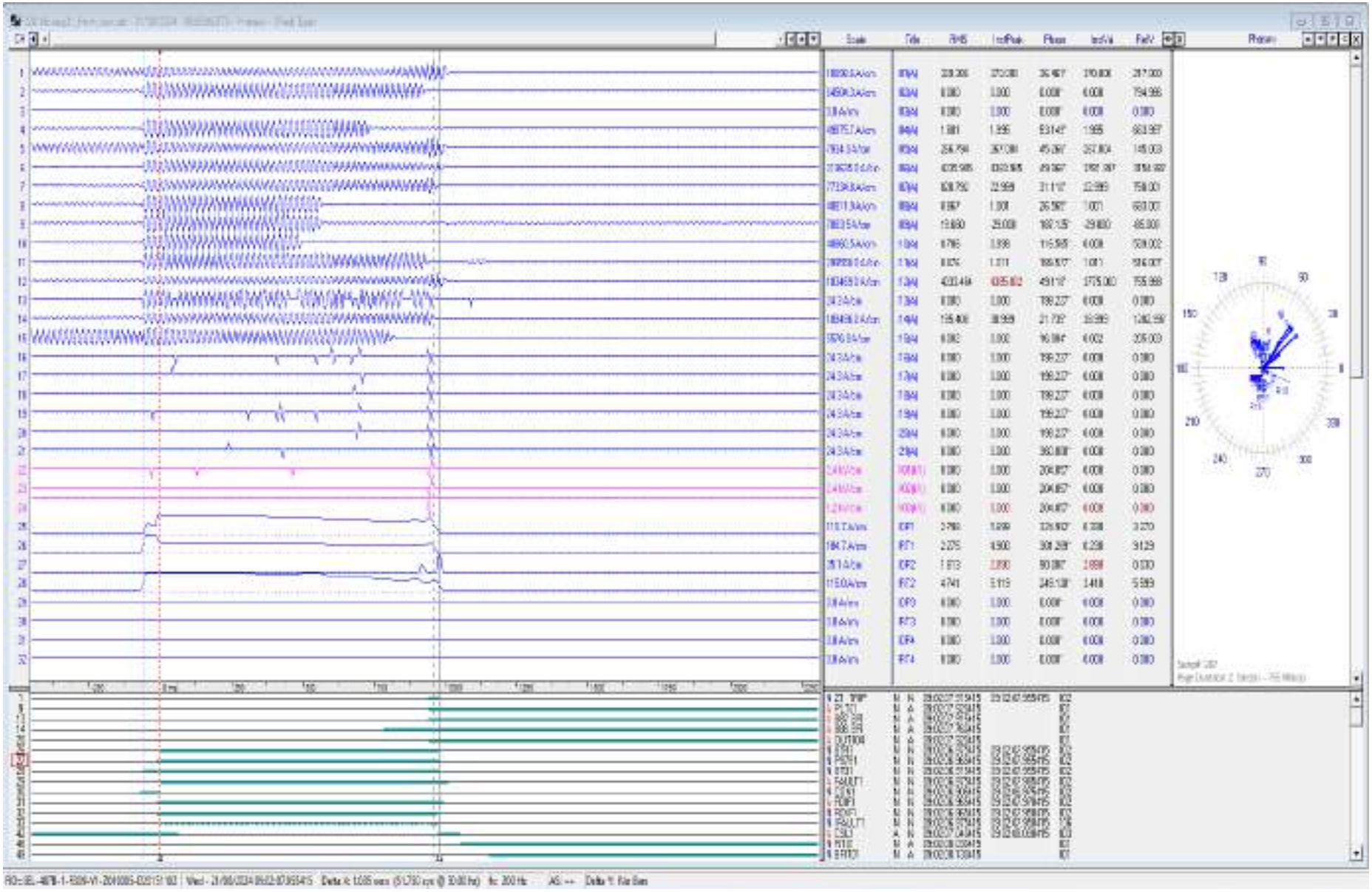
- ✓ Back up impedance protection operated, Z-3 operated; trip time: ~1.05 sec

DR of 400/220kV 500 MVA ICT-4 at Muzaffarnagar(UP)



- ✓ DEF operated

DR of bus bar protection at Muzaffarnagar(UP)



- ✓ Bus bar zone-1 operated after 1.05sec of fault starting time

SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remarks
09:02:07,391	SHMLI_UP	220kV	08MUZA1	Circuit Breaker	Open	Line CB at Shamli end of 220kV Muzaffarnagar-Shamli ckt opened
09:02:07,890	MUZA1_UP	400kV	982T2	Circuit Breaker	Open	CB at 400kV side of 400/220kV 315 MVA ICT-2 at Muzaffarnagar opened
09:02:07,898	MUZA1_UP	220kV	882T2	Circuit Breaker	Open	CB at 220kV side of 400/220kV 315 MVA ICT-2 at Muzaffarnagar opened
09:02:07,917	MUZA1_UP	400kV	987T4	Circuit Breaker	Open	CB at 400kV side of 400/220kV 500 MVA ICT-4 at Muzaffarnagar opened
09:02:07,937	MUZA1_UP	220kV	887T4	Circuit Breaker	Open	CB at 220kV side of 400/220kV 500 MVA ICT-4 at Muzaffarnagar opened
09:02:07,937	MUZA1_UP	400kV	981T1	Circuit Breaker	Open	CB at 400kV side of 400/220kV 315 MVA ICT-1 at Muzaffarnagar opened
09:02:07,944	MUZA1_UP	220kV	881T1	Circuit Breaker	Open	CB at 220kV side of 400/220kV 315 MVA ICT-1 at Muzaffarnagar opened
09:02:07,955	MUZA1_UP	220kV	85MBC	Circuit Breaker	Open	Bus coupler breaker of 400kV side opened
09:02:07,977	MUZA1_UP	220kV	81BADHA	Circuit Breaker	Open	Line CB at Muzaffarnagar end of 220kV Muzaffarnagar-Badhaikalan ckt opened

Point of discussion

i) Logic of identification of breaker ON & OFF status may be reviewed if needed.
ii) Reason for bus bar protection operation need to be shared.
iii) Remedial action taken report to be shared.

400KV MUZAFFARNAGAR SUB-STATION, UPPTCL

Multiple tripping event on 21.08.2024 at 09:02hrs. alongwith 220kV Busbar operation.

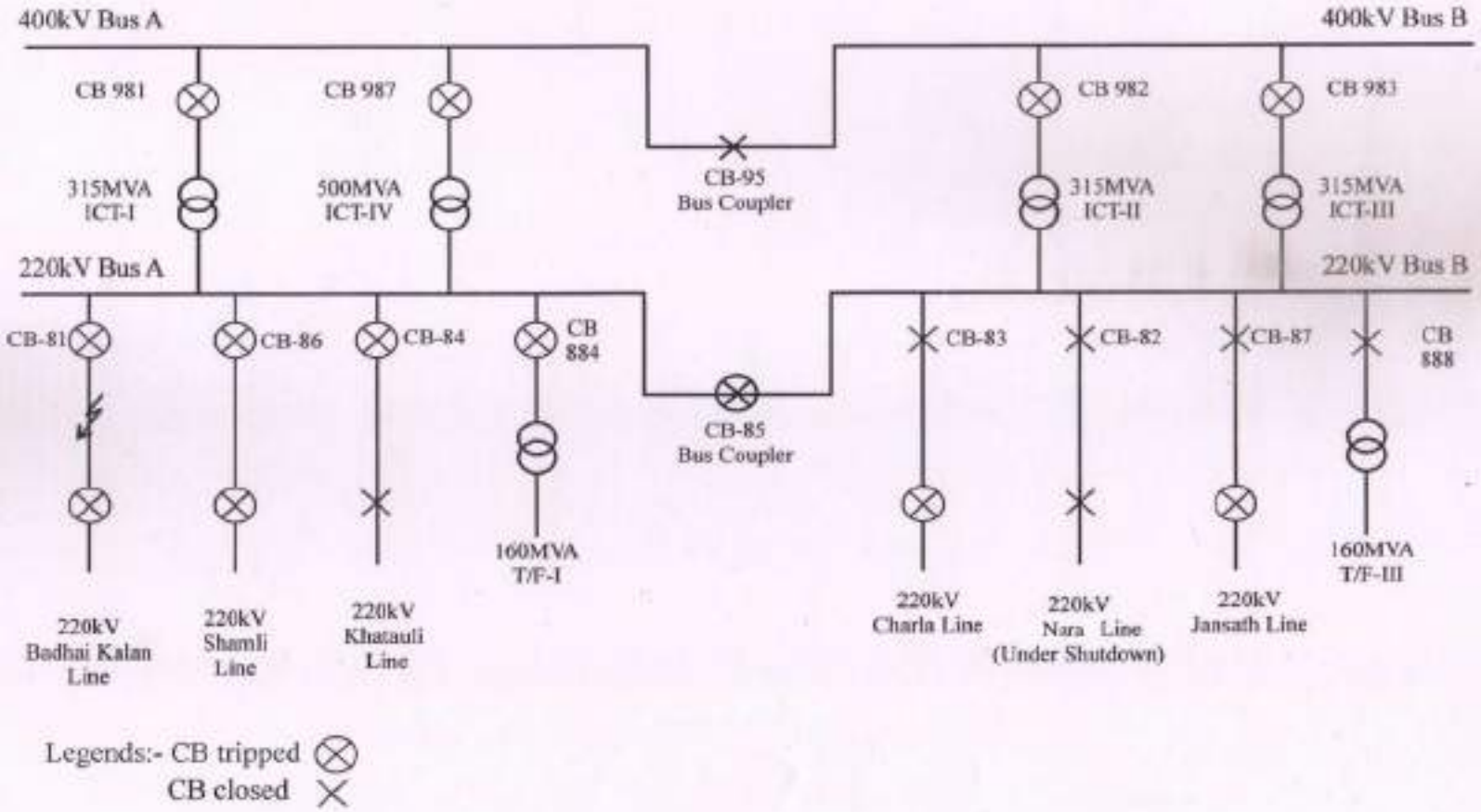
Antecedent Conditions:

- **Weather conditions** : - Clear at Muzaffarnagar
- **Date & Time of event**: 21.08.2024 at 09:02 hrs.
- **Sub-Station affected**: 220kV Bus at 400kV S/s Muzaffarnagar.
- **Load conditions on 400/220kV ICT's:** - 315MVA ICT-I, 315MVA ICT- II, 315MVA ICT-III and 500MVA ICT-IV were carrying 90MW, 96MW, 90MW and 146MW respectively**.**

	Elements tripped	Time of restoration	Bay No. (Busbar relay)
1.	315MVA ICT-I	09:55 hrs.	07
2.	315MVA ICT-II	10:00 hrs.	02
3.	315MVA ICT-III	12:13 hrs.	12
4.	500MVA ICT-IV	12:27 hrs.	14
5.	220kV Muzaffarnagar-Badhaikalan Line	18:22 hrs.	11
6.	220kV Muzaffarnagar-Shamli Line	14:23 hrs.	10
7.	220kV Muzaffarnagar-Khatauli Line	11:32 hrs.	05
8.	220kV Muzaffarnagar-Charla Line	19:28 hrs.	04
9.	220kV Muzaffarnagar-Jansath Line	10:54 hrs.	08
10.	220kV Bus Coupler	15:26 hrs.	06
11.	160MVA T/F-I	09:56 hrs.	01

NAME OF ELEMENT	RESTORATION DATE	RESTORATION TIME	FLAGS END 1 (Muzaffarnagar end) (INCLUDING A/R)	FLAGS END 2 (Remote end) (INCLUDING A/R)
CB-81 220 KV MUZAFFARNAGR-BADHAIKALAN LINE	21/08/2024	18:22 HRS	C/P: DIST.TRIP R/P: R PH,Z-1,C/S, K86R,86B IR-12.18KA DISTANCE-3.839KM (13.71%)	C/P: DIST. TRIP R/P: R PHASE, Z1,86A,86B, IR-2.724KA. Dist: 20.399KM (72.85%)
220 kV BUS BAR (BUS A)	21/08/2024	15:26 HRS	CP= BUS BAR ZONE 1 RP=R PHASE BUS BAR DIFFERENTIAL TRIP, 96(315 MVA ICT-I,96(500 MVA ICT IV,96(220 KV KHATAULI LINE, 96(220 KV BUSCOUPLER),96(220 KV SHAMALI LINE),96(160 MVA T/F-1)	
CB-84 220 KV MUZAFFARNAGAR-KHATAULI LINE	21/08/2024	11:32 HRS	R.P.: 96 TRIP,	Line radially fed from Muzaffarnagar end.
CB-86, 220 kV MUZAFFARNAGAR-SHAMLI LINE	21/08/2024	14:23 HRS	R.P.: 96 TRIP	C.P.- DPO, DPS,A/R LOCKOUT RP- R,N,Z4 , DIST:96.11KM IA-1.497KA
CB-884/784 160 MVA T/F-I	21/08/2024	09:56 HRS	R.P.: 96 TRIP	
CB-85,220 KV BUS COUPLER	21/08/2024	15:26 HRS	R.P.: 96 TRIP	
CB-981/881,315 MVA ICT-I	21/08/2024	09:55 HRS	220 BUS BAR R/P: 96 TRIP ICT C/P: DIRECTIONAL E/F TRIP ICT R/P: DIR.E/F TRIP,86 GB IA-1.228KA,IB- 126A,IC- 329A ,IN-835A	
CB-987/887,500 MVA ICT-IV	21/08/2024	12:27 HRS	220 BUS BAR R/P: 96 TRIP ICT C/P: DIRECTIONAL E/F TRIP ICT R/P: DIR.E/F TRIP, 86 A,86B IA-2.339KA,IB- 0.378KA, IC-0.596KA ,IN-1.328KA	
CB-982/882,315 MVA ICT-II	21/08/2024	10:00 HRS	C/P: DIRECTIONAL E/F TRIP R/P: DIR.E/F TRIP,86 GB IA-1.339KA,IB- 138.6A, IC-385A , IN-926.9A	
CB-983/883,315 MVA ICT-III	21/08/2024	12:13 HRS	C/P: HV BACKUP IMPEDENCE TRIP R/P: R PH,Z-3, DISTANCE: 211.9KM, 86 HV,86LV IA-1.254KA,IB- 118A, IC- 318A ,IN-835A	
CB-87, 220 kV MUZAFFARNAGAR-JANSATH LINE	21/08/2024	10:54 HRS	Not Tripped	C.P.- DPO RP-M1- R,N,Z3, DIST: 51.2 KM IA-1.70KA,IB-0.37KA,IC-0.27KA
CB-83, 220 kV MUZAFFARNAGAR-CHARLA LINE	21/08/2024	19:28 HRS	Not Tripped	C.P.-DPO,DPS, RP-R,N,Z-3,DIST: 83.68KM, IA-2.149KA,IB-

400kV S/S Muzaffarnagar Single line diagram on 21.08.2024



Sequence of Events:

- 21.08.2024, 09:02 hrs. : R-N fault occurred on 220 kV Muzaffarnagar-Badhaikalan line having distance of 3.839Km, It's distance relay operated at Muzaffarnagar end in zone-1.This line tripped from remote end also on R phase fault in Z-1 with distance of 20.399 km. During fault clearing process at Muzaffarnagar end, R phase CB interrupting chamber got damage. Which resulted into continuous sparking between R phase male contact and R phase dropper wire of breaker. However it is to make clear that no phase to earth fault developed in the switchyard. The circuit breaker operated mechanically (auxiliary contacts operated properly), thereby reporting the status of breaker as open in the busbar relay. LBB didn't operate in this event.

- Hence, this fault was fed by upstream network thereby resulting into tripping of 315MVA ICT-1,315MVA ICT-II,500MVA ICT-IV on directional E/F protection,315 MVA ICT-III on back up impedance protection. 220 kV Charla line ,220 kV Jansath line and 220 kV Shamli line tripped from remote end.

Sequence of Events (contd.):

- After fault incident, during patrolling of 220 kV Muzaffarnagar-Badhaikalan line OPGW wire found broken between tower no.-161 &162. On switchyard inspection R phase breaker pole of 220 kV Badhaikalan line found damaged. Also, R phase isolator arms' support insulators of 220 kV Shamli line got damaged due to impact of shattered pieces of Badhaikalan line CB pole interrupting chamber. Since no marks of electrical sparking were found either on isolator structure or at the ground near isolator, it is evident that the fault was already cleared by the time isolator arm fell from the post insulator.

Reason of Non operation of LBB:

- After detailed examination of disturbance records obtained from busbar and line protection we arrive at following conclusion.

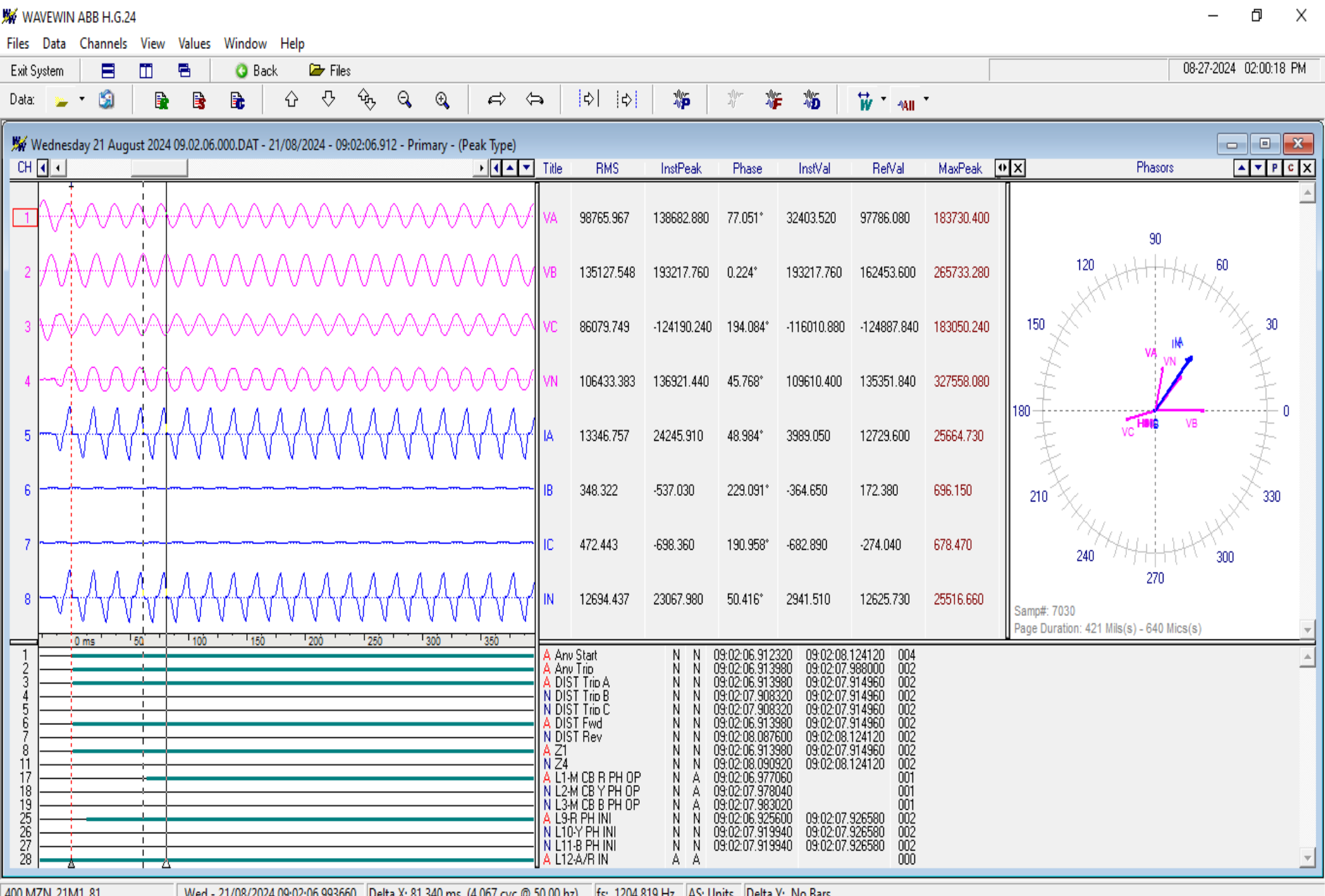
- Ideally, This fault should have been cleared by LBB protection. However, In the busbar DR, at 09:02:06:925hrs, breaker failure initiation of 220 kV Badhaikalan line can be seen as asserted. After approx 50ms, at 09:02:06:965 hrs circuit breaker open status of Badhaikalan line also can be seen as asserted.

- As soon as CB status of BadhaiKalan line changed from ON to OFF, Badhai Kalan line vanished from zone 1 of busbar i.e. its assignment to zone 1 of the busbar protection ceased to exist. As zone-1assignment logic for any bay is boolean AND of isolator A(89A) and breaker auxiliary contact (52a) status. Because of changing of CB status of Badhaikalan from ON to OFF, Badhaikalan bay de-assigned from zone-1 . Due to these facts, LBB couldn’t operate.

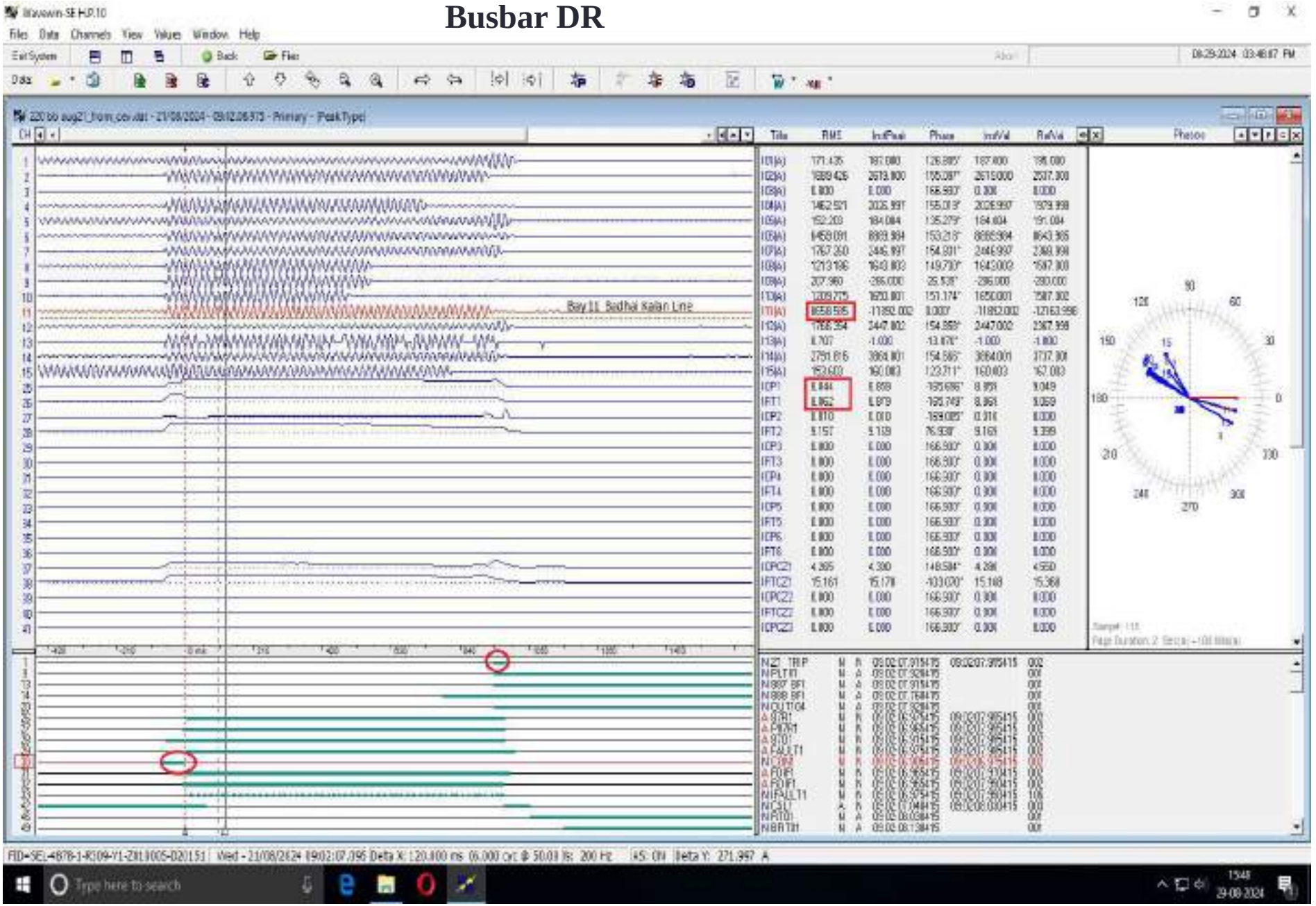
Reason of Busbar differential operation:

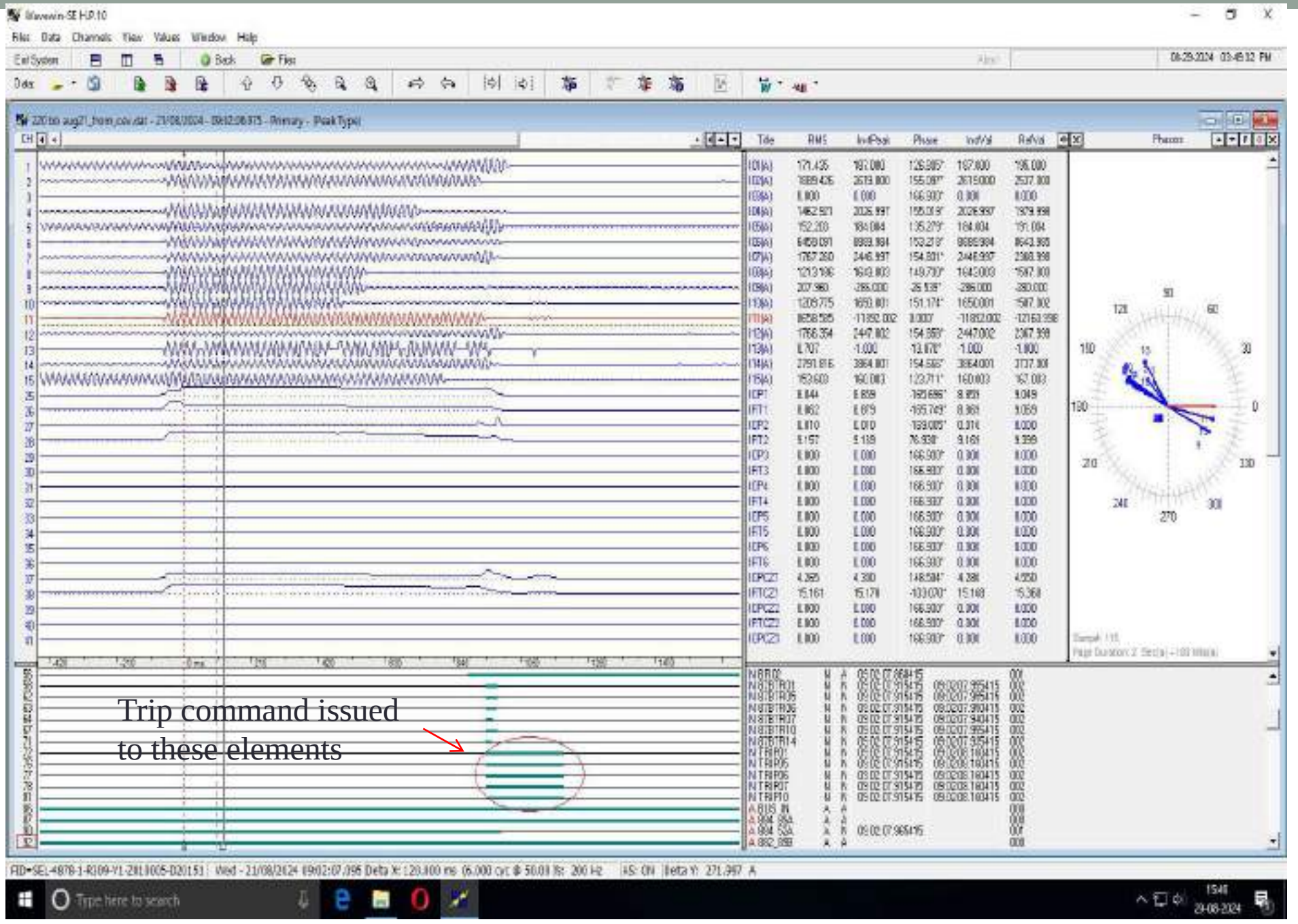
- When Badhaikalan line breaker status(52a) changed from ON to OFF, this line got vanished from zone 1 of busbar i.e. its assignment to zone 1 of the busbar protection ceased to exist. Now, because of non-accounting of BadhaiKalan line fault current (approximately 8 kA), in spite of having no actual busbar fault, the busbar relay started to show approximately 8 kA of differential current as well as the same amount of restraining current.
- Also, there is a provision in busbar relay to increase the stability of busbar relay by increasing the slope once a through fault is detected. This condition is represented by appearance of CON1 signal in DR. Once the through fault was detected, the bus bar relay increased its slope to a higher value (from normal slope of 60% to 80% in this case) for next 50 cycles i.e. 1s. This increased slope prevented busbar relay operation for next 1 second.
- Owing to these facts, the busbar relay operated on bus differential fault after one second of occurrence of through fault on BadhaiKalan line.
- Even when the busbar relay operated on differential fault it issued trip commands to all the bays connected to bus Zone 1 except bay 11 which is BadhaiKalan line. This confirms that BadhaiKalan line was totally eliminated from busbar protection scheme once its CB mechanically tripped.

220kV BADHAIKALAN LINE DR



Busbar DR




Trip command issued
to these elements

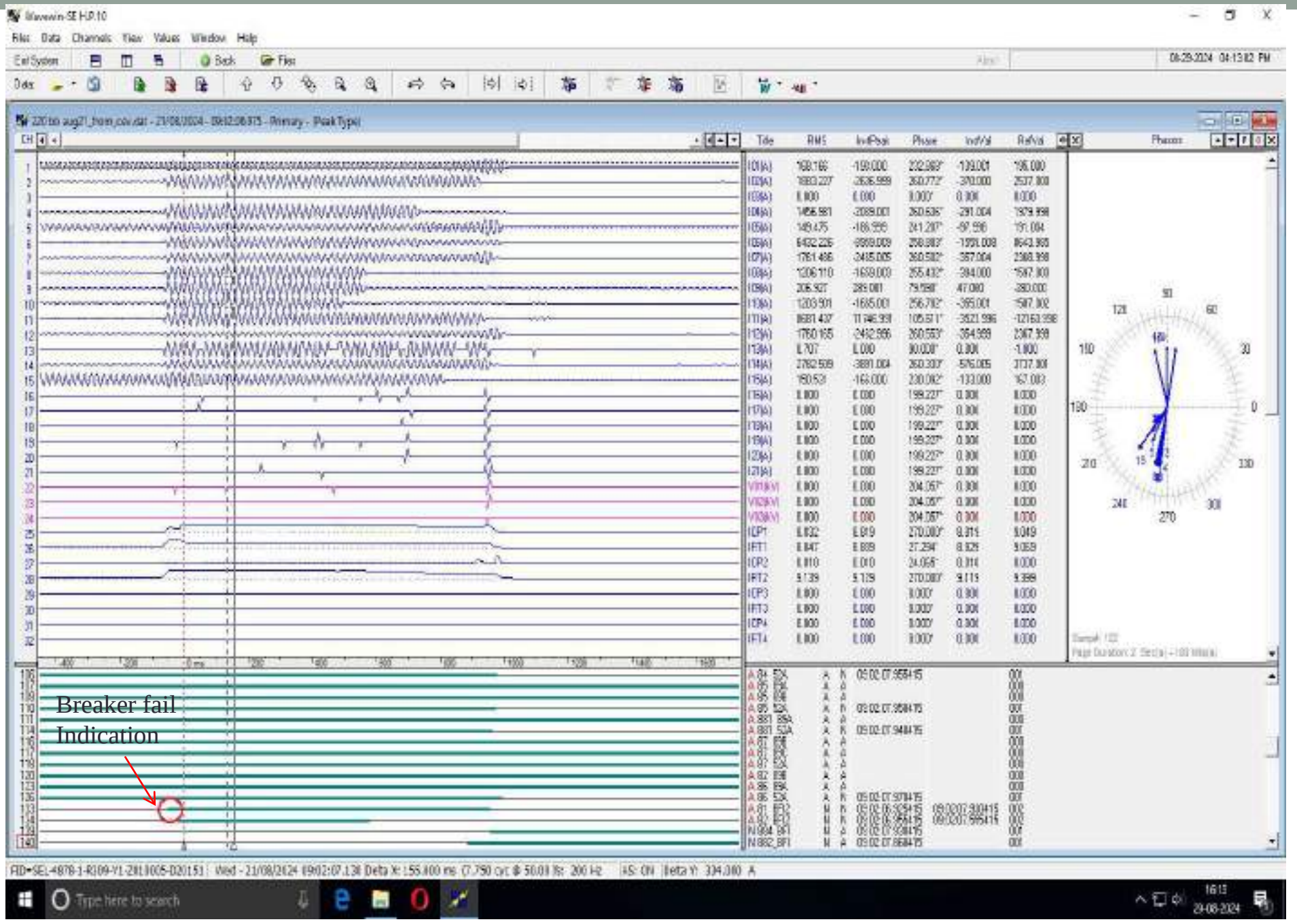

Breaker fail
Indication

Figure 5.8 Fault Detection Logic Obtaining Restraint and Operating Quantities

External Fault Detection Logic

In general, operating and restraint currents increase simultaneously for internal faults; for external faults, only the restraint current increases if there is no CT saturation. By comparing the change in operating current (ΔIOP1R) to the change in restraint current (ΔIRT1R), the relay detects external fault conditions. Because CTs can saturate during external faults, the relay asserts the external fault condition (Relay Word bit CON1) for 60 cycles after detecting an external fault. *Figure 5.9* shows the logic for detecting external fault conditions.

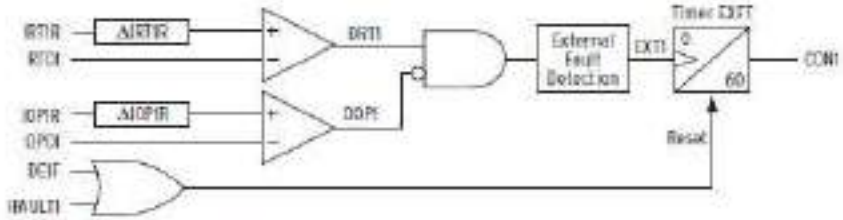


Figure 5.9 External Fault Detection Logic

Asserting CON1 for 60 cycles can slow relay operation for evolving faults (where the fault starts as an external fault and then develops into an internal fault). To prevent delayed tripping, CON1 resets when either the directional element (DE1F) detects an evolving fault or the internal fault detection logic (IFAULT1) confirms an internal fault condition.

Relay Word bit CON1 controls the operating mode of the relay by asserting when

Filtered Differential Element

The following discussion refers to the Filtered Differential Element 1, (with only Terminals 01 and 02 connected to the element) but applies equally well to the remaining five filtered differential elements. Using the output quantities from the digital band-pass filter (cosine filter), the filtered differential element calculates a restraint quantity, IRT1, and an operating quantity, IOP1, according to *Equation 5.3* and *Equation 5.4*:

$$IRT1 = |I01CF| + |I02CF|$$

Equation 5.3

and

$$IOP1 = |I01CF + I02CF|$$

Equation 5.4

where:

I01CF and I02CF = Filtered per unit current values from Terminals I01 and I02

Figure 5.2 shows a block diagram of the elements necessary for obtaining the differential and restraint quantities used in the filtered differential elements. Relay Word bit FDIF1 is the output from the differential calculation. Relay Word bit 87O1 asserts when the differential current exceeds the O87P threshold. Together these two Relay Word bits form the filtered differential element characteristic.

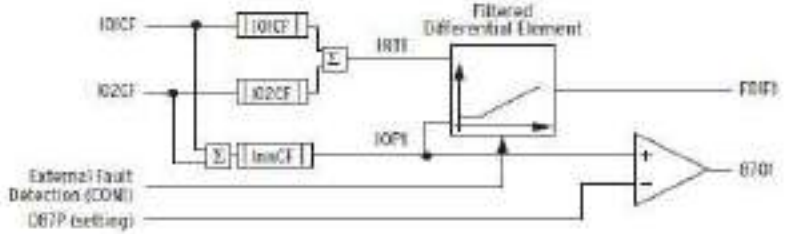


Figure 5.2 Filtered Differential Element 1

Figure 5.3 shows the characteristic of the differential element as a straight line through the origin of the form:

$$IOP1(IRT1) = SLP1 \bullet IRT1$$

Equation 5.5

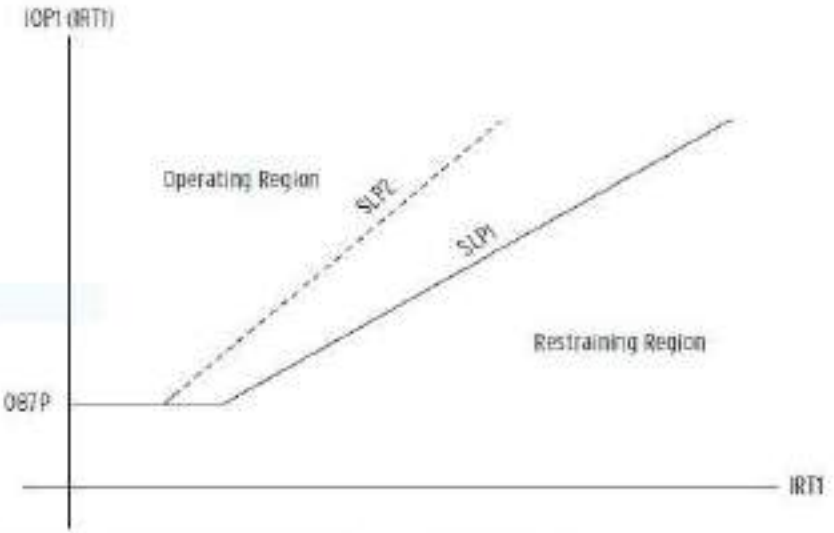


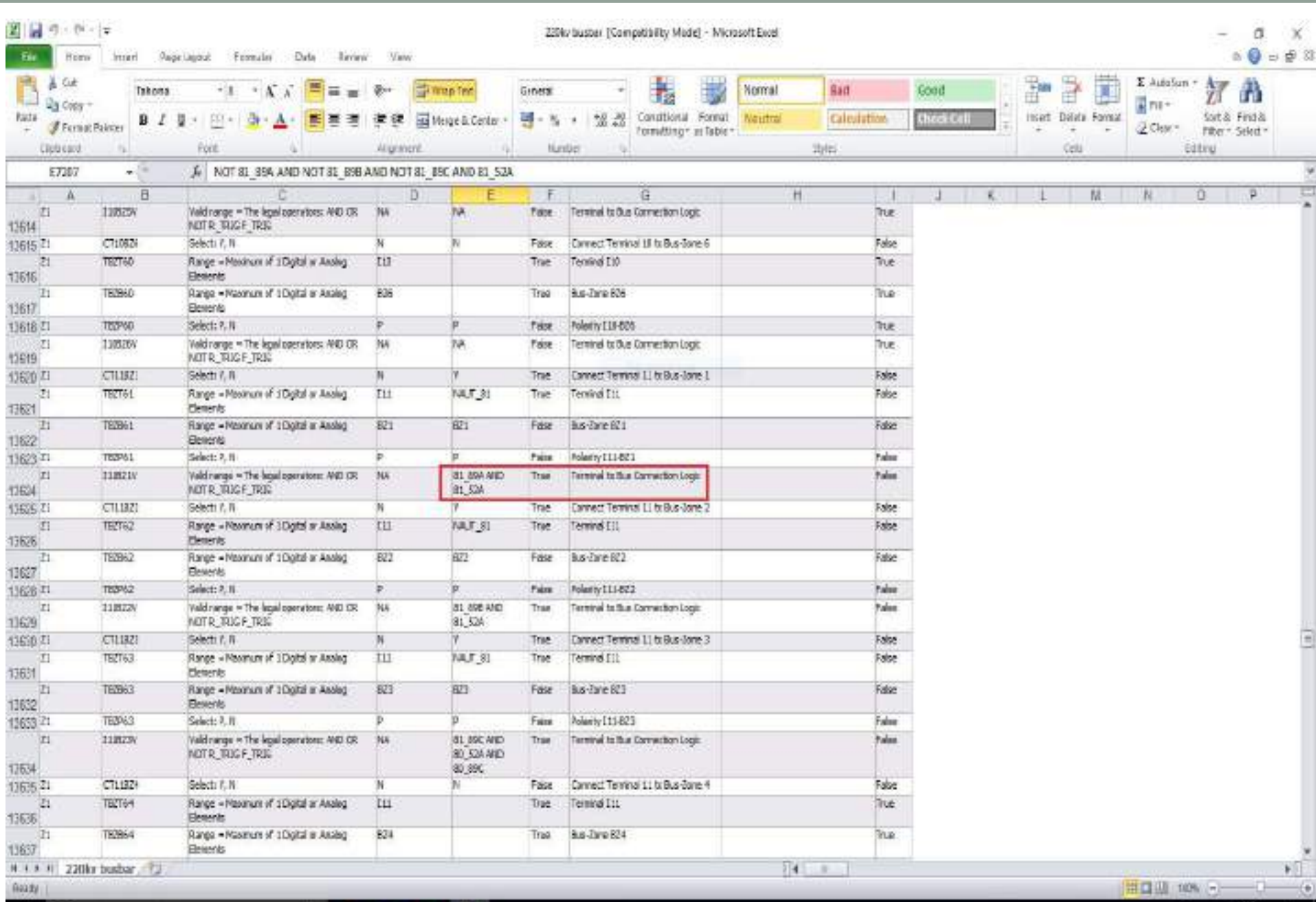
Figure 5.3 Filtered Differential Element Characteristic

For operating quantities (IOP1) exceeding the threshold level O87P and falling in the operate region of *Figure 5.3*, the filtered differential element issues an output. There are two slope settings. Slope 1 (SLP1) is effective for internal faults, and Slope 2 (SLP2) is effective for external faults. To change the slope values, first enable the advanced settings by setting EADVS := Y in Group Settings and then proceed to change the slope values. When the fault detection logic detects an external fault condition, Relay Word bit CON1 asserts. CON1 switches the slope of the differential characteristic from Slope 1 to Slope 2 to add security to the filtered differential element (see *Fault Detection Logic on page 5.7*).

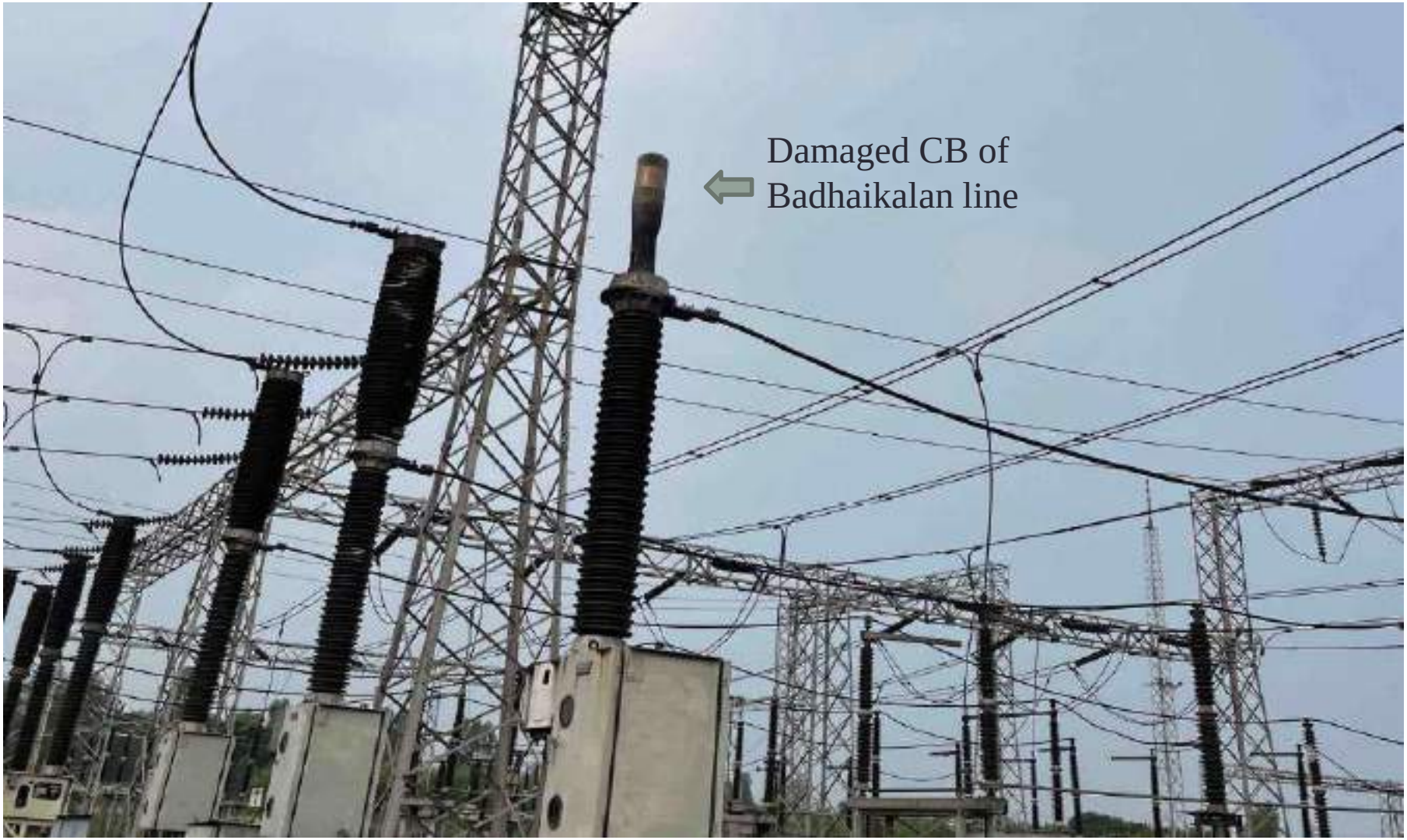
Directional Element

The relay includes directional elements that supervise the filtered differential elements. In particular, the directional elements provide additional security to the filtered differential elements during external faults with heavy CT saturation conditions. Each of the six busbar protection elements has a directional element specific to that differential element.

The directional element compares the direction of current at the reference termi-



	A	B	C	D	E	F	G	H	I
13614	Z1	118B25V	Valid range = The legal operators: AND OR NOT R_TRIG F_TRIG	NA	NA	False	Terminal to Bus Connection Logic		True
13615	Z1	CT10B2I	Select: Y, N	N	N	False	Connect Terminal 10 to Bus-Zone 6		False
13616	Z1	TB2T60	Range = Maximum of 3 Digital or Analog Elements	I10		True	Terminal I10		True
13617	Z1	TB2B60	Range = Maximum of 3 Digital or Analog Elements	B26		True	Bus-Zone B26		True
13618	Z1	TB2P60	Select: P, N	P	P	False	Polarity I10-B26		True
13619	Z1	118B26V	Valid range = The legal operators: AND OR NOT R_TRIG F_TRIG	NA	NA	False	Terminal to Bus Connection Logic		True
13620	Z1	CT11B2I	Select: Y, N	N	Y	True	Connect Terminal 11 to Bus-Zone 1		False
13621	Z1	TB2T61	Range = Maximum of 3 Digital or Analog Elements	I11	FAULT_81	True	Terminal I11		False
13622	Z1	TB2B61	Range = Maximum of 3 Digital or Analog Elements	B21	B21	False	Bus-Zone B21		False
13623	Z1	TB2P61	Select: P, N	P	P	False	Polarity I11-B21		False
13624	Z1	118B21V	Valid range = The legal operators: AND OR NOT R_TRIG F_TRIG	NA	81_89A AND 81_52A	True	Terminal to Bus Connection Logic		False
13625	Z1	CT11B2I	Select: Y, N	N	Y	True	Connect Terminal 11 to Bus-Zone 2		False
13626	Z1	TB2T62	Range = Maximum of 3 Digital or Analog Elements	I11	FAULT_81	True	Terminal I11		False
13627	Z1	TB2B62	Range = Maximum of 3 Digital or Analog Elements	B22	B22	False	Bus-Zone B22		False
13628	Z1	TB2P62	Select: P, N	P	P	False	Polarity I11-B22		False
13629	Z1	118B22V	Valid range = The legal operators: AND OR NOT R_TRIG F_TRIG	NA	81_89B AND 81_52A	True	Terminal to Bus Connection Logic		False
13630	Z1	CT11B2I	Select: Y, N	N	Y	True	Connect Terminal 11 to Bus-Zone 3		False
13631	Z1	TB2T63	Range = Maximum of 3 Digital or Analog Elements	I11	FAULT_81	True	Terminal I11		False
13632	Z1	TB2B63	Range = Maximum of 3 Digital or Analog Elements	B23	B23	False	Bus-Zone B23		False
13633	Z1	TB2P63	Select: P, N	P	P	False	Polarity I11-B23		False
13634	Z1	118B23V	Valid range = The legal operators: AND OR NOT R_TRIG F_TRIG	NA	81_89C AND 80_52A AND 80_89C	True	Terminal to Bus Connection Logic		False
13635	Z1	CT11B2I	Select: Y, N	N	N	False	Connect Terminal 11 to Bus-Zone 4		False
13636	Z1	TB2T64	Range = Maximum of 3 Digital or Analog Elements	I11		True	Terminal I11		True
13637	Z1	TB2B64	Range = Maximum of 3 Digital or Analog Elements	B24		True	Bus-Zone B24		True


Damaged CB of
Badhaikalan line


Rph Dropper wire
of Badhaikalan line


Damaged isolator of
Shamli line

Remedial Measures Taken:

- 220kV Badhaikalan line CB R phase Pole replacement work is under progress. Line is being fed by TBC.
- Broken earthwire of Badhaikalan line was repaired before charging of the line.
- 220kV Shamli line Isolator arm's post insulator was replaced on the same day of event.

CONCLUSION

- **To avoid such type of incidence in future we arrive on conclusion that in SEL487B busbar relay, zone-1assignment logic for any bay which is at present boolean AND of isolator A(89A) and breaker auxiliary contact (52a) status, needs to be revised.**

“Thank You”

Multiple elements tripping at 400/220kV Sahupuri(UP) 10th July 2024

Brief of event:

i. 400/220kV Sahupuri(UP) has double main double scheme at 400kV and 220kV level.

ii. During antecedent condition at 15:52 hrs, 400 KV Varanasi(PG)-Sahupuri(UP) (PG) Ckt-2, 400 KV Sahupuri(UP)-Biharshariff(PG) (PG) Ckt-1 and 400/220 kV 500 MVA ICT-2 were connected to 400kV bus-1 and 400 KV Varanasi(PG)-Sahupuri(UP) (PG) Ckt-1 and 400 KV Sahupuri(UP)-Biharshariff(PG) (PG) Ckt-2 were connected to 400kV bus-2 at 400kV Sahupuri(UP) S/s. 400/220 kV 500 MVA ICT-1 at Sahupuri(UP) is under installation (commissioning) process.

iii. As reported, at 15:54 hrs, Y-N phase to earth fault occurred in GIS compartment at 400kV Sahupuri(UP) (exact location of fault is yet to be received). It is suspected that fault location was in the bay of 400 KV Varanasi(PG)-Sahupuri(UP) (PG) Ckt-2 in GIS compartment at 400kV Sahupuri(UP).

iv. On this fault, 400 KV Sahupuri(UP)-Biharshariff(PG) (PG) Ckt-1 & 2 (fault current Iy=~1.1kA from Sahupuri end) tripped only from Sahupuri(UP) end on zone-4 distance protection. 400 KV Varanasi(PG)-Sahupuri(UP) (PG) Ckt-1 & 2 (fault current Iy=~3.3kA from Varanasi end, Iy=~3.6kA from Sahupuri end) tripped only from Varanasi(PG) end on zone-2 distance protection and fault sensed in zone-4 from Sahupuri(UP) end. 400/220 kV 500 MVA ICT 2 at Sahupuri(UP) and also tripped (details of protection operation is yet to receive).

v. As reported, from 15:27 hrs to 17:49 hrs, multiple 220 & 132kV line also tripped at 220kV Sahupuri S/s i.e. 220kV Sahupuri-Churk ckt, 220kV Sahupuri-Raja Talab ckt, 220kV Sahupuri(400kV)-Sahupuri(200kV) interconnector, 132kV Sahupuri-Aliapur ckt, 132kV Sahupuri-Karamnasha ckt, 132kV Sahupuri-Chandauli ckt, 132kV Sahupuri-Sadat ckt and 132kV Sahupuri-Dhanapur ckt. Reason of tripping of these lines are yet to be received.

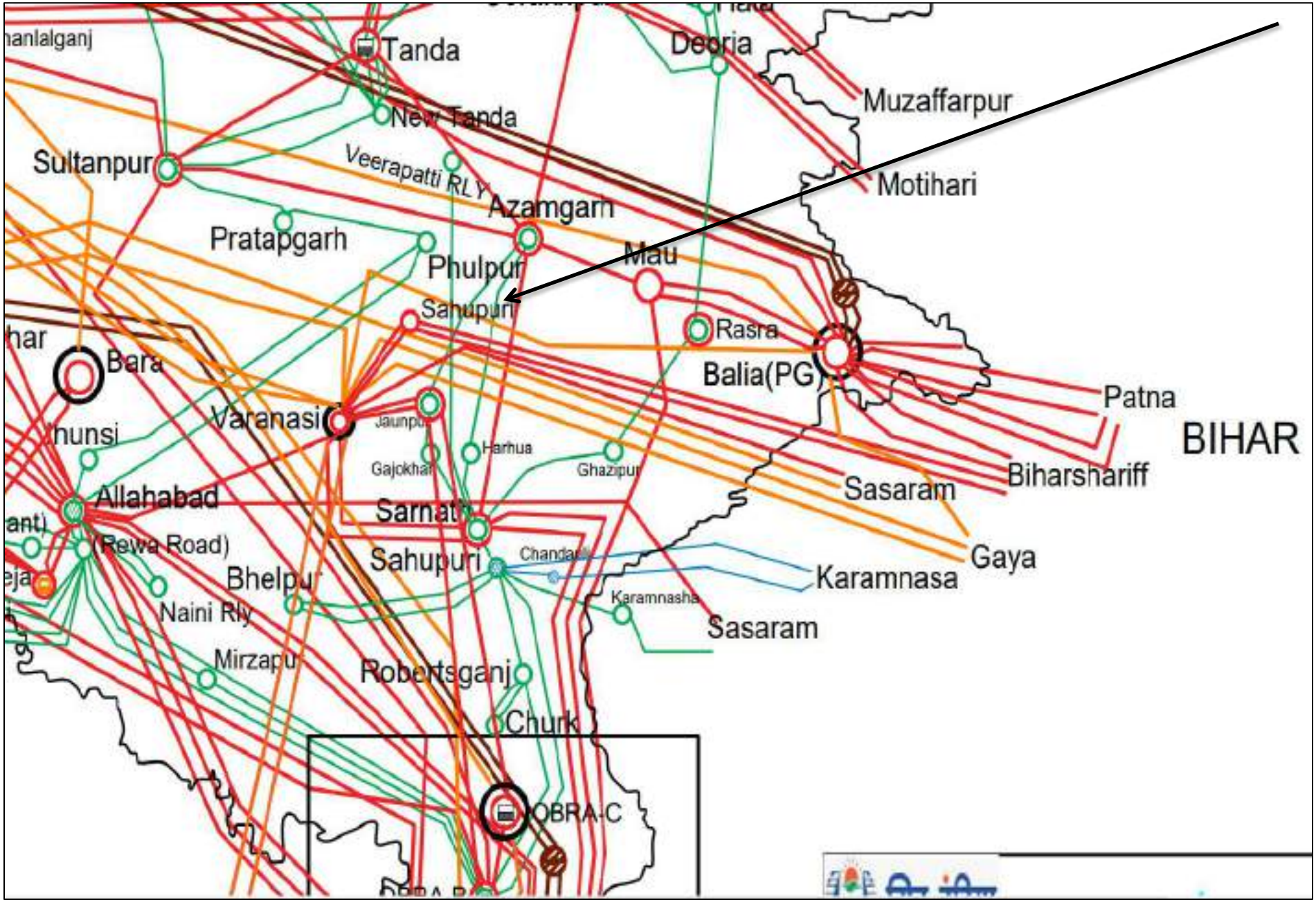
Brief of event:

vi. As per PMU at Varanasi(PG), at 15:54 hrs, Y-N phase to earth fault with delayed fault clearance time of 400msec is observed (Reason for delayed fault clearance is yet to receive).
vii. As per SCADA, at 15:54 hrs, change in demand of approx. 100 MW in UP control area.
viii. By 18:29 hrs, 400 KV Sahupuri(UP)-Biharshariff(PG) (PG) D/C and 400/220 kV 500 MVA ICT-2 were charged.

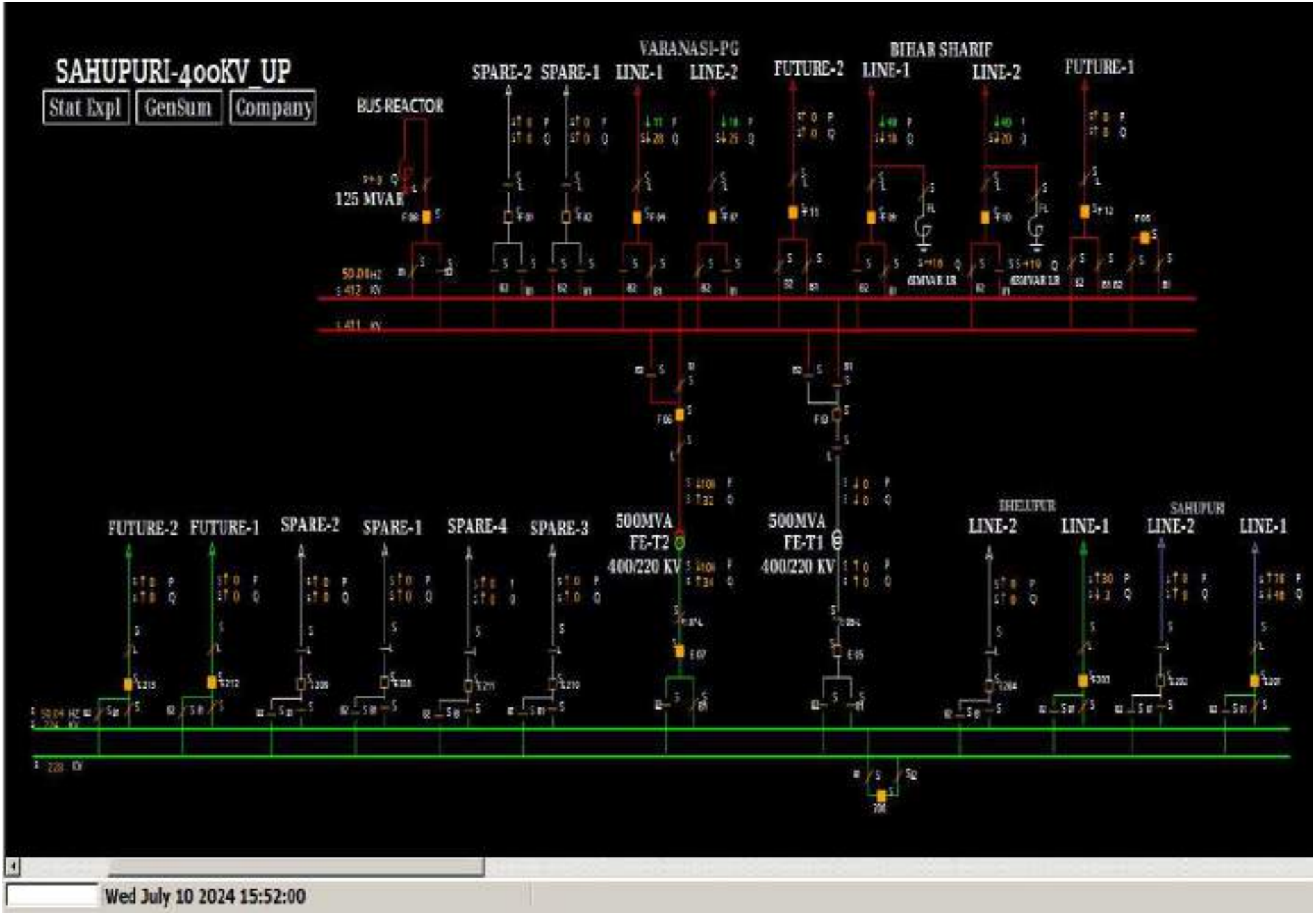
Elements tripped:

i. 400 KV Varanasi(PG)-Sahupuri(UP) (PG) Ckt-1
ii. 400 KV Varanasi(PG)-Sahupuri(UP) (PG) Ckt-2
iii. 400 KV Sahupuri(UP)-Biharshariff(PG) (PG) Ckt-1
iv. 400 KV Sahupuri(UP)-Biharshariff(PG) (PG) Ckt-2
v. 400/220 kV 500 MVA ICT 2 at Sahupuri(UP)
vi. 132 KV Sahupuri(UP)-Karamnasa(BS) (UP) Ckt-1

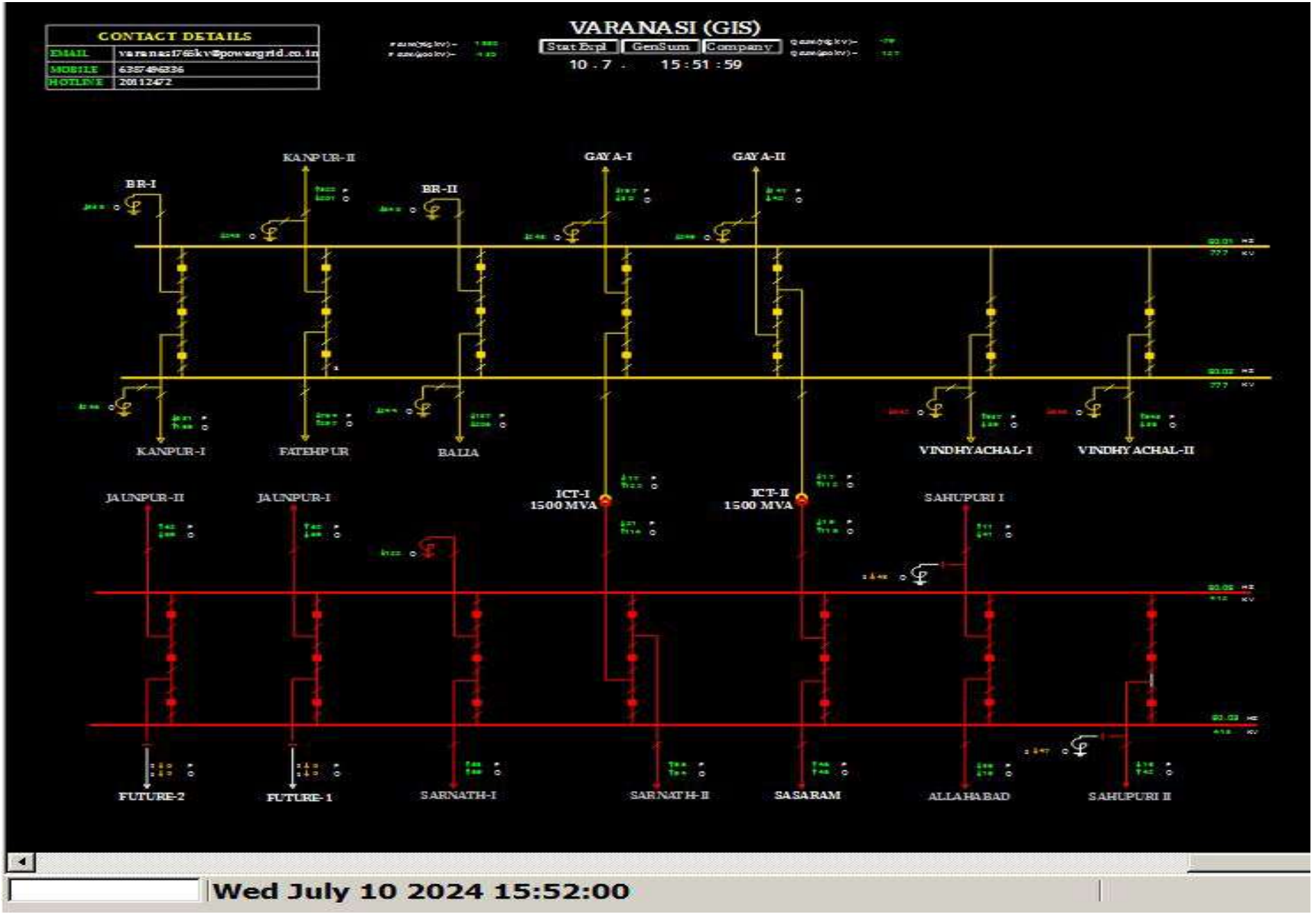
Network Diagram



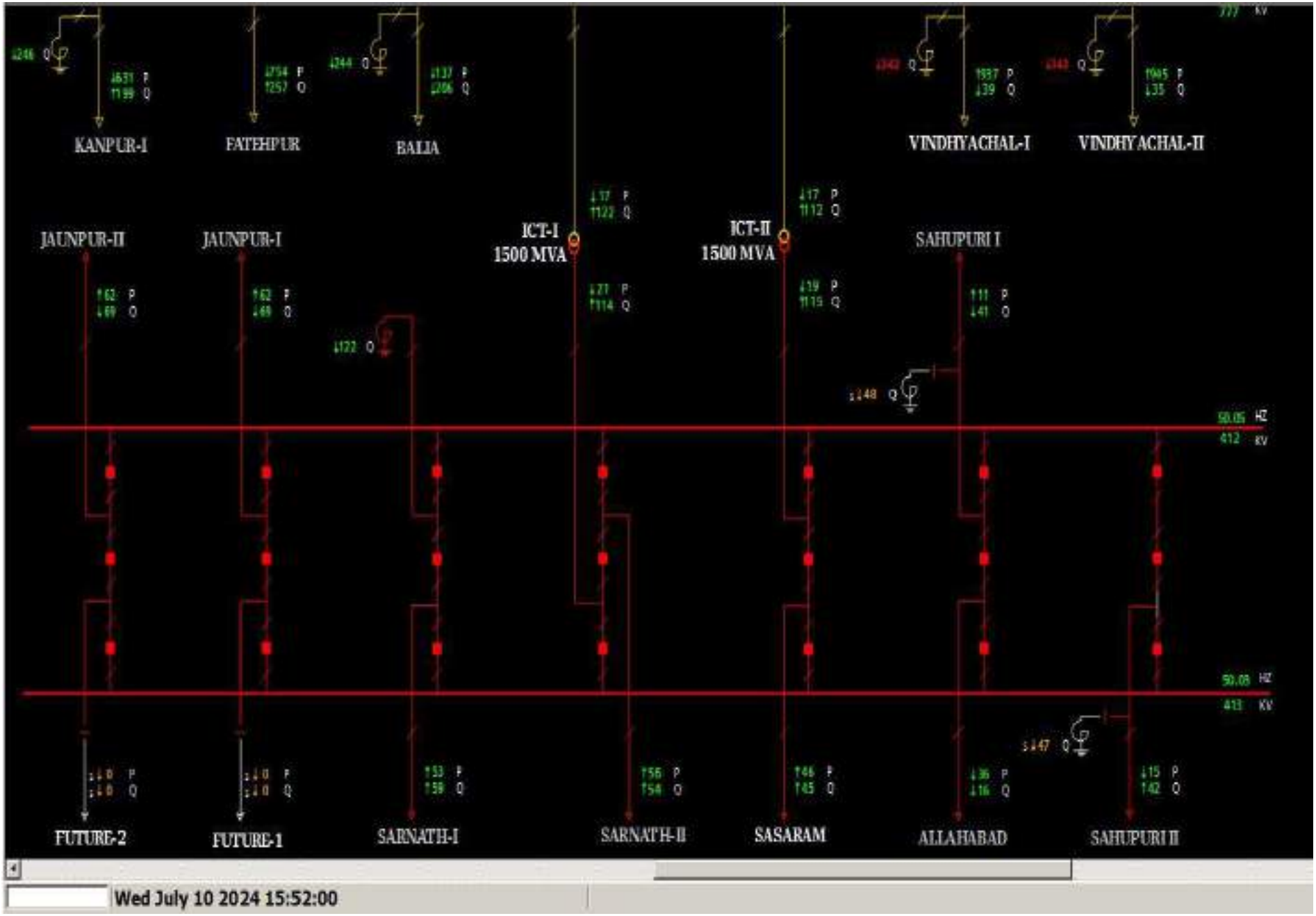
SLD of 400/220 KV Sahupuri(UP) @ 15:52 hrs



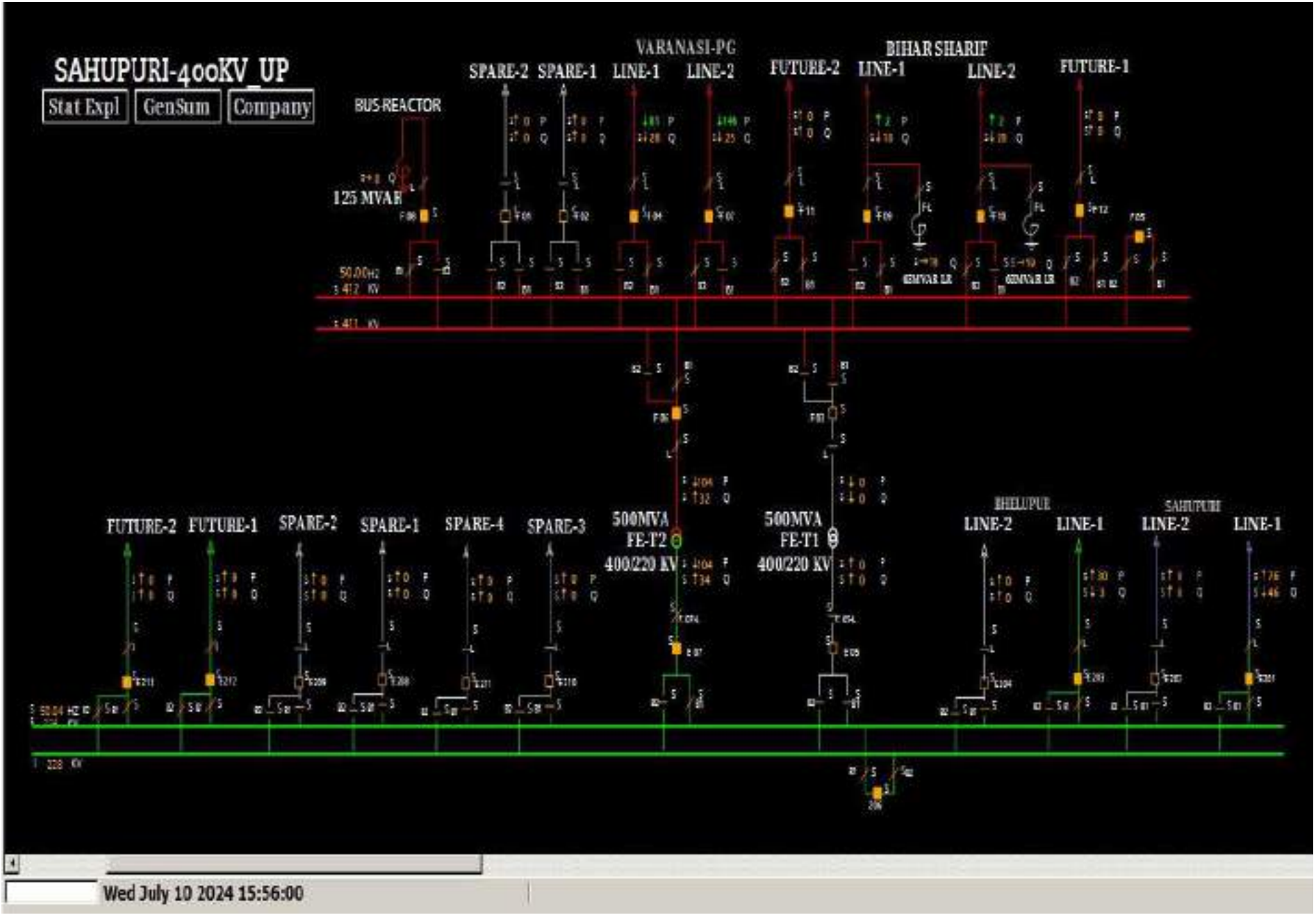
SLD of 765/400KV Varanasi(PG) @ 15:52 hrs



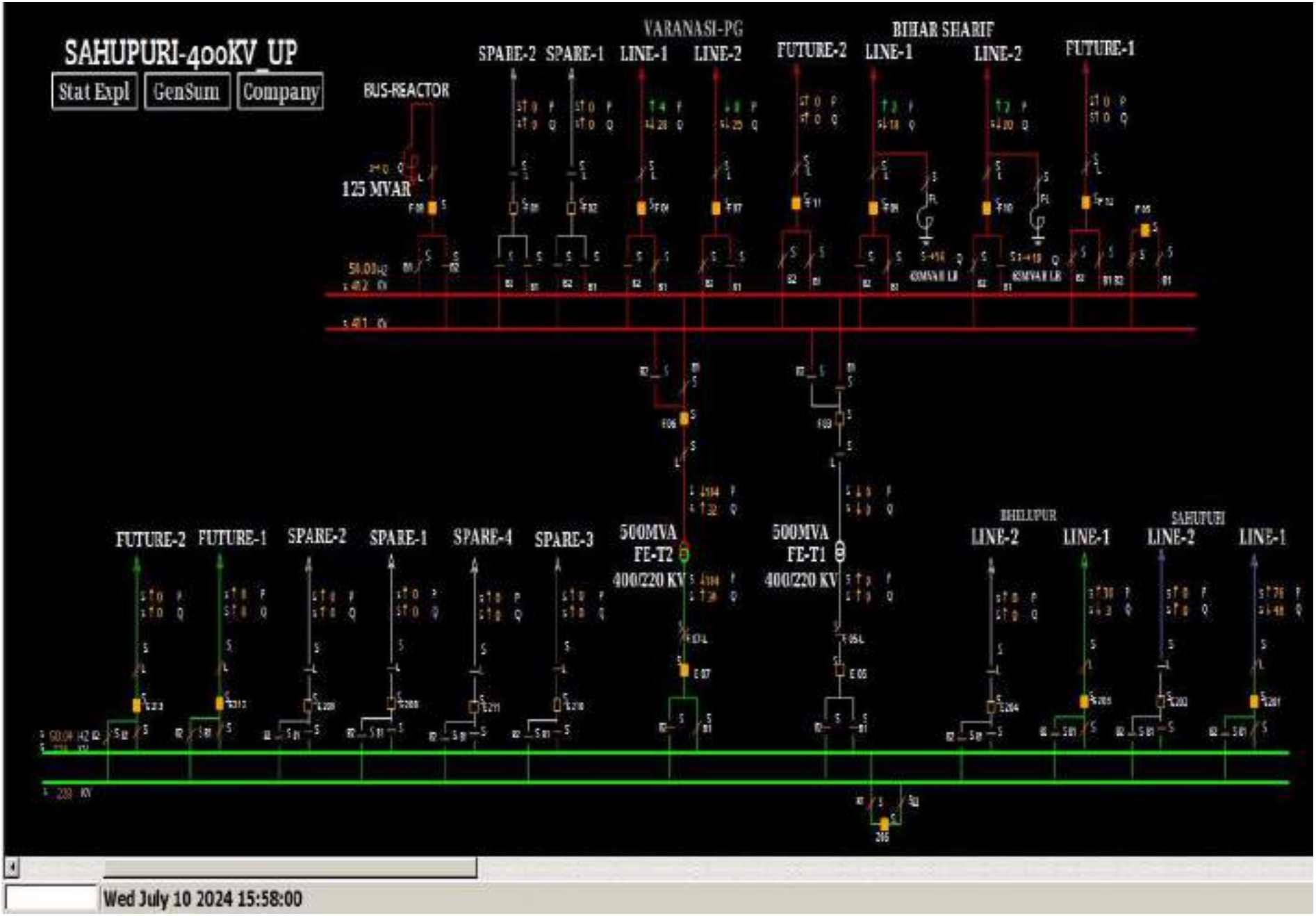
SLD of 765/400KV Varanasi(PG) @ 15:52 hrs



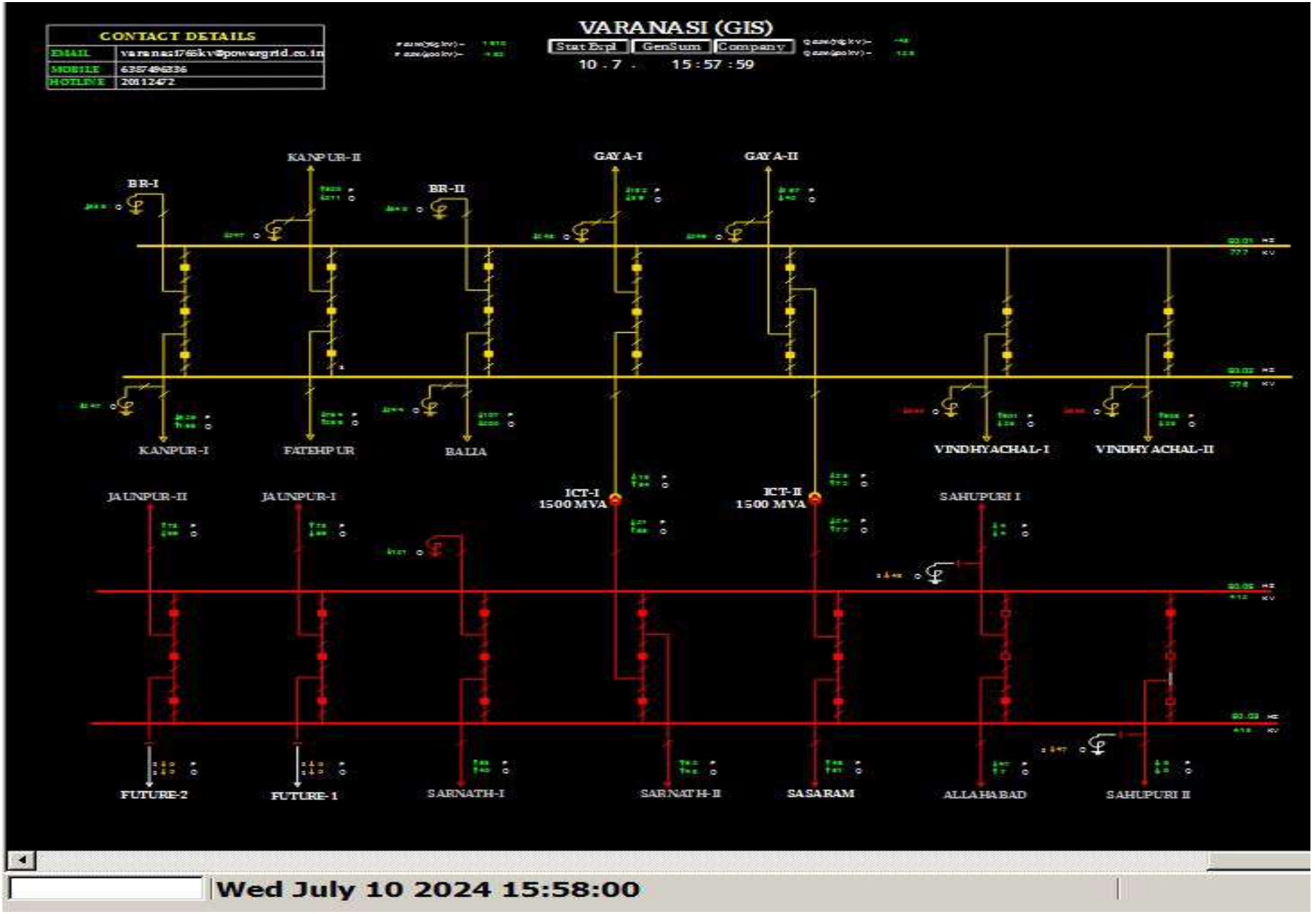
SLD of 400/220 KV Sahupuri(UP) @ 15:56 hrs



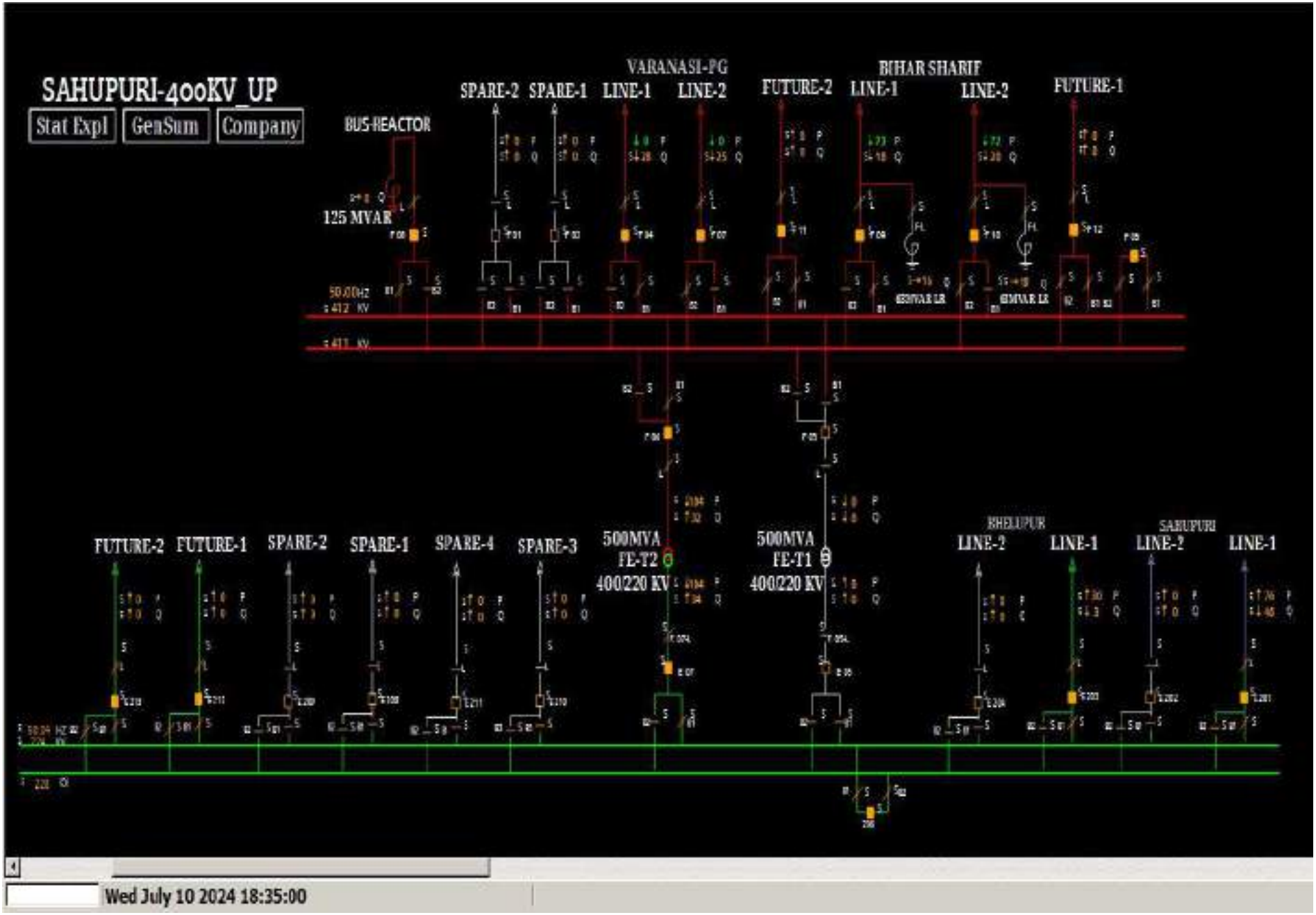
SLD of 400/220 KV Sahupuri(UP) @ 15:58 hrs



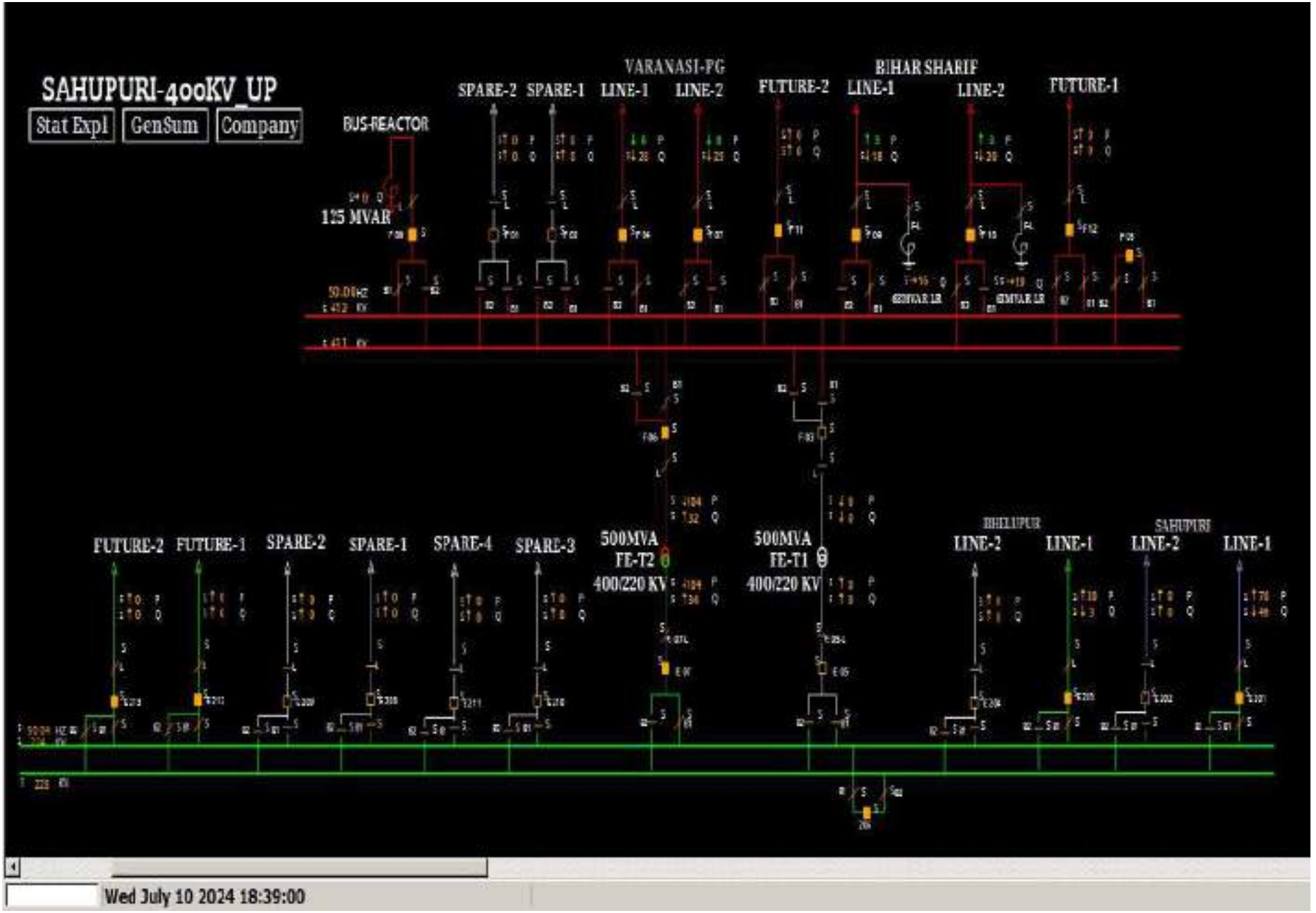
SLD of 765/400KV Varanasi(PG) @ 15:58 hrs



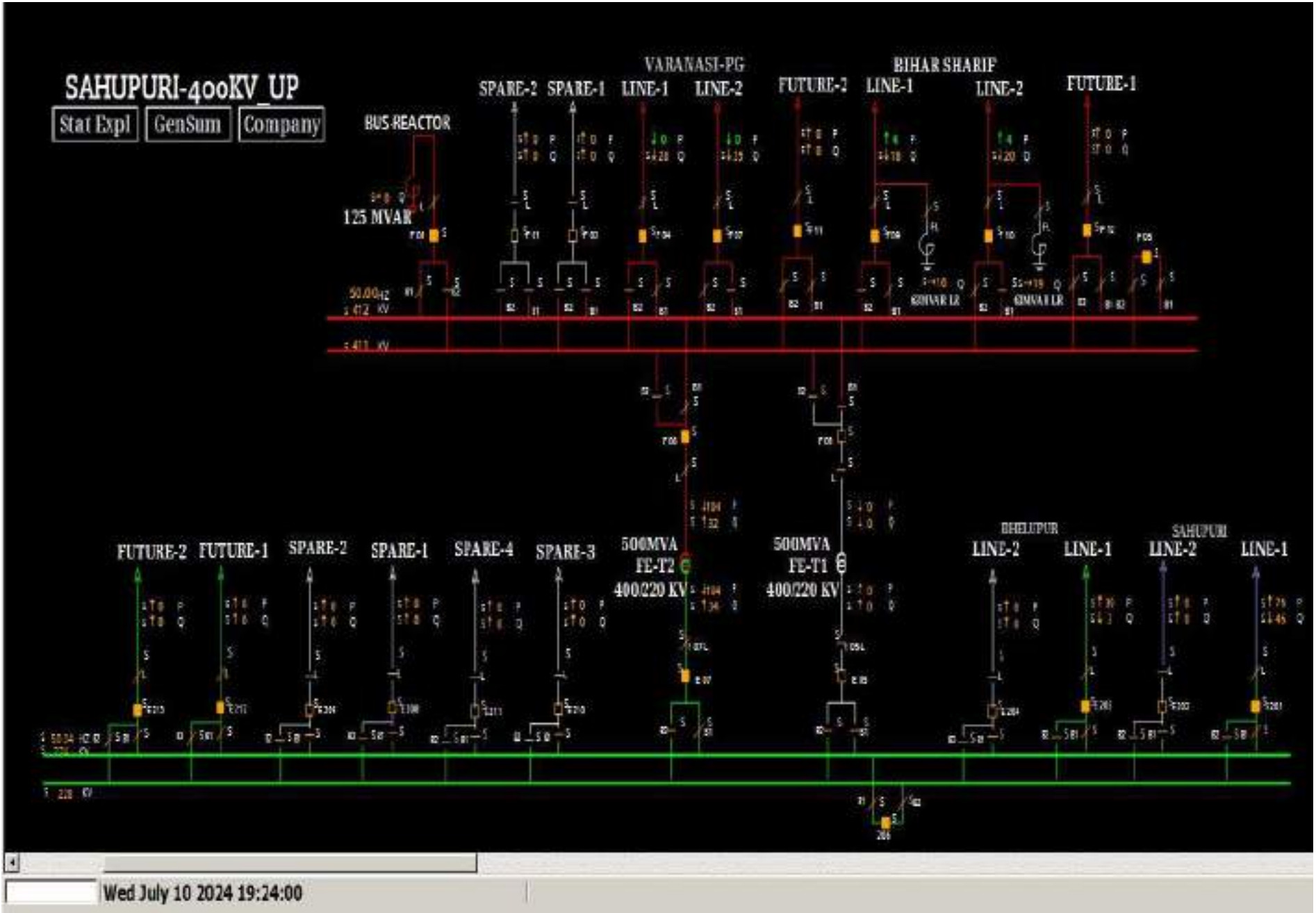
SLD of 400/220 KV Sahupuri(UP) @ 18:35 hrs



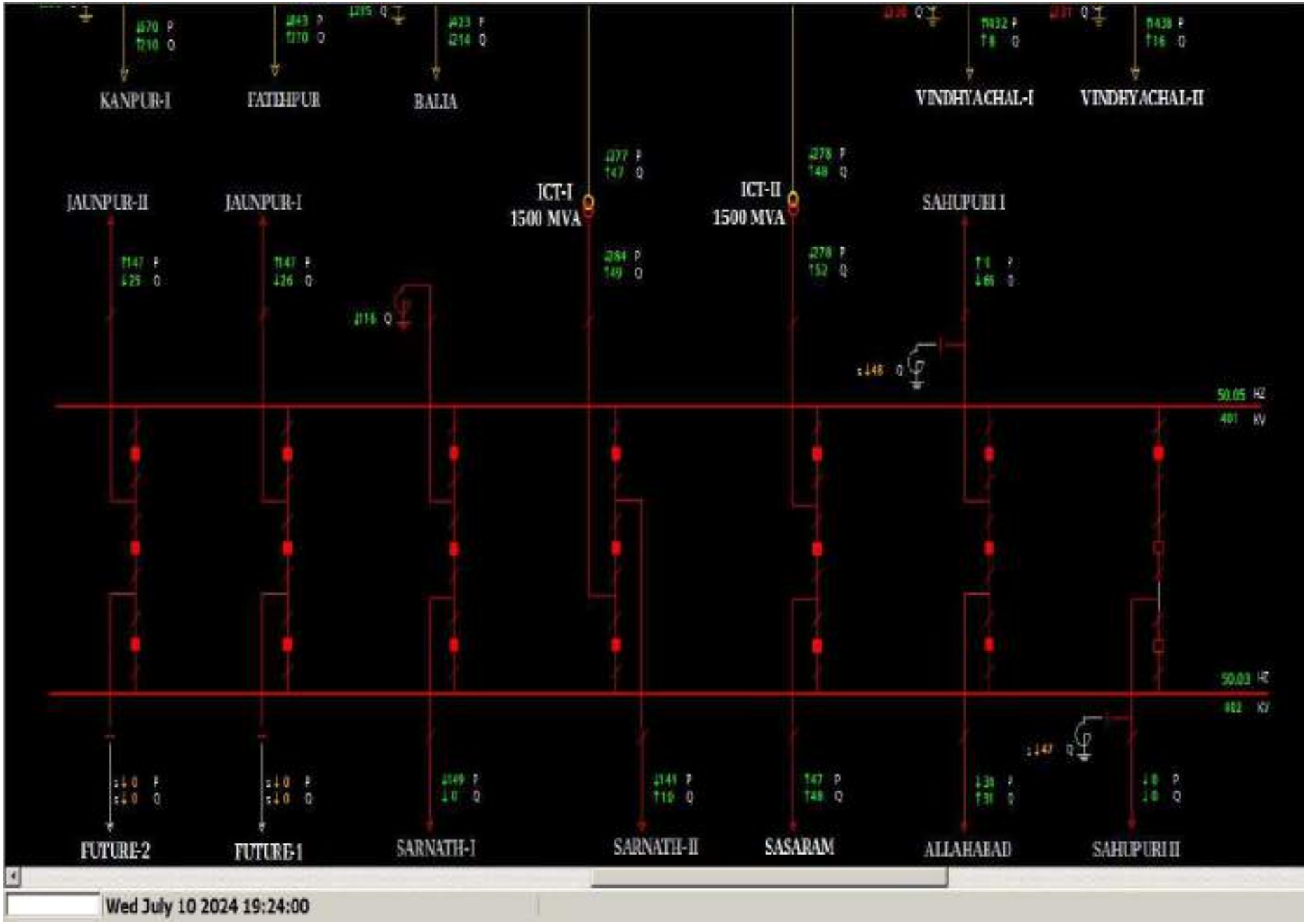
SLD of 400/220 KV Sahupuri(UP) @ 18:39 hrs



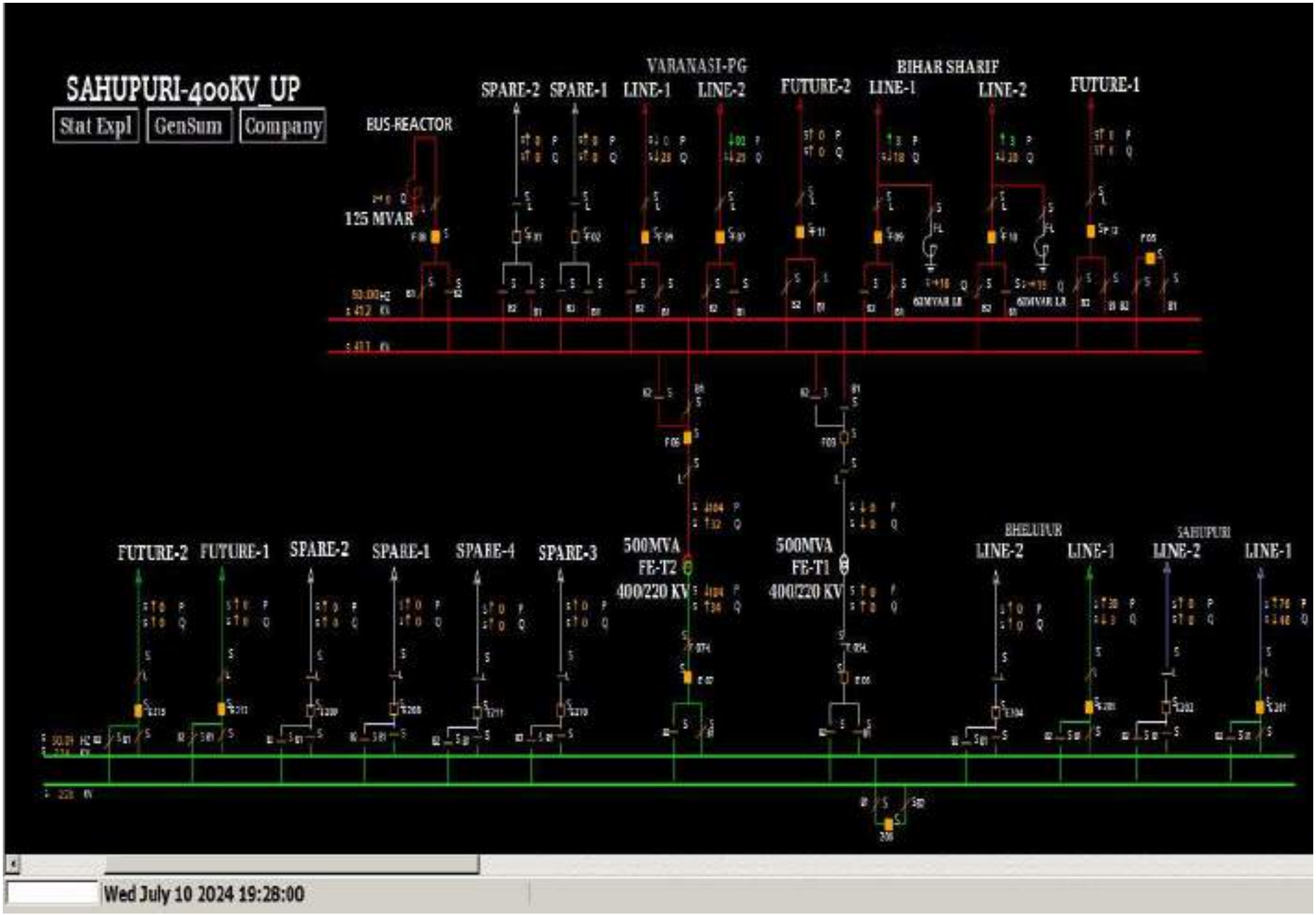
SLD of 400/220 KV Sahupuri(UP) @ 19:24 hrs



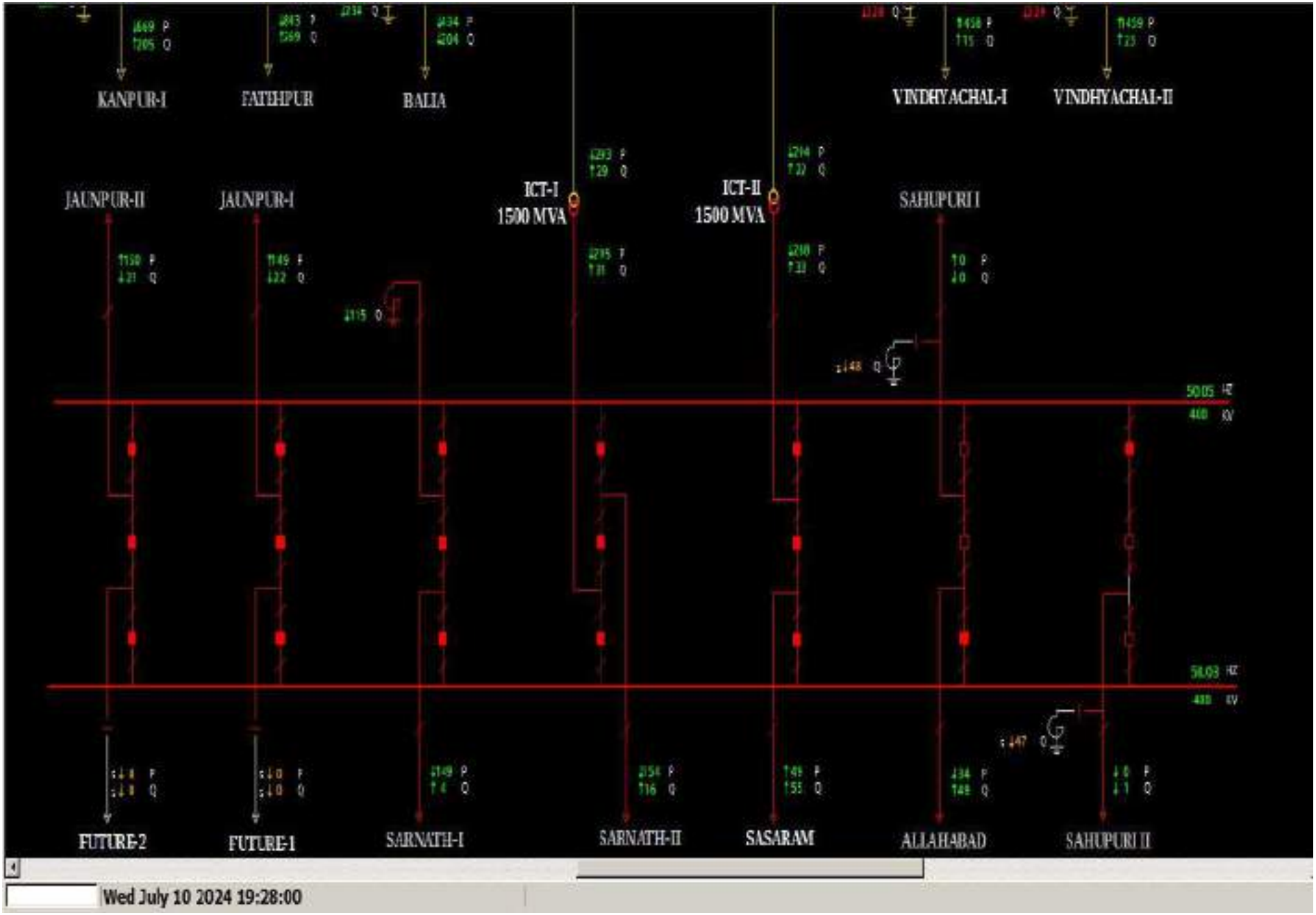
SLD of 765/400KV Varanasi(PG) @ 19:24 hrs



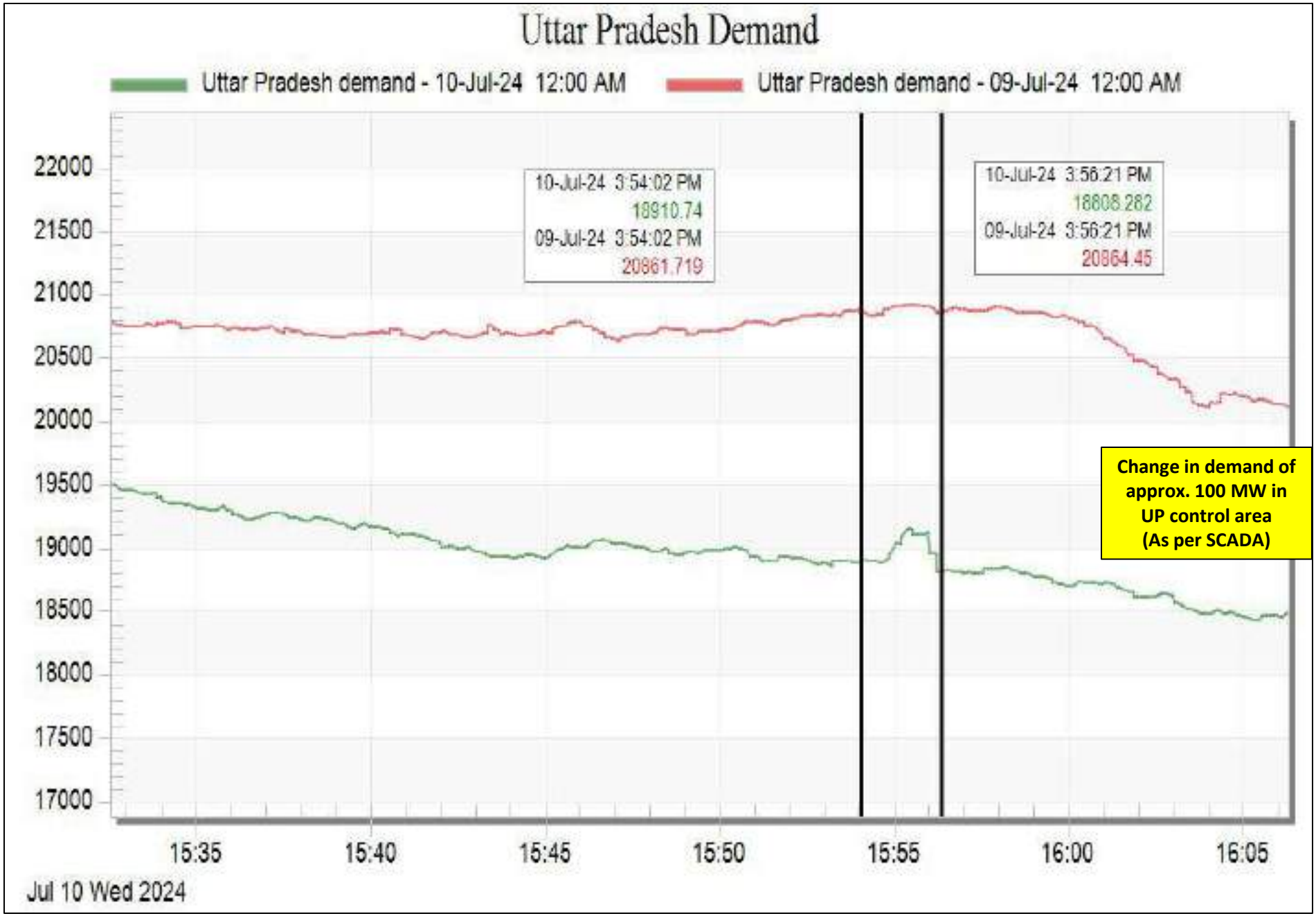
SLD of 400/220 KV Sahupuri(UP) @ 19:28 hrs



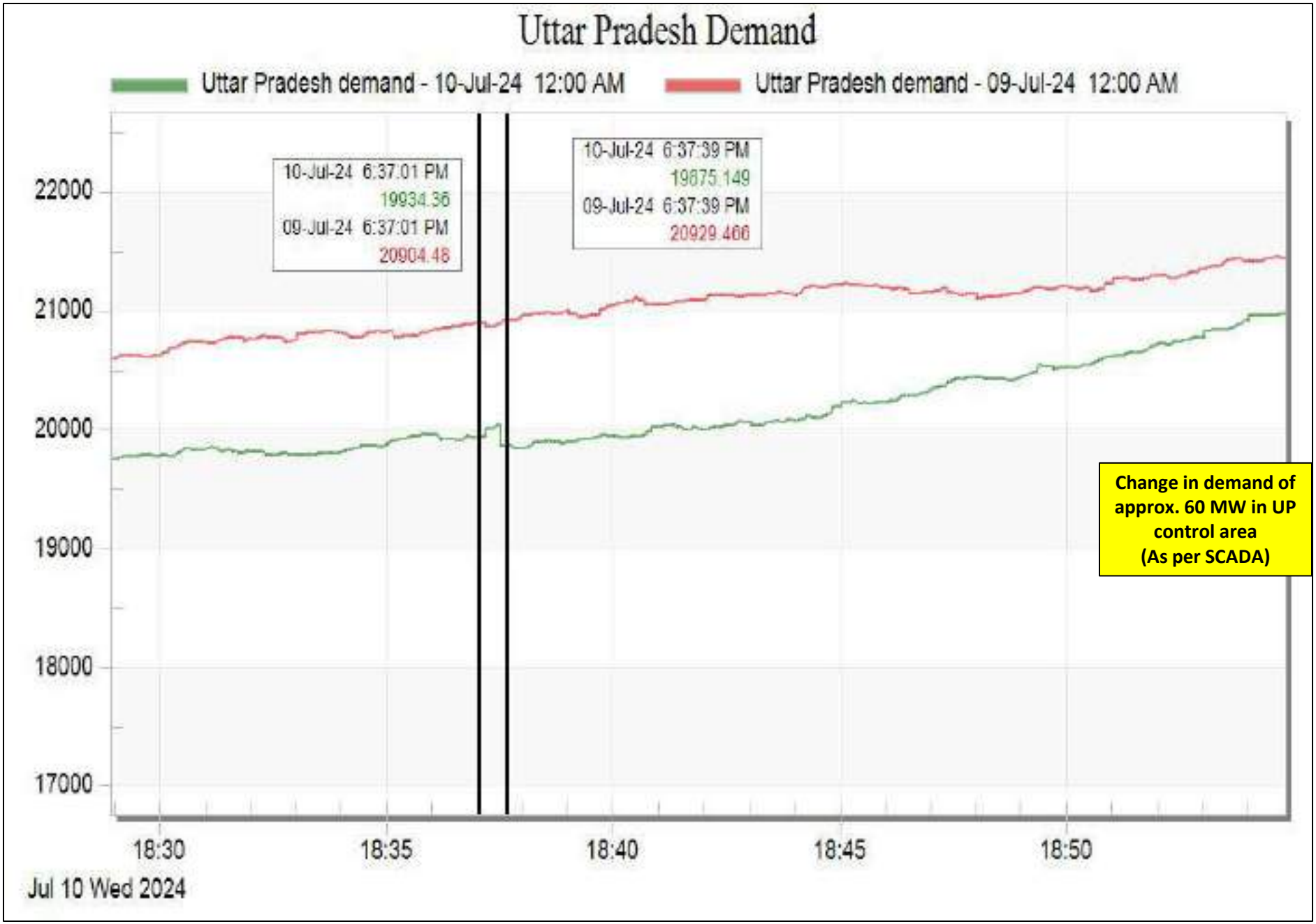
SLD of 765/400KV Varanasi(PG) @ 19:28 hrs



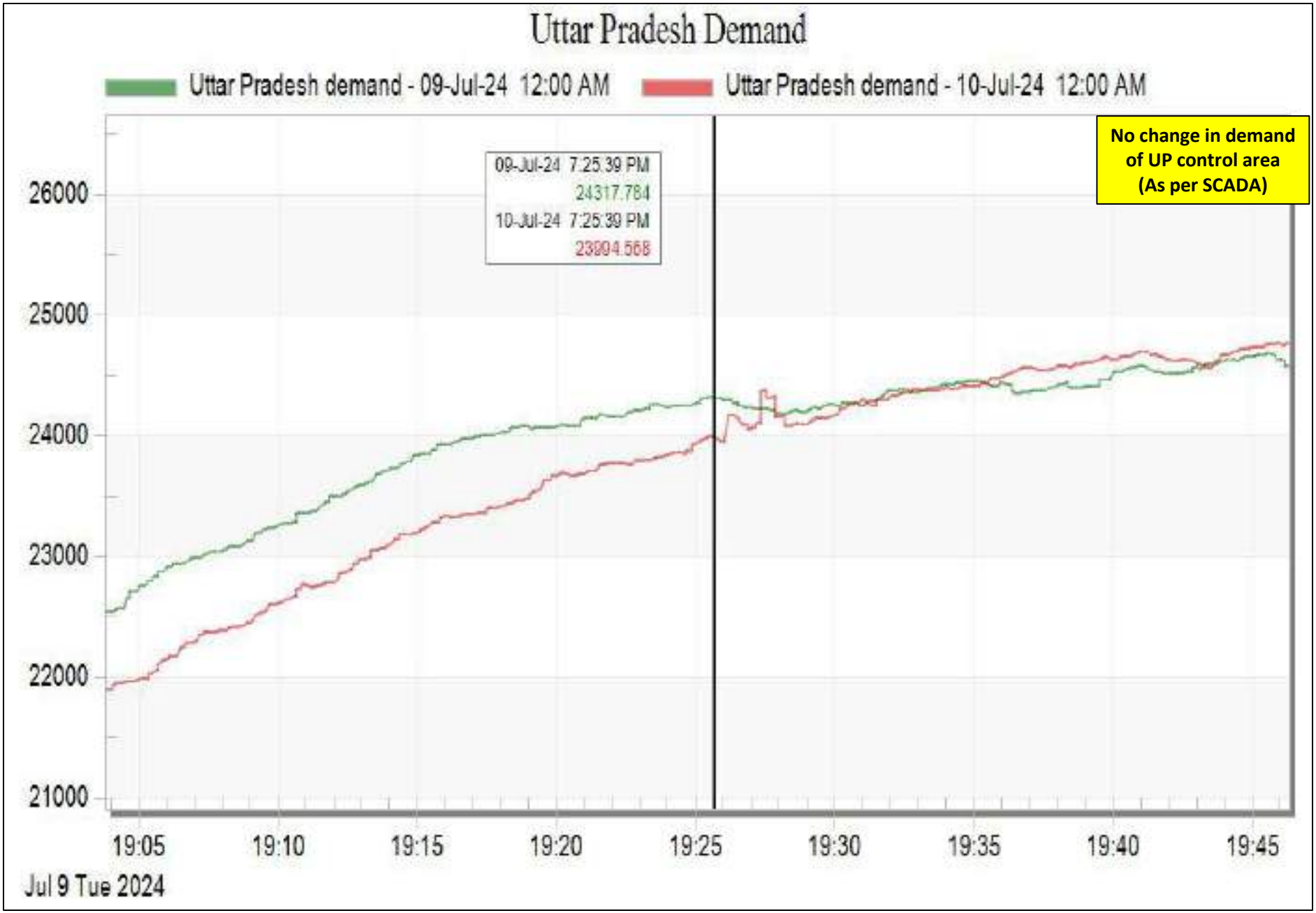
Uttar Pradesh Demand during the event (@ 15:54 hrs)



Uttar Pradesh Demand during the event (@ 18:37 hrs)



Uttar Pradesh Demand during the event (@ 19:25 hrs)



PMU Plot of frequency at Varanasi(PG)

15:54 hrs/10-July-24

PMU Plot of frequency at Varanasi(PG)

18:37 hrs/10-July-24

PMU Plot of frequency at Varanasi(PG)

19:25 hrs/10-July-24

PMU Plot of phase voltage magnitude at Varanasi(PG)

15:54 hrs/10-July-24

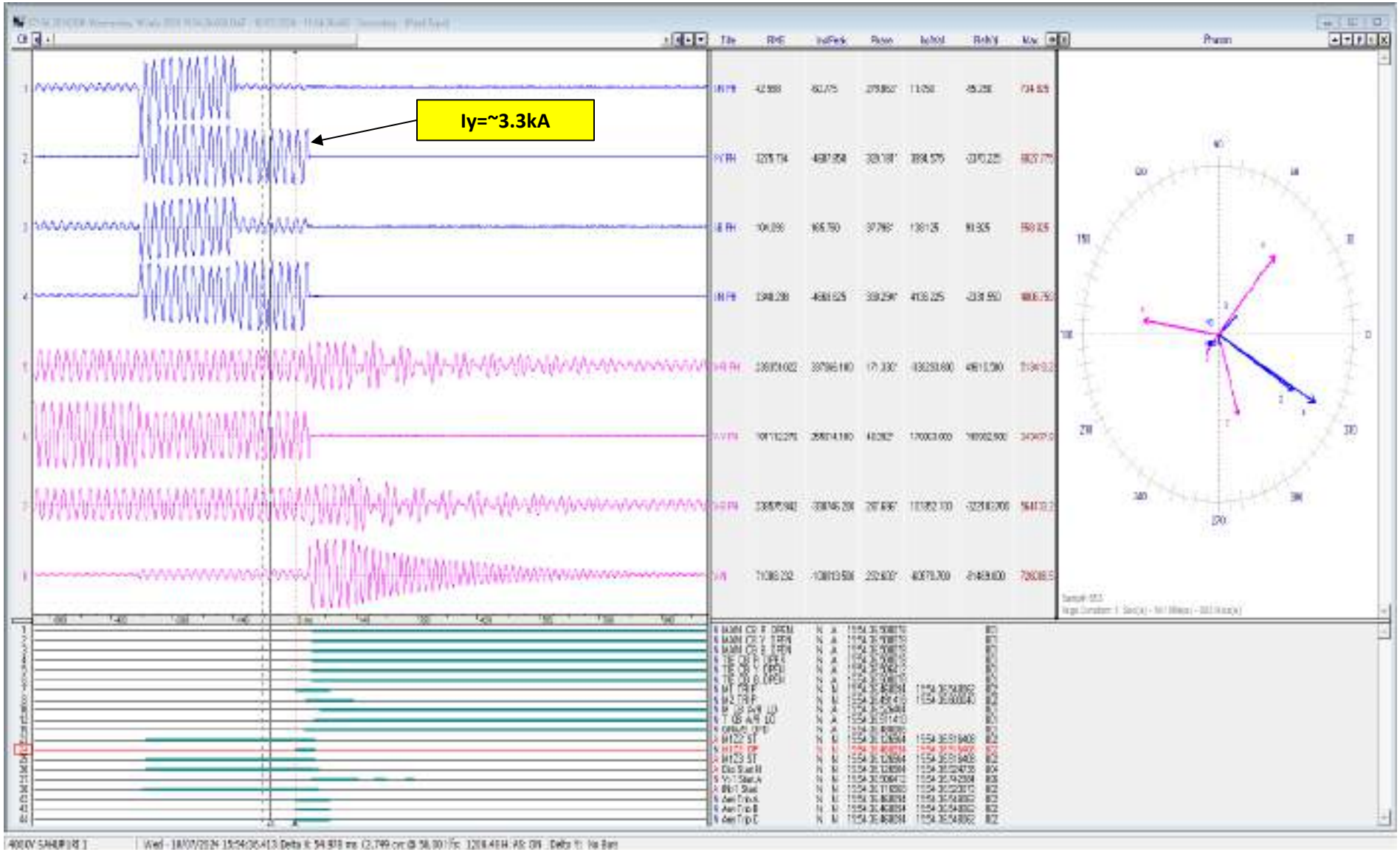
PMU Plot of phase voltage magnitude at Varanasi(PG)

18:37 hrs/10-July-24

PMU Plot of phase voltage magnitude at Varanasi(PG)

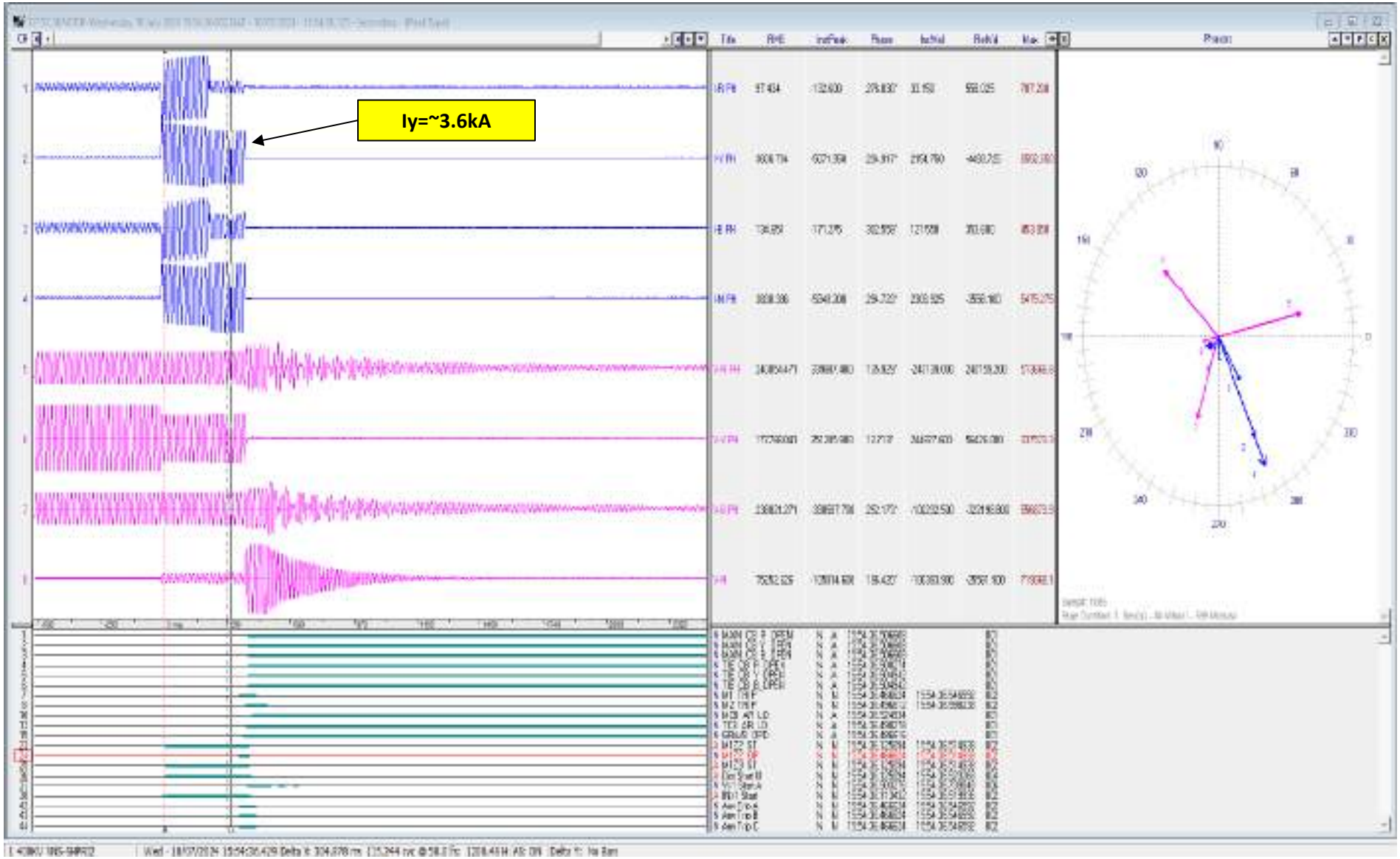
19:25 hrs/10-July-24

DR of 400 KV Varanasi(PG)(end)-Sahupuri(UP) (PG) Ckt-1 (15:54 hrs)



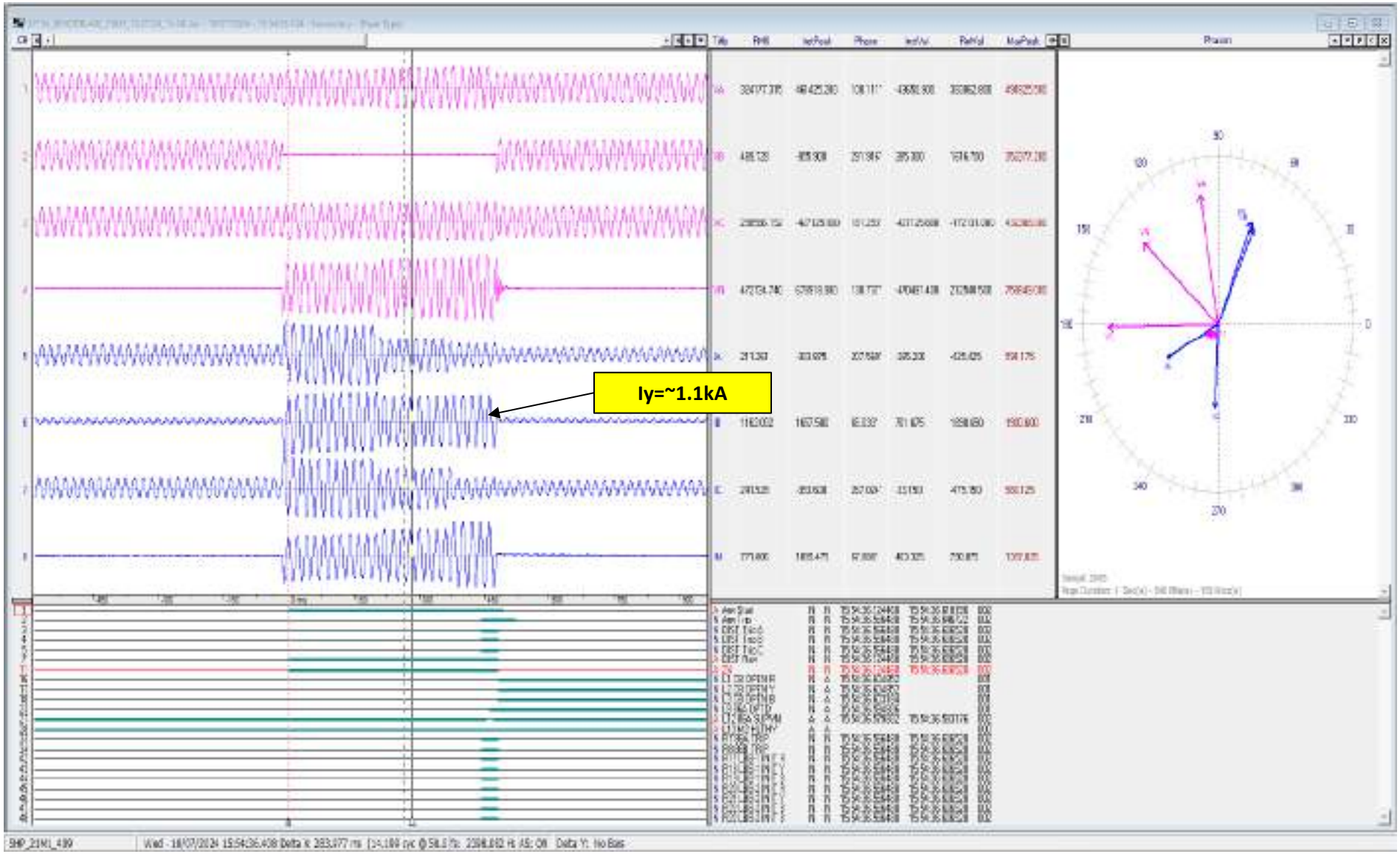
- ✓ Y-N phase to earth fault. Iy=~3.3kA.
- ✓ Zone-2 distance protection operated.

DR of 400 KV Varanasi(PG)(end)-Sahupuri(UP) (PG) Ckt-2 (15:54 hrs)



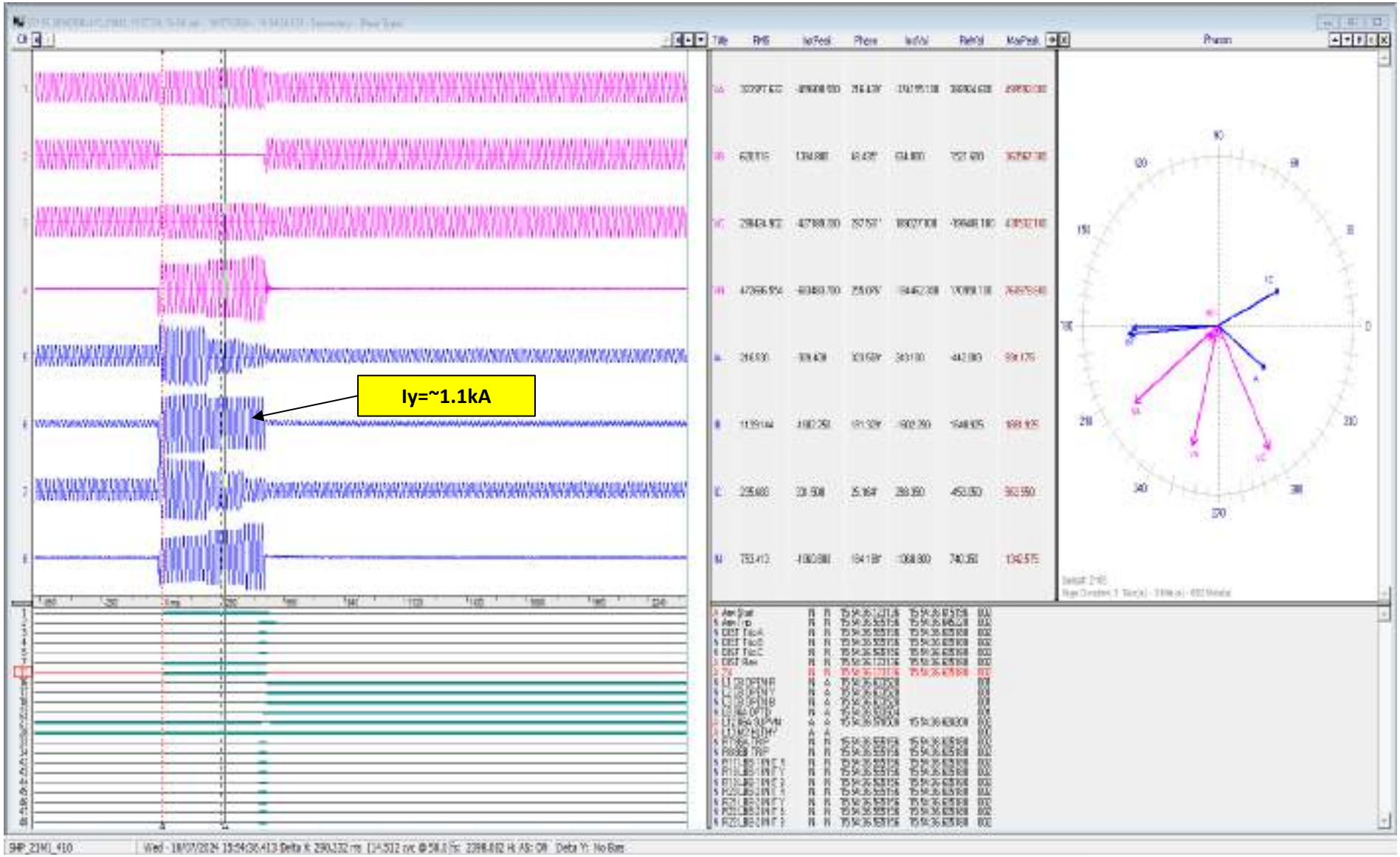
- ✓ Y-N phase to earth fault. Iy=~3.6kA.
- ✓ Zone-2 distance protection operated.

DR of 400 KV Sahupuri(UP)(end)-Biharshariff(PG) (PG) Ckt-1 (15:54 hrs)



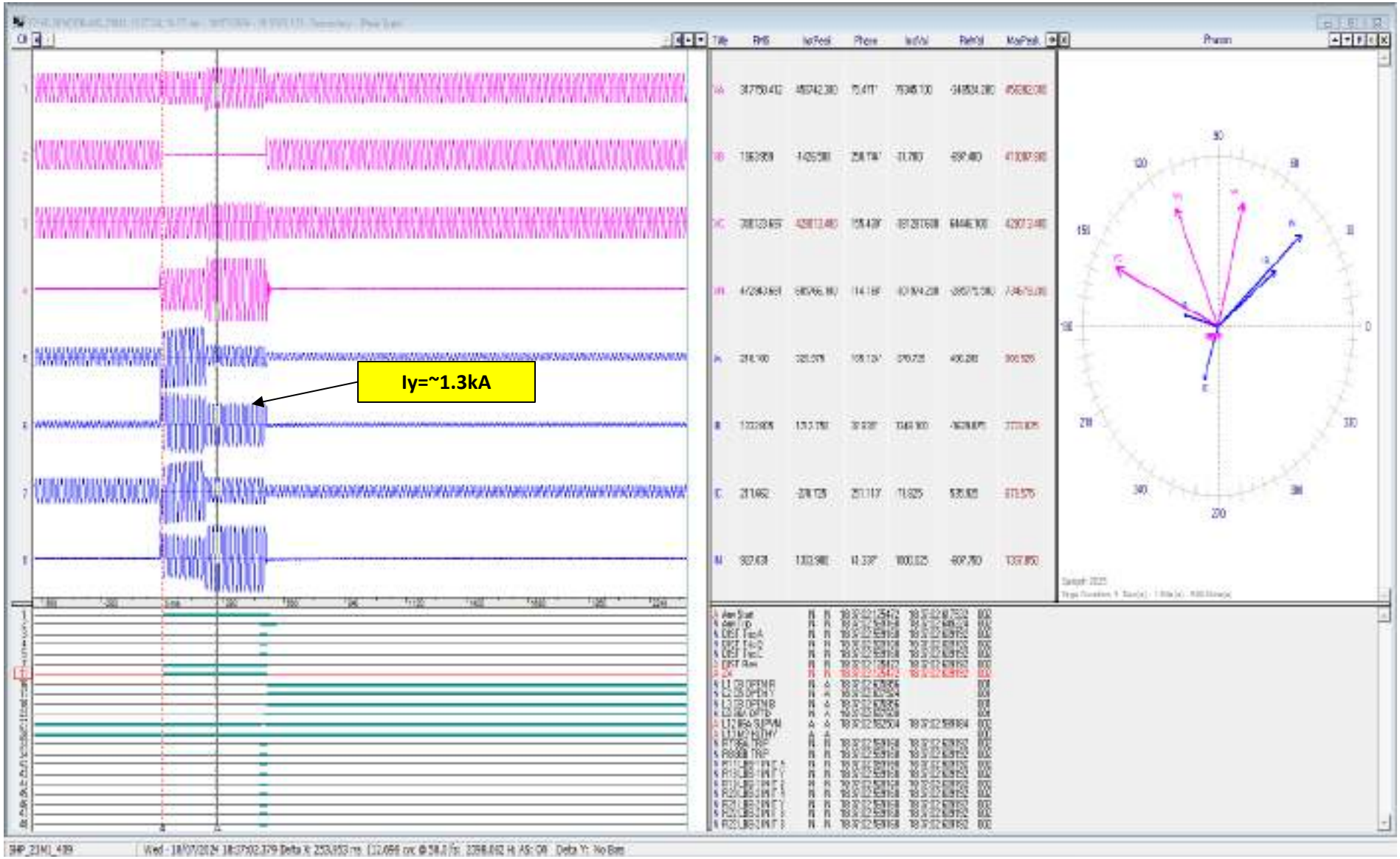
- ✓ Y-N phase to earth fault. Iy=~1.1kA.
- ✓ Zone-4 distance protection operated.

DR of 400 KV Sahupuri(UP)(end)-Biharshariff(PG) (PG) Ckt-2 (15:54 hrs)



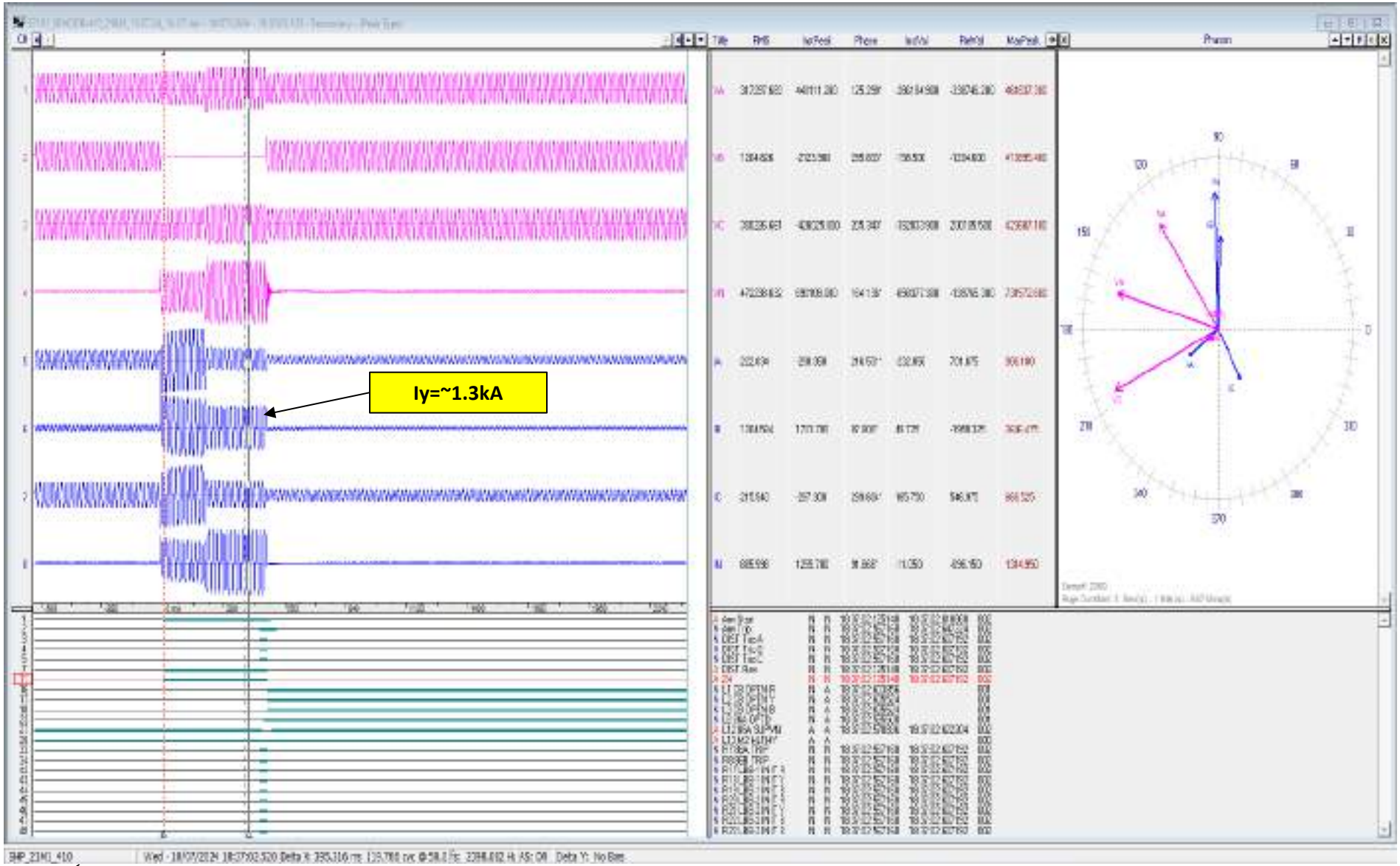
- ✓ Y-N phase to earth fault. Iy=~1.1kA.
- ✓ Zone-4 distance protection operated.

DR of 400 KV Sahupuri(UP)(end)-Biharshariff(PG) (PG) Ckt-1 (18:37 hrs)



- ✓ Y-N phase to earth fault. Iy=~1.3kA.
- ✓ Zone-4 distance protection operated.

DR of 400 KV Sahupuri(UP)(end)-Biharshariff(PG) (PG) Ckt-2 (18:37 hrs)



- ✓ Y-N phase to earth fault. Iy=~1.3kA.
- ✓ Zone-4 distance protection operated.

SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remarks
15:54:36,503	VRNS1_PG	400kV	2BHRTIE	Circuit Breaker	Open	Tie CB at Varanasi(PG) end of 400 KV Varanasi(PG)-Sahupuri(UP) (PG) Ckt-2 opened
15:54:36,503	VRNS1_PG	400kV	5ALBDBHR	Circuit Breaker	Open	Tie CB at Varanasi(PG) end of 400 KV Varanasi(PG)-Sahupuri(UP) (PG) Ckt-1 opened
15:54:36,503	VRNS1_PG	400kV	3SAHU2	Circuit Breaker	Open	Main CB at Varanasi(PG) end of 400 KV Varanasi(PG)-Sahupuri(UP) (PG) Ckt-2 opened
15:54:36,504	VRNS1_PG	400kV	4SAHU1	Circuit Breaker	Open	Main CB at Varanasi(PG) end of 400 KV Varanasi(PG)-Sahupuri(UP) (PG) Ckt-1 opened
15:57:26,280	BHLPR_UP	33kV	04BHLPR	Circuit Breaker	Open	Line CB at Bhelupur(UP) end of 33kV Bhelupur-Bhelupur (UP) ckt opened

SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remarks
19:24:24,814	VRNS1_PG	400kV	3SAHU2	Circuit Breaker	Close	Main CB at Varanasi(PG) end of 400 KV Varanasi(PG)-Sahupuri(UP) (PG) Ckt-2 closed
19:25:33,550	VRNS1_PG	400kV	5ALBDBHR	Circuit Breaker	Open	Tie CB at Varanasi(PG) end of 400 KV Varanasi(PG)-Sahupuri(UP) (PG) Ckt-2 opened
19:25:33,550	VRNS1_PG	400kV	4SAHU1	Circuit Breaker	Open	Main CB at Varanasi(PG) end of 400 KV Varanasi(PG)-Sahupuri(UP) (PG) Ckt-1 opened
19:26:06,556	VRNS1_PG	400kV	3SAHU2	Circuit Breaker	Open	Main CB at Varanasi(PG) end of 400 KV Varanasi(PG)-Sahupuri(UP) (PG) Ckt-2 opened

Point of discussion

i) Reason for delayed fault clearance in all tripping events need to be shared.

ii) Reason and type of protection operated for tripping of multiple elements at 220kV Sahupuri(UP) S/s is yet to be received.

iii) Exact location of fault need to be shared.

iv) Type of protection operated in tripping of 400/220 kV 500 MVA ICT-2 at Sahupuri(UP) need to be shared.

v) DR/EL (.dat/.cfg file) of 400/220 kV 500 MVA ICT-2 at 400kV Sahupuri(UP) and multiple elements tripped at 220kV Sahupuri(UP) along with detailed tripping report need to be shared.

vi) Remedial action taken report to be shared.

vii) SCADA data of 400kV Sahupuri(UP) S/s was freeze and some trippings were not recorded in SCADA SOE during the event. Healthiness of SCADA data at 400kV Sahupuri(UP) S/s and 220kV Sahupuri(UP) S/s need to be ensured.

Tripping Analysis Report of multiple element Tripping event on 10.07.2024 at 400 kV GIS Sub-Station Sahupuri-Chandauli

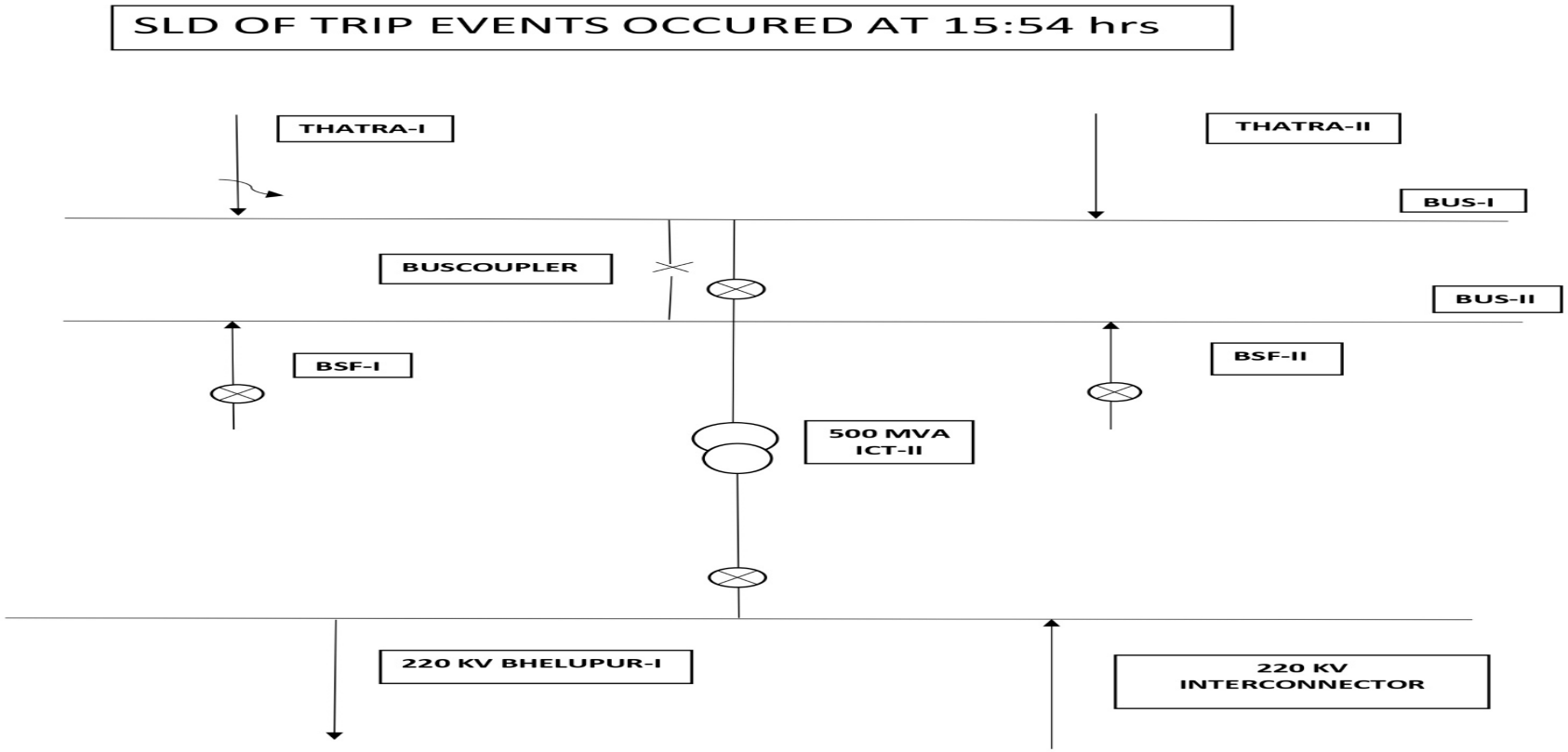
Details of Tripping

On dated 10.07.2024 at 15:54 hrs multiple tripping occurred at 400 kV GIS Sub-Station Sahupuri (Chandauli) due to fault persist in GIS Module between Breaker & Bus Isolator at 400 kV Sahupuri- Varanasi (PG)- II Line,

Both 400 kV Sahupuri-Biharsharif-I & II line Tripped in zone-4 from Sahupuri End and 400 KV Sahupuri - Varanasi (PG)- I & II Line Tripped in Zone-2 from other end. Also, 500 MVA ICT-II Tripped on E/F Highset Flag.

400 kV Biharsharif Circuit-II charged at 17:35 hrs and 400 kV Biharsharif Circuit-I charged at 17:53 Tripped but both lines tripped again at 18:37 hrs in zone-4, 400 / 220 kV 500 MVA ICT-II again tripped at 18:37 Hrs along with these two lines & finally charged at 22:59 Hrs.

400 kV Varanasi (PG)- I Line is charged at 18:54 Hrs & taken on Load. After that, 400 kV Varanasi (PG)- II Line was tried to charged at 19:26 Hrs but tripped instantaneously from Varanasi (PG) End along with Varanasi (PG)-I Line on Zone- 2.



Single Line Diagram of 400 kV GIS Sahupuri (Chandauli)

1). Exact Reason of Trippings:-

- Flashover occurred between Bus Isolator & Circuit Breaker Section of GIS Module of Bay 407, 400 kV Sahupuri - Varanasi - II (PG) LIne.

2). Nature & location of Faults

- Fault is of flashover type & location is between Bus Isolator & Circuit Breaker Section of GIS Module of Bay 407, 400 kV Sahupuri - Varanasi - II (PG) LIne.

3). <u>Sequence of tripping events</u>

At 15:54 Hrs, following elements were tripped:-

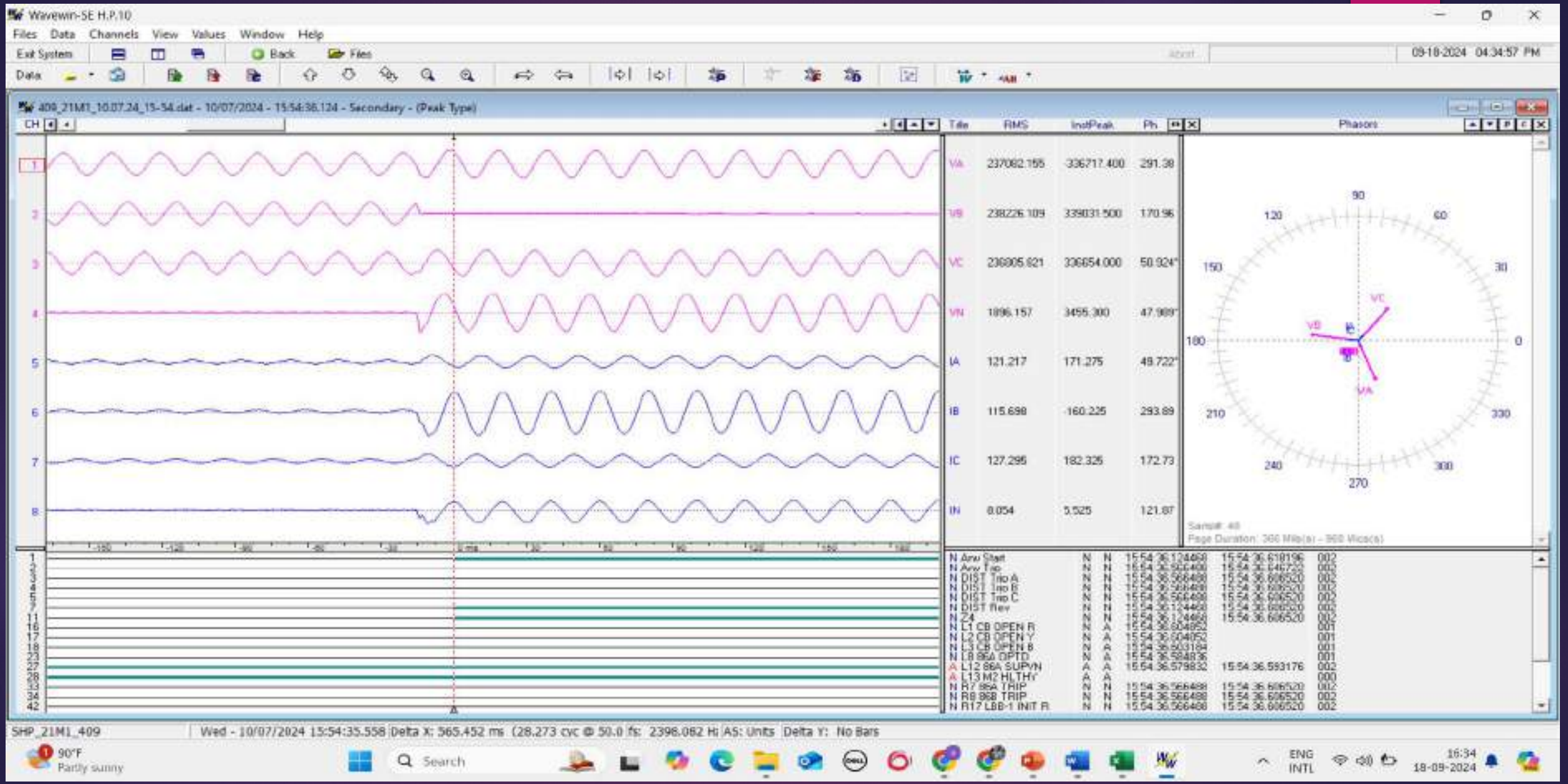
- 400 kV Sahupuri - Biharsharif - I Line
- 400 kV Sahupuri - Biharsharif - II Line
- 400 kV Sahupuri - Varanasi- I (PG) Line
- 400 kV Sahupuri - Varanasi- II (PG) Line
- 500 MVA ICT-II

After trippings at 15:54 Hrs, except Varanasi - I & II (PG) Line, Biharsharif Ckt-I & II, 500 MVA ICT-II were charged at 17:53, 17:35 & 17:59 Hrs respectively from Bus-I.

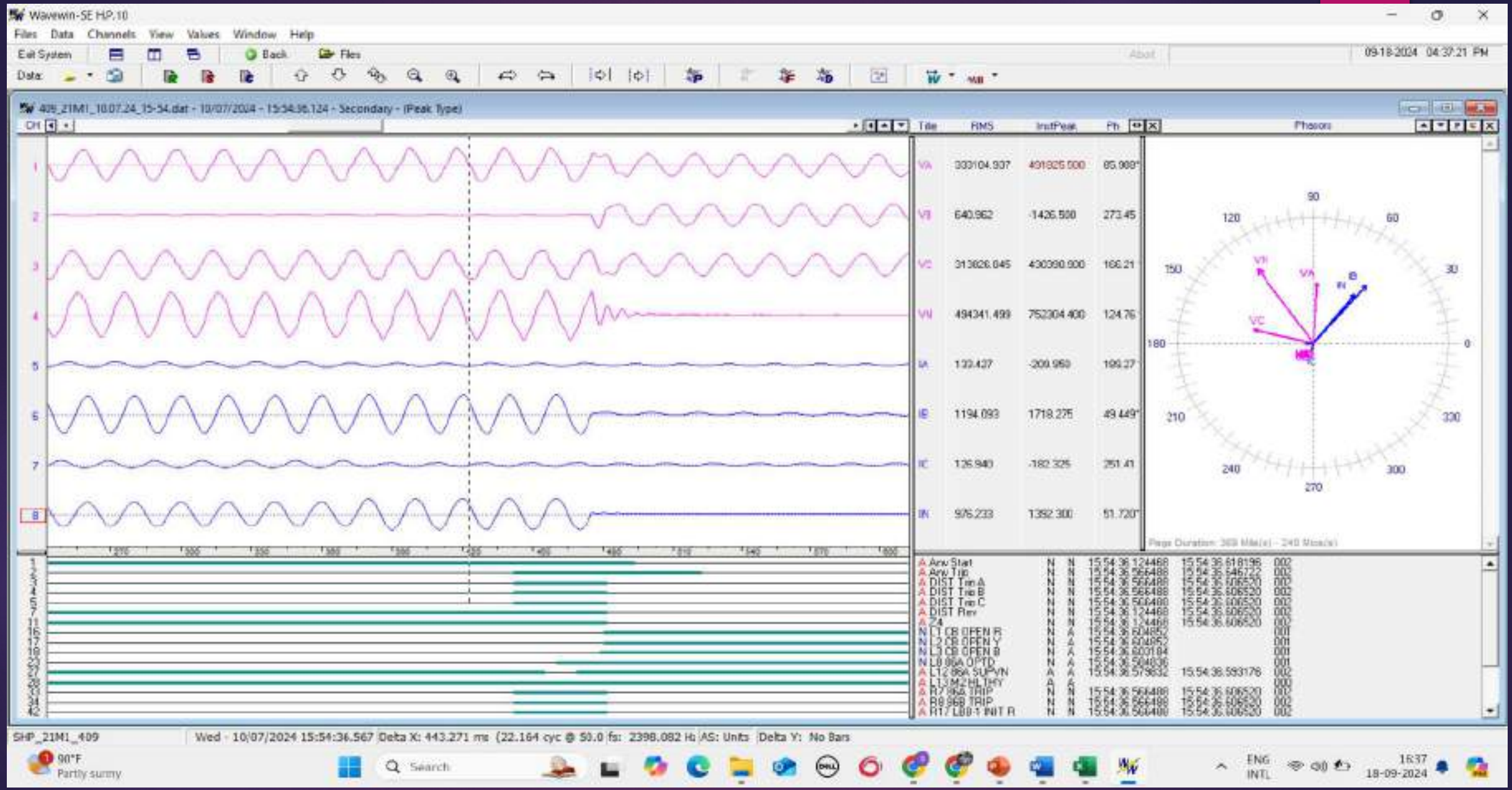
At 18:37 Hrs, following elements once again tripped:-

- 400 kV Sahupuri - Biharsharif - I Line
- 400 kV Sahupuri - Biharsharif - II Line
- 500 MVA ICT-II

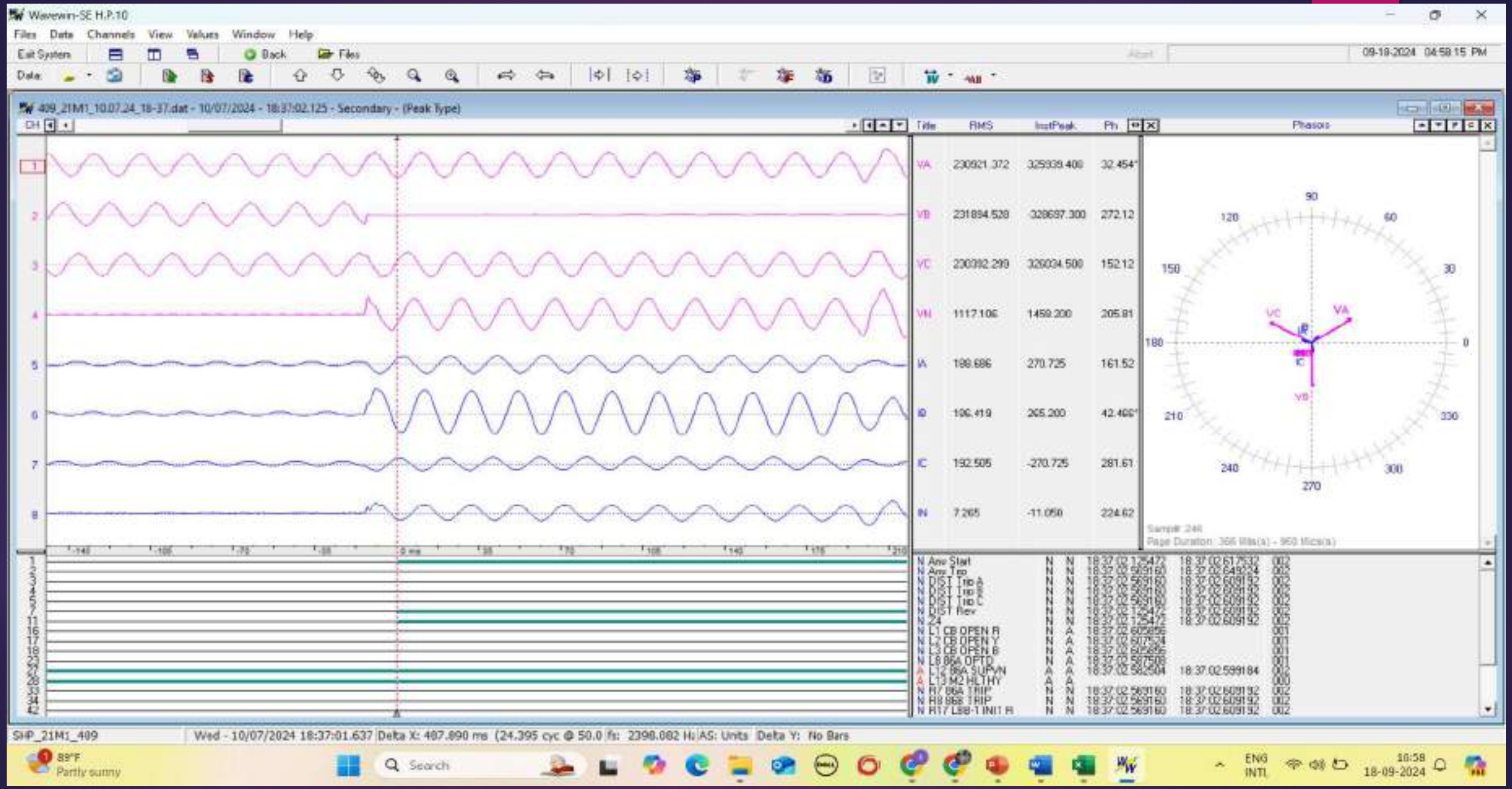
At 18:54 Hrs, Varanasi - I (PG) Line was charged from both ends. Varnasi -II (PG) line was tried to charge at 19:26 Hrs but tripped instantaneously from Varanasi (PG) End along with Varanasi-I Line on Zone- 2.



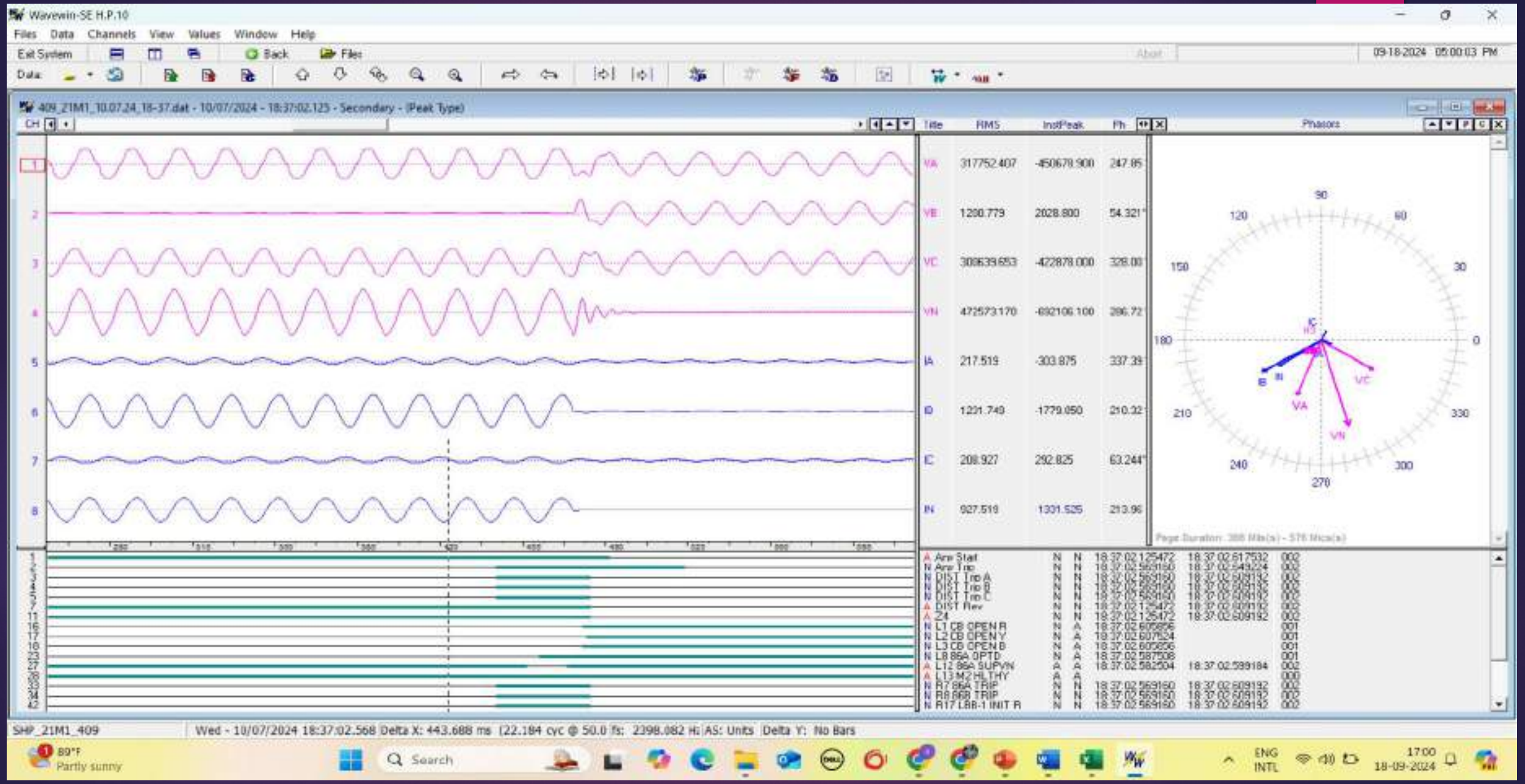
Fault Initiation, Bay 409- 400 kV SHP – Bihar Sharif-I (PG) Line at 15:54 Hrs



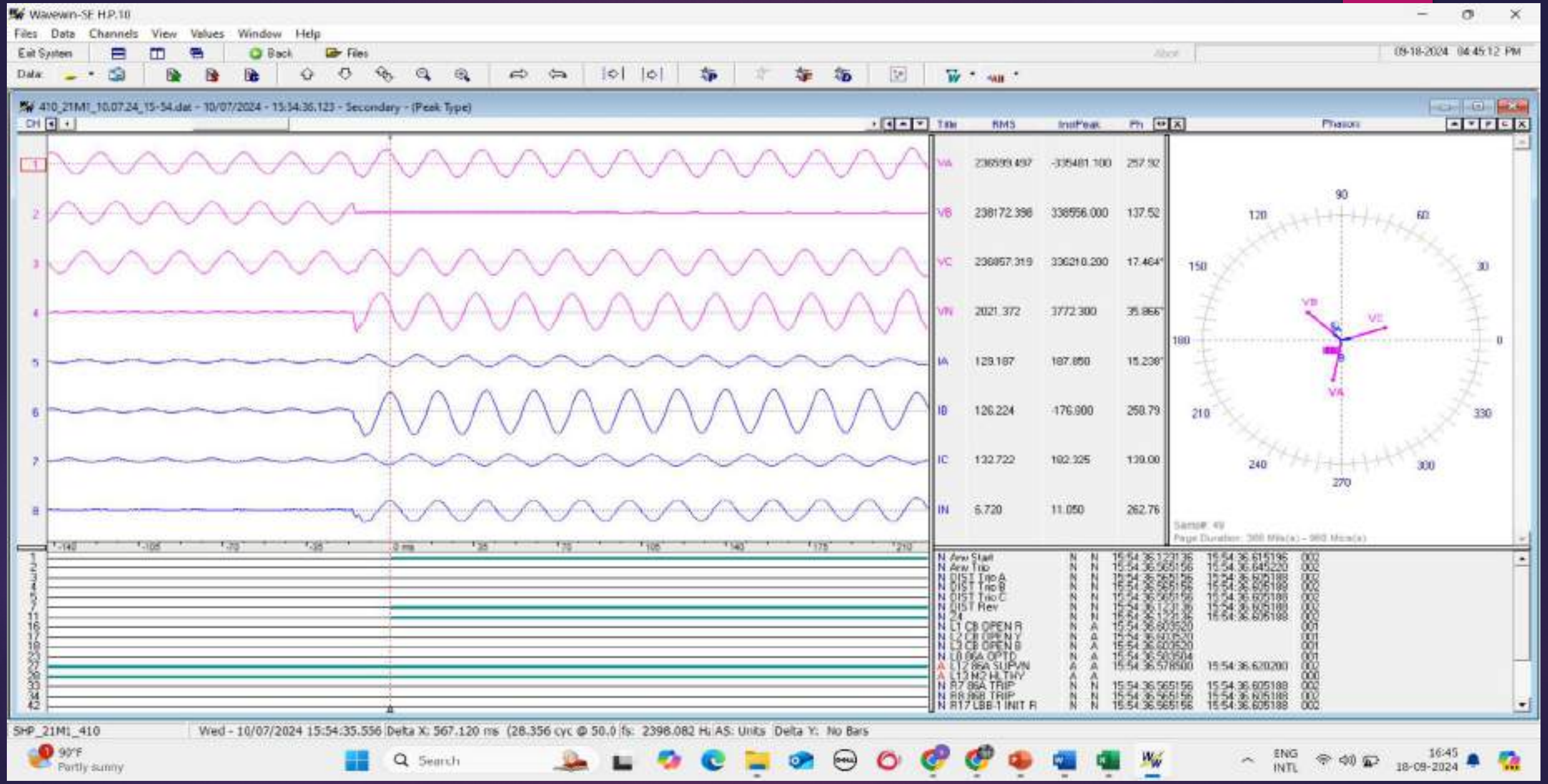
Tripping Command, Bay 409-400 kV SHP – Bihar Sharif-I (PG) Line at 15:54 Hrs



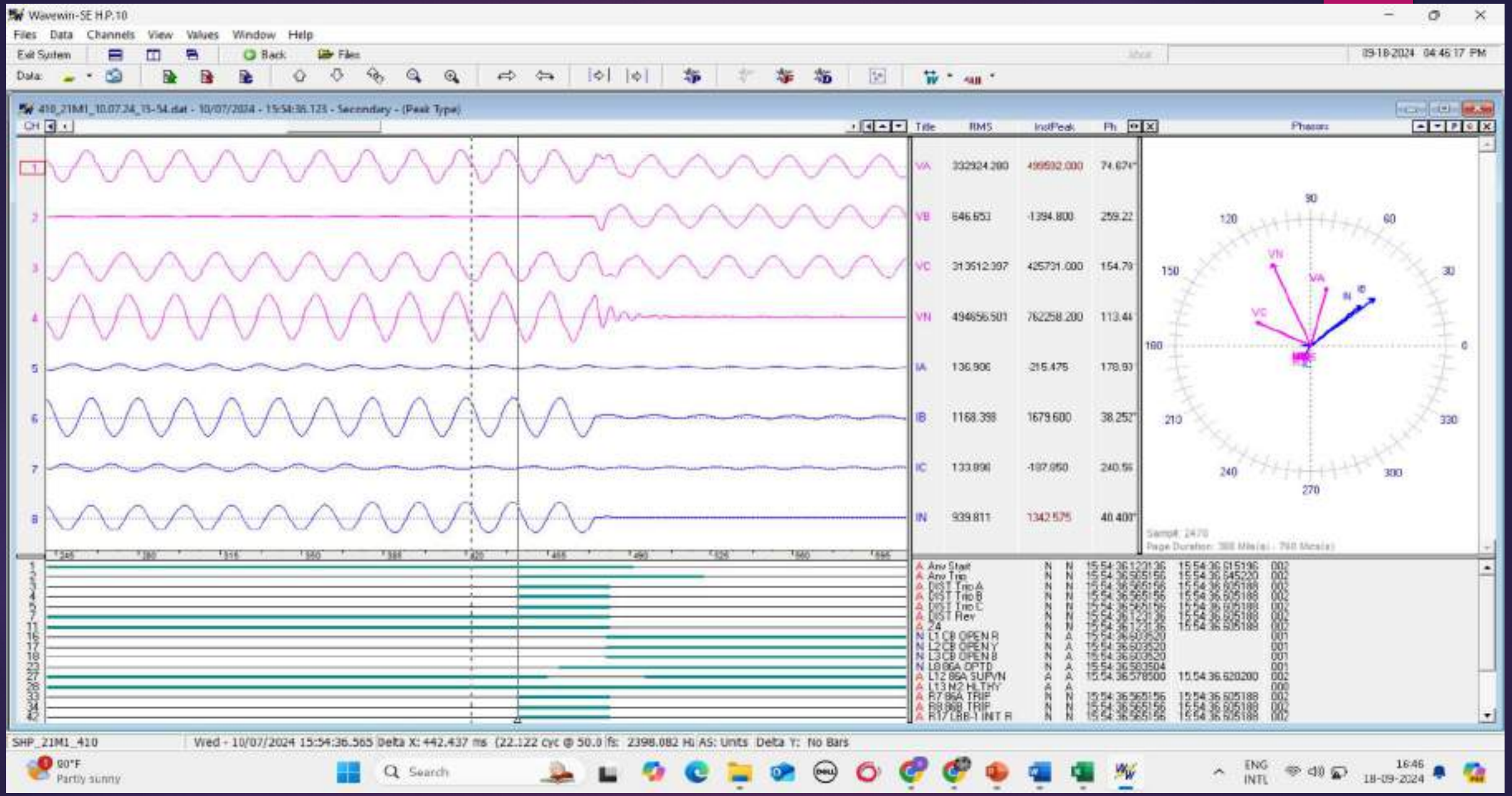
Fault Initiation, Bay 409- 400 kV SHP – Bihar Sharif-I (PG) Line at 18:37 Hrs



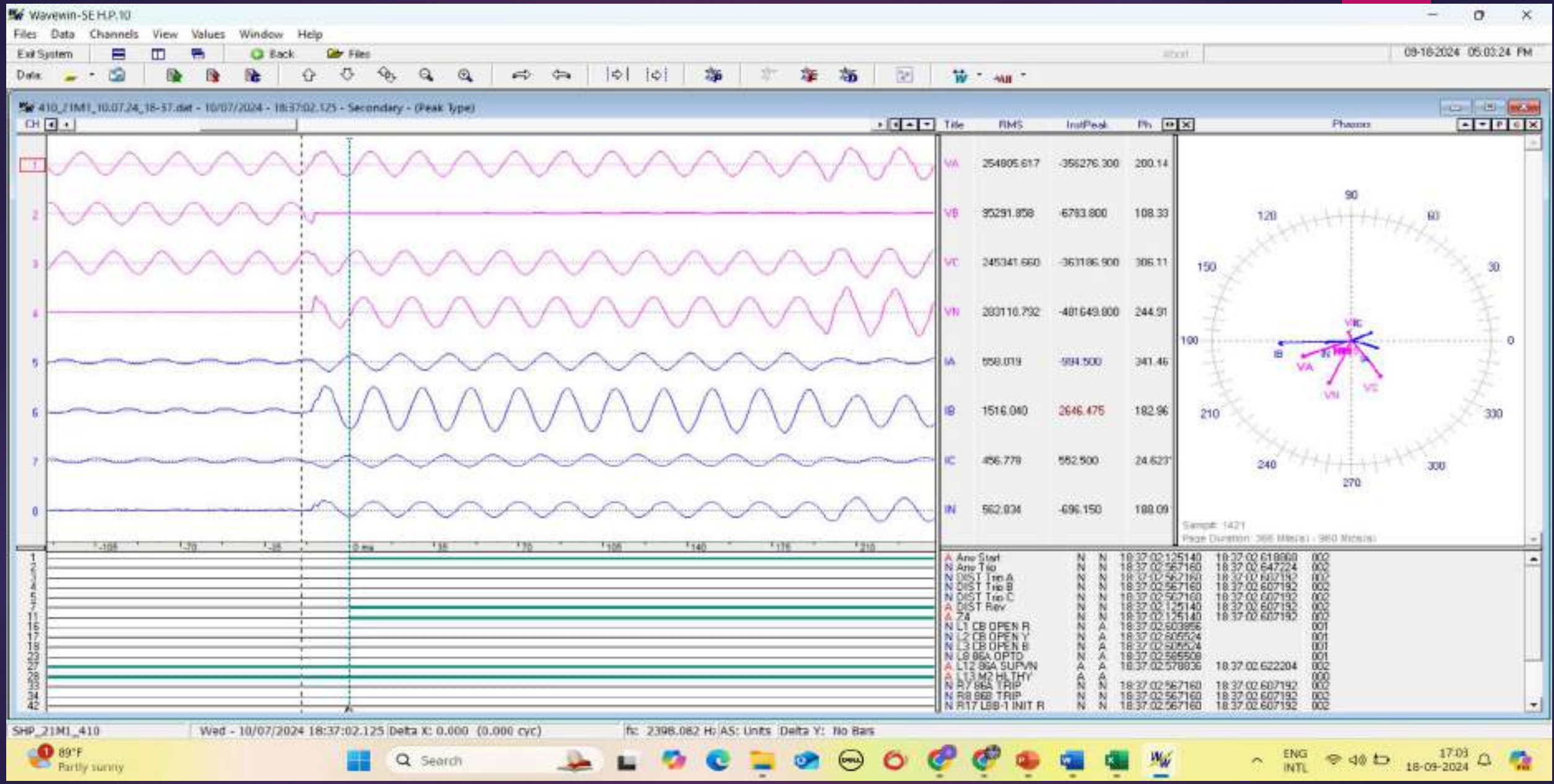
Tripping Command Bay 409- 400 kV SHP – Bihar Sharif-I (PG) Line at 18:37 Hrs



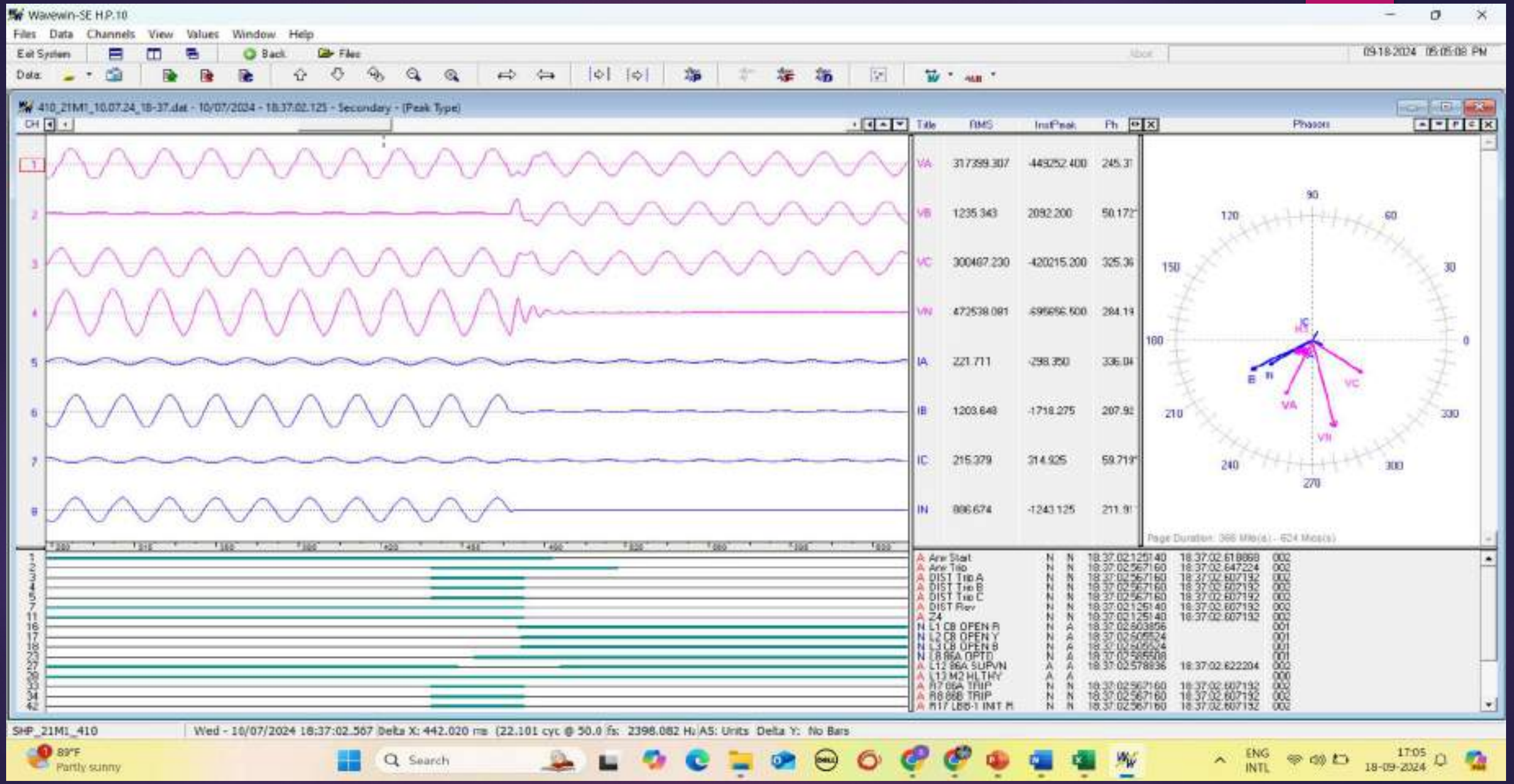
Fault Initiation Bay 410- 400 kV SHP – Bihar Sharif-II (PG) Line at 15:54 Hrs



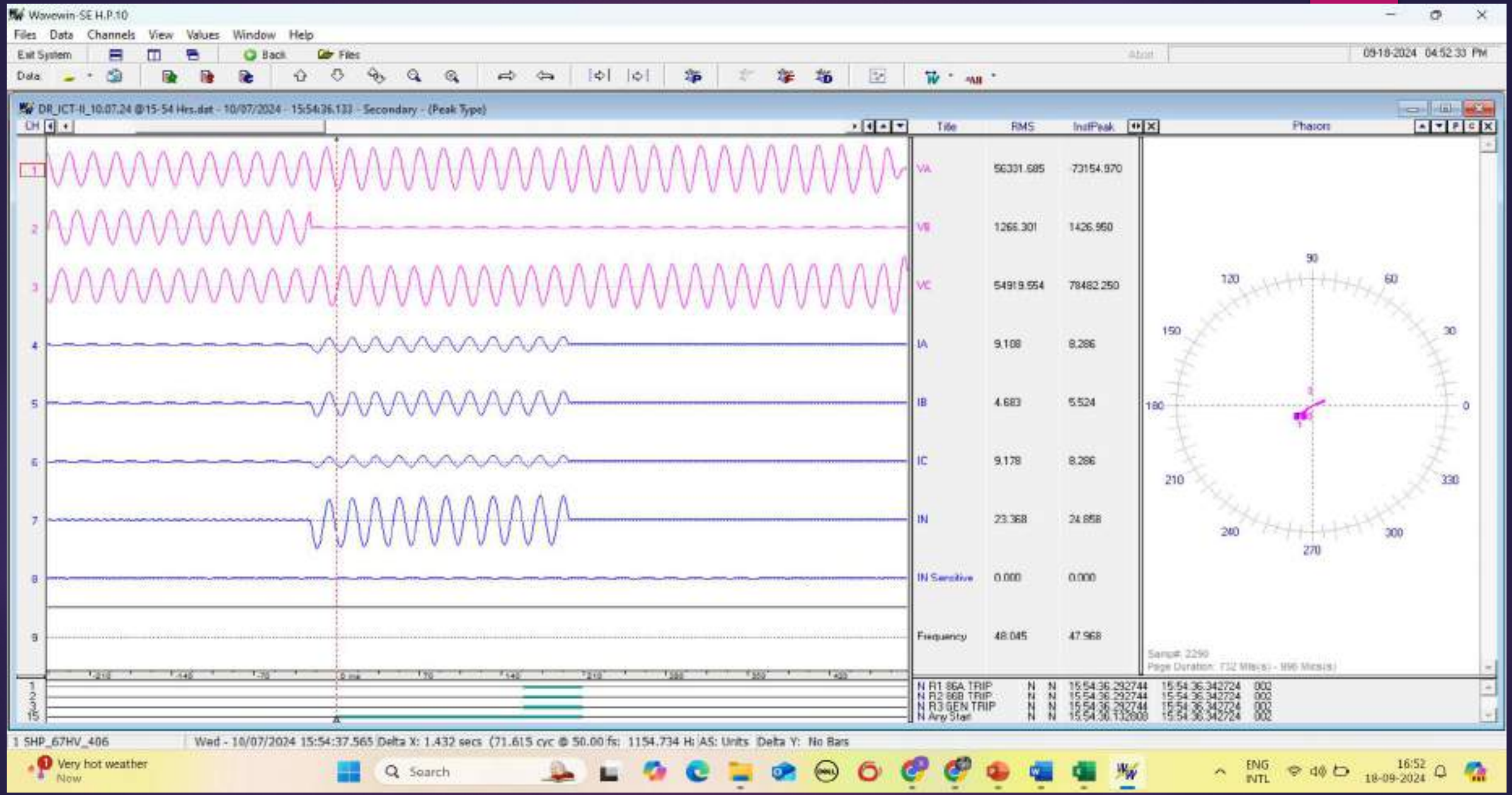
Tripping Command Bay 410- 400 kV SHP – Bihar Sharif-II (PG) Line at 15:54 Hrs



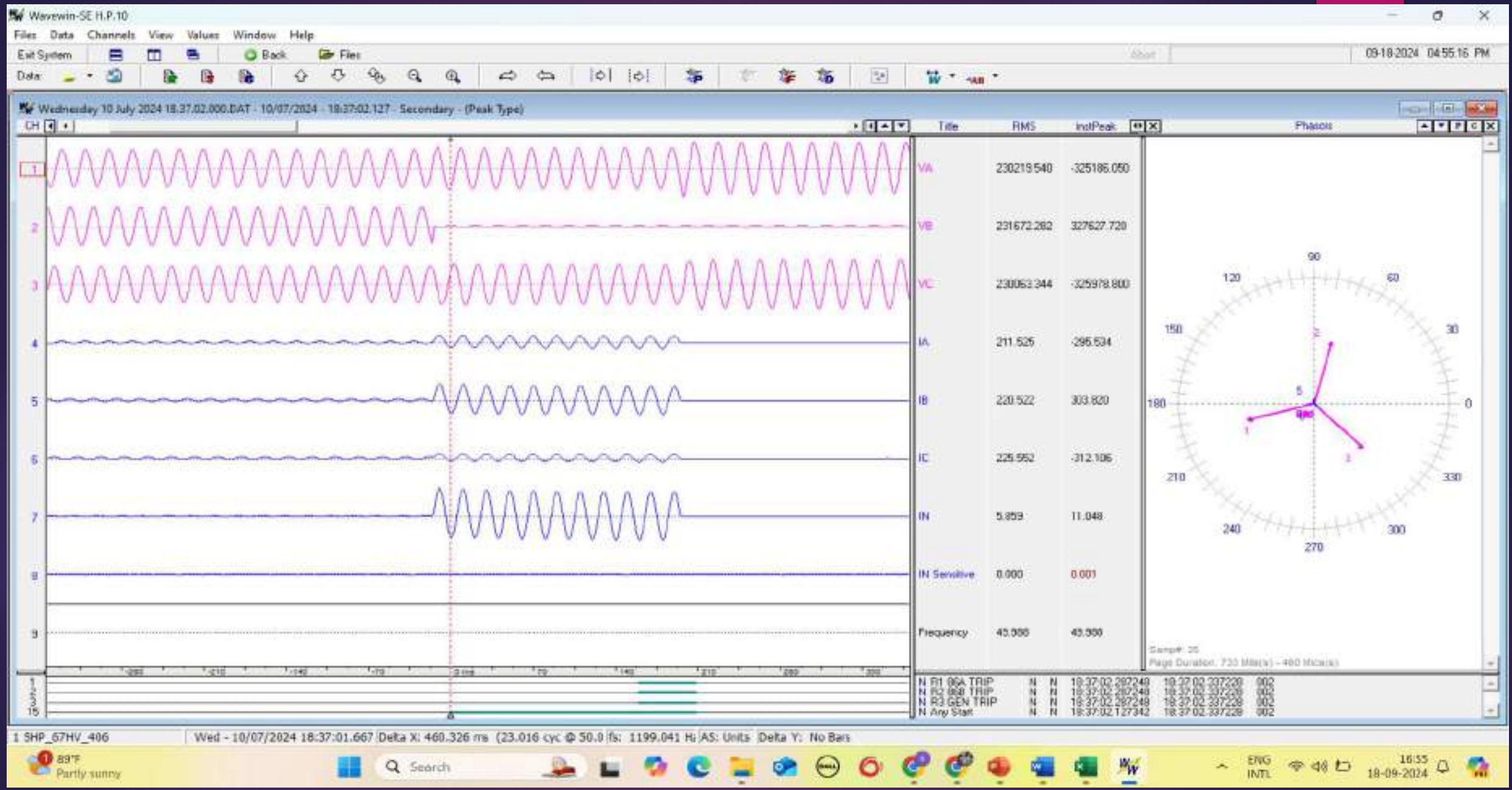
Fault Initiation Bay 410- 400 kV SHP – Bihar Sharif-II (PG) Line at 18:37 Hrs



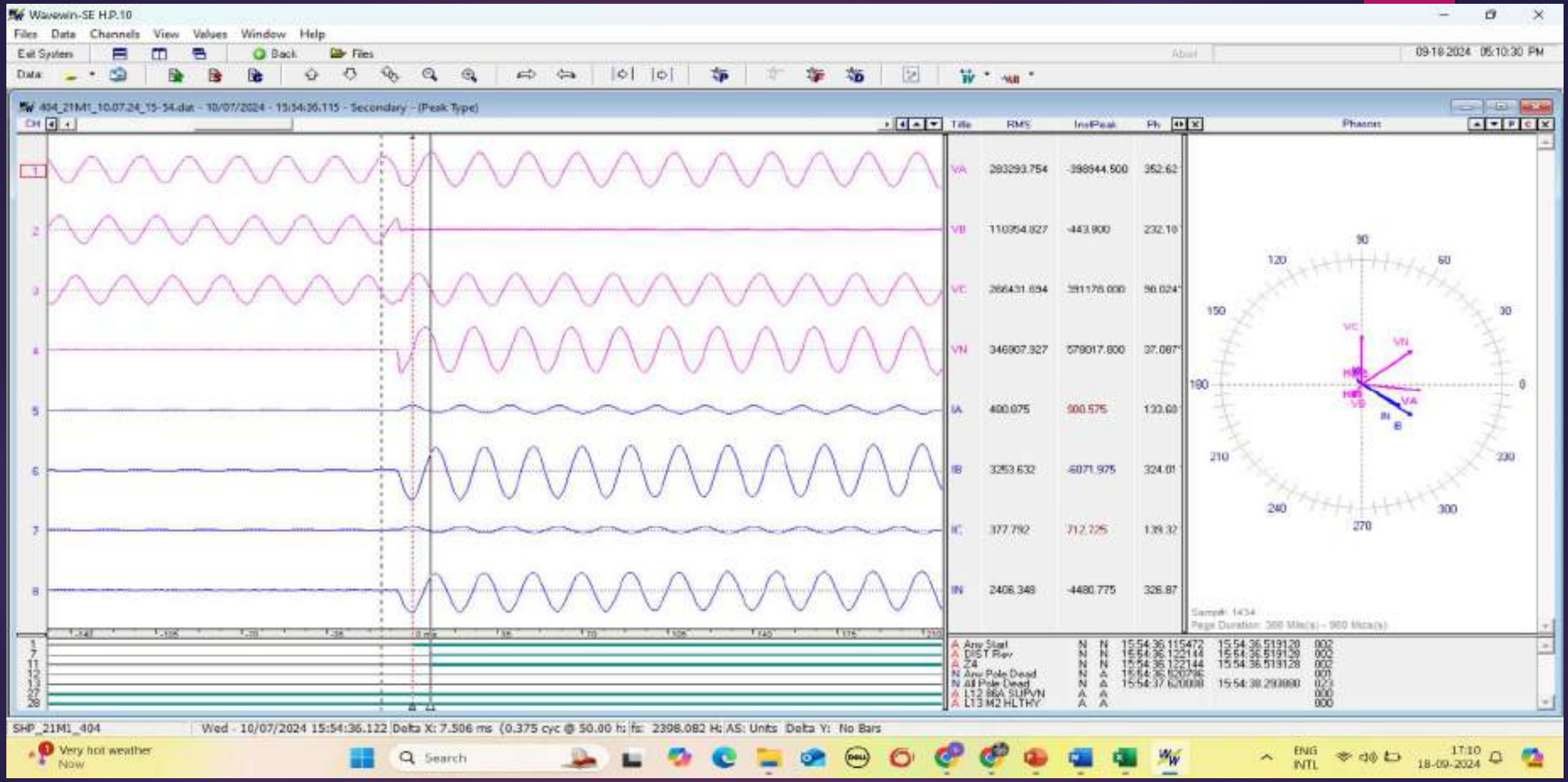
Tripping Command Bay 410- 400 kV SHP – Bihar Sharif-II (PG) Line at 18:37 Hrs



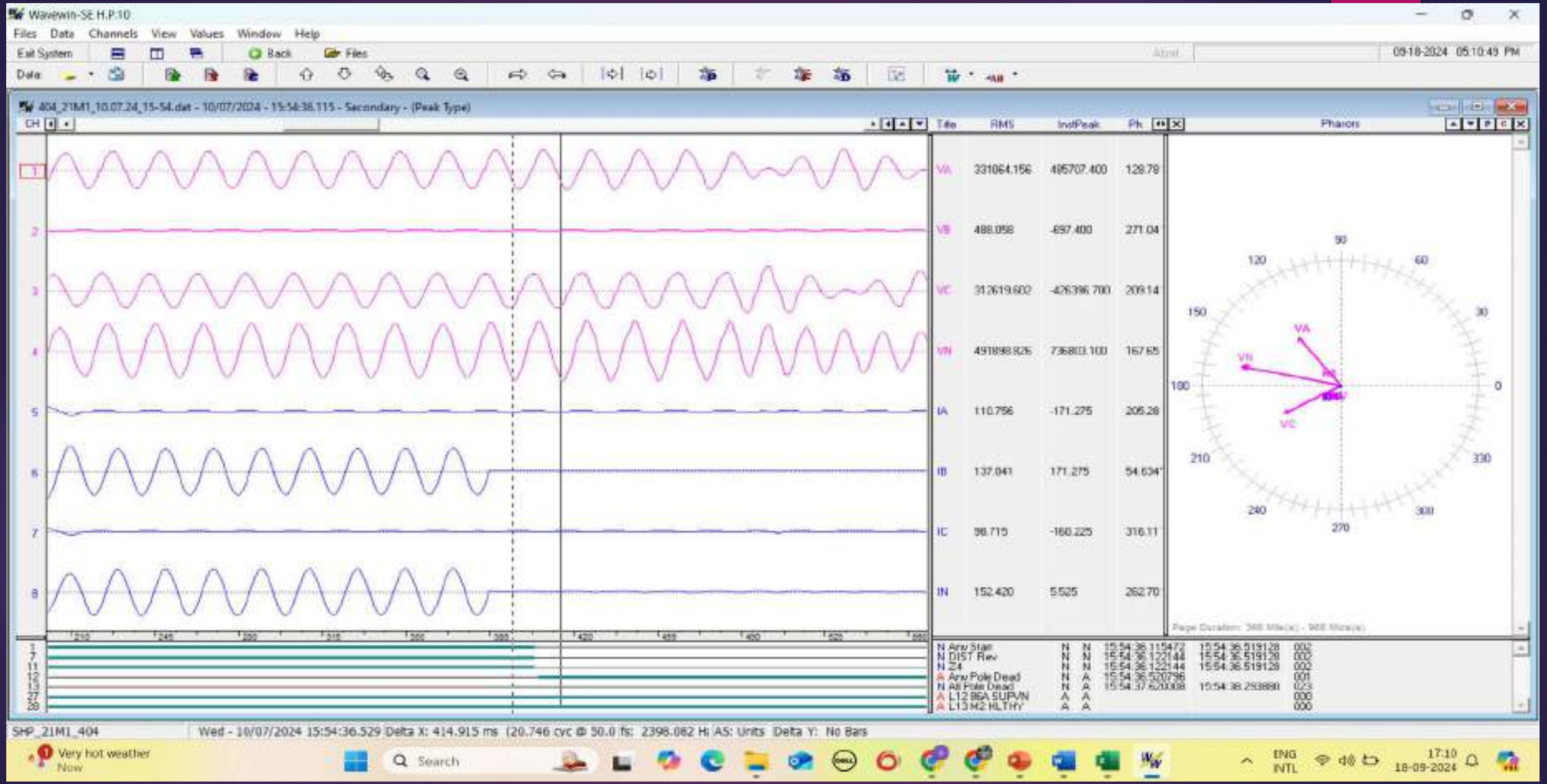
Fault Initiation & Tripping Command 500 MVA ICT-II at 15:54 Hrs



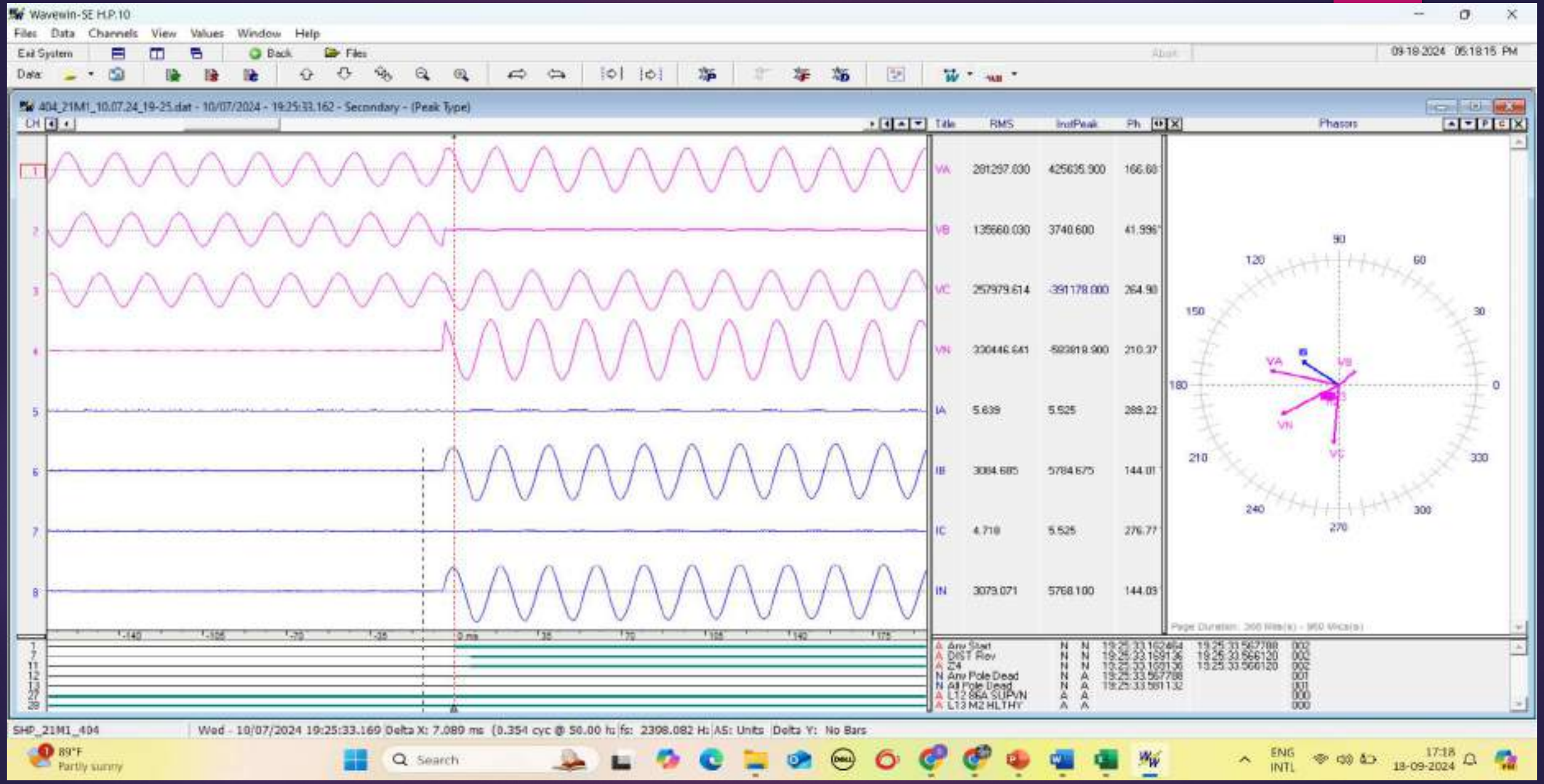
Fault Initiation & Tripping Command 500 MVA ICT-II at 18:37 Hrs



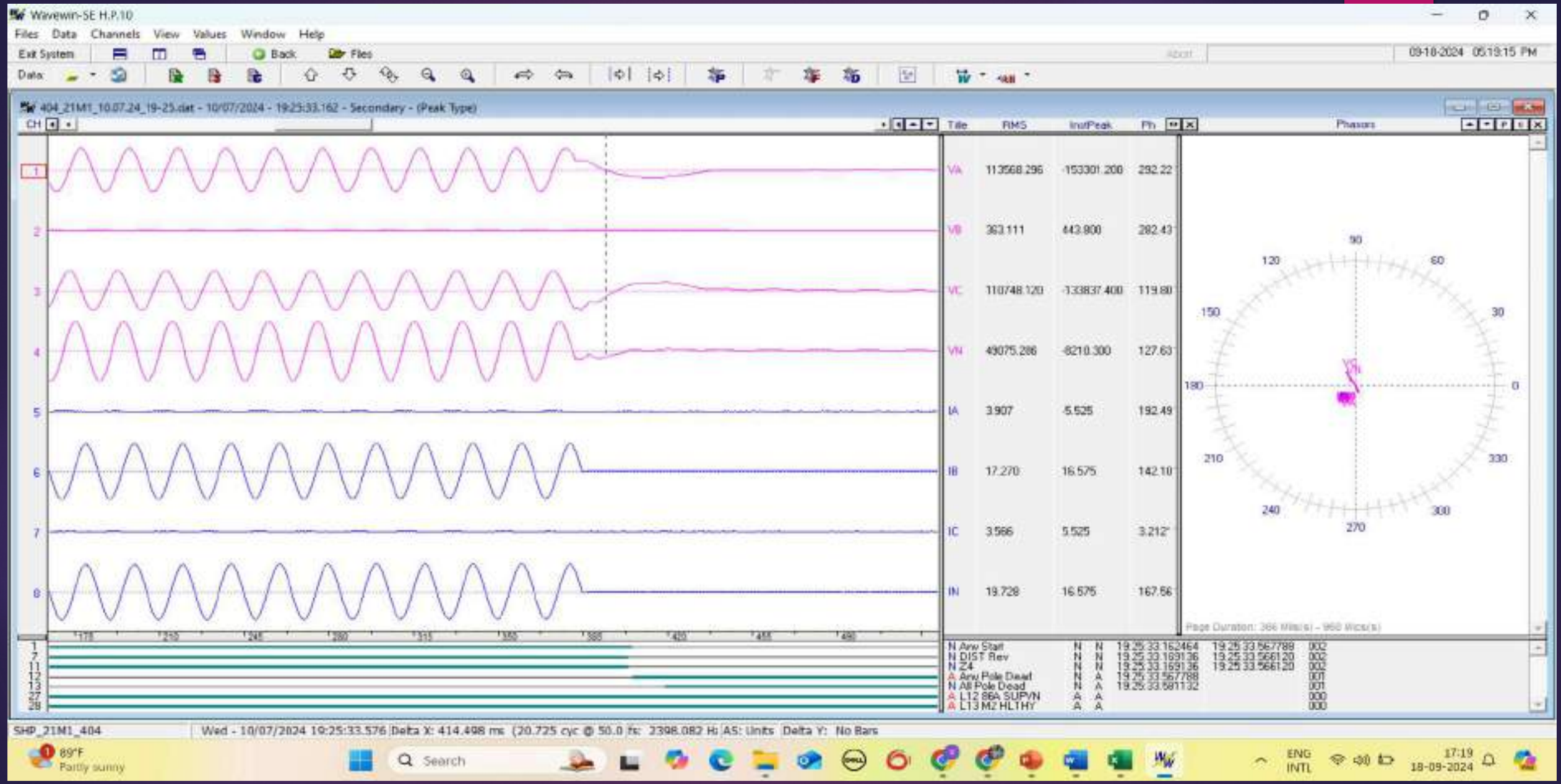
Fault Initiation Bay 404- 400 kV SHP – Varanasi-I (PG) Line at 15:54 Hrs



Fault End Point Bay 404- 400 kV SHP – Varanasi-I (PG) Line at 15:54 Hrs



Fault Initiation Bay 404- 400 kV SHP – Varanasi-I (PG) Line at 19:25 Hrs



Fault End Point Bay 404- 400 kV SHP – Varanasi-I (PG) Line at 19:25 Hrs

4). <u>Details of Protection Operation & Relay Flags:-</u>

A). 400 kV Sahupuri - Biharsharif -I Line - Y-Ph Optd, GND PU, Zone-4 Trip, 86 Trip Relay Optd

B). 400 kV Sahupuri - Biharsharif -II Line - Y-Ph Optd, GND PU, Zone-4 Trip, 86 Trip Relay Optd,

C). 400 kV Sahupuri - Varanasi (PG)- I (PG) Line - Tripped from Varanasi (PG) End on Zone - 2

D). 400 kV Sahupuri - Varanasi (PG)- II (PG) Line - Tripped from Varanasi (PG) End on Zone - 2

E). 400/220 kV 500 MVA ICT-II - E/F Highset Trip, 86 Trip Relay Optd

Note:- Above elements tripped again at 18:37 Hrs & 19:26 Hrs on almost same flags.

5). DR (.dat / .cfg) file w.r.t. protection operation

Enclosed

6). Reason for delayed fault clearance:-

400 kV Sahupuri - Biharsharif -I & II Line tripped on Zone-4 with a time delay of 450 ms as Bus Bar protection was kept out of circuit (due to some bay integration issue in busbar).

7). Details of load loss in UP Control Area / Substation

131 MW (Load on 500 MVA ICT-II at 15:30 Hrs)

8). Remedial Action taken to avoid such events in future

Bus Bar protection system is now in circuit & Replacement of GIS Module is under progress.

Multiple elements tripping at 220kV Palli(HR) 16th August 2024

Brief of event:

i. During antecedent condition, 220 kV Palli S/S importing load from 220 KV Samaypur (BB)-Palli (HV) (HVPNL) Ckt-1 & Ckt-2, 220 KV Badshahpur (HV)-Palli (HV) (HVPNL) Ckt-1 & ckt-2 and 220 KV Sector-56 (Gurgaon) -Palli (HV) (HVPNL) Ckt-1 & Ckt-2 and feeding that load to 220 KV Palla (HV) (Sec-46) & 220 KV Palli (2*100MVA+1*160MVA) S/S.

ii. As reported, to manage the line loading on sector-72 Gurgaon ckt, 220 KV Sector 52 (HV) (Sec-56 Gurgaon)-Palli (HV) (HVPNL) Ckt-1 was opened at 22:10 hrs on the instruction of SLDC-Haryana. This led to sparking on the 220 KV Sector 52 (HV) (Sec-56 Gurgaon)-Palli (HV) (HVPNL) Ckt-2 at Palli S/S end.

iii. At the same time, busbar protection operated at 220kV Palli(HV) due to which all the elements connected to 220kV Bus-1 and 2 at Palli(HV) tripped and complete blackout occurred at Palli(HV) S/s.

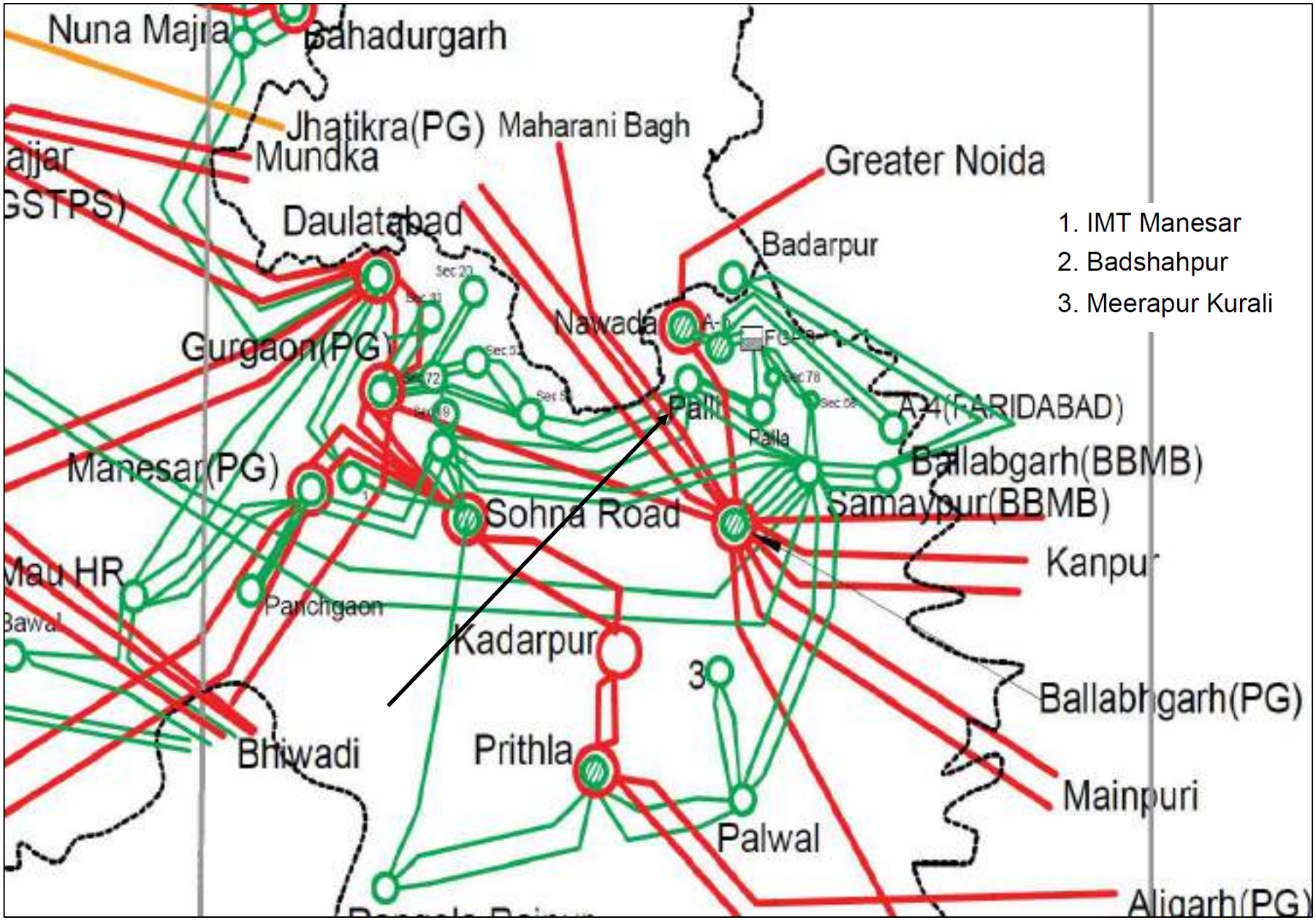
iv. As per PMU, R-Y phase to phase fault with delayed fault clearing time of 880 ms was observed.

v. As per SCADA, change in demand of approx. 600 MW and 980 MW in Delhi and Haryana control area respectively were observed. However, as reported, approx. 400 MW load loss occurred at Palli & Sec-46 (Faridabad). Rest of the change in demand is suspected due to stalling of induction motor.

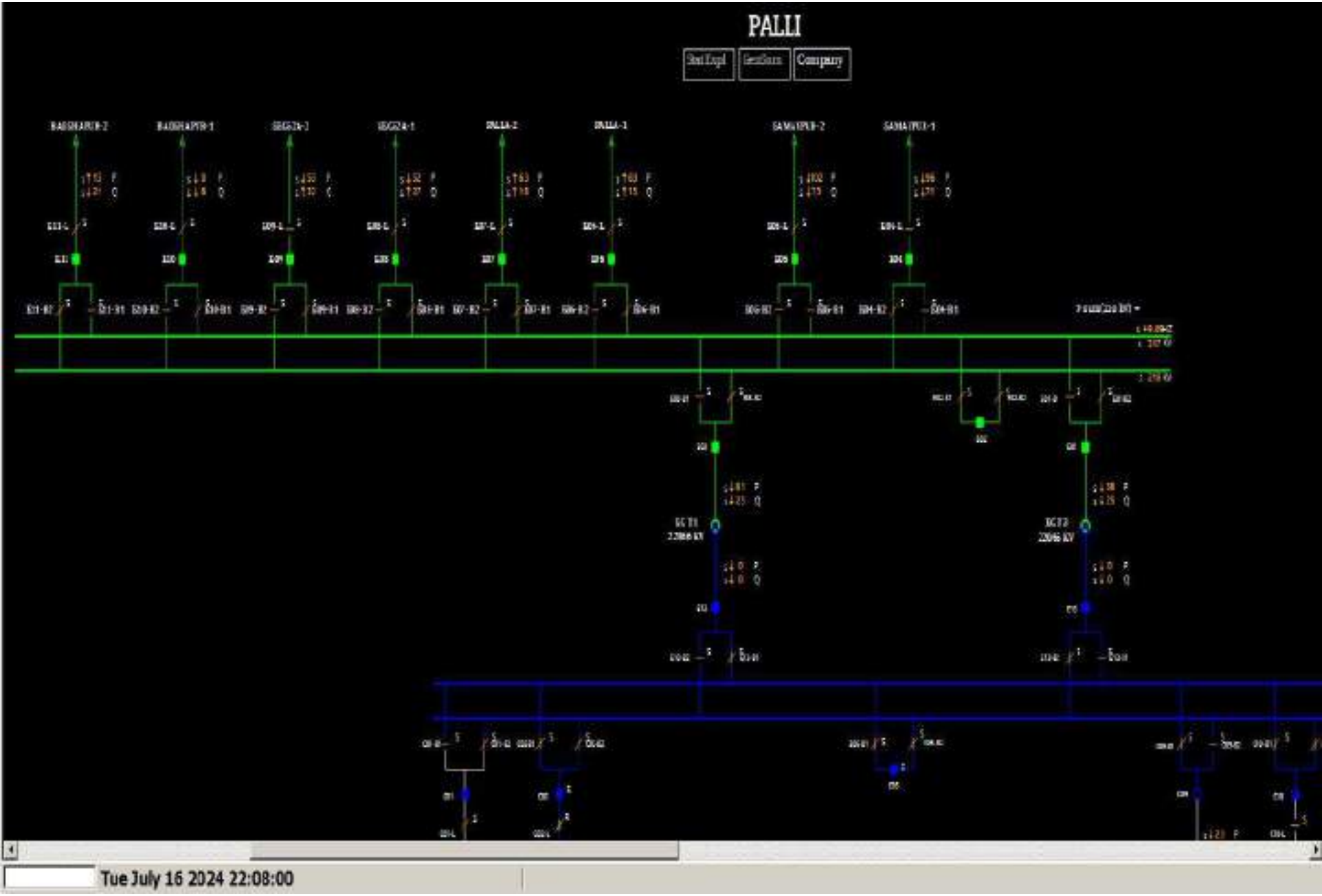
Elements tripped:

i. 220 KV Samaypur (BB)-Palli (HV) (HVPNL) Ckt-1
ii. 220 KV Samaypur (BB)-Palli (HV) (HVPNL) Ckt-2
iii. 220 KV Badshahpur (HV)-Palli (HV) (HVPNL) Ckt-1
iv. 220 KV Badshahpur (HV)-Palli (HV) (HVPNL) Ckt-2
v. 220 KV Palla (HV) (Sec-46) -Palli (HV) (HVPNL) Ckt-1
vi. 220 KV Palla (HV) (Sec-46) -Palli (HV) (HVPNL) Ckt-2
vii. 220 KV Sector 52 (HV) (Sec-56 Gurgoan)-Palli (HV) (HVPNL) Ckt-1
viii. 220 KV Sector 52 (HV) (Sec-56 Gurgoan)-Palli (HV) (HVPNL) Ckt-2

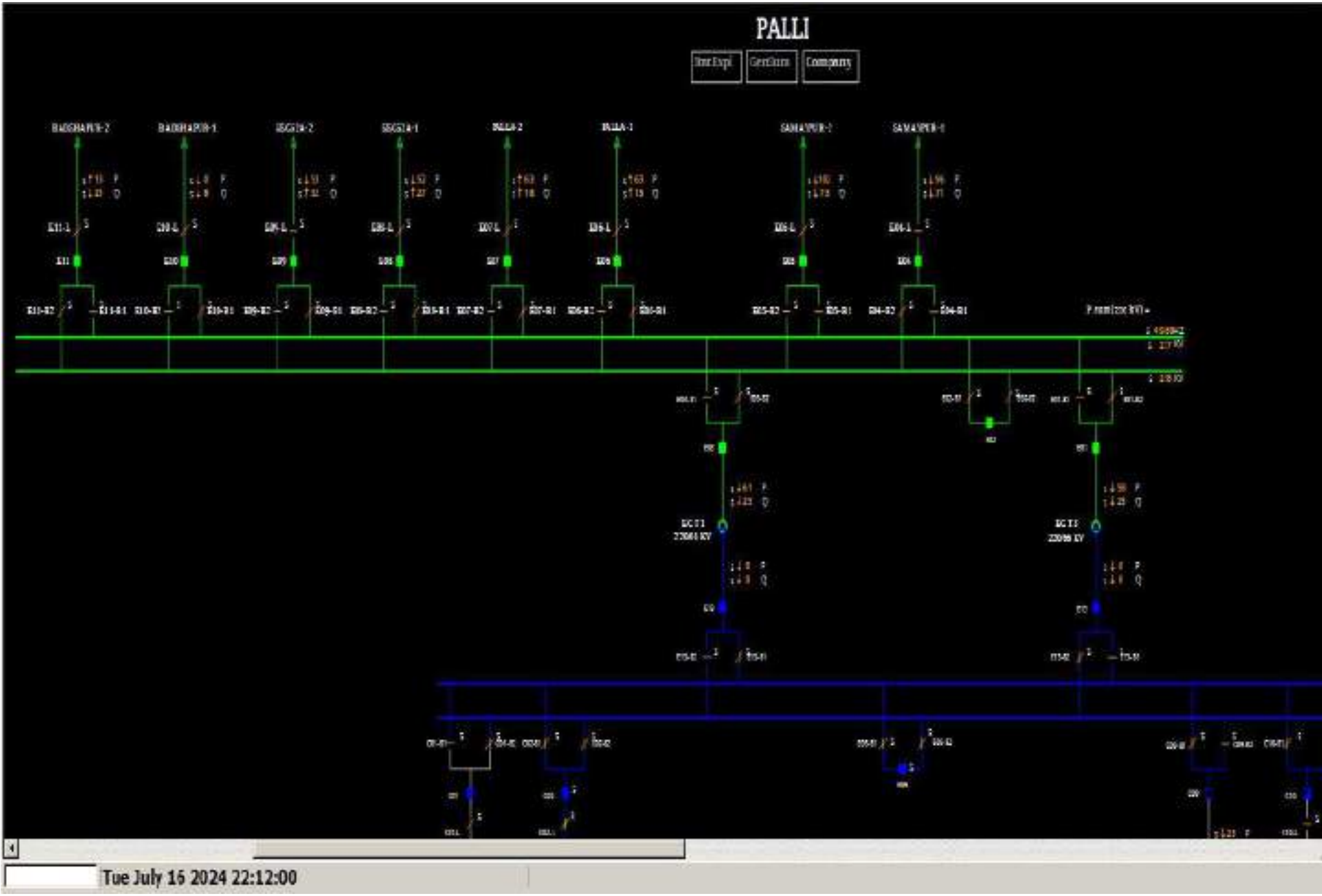
Network Diagram



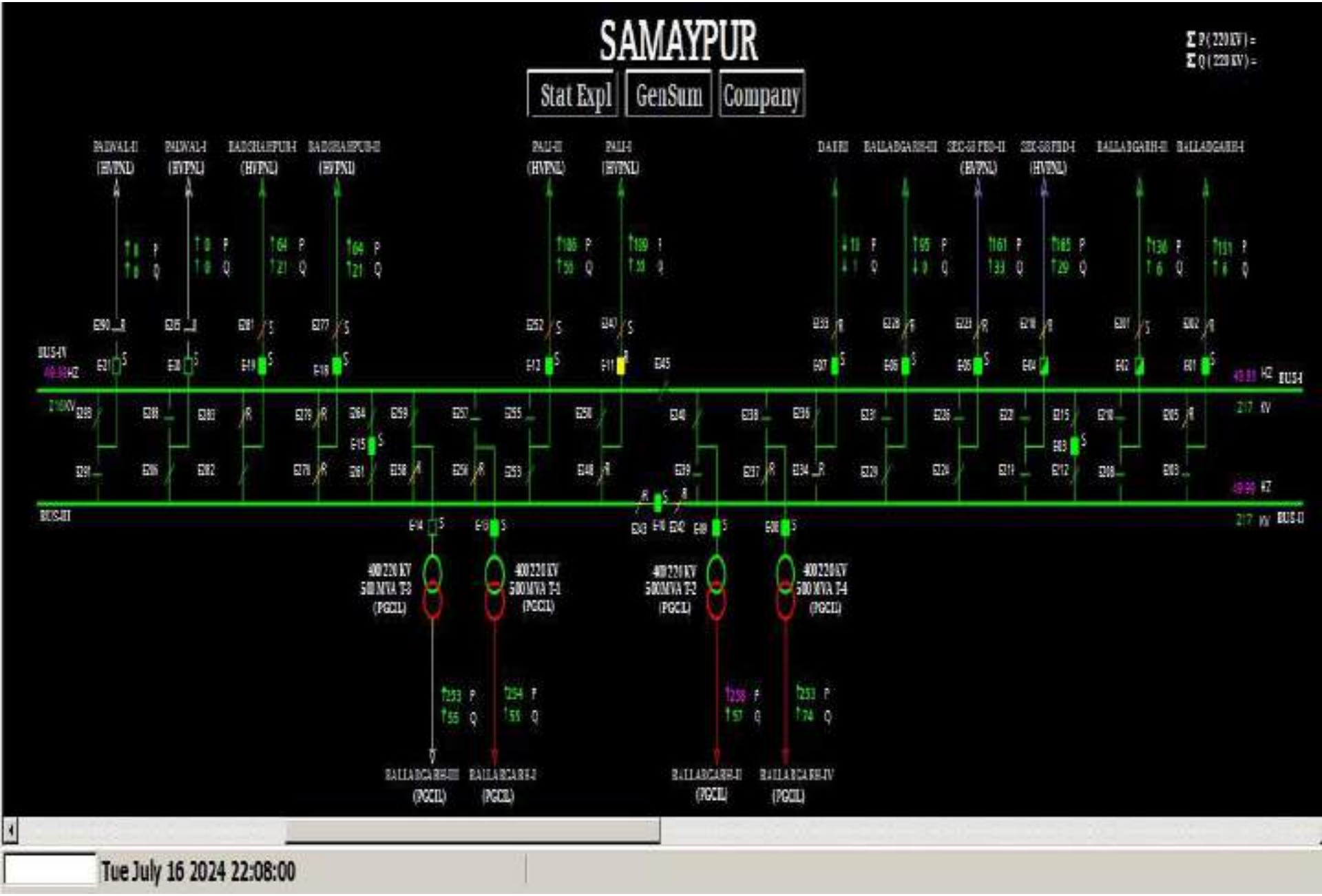
SLD of 220/66kV Palli(HV) before the event



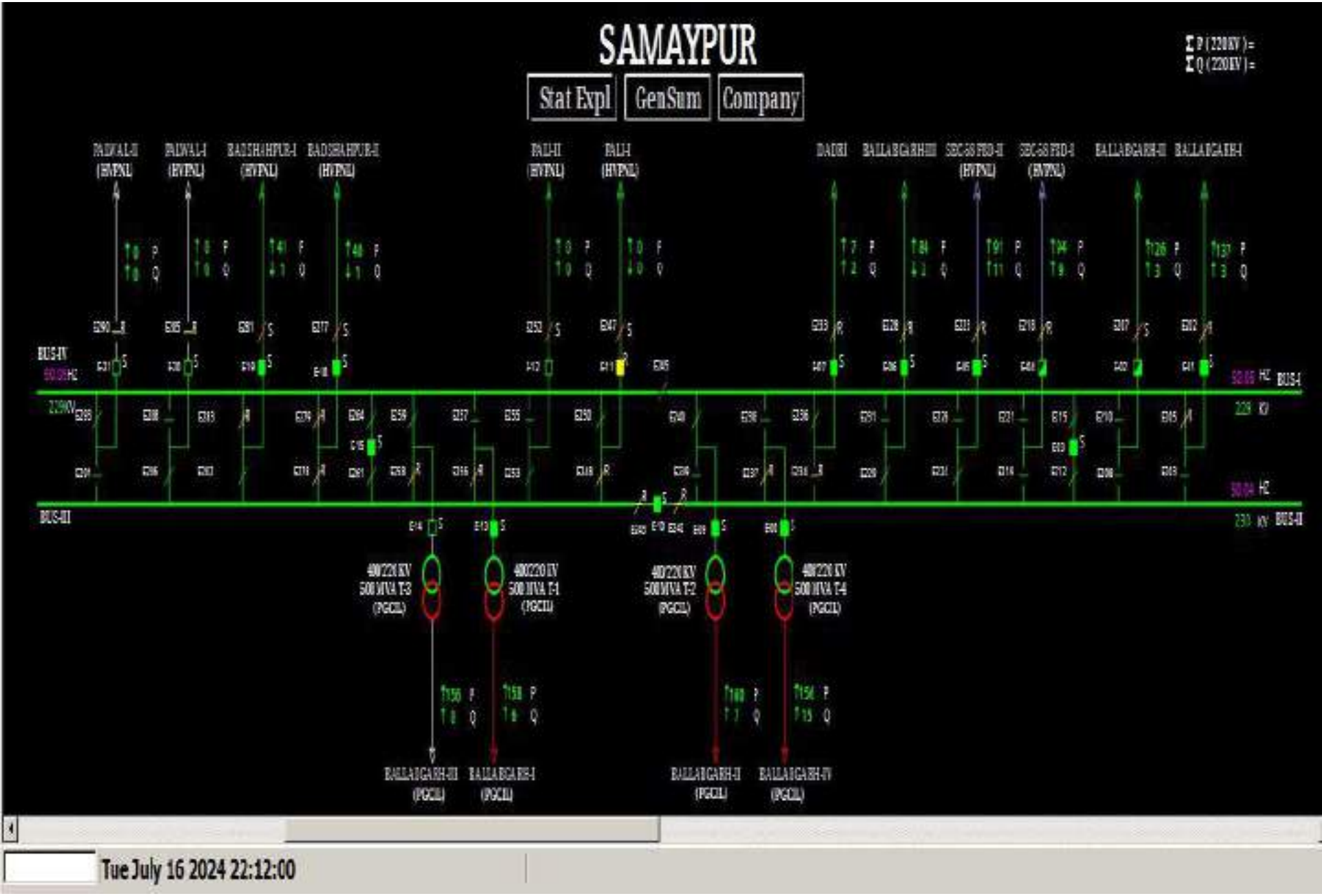
SLD of 220/66kV Palli(HV) after the event



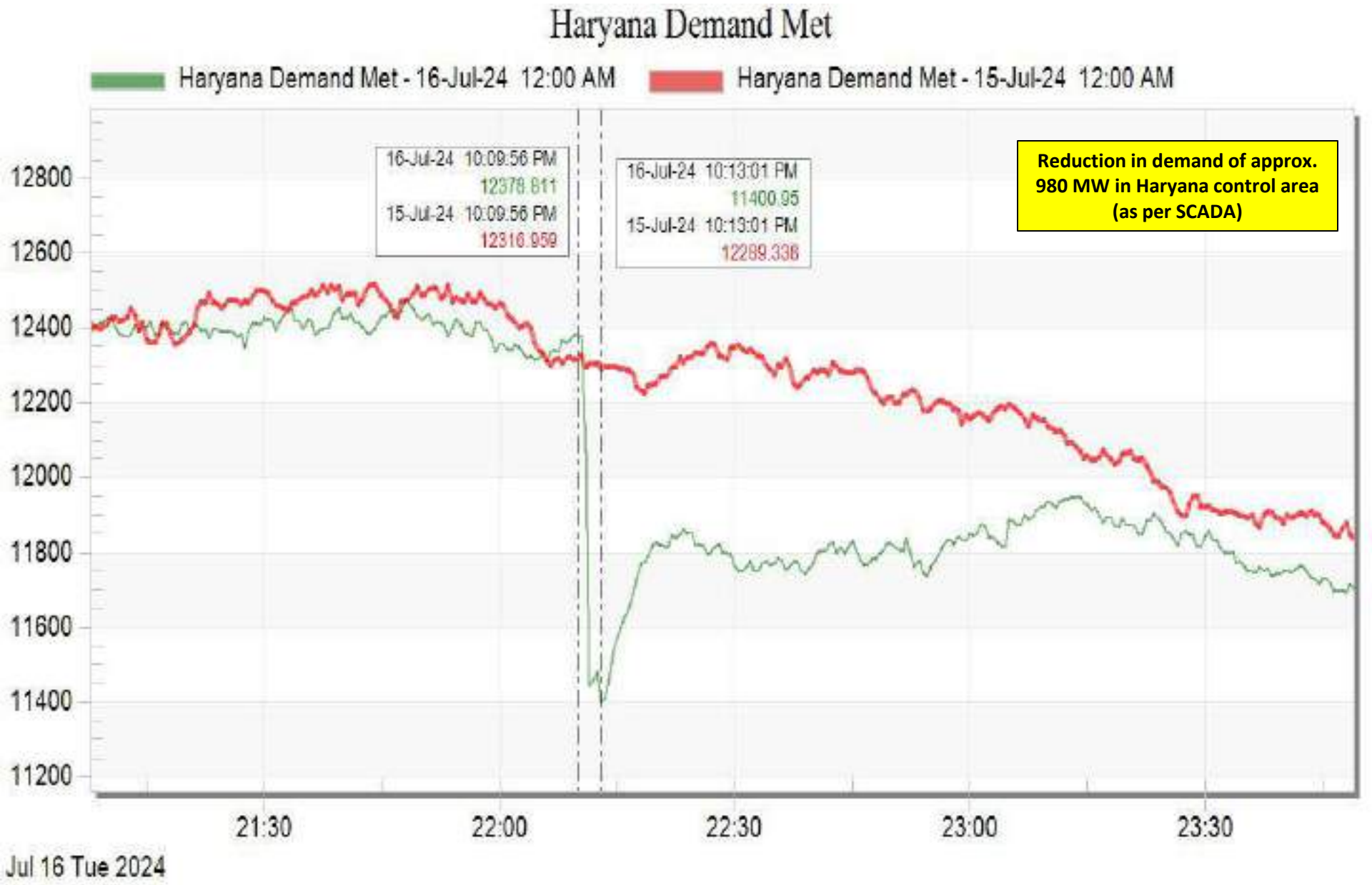
SLD of 220kV Samaypur(BB) before the event



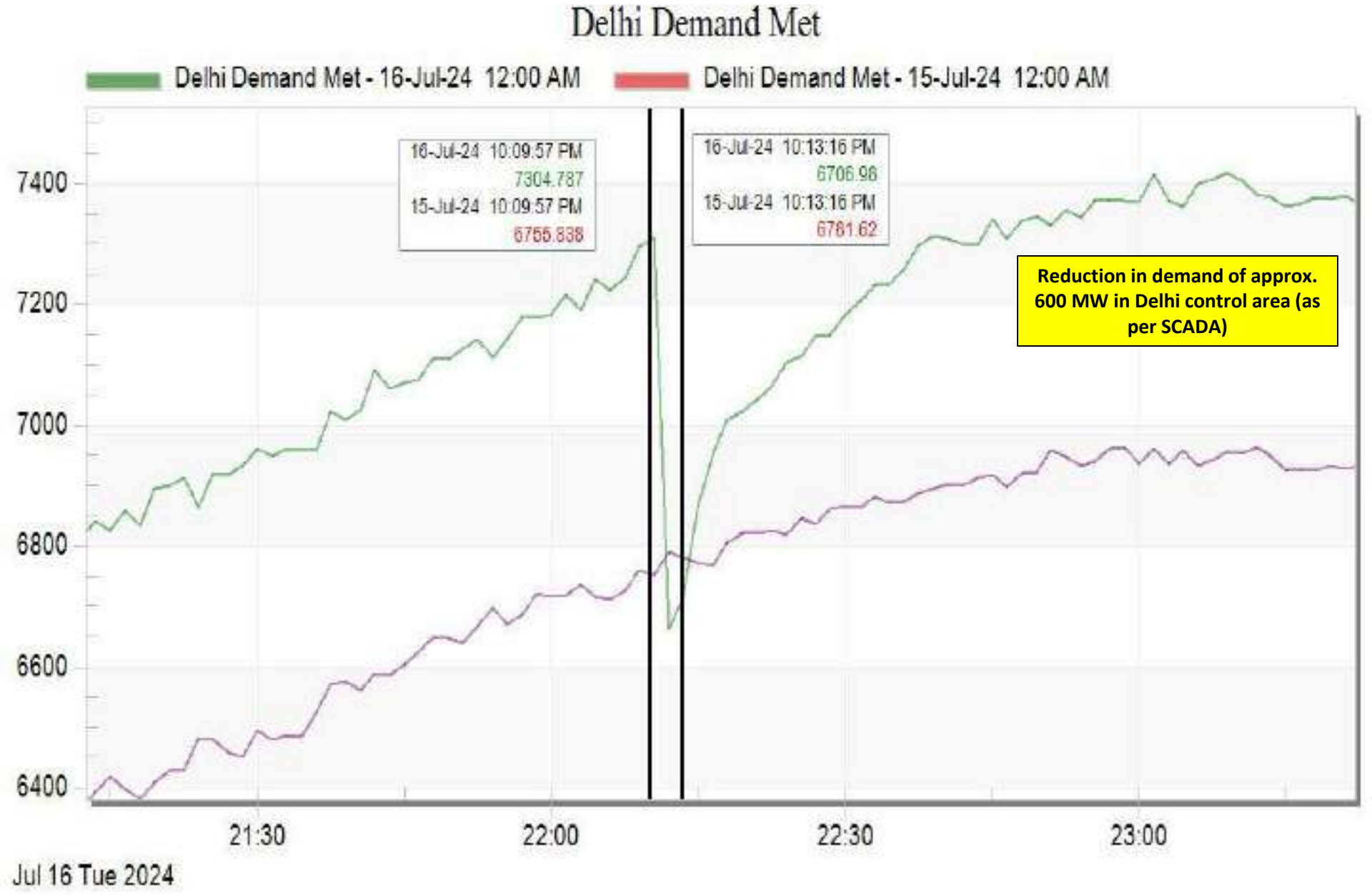
SLD of 220kV Samaypur(BB) after the event



Haryana demand during the event

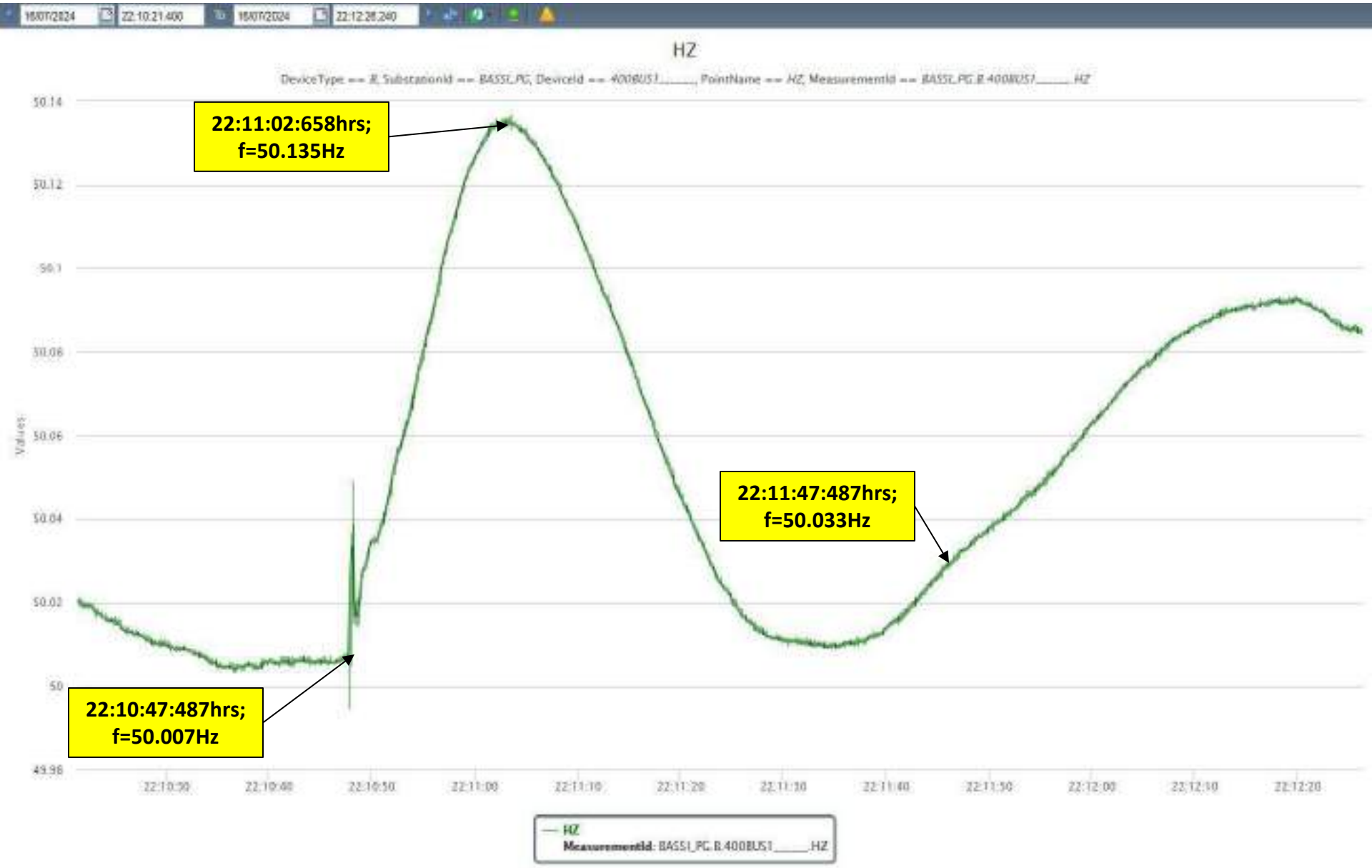


Delhi demand during the event



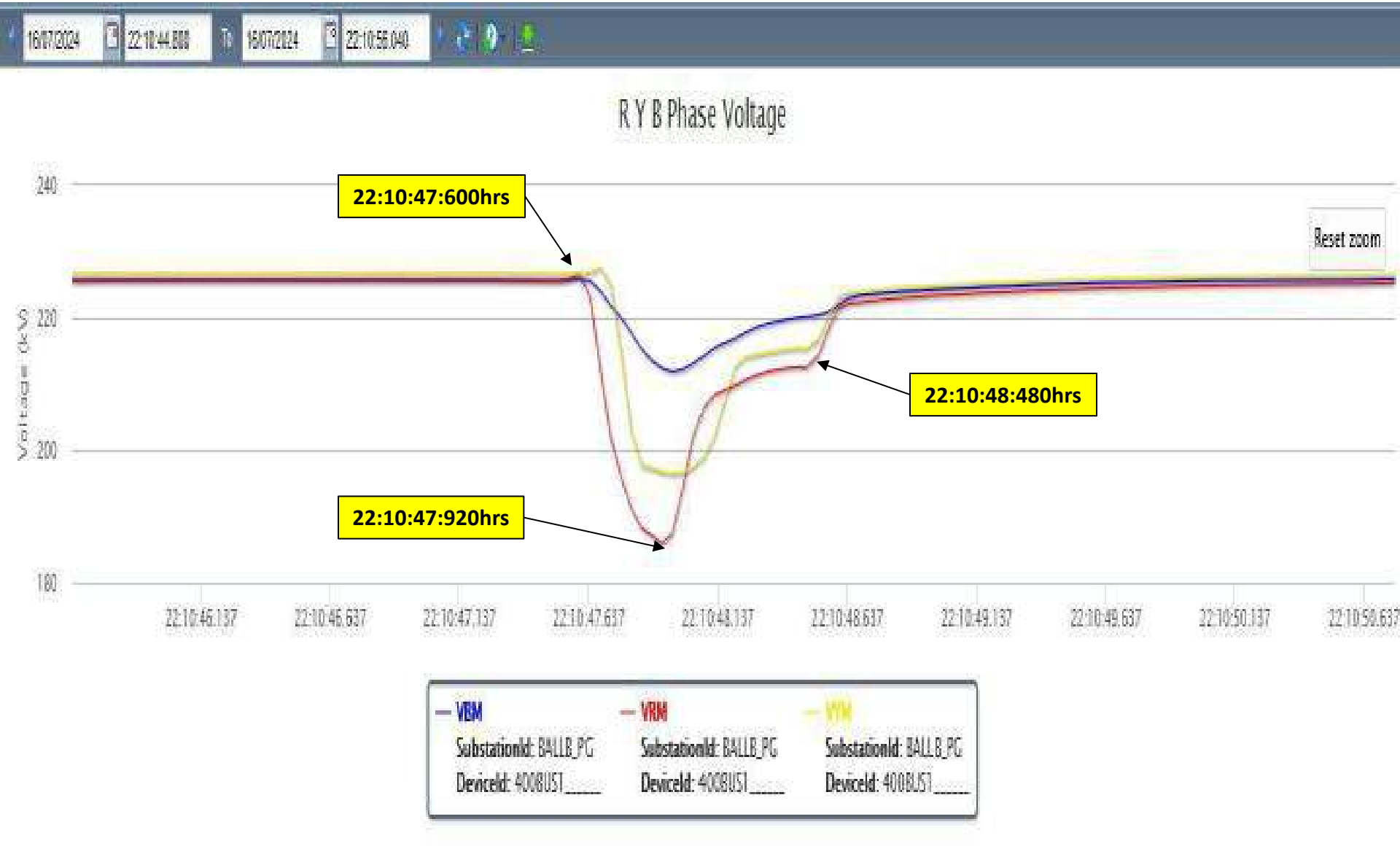
PMU Plot of frequency at Bassi(PG)

22:10 hrs/16-July-24



PMU Plot of Phase Voltage Magnitude at Ballabhgarh(PG)

22:10 hrs/16-July-24



SCADA SOE

Time	Station Name	Voltage Level	Element Name	Element Type	Element Status	Remarks
22:10:48,296	SMYUR_BB	220kV	12PALLI2	Circuit Breaker	Open	Line CB at Samaypur(BBMB) end of 220 KV Samaypur(BB)-Palli(HV) (HVPNL) Ckt-2 opened

DR summary file of 220kV Samaypur(end)-Palli ckt-2

Disturbance Short Report

Disturbance Recordings Information

Device Information

Station name	PALI-2 MCOM M-2
Object name	1

Fault Information

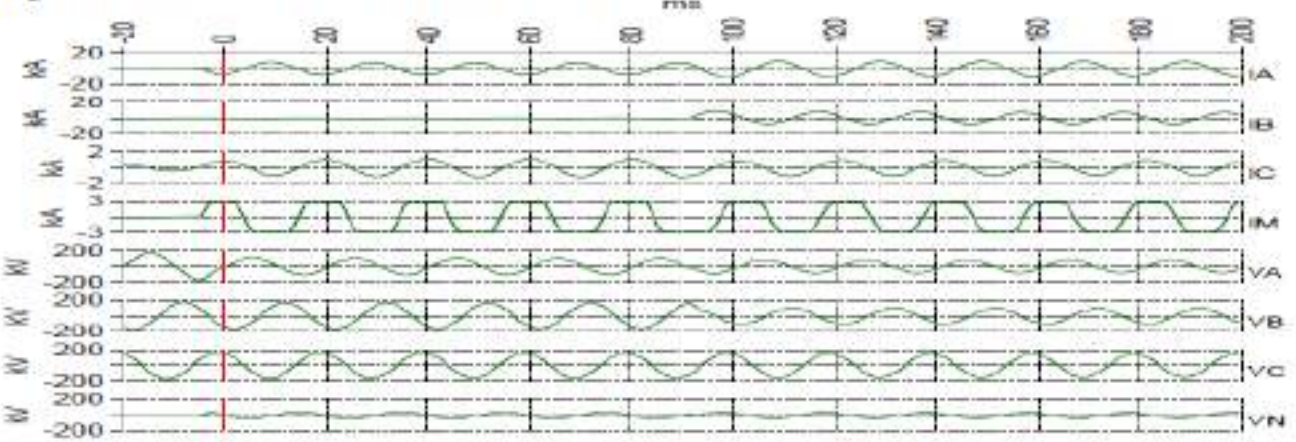
Trig date and time	16-07-2024 22:08:48.487

General Recordings Information

System frequency	50 Hz

Analog Time Diagram

Trig Date Time: 16-07-2024 22:08:48.487



Binary Time Diagram

Trig Date Time: 16-07-2024 22:08:48.487

R-N fault, Z-2, FD:13.45km

Point of discussion

i) Exact reason, location and nature of fault need to be shared.
ii) Reason of delayed clearance of fault need to be shared.
iii) Reason of tripping of multiple elements.
iv) Feeder-wise load loss details need to be shared.
v) SCADA data issue was observed at 220/66kV Palli(HV) during the event. Availability and healthiness of SCADA data need to be ensured.
vi) DR/EL (.dat/.cfg file) of all tripped elements need to be shared.
vii) Remedial action taken report need to be shared.

Multiple elements tripping at 220kV Khodri HEP 19th July 2024

Brief of event:

i. During antecedent condition, all the four 30MW units of Khodri and 60 MW units of Chhibro were running and total active power generation of Khodri and Chhibro was approx. 89 MW and 196 MW (as per SCADA). Total generation of Chhibro was evacuating through 220 KV Khodri-Chhibro (UK) Ckt-1 & 2.

ii. As reported, at 21:31 hrs, while taking out 30MW Khodri Unit-2, B-phase pole of CB of Unit-2 did not open. This led to LBB protection operation which further resulted in tripping of all the elements connected to both the buses at 220kV Khodri(UK) and complete blackout occurred at 220kV Khodri(UK) S/s.

iii. Due to tripping of 220 KV Khodri-Chhibro (UK) Ckt-1 & 2, 60 MW Chhibro Unit-1, 2, 3 & 4 also tripped due to loss of evacuation path and complete blackout occurred at 220kV Chhibro(UK) S/s.

iv. As per PMU, no fault was observed in the system.

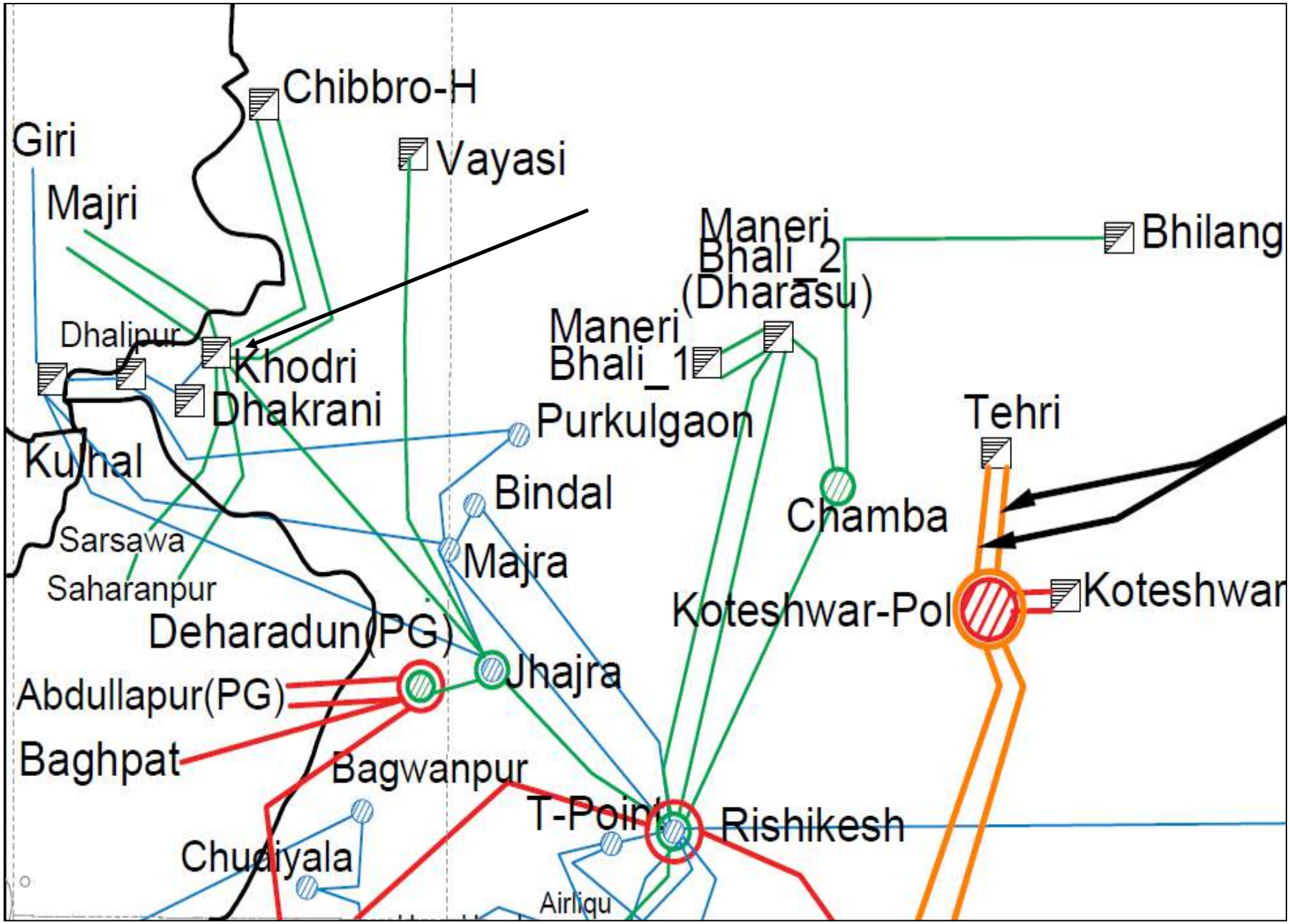
v. As per SCADA, change in demand and generation of approx. 30 MW and 300 MW respectively in Uttarakhand control area were observed.

vi. As remedial action taken, over hauling & testing of generator CB has been performed and found satisfactory.

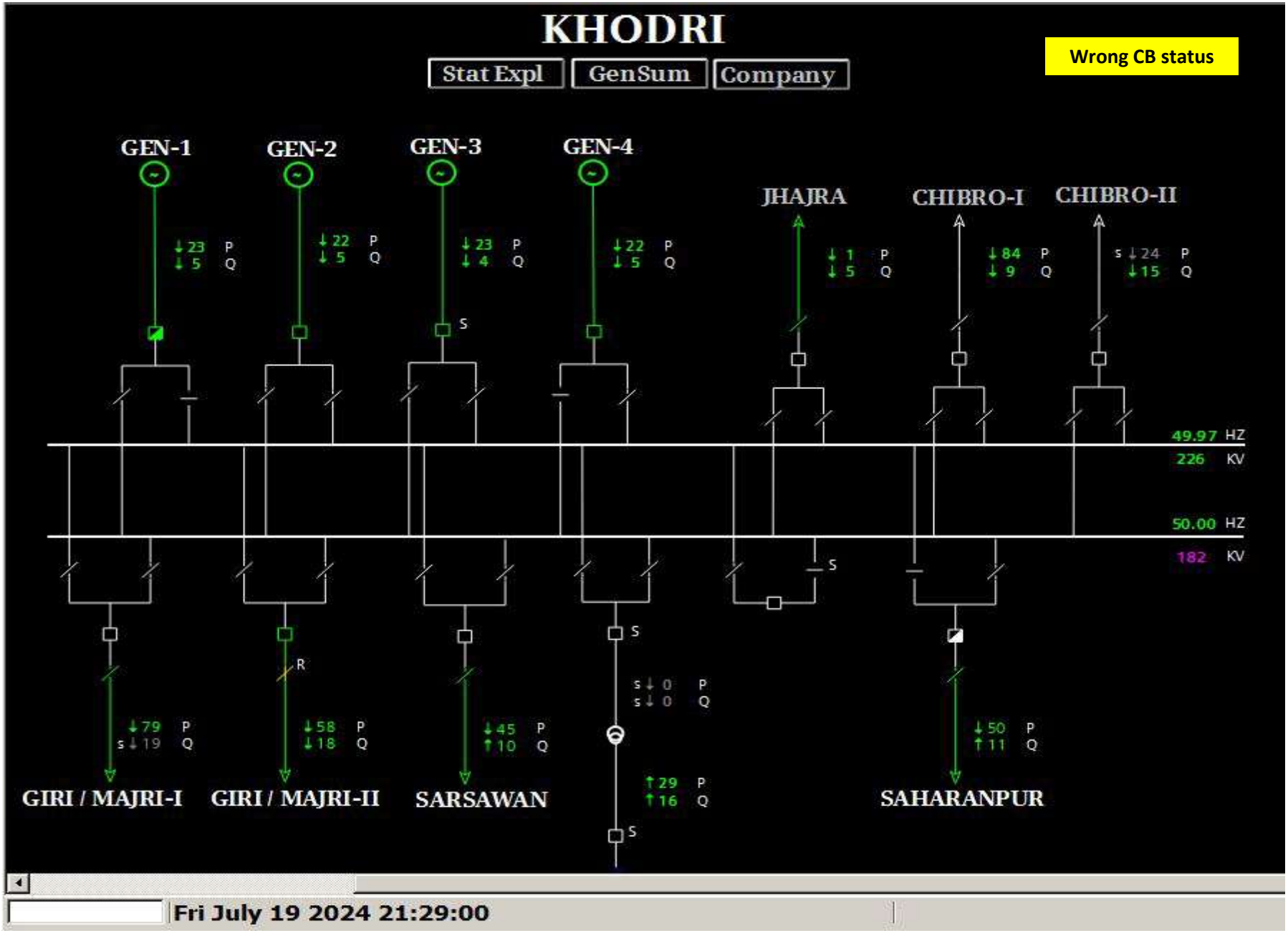
Elements tripped:

i. 220 KV Khodri(UK)-Majri(HP) (UK) Ckt-1
ii. 220 KV Khodri(UK)-Majri(HP) (UK) Ckt-2
iii. 220 KV Khodri(UK)-Sarsawan(UP) (UP) Ckt
iv. 220 KV Khodri(UK)-Saharanpur(UP) (UP) Ckt
v. 220 KV Khodri-Chhibro (UK) Ckt-1
vi. 220 KV Khodri-Chhibro (UK) Ckt-2
vii. 30 MW Khodri Unit-1, 2, 3 & 4
viii. 60 MW Chhibro Unit-1, 2, 3 & 4

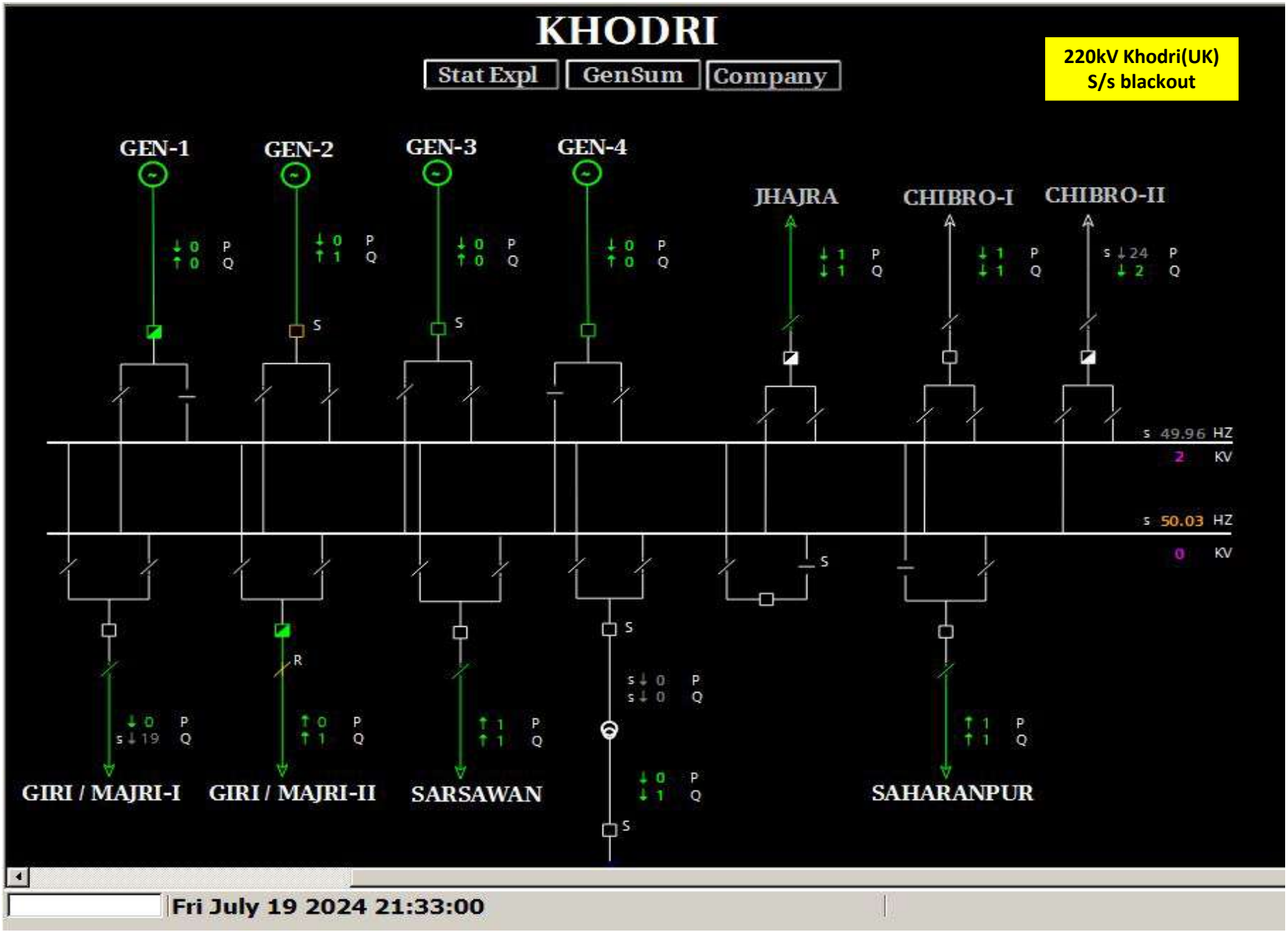
Network Diagram



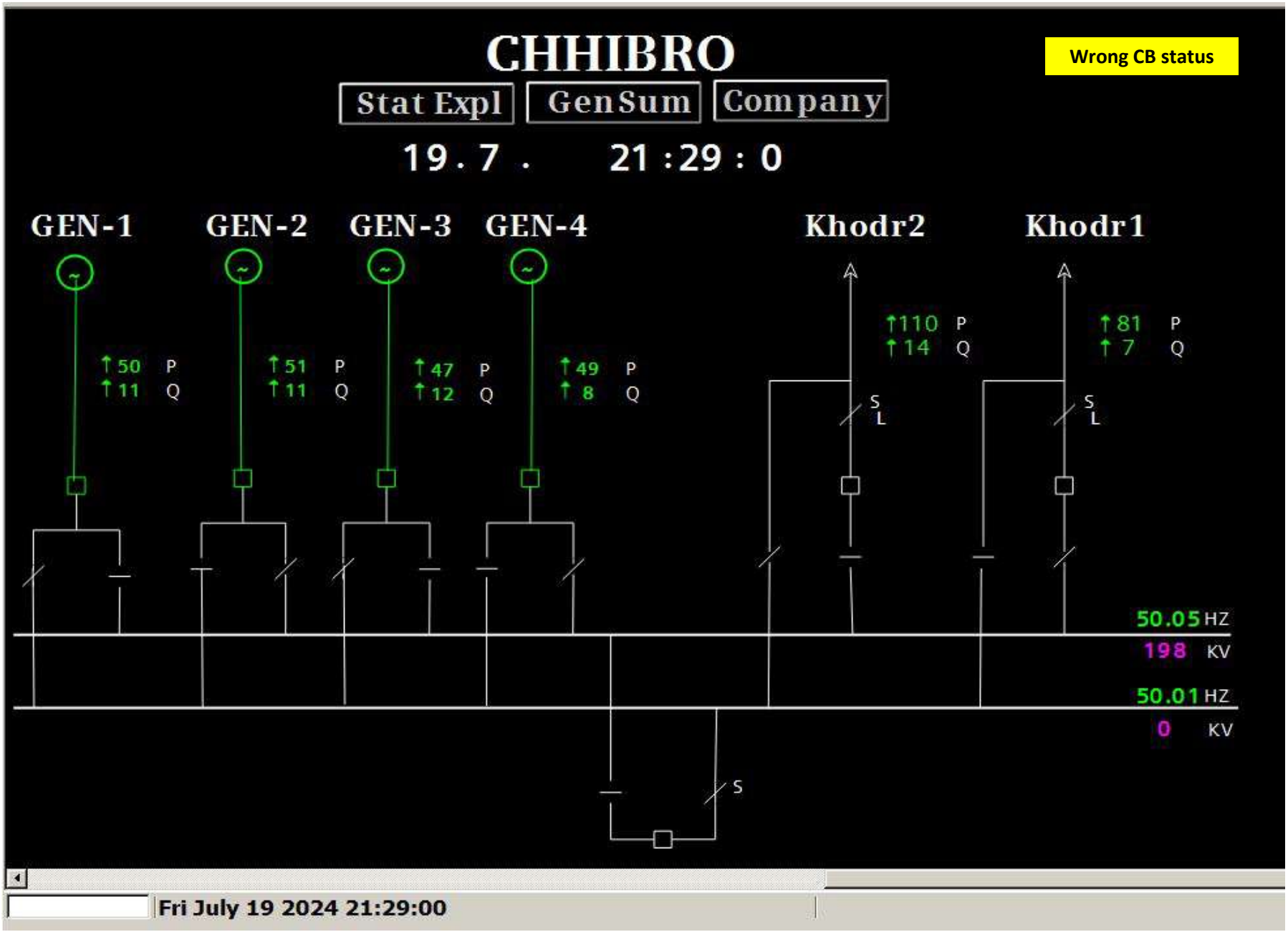
SLD of 220kV Khodri(UK) before the event



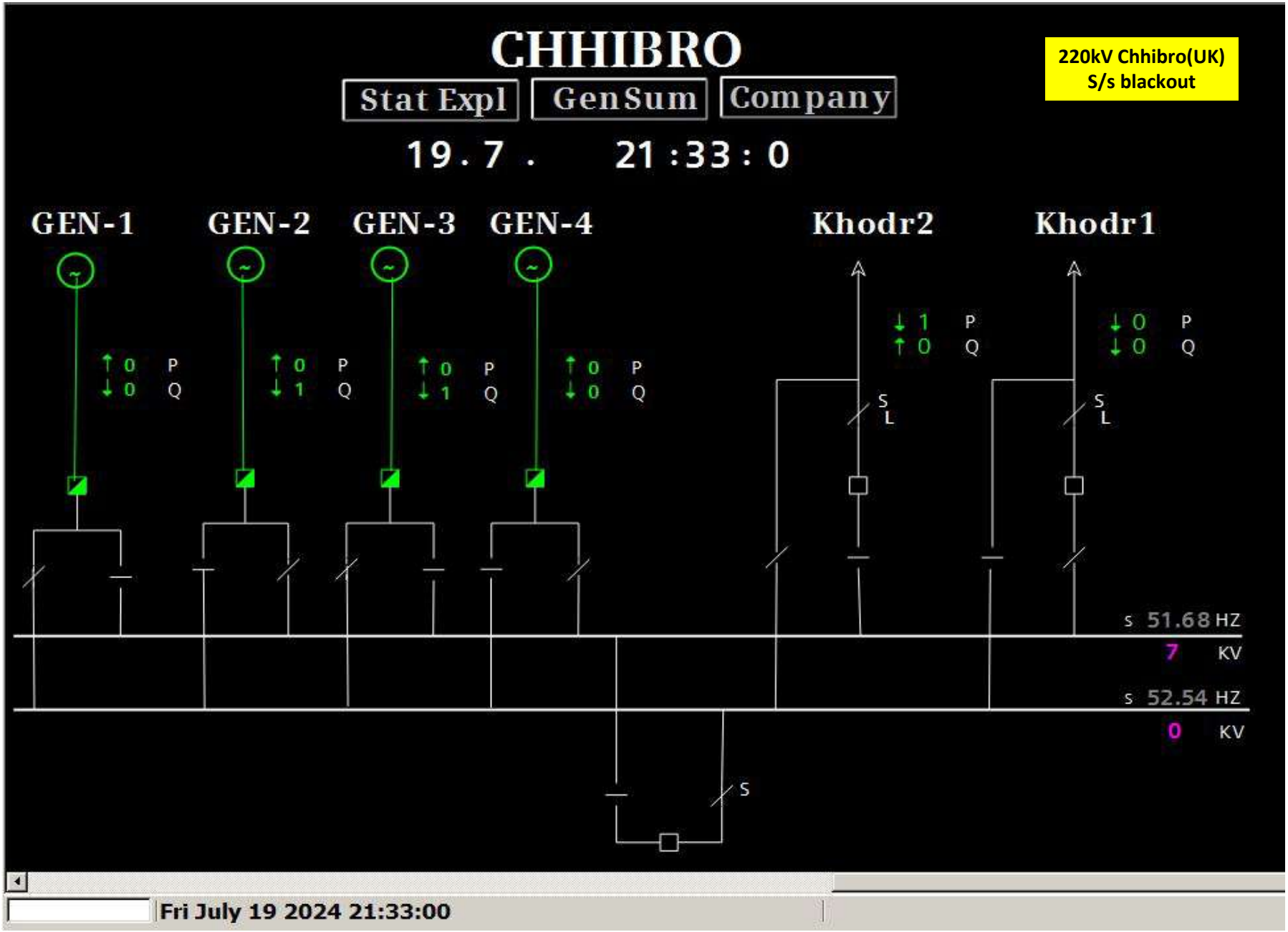
SLD of 220kV Khodri(UK) after the event



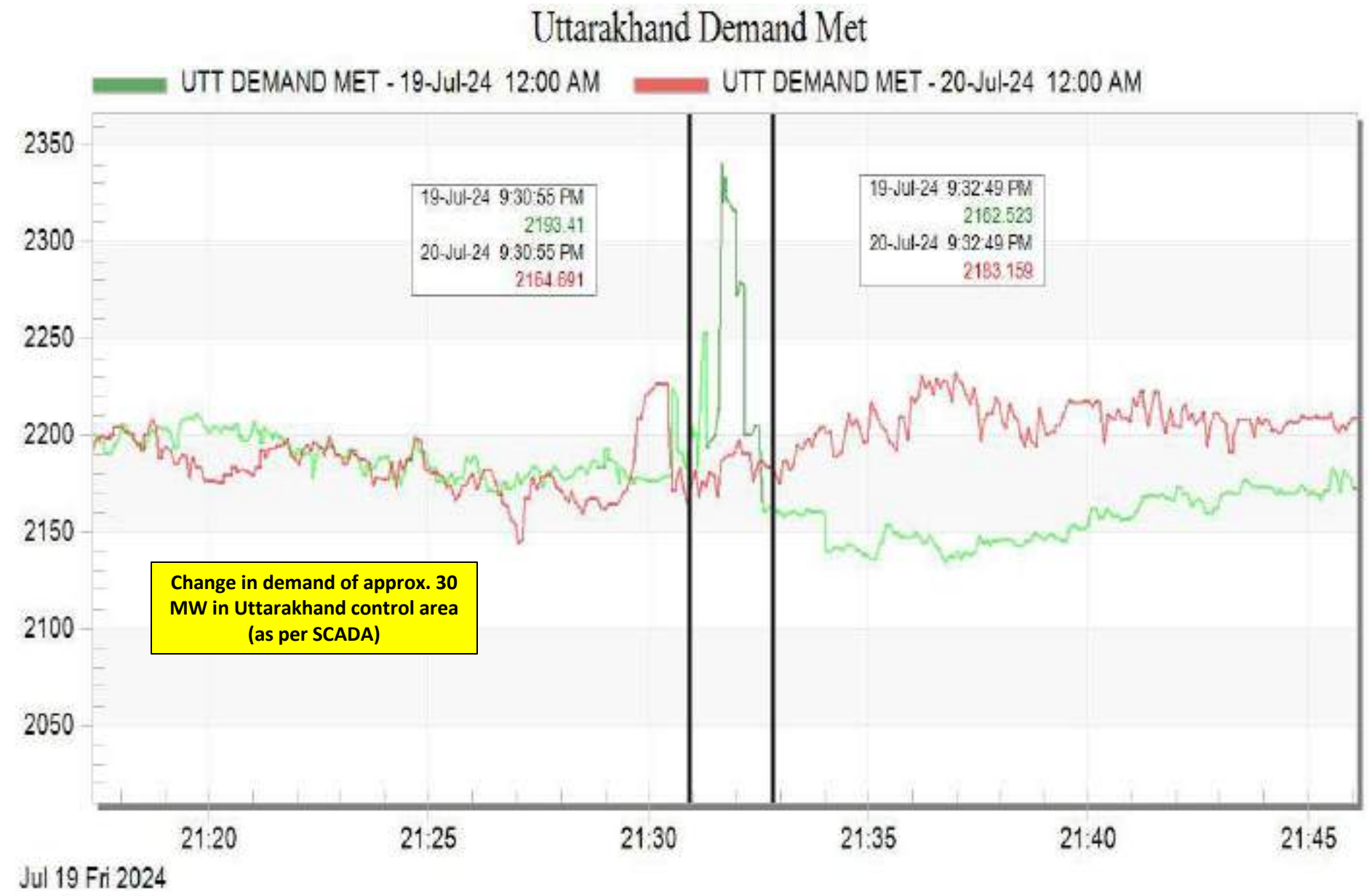
SLD of 220kV Chhibro(UK) before the event



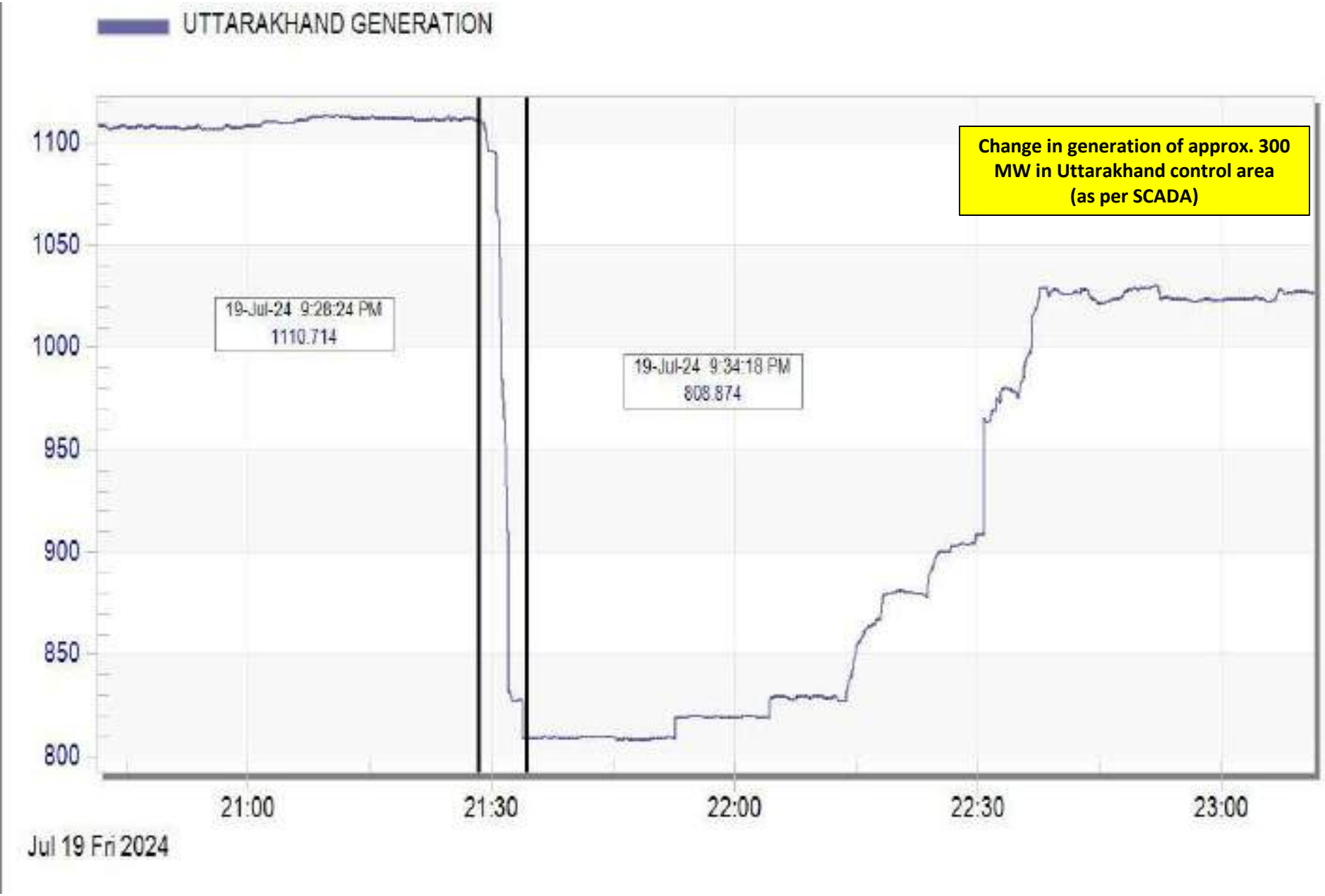
SLD of 220kV Chhibro(UK) after the event



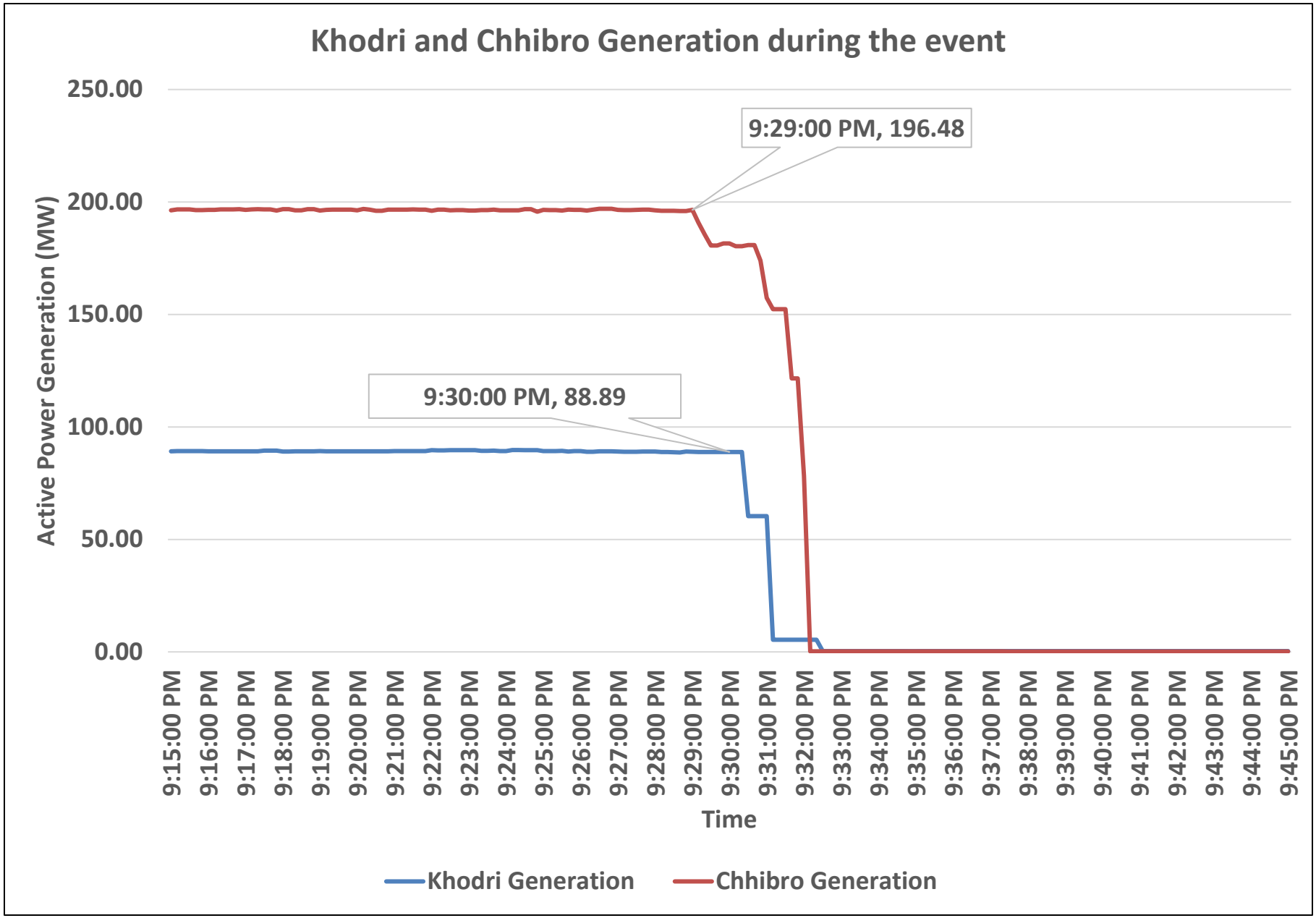
Uttarakhand demand during the event



Uttarakhand generation during the event



Khodri and Chhibro generation during the event

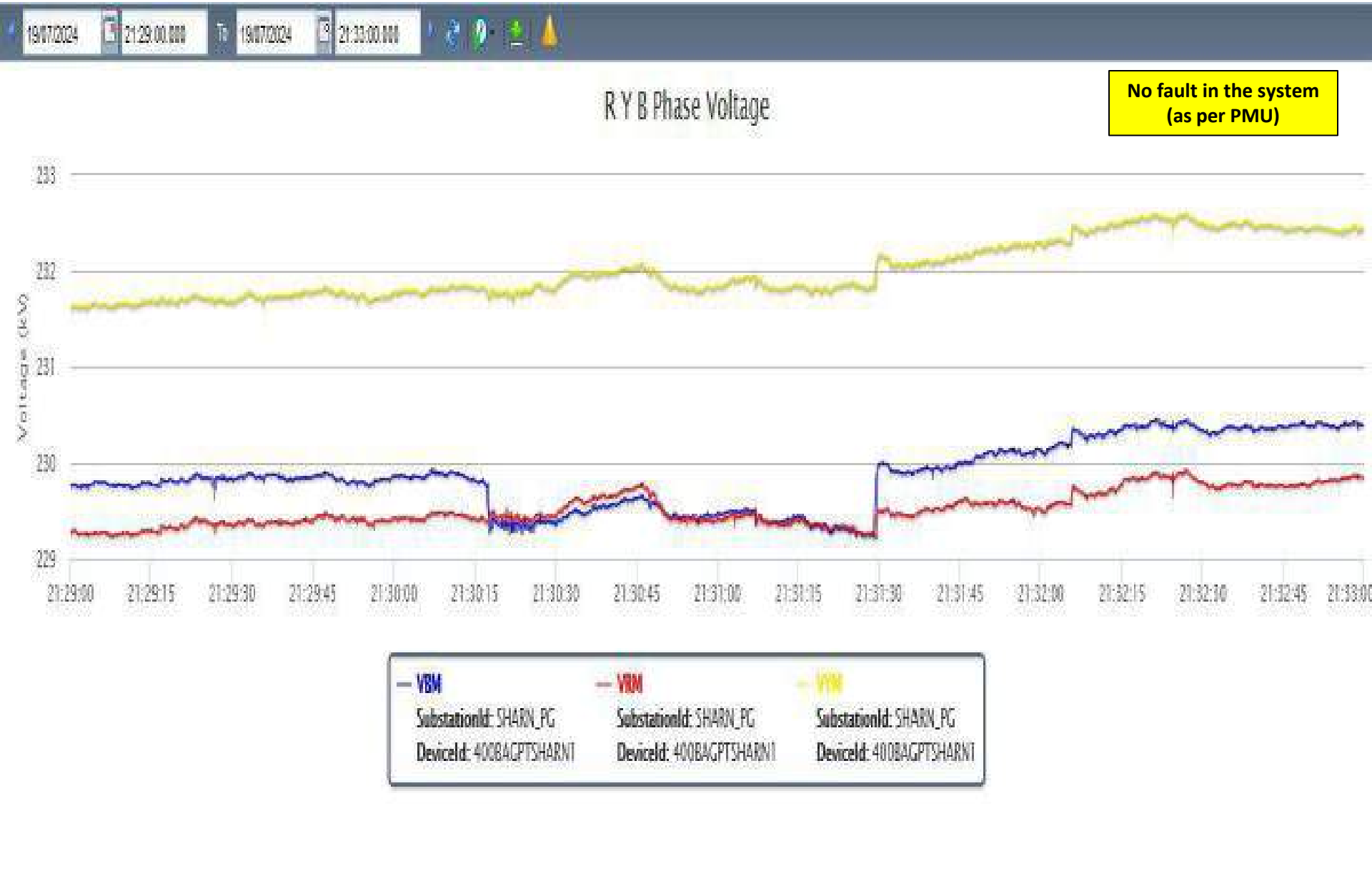


PMU Plot of frequency at Saharanpur(PG)

21:31 hrs/19-July-24

PMU Plot of Phase Voltage Magnitude at Saharanpur(PG)

21:31 hrs/19-July-24



SCADA SOE

Time	Station Name	Voltage Level	Element Name	Element Type	Element Status	Remarks
21:31:06,690	KHODR_UK	220kV	F3CHBRO1	Circuit Breaker	disturbe	
21:31:06,690	KHODR_UK	220kV	SRNPR2	Circuit	Open	Line CB at Khodri(UK) end of 220 kV Saharanpur (UP)-Khodri(UK) (UP) Ckt opened
21:31:15,904	CHBRO_UK	220kV	G3G3	Circuit	disturbe	
21:31:45,752	CHBRO_UK	220kV	G4G4	Circuit	disturbe	
21:31:45,752	CHBRO_UK	220kV	G2G2	Circuit	disturbe	
21:31:45,752	CHBRO_UK	220kV	G1G1	Circuit	disturbe	
21:32:16,208	KHODR_UK	220kV	F1JHJRA	Circuit	disturbe	
21:32:16,208	KHODR_UK	220kV	88MAJRI2	Circuit	disturbe	

Details received from Khodri(Utt)

Mechanical failure of Unit # 02 on 19.07.2024 at 4 x 30 MW Khodri Power Station.							
S.No	Brief description of deficiency	Please tick appropriate type of deficiencies		Action plan to rectify defeciencies in protection system indicating intermediate milestone with date	Date on which complete rectification of deficiency is expected	Compliance w.r.t. Time schedule indicated and constraits, if any in compliance thereof	Remark
		Categary - A (Where no procuremen t is involve)	Categary - B (Where procuremen t is involve)				
1	Mechanical failure of 220 kV GCB of Unit # 02's B phase pole trip/open mechanism on 19.07.2024 at 21:31 hrs.	-	-	The trip/open mechanism of the 220 kV GCB reparied after replacement of control valve assembly & tripping coil and overhauling done. Thereafter Open close timing noted and CRM testing performed. (Copy attached).	At 19:30 hrs on 20.07.2024 the GCB was energised.	-	The Breaker failure/LBB protection operated resulting in opening of all 220 kV Circuit breakers i.e., 04 Generation units + Feeder no. 81, 82, 83, 84, 86, 87, 88, 85 (Bus coupler) and 885 (Auto transformer) alongwith 01 no. 132 k V (785) feeder.

Testing report

Date: - 20/07/2024

Technical report

CGL make 220KV Circuit breaker # 2 installed at Khodri switchyard Power Station

In reference to offer No : SS/CR/BPO/ CG/ 0024/2024-2025, following work of replacement of defective Control valve Assembly, gasket and trip coil with new ones was carried out (Control valve Assembly, Gasket ant Trip coil was provided by the UJVN Limited and following works as mentioned below were also carried out.

1. Dismantling of control valve Assembly from the Mechanism housing.
2. Dismantling of control valve sheet, bend pipe O ring & trip coil from the Mechanism housing.
3. Fixing of new control valve Assembly into the Mechanism housing.
4. Fixing of new control valve sheet, bend pipe O ring & trip coil into the Mechanism housing
5. After replacement of spares, filled air pressure up to 15 Kg/Sq. cm
6. Electrical & manually (Close, Open, Pole Discrepancy and Anti pumping) operation checked found working satisfactorily
7. Whole breaker tested (CRM and Time interval) as per following report satisfactorily.

Timing in milli – Second(ms)	Unit #2 882 Breaker			
	C	O (TC-I)	O (TC-II)	CRM (μΩ)
R	85.0	20.0	20.0	49.2
Y	85.0	20.0	20.0	47.4
B	87.0	20.0	20.0	46.9

Work of CGL make 220KV SF6 breakers was carried out by service team of M/s Shrihar Switchgears & Services Pvt Ltd. This will ensure you,the smooth and safety operation. Now the breaker is ready for operations.

M/S Shrihari Switchgears & Services Pvt Ltd, Meerut

M/S UJVN Limited

Point of discussion

i) Due to LBB operation, only the elements connected to the same bus as Unit-2 should have tripped. Exact reason of ripping of the elements connected to the other bus at Khodri need to be shared.

ii) Wrong status of CB at Khodri and Chhibro was observed during the event. Availability and healthiness of SCADA data need to be ensured.

iii) DR/EL (.dat/.cfg file) of all tripped elements need to be shared.

Multiple elements tripping at 220kV Shahbad(HR) & Rajokheri(HR) 26th August 2024

Brief of event:

i. 220kV Rajokheri(HV) & 220kV Shahbad(HV) S/s have double main bus arrangement at 220kV side.

ii. During antecedent condition, incoming power at Rajokheri(HV) S/s through 220 KV Abdullapur(PG)-Rajokheri (HV) (HVPNL) D/C was approx. 115 MW and outgoing power from Rajokheri(HV) through 220 KV Shahbad-Rajokheri(HV)(HVPNL) D/C was approx. 90 MW. Loading of 220 KV Shahbad-Joria(HV)(HVPNL) D/C and 220 KV Shahbad Durla(HV)(HVPNL) D/C were approx. 100 MW and 75 MW feeding to Shahbad(HV) and Durla(HV) respectively.

iii. As reported, at 22:58 hrs, due to inclement weather conditions, **Y-B phase to phase occurred on 220 KV Shahbad-Rajokheri(HV)(HVPNL) Ckt-1 & 220 KV Abdullapur(PG)-Rajokheri (HV) (HVPNL) Ckt-1**.

iv. As reported, 220 KV Abdullapur(PG)-Rajokheri (HV) (HVPNL) D/C tripped only from Abdullapur(PG) end not from Rajokheri(HV) end. 220 KV Shahbad-Rajokheri(HV)(HVPNL) Ckt-1 tripped on zone-1 distance protection on Y-B-G double phase to ground fault with fault distance of 29km and fault current of Iy=~5.79kA & Ib=~5.39kA from Rajokheri(HV) end. 220 KV Shahbad-Rajokheri(HV)(HVPNL) Ckt-2 & 220 KV Tepla-Rajokheri(HV)(HVPNL) Ckt-2 tripped on direction earth fault from Rajokheri(HV) end. 220 KV Tepla-Rajokheri(HV)(HVPNL) Ckt-1 tripped on zone-3 distance protection on Y-B phase to phase fault from Rajokheri(HV) end (details regarding trippings at Shahbad(HV) S/s is yet to be received).

v. As per PMU at Abdullapur(PG), Y-B phase to phase fault converted into R-Y-B three phase fault with delayed fault clearing time of 2040msec is observed.

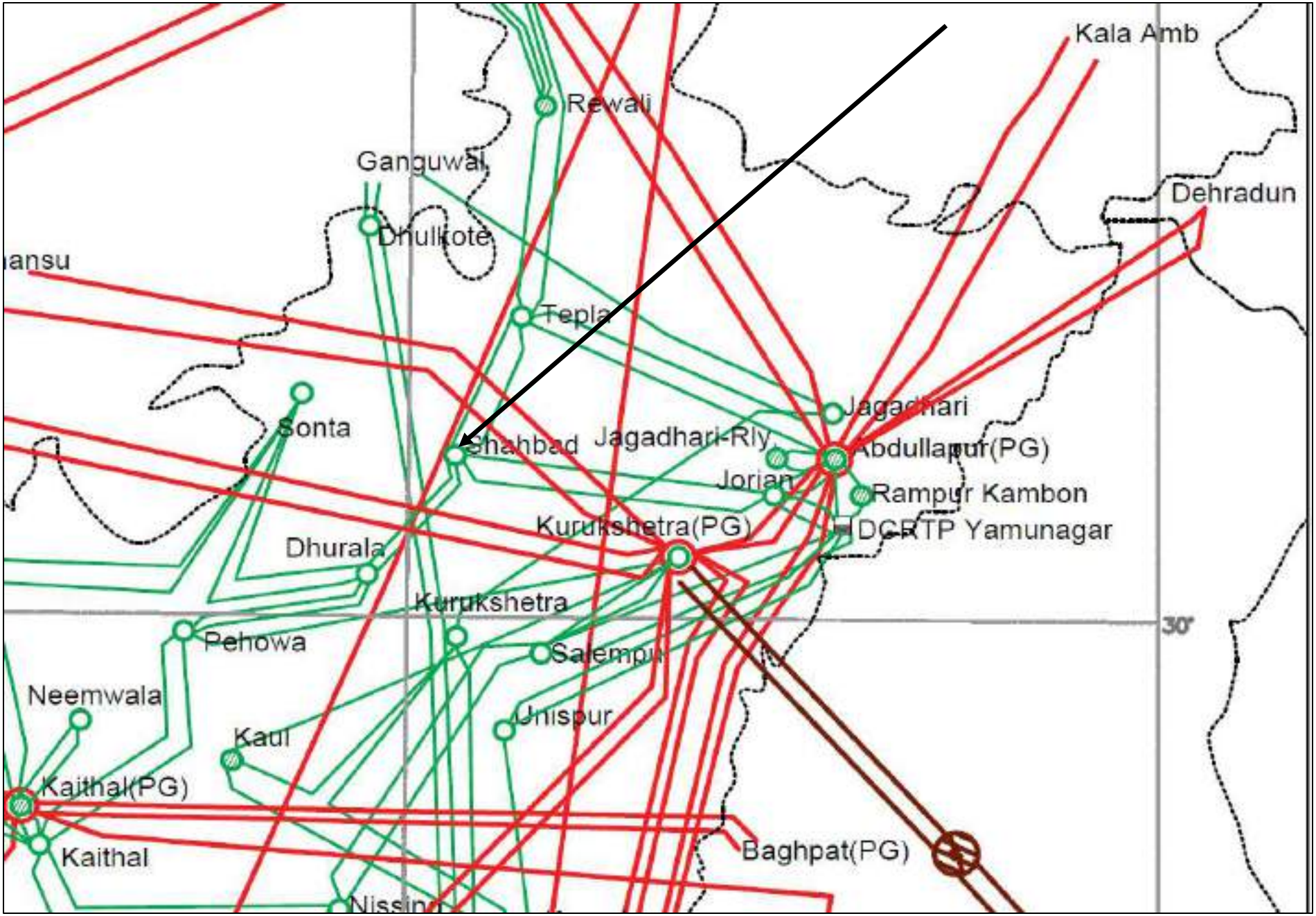
Brief of event:

vi. Due to tripping of all 220kV lines at Rajokheri(HV) & Shahbad(HV), both sub-stations lost their connectivity from Grid which led to blackout of 220kV Rajokheri(HV) S/s & 220kV Shahbad(HV) S/s.
vii. As per SCADA, change in demand of approx. 350 MW in Haryana control area.

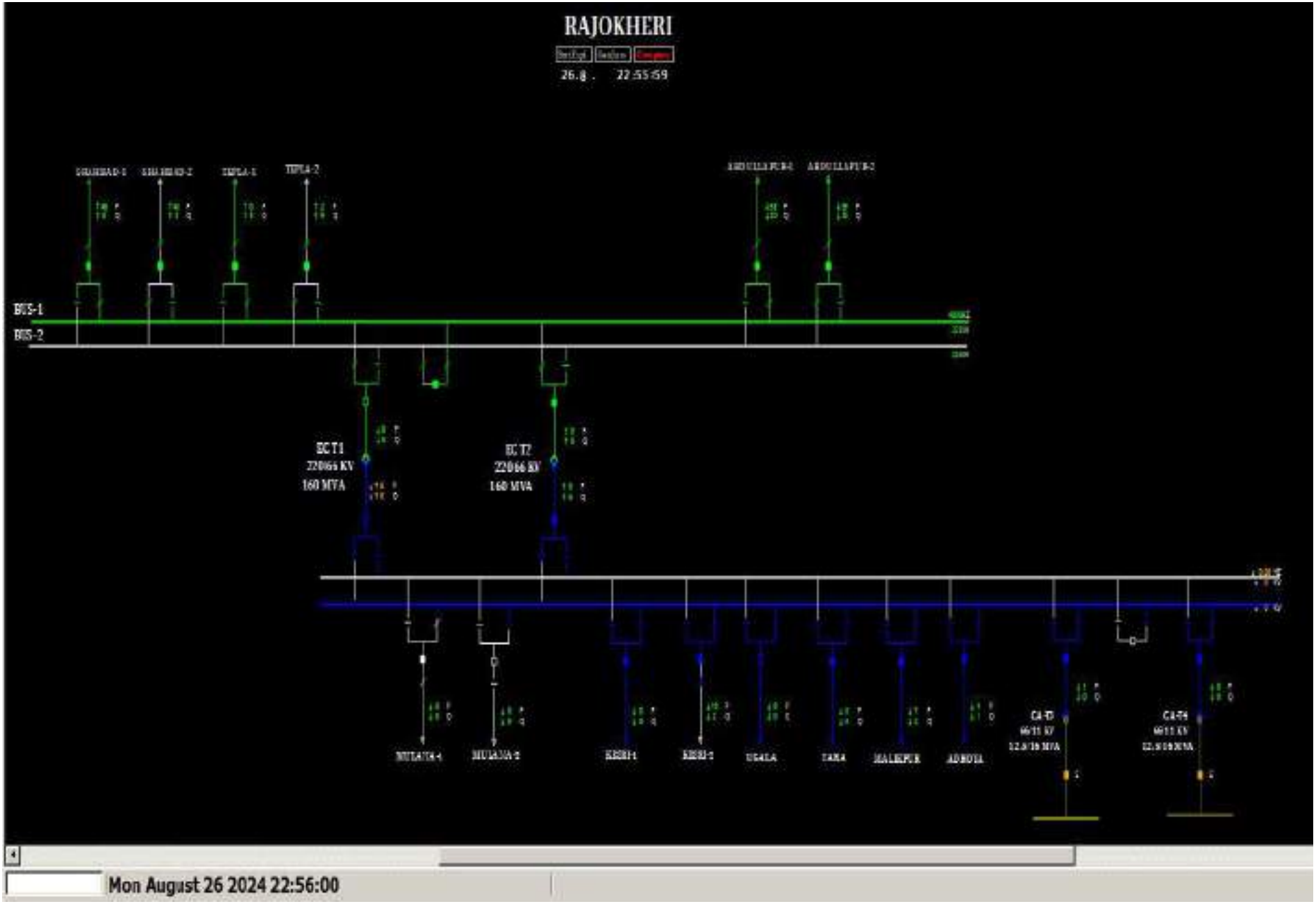
Elements tripped:

i. 220 KV Abdullapur(PG)-Rajokheri (HV) (HVPNL) Ckt-1
ii. 220 KV Abdullapur(PG)-Rajokheri (HV) (HVPNL) Ckt-2
iii. 220 KV Shahbad-Rajokheri(HV)(HVPNL) Ckt-1
iv. 220 KV Shahbad-Rajokheri(HV)(HVPNL) Ckt-2
v. 220 KV Tepla-Rajokheri(HV)(HVPNL) Ckt-1
vi. 220 KV Tepla-Rajokheri(HV)(HVPNL) Ckt-2
vii. 220 KV Shahbad-Durla(HV)(HVPNL) Ckt-1
viii. 220 KV Shahbad-Durla(HV)(HVPNL) Ckt-2
ix. 220 KV Shahbad-Joria(HV)(HVPNL) Ckt-1
x. 220 KV Shahbad-Joria(HV)(HVPNL) Ckt-2

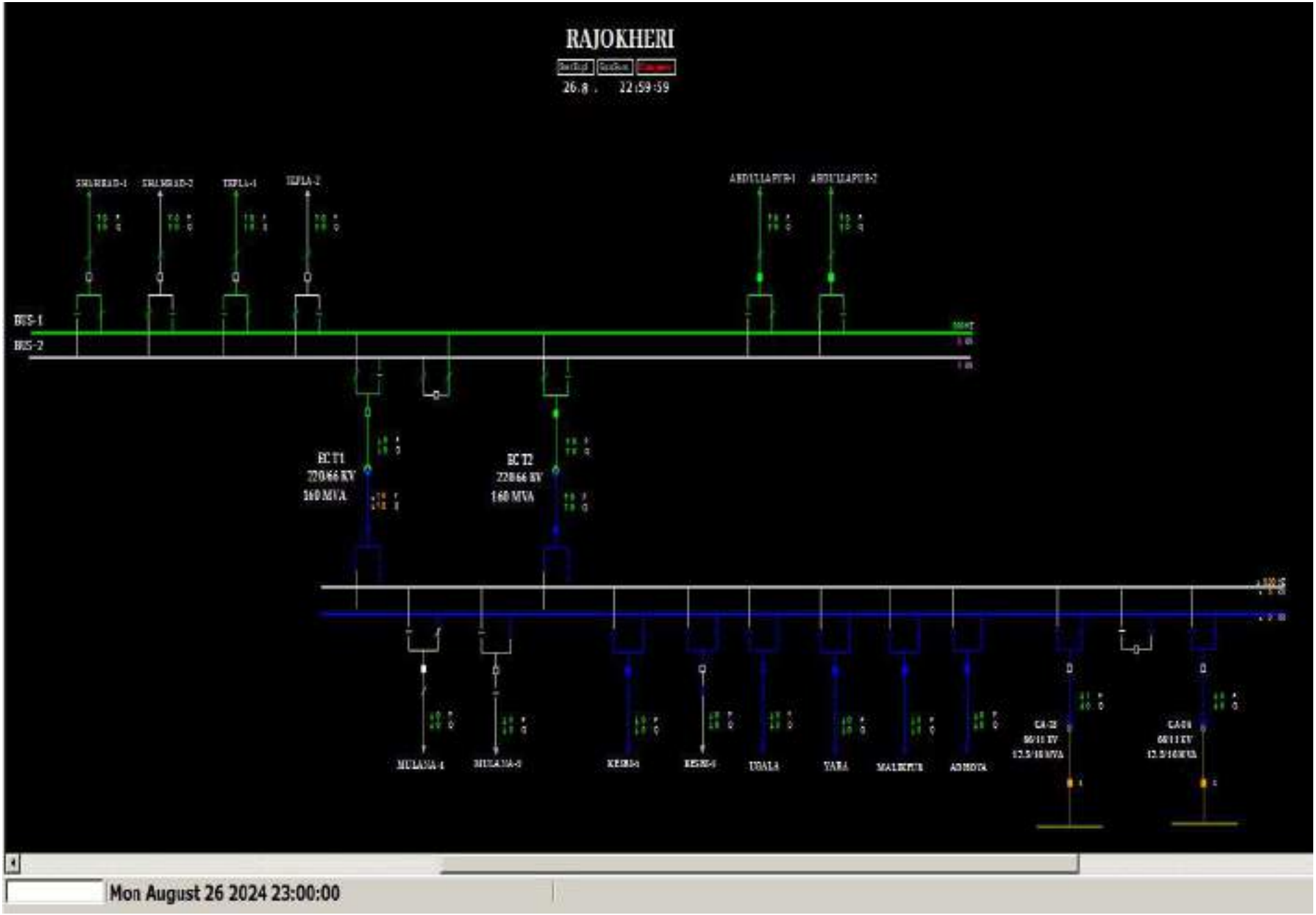
Network Diagram



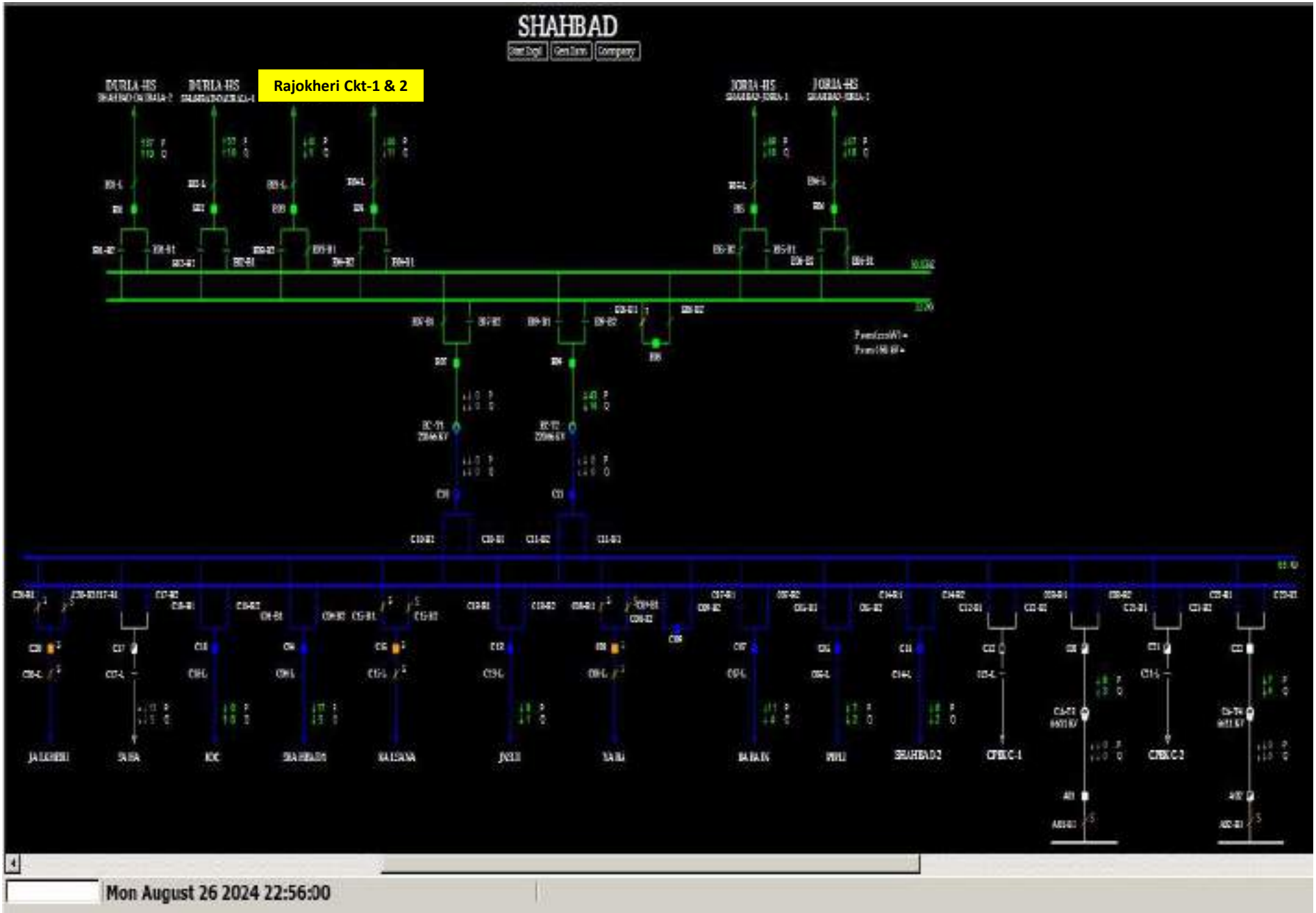
SLD of 220kV Rajokheri(HV) before the event



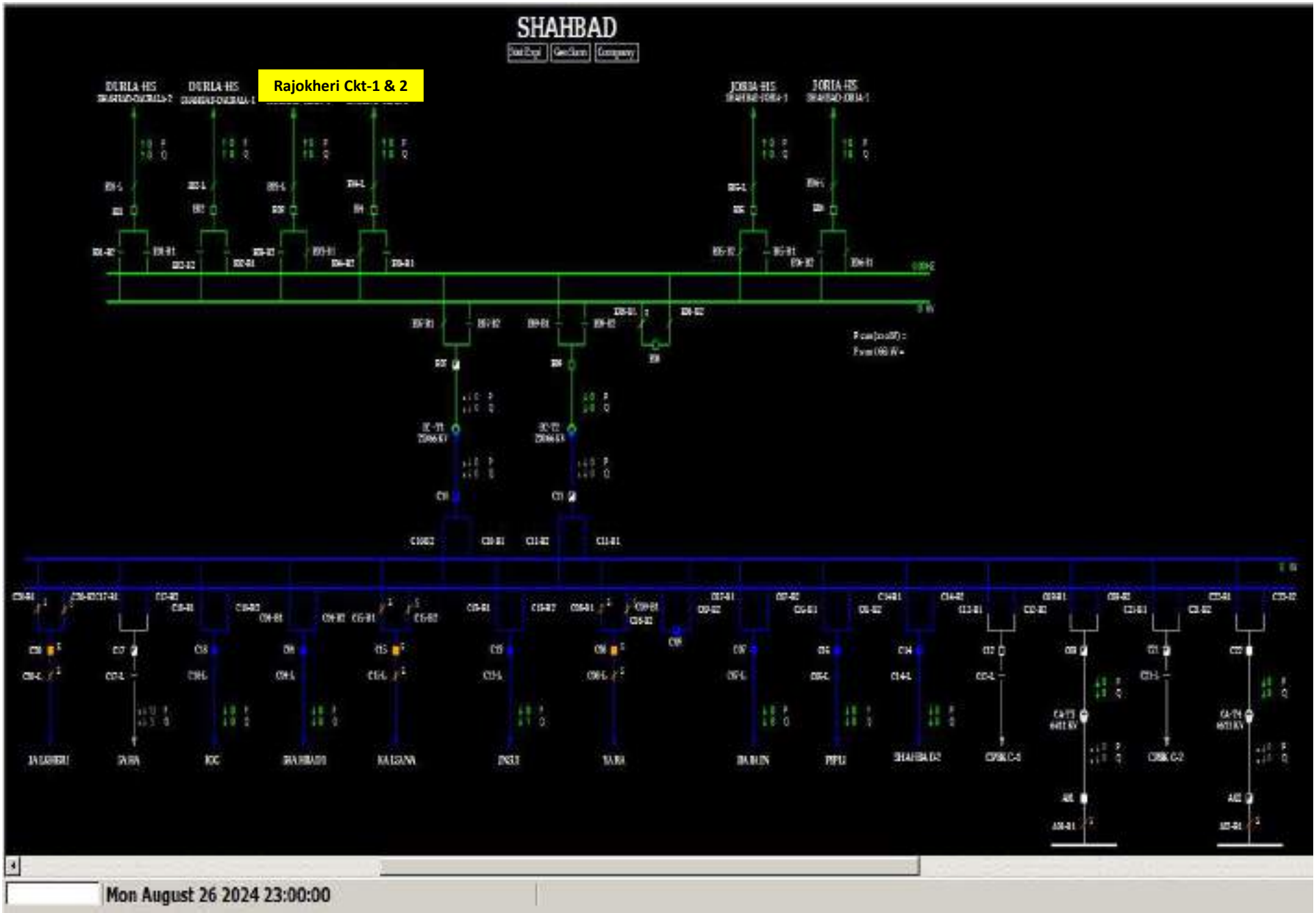
SLD of 220kV Rajokheri(HV) after the event



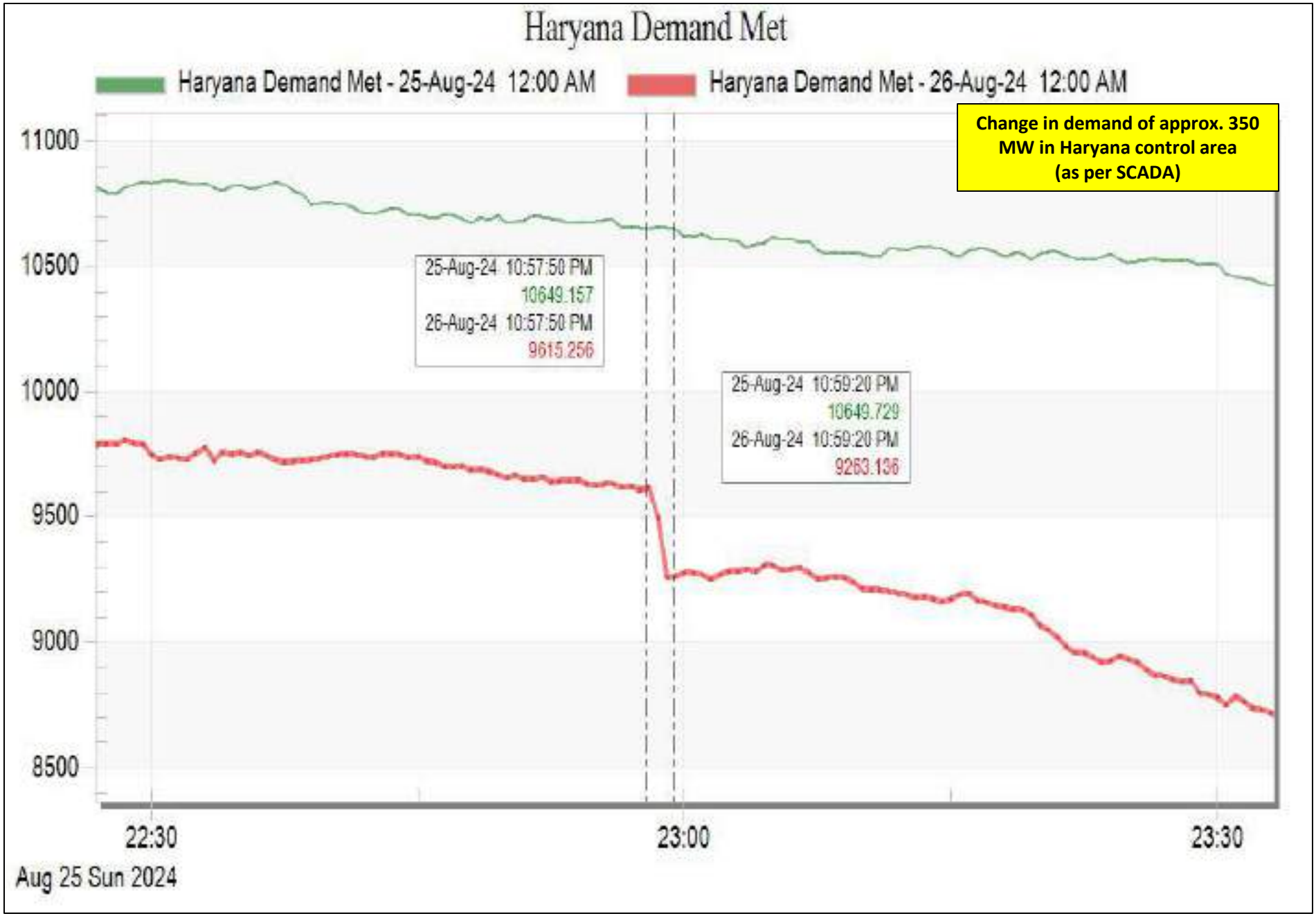
SLD of 220kV Shahbad(HV) before the event



SLD of 220kV Shahbad(HV) after the event

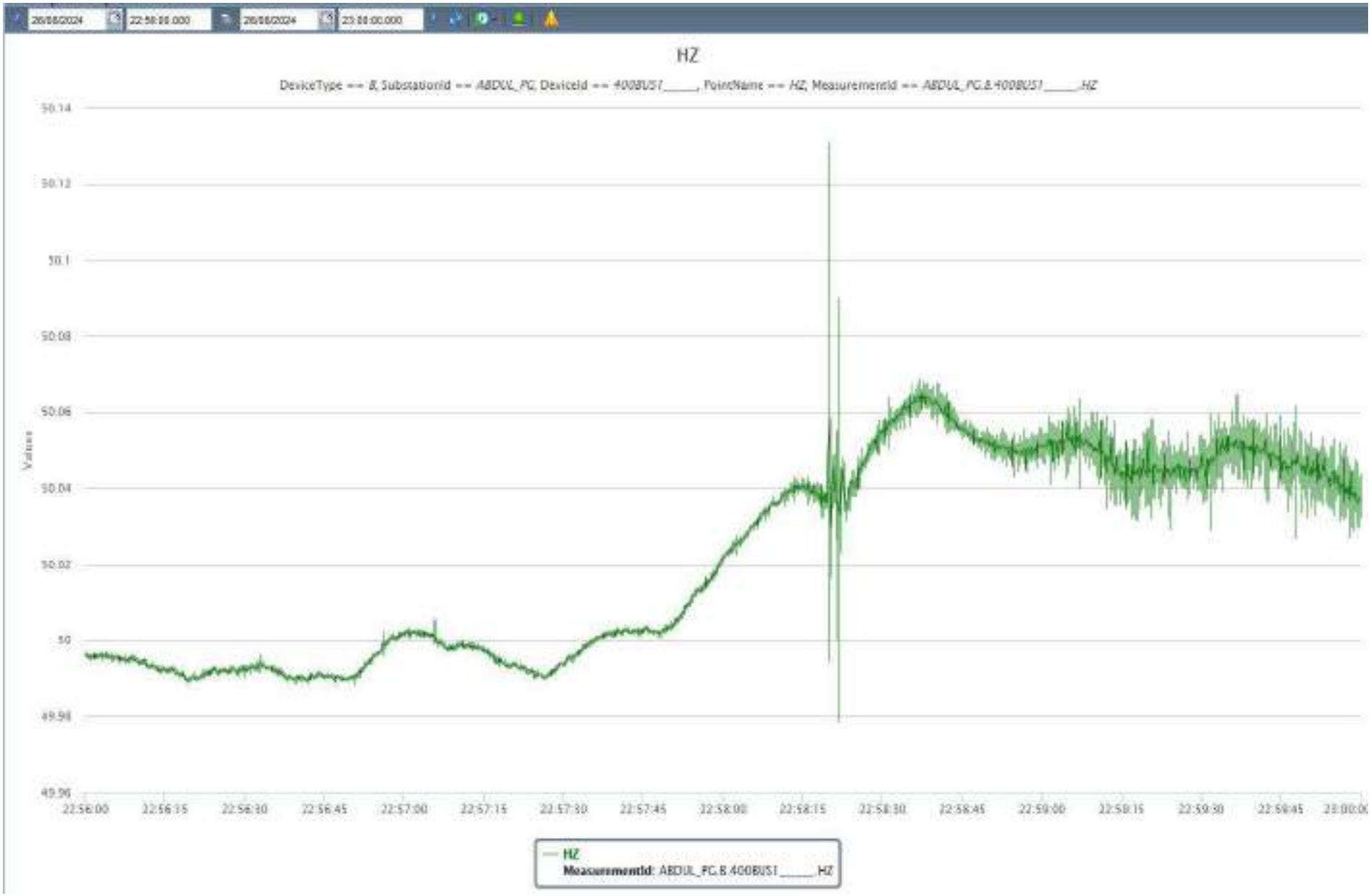


Haryana Demand during the event



PMU Plot of frequency at Abdullapur(PG)

22:58 hrs/26-August-24



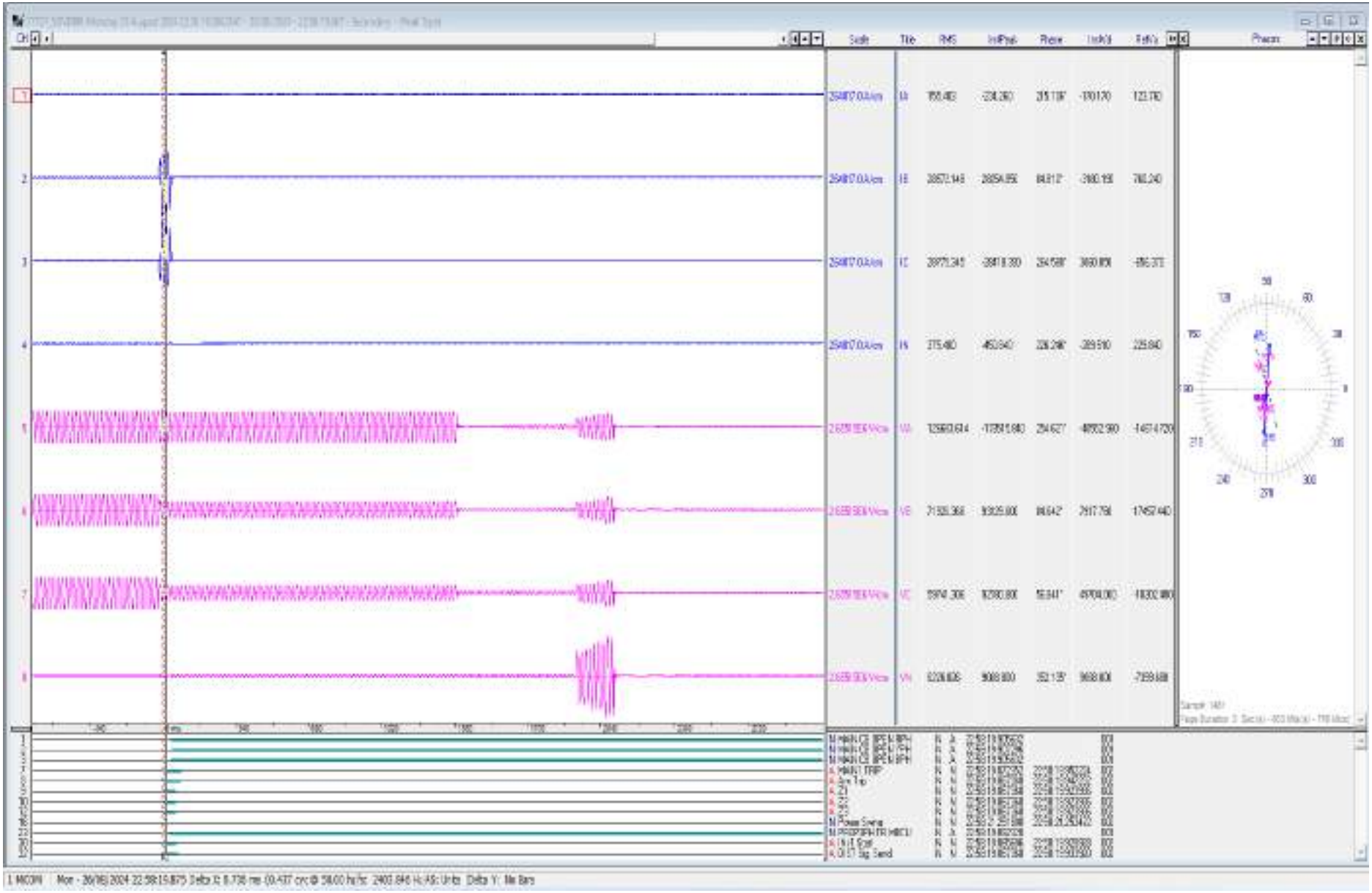
PMU Plot of Phase voltage magnitude at Abdullapur(PG)

22:58 hrs/26-August-24

SCADA SOE

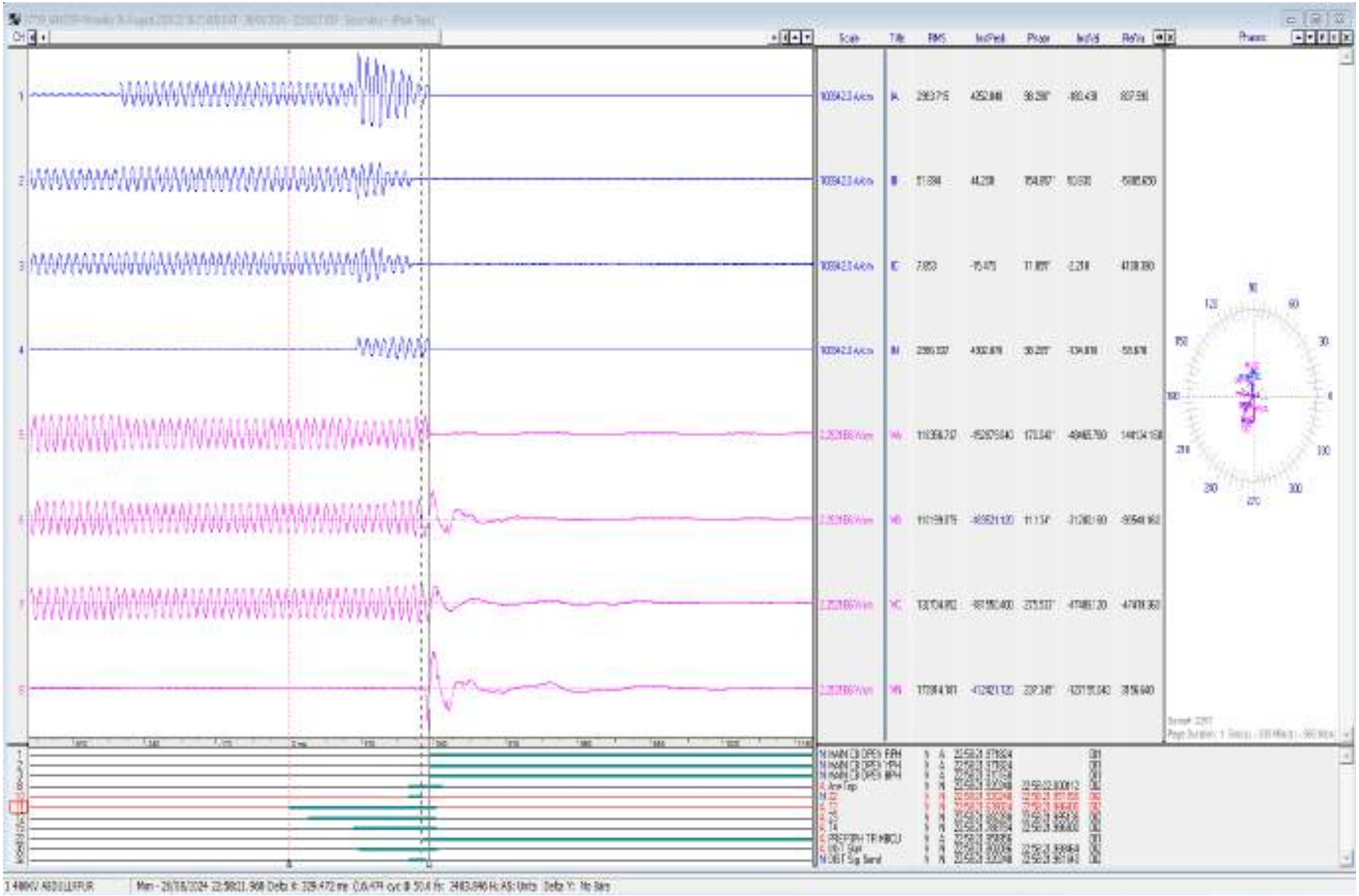
Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remarks
22:58:19,921	ABDUL_PG	220kV	15RJKHR1	Circuit Breaker	Open	Line CB at Abdullapur(PG) end of 220 KV Abdullapur(PG)-Rajokheri (HV) (HVPNL) Ckt-1 opened
22:58:21,008	RJKRI_HS	220kV	03TEPLA1	Circuit Breaker	Open	Line CB at Rajokheri(HV) end of 220 KV Tepla-Rajokheri (HVPNL) Ckt-1 opened
22:58:21,955	SHBAD_HS	220kV	09T2	Circuit Breaker	Open	CB at Shahbad(HV) end of 220/66kV ICT-2 opened from 220kV side
22:58:21,968	SHBAD_HS	220kV	03TEPLA1	Circuit Breaker	Open	Line CB at Shahbad(HV) end of 220 KV Tepla-Shahbad (HVPNL) Ckt-1 opened
22:58:21,973	RJKRI_HS	220kV	04TEPLA2	Circuit Breaker	Open	Line CB at Rajokheri(HV) end of 220 KV Tepla-Rajokheri (HVPNL) Ckt-2 opened
22:58:21,975	RJKRI_HS	220kV	08MBC	Circuit Breaker	Open	Main bus coupler at Rajokheri(HV) end of 220kV bus-1 &bus-2 opened
22:58:21,986	ABDUL_PG	220kV	16RJKHR2	Circuit Breaker	Open	Line CB at Abdullapur(PG) end of 220 KV Abdullapur(PG)-Rajokheri (HV) (HVPNL) Ckt-2 opened
22:58:21,998	SHBAD_HS	220kV	05JORIA1	Circuit Breaker	Open	Line CB at Shahbad(HV) end of 220 KV Joria-Shahbad (HVPNL) Ckt-1 opened
22:58:21,999	SHBAD_HS	220kV	08MBC	Circuit Breaker	Open	Main bus coupler at Shahbad(HV) end of 220kV bus-1 &bus-2 opened
22:58:22,005	SHBAD_HS	220kV	04TEPLA2	Circuit Breaker	Open	Line CB at Shahbad(HV) end of 220 KV Tepla-Shahbad (HVPNL) Ckt-2 opened
22:58:22,007	SHBAD_HS	220kV	02DURLA1	Circuit Breaker	Open	Line CB at Shahbad(HV) end of 220 KV Durla-Shahbad (HVPNL) Ckt-1 opened
22:58:22,009	SHBAD_HS	220kV	06JORIA2	Circuit Breaker	Open	Line CB at Shahbad(HV) end of 220 KV Joria-Shahbad (HVPNL) Ckt-2 opened
22:58:22,017	RJKRI_HS	220kV	02SHBAD2	Circuit Breaker	Open	Line CB at Rajokheri(HV) end of 220 KV Shahbad-Rajokheri (HVPNL) Ckt-2 opened
22:58:22,039	RJKRI_HS	220kV	01SHBAD1	Circuit Breaker	Open	Line CB at Rajokheri(HV) end of 220 KV Shahbad-Rajokheri (HVPNL) Ckt-1 opened
22:58:22,781	SHBAD_HS	220kV	01DURLA2	Circuit Breaker	Open	Line CB at Shahbad(HV) end of 220 KV Durla-Shahbad (HVPNL) Ckt-2 opened

DR of 220kV Abdullapur(end)-Rajokheri ckt-1



Y-B fault, Z-1, 3-ph trip (As reported, FD:1.3km)

DR of 220kV Abdullapur(end)-Rajokheri ckt-2



R-Y-B fault, Z-2, 3-ph trip (As reported, FD:23.41km)

Protection operation at 220kV Rajokheri(HR) (details submitted by HVPNL)

PANCHKULA CIRCLE

								of line)				
2	220kV Rajo Kheri XEN TS Ambala	220kV Rajo Kheri - A/pur Ckt.-1		(26.08.24) 22:57	(27.08.24) 01:57	03:00	Not tripped	Y&B Phase, D=22.4 KM, Master 88	Tripped alongwith 220kV Rajokheri - Shahbad Ckt.-1		Nil	The 220 KV Abdullapur D/C was remain intact at 220 KV Rajokheri.
3		220kV Rajo Kheri - A/pur Ckt.-2		(26.08.24) 22:57	(27.08.24) 01:58	03:01	Not tripped	DPR, D=17.34 KM,Y&B Phase, Master 88				
4		220kV Rajo Kheri - Shahbad Ckt.-1		(26.08.24) 22:57	(27.08.24) 07:35	08:38	DPR, Z-1, D=29.22 KM, YBG Phase, Master 86	DPR, Z-1, D=10.15 KM, Master 86	Transient fault		Nil	The 220 KV Shahbad ckt-1 was tripped with the operation of DPR Zone-1 at 220 KV Rajokheri end due to transient fault on YBG phase. The Autocloser was in lockout position as the fault type was phase to phase to ground.
5		220kV Rajo Kheri - Shahbad Ckt.-2		(26.08.24) 22:57	(27.08.24) 01:55	02:58	E/F & Master 86	Not tripped	Transient fault		Nil	220 KV Shahbad ckt-2 was tripped with operation of E/F relay. 220 KV Rajokheri Shahbad is D/C line and on the same tower. It is presumed that when a transient fault occurred on 220 KV Rajokheri Shahbad ckt-1 the relay at 220 KV Rajokheri has seen the fault in forward direction and cleared the fault in minimal time.
6		220kV Rajo Kheri - Tepla Ckt.-1		(26.08.24) 22:57	(26.08.24) 23:17	00:20	E/F & Master 86	Not tripped	Transient fault		Yes (220kV Rajokheri upto 23:15 hrs.)	220 KV Tepla ckt-1 was tripped with operation of E/F relay. There was thunderstorm with rain in that area and creates a transient fault in the line to isolate the fault the protection was operated.
7		220kV Rajo Kheri - Tepla Ckt.-2		(26.08.24) 22:57	(26.08.24) 23:15	00:18						220 KV Tepla ckt-2 was tripped with operation of E/F relay. There was thunderstorm with rain in that area and creates a transient fault in the line to isolate the fault the protection was operated.
8		220kV Bus Coupler		(26.08.24) 22:57	(27.08.24) 01:50	02:53	E/F & Master 86		Tripped alongwith 220kV Rajokheri - Shahbad Ckt.-II			220 KV Bus coupler was tripped because the fault current was observed by the relay on 220 KV Bus coupler during the disturbance of other 220 KV lines emanating from 220 KV Rajokheri hence the protection was operated.
9	220kV											

Protection operation at 220kV Shahbad(HR) (details submitted by HVPNL)

											protection was operated.
9	220kV Shahbad XEN TS Ambala	220kV Shahbad - Durala Ckt.-1		(26.08.24) 22:57	(26.08.24) 23:35	00:38	Bus Bar Protection operated	Not tripped	Bus Bar Protection operated alongwith 220kV Rajokheri - Shahbad Ckt.-1		Nil	1. The 220 KV Bus bar protection was operated showing check zone differential current with the tripping of 220 KV Rajokheri ckt-1 from 220 KV Shahbad. 2. During checking it was found that the open/close status of 220 KV isolators on Bus -1 and Bus-2 are not coming properly in the bus bar differential relays (R,Y & B phase). Due to this bus bar differential scheme was not able to sense the proper CT selection circuit and creates the difference in the check zone however there was no fault current recorded in the Zone-1 and Zone-2 in the Bus bar protection relay. Further the control cables in the Bus Bar Protection panel were found short circuited during set right the proper status of isolators. 3. SSE is advised to monitor the proper selection of Isolators on Bus-1 and Bus-2 and Open and close status of Breakers in the 220 KV Bus Bar protection relays.
10		220kV Shahbad - Durala Ckt.-2		(26.08.24) 22:57	(26.08.24) 23:40	00:43					
11		220kV Shahbad - Jorian Ckt.-1		(26.08.24) 22:57	(26.08.24) 23:20	00:23					Yes (220kV S/Bad upto 23:28 hrs.)
12		220kV Shahbad - Jorian Ckt.-2		(26.08.24) 22:57	(26.08.24) 23:23	00:26					
13		220kV Bus Coupler		(26.08.24) 22:57	(26.08.24) 23:25	00:28					-
14		220/66kV 100 MVA T/F T-1		(26.08.24) 22:57	(26.08.24) 23:28	00:31					Yes (220kV S/bad upto 23:28 hrs (73 Nos. 11kV Feeders)
15		220/66kV 100 MVA T/F T-2		(26.08.24) 22:57	(26.08.24) 23:30	00:33					
16		220/66kV 100 MVA T/F T-6		(26.08.24) 22:57	(26.08.24) 23:33	00:36					

Point of discussion

- Exact location of fault seen by distance protection relay at Rajokheri end at 22:58:19:800 hrs ?
- Protection operation at 22:58:19:800 hrs at Rajokheri end on Y-B fault? Delayed clearance of fault is observed.
- DR/EL of all the tripped lines at Rajokheri end not received. Same need to be submitted.
- As reported, Bus bar differential relay maloperated at 220kV Shahbad(HR) due to issue in isolator status. Exact details of issues need to be shared.
- DR of bus bar relay need to be shared.
- Remedial action taken report to be shared.

Multiple elements tripping at 220kV Barn (J&K) 02nd August 2024

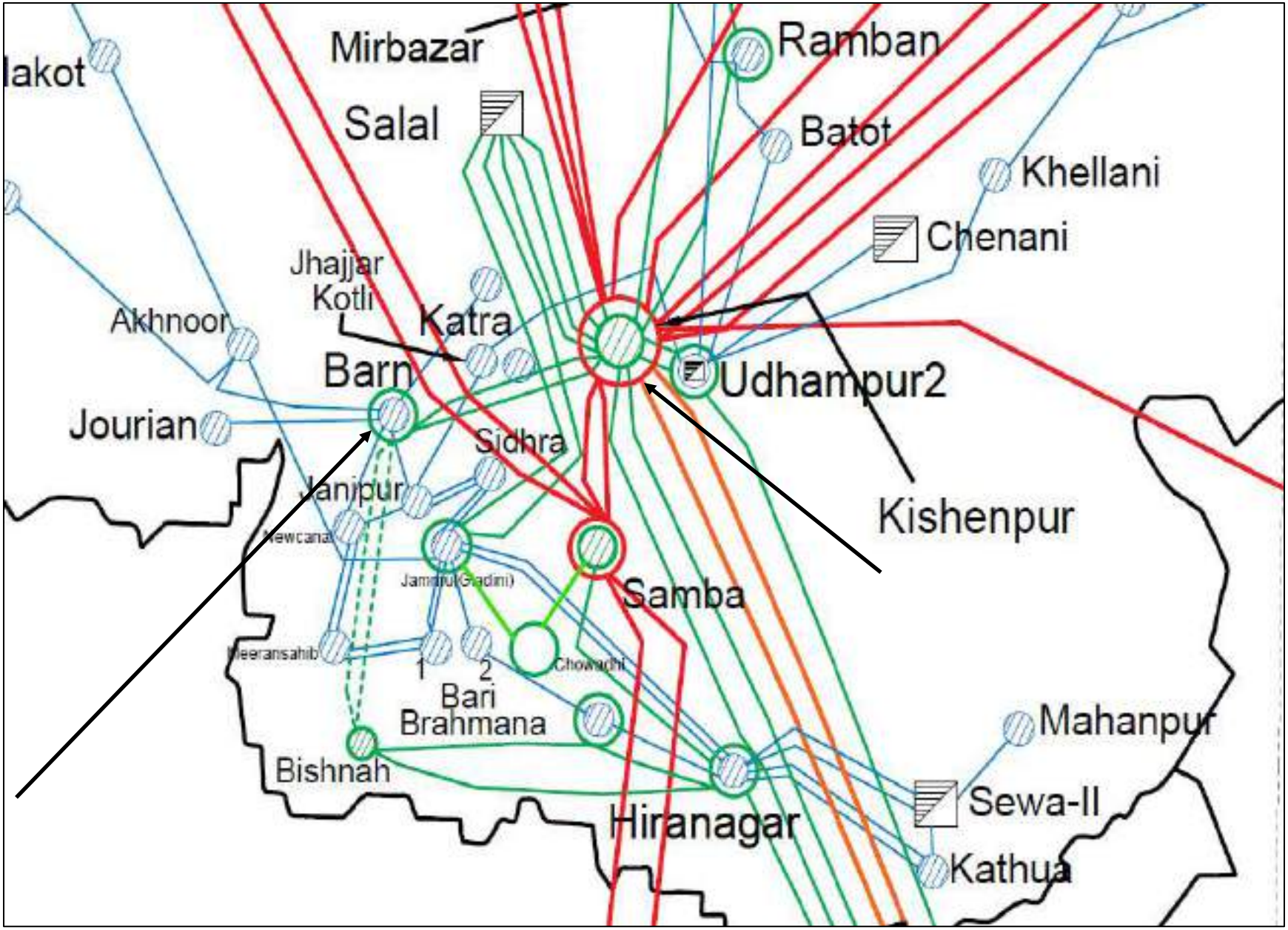
Brief of event:

i. As reported, at 15:03hrs, 220/132kV 160MVA ICT-1, 132kV Barn-Canal (JK) D/C tripped at Barn(JK) S/s on Y-B phase to phase fault which occurred on 132kV Barn-Canal (JK) D/C (exact reason, location of fault and type of protection operated is yet to be received).
ii. As reported, due to tripping of ICT-1, the complete load shifted on 220/132kV 160MVA ICT-2 & 3 which led to tripping of 220/132kV 160MVA ICT-2 & 3 on overloading at Barn(JK) S/s.
iii. As per PMU at Kishenpur(PG), Y-B phase to phase fault with fault clearing time of 120ms is observed.
iv. As per SCADA, load loss of approx. 345MW occurred in J&K control area.

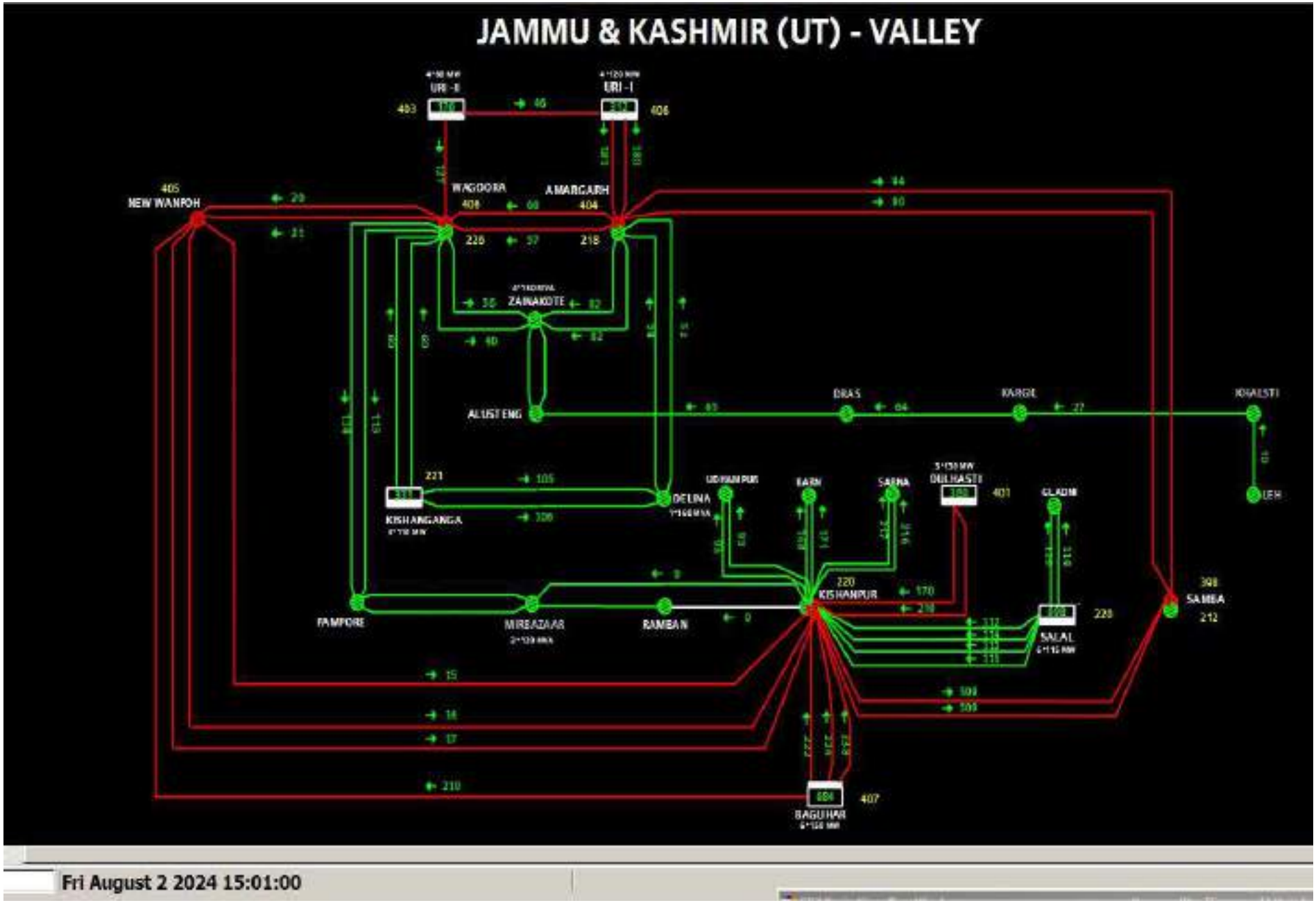
Elements tripped:

i. 220/132kV 160MVA ICT-1 at Barn (JK)
ii. 220/132kV 160MVA ICT-2 at Barn (JK)
iii. 220/132kV 160MVA ICT-3 at Barn (JK)
iv. 132kV Barn-Canal (JK) Ckt-1
v. 132kV Barn-Canal (JK) Ckt-2

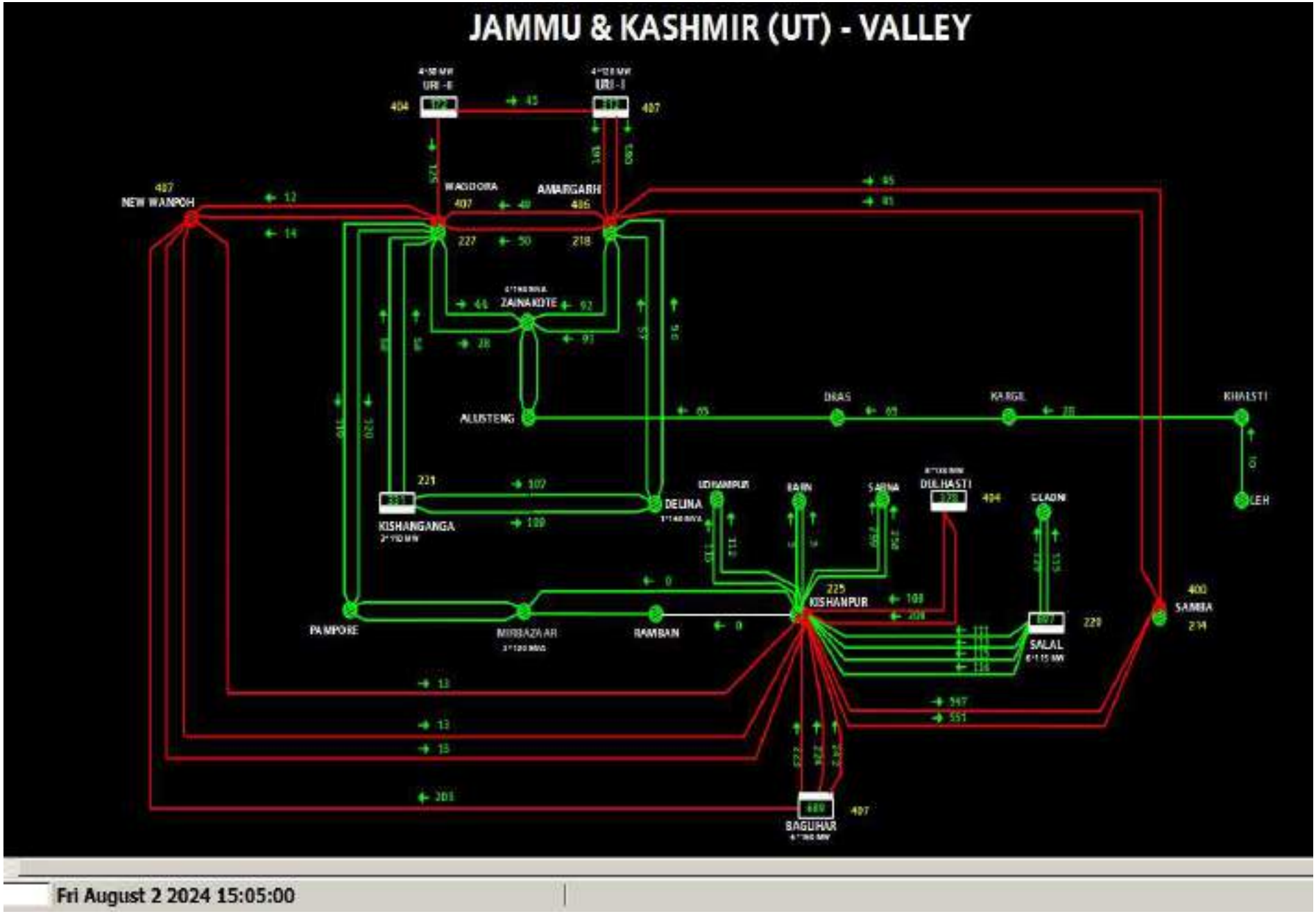
Network Diagram



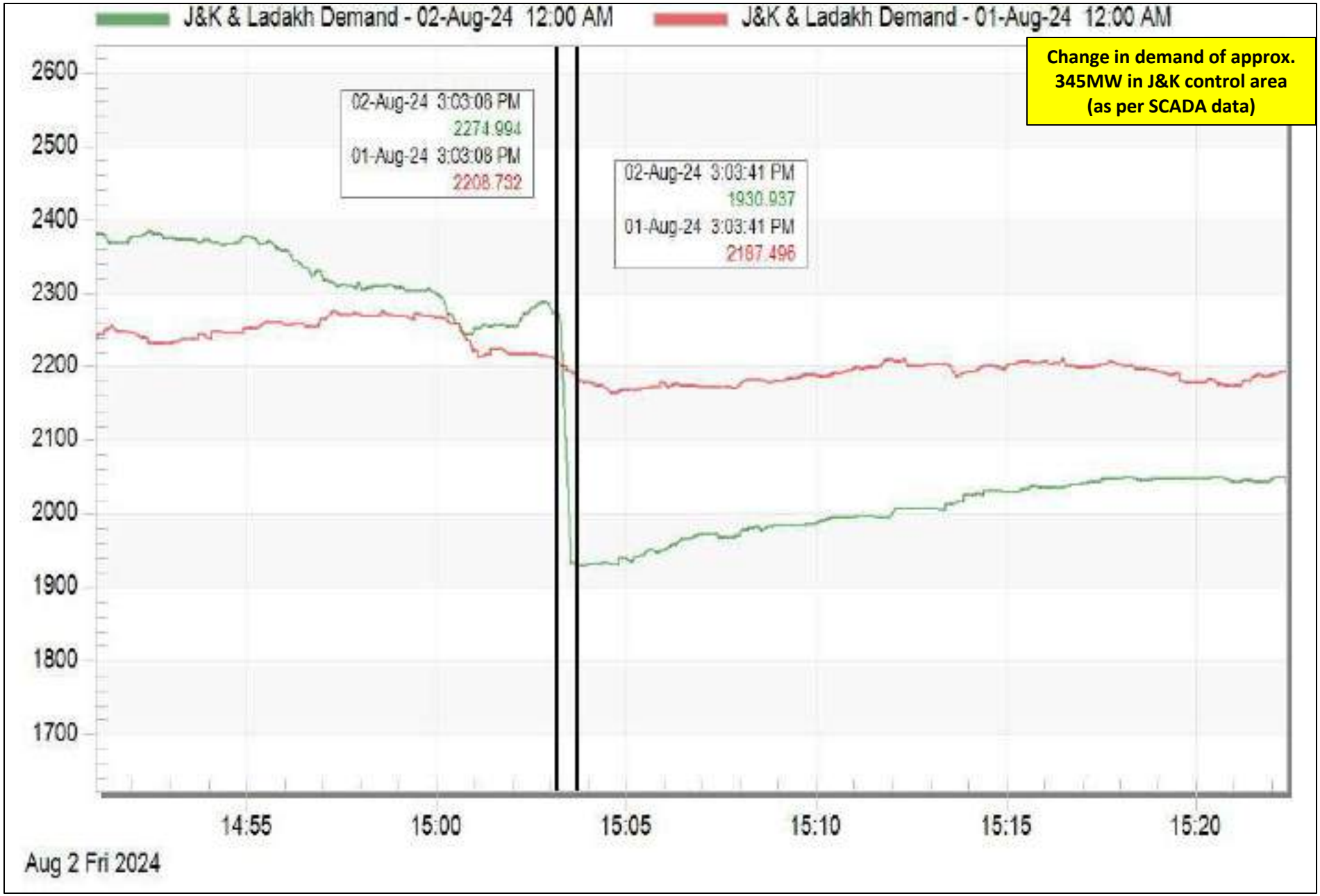
J&K (UT)-Valley Network Diagram before the event



J&K (UT)-Valley Network Diagram after the event



J&K demand during the event

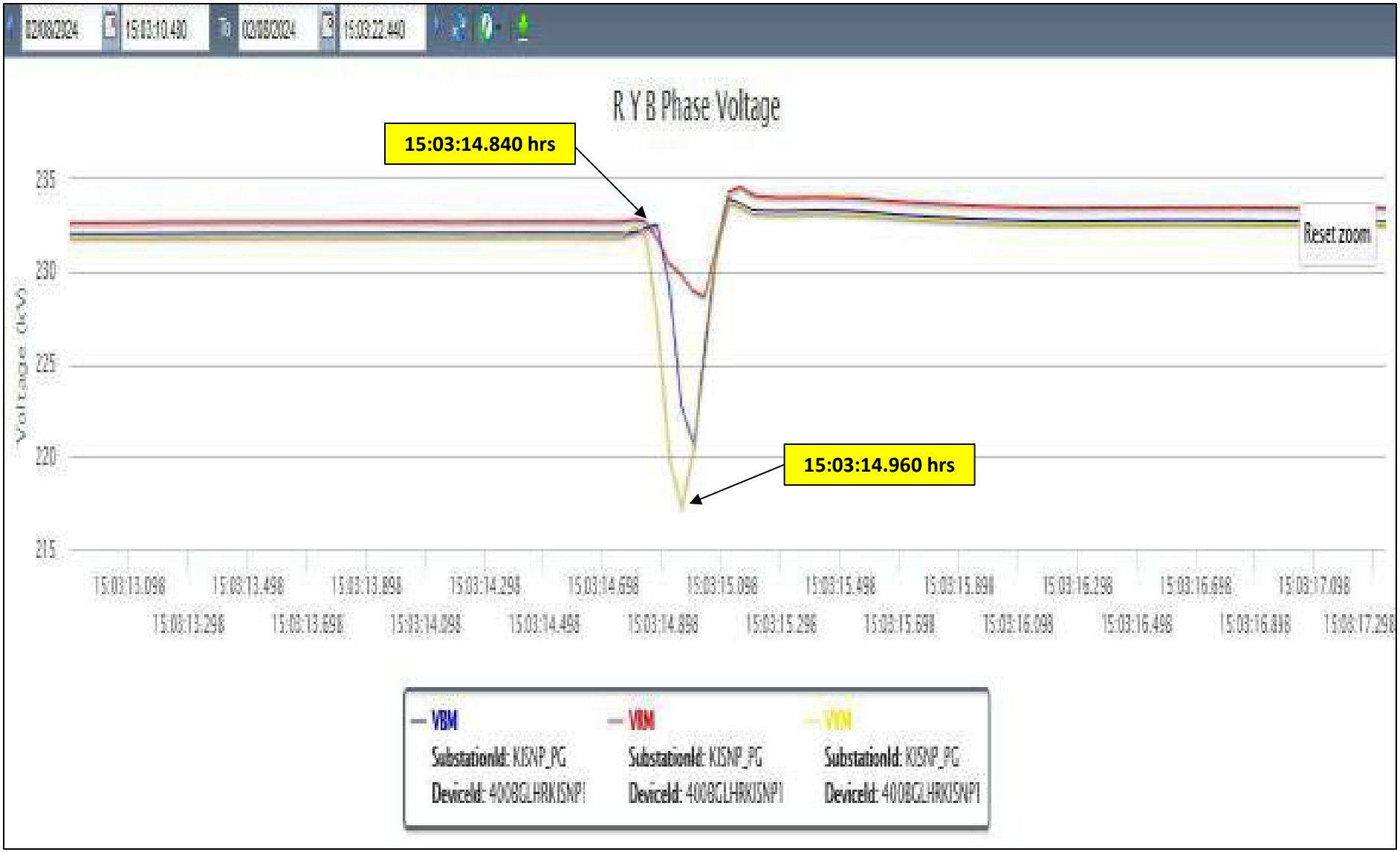


PMU Plot of frequency at Kishenpur(PG)

15:03hrs/02-Aug-24

PMU Plot of phase voltage magnitude at Kishenpur(PG)

15:03hrs/02-Aug-24



Point of discussion

i) Exact reason and location of fault need to be shared.
ii) Details of protection operated during the tripping event need to be shared.
iii) Loading of all three ICTs just before the tripping event need to be shared.
iv) Overloading protection settings of all three ICTs at Barn(JK) need to be shared.
v) DR/EL (.dat/.cfg file) of all the tripped elements along with tripping report of the event need to be shared.
vi) SLD of 220/132kV Barn(JK) S/s need to be shared.
vii) Remedial action taken report to be shared.

Annexure-XIX

RE: Mock testing of SPS of 500kV HVDC Mundra-Mahindergarh link

Thu 8/29/2024 7:29 PM

To:NRLDC SO 2 <nrldcso2@grid-india.in>; CPCC1 <rtamc.nr1@powergrid.in>;

Cc:seo-nrpc <seo-nrpc@nic.in>; Somara Lakra (सोमारा लाकरा) <somara.lakra@grid-india.in>; Mahavir Prasad Singh (महावीर प्रसाद सिंह) <mahavir@grid-india.in>; Arunkumar P <Arunkumar.P@adani.com>; Sugata Bhattacharya (सुगाता भट्टाचार्या) <sugata@grid-india.in>; Deepak Kumar <deepak.kr@grid-india.in>; AMIT SHARMA <amsharma@grid-india.in>; Bikas Kumar Jha (बिकास कुमार झा) <bikaskjha@grid-india.in>; Manas Ranjan Chand (मानस रंजन चंद) <manas@grid-india.in>; Aman Gautam (अमन गौतम) <amangautam@grid-india.in>; Gnanaguru . <Gnanaguru.1@adani.com>; Sumeet Sharma <Sumeet.Sharma@adani.com>; Naman Vyas <Namany.Vyas@adani.com>; Milan Popat <Milan.Popat@adani.com>; Nihar Raj <nihar.raj@adani.com>; Abhishek Kukreja <Abhishek.Kukreja@adani.com>;

5 attachments (9 MB)

Counter (2).jpg; Counter.jpg; TPS (2).jpg; TPS.jpg; 220KV Alwar ss.jpg;

Dear Sir,

Please find the attached Photos. on 28-08-2024, a representative from M/s. Commtel Networks visited the Mahendragarh site and confirmed the healthiness of the SDH and TPS, along with their associated cards.

All SPS System equipment are functioning properly. The 15 TPS installed in the remote substation.

The details and status of TPS and Counter at Mahendragarh End.

S.No	TPS	TPS Status	Counter	Counter Status
1	PG Hissar	ON	17	OKAY
2	Bhiwani	ON	17	OKAY
3	Dadari	ON	17	OKAY
4	Alwar	ON	-	OFF
5	Bhilwara	ON	12	OKAY
6	Merta	ON	14	OKAY
7	Ratangarh	ON	-	OFF
8	Gobinugarg	ON	-	OFF
9	Malerkotla	ON	-	OFF
10	Laton Kalan	ON	6	OKAY
11	Mandula	ON	12	OKAY
12	Bamnauli	ON	-	OFF
13	Shamli	ON	-	OFF
14	Bahadurgarh	ON	10	OKAY

15	Dhanonda	ON	-	OFF

There alarms on the system are due to the following reasons.

1. Equipment Failure/ card failure/ power failure at Remote Sites.
2. Cable connectivity break between the remote System and cable coming from Field.
3. E1 connectivity outage at remote Sites.

Our team, with support from Commtel Networks, visited the nearest TPS installed at the 220/132 kV Alwar Substation to check its healthiness. However, during the inspection, the panel was found to be de-energized, necessitating an end-to-end test. (Photo Attached) Similarly, each substation needs to be ensured the healthiness of the TPS by respective Substation owner.

We request you to please confirm the healthiness of the Sr no 1 and 2 .

Thanks and Regards,

Kalicharan Sahu
(O&M) HVDC & EHV Substations,
Adani Energy Solutions Limited
| ±500kV HVDC Mahendragarh Terminal Sub Station I
Village-Kheri- Aghiyar, Taluka- Kanina, Mahendragarh 123 029, Haryana, India
Mob +91 9764006167| Off +91 1285 277326

From: NRLDC SO 2 <nrldcso2@grid-india.in>
Sent: Tuesday, August 27, 2024 10:07 AM
To: SLDC Punjab <se-sldcprojects@pstcl.org>; PC PSTCL SLDC PUNJAB <pcpstcl@gmail.com>; Haryana <sldcharyanacr@gmail.com>; Delhi <sldcmintoroad@gmail.com>; UP <sera@upsldc.org>; Rajasthan <SE.LDRVPNL@RVPN.CO.IN>; ce.ld@rvpn.co.in; CPCC1 <rtamc.nr1@powergrid.in>; neerajk@powergrid.in; setncmrt@upptcl.org; bharatlalgujar@gmail.com; akashdeep3433786@gmail.com; xenemtcbhpp2@bbmb.nic.in; PC Control Room <pccont@bbmb.nic.in>; se.prot.engg@rvpn.co.in; Arunkumar P <Arunkumar.P@adani.com>; Kali Charan Sahu <Kalicharan.Sahu@adani.com>; rajbir-walia79@yahoo.com; ase-sldcop@pstcl.org; sesldcop@hvpn.org.in; cepso@upsldc.org; se-sldcop <se-sldcop@pstcl.org>; SICHVDC Controlroom <SICHVDC.Controlroom@adani.com>
Cc: seo-nrpc <seo-nrpc@nic.in>; somara.lakra <somara.lakra@grid-india.in>; Mahavir Prasad Singh (महावीर प्रसाद सिंह) <mahavir@grid-india.in>; Sugata Bhattacharya (सुगाता भट्टाचार्या) <sugata@grid-india.in>; deepak.kr <deepak.kr@grid-india.in>; AMIT SHARMA <amsharma@grid-india.in>; bikaskjha <bikaskjha@grid-india.in>; Manas Ranjan Chand (मानस रंजन चंद) <manas@grid-india.in>; Aman Gautam (अमन गौतम) <amangautam@grid-india.in>
Subject: Re: Mock testing of SPS of 500kV HVDC Mundra-Mahindergarh link

Sir,

In reference of the trailing mail, it is to be mentioned that inputs have received from Rajasthan only. Members agreed to shared the details by 22nd August 2024, however no further details received from Haryana, Punjab, Delhi, UP & ADANI.

Kindly share the details as discussed during the meeting held on 20th August 2024, so that further remedial actions can be initiated on the basis of those details.

सादर धन्यवाद/ Thanks & Regards
प्रणाली संचालन-II/ System Operation-II
उ°क्षे°भा°प्रे°के°/ NRLDC
ग्रिड कंट्रोलर ऑफ इंडिया लिमिटेड/ Grid Controller of India Limited
Formerly known as
पोसोको / POSOCO

From: NRLDC SO 2
Sent: Tuesday, August 20, 2024 12:49:55 PM
To: SLDC Punjab; PC PSTCL SLDC PUNJAB; Haryana; Delhi; UP; Rajasthan; ce.ld@rvpn.co.in; CPCC1; neerajk@powergrid.in; setncmrt@upptcl.org; bharatlalgujar@gmail.com; akashdeep3433786@gmail.com; xenemtcbhpp2@bbmb.nic.in; PC Control Room; se.prot.engg@rvpn.co.in; Arunkumar.P@adani.com; Kalicharan.Sahu@adani.com; rajbir-walia79@yahoo.com; ase-sldcop@pstcl.org; sesldcop@hvpn.org.in
Cc: seo-nrpc; Somara Lakra (सोमारा लाकरा); Mahavir Prasad Singh (महावीर प्रसाद सिंह); Sugata Bhattacharya (सुगाता भट्टाचार्या); Deepak Kumar; AMIT SHARMA; Bikas Kumar Jha (बिकास कुमार झा); Manas Ranjan Chand (मानस रंजन चंद); Aman Gautam (अमन गौतम)
Subject: Re: Mock testing of SPS of 500kV HVDC Mundra-Mahindergarh link

Sir,

Please find attached presentation w.r.t. review of SPS of HVDC Mundra-Mahindergarh link.

As discussed during online meeting held today from 10:30hrs onward with SLDCs, ADANI and POWERGRID, following action plan has been decided:

1. SLDCs shall share the revised updated feeder details (radial) along with expected average/peak load

relief through respective feeders.

2. SLDCs in coordination with their transmission and protection team shall share the status and healthiness of existing SPS system along with details of availability of communication path for incorporation of proposed revised/additional feeders.
3. Mahindergarh(ADANI) shall coordinate with the POWERGRID and share the action plan to make the SPS system healthy and operational at Mahindergarh(ADAIN), Bhiwani(PG) & Bhiwani(BBMB).
4. POWERGRID & ADANI shall review the healthiness of SPS system at different load centers and communication path between them in coordination with the SLDCs.

Kindly take necessary actions w.r.t. your control area and share the inputs by afternoon of 22nd August 2024.

सादर धन्यवाद/ Thanks & Regards
प्रणाली संचालन-II/ System Operation-II
उ॰क्षे॰भा॰प्रे॰के॰/ NRLDC
ग्रिड कंट्रोलर ऑफ इंडिया लिमिटेड/ Grid Controller of India Limited
Formerly known as
पोसोको / POSOCO

From: NRLDC SO 2
Sent: Friday, August 16, 2024 5:36:26 PM
To: SLDC Punjab; PC PSTCL SLDC PUNJAB; Haryana; Delhi; UP; Rajasthan; ce.ld@rvpn.co.in; CPCC1; neerajk@powergrid.in; setncmrt@upptcl.org; bharatlalgujar@gmail.com; akashdeep3433786@gmail.com; xenemtcbhpp2@bbmb.nic.in; PC Control Room; se.prot.engg@rvpn.co.in; Arunkumar.P@adani.com; Kalicharan.Sahu@adani.com; rajbir-walia79@yahoo.com; ase-sldcop@pstcl.org
Cc: seo-nrpc; Somara Lakra (सोमारा लाकरा); Mahavir Prasad Singh (महावीर प्रसाद सिंह); Sugata Bhattacharya (सुगाता भट्टाचार्या); Deepak Kumar; AMIT SHARMA; Bikas Kumar Jha (बिकास कुमार झा); Manas Ranjan Chand (मानस रंजन चंद); Aman Gautam (अमन गौतम)
Subject: Re: Mock testing of SPS of 500kV HVDC Mundra-Mahindergarh link

Sir,

Kindly refer trailing mail.

ADANI has shared the identified issues in communication link of SPS and load related details have been received from UP only. Other members are also requested to share the details w.r.t. their control area. POWERGRID and ADANI are requested to review the status of healthiness of communication links to load centers.

In this regard an online meeting has been scheduled on 20th August 2024 (Tuesday). Kindly ensure that concerned members shall connect in the meeting.

Online meeting to review the healthiness of SPS of 500kV HVDC Mundra-Mahindergarh link
Hosted by NRLDCSO Grid_India

https://nrldc.webex.com/nrldc/j.php?MTID=m8a6b11dfbb5341cc4b8de3e5403b9ff6
Tuesday, August 20, 2024 10:30 AM | 5 hours | (UTC+05:30) Chennai, Kolkata, Mumbai, New Delhi
Meeting number: 2514 426 7076
Password: rgEcnsPB934

सादर धन्यवाद/ Thanks & Regards
प्रणाली संचालन-II/ System Operation-II
उ°क्षे°भा°प्रे°के°/ NRLDC
ग्रिड कंट्रोलर ऑफ इंडिया लिमिटेड/ Grid Controller of India Limited
Formerly known as
पोसोको / POSOCO

From: NRLDC SO 2
Sent: Tuesday, August 13, 2024 4:32 PM
To: SLDC Punjab; PC PSTCL SLDC PUNJAB; Haryana; Delhi; UP; Rajasthan; ce.ld@rvpn.co.in; CPCC1; neerajk@powergrid.in; setncmrt@upptcl.org; bharatlalgujar@gmail.com; akashdeep3433786@gmail.com; xenemtcbhpp2@bbmb.nic.in; PC Control Room; se.prot.engg@rvpn.co.in; Arunkumar.P@adani.com; Kalicharan.Sahu@adani.com; rajbir-walia79@yahoo.com; ase-sldcop@pstcl.org
Cc: seo-nrpc; Somara Lakra (सोमारा लाकरा); Mahavir Prasad Singh (महावीर प्रसाद सिंह); Sugata Bhattacharya (सुगाता भट्टाचार्या); Deepak Kumar; AMIT SHARMA; Bikas Kumar Jha (बिकास कुमार झा)

Subject: Re: Mock testing of SPS of 500kV HVDC Mundra-Mahindergarh link

Sir,

Non operation of SPS of 500kV HVDC Mundra-Mahindergarh inter regional link on 17th May 2024 on outage of both pole (carrying total ~1500MW) was discussed during 51st PSC meeting. ADANI was requested to share the details w.r.t. SPS operation during the meeting.

As per details received from ADANI, there are two links for SPS signal communication to load centers. One is directly to 220kV Dhanonda(HR) and communication to rest of load centers is through Bhiwani & Hissar S/s of POWERGRID. Other stations are also involved in further communication to all the load centers. SPS communication network (received from ADANI) is attached herewith the mail.

During 17th May incident, SPS operated at Dhanonda S/s however, operation didn't occur at load centers on second path. During investigation by ADANI team, it was identified that communication link between Bhiwani and Hissar is not healthy and there are chances that communication link between other stations may also be not healthy.

During online meeting conducted on 05th August 2023, states also highlighted the challenges regarding changes / unavailability in identified load feeders and load shedding in Punjab, Haryana, Delhi, UP and Rajasthan.

In view of above following actions are desired:

1. POWERGRID and concerned states are requested to identify the issue in communication links and take expeditious actions to make the all the communication link healthy.
2. States are requested to go through the details of load feeders mentioned in SPS document and share the changes / modifications as per present scenario and also share the inputs w.r.t. unavailability in identified load feeders and load shedding.

Details have received from UP only. POWERGRID and states are requested to share their inputs at the earliest. Necessary actions also need to be taken on priority.

सादर धन्यवाद/ Thanks & Regards
प्रणाली संचालन-II/ System Operation-II
उ°क्षे°भा°प्रे°के°/ NRLDC
ग्रिड कंट्रोलर ऑफ इंडिया लिमिटेड/ Grid Controller of India Limited
Formerly known as
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From: NRLDC SO 2
Sent: Thursday, August 8, 2024 12:22:45 PM
To: SLDC Punjab; PC PSTCL SLDC PUNJAB; Haryana; Delhi; UP; Arshad Jamal; Rajasthan; ce.ld@rvpn.co.in
Cc: seo-nrpc; N Roy (एन रॉय); S Usha (एस उषा); Somara Lakra (सोमारा लाकरा); Mahavir Prasad Singh (महावीर प्रसाद सिंह); Manas Ranjan Chand (मानस रंजन चंद); Rahul Shukla (राहुल शुक्ला); Aman Gautam (अमन गौतम); Minnakuri Venkateswara Rao (मिन्नाकुरी वेंकटेश्वर राव); Sugata Bhattacharya (सुगाता भट्टाचार्या); Deepak Kumar; AMIT SHARMA
Subject: Mock testing of SPS of 500kV HVDC Mundra-Mahindergarh link

Ma'am/Sir,

As you are well aware that an online meeting was scheduled on 05.08.2024 among NLDC, WRLDC, NRLDC, SLDC Gujarat, SLDC Delhi, SLDC UP, SLDC Haryana, SLDC Punjab and ATL team to discuss the mock testing of SPS of 500kV HVDC Mundra-Mahindergarh link and some challenges were highlighted during the meeting regarding changes/unavailability in identified load feeders and load shedding in Punjab, Haryana, Delhi, UP and Rajasthan.

As per IEGC clause 16.1, *“SPS for identified system shall have redundancies in measurement of input signals and communication paths involved up to the last mile to ensure security and dependability.”*

As per IEGC clause 16.2, *"For the operational SPS, RLDC or NLDC, as the case may be, in consultation with the concerned RPC(s) shall perform regular load flow and dynamic studies and mock testing for reviewing SPS parameters & functions, at least once in a year. RLDC or NLDC shall share the report of such studies and mock testing including any short comings to respective RPC(s). The data for such studies shall be provided by CTU to the concerned RPC, RLDC and NLDC.’’*

In view of the above, states may confirm the status of the identified load feeders (whether operational or not) and whether any changes done in the existing load details. SPS scheme of 500kV HVDC Mundra-Mahindergarh is attached herewith.

सादर धन्यवाद/ Thanks & Regards
सुगता भट्टाचार्य/ Sugata Bhattacharya
प्रणाली संचालन-II/ System Operation-II
उ॰क्षे॰भा॰प्रे॰के॰/ NRLDC
ग्रिड कंट्रोलर ऑफ इंडिया लिमिटेड/ Grid Controller of India Limited
Formerly known as
पोसोको / POSOCO

Fwd: Mock testing of SPS of 500kV HVDC Mundra-Mahindergarh link

Tue 8/27/2024 4:58 PM

Inbox

To:NRLDC SO 2 <nrldcso2@grid-india.in>;

---------- Forwarded message ---------
From: SE T&C Meerut < setncmrt@upptcl.org>
Date: Tue, Aug 27, 2024 at 4:34 PM
Subject: Re: Mock testing of SPS of 500kV HVDC Mundra-Mahindergarh link
To: SE (R&A) <sera@upsldc.org>

As per telephonic conversation with EEEMTD,Meerut,It is to inform that Six pairs(12Nos)fiber are available between 220KV Substation, Shamli&400KV Substation, Shamli. Further modalities regarding availability &sharing of these fiber can be discussed with EMTD&Transmission wing.

On Tue, 27 Aug, 2024, 16:24 SE (R&A), <sera@upsldc.org> wrote:

> Sir ,
>
> As per trailing mail and in reference to the meeting held on 20.08.2024, kindly share the status of availability/status/healthiness of communication path between 220kV Shamli and 400kV Shamli, availability of communication path for incorporation of proposed revised/additional feeders along with the healthiness of existing communication path of SPS incorporated feeders at 220kV Shamli.
>
> ---------- Forwarded message ---------
> From: NRLDC SO 2 < nrldcso2@grid-india.in>
> Date: Tue, Aug 27, 2024 at 10:07 AM
> Subject: Re: Mock testing of SPS of 500kV HVDC Mundra-Mahindergarh link
> To: SLDC Punjab <se-sldcprojects@pstcl.org>, PC PSTCL SLDC PUNJAB <pcpstcl@gmail.com>, Haryana <sldcharyanacr@gmail.com>, Delhi <sldcmintoroad@gmail.com>, UP <sera@upsldc.org>, Rajasthan <SE.LDRVPNL@rvpn.co.in>, ce.ld@rvpn.co.in <ce.ld@rvpn.co.in>, CPCC1 <rtamc.nr1@powergrid.in>, neerajk@powergrid.in <neerajk@powergrid.in>, setncmrt@upptcl.org <setncmrt@upptcl.org>, bharatlalgujar@gmail.com <bharatlalgujar@gmail.com>, akashdeep3433786@gmail.com <akashdeep3433786@gmail.com>, xenemtcbhpp2@bbmb.nic.in <xenemtcbhpp2@bbmb.nic.in>, PC Control Room <pccont@bbmb.nic.in>, se.prot.engg@rvpn.co.in <se.prot.engg@rvpn.co.in>, Arunkumar.P@adani.com <Arunkumar.P@adani.com>, Kalicharan.Sahu@adani.com <Kalicharan.Sahu@adani.com>, rajbir-walia79@yahoo.com <rajbir-walia79@yahoo.com>, ase-sldcop@pstcl.org <ase-sldcop@pstcl.org>, sesldcop@hvpn.org.in <sesldcop@hvpn.org.in>, cepso@upsldc.org <cepso@upsldc.org>, se-sldcop <se-sldcop@pstcl.org>, sicHVDC.Controlroom@adani.com <sicHVDC.Controlroom@adani.com>
> Cc: seo-nrpc <seo-nrpc@nic.in>, Somara Lakra (सोमारा लाकरा) <somara.lakra@grid-india.in>, Mahavir Prasad Singh (महावीर प्रसाद सिंह) <mahavir@grid-india.in>, Sugata Bhattacharya (सुगाता भट्टाचार्या) <sugata@grid-india.in>, Deepak Kumar <deepak.kr@grid-india.in>, AMIT SHARMA <amsharma@grid-india.in>, Bikas Kumar Jha (बिकास कुमार झा) <bikaskjha@grid-india.in>, Manas Ranjan Chand (मानस रंजन चंद) <manas@grid-india.in>, Aman Gautam (अमन गौतम) <amangautam@grid-india.in>
>
> Sir,

In reference of the trailing mail, it is to be mentioned that inputs have received from Rajasthan only. Members agreed to shared the details by 22nd August 2024, however no further details received from Haryana, Punjab, Delhi, UP & ADANI.
Kindly share the details as discussed during the meeting held on 20th August 2024, so that further remedial actions can be initiated on the basis of those details.

सादर धन्यवाद/ Thanks & Regards
प्रणाली संचालन-II/ System Operation-II
उ॰क्षे॰भा॰प्रे॰के॰/ NRLDC
ग्रिड कंट्रोलर ऑफ इंडिया लिमिटेड/ Grid Controller of India Limited
Formerly known as
पोसोको / POSOCO

From: NRLDC SO 2
Sent: Tuesday, August 20, 2024 12:49:55 PM
To: SLDC Punjab; PC PSTCL SLDC PUNJAB; Haryana; Delhi; UP; Rajasthan; ce.ld@rvpn.co.in; CPCC1; neerajk@powergrid.in; setncmrt@upptcl.org; bharatlalgujar@gmail.com; akashdeep3433786@gmail.com; xenemtcbhpp2@bbmb.nic.in; PC Control Room; se.prot.engg@rvpn.co.in; Arunkumar.P@adani.com; Kalicharan.Sahu@adani.com; rajbir-walia79@yahoo.com; ase-sldcop@pstcl.org; sesldcop@hvpn.org.in
Cc: seo-nrpc; Somara Lakra (सोमारा लाकरा); Mahavir Prasad Singh (महावीर प्रसाद सिंह); Sugata Bhattacharya (सुगाता भट्टाचार्या); Deepak Kumar; AMIT SHARMA; Bikas Kumar Jha (बिकास कुमार झा); Manas Ranjan Chand (मानस रंजन चंद); Aman Gautam (अमन गौतम)
Subject: Re: Mock testing of SPS of 500kV HVDC Mundra-Mahindergarh link

Sir,

Please find attached presentation w.r.t. review of SPS of HVDC Mundra-Mahindergarh link.

As discussed during online meeting held today from 10:30hrs onward with SLDCs, ADANI and POWERGRID, following action plan has been decided:

1. SLDCs shall share the revised updated feeder details (radial) along with expected average/peak load relief through respective feeders.
2. SLDCs in coordination with their transmission and protection team shall share the status and healthiness of existing SPS system along with details of availability of communication path for incorporation of proposed revised/additional feeders.

उत्तर प्रदेश राज्य भार प्रेषण केन्द्र लि०
यू०पी०एस०एल०डी०सी०परिसर, विभूति
खण्ड II,गोमती नगर, 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

No: - 2661 /SE(R&A)/EE-II/SPS Dated:- 07/08/ 2024

General Manager, NRLDC18-A,
SJSS Marg, Katwaria Sarai,
New Delhi – 110016

Subject- Regarding SPS of HVDC Mundra-Mahendargarh line

Kindly refer to SE (ETC) Muzaffarnagar letter no/062/E.T.C./MZN/400 kV S/S Shamli dated 05.05.2024. (copy enclosed) regarding feeder wise load of Shamli area. As per the letter, at present complete load relief (i.e. 300MW) may not be provided by 220 kV Shamli, so that alternatively feeder and load details of 400 kV Shamli has also been provided. Also it is informed that at present SPS system at 220 kV Shamli is not healthy which is being maintained by PGCIL.

It is therefore requested to kindly instruct the concerned to incorporate 132 kV feeders of 220 kV Shamli & 400 kV Shamli in SPS of HVDC Mundra-Mahendargarh line so that appropriated load relief may be provided from UP Control area and take necessary action regarding healthiness of SPS system

Sangeet
(Sangeeta)
Superintending Engineer (R&A)

No: - /SE(R&A)/EE-II/SPS Dated: - 2024

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

1. Director, UPSLDC, Vibhuti Khand – II, Gomti Nagar, Lucknow.
2. Director (Operation), UPPTCL, 11th Floor, Shakti Bhawan Extn., Lucknow.
3. Chief Engineer (PSO), Vibhuti Khand – II, Gomti Nagar, Lucknow.
4. Chief Engineer (Trans. West),PareshanBhawan, 130D, Hydel Colony, Victoria Park, Meerut 250001.
5. SE (Operations), 18 – A SJSS Marg, Katwaria Sarai, New Delhi, 110016.

/
(Sangeeta)
Superintending Engineer (R&A)

कार्यालय
अधीक्षण अभियन्ता
विद्युत पारेषण मण्डल
उ०प्र०पावर ट्रांसमिशन कारपोरेशन लि०
132 के०वी० भोपारोड उपकेन्द्र
मुजफ्फरनगर-251001

OFFICE OF THE
SUPERINTENDING ENGINEER
Electricity Transmission Circle
U.P. Power Transmission Corporation Ltd.
132 KV Bhopa Road Sub-station
Muzaffarnagar-251001

दूरभाष : 0131-2608038 Ph. 0131-2608038
E-mail : seetcmzn@upptcl.org, seetcmzn@gmail.com

संख्या / No. 1062 /E.T.C./MZN/400 KV S/S Shamli दिनांक / DATED 05/08/24

Subject: - Regarding SPS of HVDC Mundra-Mahendargarh.

Superintending Engineer (R & A)
U.P State Load Despatch Centre Ltd.
UPSLDC Complex, Vibhuti Khand-II
Gomti Nagar, Lucknow.
Email. sera@upsldc.org

Please refer to your office letter no. 2187 dt. 01.07.2024, forwarded to this office by SE (T&C), Meerut vide endorsement no. 2237/CE(TW)/MT/SPS dt. 23.07.2024 vide which it has been requested to provide details of 132 KV feeders for planned relief to HVDC Mundra-Mahendargarh SPS.

In this reference, it is to apprise that following is the details of 132 KV feeders being fed from 220 KV Sub-Station Shamli.

S.No.	Name of feeder	Connected Load (MVA)	Maximum Load (MW)	Average Load (MW)
1	132 KV Lalukheri	63+63	72	47
2	132 KV Jhinjhana	63+40+40	80	52
3	132 KV Kairana-I/II	63+63	41	27
4	132 KV Jasala	63+40	58	38
	Total		251	164

1. Following Case wise Trippings of 132 KV Feeders at 220 KV Sub-Station, Shamli for tripping of HVDC Mundra-Mahendergarh Line may be used.

(A) In Maximum Load Condition:-

S. No.	State.L.S quantum	Name of feeding substation	Feeder/line/ equipment	MW	Case-1 50 MW	Case-2 100 MW	Case-3 200MW	Case-4 300 MW
1	Uttar Pradesh Case-1 =50 MW Case-2 =100 MW Case-3 =200 MW Case-4 =300 MW	220 KV Subsatatio n, Shamli	132 KV Jasala	58	1	1	1	1
2			132 KV Kairana-I	20.5		1		1
3			132 KV Kairana-II	20.5	-	1		1
4			132 KV Lalukheri	72	-	-	1	1
5			132 KV Jinjhana	80	-		1	1
			Total Relief	251	58	99	210	251

(B) In Average Load Condition :-

S. No.	State.L.S quantum	Name of feeding substation	Feeder/line/ equipment	MW	Case-1 50 MW	Case-2 100 MW	Case-3 200MW	Case-4 300 MW
1	Uttar Pradesh Case-1 =50 MW Case-2 =100 MW Case-3 =200 MW Case-4 =300 MW	220 KV Subsatatio n, Shamli	132 KV Jasala	38	1		1	1
2			132 KV Kairana-I	13.5	1		1	1
3			132 KV Kairana-II	13.5	-		1	1
4			132 KV Lalukheri	47	-	1	1	1
5			132 KV Jinjhana	52	-	1	1	1
			Total Relief	164	51.5	99	164	164

Alternatively HVDC Mundra-Mahendargarh SPS may be shifted to 400 KV Sub-Station Shamli, details of 132 KV feeders from 400 KV Sub-Station Shamli with its Maximum and Average load is as follows :

S.No.	Name of feeder	Connected Load (MVA)	Maximum Load (MW)	Average Load (MW)
1	132 KV Budhana	63+40	82	53
2	132 KV Kharad	63+40	78	51
3	132 KV Jalalpur	40+40	41	27
4	132 KV Thanabhawan	63+63+40	74	48
5	132 KV Kaniyan	40+40	35	23
	Total		310	202

2. Following Case wise Trippings of 132 KV Feeders at 400 KV Sub-Station, Shamli for tripping of HVDC Mundra-Mahendergarh Line is hereby recommended

(A). In Maximum Load Condition :-

S. No.	State.L.S quantum	Name of feeding substation	Feeder/line/ equipment	MW	Case-1 50 MW	Case-2 100 MW	Case-3 200MW	Case-4 300 MW
1	Uttar Pradesh Case-1 =50 MW Case-2 =100 MW Case-3 =200 MW Case-4 =300 MW	400 KV Subsatation, Shamli	132 KV Budhana	82	-	-	1	1
2			132 KV Kharad	78	-	-	1	1
3			132 KV Jalalpur	41	1	-	1	1
4			132 KV Thanabhawan	74	-	1	-	1
5			132 KV Kaniyan	35	1	1	-	1
			Total Relief	310	76	109	201	310

(B). In Average Load Condition :-

S. No.	State.L.S quantum	Name of feeding substation	Feeder/line/ equipment	MW	Case-1 50 MW	Case-2 100 MW	Case-3 200MW	Case-4 300 MW
1	Uttar Pradesh Case-1 =50 MW Case-2 =100 MW Case-3 =200 MW Case-4 =300 MW	400 KV Subsatation, Shamli	132 KV Budhana	53	-	1	1	1
2			132 KV Kharad	51	1	1	1	1
3			132 KV Jalalpur	27	-	-	1	1
4			132 KV Thanabhawan	48	-	-	1	1
5			132 KV Kaniyan	23	-	-	1	1
			Total Relief	202	51	104	202	202

Submitted for information and necessary action

(Nikhil Kumar)
Superintending Engineer

संख्या / No. /E.T.C./MZN/ दिनांक / DATED

Copy forwarded to the following for information and necessary action :

1. Chief Engineer (TW) UPPTCL Meerut.
2. Superintending Engineer, Electricity (T&C) Circle, UPPTCL Meerut.
3. Executive Engineer Electricity Transmission Division, Shamli

(Nikhil Kumar)
Superintending Engineer

कार्यालय
अधीक्षण अभियन्ता
विद्युत परीक्षण एवं परिचालन मण्डल
उ0प्र0 पावर ट्रांसमिशन कारपोरेशन लि0
प्रथम तल पारेषण भवन, 130–डी, विक्टोरिया पार्क
मेरठ– 250 003
मोबाइल: 9412749817

U.P. POWER TRANSMISSION CORPORATION LIMITED
UPPTCL

OFFICE OF THE
SUPERINTENDING ENGINEER
Electricity Test & Commissioning Circle
U.P. POWER TRANSMISSION CORPORATION LTD.
1st Floor Pareshan Bhawan, 130-D, Victoria Park,
Meerut 250 003
Mobile: 9412749817

No. 82 **/ ETCC-MT /** **Dated-** 30/05/24

Sub :- SPS related to HVDC Mundra-Mahendargarh.

(By e-mail)

Superintending Engineer (R&A)
UPSLDC Vibhuti Khand ,
Gomti Nagar,
Lucknow.

In reference to the above cited subject, UPSLDC via email on 22.05.2024 informed that on 17.05.2024 at 16:20 hrs, Case-3 of SPS related to HVDC Mundra - Mahendergarh operated. As per action in case-3 operation of this line SPS, 200MW load relief at 220kV Shamli (UP) is desired. However, no load relief at 220kV Shamli was observed at given date and time. It is to bring in your notice that due to commissioning of 400kV Shamli S/s entire power flow scenario has been changed. Current situation is summarized as below.

At 220kV Shamli S/s feeders shown in the list	Planned load relief (MW)	Current situation
Thana Bhawan -1	25	The only line cateting Thana Bhawan has been made LILO at 132kV Jalalpur. Now Jalalpur is fed from 220kV Shamli S/s while load of Thana Bhawan is fed from 400kV Shamli S/s.
Thana Bhawan -2	25	
Jasala-1	25	Only one line exists.
Jasala-2	25	
Kharad-1	50	Only one line exists which is normally kept open at Kharad and load of Kharad is normally fed from 400kV Shamli S/s.
Kharad-2	50	
Baraut-1	150 (case-4)	No such line exist at 220kV Shamli S/s.
Baraut-2	150 (case-4)	

In view of the above facts, entire load relief strategy needs to be reviewed and redesigned for SPS. On 17.05.2024 at 16:20 hrs, no tripping observed at 220kV S/S Shamli as SPS system is unhealthy, which is being maintained by M/s PGCIL.

Hence it is requested to you to kindly coordinate with M/s PGCIL for modification of the scheme and rectification of the fault in SPS.

(Pramod Kumar Mishra)
Superintending Engineer

No. 82 **/ETCC-MT/** **Dated/–** 30/05/24

Copy forwarded to the following for information & necessary action:-

1. Chief Engineer (TW), UPPTCL Victoria Park, Meerut.
2. Executive Engineer, Electricity Test & Commissioning Div., Muzaffarnagar.

(Pramod Kumar Mishra)
Superintending Engineer

SK/SENew/NewEngLetter01

Revised updated feeder details (radial) along with expected average Load Relief

S.No.	Name of Sub- Station	Feeder name as per existing detail	Revised name of Existing Feeder /Line/Equipment	Average Load relief (MW)	Remark
1	220 kV GSS Alwar	132 kV GSS Mundawar	132 kV GSS Pinan	25	
		132 kv GSS Bansoor	132 kV GSS Telco	45	
		132 kV GSS Ramgarh	132 kV GSS Ramgarh	65	
		132 kV GSS Malakhera	132 kV GSS Malakhera	50	
		132 kV Alwar (LOCAL)	132 kV GSS Alwar (LOCAL)	120	
2	220 kV GSS Ratangarh	132 kV Sardar Sher			Generally Feed from 220 kV Halasar
3	220 kV GSSV Bhilwara	132 kV GSS Gangapur	132 kv GSS Karoi	15	
		132 kV GSS Danta	132 kV GSS Danta	30	
		132 kV GSS Devgarh	132 kV GSS Bankali	18	
		132 kV GSS Kareda			
4	400 kV GSS Merta	132 kV GSS Kuchera	132 kV GSS Dhawa	25	
		132 kV GSS Lamba	132 kV GSS Lamba jatan	55	
		132 kV GSS Gotan			

Email **Control Room CONTROL ROOM SLDC**

Re: Review of SPS installed for 500kV HVDC Mundra - Mahindergarh.

From : Executive Engineer TS Rewari <xentsrwr@hvpn.org.in> Thu, Aug 29, 2024 01:20 PM

Subject : Re: Review of SPS installed for 500kV HVDC Mundra - Mahindergarh.

To : Control Room CONTROL ROOM SLDC <controlroomsldc@hvpn.org.in>

Cc : SE TS GGN <setsggn@hvpn.org.in>, Executive Engineer Executive Engineer <xen400kvdhanoda@hvpn.org.in>, Substation Engineer <sse220kvlulaahir@hvpn.org.in>

In continuation of trailing email and discussion held today telephonically, it is gathered that desired load relief shall not get as load of 220 kV Lula Ahir shall be fed through 220 kV Dadri-Lula Ahir line being synchronized. Therefore, it is proposed that in the existing scheme SPS, the tripping of 220 kV D/C Lula Ahir line at 400 kV Dhanonda end may be removed and tripping of all incomers (2 no. 132 kV Incomers of 100 MVA 220/132 kV TFs and one no. 33 kV incomer of 100 MVA 220/33 kV TF) at 220 kV Lula Ahir substation may be added.

The maximum load (for FY 2023-24) on three no. 100 MVA TFs installed at 220 kV Lula Ahir is 53.46 MVA, 86.26 MVA and 87.02 MVA

The average load on three no. 100 MVA TFs installed at 220 kV Lula Ahir is 50 MVA, 70 MVA and 70 MVA

From: "Executive Engineer TS Rewari" <xentsrwr@hvpn.org.in>
To: "Control Room CONTROL ROOM SLDC" <controlroomsldc@hvpn.org.in>
Cc: "SE TS GGN" <setsggn@hvpn.org.in>, "Executive Engineer Executive Engineer" <xen400kvdhanoda@hvpn.org.in>, "Substation Engineer" <sse220kvnarnaul@hvpn.org.in>
Sent: Wednesday, August 28, 2024 12:46:13 PM
Subject: Re: Review of SPS installed for 500kV HVDC Mundra - Mahindergarh.

In reference of trailing email it is submitted that 220 kV Lula Ahir is connected with 400 kV Dhanonda through 220kV D/C line and with 220 kV Dadri through 220kV S/C line and with 220 kV Rewari with 220kV S/C line.
In general circuits of 400 kV Dhanonda and 220 kV Dadri runs in synchronization. The maximum load (for FY 2023-24) on three no. 100 MVA TFs installed at 220 kV Lula Ahir is 53.46 MVA, 86.26 MVA and 87.02 MVA. It is further added that in general 220 kV Dadri takes load from 220 kV Lula Ahir substation and thus act as sink.

In case of operation of SPS at 400 kV Dhanonda, the desired load relief as mentioned in trailing email (90+95 MW) can be achieved through existing scheme (by outage of three no. 100 MVA TFs and 220 kV Dadri (acting as sink)).

Regards
XEN/TS Division
HVPNL Rewari.

From: "Control Room CONTROL ROOM SLDC" <controlroomsldc@hvpn.org.in>
To: "Executive Engineer TS Rewari" <xentsrwr@hvpn.org.in>, "Executive Engineer TS Rohtak" <xentsrtk@hvpn.org.in>, "Executive Engineer Ts Bhiwani" <xentsbhw@hvpn.org.in>, "Executive Engineer Executive Engineer" <xen400kvdhanoda@hvpn.org.in>, xendhanonda@gmail.com
Cc: "Chief Engineer SO Commercial" <cesocomml@hvpn.org.in>, "Chief Engineer TS Panchkula" <cetspkl@hvpn.org.in>, "Chief Engineer TS Hisar" <cetshsr@hvpn.org.in>, "Superintending Engineer SLDC OP" <sesldcop@hvpn.org.in>, "SE TS Rohtak" <setsrtk@hvpn.org.in>, "SE TS GGN" <setsggn@hvpn.org.in>, "Superintending Engineer TS Hisar" <setshsr@hvpn.org.in>, "Superintending Engineer MP CC Dhulkote" <sempccdkt@hvpn.org.in>, "Superintending Engineer MP CC Delhi" <sempccdelhi@hvpn.org.in>, "Executive Engineer MP Rohtak" <xenmpccrtk@hvpn.org.in>, "XEN MP Hisar" <xenmpcchsr@hvpn.org.in>, "XEN MP CC" <xenmpccggn@hvpn.org.in>
Sent: Wednesday, August 21, 2024 11:57:59 AM
Subject: Review of SPS installed for 500kV HVDC Mundra - Mahindergarh.

Sir,

Please see the attachments.

--
Regards,
SCE (पाली प्रभारी अभियंता)/SLDC Control room,
HVPNL Panipat
Contact No- 9053090722,9053090721,0180-2664095

Fwd: Review of SPS installed for 500kV HVDC Mundra - Mahindergarh.

Control Room CONTROL ROOM SLDC <controlroomsldc@hvpn.org.in>

Fri 8/30/2024 12:44 PM

To:NRLDC SO 2 <nrldcso2@grid-india.in>; NRLDC SO-II <nrldcso2@gmail.com>; Deepak Kumar <deepak.kr@grid-india.in>;

Cc:Superintending Engineer SLDC OP <sesldcop@hvpn.org.in>;

2 attachments (209 KB)

Email SPS Rewari.pdf; Regarding SPS Bhiwani.pdf;

Sir,

In reference to the SPS installed for 500kV HVDC Munda - Mahindergarh link the information received from TS wing (copy attached) is as under:

1. At 400kV Dhanonda through Lula Ahir substation:- It is proposed that in the existing scheme SPS, the tripping of 220 kV D/C Lula Ahir line at 400 kV Dhanonda end may be removed and tripping of all incomers (2 no. 132 kV Incomers of 100 MVA 220/132 kV TFs and one no. 33 kV incomer of 100 MVA 220/33 kV TF) at 220 kV Lula Ahir substation may be added. The maximum load (for FY 2023-24) on three no. 100 MVA TFs installed at 220 kV Lula Ahir is 53.46 MVA, 86.26 MVA and 87.02 MVA. The average load on three no. 100 MVA TFs installed at 220 kV Lula Ahir is 50 MVA, 70 MVA and 70 MVA.

2. At 400/220kV Bhiwani BBMB: It is proposed that in the existing scheme SPS, the tripping of 220 kV Bapora (Bhiwani HVPNL) D/C line at Bhiwani BBMB end may be removed and tripping of all incomers (2 no. 132 kV Incomers of 100 MVA 220/132 kV T-1 & T-2 TFs) at 220 kV Bapora (Bhiwani HVPNL) substation may be added. The maximum load on two no. 100 MVA TFs installed at 220kV Bhiwani HVPNL is 80 MW and 85 MW respectively. The average load on two no. 100 MVA TFs installed at 220kV Bhiwani HVPNL is 70 MW and 70 MW respectively.

3. At 132kV Charkhi Dadri: It is proposed that in the existing scheme SPS, the tripping of 132kV Kalanaur line at Dadri BBMB end may be removed and tripping of 132kV Haluwas & 132kV Dadri old at Dadri BBMB may be added. The maximum load on 132kV Haluwas & 132kV Dadri old line is 45 MW and 50 MW respectively. The average load on 132kV Haluwas & 132kV Dadri old line is 40 MW and 40 MW respectively.

Rest information kept unchanged. It is also added here that the fiber connectivity is also available on all the above substations.
It is also pertinent to mention here that 700 MW load relief is expected from Haryana. Rest of the states have been allotted with a relative less amount of relief as compared to Haryana for 500kV HVDC Mundra - Mahendargarh link. The Haryana share from APL Mundra has also been reduced now. In view of the above, the expected load relief from the NR states is required to be reviewed accordingly. The same was also pointed out by this office during the online meeting held on dated 20.08.2024.

This is for information & further necessary action please.

From: "Executive Engineer TS Rewari" <xentsrwr@hvpn.org.in>
To: "Control Room CONTROL ROOM SLDC" <controlroomsldc@hvpn.org.in>
Cc: "SE TS GGN" <setsggn@hvpn.org.in>, "Executive Engineer Executive Engineer" <xen400kvdhanoda@hvpn.org.in>, "Substation Engineer" <sse220kvlulaahir@hvpn.org.in>
Sent: Thursday, August 29, 2024 1:20:08 PM
Subject: Re: Review of SPS installed for 500kV HVDC Mundra - Mahindergarh.

In continuation of trailing email and discussion held today telephonically, it is gathered that desired load relief shall not get as load of 220 kV Lula Ahir shall be fed through 220 kV Dadri-Lula Ahir line being synchronized. Therefore, it is proposed that in the existing scheme SPS, the tripping of 220 kV D/C Lula Ahir line at 400 kV Dhanonda end may be removed and tripping of all incomers (2 no. 132 kV Incomers of 100 MVA 220/132 kV TFs and one no. 33 kV incomer of 100 MVA 220/33 kV TF) at 220 kV Lula Ahir substation may be added.

The maximum load (for FY 2023-24) on three no. 100 MVA TFs installed at 220 kV Lula Ahir is 53.46 MVA, 86.26 MVA and 87.02 MVA
The average load on three no. 100 MVA TFs installed at 220 kV Lula Ahir is 50 MVA, 70 MVA and 70 MVA

From: "Executive Engineer TS Rewari" <xentsrwr@hvpn.org.in>
To: "Control Room CONTROL ROOM SLDC" <controlroomsldc@hvpn.org.in>
Cc: "SE TS GGN" <setsggn@hvpn.org.in>, "Executive Engineer Executive Engineer" <xen400kvdhanoda@hvpn.org.in>, "Substation Engineer" <sse220kvnarnaul@hvpn.org.in>
Sent: Wednesday, August 28, 2024 12:46:13 PM
Subject: Re: Review of SPS installed for 500kV HVDC Mundra - Mahindergarh.

In reference of trailing email it is submitted that 220 kV Lula Ahir is connected with 400 kV Dhanonda through 220kV D/C line and with 220 kV Dadri through 220kV S/C line and with 220 kV Rewari with 220kV S/C line.
In general circuits of 400 kV Dhanonda and 220 kV Dadri runs in synchronization. The maximum load (for FY 2023-24) on three no. 100 MVA TFs installed at 220 kV Lula Ahir is 53.46 MVA, 86.26 MVA and 87.02 MVA. It is further added that in general 220 kV Dadri takes load from 220 kV Lula Ahir substation and thus act as sink.

In case of operation of SPS at 400 kV Dhanonda, the desired load relief as mentioned in trailing email (90+95 MW) can be achieved through existing scheme (by outage of three no. 100 MVA TFs and 220 kV Dadri (acting as sink)).

Regards
XEN/TS Division
HVPNL Rewari.

From: "Control Room CONTROL ROOM SLDC" <controlroomsldc@hvpn.org.in>
To: "Executive Engineer TS Rewari" <xentsrwr@hvpn.org.in>, "Executive Engineer TS Rohtak" <xentsrtk@hvpn.org.in>, "Executive Engineer Ts Bhiwani" <xentsbhw@hvpn.org.in>, "Executive Engineer Executive Engineer" <xen400kvdhanoda@hvpn.org.in>, xendhanonda@gmail.com
Cc: "Chief Engineer SO Commercial" <cesocomml@hvpn.org.in>, "Chief Engineer TS Panchkula" <cetspkl@hvpn.org.in>, "Chief Engineer TS Hisar" <cetshsr@hvpn.org.in>, "Superintending Engineer SLDC OP" <sesldcop@hvpn.org.in>, "SE TS Rohtak" <setsrtk@hvpn.org.in>, "SE TS GGN" <setsggn@hvpn.org.in>, "Superintending Engineer TS Hisar" <setshsr@hvpn.org.in>, "Superintending Engineer MP CC Dhulkote" <sempccdkt@hvpn.org.in>, "Superintending Engineer MP CC Delhi" <sempccdelhi@hvpn.org.in>, "Executive Engineer MP Rohtak" <xenmpccrtk@hvpn.org.in>, "XEN MP Hisar" <xenmpcchsr@hvpn.org.in>, "XEN MP CC" <xenmpccggn@hvpn.org.in>
Sent: Wednesday, August 21, 2024 11:57:59 AM
Subject: Review of SPS installed for 500kV HVDC Mundra - Mahindergarh.

Sir,

Please see the attachments.

--
Regards,
SCE (पाली प्रभारी अभियंता)/SLDC Control room,
HVPNL Panipat
Contact No- 9053090722,9053090721,0180-2664095

--
Regards,
SCE (पाली प्रभारी अभियंता)/SLDC Control room,
HVPNL Panipat
Contact No- 9053090722,9053090721,0180-2664095

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HARYANA VIDYUT PRASARAN NIGAM LIMITED

Regd. Office: Shakti Bhawan, Plot No. C-4, Sector-6, Panchkula, 134109.
Corporate Identity Number: U40101HR1997SGC033683
Website: www.hvpn.org.in, E-mail - xentsbhw@hvpn.org.in
Phone No: 01664-242797(O)

To

The Executive Engineer,
LDPC, HVPNL,
Panipat.

Memo No.Ch-116/OMBE-7 Dated: 29.08.2024

Subject: SPS scheme at HVPNL substations for getting load relief due to tripping of 500Kv HVDC Mundra – Mahendargarh

Please refer to this O/Memo No. 108/OMBE-7 dated 27.08.2024 and O/Email dated 09.08.2024 on the subject cited matter.

In this continuation to above, the details of SPS under TS division, HVPNL, Bhiwani is as under:

S No.	Name of feeding S/Stn	Feeder/Line/Equipment	SPS Installed	Max. Load	Load Relief (Avg Load)	Remarks
1	220KV S/Stn Bhiwani	132KV IA Bhiwani Line	UFR	50MW	40 MW	SPS (UFR)Installed and healthy
2	220KV S/Stn Bhiwani	132KV Bhiwani Ckt 2	UFR	50MW	40 MW	SPS (UFR)Installed and healthy
3	220KV S/Stn Bhiwani	132KV Tosham	UFR	-	-	SPS (UFR) Installed and healthy but line is running on No load as 2nd source to 132KV Tosham
4	220KV S/Stn Bhiwani	132KV Incomer of Transformer 100MVA Transformer T2	-	85MW	70 MW	SPS may be provided for load relief as mentioned on subject above.
5	220KV S/Stn Bhiwani	132KV Incomer of 100MVA Transformer T1	-	80MW	70 MW	SPS may be provided for load relief as mentioned on subject above.
6	132kV substation Dadri-2	132kV Dadri-kalanaur ckt	Yes		Nil	SPS Installed and healthy but line is running on No load as 2nd source to 132KV Kalanaur
7	132kV substation Dadri-2	132kV Dadri-Makrani ckt	Yes		Nil	SPS Installed and healthy but line is running on No load as 2nd source to 132KV Makrani
8	132kV substation Dadri-2	132kV Dadri-Haluwas ckt	-	45MW	40MW	SPS may be provided for load relief as mentioned on subject above.
9	132kV substation Dadri-2	132kV Dadri-Dadri old	-	50MW	40MW	SPS may be provided for load relief as mentioned on subject above.

This is for kind information and necessary action please.

Executive Engineer,
Transmission System Division,
HVPNL, Bhiwani

CC to:

1. SE/TS Circle, HVPNL, Hisar for kind information, please.

Re: Mock testing of SPS of 500kV HVDC Mundra-Mahindergarh link

SLDC, DELHI <sldcmintoroad@gmail.com>

Wed 8/28/2024 3:48 PM

To:NRLDC SO 2 <nrldcso2@grid-india.in>;

Cc:sinha.surendra <sinha.surendra@yahoo.com>; dgmsodelhisldc@gmail.com <dgmsodelhisldc@gmail.com>; Manager (T) SO <managersogd@gmail.com>;

In reference to trailing mail, the maximum load on 220kV feeders covered under SPS of 500kV HVDC Mundra-Mahindergarh link are as under:

S. No.	Name of the Element	MW
1	220 KV BAMNAULI-PAPANKALAN-I CKT.-I	120
2	220 KV BAMNAULI-PAPANKALAN-I CKT.-II	120
3	220 KV MANDAULA- GOPALPUR CKT.-I	212
4	220 KV MANDAULA- GOPALPUR CKT.-II	214

Regards,
SLDC Delhi

On Tue, Aug 27, 2024 at 10:07 AM NRLDC SO 2 <nrldcso2@grid-india.in> wrote:

> Sir,
>
> In reference of the trailing mail, it is to be mentioned that inputs have received from Rajasthan only. Members agreed to shared the details by 22nd August 2024, however no further details received from Haryana, Punjab, Delhi, UP & ADANI.
>
> Kindly share the details as discussed during the meeting held on 20th August 2024, so that further remedial actions can be initiated on the basis of those details.
>
> सादर धन्यवाद/ Thanks & Regards
> प्रणाली संचालन-II/ System Operation-II
> उ॰क्षे॰भा॰प्रे॰के॰/ NRLDC
> ग्रिड कंट्रोलर ऑफ इंडिया लिमिटेड/ Grid Controller of India Limited
> Formerly known as
> पोसोको / POSOCO

Date	Time	Load throw-off quantum (State-wise)						Total Load throw-off quantum	Remarks
		Delhi	Punjab	Haryana	Rajasthan	UP	Uttarakhand		
5/25/2024	12:46	82	1375	0	140	172	0	1769	as reported by SLDCs
5/27/2024	14:36	280	0	540	0	140	100	1060	as per SCADA data at NRLDC, SLDCs have not confirmed yet
6/1/2024	13:26	0	440	0	0	100	0	540	as per SCADA data at NRLDC, SLDC-Punjab have confirmed
6/1/2024	13:44	270	580	120	0	220	0	1190	SLDC-Punjab & UP have confirmed
6/3/2024	5:28	0	300	0	0	0	0	300	as reported by SLDC-Punjab
6/4/2024	12:35	0	400	0	0	0	0	400	as per SCADA data at NRLDC, SLDC-Punjab have confirmed
6/9/2024	11:21	0	435	0	0	0	0	435	as per SCADA data at NRLDC, SLDC-Punjab have not confirmed yet
6/19/2024	12:42	0	723	0	107	220	0	1050	as reported by SLDCs
6/23/2024	9:11	0	880	0	0	0	0	0	as reported by SLDC-Punjab

Bays Report from 01-07-2024 to 10-09-2024

S.No	CASE ID	Application Month	Name of element	Owner	Voltage Level (in kV)	Bay No	Bay Type	Substation	State	Approved in SCM/Statuto Body	Remark	intimation request for charging of new element (FormatA1)	Acknowledgement sent by NRLDC (Format I1)	Request for test charging and trial run (FormatB)	Provisional Approval for Test Charging/Trial operation(Format IV)	Actual date & time of charging		Request for Trial Operation Certificate(Format C)	Trial Run Operation Certificate Details	
												Date	Date	Date	Date	Date	Time	Date	Trial Run/Operation Period	Certificate No.
7	1119112	May - 2024	400kV Main Bay 401 of 400 KV ALIGARH- SHAMLI CKT-I at Shamli(UP)	UPPTCL	400kV	401	Main Bay	Shamli(UP)	UTTAR PRADESH	19-02-2021 - 00:00, 3, 29.1(ANNEXURE C)(7), 55		11 May 2024 19:38	15 May 2024 17:18	29 Jun 2024 15:51, 24 Jun 2024 16:13	02 Jul 2024 15:02, 28 Jun 2024 09:38	03-Jul-2024	17:51			
8	1119115	May - 2024	400kV Main Bay 402 of 400 KV ALIGARH- SHAMLI CKT-II at Shamli(UP)	UPPTCL	400kV	402	Main Bay	Shamli(UP)	UTTAR PRADESH	19-02-2021 - 00:00, 3, 29.1(ANNEXURE C)(7), 55		11 May 2024 19:41	15 May 2024 15:39	29 Jun 2024 15:51, 24 Jun 2024 16:14	02 Jul 2024 15:03, 28 Jun 2024 09:39	03-Jul-2024	18:36			
11	1119122	May - 2024	765kV Main Bay 710 of GT-II at Jawaharpur TPS(UP)	UPRVUNL	765kV	710	Main Bay	Jawaharpur TPS(UP)	UTTAR PRADESH	30-05-2016 - 00:00, 38, 3.9.1(D), 7&8		14 May 2024 16:37	20 May 2024 12:13	02 Jul 2024 16:27	05 Jul 2024 16:57	12-Jul-2024	20:06			
12	1119139	Jun - 2024	400kV Main Bay 401 of 400 KV Main Line Ludhiana 1 Bay (Bay No. 401) at Ropar(PSTCL)	PSTCL	400kV	401	Main Bay	Ropar(PSTCL)	PUNJAB	24-05-2019 - 10:30, 3rd, 25.0, 85		05 Jul 2024 15:23, 04 Jul 2024 16:36, 30 Jun 2024 14:24, 27 Jun 2024 12:31	06 Jul 2024 10:37, 05 Jul 2024 11:50, 03 Jul 2024 10:22, 27 Jun 2024 14:38	19 Jul 2024 19:22, 16 Jul 2024 23:52	20 Jul 2024 10:11, 19 Jul 2024 10:48	20-Jul-2024	15:35			
13	1119139	Jun - 2024	400kV Main Bay 404 of 400 KV Main Line Koldam 1 Bay (Bay No. 404) and NA at Ropar(PSTCL)	PSTCL	400kV	404	Main Bay	Ropar(PSTCL)	PUNJAB	24-05-2019 - 10:30, 3rd, 25.0, 85		05 Jul 2024 15:23, 04 Jul 2024 16:36, 30 Jun 2024 14:24, 27 Jun 2024 12:31	06 Jul 2024 10:37, 05 Jul 2024 11:50, 03 Jul 2024 10:22, 27 Jun 2024 14:38	19 Jul 2024 19:22, 16 Jul 2024 23:52	20 Jul 2024 10:11, 19 Jul 2024 10:48	20-Jul-2024	16:31			
14	1119177	Jul - 2024	400kV Main Bay 431 A of 400 kV S/c line from 400 kV GSS Jaisalmer-2 to Renew Hans Urja Pvt. Ltd. at Jaisalmer(RS)	RRVPNL,Renew Hans urja pvt Ltd	400kV	431 A	Main Bay	Jaisalmer(RS)	RAJASTHAN	01-08-2023 - 10:00, 1, 1, 1		23 Jul 2024 21:36, 23 Jul 2024 17:43	23 Jul 2024 21:48, 23 Jul 2024 20:51	25 Jul 2024 17:41, 24 Jul 2024 15:07, 23 Jul 2024 22:30	26 Jul 2024 12:38, 25 Jul 2024 12:52, 24 Jul 2024 09:39	24-Jul-2024	12:34			
15	1119177	Jul - 2024	400kV Tie Bay 432 T of 400 kV S/c line from 400 kV GSS Jaisalmer-2 to Renew Hans Urja Pvt. Ltd. and Future Bay at Jaisalmer(RS)	RRVPNL,Renew Hans urja pvt Ltd	400kV	432 T	Tie Bay	Jaisalmer(RS)	RAJASTHAN	01-08-2023 - 10:00, 1, 1, 1		23 Jul 2024 21:36, 23 Jul 2024 17:43	23 Jul 2024 21:48, 23 Jul 2024 20:51	25 Jul 2024 17:41, 24 Jul 2024 15:07, 23 Jul 2024 22:30	26 Jul 2024 12:38, 25 Jul 2024 12:52, 24 Jul 2024 09:39	24-Jul-2024	12:36			
16	1119177	Jul - 2024	400kV Main Bay 401 of 400 kV S/c line from 400 kV GSS Jaisalmer-2 to Renew Hans Urja Pvt. Ltd. at M/s Renew Hans urja pvt Ltd (RS)	RRVPNL,Renew Hans urja pvt Ltd	400kV	401	Main Bay	M/s Renew Hans urja pvt Ltd (RS)	RAJASTHAN	01-08-2023 - 10:00, 1, 1, 1		23 Jul 2024 21:36, 23 Jul 2024 17:43	23 Jul 2024 21:48, 23 Jul 2024 20:51	25 Jul 2024 17:41, 24 Jul 2024 15:07, 23 Jul 2024 22:30	26 Jul 2024 12:38, 25 Jul 2024 12:52, 24 Jul 2024 09:39	24-Jul-2024	15:33			
17	1119177	Jul - 2024	400kV Tie Bay 402 of 400 kV S/c line from 400 kV GSS Jaisalmer-2 to Renew Hans Urja Pvt. Ltd. and 400/33 kV, 200 MVA, T/F NO. 1 at M/s Renew Hans urja pvt Ltd (RS)	RRVPNL,Renew Hans urja pvt Ltd	400kV	402	Tie Bay	M/s Renew Hans urja pvt Ltd (RS)	RAJASTHAN	01-08-2023 - 10:00, 1, 1, 1		23 Jul 2024 21:36, 23 Jul 2024 17:43	23 Jul 2024 21:48, 23 Jul 2024 20:51	25 Jul 2024 17:41, 24 Jul 2024 15:07, 23 Jul 2024 22:30	26 Jul 2024 12:38, 25 Jul 2024 12:52, 24 Jul 2024 09:39	24-Jul-2024	15:33			
18	1119181	Jul - 2024	400kV Tie Bay 408 of 400/33 kV, 200 MVA, ICT No. 3 and Future Bay at M/s Renew Hans urja pvt Ltd (RS)	Renew Hans urja pvt Ltd	400kV	408	Tie Bay	M/s Renew Hans urja pvt Ltd (RS)	RAJASTHAN	01-08-2023 - 10:00, 1, 1, 1		25 Jul 2024 14:38	25 Jul 2024 18:01	26 Jul 2024 12:11, 25 Jul 2024 20:11	26 Jul 2024 14:18, 26 Jul 2024 11:45	26-Jul-2024	16:48			
19	1119181	Jul - 2024	400kV Main Bay 409 of 400/33 kV, 200 MVA, ICT No. 3 at M/s Renew Hans urja pvt Ltd (RS)	Renew Hans urja pvt Ltd	400kV	409	Main Bay	M/s Renew Hans urja pvt Ltd (RS)	RAJASTHAN	01-08-2023 - 10:00, 1, 1, 1		25 Jul 2024 14:38	25 Jul 2024 18:01	26 Jul 2024 12:11, 25 Jul 2024 20:11	26 Jul 2024 14:18, 26 Jul 2024 11:45	26-Jul-2024	16:48			
20	1119181	Jul - 2024	400kV Main Bay 406 of 400/33 kV, 200 MVA, ICT No. 2 at M/s Renew Hans urja pvt Ltd (RS)	Renew Hans urja pvt Ltd	400kV	406	Main Bay	M/s Renew Hans urja pvt Ltd (RS)	RAJASTHAN	01-08-2023 - 10:00, 1, 1, 1		25 Jul 2024 14:38	25 Jul 2024 18:01	26 Jul 2024 12:11, 25 Jul 2024 20:11	26 Jul 2024 14:18, 26 Jul 2024 11:45	26-Jul-2024	17:12			
21	1119181	Jul - 2024	400kV Tie Bay 405 of 400/33 kV, 200 MVA, ICT No. 2 and Future bay at M/s Renew Hans urja pvt Ltd (RS)	Renew Hans urja pvt Ltd	400kV	405	Tie Bay	M/s Renew Hans urja pvt Ltd (RS)	RAJASTHAN	01-08-2023 - 10:00, 1, 1, 1		25 Jul 2024 14:38	25 Jul 2024 18:01	26 Jul 2024 12:11, 25 Jul 2024 20:11	26 Jul 2024 14:18, 26 Jul 2024 11:45	26-Jul-2024	17:16			
22	1119181	Jul - 2024	400kV Main Bay 403 of 400/33 kV, 200 MVA, ICT No. 1 at M/s Renew Hans urja pvt Ltd (RS)	Renew Hans urja pvt Ltd	400kV	403	Main Bay	M/s Renew Hans urja pvt Ltd (RS)	RAJASTHAN	01-08-2023 - 10:00, 1, 1, 1		25 Jul 2024 14:38	25 Jul 2024 18:01	26 Jul 2024 12:11, 25 Jul 2024 20:11	26 Jul 2024 14:18, 26 Jul 2024 11:45	26-Jul-2024	17:33			
23	1119182	Jul - 2024	765kV Main Bay 722 of 765/400 kV 1500 MVA ICT-5 at Fatehgarh_II(PG)	POWERGRID	765kV	722	Main Bay	Fatehgarh_II(PG)	RAJASTHAN	13-09-2019 - 10:30, 5, 2.2(iv), 4		26 Jul 2024 14:21	27 Jul 2024 12:14	27 Jul 2024 15:01	28 Jul 2024 14:33	29-Jul-2024	23:39	16 Aug 2024 11:03, 03 Aug 2024 12:02	29-07-2024 - 23:40 to 30-07-2024 - 23:40	GRID-INDIA/NRLDC/SO/530
24	1119182	Jul - 2024	765kV Tie Bay 723 of 765/400 kV 1500 MVA ICT-5 and 765KV Fatehgarh-2 to Bhadla-2 circuit 4 at Fatehgarh_II(PG)	POWERGRID	765kV	723	Tie Bay	Fatehaarh II(PG)	RAJASTHAN	13-09-2019 - 10:30, 5, 2.2(iv), 4		26 Jul 2024 14:21	27 Jul 2024 12:14	27 Jul 2024 15:01	28 Jul 2024 14:33	30-Jul-2024	00:18	16 Aug 2024 11:03, 03 Aug 2024 12:02	30-07-2024 - 00:20 to 31-07-2024 - 00:20	GRID-INDIA/NRLDC/SO/530
25	1119166	Jul - 2024	400kV Main Bay 412 of 400 KV Bhadla_2- Azure Line at Bhadla _2 (PG)	POWERGRID	400kV	412	Main Bay	Bhadla _2 (PG)	RAJASTHAN	20-01-2020 - 10:30, 4, 7.2, SI.2, 41		16 Jul 2024 18:49	19 Jul 2024 15:19	31 Jul 2024 16:24, 24 Jul 2024 22:55	01 Aug 2024 13:25, 31 Jul 2024 09:03	01-Aug-2024	18:01			
26	1119167	Jul - 2024	400kV Main Bay 415 of 400 KV Bhadla_2-Adani Green Energy Four Ltd. Line at Bhadla _2 (PG)	POWERGRID	400kV	415	Main Bay	Bhadla _2 (PG)	RAJASTHAN	20-01-2020 - 10:30, 4, 7.2, SI.3, 41		16 Jul 2024 18:49	19 Jul 2024 15:18	31 Jul 2024 16:19, 24 Jul 2024 22:55	01 Aug 2024 13:25, 31 Jul 2024 09:02	01-Aug-2024	18:20			
27	1119167	Jul - 2024	400kV Tie Bay 414 of 400 KV Bhadla_2-Adani Green Energy Four Ltd. Line and Future at Bhadla _2 (PG)	POWERGRID	400kV	414	Tie Bay	Bhadla _2 (PG)	RAJASTHAN	20-01-2020 - 10:30, 4, 7.2, SI.3, 41		16 Jul 2024 18:49	19 Jul 2024 15:18	31 Jul 2024 16:19, 24 Jul 2024 22:55	01 Aug 2024 13:25, 31 Jul 2024 09:02	01-Aug-2024	18:21			
28	1119166	Jul - 2024	400kV Tie Bay 411 of 400 KV Bhadla_2- Azure Line and Future at Bhadla _2 (PG)	POWERGRID	400kV	411	Tie Bay	Bhadla _2 (PG)	RAJASTHAN	20-01-2020 - 10:30, 4, 7.2, SI.2, 41		16 Jul 2024 18:49	19 Jul 2024 15:19	31 Jul 2024 16:24, 24 Jul 2024 22:55	01 Aug 2024 13:25, 31 Jul 2024 09:03	01-Aug-2024	18:22			
29	1119153	Jun - 2024	400kV Main Bay 403 of 400 KV, 500 MVA ICT-1 at Ropar(PSTCL)	PSTCL	400kV	403	Main Bay	Ropar(PSTCL)	PUNJAB	24-05-2019 - 10:30, 3rd, 25.0, 85		05 Jul 2024 15:25, 04 Jul 2024 16:36, 01 Jul 2024 16:13, 30 Jun 2024 14:22	06 Jul 2024 10:36, 05 Jul 2024 10:51, 03 Jul 2024 10:18, 01 Jul 2024 09:08	09 Aug 2024 10:22	09 Aug 2024 17:56	10-Aug-2024	13:59			
30	1119139	Jun - 2024	400kV Tie Bay 402 of 400 KV Ropar Ludhiana Ckt 1 and 500 MVA ICT 1 at Ropar(PSTCL)	PSTCL	400kV	402	Tie Bay	Ropar(PSTCL)	PUNJAB	24-05-2019 - 10:30, 3rd, 25.0, 85		05 Jul 2024 15:23, 04 Jul 2024 16:36, 30 Jun 2024 14:24, 27 Jun 2024 12:31	06 Jul 2024 10:37, 05 Jul 2024 11:50, 03 Jul 2024 10:22, 27 Jun 2024 14:38	19 Jul 2024 19:22, 16 Jul 2024 23:52	20 Jul 2024 10:11, 19 Jul 2024 10:48	10-Aug-2024	13:59			
31	1119153	Jun - 2024	220kV Main Bay 209 of LV side of 500 MVA ICT -1 at Ropar(PSTCL)	PSTCL	220kV	209	Main Bay	Ropar(PSTCL)	PUNJAB	24-05-2019 - 10:30, 3rd, 25.0, 85		05 Jul 2024 15:25, 04 Jul 2024 16:36, 01 Jul 2024 16:13, 30 Jun 2024 14:22	06 Jul 2024 10:36, 05 Jul 2024 10:51, 03 Jul 2024 10:18, 01 Jul 2024 09:08	09 Aug 2024 10:22	09 Aug 2024 17:56	10-Aug-2024	14:23			
32	1119153	Jun - 2024	400kV Main Bay 406 of 400 KV, 500 MVA ICT -2 at Ropar(PSTCL)	PSTCL	400kV	406	Main Bay	Ropar(PSTCL)	PUNJAB	24-05-2019 - 10:30, 3rd, 25.0, 85		05 Jul 2024 15:25, 04 Jul 2024 16:36, 01 Jul 2024 16:13, 30 Jun 2024 14:22	06 Jul 2024 10:36, 05 Jul 2024 10:51, 03 Jul 2024 10:18, 01 Jul 2024 09:08	09 Aug 2024 10:22	09 Aug 2024 17:56	10-Aug-2024	14:39			
33	1119139	Jun - 2024	400kV Tie Bay 405 of 400 KV Ropar-koldam Ckt 1 and 500 MVA ICT 2 at Ropar(PSTCL)	PSTCL	400kV	405	Tie Bay	Ropar(PSTCL)	PUNJAB	24-05-2019 - 10:30, 3rd, 25.0, 85		05 Jul 2024 15:23, 04 Jul 2024 16:36, 30 Jun 2024 14:24, 27 Jun 2024 12:31	06 Jul 2024 10:37, 05 Jul 2024 11:50, 03 Jul 2024 10:22, 27 Jun 2024 14:38	19 Jul 2024 19:22, 16 Jul 2024 23:52	20 Jul 2024 10:11, 19 Jul 2024 10:48	10-Aug-2024	14:41			
34	1119153	Jun - 2024	220kV Main Bay 208 of LV side of 500 MVA ICT -2 at Ropar(PSTCL)	PSTCL	220kV	208	Main Bay	Ropar(PSTCL)	PUNJAB	24-05-2019 - 10:30, 3rd, 25.0, 85		05 Jul 2024 15:25, 04 Jul 2024 16:36, 01 Jul 2024 16:13, 30 Jun 2024 14:22	06 Jul 2024 10:36, 05 Jul 2024 10:51, 03 Jul 2024 10:18, 01 Jul 2024 09:08	09 Aug 2024 10:22	09 Aug 2024 17:56	10-Aug-2024	14:51			
35	1119187	Aug - 2024	220kV Main Bay 232(A202) of 220 kV EDEN Renewable Bercy Ltd at Fatehgarh_II(PG)	POWERGRID	220kV	232(A202)	Main Bay	Fatehaarh II(PG)	RAJASTHAN	13-09-2019 - 10:30, 5, 2.2, xix, 5		08 Aug 2024 14:31, 04 Aug 2024 23:03	09 Aug 2024 12:21, 07 Aug 2024 14:24	12 Aug 2024 13:11, 11 Aug 2024 13:20	12 Aug 2024 15:00, 12 Aug 2024 12:57	12-Aug-2024	19:17			
36	1119187	Aug - 2024	220kV Main Bay 233(A203) of 220 kV EDEN Renewable Passy Ltd at Fatehgarh_II(PG)	POWERGRID	220kV	233(A203)	Main Bay	Fatehgarh_II(PG)	RAJASTHAN	13-09-2019 - 10:30, 5, 2.2, xix, 5		08 Aug 2024 14:31, 04 Aug 2024 23:03	09 Aug 2024 12:21, 07 Aug 2024 14:24	12 Aug 2024 13:11, 11 Aug 2024 13:20	12 Aug 2024 15:00, 12 Aug 2024 12:57	12-Aug-2024	19:18			
37	1119187	Aug - 2024	220kV Main Bay 235(A205) of Bay Vacant and Yet to be allocated by CTU at Fatehaarh II(PG)	POWERGRID	220kV	235(A205)	Main Bay	Fatehaarh II(PG)	RAJASTHAN	13-09-2019 - 10:30, 5, 2.2, xix, 5		08 Aug 2024 14:31, 04 Aug 2024 23:03	09 Aug 2024 12:21, 07 Aug 2024 14:24	12 Aug 2024 13:11, 11 Aug 2024 13:20	12 Aug 2024 15:00, 12 Aug 2024 12:57	12-Aug-2024	19:21			
38	1119187	Aug - 2024	220kV Main Bay 236(A206) of Bay Vacant and Yet to be allocated by CTU at Fatehgarh_II(PG)	POWERGRID	220kV	236(A206)	Main Bay	Fatehgarh_II(PG)	RAJASTHAN	13-09-2019 - 10:30, 5, 2.2, xix, 5		08 Aug 2024 14:31, 04 Aug 2024 23:03	09 Aug 2024 12:21, 07 Aug 2024 14:24	12 Aug 2024 13:11, 11 Aug 2024 13:20	12 Aug 2024 15:00, 12 Aug 2024 12:57	12-Aug-2024	19:23			
39	1119187	Aug - 2024	220kV Main Bay 239(A209) of 220 kV Adani Renewable Energy Holding Four Ltd ckt-I at Fatehaarh II(PG)	POWERGRID	220kV	239(A209)	Main Bay	Fatehaarh II(PG)	RAJASTHAN	13-09-2019 - 10:30, 5, 2.2, xix, 5		08 Aug 2024 14:31, 04 Aug 2024 23:03	09 Aug 2024 12:21, 07 Aug 2024 14:24	12 Aug 2024 13:11, 11 Aug 2024 13:20	12 Aug 2024 15:00, 12 Aug 2024 12:57	12-Aug-2024	19:24			
40	1119187	Aug - 2024	220kV Main Bay 240(A210) of 220 kV Adani Renewable Energy Holding Four Ltd ckt-II at Fatehgarh_II(PG)	POWERGRID	220kV	240(A210)	Main Bay	Fatehgarh_II(PG)	RAJASTHAN	13-09-2019 - 10:30, 5, 2.2, xix, 5		08 Aug 2024 14:31, 04 Aug 2024 23:03	09 Aug 2024 12:21, 07 Aug 2024 14:24	12 Aug 2024 13:11, 11 Aug 2024 13:20	12 Aug 2024 15:00, 12 Aug 2024 12:57	12-Aug-2024	19:27			
41	1119133	Jun - 2024	400kV Main Bay 422 of 400kV Sikar-II (PSTL)-Neemrana (PG) Ckt-1 at Neemrana(PG)	POWERGRID D SIKAR TRANSMISSION LIMITED	400kV	422	Main Bay	Neemrana(PG)	RAJASTHAN	13-09-2019 - 10:30, 5, 2.2? Sl.11, 4		13 Jun 2024 17:54, 07 Jun 2024 20:32	14 Jun 2024 12:27, 12 Jun 2024 10:08	30 Jul 2024 12:56, 16 Jul 2024 14:02	02 Aug 2024 08:56, 19 Jul 2024 15:00, 19 Jul 2024 14:58	13-Aug-2024	18:35			
42	1119133	Jun - 2024	400kV Tie Bay 423 of 400kV Sikar-II (PSTL)-Neemrana (PG) Ckt-1 and Future at Neemrana(PG)	POWERGRID D SIKAR TRANSMISSION LIMITED	400kV	423	Tie Bay	Neemrana(PG)	RAJASTHAN	13-09-2019 - 10:30, 5, 2.2? Sl.11, 4		13 Jun 2024 17:54, 07 Jun 2024 20:32	14 Jun 2024 12:27, 12 Jun 2024 10:08	30 Jul 2024 12:56, 16 Jul 2024 14:02	02 Aug 2024 08:56, 19 Jul 2024 15:00, 19 Jul 2024 14:58	13-Aug-2024	18:36			
43	1119133	Jun - 2024	400kV Main Bay 425 of 400kV Sikar-II (PSTL)-Neemrana (PG) Ckt- 2 at Neemrana(PG)	POWERGRID D SIKAR TRANSMISSION LIMITED	400kV	425	Main Bay	Neemrana(PG)	RAJASTHAN	13-09-2019 - 10:30, 5, 2.2? Sl.11, 4		13 Jun 2024 17:54, 07 Jun 2024 20:32	14 Jun 2024 12:27, 12 Jun 2024 10:08	30 Jul 2024 12:56, 16 Jul 2024 14:02	02 Aug 2024 08:56, 19 Jul 2024 15:00, 19 Jul 2024 14:58	13-Aug-2024	18:37			
44	1119133	Jun - 2024	400kV Tie Bay 426 of 400kV Sikar-II (PSTL)-Neemrana (PG) Ckt-2 and Future at Neemrana(PG)	POWERGRID D SIKAR TRANSMISSION LIMITED	400kV	426	Tie Bay	Neemrana(PG)	RAJASTHAN	13-09-2019 - 10:30, 5, 2.2? Sl.11, 4		13 Jun 2024 17:54, 07 Jun 2024 20:32	14 Jun 2024 12:27, 12 Jun 2024 10:08	30 Jul 2024 12:56, 16 Jul 2024 14:02	02 Aug 2024 08:56, 19 Jul 2024 15:00, 19 Jul 2024 14:58	13-Aug-2024	18:38			
45	1119125	May - 2024	400kV Main Bay 403 of HV SIDE OF 500 MVA ICT-III at Jawaharpur TPS(UP)	UPRVUNL	400kV	403	Main Bay	Jawaharpur TPS(UP)	UTTAR PRADESH	30-05-2016 - 00:00, 38, 3.9.1(D), 7		22 May 2024 15:14	25 May 2024 12:23	18 Jul 2024 12:24, 08 Jul 2024 11:27	19 Jul 2024 16:53, 10 Jul 2024 09:16	14-Aug-2024	17:16			
46	1119178	Jul - 2024	220kV Main Bay 215 of 220KV Sonipat (PG)-IMT Kharkhoda CKT 1 at Sonipat(PG)	POWERGRID	220kV	215	Main Bay	Sonipat(PG)	HARYANA	28-09-2022 - 10:30, 9, 4.1.2(ii), 10		25 Jul 2024 10:49	26 Jul 2024 14:43	16 Aug 2024 21:10, 16 Aug 2024 14:12	17 Aug 2024 13:44, 16 Aug 2024 20:45	18-Aug-2024	15:29	23 Aug 2024 15:19	18-08-2024 - 15:30 to 19-08-2024 - 15:30	
47	1119178	Jul - 2024	220kV Main Bay 216 of 220KV Sonipat (PG)- IMT Kharkhoda CKT 2 at Sonipat(PG)	POWERGRID	220kV	216	Main Bay	Sonipat(PG)	HARYANA	28-09-2022 - 10:30, 9, 4.1.2(ii), 10		25 Jul 2024 10:49	26 Jul 2024 14:43	16 Aug 2024 21:10, 16 Aug 2024 14:12	17 Aug 2024 13:44, 16 Aug 2024 20:45	18-Aug-2024	15:33	23 Aug 2024 15:19	18-08-2024 - 15:35 to 19-08-2024 - 15:35	
48	1119123	May - 2024	220kV Main Bay 207 of LV SIDE OF 500 MVA ICT-III at Jawaharpur_TPS(UP)	UPRVUNL	220kV	207	Main Bay	Jawaharpur_TPS(UP)	UTTAR PRADESH	30-05-2016 - 00:00, 38, 3.9.1(D), 7		22 May 2024 15:14	25 May 2024 12:23	18 Jul 2024 12:24, 08 Jul 2024 11:27	19 Jul 2024 16:53, 10 Jul 2024 09:16	20-Aug-2024	17:04			
49	1119128	May - 2024	400kV Main Bay 401 of HV SIDE OF 500 MVA ICT-IV at Jawaharpur_TPS(UP)	UPRVUNL	400kV	401	Main Bay	Jawaharpur_TPS(UP)	UTTAR PRADESH	30-05-2016 - 00:00, 38, 3.9.1(D), 7		22 May 2024 15:17	25 May 2024 12:22	18 Jul 2024 12:25, 08 Jul 2024 11:27	19 Jul 2024 16:52, 10 Jul 2024 09:18	22-Aug-2024	18:09			
50	1119175	Jul - 2024	400kV Main Bay 404 of 400 KV MODIPURAM(MEERUT) LINE-I at Shamli(UP)	UPPTCL	400kV	404	Main Bay	Shamli(UP)	UTTAR PRADESH	19-02-2021 - 00:00, 3, 29.1(ANNEXUREC)(7), 55		26 Jul 2024 11:19, 23 Jul 2024 11:14	30 Jul 2024 11:07, 24 Jul 2024 11:11	14 Aug 2024 16:13, 02 Aug 2024 11:42	20 Aug 2024 10:19, 06 Aug 2024 15:50	23-Aug-2024	16:50			

51	1119175	Jul - 2024	400kV Main Bay 408 of 400 KV MODIPURAM(MEERUT) LINE-II at Shamli(UP)	UPPTCL	400kV	408	Main Bay	Shamli(UP)	UTTAR PRADESH	19-02-2021 - 00:00, 3, 29.1(ANNEXURE(7).55		26 Jul 2024 11:19, 23 Jul 2024 11:14	30 Jul 2024 11:07, 24 Jul 2024 11:11	14 Aug 2024 16:13, 02 Aug 2024 11:42	20 Aug 2024 10:19, 06 Aug 2024 15:50	23-Aug-2024	16:52				
52	1119175	Jul - 2024	400kV Main Bay 407 of HV SIDE OF 500 MVA ICT-II at Shamli(UP)	UPPTCL	400kV	407	Main Bay	Shamli(UP)	UTTAR PRADESH	19-02-2021 - 00:00, 3, 29.1(ANNEXURE(7).55		26 Jul 2024 11:19, 23 Jul 2024 11:14	30 Jul 2024 11:07, 24 Jul 2024 11:11	14 Aug 2024 16:13, 02 Aug 2024 11:42	20 Aug 2024 10:19, 06 Aug 2024 15:50	23-Aug-2024	16:55				
53	1119175	Jul - 2024	220kV Main Bay 208 of LV SIDE OF 500 MVA ICT-II at Shamli(UP)	UPPTCL	220kV	208	Main Bay	Shamli(UP)	UTTAR PRADESH	19-02-2021 - 00:00, 3, 29.1(ANNEXURE(7).55		26 Jul 2024 11:19, 23 Jul 2024 11:14	30 Jul 2024 11:07, 24 Jul 2024 11:11	14 Aug 2024 16:13, 02 Aug 2024 11:42	20 Aug 2024 10:19, 06 Aug 2024 15:50	23-Aug-2024	16:57				
54	1119128	May - 2024	220kV Main Bay 206 of LV SIDE OF 500 MVA ICT-IV at Jawaharpur_TPS(UP)	UPRVUNL	220kV	206	Main Bay	Jawaharpur_TPS(UP)	UTTAR PRADESH	30-05-2016 - 00:00, 38, 3.9.1(D), 7		22 May 2024 15:17	25 May 2024 12:22	18 Jul 2024 12:25, 08 Jul 2024 11:27	19 Jul 2024 16:52, 10 Jul 2024 09:18	24-Aug-2024	13:18				
55	1119123	May - 2024	400kV Tie Bay 402 of 500 MVA ICT-III and 500 MVA ICT-IV at Jawaharpur_TPS(UP)	UPRVUNL	400kV	402	Tie Bay	Jawaharpur_TPS(UP)	UTTAR PRADESH	30-05-2016 - 00:00, 38, 3.9.1(D), 7		22 May 2024 15:14	25 May 2024 12:23	18 Jul 2024 12:24, 08 Jul 2024 11:27	19 Jul 2024 16:53, 10 Jul 2024 09:16	24-Aug-2024	15:06				
56	1119206	Aug - 2024	400kV Main Bay 413 (C13) of 400KV TEHRI PSP-KOTESHWAR(PG) LINE#3 at Tehri(THDC)	Tehri PSP	400kV	413 (C13)	Main Bay	Tehri(THDC)	UTTARAKHAND	30-05-2009 - 10:00, 27th , 9.0, 10 of 41		20 Aug 2024 10:58, 17 Aug 2024 09:25	21 Aug 2024 09:30, 19 Aug 2024 14:39	22 Aug 2024 16:35, 21 Aug 2024 11:57	22 Aug 2024 17:13, 22 Aug 2024 14:34	29-Aug-2024	13:51				
57	1119141	Jun - 2024	400kV Main Bay 427 of 400/220 kV, 500 MVA ICT-3 at Bikaner(PG)	POWERGRID	400kV	427	Main Bay	Bikaner(PG)	RAJASTHAN	30-06-2022 - 10:30, 8, Sl. no.03, 22		15 Jun 2024 12:21	17 Jun 2024 15:51	29 Aug 2024 21:30, 28 Aug 2024 14:54, 28 Aug 2024 14:38	30 Aug 2024 10:03, 29 Aug 2024 21:00	30-Aug-2024	23:40			01-09-2024 - 03:10 to 02-09-2024 - 03:10	
58	1119141	Jun - 2024	400kV Tie Bay 426 of 400/220 kV, 500 MVA ICT-3 and Future at Bikaner(PG)	POWERGRID	400kV	426	Tie Bay	Bikaner(PG)	RAJASTHAN	30-06-2022 - 10:30. 8. Sl. no.03, 22		15 Jun 2024 12:21	17 Jun 2024 15:51	29 Aug 2024 21:30, 28 Aug 2024 14:54, 28 Aug 2024 14:38	30 Aug 2024 10:03, 29 Aug 2024 21:00	30-Aug-2024	23:54			01-09-2024 - 03:10 to 02-09-2024 - 03:10	
59	1119141	Jun - 2024	220kV Main Bay 211 of 400/220 kV, 500 MVA ICT-3 at Bikaner(PG)	POWERGRID	220kV	211	Main Bay	Bikaner(PG)	RAJASTHAN	30-06-2022 - 10:30, 8, Sl. no.03, 22		15 Jun 2024 12:21	17 Jun 2024 15:51	29 Aug 2024 21:30, 28 Aug 2024 14:54, 28 Aug 2024 14:38	30 Aug 2024 10:03, 29 Aug 2024 21:00	01-Sep-2024	03:06			01-09-2024 - 03:10 to 02-09-2024 - 03:10	
60	1119172	Jul - 2024	220kV Main Bay 202 of 220 kV Bikaner_2-Juna Line at Bikaner_2 (PBTSL)	PBTSL	220kV	202	Main Bay	Bikaner_2 (PBTSL)	RAJASTHAN	29-09-2021 - 10:30, 50, 4.B (Point No.)1, 12		29 Aug 2024 22:26, 23 Jul 2024 16:15, 20 Jul 2024 15:00	30 Aug 2024 17:33, 25 Jul 2024 10:39, 22 Jul 2024 17:00	31 Aug 2024 13:10	02 Seo 2024 15:03	02-Seo-2024	17:25				
61	1119183	Jul - 2024	400kV Main Bay 416 of 400 kV Bikaner_2-SIVN Line at Bikaner_2 (PBTSL)	PBTSL	400kV	416	Main Bay	Bikaner_2 (PBTSL)	RAJASTHAN	29-12-2021 - 10:30. 2. 4. 10		30 Aug 2024 15:25, 27 Jul 2024 14:59	02 Sep 2024 11:52, 29 Jul 2024 09:55	03 Sep 2024 12:20, 02 Sep 2024 15:15	03 Sep 2024 17:07, 02 Sep 2024 17:10	04-Sep-2024	18:29				
62	1119137	Jun - 2024	765kV Tie Bay 726 of 765KV Fatehgarh-2 to Bhadla-2 circuit 3 (Upcoming) and 765/400 kV ICT-6 at Fatehgarh_II(PG)	POWERGRID	765kV	726	Tie Bay	Fatehgarh_II(PG)	RAJASTHAN	13-09-2019 - 10:30, 5, 15 & 16, 7		09 Jun 2024 09:02	13 Jun 2024 11:03	08 Jul 2024 18:03, 03 Jul 2024 23:18	10 Jul 2024 16:31, 08 Jul 2024 17:07	05-Sep-2024	19:15				
63	1119170	Jul - 2024	400kV Main Bay 409 of 125 MVAr BUS REACTOR at Jawaharpur_TPS(UP)	UPRVUNL	400kV	409	Main Bay	Jawaharpur_TPS(UP)	UTTAR PRADESH	27-10-2022 - 00:00, 24381/2022, 2.5(ii). 2		19 Jul 2024 17:03	23 Jul 2024 10:32	03 Sep 2024 15:29, 30 Aug 2024 16:21, 24 Aug 2024 15:43	04 Sep 2024 15:21, 02 Sep 2024 11:22, 28 Aug 2024 11:04	06-Sep-2024	18:30				
64	1119170	Jul - 2024	400kV Main Bay 407 of 400 KV SPARE BAY at Jawaharpur_TPS(UP)	UPRVUNL	400kV	407	Main Bay	Jawaharpur_TPS(UP)	UTTAR PRADESH	27-10-2022 - 00:00, 24381/2022, 2.5(ii). 2		19 Jul 2024 17:03	23 Jul 2024 10:32	03 Sep 2024 15:29, 30 Aug 2024 16:21, 24 Aug 2024 15:43	04 Sep 2024 15:21, 02 Sep 2024 11:22, 28 Aug 2024 11:04	06-Sep-2024	18:48				
65	1119170	Jul - 2024	400kV Tie Bay 408 of 125 MVAr BUS REACTOR and SPARE BAY at Jawaharpur_TPS(UP)	UPRVUNL	400kV	408	Tie Bay	Jawaharpur_TPS(UP)	UTTAR PRADESH	27-10-2022 - 00:00, 24381/2022, 2.5(ii). 2		19 Jul 2024 17:03	23 Jul 2024 10:32	03 Sep 2024 15:29, 30 Aug 2024 16:21, 24 Aug 2024 15:43	04 Sep 2024 15:21, 02 Sep 2024 11:22, 28 Aug 2024 11:04	06-Sep-2024	18:49				
66	1119127	May - 2024	765kV Main Bay 803R of 330 MVAr LINE REACTOR at Ghatampur_TPS(UP)	GTL_PQYTL	765kV	803R	Main Bay	Ghatampur_TPS(UP)	UTTAR PRADESH	13-11-2018 - 00:00, 2 & 37, 18 & 1.2.2.2(d), 42 &4		22 May 2024 15:18	28 May 2024 16:43	30 Aug 2024 15:54, 21 Aug 2024 12:21, 13 Aug 2024 14:06	02 Sep 2024 16:15, 23 Aug 2024 17:01, 16 Aug 2024 16:38	06-Sep-2024	21:13				
67	1119144	Jun - 2024	765kV Main Bay 724 of 765/400KV 1500 MVA ICT-4 at Bhadla_2 (PG)	POWERGRID	765kV	724	Main Bay	Bhadla_2 (PG)	RAJASTHAN	30-09-2019 - 10:30, 6, Point no. (xiv). 5		25 Jun 2024 09:02, 24 Jun 2024 12:15	26 Jun 2024 14:26, 25 Jun 2024 08:53	31 Aug 2024 13:16	03 Seo 2024 10:23	07-Seo-2024	01:04				
68	1119203	Aug - 2024	400kV Main Bay 403 of 400 kV AGE2SL SL_BHD2_PG-Bhadla_2(PG)-1 at AGE2SL SL_BHD2_PG	AGE2SL	400kV	403	Main Bay	AGE2SL SL_BHD2_PG	RAJASTHAN	01-09-2020 - 11:00, 2nd NRPCTP Meeting , Anne.V/Table 2/7 , 56		20 Aug 2024 12:18, 16 Aug 2024 13:27, 14 Aug 2024 20:27	20 Aug 2024 15:54, 20 Aug 2024 10:50, 16 Aug 2024 11:00	05 Sep 2024 12:30, 04 Sep 2024 17:01, 04 Sep 2024 16:51, 02 Sep 2024 17:13	06 Sep 2024 17:40, 05 Sep 2024 12:19, 04 Sep 2024 14:37	07-Sep-2024	22:36			07-09-2024 - 22:20 to 07-09-2024 - 23:40	
69	1119203	Aug - 2024	400kV Tie Bay 402 of 400 kV AGE2SL SL_BHD2_PG-Bhadla_2 (PG)-1 ant ICT -1 at AGE2SL SL_BHD2_PG	AGE2SL	400kV	402	Tie Bay	AGE2SL SL_BHD2_PG	RAJASTHAN	01-09-2020 - 11:00, 2nd NRPCTP Meetine . Anne.V/Table 2/7 . 56		20 Aug 2024 12:18, 16 Aug 2024 13:27, 14 Aug 2024 20:27	20 Aug 2024 15:54, 20 Aug 2024 10:50, 16 Aug 2024 11:00	05 Sep 2024 12:30, 04 Sep 2024 17:01, 04 Sep 2024 16:51, 02 Sep 2024 17:13	06 Sep 2024 17:40, 05 Sep 2024 12:19, 04 Sep 2024 14:37	07-Seo-2024	23:24				
70	1119203	Aug - 2024	400kV Main Bay 401 of ICT -1 at AGE2SL SL_BHD2_PG	AGE2SL	400kV	401	Main Bay	AGE2SL SL_BHD2_PG	RAJASTHAN	01-09-2020 - 11:00, 2nd NRPCTP Meeting , Anne.V/Table 2/7 , 56		20 Aug 2024 12:18, 16 Aug 2024 13:27, 14 Aug 2024 20:27	20 Aug 2024 15:54, 20 Aug 2024 10:50, 16 Aug 2024 11:00	05 Sep 2024 12:30, 04 Sep 2024 17:01, 04 Sep 2024 16:51, 02 Sep 2024 17:13	06 Sep 2024 17:40, 05 Sep 2024 12:19, 04 Sep 2024 14:37	07-Sep-2024	23:47				
71	1119203	Aug - 2024	400kV Main Bay 404 of ICT 2 at AGE2SL SL_BHD2_PG	AGE2SL	400kV	404	Main Bay	AGE2SL SL_BHD2_PG	RAJASTHAN	01-09-2020 - 11:00, 2nd NRPCTP Meeting , Anne.V/Table 2/7 , 56		20 Aug 2024 12:18, 16 Aug 2024 13:27, 14 Aug 2024 20:27	20 Aug 2024 15:54, 20 Aug 2024 10:50, 16 Aug 2024 11:00	05 Sep 2024 12:30, 04 Sep 2024 17:01, 04 Sep 2024 16:51, 02 Sep 2024 17:13	06 Sep 2024 17:40, 05 Sep 2024 12:19, 04 Sep 2024 14:37	08-Sep-2024	00:16				
72	1119203	Aug - 2024	400kV Tie Bay 405 of Bus no. 01 and ICT 2 at AGE2SL SL_BHD2_PG	AGE2SL	400kV	405	Tie Bay	AGE2SL SL_BHD2_PG	RAJASTHAN	01-09-2020 - 11:00, 2nd NRPCTP Meetine . Anne.V/Table 2/7 . 56		20 Aug 2024 12:18, 16 Aug 2024 13:27, 14 Aug 2024 20:27	20 Aug 2024 15:54, 20 Aug 2024 10:50, 16 Aug 2024 11:00	05 Sep 2024 12:30, 04 Sep 2024 17:01, 04 Sep 2024 16:51, 02 Sep 2024 17:13	06 Sep 2024 17:40, 05 Sep 2024 12:19, 04 Sep 2024 14:37	08-Sep-2024	00:34				

BUS Report from 01-07-2024 to 10-09-2024

S.No	CASE ID	Applicable Month	Name of element	Owner	Voltage Level (in kV)	Bus No	Bus Type	Bus Scheme	Fault Level	Normal Current Capacity	Substation	State	Approved in SCM/Status Bodi	Remark	Intimation request for charging of new element (Format.6	Acknowledgment sent by NRLDC (Format 6)	Request for test charging and trial run (Format.8	Provisional Approval for Test Charging/Trial operation(Format.9)	Actual date & time of charging		Request for Trial Operation Certificate(Format.C)	Trial Run Operation Certificate Details	
															Date	Date	Date	Date	Date	Time	Date	Trial Run/Operation Period	Certificate No.
1	1119139	Jun - 2024	400kV Main Bus 2 at Roper(PSTCL)	PSTCL	400kV	2	Main Bus	One & Half Breaker	NA	245E A	Roper(PSTCL)	PUNJAB	24-05-2019 - 10:30, 3rd, 25.0 .BS		05 Jul 2024 15:23, 04 Jul 2024 16:36, 30 Jun 2024 14:24, 27 Jun 2024 12:31	06 Jul 2024 10:37, 05 Jul 2024 11:50, 03 Jul 2024 10:22, 27 Jun 2024 14:38	19 Jul 2024 19:22, 16 Jul 2024 23:52	20 Jul 2024 10:11, 19 Jul 2024 10:48	10-Aug-2024	13:59			
2	1119153	Jun - 2024	220kV Main Bus 1 at Roper(PSTCL)	PSTCL	220kV	1	Main Bus	Double Main & Transfer	40 KA	2500 A	Roper(PSTCL)	PUNJAB	24-05-2019 - 10:30, 3rd, 25.0 .BS		05 Jul 2024 15:25, 04 Jul 2024 16:36, 01 Jul 2024 16:13, 30 Jun 2024 14:22	06 Jul 2024 10:36, 05 Jul 2024 10:51, 03 Jul 2024 10:18, 01 Jul 2024 09:08	09 Aug 2024 10:22	09 Aug 2024 17:56	10-Aug-2024	14:23			
3	1119153	Jun - 2024	220kV Main Bus 2 at Roper(PSTCL)	PSTCL	220kV	2	Main Bus	Double Main & Transfer	40 KA	2500 A	Roper(PSTCL)	PUNJAB	24-05-2019 - 10:30, 3rd, 25.0 .BS		05 Jul 2024 15:25, 04 Jul 2024 16:36, 01 Jul 2024 16:13, 30 Jun 2024 14:22	06 Jul 2024 10:36, 05 Jul 2024 10:51, 03 Jul 2024 10:18, 01 Jul 2024 09:08	09 Aug 2024 10:22	09 Aug 2024 17:56	10-Aug-2024	14:51			

Bus Coupler Report from 01-07-2024 to 10-09-2024

S.No	CASE ID	Application Month	Name of element	Owner	Voltage Level (in kV)	Associated Transmission Element1	Associated Transmission Element2	Substation	State	Approved in SCM/Statury Body	Remark	Intimation request for charging of new element (FormatA)	Acknowledment sent by NRLDC (Format II)	Request for test charging and trial run (FormatB)	Provisional Approval for Test Charging/Trial operation(Format IV)	Actual date & time of charging		Request for Trial Operation Certificate(Format C)	Trial Run Operation Certificate Details	
												Date	Date	Date	Date	Date	Time	Date	Trial Run/Operation Period	Certificate No.
1	1119209	Aug - 2024	400kV Bus Coupler Bay 405 of 400 KV BUS-I and 400 KV BUS -II at Shamli(UP)	UPPTCL	400kV	400 KV BUS -II	400 KV BUS-I	Shamli(UP)	UTTAR PRADESH	19-02-2021 - 00:00, 3, 29.1(ANNEXURE)(7), 55		24 Aug 2024 15:41	28 Aug 2024 12:39	04 Sep 2024 15:09, 31 Aug 2024 11:47	05 Sep 2024 10:01, 02 Sep 2024 12:11	06-Sep-2024	17:22			

BUS REACTOR Report from 01-07-2024 to 10-09-2024

S.No	CASE ID	Application Month	Name of element	Owner	Voltage Level	MVAR Capacity	Substation	Make	Configuration	Serial No	State	Approved in SCM/Statury Body	Remark	Bus Reactor Details	OLD MVAR Capacity	Intimation request for charging of new element (Format-I)	Acknowledment sent by NRLDC (Format-II)	Request for test charging and trial run (Format-III)	Provisional Approval for Test Charging/Trial operation(Format-IV)	Actual date & time of charging		Request for Trial Operation Certificate(Format-C)	Trial Run/Operation Certificate Details	
																Date	Date	Date	Date	Date	Time	Date	Trial Run/Operation Period	Certificate No.
1	1119171	Jul - 2024	400kV, 125 MVAr Bus Reactor at Shamli(UP)	UPPTCL	400kV	125 MVAr	Shamli(UP)	BHEL	3-Phase	6007896	UTTAR PRADESH	19-02-2021 - 00:00, 326 1(WINDN/ER/CT/SS		New		23 Jul 2024 11:15	24 Jul 2024 16:36	13 Aug 2024 16:30, 12 Aug 2024 17:00, 01 Aug 2024 15:48	14 Aug 2024 12:13, 13 Aug 2024 16:14, 06 Aug 2024 09:45	14-Aug-2024	21:19			
2	1119170	Jul - 2024	400kV, 125 MVAr Bus Reactor at Jawaharpur_TPS(UP)	UPRVUNL	400kV	125 MVAr	Jawaharpur_TPS (UP)	GE	3-Phase	T-7154/01.B-31246	UTTAR PRADESH	27-10-2022 - 00:00, 243B1/2022_2.501_2		New		19 Jul 2024 17:03	23 Jul 2024 10:32	03 Sep 2024 15:29, 30 Aug 2024 16:21, 24 Aug 2024 15:43	04 Sep 2024 15:21, 02 Sep 2024 11:22, 28 Aug 2024 11:06	06-Sep-2024	18:30			

LILO Line Charging Report from 01-07-2024 to 10-09-2024

S.No	CASE ID	Application Month	Name of element	Voltage Level (in kV)	Name of Line to be LILOed	Line length of Line to be LILOed	Line Length of New Line after LILO (in Km)	LILO Portion Line Length (in Km)	Conductor Type	Circuit Type	Tower Configuration	Agency/Owner	Location	SCM/CEA/CTU/NRPC Meetine minutes	Remark	Intimation request for charging of new element (Format-I)	Acknowledment sent by NR2DC (Format II)	Request for test charging and trial run (Format-III)	Provisional Approval for Test Charging/Trial operation(format-IV)	Actual date & time of charging		Request for Trial Operation Certificate(Format-C)	Trial Run Operation Certificate Details	
																Date	Date	Date	Date	Date	Time	Date	Trial Run/Operation Period	Certificate No.
1	1119152	Jun - 2024	400KV Roper(PG)-Ludhiana(PG) 1)After LILO of 400 KV KOLDAM - 400 KV LUDHIANA(PG) at 400 KV ROPAR)	400kV	400 KV KOLDAM - 400 KV LUDHIANA(PG)		101.088 KMS	6.747 kms	Triople Snowbird		Double	PKTCL/PSTCL	PUNJAB to PUNJAB	24-05-2019 - 10:30, 3rd, 25.0. 85		05 Jul 2024 15:49, 04 Jul 2024 15:48, 01 Jul 2024 14:38, 29 Jun 2024 14:05, 28 Jun 2024 13:27	06 Jul 2024 10:32, 05 Jul 2024 11:51, 03 Jul 2024 10:19, 01 Jul 2024 09:28, 28 Jun 2024 16:01	19 Jul 2024 19:26, 16 Jul 2024 23:51	20 Jul 2024 10:08, 19 Jul 2024 10:56	20-Jul-2024	15:35			
2	1119151	Jun - 2024	400KV Koldam(NT)-Ropar(PSTCL)- 1)After LILO of 400 KV KOLDAM - 400 KV LUDHIANA(PG) at 400 KV ROPAR)	400kV	400 KV KOLDAM - 400 KV LUDHIANA(PG)		63.068 kms	6.747 kms	Triople Snowbird		Double	PKTCL/PSTCL	HIMACHAL PRADESH to PUNJAB	24-05-2019 - 10:30, 3rd, 25.0. 85		05 Jul 2024 15:49, 04 Jul 2024 15:49, 01 Jul 2024 14:37, 29 Jun 2024 14:02, 28 Jun 2024 13:26	06 Jul 2024 10:34, 05 Jul 2024 10:55, 03 Jul 2024 10:21, 01 Jul 2024 09:28, 28 Jun 2024 16:02	19 Jul 2024 19:25, 16 Jul 2024 23:51	20 Jul 2024 10:10, 19 Jul 2024 10:56	20-Jul-2024	16:31			

LINE REACTOR Report from 01-07-2024 to 10-09-2024

S.No	CASE ID	Application Month	Name of element	Owner	Voltage Level (in kV)	MVAR Capacity	Line Name	Substation	Make	Configuration	Serial No	State	Approved in SCM/Statury Body	Remark	Line Reactor Details	OLD MVAR Capacity	Intimation request for charging of new element (Format-iii)	Acknowledment sent by NRLDC (Format iii)	Request for test charging and trial run (Format-iii)	Provisional Approval for Test Charging/Trial operation(Format iv)	Actual date & time of charging		Request for Trial Operation Certificate(Format-C)	Trial Run/Operation Certificate Details	
																	Date	Date	Date	Date	Date	Time	Date	Period	Certificate No.
3	1119112	May - 2024	50 Non-Switchable Non-Convertable LINE_REACTOR of 400 KV ALIGARH- SHAMLI CKT-I at Shamli(UP)	UPPTCL	400kV	50	400 KV ALIGARH-SHAMLI CKT-I	Shamli(UP)	BHEL	3-Phase	6307898	UTTAR PRADESH	19-02-2021 - 00:00, 3, 29.1(ANNEXURE C)(7), 55		New		11 May 2024 19:38		29 Jun 2024 15:51, 24 Jun 2024 16:13	02 Jul 2024 15:02, 28 Jun 2024 09:38	03-Jul-2024	17:04			
4	1119115	May - 2024	50 MVAr Non-Switchable Non-Convertable LINE_REACTOR of 400 KV ALIGARH- SHAMLI CKT-II at Shamli(UP)	UPPTCL	400kV	50 MVAr	400 KV ALIGARH-SHAMLI CKT-II	Shamli(UP)	BHEL	3-Phase	6307897	UTTAR PRADESH	19-02-2021 - 00:00, 3, 29.1(ANNEXURE C)(7), 55		New		11 May 2024 19:41		29 Jun 2024 15:51, 24 Jun 2024 16:14	02 Jul 2024 15:03, 28 Jun 2024 09:39	03-Jul-2024	18:15			
6	1119127	May - 2024	330 MVAr Switchable Non-Convertable LINE_REACTOR of 765 KV GHATAMPUR TPS - RAMPUR LINE at Ghatampur_TPS(UP)	GTL-PVTL	765kV	330 MVAr	765 KV GHATAMPUR TPS - RAMPUR LINE	Ghatampur_TPS(UP)	ABB	3x1-Phase	1SDA3-01,1SDA3-02,1SDA3-03	UTTAR PRADESH	13-11-2018 - 00:00, 2 & 37, 18 & 1.2.2.2(d), 42 &4		New		22 May 2024 15:18	28 May 2024 16:43	30 Aug 2024 15:56, 21 Aug 2024 12:21, 11 Aug 2024 14:06	02 Sep 2024 16:15, 23 Aug 2024 17:01, 16 Aug 2024 16:38	06-Sep-2024	21:13			

New AC Lines Report from 01-07-2024 to 10-09-2024

S.No	CASE ID	Application Month	Name of element	Owner	Voltage Level (in kV)	Circuit No	Line Length	Conductor Type	Tower Configuration	State	Approved in SCM/Staturo Body	Remark	Intimation request for charging of new element (FormatA)	Acknowledment sent by NRLDC (Format II)	Request for test charging and trial run (FormatIII	Provisional Approval for Test Charging/Trial operation(Format IV)	Actual date & time of charaine		Request for Trial Operation Certificate(Format C)	Trial Run Operation Certificate Details	
																				Trial Run/Operation Period	Certificate No.
													Date	Date	Date	Date	Date	Time	Date		
1	1119112	May - 2024	400kV Aligarh(UP)-Shamli(UP)-1	UPPTCL	400kV		1 240 KM	Twin Moose	Double	UTTAR PRADESH to UTTAR PRADESH	19-02-2021 - 00:00, 3, 29.1(ANNEXURE C)(7), 55		11 May 2024 19:38	15 May 2024 17:18	29 Jun 2024 15:51, 24 Jun 2024 16:13	02 Jul 2024 15:02, 28 Jun 2024 09:38	03-Jul-2024	17:51			
2	1119115	May - 2024	400kV Aligarh(UP)-Shamli(UP)-2	UPPTCL	400kV		2 240 KM	Twin Moose	Double	UTTAR PRADESH to UTTAR PRADESH	19-02-2021 - 00:00, 3, 29.1(ANNEXURE C)(7), 55		11 May 2024 19:41	15 May 2024 15:39	29 Jun 2024 15:51, 24 Jun 2024 16:14	02 Jul 2024 15:03, 28 Jun 2024 09:39	03-Jul-2024	18:36			
3	1119119	May - 2024	765kV Fatehgarh_II(PG)-Bhadla_2 (PG)-3	POWERGRID BHADLA TRANSMISSION LIMITED (PBTL)	765kV		3 202.23 KM	ACSR Zebra	Double	RAJASTHAN to RAJASTHAN	30-09-2019 - 15:30, 6, 4.3.3. point1 2.3, 9		26 Jun 2024 09:09, 15 May 2024 23:06	27 Jun 2024 12:38, 22 May 2024 15:00	10 Jul 2024 15:39, 06 Jul 2024 22:31, 28 Jun 2024 20:10	11 Jul 2024 15:00, 09 Jul 2024 08:54, 03 Jul 2024 12:15	12-Jul-2024	01:25	06 Sep 2024 19:32	12-07-2024 - 01:25 to 13-07-2024 - 01:25	
4	1119177	Jul - 2024	400kV Jaisalmer(RS)-M/s Renew Nans urja pvt Ltd (RS)-1	RRVPNL,Renew Nans urja pvt Ltd	400kV		1 12.5 KM	Twin Moose	Double	RAJASTHAN to RAJASTHAN	01-08-2023 - 10:00, 1, 1, 1		23 Jul 2024 21:36, 23 Jul 2024 17:43	23 Jul 2024 21:48, 23 Jul 2024 20:51	25 Jul 2024 17:41, 24 Jul 2024 15:07, 23 Jul 2024 22:30	26 Jul 2024 12:38, 25 Jul 2024 12:52, 24 Jul 2024 09:39	24-Jul-2024	15:33			
5	1119159	Jul - 2024	220kV Abdullapur(PG)-Rajokheri (HV)-2	HVPNL	220kV		2 22.35	MOOSE	Double	HARYANA to HARYANA	22-06-2018 - 10:30, 40th Meeting, 34.1, 95		10 Jul 2024 14:38, 09 Jul 2024 16:27, 08 Jul 2024 12:56	12 Jul 2024 16:28, 10 Jul 2024 12:06, 09 Jul 2024 09:48	03 Aug 2024 10:49, 27 Jul 2024 16:25, 23 Jul 2024 10:51, 16 Jul 2024 17:41	05 Aug 2024 17:09, 30 Jul 2024 08:52, 24 Jul 2024 17:20, 19 Jul 2024 15:02	05-Aug-2024	20:10			
6	1119159	Jul - 2024	220kV Abdullapur(PG)-Rajokheri (HV)-1	HVPNL	220kV		1 22.35	MOOSE	Double	HARYANA to HARYANA	22-06-2018 - 10:30, 40th Meeting, 34.1, 95		10 Jul 2024 14:38, 09 Jul 2024 16:27, 08 Jul 2024 12:56	12 Jul 2024 16:28, 10 Jul 2024 12:06, 09 Jul 2024 09:48	03 Aug 2024 10:49, 27 Jul 2024 16:25, 23 Jul 2024 10:51, 16 Jul 2024 17:41	05 Aug 2024 17:09, 30 Jul 2024 08:52, 24 Jul 2024 17:20, 19 Jul 2024 15:02	06-Aug-2024	16:13			
7	1119120	May - 2024	765kV Fatehgarh_II(PG)-Bhadla_2 (PG)-4	POWERGRID BHADLA TRANSMISSION LIMITED (PBTL)	765kV		4 202.23 KM	ACSR Zebra	Double	RAJASTHAN to RAJASTHAN	30-09-2019 - 15:30, 6, 4.3.3. point1 2.3, 9		26 Jun 2024 09:11, 15 May 2024 23:07	27 Jun 2024 12:37, 22 May 2024 15:00	10 Jul 2024 15:39, 06 Jul 2024 22:31, 28 Jun 2024 20:10	11 Jul 2024 15:00, 09 Jul 2024 08:53, 03 Jul 2024 12:15	14-Aug-2024	01:08	06 Sep 2024 19:32	14-08-2024 - 01:10 to 15-08-2024 - 01:10	
8	1119207	Aug - 2024	400kV Talni(THDC)-Koteshwar(PG)-3	POWERGRID	400kV		3 13.5 KM	Quad Moose	Single	UTTARAKHAND to UTTARAKHAND	30-05-2009 - 10:00, 27, 9.0 point-1, 10		21 Aug 2024 08:11	21 Aug 2024 16:58	26 Aug 2024 12:33, 24 Aug 2024 14:29, 22 Aug 2024 21:10	26 Aug 2024 16:51, 25 Aug 2024 15:30, 23 Aug 2024 18:01	28-Aug-2024	16:12			
9	1119127	May - 2024	765kV Ghatampur_TPS(UP)-Rampur PRSTL (UP)-1	GTL-PGITL	765kV		1 406.604 KM	Quad Bersimis	Single	UTTAR PRADESH to UTTAR PRADESH	13-11-2018 - 00:00, 2 & 37, 18 & 1.2.2.2(d), 42 &4		22 May 2024 15:18	28 May 2024 16:43	30 Aug 2024 15:54, 21 Aug 2024 12:21, 13 Aug 2024 14:06	02 Sep 2024 16:15, 23 Aug 2024 17:01, 16 Aug 2024 16:38	07-Sep-2024	19:57			
10	1119203	Aug - 2024	400kV AGE2SL SL_BHD2_PG-Bhadla_2 (PG)-1	AGE2SL	400kV		1 400.604 KM	ACSR Bersimis	Double,Multiple	RAJASTHAN to RAJASTHAN	01-09-2020 - 11:00, 2nd NRPCTP Meeting , Anne.V/Table 2/7, 56	400 kV S/C line on D/C tower from 400/33 kV AGE2SL S/s at Badi Sid to 765/400/220 kV Bhadla-II S/s (Length: 11.038 km)	20 Aug 2024 12:18, 16 Aug 2024 13:27, 14 Aug 2024 20:27	20 Aug 2024 15:54, 20 Aug 2024 10:50, 16 Aug 2024 11:00	05 Sep 2024 12:30, 04 Sep 2024 17:01, 04 Sep 2024 16:51, 02 Sep 2024 17:13	06 Sep 2024 17:40, 05 Sep 2024 12:19, 04 Sep 2024 14:37	07-Sep-2024	22:05		07-09-2024 - 20:00 to 07-09-2024 - 23:50	

SOLAR ICR/BLOCK Report from 01-07-2024 to 10-09-2024

S.No	CASE ID	Application Month	Plant Name	Capacity to be Availed	Voltage Level	Total Installed Capacity of Plant	Type of RE	Feeder No	Solar ICR/Block No	ISTS No	ISTS Make	ISTS MVA Ratio	ISTS Voltage Ratio(KV/KV)	Inverter Type	Inverter Make	Total No of Inverters	Inverter AC Rating	Ammicr/ Charer	Evacuation Path	Remark	Intimation request for charging of new element Format-6A	Acknowledement sent for MRI/SCP Format-6B	Request for test charging and trial run Format-6C	Provisional Approval for Test Charging/Trial operation/format-6D	Actual date & time of charging		Power Flow Started		COD Declared by Transmission Licensee
																					Photo	Photo	Photo	Photo	Photo	Photo	Photo	Photo	
3	1139598	Jul - 2024	AVAAN RENEWABLE POWER THREE PRIVATE LIMITED (ARSPSC)	NA S	33kV	272	Solar	103	27	27	Shichar	12.5 MVA	33 kV/ 660 V	Central Inverter	Sungrow	4	2.952 MVA	Avanci PP3PL			12 Jul 2024 04:00, 11 Jul 2024 04:05, 08 Jul 2024 14:05	16 Jul 2024 03:25, 12 Jul 2024 11:27, 09 Jul 2024 09:41	25 Jul 2024 12:45, 29 Jul 2024 17:05, 16 Jul 2024 09:26	29 Jul 2024 06:55, 30 Jul 2024 06:43, 22 Jul 2024 08:57	29-Jul-2024	21:02			
4	1139598	Jul - 2024	AVAAN RENEWABLE POWER THREE PRIVATE LIMITED (ARSPSC)	NA S	33kV	265	Solar	101	26	26	Tesla	12.5 MVA	33 kV/ 660 V	Central Inverter	Sungrow	4	2.952 MVA	Avanci PP3PL			12 Jul 2024 04:00, 11 Jul 2024 04:05, 08 Jul 2024 14:05	16 Jul 2024 03:25, 12 Jul 2024 11:27, 09 Jul 2024 09:41	25 Jul 2024 12:45, 29 Jul 2024 17:05, 16 Jul 2024 09:26	29 Jul 2024 06:55, 30 Jul 2024 06:43, 22 Jul 2024 08:57	29-Jul-2024	21:02			
5	1139598	Jul - 2024	AVAAN RENEWABLE POWER THREE PRIVATE LIMITED (ARSPSC)	NA S	33kV	272	Solar	102	26	26	Tesla	12.5 MVA	33 kV/ 660 V	Central Inverter	Sungrow	4	2.952 MVA	Avanci PP3PL			12 Jul 2024 04:00, 11 Jul 2024 04:05, 08 Jul 2024 14:05	16 Jul 2024 03:25, 12 Jul 2024 11:27, 09 Jul 2024 09:41	25 Jul 2024 12:45, 29 Jul 2024 17:05, 16 Jul 2024 09:26	29 Jul 2024 06:55, 30 Jul 2024 06:43, 22 Jul 2024 08:57	29-Jul-2024	21:02			

Other Blocks

Transformer Report from 01-07-2024 to 10-09-2024

S.N o.	Applicatio n Month	Name of aConsum	Persona	Voltage Level (HV/LV/Distribut	MRI Constitu	Type of Transformation	Make	Certification	Tone Tim	Breaktool Tim	Remark Tim	Income Range	Id Identificatio	Add Station	Prefix	Approved on (YYYY-mm-dd hh:mm:ss)	Remark	Name	Transformers Details	PAN With Consulta	Information request for charging of new Connection	Acknowledgement on (YYYY-mm-dd hh:mm:ss)	Request for test charging and Visit on (YYYY-mm-dd hh:mm:ss)	Provisional Approval for Test Charging (Yes/ No)	Actual date & time of charging (YYYY-mm-dd hh:mm)		Actual date & time of connection (YYYY-mm-dd hh:mm)		Remote Disconnection	Request for Trial Operation Certificate (Yes/no?)	Trial Run Operation Period	Certificate No.	Actual date & time of charging	
																					Date	Time	Date	Time	Date	Time	Date	Time	Date	Time			Date	Time
1	01/2024	Mary Wire	7/61/2/44, 8/8, Mill, Tell Phase, 02, 07 - 2 at Mary Wireless, Tamil Nadu	Retail Users	230	LT	DT	Raj Electric			0	0	2dec0_1dec1	07.7kW		01-06-2024 - 09:00, 18, 06, 2024 - 18:00		None			13-May-2024 14:07	13-May-2024 17:09	20-Jul-2024 10:27		20-Jul-2024 14:27						20-Jul-2024	16:00
2	01/2024	Jul - Wire	456/7/8/9, 2/8, Mill, Tell Phase, Wireless, 07 - 3 at 66, Rohini Nagar, Jharkhand, 834002	Retail Users	230/415 Volt	LT	Ultrafine	S.Mecca	2.5	0	0	0	28ecd1ecf_18ecd1ecf	2.5kW		01-06-2023 - 10:00, 1, 1, 1		None			18-Jul-2024 14:58	18-Jul-2024 16:00	20-Jul-2024 10:27, 29-Jul-2024 10:00		20-Jul-2024 14:27, 29-Jul-2024 14:00						20-Jul-2024	16:00
3	01/2024	Jul - Wire	456/7/8/9, 2/8, Mill, Tell Phase, Wireless, 07 - 3 at 66, Rohini Nagar, Jharkhand, 834002	Retail Users	230/415 Volt	LT	Ultrafine	S.Mecca	2.5	0	0	0	28ecd1ecf_18ecd1ecf	2.5kW		01-06-2023 - 10:00, 1, 1, 1		None			18-Jul-2024 14:58	18-Jul-2024 16:00	20-Jul-2024 10:27, 29-Jul-2024 10:00		20-Jul-2024 14:27, 29-Jul-2024 14:00						20-Jul-2024	16:00
4	01/2024	Jul - Wire	456/7/8/9, 2/8, Mill, Tell Phase, Wireless, 07 - 3 at 66, Rohini Nagar, Jharkhand, 834002	Retail Users	230/415 Volt	LT	Ultrafine	S.Mecca	2.5	0	0	0	28ecd1ecf_18ecd1ecf	2.5kW		01-06-2023 - 10:00, 1, 1, 1		None			18-Jul-2024 14:58	18-Jul-2024 16:00	20-Jul-2024 10:27, 29-Jul-2024 10:00		20-Jul-2024 14:27, 29-Jul-2024 14:00						20-Jul-2024	16:00
5	01/2024	Jul - Wire	7/61/2/82/3/44, 1/2/8 Mill, Tell Phase, 8/65, 07 - 5 at 65, Rohini Nagar, Jharkhand, 834002	Retail Users	230/415 Volt	LT	Ultrafine	S.Mecca	2.5	0	0	0	28ecd1ecf_18ecd1ecf	2.5kW		01-06-2023 - 10:00, 1, 1, 1		None			18-Jul-2024 14:58	18-Jul-2024 16:00	20-Jul-2024 10:27, 29-Jul-2024 10:00		20-Jul-2024 14:27, 29-Jul-2024 14:00						20-Jul-2024	16:00
6	01/2024	Jul - Wire	7/61/2/82/3/44, 1/2/8 Mill, Tell Phase, 8/65, 07 - 5 at 65, Rohini Nagar, Jharkhand, 834002	Retail Users	230/415 Volt	LT	Ultrafine	S.Mecca	2.5	0	0	0	28ecd1ecf_18ecd1ecf	2.5kW		01-06-2023 - 10:00, 1, 1, 1		None			18-Jul-2024 14:58	18-Jul-2024 16:00	20-Jul-2024 10:27, 29-Jul-2024 10:00		20-Jul-2024 14:27, 29-Jul-2024 14:00						20-Jul-2024	16:00
7	01/2024	Jul - Wire	7/61/2/82/3/44, 1/2/8 Mill, Tell Phase, 8/65, 07 - 5 at 65, Rohini Nagar, Jharkhand, 834002	Retail Users	230/415 Volt	LT	Ultrafine	S.Mecca	2.5	0	0	0	28ecd1ecf_18ecd1ecf	2.5kW		01-06-2023 - 10:00, 1, 1, 1		None			18-Jul-2024 14:58	18-Jul-2024 16:00	20-Jul-2024 10:27, 29-Jul-2024 10:00		20-Jul-2024 14:27, 29-Jul-2024 14:00						20-Jul-2024	16:00
8	01/2024	Jul - Wire	7/61/2/82/3/44, 1/2/8 Mill, Tell Phase, 8/65, 07 - 5 at 65, Rohini Nagar, Jharkhand, 834002	Retail Users	230/415 Volt	LT	Ultrafine	S.Mecca	2.5	0	0	0	28ecd1ecf_18ecd1ecf	2.5kW		01-06-2023 - 10:00, 1, 1, 1		None			18-Jul-2024 14:58	18-Jul-2024 16:00	20-Jul-2024 10:27, 29-Jul-2024 10:00		20-Jul-2024 14:27, 29-Jul-2024 14:00						20-Jul-2024	16:00
9	01/2024	Jul - Wire	7/61/2/82/3/44, 1/2/8 Mill, Tell Phase, 8/65, 07 - 5 at 65, Rohini Nagar, Jharkhand, 834002	Retail Users	230/415 Volt	LT	Ultrafine	S.Mecca	2.5	0	0	0	28ecd1ecf_18ecd1ecf	2.5kW		01-06-2023 - 10:00, 1, 1, 1		None			18-Jul-2024 14:58	18-Jul-2024 16:00	20-Jul-2024 10:27, 29-Jul-2024 10:00		20-Jul-2024 14:27, 29-Jul-2024 14:00						20-Jul-2024	16:00
10	01/2024	Jul - Wire	7/61/2/82/3/44, 1/2/8 Mill, Tell Phase, 8/65, 07 - 5 at 65, Rohini Nagar, Jharkhand, 834002	Retail Users	230/415 Volt	LT	Ultrafine	S.Mecca	2.5	0	0	0	28ecd1ecf_18ecd1ecf	2.5kW		01-06-2023 - 10:00, 1, 1, 1		None			18-Jul-2024 14:58	18-Jul-2024 16:00	20-Jul-2024 10:27, 29-Jul-2024 10:00		20-Jul-2024 14:27, 29-Jul-2024 14:00						20-Jul-2024	16:00
11	01/2024	Jul - Wire	7/61/2/82/3/44, 1/2/8 Mill, Tell Phase, 8/65, 07 - 5 at 65, Rohini Nagar, Jharkhand, 834002	Retail Users	230/415 Volt	LT	Ultrafine	S.Mecca	2.5	0	0	0	28ecd1ecf_18ecd1ecf	2.5kW		01-06-2023 - 10:00, 1, 1, 1		None			18-Jul-2024 14:58	18-Jul-2024 16:00	20-Jul-2024 10:27, 29-Jul-2024 10:00		20-Jul-2024 14:27, 29-Jul-2024 14:00						20-Jul-2024	16:00
12	01/2024	Jul - Wire	7/61/2/82/3/44, 1/2/8 Mill, Tell Phase, 8/65, 07 - 5 at 65, Rohini Nagar, Jharkhand, 834002	Retail Users	230/415 Volt	LT	Ultrafine	S.Mecca	2.5	0	0	0	28ecd1ecf_18ecd1ecf	2.5kW		01-06-2023 - 10:00, 1, 1, 1		None			18-Jul-2024 14:58	18-Jul-2024 16:00	20-Jul-2024 10:27, 29-Jul-2024 10:00		20-Jul-2024 14:27, 29-Jul-2024 14:00						20-Jul-2024	16:00
13	01/2024	Jul - Wire	7/61/2/82/3/44, 1/2/8 Mill, Tell Phase, 8/65, 07 - 5 at 65, Rohini Nagar, Jharkhand, 834002	Retail Users	230/415 Volt	LT	Ultrafine	S.Mecca	2.5	0	0	0	28ecd1ecf_18ecd1ecf	2.5kW		01-06-2023 - 10:00, 1, 1, 1		None			18-Jul-2024 14:58	18-Jul-2024 16:00	20-Jul-2024 10:27, 29-Jul-2024 10:00		20-Jul-2024 14:27, 29-Jul-2024 14:00						20-Jul-2024	16:00
14	01/2024	Jul - Wire	7/61/2/82/3/44, 1/2/8 Mill, Tell Phase, 8/65, 07 - 5 at 65, Rohini Nagar, Jharkhand, 834002	Retail Users	230/415 Volt	LT	Ultrafine	S.Mecca	2.5	0	0	0	28ecd1ecf_18ecd1ecf	2.5kW		01-06-2023 - 10:00, 1, 1, 1		None			18-Jul-2024 14:58	18-Jul-2024 16:00	20-Jul-2024 10:27, 29-Jul-2024 10:00		20-Jul-2024 14:27, 29-Jul-2024 14:00						20-Jul-2024	16:00
15	01/2024	Jul - Wire	7/61/2/82/3/44, 1/2/8 Mill, Tell Phase, 8/65, 07 - 5 at 65, Rohini Nagar, Jharkhand, 834002	Retail Users	230/415 Volt	LT	Ultrafine	S.Mecca	2.5	0	0	0	28ecd1ecf_18ecd1ecf	2.5kW		01-06-2023 - 10:00, 1, 1, 1		None			18-Jul-2024 14:58	18-Jul-2024 16:00	20-Jul-2024 10:27, 29-Jul-2024 10:00		20-Jul-2024 14:27, 29-Jul-2024 14:00						20-Jul-2024	16:00
16	01/2024	Jul - Wire	7/61/2/82/3/44, 1/2/8 Mill, Tell Phase, 8/65, 07 - 5 at 65, Rohini Nagar, Jharkhand, 834002	Retail Users	230/415 Volt	LT	Ultrafine	S.Mecca	2.5	0	0	0	28ecd1ecf_18ecd1ecf	2.5kW		01-06-2023 - 10:00, 1, 1, 1		None			18-Jul-2024 14:58	18-Jul-2024 16:00	20-Jul-2024 10:27, 29-Jul-2024 10:00		20-Jul-2024 14:27, 29-Jul-2024 14:00						20-Jul-2024	16:00
17	01/2024	Jul - Wire	7/61/2/82/3/44, 1/2/8 Mill, Tell Phase, 8/65, 07 - 5 at 65, Rohini Nagar, Jharkhand, 834002	Retail Users	230/415 Volt	LT	Ultrafine	S.Mecca	2.5	0	0	0	28ecd1ecf_18ecd1ecf	2.5kW		01-06-2023 - 10:00, 1, 1, 1		None			18-Jul-2024 14:58	18-Jul-2024 16:00	20-Jul-2024 10:27, 29-Jul-2024 10:00		20-Jul-2024 14:27, 29-Jul-2024 14:00						20-Jul-2024	16:00
18	01/2024	Jul - Wire	7/61/2/82/3/44, 1/2/8 Mill, Tell Phase, 8/65, 07 - 5 at 65, Rohini Nagar, Jharkhand, 834002	Retail Users	230/415 Volt	LT	Ultrafine	S.Mecca	2.5	0	0	0	28ecd1ecf_18ecd1ecf	2.5kW		01-06-2023 - 10:00, 1, 1, 1		None			18-Jul-2024 14:58	18-Jul-2024 16:00	20-Jul-2024 10:27, 29-Jul-2024 10:00		20-Jul-2024 14:27, 29-Jul-2024 14:00						20-Jul-2024	16:00
19	01/2024	Jul - Wire	7/61/2/82/3/44, 1/2/8 Mill, Tell Phase, 8/65, 07 - 5 at 65, Rohini Nagar, Jharkhand, 834002	Retail Users	230/415 Volt	LT	Ultrafine	S.Mecca	2.5	0	0	0	28ecd1ecf_18ecd1ecf	2.5kW		01-06-2023 - 10:00, 1, 1, 1		None			18-Jul-2024 14:58	18-Jul-2024 16:00	20-Jul-2024 10:27, 29-Jul-2024 10:00		20-Jul-2024 14:27, 29-Jul-2024 14:00						20-Jul-2024	16:00
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AC Transmission line Shifting Reportfrom 01-07-2024 to 10-09-2024

S.No	CASE ID	Application Month	Name of element	Owner	Voltage Level (in kV)	Circuit No	Line Length	Conductor Type	Tower Configuration	State	Approved in SCM/Staturo Body	Remark	Intimation request for charging of new element (formatA)	Acknowledment sent by NRLDC (format II)	Request for test charging and trial run (formatIII	Provisional Approval for Test Charging/Trial operation(Format IV)	Actual date & time of charaine		Request for Trial Operation Certificate(Format C)	Trial Run Operation Certificate Details	
													Date	Date	Date	Date	Date	Time	Date	Trial Run/Operation Period	Certificate No.
1	1119165	Jul - 2024	220kV Faridabad(NT)-Samaypur(SB) 1	POWERGRID	220kV	1	17.545 KM	ZEBRA	Double	HARYANA to HARYANA	03-06-2024 - 11:00, MOM of NRPC_1_All		17 Jul 2024 11:44	18 Jul 2024 15:45	29 Jul 2024 21:01, 29 Jul 2024 14:05	30 Jul 2024 15:20, 29 Jul 2024 20:25	30-Jul-2024	17:30			

HITACHI
Inspire the Next

ADANI GREEN ENERGY TWENTY FIVE LIMITED (ADANI RENEWABLES)

400kV BADISID SUBSTATION LINE PROTECTION RELAY SETTING CALCULATION

400kV BADISID SUBSTATION

500 MW BADISID SOLAR POWER PROJECT

adani

VISHRAM Digitally signed by VISHRAM Date: 2024.09.02 17:14:28 +05'30'
Reviewer

Shaheed Patel Digitally signed by Shaheed Patel Date: 2024.09.02 18:16:06 +05'30'
Approver

Categories:

- ☐ Cat-I — Approved. Good for Manufacturing/Construction/Fabrication.
- ☑ Cat-I* — Approved with minor comments. No resubmission is required. To be incorporated in As-Built. Good for Manufacturing/ Construction/ Fabrication subject to incorporation of comments.
- ☐ Cat-II — Resubmission is required. Approved & Released for Manufacturing/ fabrication/ construction subjected to incorporation of comments.
- ☐ Cat-III — Not Approved. Revise & Resubmit for Approval
- ☐ Cat-IV — For Information & Records.
- ☐ Cat-IV* — Incorporate Comments & resubmit for Information & records.

Note: "Approval of this document does not absolve the Contractor/ Supplier/Fabricator from fulfilling Contractual obligations in any way"

Hitachi Energy

DOCUMENT	400kV BADISID SUBSTATION LINE PROTECTION RELAY SETTING CALCULATION
PROJECT	500 MW BADISID SOLAR POWER PROJECT
SUBSTATION	400kV BADISID SUBSTATION
CLIENT	ADANI GREEN ENERGY TWENTY FIVE LIMITED
SUPPLIER	HITACHI ENERGY INDIA LIMITED
PO / LOA No.	IDTO-VI/ Adani Green-400 kV at Badi Sid - Rajasthan /PGGA/CRP & SAS
HEIL SO REF.	3100139976, 1MNS500950-PAAA

Revisions:

Rev.	Prep. / Appr.	Description	Date
00	SS / PN	First Submission	02-Aug-24
01	SS / PN	Revised as per customer comments	19-Aug-24

General Data of 400 KV LINE CONTROL AND RELAY PANEL (BAY-403)

Relay Details

Type	=	Micom P546

Bay Details

Local Station:	=	400kV BADISID SUBSTATION
Bay Reference	=	BAY -403
Remote Station:	=	Bhadla

Network Details

Voltage	=	400	kV
Frequency	=	50	Hz
OHL length of this circuit	=	12.00	km

CT Details (Local end):

CT Ratio	=	2000-1000-500/1	A
Rated Primary current	=	1000	A
Rated Secondary current	=	1	A

Information

All the settings are in Secondary values

The Relay Bias characteristics is determined by four protection settings

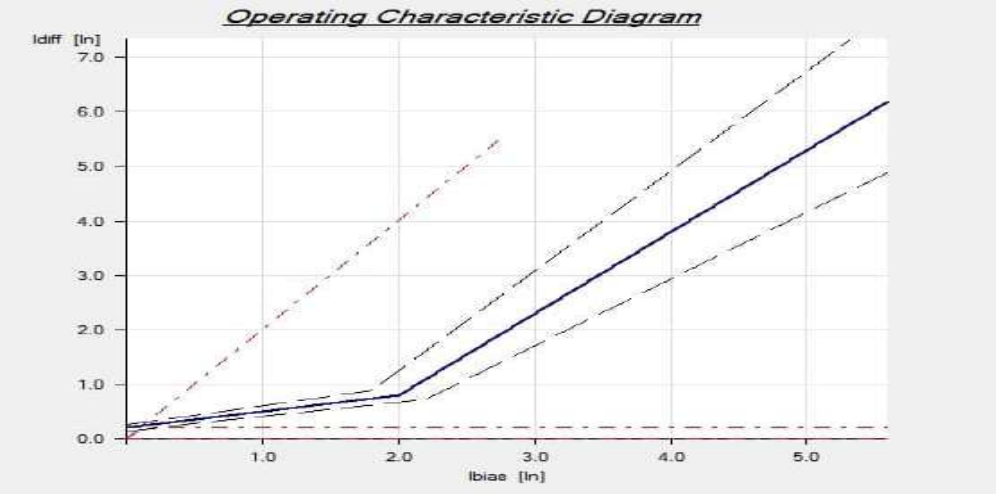
Is1	=	The basic differential current setting which determines the minimum pick up of the relay
Is2	=	A bias threshold setting, above which the higher percentage bias k2 is used
K1	=	The lower percentage bias setting used when the bias current is below IS2, This provides stability for small CT mismatches, whilst ensuring good sensitivity to resistive faults under heavy load conditions.
K2	=	The higher percentage bias setting used to improve relay stability under heavy through fault current conditions.

Basic Differential setting

This is basic differential current setting which determines the minimum pick up level of the relay. Where Capacitive Charging Current compensation is disabled, the setting of Is1 must be >2.5 times of total line charging current value.

The Charging current is calculated according to the following equation

I charge	=	U/ (√3 * Xc1)	
Where,			
U	=	System Line Voltage	
Xc1	=	Positive Sequence Line Capacitance value	
I charge	=	Line charging current/kM due to Line Capacitance	
Xc1	=	1/(2 * π * f * C1)	
C1	=	Line Capacitance value/kM	
	=	0.0119	µF/kM
Xc1	=	1/(2 * π * f * C1)	
	=	1/(2*3.14*50 * 0.0000000119)	
Xc1	=	267623	Ω
I charge	=	U/ (√3 * Xc1)	
I charge	=	400/(√3*267622.97)	
	=	0.86	A
Primary Charging Current of line	=	0.86*12	
	=	10.32	A
Sec.Charging Current of line, Ic	=	Icharge / CTR	
	=	10.32/1000	
	=	0.01032	A



The below mention settting recommended As per Main-1 relay

In_Nominal current (CT secondary)	=	1	A
Is1	=	0.25% of In	
	=	0.25	A
k1	=	30%	
Is2	=	2*In	
	=	2.0	A
K2	=	150%	

CT Ratio Correction

Local End CT Ratio	=	1000 / 1 A
Remote End CT Ratio	=	3000 / 1 A
CT Correction factor	=	CT Primary/Min Scheme CT Primary
	=	Min Scheme CT Primary ---> Lowest CT ratio
Local end CT Correction factor	=	1.0
Remote end CT Correction factor	=	3.0

Compenstation

Compenstation	=	Cap Charging
Susceptance (B)	=	ωC
	=	Ich/V * 10^{-3}
	=	(0.86/ (400 / 1.732)) * 10^-3
	=	0.0037 mS

Setting Calculation of Distance

General Data=

Total Line length is	=	**12.00**			**km**

OHL data

Basic Line OHL parameters					
Positive sequence imp. per km	=	0.0266	+j	0.313	Ohm/km
Zero sequence imp. per km	=	0.162	+j	1.187	Ohm/km
continuous current carrying capacity for each OHL - Icon					
Considered as per Maximum power flow In the line (0 MVA)	=	953			A
Line length	=	12.00			Km

Line data= OHL

(Pos. seq. impedance of the line)	=	0.319	+j	3.750	Ohm
R1A´ + jX1A´		3.764	L	85.13	
(Zero seq. impedance of the line)	=	1.940	+j	14.244	Ohm
R0A´ + jX0A´		14.376	L	82.24	
CT Ratio (Adopted)	=	1000	/	1	A
VT ratio	=	400	/	0.11	kV
CT / VT Ratio conversion	=	CT ratio / VT ratio			
	=	(1000/1)/(400/0.11)			
	=	0.275			
Maximum load on line	=	953			A

	Zload' =	(400*0.85*1000) / (952.7*1.732*1.5)	
	Zload' =	137.4	Ohm/ph
Referred to Secondary side	=	Maximum load on line * (CT/VT ratio)	
	=	137.37 x 0.275	
	Zload =	37.777	Ohm/ph
Cosφmin	=	0.85	Minimum power factor
	=	32	Deg
Set Load Angle	=	ϕmin + 5	
(Load encroachment angle)	=	(32+5)	
	=	37	Deg
Arc Resistance Phase- Phase	Rarc p-p' =	15	Ohm/ph
Referred to Secondary side	Rarc p-p =	4.1	Ohm/ph
Arc Resistance Phase- Earth	Rarc p-e' =	15	Ohm/ph
Referred to Secondary side	Rarc p-e' =	4.1	Ohm/ph
Tower Foot Resistance	Rtower' =	10	Ohm/ph
Referred to Secondary side	Rtower' =	2.8	Ohm/ph

General settings

Protected Line Impedance

Line Impedance secondary = 3.7636 * 0.275

= **1.03** Ohm/ph

Line Angle (Deg) = **85.1** Deg

Short Line Feeder Details at Remote Station

Name of the line	=	-		
Length of the line	=	30.45		Km
Positive sequence imp. per km	=	0.015	+j 0.253	Ohm/Km
Zero sequence imp. per km	=	0.249	+j 0.999	Ohm/Km
Positive sequence imp. for total line km	=	0.448	+j 7.698	Ohm
Zero sequence imp. for total line km	=	7.585	+j 30.420	Ohm

Longest Line Feeder Details at Remote Station

Name of the line	=	-		
Length of the line	=	52.00		Km
Positive sequence imp. per km	=	0.036	+j 0.310	Ohm/Km
Zero sequence imp. per km	=	0.256	+j 1.104	Ohm/Km
Positive sequence imp. for total line km	=	1.872	+j 16.141	Ohm
Zero sequence imp. for total line km	=	13.312	+j 57.408	Ohm

Distance Measuring zones settings

To find KN magnitude and KN angle for Zone 1

KZ1 Res Comp & KZ1 Angle = (Z0-Z1)/3Z1

= (14.376-3.764)/(3x3.764)

= 0.94 L -3.917

To find KN magnitude and KN angle for Zone 2, 3, 4

Positive sequence imp. for total line km	=	0.409	+j 5.290	Ohm
	=	5.305	L 85.58	
Zero sequence imp. for total line km	=	3.457	+j 20.328	Ohm
	=	20.620	L 80.35	

KZ2/3/4 Res Comp & KZ2/3/4 Angle = (Z0-Z1)/3Z1

= 0.96 L -7.036

Distance Zone 1 setting (Zone-1 Enabled only during communication failure)

Relay zone-1 reach shall be set to cover 80% forward direction considering the parallel line in operation

Operation direction

OperationDir = Forward **(*Fixed Direction mode as Forward for Zone-1)**

Positive sequence reactance reach

Zone 1 phase fault reach is set to **80%** of the total line reactance

Zone-1 reactance reach setting for phase faults, X1Z1'

= 0.8 * jX1´

= 0.8 * 3.75

X1Z1' = 3.00 **Ohm/P**

The secondary setting will thus be

= X1Z1' * CT ratio / VT ratio

X1Z1 = **0.83** **Ohm/P**

Positive sequence resistance for zone characteristics angle

= 0.8 * R1´

= 0.8 * 0.32

R1Z1' = 0.26 **Ohm/P**

The secondary setting will thus be

= R1Z1' * CT ratio / VT ratio

R1Z1 = **0.07** **Ohm/P**

Positive sequence Impedance reach

Z1' = 3.01

The secondary setting will thus be

= Z1' * CT ratio / VT ratio

Z1 = **0.83** **Ohm/P**

Fault resistance reach in Ohm/loop (Phase-Phase)

Set the resistive reach for phase faults to=

R1ph' = 30.00 **Ohm/l**

The secondary setting will thus be

= R1ph' * CT ratio / VT ratio

R1ph = **8.25** **Ohm/l**

Fault resistance reach in Ohm/loop (Phase-Earth)

Set the resistive reach for earth faults to

R1G' = 25.00 **Ohm/l**

The secondary setting will thus be

= R1G' * CT ratio / VT ratio

R1G = **6.88** **Ohm/l**

Time delay of trip

tZ1 = 0.00 Sec

Distance Zone 2 setting

Relay zone-2 reach shall be set to cover

100 % of protected line + 20 % of Remote end shortest line forward direction

Operation direction

OperationDir = Forward **(*Fixed Direction mode as Forward for Zone-2)**

Positive sequence reactance reach

Zone 2 phase fault reach is set to **100%** of the total line reactance

\+ **20%** of Remote end shortest line forward direction

Zone-2 reactance reach setting for phase faults, X1Z2

= (100% x 3.75) + (20% x 7.7)

= (1x3.75) + (0.2 x 7.7)

X1Z2' = 5.29 **Ohm/p**

The secondary setting will thus be

= X1Z2' * CT ratio / VT ratio

X1Z2 = **1.46** **Ohm/p**

Positive sequence resistance for zone characteristics angle

= (100% x 0.32) + (20% x 0.45)

= (1x0.32) + (0.2 x 0.45)

R1Z2' = 0.41 **Ohm/p**

The secondary setting will thus be

= R1Z2' * CT ratio / VT ratio

R1Z2 = **0.11** **Ohm/p**

Positive sequence Impedance reach

Z2' = 5.31

The secondary setting will thus be

= Z2' * CT ratio / VT ratio

Z2 = **1.46** **Ohm/P**

Fault resistance reach in Ohm/loop (Phase-Phase)

The resistive reach for phase to phase is set to cover a maximum expected fault resistance of 30 ohm

Considering a factor of 2 on the zone-1 resistive reach value to take care of in feed effect.

R2ph = 60

Set the resistive reach for phase faults to=

R2ph' = 60.00 **Ohm/l**

The secondary setting will thus be

= R2ph' * CT ratio / VT ratio

R2ph = **16.50** **Ohm/l**

Fault resistance reach in Ohm/loop (Phase-Earth)

Setting of the resistive reach for the underreaching zone 2 should follow the condition to minimize the risk for overreaching

Set the resistive reach for earth faults to

R2G´ = 50.00 **Ohm/l**

The secondary setting will thus be

= R2G' * CT ratio / VT ratio

R2G = **13.75** **Ohm/l**

Time delay of trip Phase-Phase loops

Setting of Zone timers=

Normal values the needed time difference can be calculated

t2 = 40ms +40ms + 40ms + 50ms = 170ms

Where,

the operation time of protection is 40 ms (Distance relay operation of other line at Remote End)
the breaker opening time is 40 ms
the resetting time of protection is 40 ms and
the additional margin is 50 ms

tZ2 = 0.35 Sec

Distance Zone 3 setting

Relay zone-3 reach shall be set to cover
120 % of protected line + 100 % of Remote end longest line forward direction

Operation direction

OperationDir = Forward

Positive sequence reactance reach

Zone 3 phase fault reach is set to **120%** of the total line reactance
\+ **100%** of Remote end longest line forward direction

Zone-3 reactance reach setting for phase faults, X1Z3

= (120% x 3.75) + (100% x 16.14)
= (1.2x3.75) + (1 x 16.14)
X1Z3' = 20.64 **Ohm/p**

The secondary setting will thus be

= X1Z3' * CT ratio / VT ratio
X1Z3 = **5.68** **Ohm/p**

Positive sequence resistance for zone characteristics angle

(120% x 0.32) + (100% x 1.87)
(1.2x0.32) + (1 x 1.87)
R1Z3' = 2.26 **Ohm/p**

The secondary setting will thus be

= R1Z3' * CT ratio / VT ratio
R1Z3 = **0.62** **Ohm/p**

Positive sequence Impedance reach

Z3' = 20.76

The secondary setting will thus be

= Z3' * CT ratio / VT ratio
Z3 = **5.71** **Ohm/P**

Fault resistance reach in Ohm/loop (Phase-Phase)

Considering a factor of 2.5 on the zone-1 resistive reach value to take care of in feed effect.

Set the resistive reach for phase faults to

R3ph' = 75.00 **Ohm/l**

The secondary setting will thus be

= R3ph' * CT ratio / VT ratio

R3ph = **20.63** **Ohm/l**

Fault resistance reach in Ohm/loop (Phase-Earth)

Setting of the resistive reach for the underreaching zone 3 should follow the condition to minimize the risk for overreaching

Set the resistive reach for earth faults to

R3G´ = 65.00 **Ohm/l**

The secondary setting will thus be

= R3G' * CT ratio / VT ratio

R3G = **17.88** **Ohm/l**

Time delay of trip

Setting of Zone timers=

Normal values the needed time difference can be calculated

t3 = 350ms + 40ms +40ms + 40ms + 50ms = 520ms

Where, Zone-2 operation is 350 ms (Distance relay operation of other line at Remote End)

the operation time of protection is 40 ms (Distance relay operation of other line at Remote End)

the breaker opening time is 100 ms

the resetting time of protection is 40 ms and

the additional margin is 50 ms

tZ3 = 1.00 Sec

<u>Distance Zone 4 setting</u>

Relay zone-4 reach shall be set to cover 20 % of protected line + 0 % of Remote end longest line forward direction

Operation direction

OperationDir = Reverse

Positive sequence reactance reach

Zone 4 phase fault reach is set to **20%** of the total line reactance

\+ **0%** of Remote end longest line forward direction

Zone-4 reactance reach setting for phase faults, X1Z4

= (20% x 3.75) + (0% x 16.14)

= (0.2x3.75) + (0 x 16.14)

X1Z4' = 0.75 Ohm/p

The secondary setting will thus be

= X1Z4' * CT ratio / VT ratio

X1Z4 = **0.21** **Ohm/p**

Positive sequence resistance for zone characteristics angle

= (20% x 0.32) + (0% x 1.87)

= (0.2x0.32) + (0 x 1.87)

R1Z4' = 0.06 Ohm/p

The secondary setting will thus be

= R1Z4' * CT ratio / VT ratio

R1Z4 = **0.02** **Ohm/p**

Positive sequence Impedance reach

Z4' = 0.75

The secondary setting will thus be

= Z4' * CT ratio / VT ratio

Z4 = **0.21** **Ohm/P**

Fault resistance reach in Ohm/loop (Phase-Phase)

The faults on remote lines will have in-feed of fault current through the fault resistance from other remote feeders which will make an apparent increase of the value. The setting is selected to take care of above factors. Set the resistive reach for phase faults to=

Setting the RF/X factor giving the PhF resistive coverage

Set the resistive reach for phase faults to

R4ph' = 75.00 **Ohm/l**

The secondary setting will thus be

= R4ph' * CT ratio / VT ratio

R4ph = **20.63** **Ohm/l**

Fault resistance reach in Ohm/loop (Phase-Earth)

Setting of the resistive reach for the underreaching zone 4 should follow the condition to minimize the risk for overreaching

Set the resistive reach for earth faults to

R4G´ = 65.00 **Ohm/l**

The secondary setting will thus be

= R4G' * CT ratio / VT ratio

R4G = **17.88** **Ohm/l**

Time delay of trip

Setting of Zone timers=

Normal values the needed time difference can be calculated

t4 = 40ms +40ms + 40ms + 50ms = 170ms

Where,

the operation time of protection is 40 ms (Busbar Protection relay)

the breaker opening time is 40 ms

the resetting time of protection is 40 ms and

the additional margin is 50 ms

tZ4 = 0.35 Sec

Load Blinders

Z< Blinder Imp (90% of LR) = **34.0** **Ohm**

Load/B Angle = **37.0** **Deg**

POWER SWING BLOCK=

PSB Blocking zone	=	Zone-1, 2,3,4	
PSB Unblock delay	=	2.0 Sec	

Slow Swing Setting

R7=-R7=1.2 x Maximum Resistive reach (Zone 3)	=	1.2*17.875 21.45	Ω
Z7=-Z7=1.2 x Maximum Zone reach (Zone 3)	=	1.2*5.71 6.85	Ω
R8=R8'=>1.1*R7	=	1.1*21.45 23.60	Ω
Z8=Z8'=>1.1*Z7	=	1.1*6.852 7.54	Ω
Alpha	=	0	deg
PSB Timer	=	50	mSec

SOTF=

SOTF Status	=	En Pdead + Pulse	
SOTF Tripping	=	Zone-2	
SOTF Delay	=	110	sec
TOR Status	=	Enabled	
TOR Tripping	=	Zone-2	

VT SUPERVISION=

VTS Mode	=	Measured + MCB	
VTS Status	=	Blocking	
VTS Reset Mode	=	Auto	
VTS Time Delay	=	5 Sec	
VTS I> Inhibit	=	10 A	
VTS I2> Inhibit	=	50mA	

OVERVOLTAGE PROTECTION=

V> Measur't Mode	=	V1> & V>2 Ph- N	
V> Operate Mode	=	V1> & V>2 Any Ph	
V>1 Function	=	DT	
V>1 Set	=	70	V
V>1 time delay	=	5	sec
V>2 Set	=	89	V
V>2 time delay	=	0.1	sec

UNDERVOLTAGE PROTECTION (Only DR Trigger - No Tripping)

V< Measur't Mode	=	V1< & V<2 Ph- N	
V< Operate Mode	=	V1> & V>2 Any Ph	
V<1 Function	=	DT	
V<1 Set	=	57	V
V<1 time delay	=	0	sec
V<1 Poledead Inh	=	Enabled	

DIR. EARTH FAULT SETTINGS = 67N

Pickup current should be set above the continuous residual current under normal operation.

Max Load Current	=	952.7
IN>1 Function	=	IEC S Inverse
IN>1 Directional	=	Directional Fwd

IN>1 Pickup current in A = 23 % of Maximum Load current of the Conductor
0.23*952.7=219.121A
IN>1 Current Set (Is) = 0.22 A

The Earth fault function has to be graded with the Zone-3 Protection
Required time (Treq) = 1.13 Sec

The IDMT curve shall saturate if the fault current more than 20 times of pickup current. In this case fault current more than 20 times. Hence 20 times of set current considered for TMS calculation.

Fault = 20*Pickup
Current = 4382.42 A
IN>1 TMS = (Treq*(IF/Is)^0.02-1)/0.14
= (1.13*(4382.42/219.121)^0.02-1)/0.14
= 0.50
Char Angle = -45 Deg

BROKEN CONDUCTOR: (Alarm Only)

I2/I1 Ratio = 0.2
time delay = 5

DISTURBANCE RECORDER:

Pre-Fault time = 0.5 Sec
Posr-Fault time = 2.5 Sec
Total time = 3 Sec

STUB PROTECTION: 50STUB

Max Load Current = 952.7
I>4 Function = IEC DT
I>4 Directional = Non Directional
I>4 Pickup current in A = 200 % of Maximum Load current of the Conductor
= 2*952.7=1905.4A
I>4 Current Set (Is) = 1.91 A
I>4 operating time = 0.05 Sec

TELE PROTECTION

Scheme type = Permissive OR

Settings File Report
Substation:
File: p546.set
Model Number: P546?1109?552?K

Printed on: 23/08/2024 17:17:34

- SYSTEM DATA
  - 00.01: Language: English
  - 00.02: Password: ****
  - 00.03: Sys Fn Links: 0
  - 00.04: Description: Bhadla line
  - 00.05: Plant Reference: Badisid
  - 00.06: Model Number: P546?1109?552?K
  - 00.08: Serial Number: 12345
  - 00.09: Frequency: 50 Hz
  - 00.0A: Comms Level: 2
  - 00.0B: Relay Address: 1
  - 00.0C: Plant Status: 0000001000000010
  - 00.0D: Control Status: 0000000000000000
  - 00.0E: Active Group: 1
  - 00.10: CB Trip/Close: No Operation
  - 00.11: Software Ref. 1: P546____4__520_A
  - 00.20: Opto I/P Status: 00000000000000000000000000000000
  - 00.21: Relay O/P Status: 00000000000000000000001000
  - 00.22: Alarm Status 1: 00000010000000000000000000000000
  - 00.50: Alarm Status 1: 00000010000000000000000000000000
  - 00.51: Alarm Status 2: 00000000000000000000000000000000
  - 00.52: Alarm Status 3: 00000000000000000000000000000000
  - 00.D0: Access Level: 2
  - 00.D1: Password Control: 2
  - 00.D2: Password Level 1: ****
  - 00.D3: Password Level 2: ****
- CB CONTROL
  - 07.01: CB Control by: Disabled
  - 07.11: CB Status Input: 52B 1 pole
- DATE AND TIME
  - 08.01: Date/Time: 2007-04-08 23:39:09.855
  - 08.06: Battery Status: Healthy
  - 08.07: Battery Alarm: Enabled
  - 08.20: LocalTime Enable: Flexible
  - 08.21: LocalTime Offset: 330.0 min
  - 08.22: DST Enable: Disabled
  - 08.30: RP1 Time Zone: Local
- CONFIGURATION
  - 09.01: Restore Defaults: No Operation
  - 09.02: Setting Group: Select via Menu
  - 09.03: Active Settings: Group 1
  - 09.04: Save Changes: No Operation
  - 09.05: Copy From: Group 1
  - 09.06: Copy To: No Operation
  - 09.07: Setting Group 1: Enabled
  - 09.08: Setting Group 2: Disabled
  - 09.09: Setting Group 3: Disabled
  - 09.0A: Setting Group 4: Disabled
  - 09.0B: Distance: Enabled
  - 09.0C: Directional E/F: Disabled
  - 09.0F: Phase Diff: Enabled
  - 09.10: Overcurrent: Enabled
  - 09.11: Neg Sequence O/C: Disabled
  - 09.12: Broken Conductor: Enabled
  - 09.13: Earth Fault: Enabled
  - 09.15: Sensitive E/F: Disabled
  - 09.16: Residual O/V NVD: Disabled
  - 09.17: Thermal Overload: Disabled
  - 09.18: PowerSwing Block: Enabled
  - 09.1D: Volt Protection: Enabled
  - 09.1E: Freq Protection: Disabled
  - 09.1F: df/dt Protection: Disabled
  - 09.20: CB Fail: Disabled
  - 09.21: Supervision: Enabled
  - 09.25: Input Labels: Visible
  - 09.26: Output Labels: Visible

Settings File Report
Substation:
File: p546.set
Model Number: P546?1109?552?K

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09.28: CT & VT Ratios:	Visible
09.29: Record Control:	Visible
09.2A: Disturb Recorder:	Visible
09.2B: Measure't Setup:	Visible
09.2C: Comms Settings:	Visible
09.2D: Commission Tests:	Visible
09.2E: Setting Values:	Secondary
09.2F: Control Inputs:	Visible
09.35: Ctrl I/P Config:	Visible
09.36: Ctrl I/P Labels:	Visible
09.39: Direct Access:	Enabled
09.50: Function Key:	Visible
09.FF: LCD Contrast:	11
CT AND VT RATIOS	
0A.01: Main VT Primary:	400kV
0A.02: Main VT Sec'y:	110.0 V
0A.07: Phase CT Primary:	1000 A
0A.08: Phase CT Sec'y:	1.000 A
0A.0B: SEF CT Primary:	1000 A
0A.0C: SEF CT Secondary:	1.000 A
0A.0D: MComp CT Primary:	1000 A
0A.0E: MComp CT Sec'y:	1.000 A
0A.11: CT Polarity:	Standard
0A.12: CT2 Polarity:	Standard
0A.13: SEF CT Polarity:	Standard
0A.14: M CT Polarity:	Standard
0A.18: VT Connected:	Yes
RECORD CONTROL	
0B.01: Clear Events:	No
0B.02: Clear Faults:	No
0B.03: Clear Maint:	No
0B.04: Alarm Event:	Enabled
0B.05: Relay O/P Event:	Enabled
0B.06: Opto Input Event:	Enabled
0B.07: General Event:	Enabled
0B.08: Fault Rec Event:	Enabled
0B.09: Maint Rec Event:	Enabled
0B.0A: Protection Event:	Enabled
0B.30: Clear Dist Recs:	No
0B.40: DDB 31 - 0:	11111111111111111111111111111111
0B.41: DDB 63 - 32:	11111111111111111111111111111111
0B.42: DDB 95 - 64:	11111111111111111111111111111111
0B.43: DDB 127 - 96:	11111111111111111111111111111111
0B.44: DDB 159 - 128:	11111111111111111111111111111111
0B.45: DDB 191 - 160:	11111111111111111111111111111111
0B.46: DDB 223 - 192:	11111111111111111111111111111111
0B.47: DDB 255 - 224:	11111111111111111111111111111111
0B.48: DDB 287 - 256:	11111111111111111111111111111111
0B.49: DDB 319 - 288:	11111111111111111111111111111111
0B.4A: DDB 351 - 320:	11111111111111111111111111111111
0B.4B: DDB 383 - 352:	11111111111111111111111111111111
0B.4C: DDB 415 - 384:	11111111111111111111111111111111
0B.4D: DDB 447 - 416:	11111111111111111111111111111111
0B.4E: DDB 479 - 448:	11111111111111111111111111111111
0B.4F: DDB 511 - 480:	11111111111111111111111111111111
0B.50: DDB 543 - 512:	11111111111111111111111111111111
0B.51: DDB 575 - 544:	11111111111111111111111111111111
0B.52: DDB 607 - 576:	11111111111111111111111111111111
0B.53: DDB 639 - 608:	11111111111111111111111111111111
0B.54: DDB 671 - 640:	11111111111111111111111111111111
0B.55: DDB 703 - 672:	11111111111111111111111111111111
0B.56: DDB 735 - 704:	11111111111111111111111111111111
0B.57: DDB 767 - 736:	11111111111111111111111111111111
0B.58: DDB 799 - 768:	11111111111111111111111111111111
0B.59: DDB 831 - 800:	11111111111111111111111111111111
0B.5A: DDB 863 - 832:	11111111111111111111111111111111

Settings File Report
Substation:
File: p546.set
Model Number: P546?1109?552?K

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0B.5B: DDB 895 - 864: 11111111111111111111111111111111
0B.5C: DDB 927 - 896: 11111111111111111111111111111111
0B.5D: DDB 959 - 928: 11111111111111111111111111111111
0B.5E: DDB 991 - 960: 11111111111111111111111111111111
0B.5F: DDB 1023 - 992: 11111111111111111111111111111111
0B.60: DDB 1055 - 1024: 11111111111111111111111111111111
0B.61: DDB 1087 - 1056: 11111111111111111111111111111111
0B.62: DDB 1119 - 1088: 11111111111111111111111111111111
0B.63: DDB 1151 - 1120: 11111111111111111111111111111111
0B.64: DDB 1183 - 1152: 11111111111111111111111111111111
0B.65: DDB 1215 - 1184: 11111111111111111111111111111111
0B.66: DDB 1247 - 1216: 11111111111111111111111111111111
0B.67: DDB 1279 - 1248: 11111111111111111111111111111111
0B.68: DDB 1311 - 1280: 11111111111111111111111111111111
0B.69: DDB 1343 - 1312: 11111111111111111111111111111111
0B.6A: DDB 1375 - 1344: 11111111111111111111111111111111
0B.6B: DDB 1407 - 1376: 11111111111111111111111111111111

DISTURB RECORDER

0C.01: Duration: 3.000 s
0C.02: Trigger Position: 16 %
0C.03: Trigger Mode: Single
0C.04: Analog Channel 1: VA
0C.05: Analog Channel 2: VB
0C.06: Analog Channel 3: VC
0C.07: Analog Channel 4: IA
0C.08: Analog Channel 5: IB
0C.09: Analog Channel 6: IC
0C.0A: Analog Channel 7: IN
0C.0B: Analog Channel 8: IN Sensitive
0C.0C: Digital Input 1: Relay 1
0C.0D: Input 1 Trigger: No Trigger
0C.0E: Digital Input 2: Relay 2
0C.0F: Input 2 Trigger: No Trigger
0C.10: Digital Input 3: Relay 3
0C.11: Input 3 Trigger: Trigger L/H
0C.12: Digital Input 4: Relay 4
0C.13: Input 4 Trigger: No Trigger
0C.14: Digital Input 5: Relay 5
0C.15: Input 5 Trigger: No Trigger
0C.16: Digital Input 6: Relay 6
0C.17: Input 6 Trigger: No Trigger
0C.18: Digital Input 7: Relay 7
0C.19: Input 7 Trigger: No Trigger
0C.1A: Digital Input 8: Relay 8
0C.1B: Input 8 Trigger: No Trigger
0C.1C: Digital Input 9: Relay 9
0C.1D: Input 9 Trigger: No Trigger
0C.1E: Digital Input 10: Relay 10
0C.1F: Input 10 Trigger: No Trigger
0C.20: Digital Input 11: Relay 11
0C.21: Input 11 Trigger: No Trigger
0C.22: Digital Input 12: Relay 12
0C.23: Input 12 Trigger: No Trigger
0C.24: Digital Input 13: Relay 13
0C.25: Input 13 Trigger: No Trigger
0C.26: Digital Input 14: Relay 14
0C.27: Input 14 Trigger: No Trigger
0C.28: Digital Input 15: Relay 15
0C.29: Input 15 Trigger: No Trigger
0C.2A: Digital Input 16: Relay 16
0C.2B: Input 16 Trigger: No Trigger
0C.2C: Digital Input 17: Opto 1
0C.2D: Input 17 Trigger: No Trigger
0C.2E: Digital Input 18: Opto 2
0C.2F: Input 18 Trigger: No Trigger
0C.30: Digital Input 19: Opto 3

Settings File Report
Substation:
File: p546.set
Model Number: P546?1109?552?K

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- 0C.31: Input 19 Trigger: No Trigger
- 0C.32: Digital Input 20: Opto 4
- 0C.33: Input 20 Trigger: No Trigger
- 0C.34: Digital Input 21: Opto 5
- 0C.35: Input 21 Trigger: No Trigger
- 0C.36: Digital Input 22: Opto 6
- 0C.37: Input 22 Trigger: No Trigger
- 0C.38: Digital Input 23: Opto 7
- 0C.39: Input 23 Trigger: No Trigger
- 0C.3A: Digital Input 24: Opto 8
- 0C.3B: Input 24 Trigger: No Trigger
- 0C.3C: Digital Input 25: Opto 9
- 0C.3D: Input 25 Trigger: No Trigger
- 0C.3E: Digital Input 26: Opto 10
- 0C.3F: Input 26 Trigger: No Trigger
- 0C.40: Digital Input 27: Opto 11
- 0C.41: Input 27 Trigger: No Trigger
- 0C.42: Digital Input 28: Opto 12
- 0C.43: Input 28 Trigger: No Trigger
- 0C.44: Digital Input 29: Opto 13
- 0C.45: Input 29 Trigger: No Trigger
- 0C.46: Digital Input 30: Opto 14
- 0C.47: Input 30 Trigger: No Trigger
- 0C.48: Digital Input 31: Opto 15
- 0C.49: Input 31 Trigger: No Trigger
- 0C.4A: Digital Input 32: Opto 16
- 0C.4B: Input 32 Trigger: No Trigger
- 0C.50: Analog Channel 9: IM
- 0C.51: Analog Channel10: IA2
- 0C.52: Analog Channel11: IB2
- 0C.53: Analog Channel12: IC2

MEASURE'T SETUP

- 0D.01: Default Display: Description
- 0D.02: Local Values: Primary
- 0D.03: Remote Values: Primary
- 0D.04: Measurement Ref: VA
- 0D.05: Measurement Mode: 0
- 0D.06: Fix Dem Period: 30.00 min
- 0D.07: Roll Sub Period: 30.00 min
- 0D.08: Num Sub Periods: 1
- 0D.09: Distance Unit: Kilometres
- 0D.0A: Fault Location: Distance

COMMISSION TESTS

- 0F.01: Opto I/P Status: 00000000000000000000000000
- 0F.02: Relay O/P Status: 00000000000000000001010
- 0F.03: Test Port Status: 00001000
- 0F.05: Monitor Bit 1: 1060
- 0F.06: Monitor Bit 2: 1062
- 0F.07: Monitor Bit 3: 1064
- 0F.08: Monitor Bit 4: 1066
- 0F.09: Monitor Bit 5: 1068
- 0F.0A: Monitor Bit 6: 1070
- 0F.0B: Monitor Bit 7: 1072
- 0F.0C: Monitor Bit 8: 1074
- 0F.0D: Test Mode: Disabled
- 0F.0E: Test Pattern: 000000000000000000000000
- 0F.0F: Contact Test: No Operation
- 0F.10: Test LEDs: No Operation
- 0F.12: Static Test: Disabled
- 0F.13: Test Loopback: Disabled
- 0F.14: IM64 TestPattern: 0000000000000000
- 0F.15: IM64 Test Mode: Disabled
- 0F.1A: Red LED Status: 000000000000001000
- 0F.1B: Green LED Status: 000000000000001000
- 0F.20: DDB 31 - 0: 00000000000000000000000000001010
- 0F.21: DDB 63 - 32: 00000000000000000000000000000000

Settings File Report
Substation:
File: p546.set
Model Number: P546?1109?552?K

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- 0F.22: DDB 95 - 64: 00000000000000000000000000000000
- 0F.23: DDB 127 - 96: 00000000000000000000000000000000
- 0F.24: DDB 159 - 128: 00000000000000000000000000001010
- 0F.25: DDB 191 - 160: 00000000000000000000000000000000
- 0F.26: DDB 223 - 192: 00000000000000000000000000000000
- 0F.27: DDB 255 - 224: 00000000000000000000000000000000
- 0F.28: DDB 287 - 256: 00000000000000000000000000000000
- 0F.29: DDB 319 - 288: 00000010100000000000000000000000
- 0F.2A: DDB 351 - 320: 00000000000000000000000000000000
- 0F.2B: DDB 383 - 352: 00000000000000000000000000000000
- 0F.2C: DDB 415 - 384: 00000000000000000000000000000000
- 0F.2D: DDB 447 - 416: 00000000001100000000000000000000
- 0F.2E: DDB 479 - 448: 00000000000000000000000000000000
- 0F.2F: DDB 511 - 480: 00000000000000000000000000000000
- 0F.30: DDB 543 - 512: 00000000001000000000000000000000
- 0F.31: DDB 575 - 544: 00000000000000000000000000000000
- 0F.32: DDB 607 - 576: 00000000000000000000000000000000
- 0F.33: DDB 639 - 608: 00000000000000000000000000000000
- 0F.34: DDB 671 - 640: 00000000000000000000000000000000
- 0F.35: DDB 703 - 672: 00000000000000000000000000000000
- 0F.36: DDB 735 - 704: 00000000000000000000000000000000
- 0F.37: DDB 767 - 736: 00000000000000000000000000000000
- 0F.38: DDB 799 - 768: 00000000000000000000000000000000
- 0F.39: DDB 831 - 800: 11100000000000000000000000000000
- 0F.3A: DDB 863 - 832: 00000000000000000000000000000000
- 0F.3B: DDB 895 - 864: 01111100001001101010001111111111
- 0F.3C: DDB 927 - 896: 00000000011100000111000000000100
- 0F.3D: DDB 959 - 928: 00000000000000000000000000000000
- 0F.3E: DDB 991 - 960: 00000000000000000000000000000000
- 0F.3F: DDB 1023 - 992: 00000000000000000000000000000000
- 0F.40: DDB 1055 - 1024: 00000000000000000000000011000000
- 0F.41: DDB 1087 - 1056: 00000000000000000000110000000000
- 0F.42: DDB 1119 - 1088: 00000000000000000000000000000000
- 0F.43: DDB 1151 - 1120: 00000100000000000000000000000001
- 0F.44: DDB 1183 - 1152: 10001010000000000000000000000000
- 0F.45: DDB 1215 - 1184: 00000000000000000000000000001000
- 0F.46: DDB 1247 - 1216: 00000000000000000000000000000000
- 0F.47: DDB 1279 - 1248: 00000000000000000000000000000000
- 0F.48: DDB 1311 - 1280: 00000000000000000000000000000000
- 0F.49: DDB 1343 - 1312: 00000001000000000000000000000000
- 0F.4A: DDB 1375 - 1344: 00000100000000000000000000000000
- 0F.4B: DDB 1407 - 1376: 00000000000000000000000000000000

OPTO CONFIG

- 11.01: Global Nominal V: 220/250V
- 11.60: Opto Filter Cntl: 11111111111011111111011
- 11.80: Characteristic: Standard 60%-80%

CONTROL INPUTS

- 12.01: Ctrl I/P Status: 00000000000000000000000000000000
- 12.02: Control Input 1: No Operation
- 12.03: Control Input 2: No Operation
- 12.04: Control Input 3: No Operation
- 12.05: Control Input 4: No Operation
- 12.06: Control Input 5: No Operation
- 12.07: Control Input 6: No Operation
- 12.08: Control Input 7: No Operation
- 12.09: Control Input 8: No Operation
- 12.0A: Control Input 9: No Operation
- 12.0B: Control Input 10: No Operation
- 12.0C: Control Input 11: No Operation
- 12.0D: Control Input 12: No Operation
- 12.0E: Control Input 13: No Operation
- 12.0F: Control Input 14: No Operation
- 12.10: Control Input 15: No Operation
- 12.11: Control Input 16: No Operation
- 12.12: Control Input 17: No Operation
- 12.13: Control Input 18: No Operation

Settings File Report
Substation:
File: p546.set
Model Number: P546?1109?552?K

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- 12.14: Control Input 19: No Operation
- 12.15: Control Input 20: No Operation
- 12.16: Control Input 21: No Operation
- 12.17: Control Input 22: No Operation
- 12.18: Control Input 23: No Operation
- 12.19: Control Input 24: No Operation
- 12.1A: Control Input 25: No Operation
- 12.1B: Control Input 26: No Operation
- 12.1C: Control Input 27: No Operation
- 12.1D: Control Input 28: No Operation
- 12.1E: Control Input 29: No Operation
- 12.1F: Control Input 30: No Operation
- 12.20: Control Input 31: No Operation
- 12.21: Control Input 32: No Operation

CTRL I/P CONFIG

- 13.01: Hotkey Enabled: 11111111111111111111111111111111
- 13.10: Control Input 1: Latched
- 13.11: Ctrl Command 1: SET/RESET
- 13.14: Control Input 2: Latched
- 13.15: Ctrl Command 2: SET/RESET
- 13.18: Control Input 3: Latched
- 13.19: Ctrl Command 3: SET/RESET
- 13.1C: Control Input 4: Latched
- 13.1D: Ctrl Command 4: SET/RESET
- 13.20: Control Input 5: Latched
- 13.21: Ctrl Command 5: SET/RESET
- 13.24: Control Input 6: Latched
- 13.25: Ctrl Command 6: SET/RESET
- 13.28: Control Input 7: Latched
- 13.29: Ctrl Command 7: SET/RESET
- 13.2C: Control Input 8: Latched
- 13.2D: Ctrl Command 8: SET/RESET
- 13.30: Control Input 9: Latched
- 13.31: Ctrl Command 9: SET/RESET
- 13.34: Control Input 10: Latched
- 13.35: Ctrl Command 10: SET/RESET
- 13.38: Control Input 11: Latched
- 13.39: Ctrl Command 11: SET/RESET
- 13.3C: Control Input 12: Latched
- 13.3D: Ctrl Command 12: SET/RESET
- 13.40: Control Input 13: Latched
- 13.41: Ctrl Command 13: SET/RESET
- 13.44: Control Input 14: Latched
- 13.45: Ctrl Command 14: SET/RESET
- 13.48: Control Input 15: Latched
- 13.49: Ctrl Command 15: SET/RESET
- 13.4C: Control Input 16: Latched
- 13.4D: Ctrl Command 16: SET/RESET
- 13.50: Control Input 17: Latched
- 13.51: Ctrl Command 17: SET/RESET
- 13.54: Control Input 18: Latched
- 13.55: Ctrl Command 18: SET/RESET
- 13.58: Control Input 19: Latched
- 13.59: Ctrl Command 19: SET/RESET
- 13.5C: Control Input 20: Latched
- 13.5D: Ctrl Command 20: SET/RESET
- 13.60: Control Input 21: Latched
- 13.61: Ctrl Command 21: SET/RESET
- 13.64: Control Input 22: Latched
- 13.65: Ctrl Command 22: SET/RESET
- 13.68: Control Input 23: Latched
- 13.69: Ctrl Command 23: SET/RESET
- 13.6C: Control Input 24: Latched
- 13.6D: Ctrl Command 24: SET/RESET
- 13.70: Control Input 25: Latched
- 13.71: Ctrl Command 25: SET/RESET

Settings File Report
Substation:
File: p546.set
Model Number: P546?1109?552?K

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13.74: Control Input 26: Latched
13.75: Ctrl Command 26: SET/RESET
13.78: Control Input 27: Latched
13.79: Ctrl Command 27: SET/RESET
13.7C: Control Input 28: Latched
13.7D: Ctrl Command 28: SET/RESET
13.80: Control Input 29: Latched
13.81: Ctrl Command 29: SET/RESET
13.84: Control Input 30: Latched
13.85: Ctrl Command 30: SET/RESET
13.88: Control Input 31: Latched
13.89: Ctrl Command 31: SET/RESET
13.8C: Control Input 32: Latched
13.8D: Ctrl Command 32: SET/RESET

FUNCTION KEYS
17.01: Fn Key Status: 0000000000
17.02: Fn Key 1: Unlocked
17.03: Fn Key 1 Mode: Normal
17.04: Fn Key 1 Label: Function Key 1
17.05: Fn Key 2: Unlocked
17.06: Fn Key 2 Mode: Normal
17.07: Fn Key 2 Label: Function Key 2
17.08: Fn Key 3: Unlocked
17.09: Fn Key 3 Mode: Normal
17.0A: Fn Key 3 Label: Function Key 3
17.0B: Fn Key 4: Unlocked
17.0C: Fn Key 4 Mode: Normal
17.0D: Fn Key 4 Label: Function Key 4
17.0E: Fn Key 5: Unlocked
17.0F: Fn Key 5 Mode: Normal
17.10: Fn Key 5 Label: Function Key 5
17.11: Fn Key 6: Unlocked
17.12: Fn Key 6 Mode: Normal
17.13: Fn Key 6 Label: Function Key 6
17.14: Fn Key 7: Unlocked
17.15: Fn Key 7 Mode: Normal
17.16: Fn Key 7 Label: Function Key 7
17.17: Fn Key 8: Unlocked
17.18: Fn Key 8 Mode: Normal
17.19: Fn Key 8 Label: Function Key 8
17.1A: Fn Key 9: Unlocked
17.1B: Fn Key 9 Mode: Normal
17.1C: Fn Key 9 Label: Function Key 9
17.1D: Fn Key 10: Unlocked
17.1E: Fn Key 10 Mode: Normal
17.1F: Fn Key 10 Label: Function Key 10

PROT COMMS/ IM64
20.01: Scheme Setup: 2 Terminal
20.03: Address: 0-0
20.10: Comms Mode: Standard
20.11: Baud Rate Ch1: 64kbits/s
20.13: Clock Source Ch1: Internal
20.17: Comm Delay Tol: 350.0 us
20.18: Comm Fail Timer: 10.00 s
20.1A: GPS Sync:Disabled
20.1B: Char Mod Time: 500.0 ms
20.1F: Alarm Level: 25.00 %
20.20: Prop Delay Stats: Enabled
20.21: MaxCh1 PropDelay: 15.00 ms
20.30: IM1 Cmd Type: Permissive
20.31: IM1 Fallbck Mode: Default
20.32: IM1 Default Val: 0
20.34: IM2 Cmd Type: Permissive
20.35: IM2 Fallbck Mode: Default
20.36: IM2 Default Val: 0
20.38: IM3 Cmd Type: Permissive

Settings File Report
Substation:
File: p546.set
Model Number: P546?1109?552?K

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- 20.39: IM3 Fallbck Mode: Default
- 20.3A: IM3 Default Val: 0
- 20.3C: IM4 Cmd Type: Permissive
- 20.3D: IM4 Fallbck Mode: Default
- 20.3E: IM4 Default Val: 0
- 20.40: IM5 Cmd Type: Permissive
- 20.41: IM5 Fallbck Mode: Default
- 20.42: IM5 Default Val: 0
- 20.44: IM6 Cmd Type: Permissive
- 20.45: IM6 Fallbck Mode: Default
- 20.46: IM6 Default Val: 0
- 20.48: IM7 Cmd Type: Permissive
- 20.49: IM7 Fallbck Mode: Default
- 20.4A: IM7 Default Val: 0
- 20.4C: IM8 Cmd Type: Permissive
- 20.4D: IM8 Fallbck Mode: Default
- 20.4E: IM8 Default Val: 0

CTRL I/P LABELS

- 29.01: Control Input 1: Control Input 1
- 29.02: Control Input 2: Control Input 2
- 29.03: Control Input 3: Control Input 3
- 29.04: Control Input 4: Control Input 4
- 29.05: Control Input 5: Control Input 5
- 29.06: Control Input 6: Control Input 6
- 29.07: Control Input 7: Control Input 7
- 29.08: Control Input 8: Control Input 8
- 29.09: Control Input 9: Control Input 9
- 29.0A: Control Input 10: Control Input 10
- 29.0B: Control Input 11: Control Input 11
- 29.0C: Control Input 12: Control Input 12
- 29.0D: Control Input 13: Control Input 13
- 29.0E: Control Input 14: Control Input 14
- 29.0F: Control Input 15: Control Input 15
- 29.10: Control Input 16: Control Input 16
- 29.11: Control Input 17: Control Input 17
- 29.12: Control Input 18: Control Input 18
- 29.13: Control Input 19: Control Input 19
- 29.14: Control Input 20: Control Input 20
- 29.15: Control Input 21: Control Input 21
- 29.16: Control Input 22: Control Input 22
- 29.17: Control Input 23: Control Input 23
- 29.18: Control Input 24: Control Input 24
- 29.19: Control Input 25: Control Input 25
- 29.1A: Control Input 26: Control Input 26
- 29.1B: Control Input 27: Control Input 27
- 29.1C: Control Input 28: Control Input 28
- 29.1D: Control Input 29: Control Input 29
- 29.1E: Control Input 30: Control Input 30
- 29.1F: Control Input 31: Control Input 31
- 29.20: Control Input 32: Control Input 32

Group 1

GROUP 1 LINE PARAMETERS

- 30.01: Line Length: 12.00 km
- 30.03: Line Impedance: 1.030 Ohm
- 30.04: Line Angle: 85.00 deg
- 30.05: kZN Res Comp: 940.0e-3
- 30.06: kZN Res Angle: -4.000 deg
- 30.07: Mutual Comp: Disabled
- 30.0B: Phase Sequence: Standard ABC
- 30.0C: Tripping Mode: 1 Pole & 3 Pole

GROUP 1 DISTANCE SETUP

- 31.0C: Setting Mode: Advanced
- 31.10: PHASE DISTANCE:
- 31.11: Phase Chars.: Quad
- 31.20: Zone 1 Ph Status: Enabled Ch Fail
- 31.30: Zone 2 Ph Status: Enabled

Settings File Report
Substation:
File: p546.set
Model Number: P546?1109?552?K

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- 31.40: Zone 3 Ph Status: Enabled
- 31.42: Zone 3 Ph Offset: Enabled
- 31.50: Zone P Ph Status: Disabled
- 31.60: Zone 4 Ph Status: Enabled
- 31.70: GROUND DISTANCE:
- 31.71: Ground Chars.: Quad
- 31.80: Zone 1 Gnd Stat.: Enabled Ch Fail
- 31.90: Zone 2 Gnd Stat.: Enabled
- 31.A0: Zone 3 Gnd Stat.: Enabled
- 31.A2: Zone3 Gnd Offset: Enabled
- 31.B0: Zone P Gnd Stat.: Disabled
- 31.C0: Zone 4 Gnd Stat.: Enabled
- 31.D0: Digital Filter: Standard
- 31.D1: CVT Filters: Disabled
- 31.D3: Load Blinders: Enabled
- 31.D4: Z< Blinder Imp: 34.00 Ohm
- 31.D5: Load/B Angle: 37.00 deg
- 31.D6: Load Blinder V<: 15.01 V
- 31.D7: Dist. Polarizing: 1.000
- 31.E0: DELTADIRECTIONAL:
- 31.E1: Dir. Status: Disabled

GROUP 1 DIST. ELEMENTS

- 32.01: PHASE DISTANCE:
- 32.02: Z1 Ph. Reach: 830.0 mOhm
- 32.03: Z1 Ph. Angle: 85.00 deg
- 32.07: R1 Ph. Resistive: 8.250 Ohm
- 32.08: Z1 Tilt Top Line: 0 deg
- 32.09: Z1 Sensit. Iph>1: 50.00 mA
- 32.10: Z2 Ph. Reach: 1.460 Ohm
- 32.11: Z2 Ph. Angle: 85.00 deg
- 32.15: R2 Ph. Resistive: 16.50 Ohm
- 32.16: Z2 Tilt Top Line: 0 deg
- 32.17: Z2 Sensit. Iph>2: 50.00 mA
- 32.20: Z3 Ph. Reach: 5.710 Ohm
- 32.21: Z3 Ph. Angle: 85.00 deg
- 32.22: Z3' Ph Rev Reach: 5.710 Ohm
- 32.25: R3 Ph. Res. Fwd.: 20.63 Ohm
- 32.26: R3' Ph. Res. Rev: 20.63 Ohm
- 32.27: Z3 Tilt Top Line: 0 deg
- 32.28: Z3 Sensit. Iph>3: 50.00 mA
- 32.40: Z4 Ph. Reach: 210.0 mOhm
- 32.41: Z4 Ph. Angle: 85.00 deg
- 32.42: R4 Ph. Resistive: 20.63 Ohm
- 32.45: Z4 Tilt Top Line: -3.000 deg
- 32.46: Z4 Sensit. Iph>4: 50.00 mA
- 32.50: GROUND DISTANCE:
- 32.51: Z1 Gnd. Reach: 830.0 mOhm
- 32.52: Z1 Gnd. Angle: 85.00 deg
- 32.53: Z1 Dynamic Tilt: Disabled
- 32.54: Z1 Tilt Top Line: -3.000 deg
- 32.55: kZN1 Res. Comp.: 940.0e-3
- 32.56: kZN1 Res. Angle: -4.000 deg
- 32.59: R1 Gnd Resistive: 6.880 Ohm
- 32.5B: Z1 Sensit Ignd>1: 50.00 mA
- 32.60: Z2 Gnd. Reach: 1.460 Ohm
- 32.61: Z2 Gnd. Angle: 85.00 deg
- 32.63: Z2 Dynamic Tilt: Disabled
- 32.64: Z2 Tilt Top Line: -3.000 deg
- 32.65: kZN2 Res. Comp.: 940.0e-3
- 32.66: kZN2 Res. Angle: -4.000 deg
- 32.69: R2 Gnd Resistive: 13.75 Ohm
- 32.6B: Z2 Sensit Ignd>2: 50.00 mA
- 32.70: Z3 Gnd. Reach: 5.710 Ohm
- 32.71: Z3 Gnd. Angle: 85.00 deg
- 32.72: Z3' Gnd Rev Rch: 5.710 Ohm
- 32.73: Z3 Dynamic Tilt: Disabled

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- 32.74: Z3 Tilt Top Line: -3.000 deg
- 32.75: kZN3 Res. Comp.: 940.0e-3
- 32.76: kZN3 Res. Angle: -4.000 deg
- 32.79: R3 Gnd. Res. Fwd: 17.88 Ohm
- 32.7A: R3' Gnd Res. Rev: 1.000 Ohm
- 32.7C: Z3 Sensit Ignd>3: 50.00 mA
- 32.90: Z4 Gnd. Reach: 210.0 mOhm
- 32.91: Z4 Gnd. Angle: 85.00 deg
- 32.93: Z4 Dynamic Tilt: Disabled
- 32.94: Z4 Tilt Top Line: -3.000 deg
- 32.95: kZN4 Res. Comp.: 940.0e-3
- 32.96: kZN4 Res. Angle: -4.000 deg
- 32.99: R4 Gnd Resistive: 17.88 Ohm
- 32.9B: Z4 Sensit Ignd>4: 50.00 mA

GROUP 1 PHASE DIFF

- 33.01: Phase Diff: Enabled
- 33.06: Phase Is1: 250.0 mA
- 33.07: Phase Is2: 2.000 A
- 33.08: Phase k1: 30.00 %
- 33.09: Phase k2: 150.0 %
- 33.0A: Phase Char: DT
- 33.0B: Phase Time Delay: 0 s
- 33.0E: PIT Time: 200.0 ms
- 33.0F: Ph CT Corr'tion: 1.000
- 33.10: Compensation: Cap Charging
- 33.11: Susceptance: 3.700 uS
- 33.17: PIT I selection: Remote

GROUP 1 SCHEME LOGIC

- 34.01: BASIC SCHEME:
- 34.08: Zone1 Tripping: Phase And Ground
- 34.09: tZ1 Ph. Delay: 0 s
- 34.0A: tZ1 Gnd. Delay: 0 s
- 34.10: Zone2 Tripping: Phase And Ground
- 34.11: tZ2 Ph. Delay: 350.0 ms
- 34.12: tZ2 Gnd. Delay: 350.0 ms
- 34.18: Zone3 Tripping: Phase And Ground
- 34.19: tZ3 Ph. Delay: 1.000 s
- 34.1A: tZ3 Gnd. Delay: 1.000 s
- 34.20: ZoneP Tripping: Disabled
- 34.28: Zone4 Tripping: Phase And Ground
- 34.29: tZ4 Ph. Delay: 350.0 ms
- 34.2A: tZ4 Gnd. Delay: 350.0 ms
- 34.40: AIDED SCHEME 1:
- 34.41: Aid. 1 Selection: POR
- 34.42: Aid 1 Distance: Phase And Ground
- 34.43: Aid.1 Dist. Dly: 0 s
- 34.60: AIDED SCHEME 2:
- 34.61: Aid. 2 Selection: Disabled
- 34.80: Trip On Close:
- 34.81: SOTF Status: Enabled PoleDead + Pulse
- 34.82: SOTF Delay: 110.0 s
- 34.83: SOTF Tripping: 000010 Zone1 and Zone2
- 34.84: TOR Status: Enabled
- 34.85: TOR Tripping: 000010
- 34.86: TOC Reset Delay: 500.0 ms
- 34.88: TOC Delay: 200.0 ms
- 34.B0: Z1 Extension:
- 34.B1: Z1 Ext Scheme: Disabled
- 34.C0: Loss Of Load:
- 34.C1: LOL Scheme: Disabled

GROUP 1 OVERCURRENT

- 35.01: I>1 Status: Disabled
- 35.0A: I>2 Status: Disabled
- 35.13: I>3 Status: Disabled
- 35.18: I>4 Status: Enabled
- 35.19: I>4 Directional: Non-Directional

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- 35.1A: I>4 Current Set: 1.910 A
- 35.1B: I>4 Time Delay: 50.00 ms
- 35.1C: I> Char Angle: 30.00 deg
- 35.1D: I> Blocking: 001111

GROUP 1 BROKEN CONDUCTOR
- 37.01: Broken Conductor: Enabled
- 37.02: I2/I1 Setting: 200.0e-3
- 37.03: I2/I1 Time Delay: 5.000 s

GROUP 1 EARTH FAULT
- 38.01: IN>1 Status: Enabled
- 38.25: IN>1 Function: IEC S Inverse
- 38.26: IN>1 Directional: Directional Fwd
- 38.29: IN>1 Current Set: 220.0 mA
- 38.2D: IN>1 TMS: 500.0e-3
- 38.33: IN>1 tRESET: 0 s
- 38.35: IN>2 Status: Disabled
- 38.46: IN>3 Status: Disabled
- 38.4D: IN>4 Status: Disabled
- 38.54: IN> Blocking: 001111
- 38.55: IN> DIRECTIONAL:
- 38.56: IN> Char Angle: -45.00 deg
- 38.57: IN> Polarisation: Zero Sequence
- 38.59: IN> VNpol Set: 1.000 V

GROUP 1 POWER SWING BLK.
- 3D.01: PSB Status: Blocking
- 3D.03: Zone 1 Ph. PSB: Blocking
- 3D.05: Zone 2 Ph. PSB: Blocking
- 3D.07: Zone 3 Ph. PSB: Blocking
- 3D.09: Zone P Ph. PSB: Blocking
- 3D.0B: Zone 4 Ph. PSB: Blocking
- 3D.0D: Zone 1 Gnd. PSB: Blocking
- 3D.0F: Zone 2 Gnd. PSB: Blocking
- 3D.11: Zone 3 Gnd. PSB: Blocking
- 3D.13: Zone P Gnd. PSB: Blocking
- 3D.15: Zone 4 Gnd. PSB: Blocking
- 3D.20: PSB Unblocking: Enabled
- 3D.21: PSB Unblock dly: 2.000 s
- 3D.22: PSB Reset Delay: 200.0 ms
- 3D.23: OST Mode: OST Trip
- 3D.24: Z5: 6.850 Ohm
- 3D.25: Z6: 7.540 Ohm
- 3D.26: Z5': -6.850 Ohm
- 3D.27: Z6': -7.540 Ohm
- 3D.28: R5: 21.45 Ohm
- 3D.29: R6: 23.60 Ohm
- 3D.2A: R5': -21.45 Ohm
- 3D.2B: R6': -23.60 Ohm
- 3D.2C: Blinder Angle: 20.00 deg
- 3D.2D: delta T: 40.00 ms
- 3D.2E: Tost: 0 s

GROUP 1 VOLT PROTECTION
- 42.01: UNDER VOLTAGE:
- 42.02: V< Measur't Mode: V<1 & V<2 Ph-N
- 42.03: V< Operate Mode: V<1 & V<2 Any Ph
- 42.04: V<1 Function: DT
- 42.05: V<1 Voltage Set: 57.00 V
- 42.06: V<1 Time Delay: 0 s
- 42.08: V<1 Poledead Inh: Disabled
- 42.09: V<2 Status: Disabled
- 42.0D: OVERVOLTAGE:
- 42.0E: V> Measur't Mode: V>1 & V>2 Ph-N
- 42.0F: V> Operate Mode: V>1 & V>2 Any Ph
- 42.10: V>1 Function: DT
- 42.11: V>1 Voltage Set: 70.01 V
- 42.12: V>1 Time Delay: 5.000 s
- 42.14: V>2 Status: Enabled

UNDER VOLATGE - ONLY DR TRIGGERING
NO CB TRIP

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- 42.15: V>2 Voltage Set: 89.01 V
- 42.16: V>2 Time Delay: 100.0 ms

GROUP 1 CB FAIL & P.DEAD
- 45.0A: UNDER CURRENT:
- 45.0B: I< Current Set: 50.00 mA
- 45.0D: ISEF< Current: 20.00 mA
- 45.0E: POLEDEAD VOLTAGE:
- 45.10: V<: 38.11 V

GROUP 1 SUPERVISION
- 46.01: VTS Mode: Measured + MCB
- 46.02: VTS Status: Blocking
- 46.03: VTS Reset Mode: Auto
- 46.04: VTS Time Delay: 5.000 s
- 46.05: VTS I> Inhibit: 10.00 A
- 46.06: VTS I2> Inhibit: 50.00 mA
- 46.0E: INRUSH DETECTION:
- 46.0F: I>2nd Harmonic: 20.00 %
- 46.10: WEAK INFEED BLK:
- 46.11: WI Inhibit: Disabled
- 46.12: I0/I2 Setting: 3.000
- 46.30: CT SUPERVISION:
- 46.31: CTS Mode: Disabled

GROUP 1 INPUT LABELS
- 4A.01: Opto Input 1: Input L1
- 4A.02: Opto Input 2: Input L2
- 4A.03: Opto Input 3: Input L3
- 4A.04: Opto Input 4: Input L4
- 4A.05: Opto Input 5: Input L5
- 4A.06: Opto Input 6: Input L6
- 4A.07: Opto Input 7: Input L7
- 4A.08: Opto Input 8: Input L8
- 4A.09: Opto Input 9: Input L9
- 4A.0A: Opto Input 10: Input L10
- 4A.0B: Opto Input 11: Input L11
- 4A.0C: Opto Input 12: Input L12
- 4A.0D: Opto Input 13: Input L13
- 4A.0E: Opto Input 14: Input L14
- 4A.0F: Opto Input 15: Input L15
- 4A.10: Opto Input 16: Input L16
- 4A.11: Opto Input 17: Input L17
- 4A.12: Opto Input 18: Input L18
- 4A.13: Opto Input 19: Input L19
- 4A.14: Opto Input 20: Input L20
- 4A.15: Opto Input 21: Input L21
- 4A.16: Opto Input 22: Input L22
- 4A.17: Opto Input 23: Input L23
- 4A.18: Opto Input 24: Input L24

GROUP 1 OUTPUT LABELS
- 4B.01: Relay 1: Output R1
- 4B.02: Relay 2: Output R2
- 4B.03: Relay 3: Output R3
- 4B.04: Relay 4: Output R4
- 4B.05: Relay 5: Output R5
- 4B.06: Relay 6: Output R6
- 4B.07: Relay 7: Output R7
- 4B.08: Relay 8: Output R8
- 4B.09: Relay 9: Output R9
- 4B.0A: Relay 10: Output R10
- 4B.0B: Relay 11: Output R11
- 4B.0C: Relay 12: Output R12
- 4B.0D: Relay 13: Output R13
- 4B.0E: Relay 14: Output R14
- 4B.0F: Relay 15: Output R15
- 4B.10: Relay 16: Output R16
- 4B.11: Relay 17: Output R17
- 4B.12: Relay 18: Output R18

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- 4B.13: Relay 19: Output R19
- 4B.14: Relay 20: Output R20
- 4B.15: Relay 21: Output R21
- 4B.16: Relay 22: Output R22
- 4B.17: Relay 23: Output R23
- 4B.18: Relay 24: Output R24

General Data

Network Details

Voltage	=	400			kV
Frequency	=	50			Hz
System X/R Ratio	=	40			
Fault Current	=	10500			A

Local End Bay Details

Station Name	=	400kV ADST SS			
Object Name	=	400 KV LINE CONTROL AND RELAY PANEL			
Object Number	=	B-403			
Relay Type	=	7SL87			
CT Primary current (Adopted)	=	1000			A
CT Secondary current	=	1			A

Protected Line details

Line details

Line length	=	12.00			km
Rated current capacity	=	953			A
Positive sequence imp. per km	=	0.0266	+j	0.313	Ohm/km
Zero sequence imp. per km	=	0.168	+j	1.187	Ohm/km

Short Line Feeder Details at Remote Station

Remote end station name	=	-			
Length of the line	=	30.45			Km
Positive sequence imp. per km	=	0.015	+j	0.253	Ohm/Km
Zero sequence imp. per km	=	0.249	+j	0.999	Ohm/Km

Longest Line Feeder Details at Remote Station

Remote end station name	=	-			
Length of the line	=	52.00			Km
Positive sequence imp. per km	=	0.036	+j	0.310	Ohm/Km
Zero sequence imp. per km	=	0.256	+j	1.104	Ohm/Km

CALCULATION FOR DIFFERENTIAL FUNCTION :

If the charging current compensation is ON, the pickup value I-DIFF> can be set equal I_{charge}. Thus the residual error of the charging current compensation is considered. Without charging current compensation, this pickup value must be set to a value that is higher than the total steady-state charging current of the protected object

Charging Current Calculation:

The charging current is calculated according to the following equation,

I_{charge} : $U/ (\sqrt{3} * Xc1)$

Where,

U : System Line Voltage
Xc1 : Positive Sequence Line Capacitive reactance value
I charge : Line charging current/kM due to Line Capacitance
Xc1 : $1/(2 * \pi * f * C1)$
C1 : Line Capacitance value/kM

Xc1 : $1/(2 * \pi * f * C1)$
Xc1 : 1/(2*3.14*50*0.0000000119)
: 267622.97 Ω

I_{charge} : $U/ (\sqrt{3} * Xc1)$
I_{charge} : $400000/(\sqrt{3}*267622.97)$
: 0.86 A

Total Primary Charging Current : 0.86*12
: 10.32 A

Total Sec.Charging Current, Ic : Icharge / CTR
: 10.32/1000
: 0.01032 A

I-DIFF:Threshold:

Considering the variations of voltage and frequency, the set value should be at least 2 to 3 times higher than the calculated charging current or 20% of the rated current of the line whichever is greater.

3 times of : 3 * Ic
: 0.03096 A

I-DIFF:Threshold : 0.25 A

I-DIFF Switch-on:

A setting to three to four times the steady-state charging current usually ensures the stability of the protection during switch-on of the line.

I-DIFF:Threshold Switch On : 0.30 A

I-DIFF Fast :

As per the relay Recommendation, set the pickup value is 1.0 times to 2 times of Rated Current

Rated current : 952.66 A
: 2*952.66
: 1905.32 A
Therefore, as seen by the CT : 1.91 A

I-DIFF fast:Threshold : 2 A

I-DIFF fast Switch on :

I-DIFF fast SWITCHON should be 2 to 3 times the setting value of I-DIFF fast

I-DIFF fast:Threshold Switch : 2*1.91
: 3.82 A

The below mentioned settting recommended,

I-DIFF:Threshold	:	0.25	A
I-DIFF:Threshold Switch On	:	0.30	A
I-DIFF:Operate delay	:	0.00	Sec
Ic-compensat.:Mode	:	ON	
Ic-stabilization/Ic-rated	:	1.00	
I-DIFF fast:Threshold	:	2	A
I-DIFF fast:Threshold Switch On	:	3.82	A
INRUSH REST.	:	On	

CT ratio correction: _:9001:101 Rated current to be same at both end of the line to compensate CT ratio

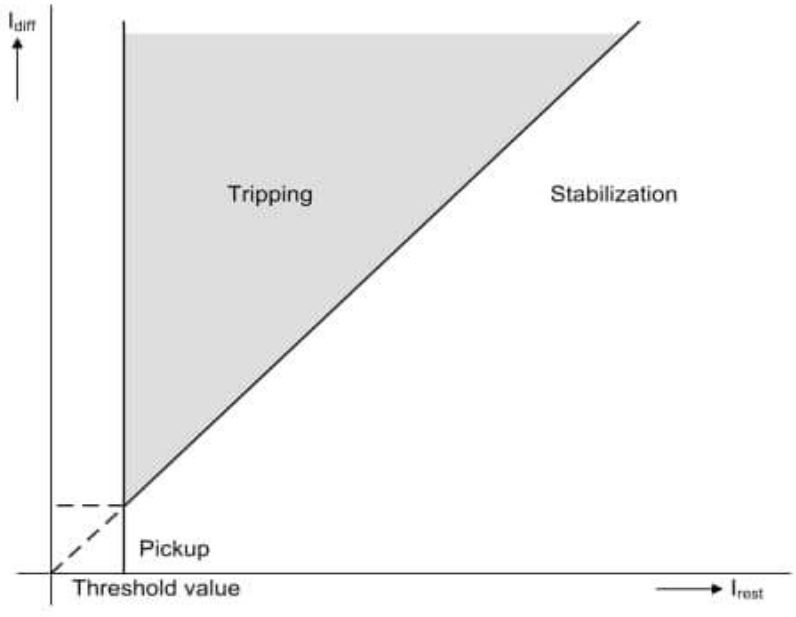

Figure 6-13 Operate Curve of the Differential Protection

CALCULATION FOR DISTANCE FUNCTION : QUADRILATERAL

Zone Reach Details

Zone 1	:	80%	of the protected Line
Zone 2	:	100%	of the protected Line +
		20%	of the shortest adjacent Line)
Zone 3	:	120%	of the protected Line +
		100%	of Remote end Longest Line
Zone 4	:	20%	of the protected l (Reverse Zone)
Zone 1B	:	Setting same as Zone-2	
VT Ratio	:	400x1000 / 110	
	:	3636	
CT Ratio	:	1000 / 1	
	:	1000	

Transformation Ratio N : CT Ratio / VT Ratio
: 1000/3636
: 0.275

Calculated Sec Impedance Z_{sec} : N x Z_{prim} in ohm

Z_{prim} : Primary Impedance in ohm

Protected Line:

Line Length : 12.00 km

Line Total +VE Seq Impedance : (R_1 +j X_1)
: 0.319 +j 3.75
: 3.764 L85.14

Line Total Zero Seq Impedance : (R_0 +j Xo)
: 2.012 +j 14.244
: 14.385 L81.96

Adjacent Shortest Line: (Remote End)

Line Length : 30.5 km

Total +VE Sequence Impedance : (R_1 +j X1)
: 0.448 +j 7.698
: 7.711 L86.67

Total Zero Sequence Impedance : (R_0 +j Xo)
: 7.585 +j 30.42
: 31.351 L76

Adjacent Longest Line: (Remote End)

Line Length : 52.00 km

Total +VE Sequence Impedance : (R_1 +j X1)
: 1.872 +j 16.141
: 16.249 L83.38

Total Zero Sequence Impedance : (R_0 +j Xo)
: 13.312 +j 57.408
: 58.931 L76.94

Zero Sequence Compensation Factor:

Resistance Ratio Kr : $1/3((R_0/R_1)-1)$
: 1.769

Reactance Ratio Kx : $1/3((X_0/X_1)-1)$
: 0.933

Line Angle Setting
Tan ϕ : XL/RL
: X_1/R_1
ϕ : 85.14 deg

Earth Impedance Compensation K_o Factor.
K_o : ZE / ZL
: $1/3 ((Z_0/Z_1)-1)$
Z_1 : Positive sequence Impedance of the Line
Z_0 : Zero sequence Impedance of the Line

Z_0 / Z_1 : 3.822 L -3.18
: 3.816 +j -j0.212

$1/3 ((Z_0/Z_1)-1)$: $1/3(3.82+j-0.212-1)$
: 0.942 L-4.32
K_o : 0.94
ϕ_o : -4.32 deg

Load Impedance and Load Angle Calculation:

Rated Current : 952.66 A

At worst case, the maximum load current of the transmission line has been considered slightly higher than nominal loading (120%) to cover emergency loading of the protected line in case of heavy load flow.

Maximum Load Current (Imax) : 1429.00 A (1.5 times of Load current)

Minimum Operating Voltage : 85% of rated voltage
: 0.85*400000
: 340000 V
Load Impedance R_{Load} : U_{min} / sqrt(3) x I_{max}
: 340000 / sqrt(3) x 1429
R_{Load} Primary : 137.370 ohm
R_{Load} Secondary : 137.37 x 0.275
: 37.78 ohm

The largest angle of the load impedance is given by the worst, smallest power factor. Hence,

Minimum Power Factor $Cos\phi_{min}$: 0.850 (Assumed)
ϕ_{min} : 32 deg

Set Load Angle : ϕ_{min} + 5
: 32 + 5
: 37 deg

To avoid load enchrochment for the phase-phase measuring elements, the set resistive reach of any distance protection

zone should not exceed 60% of the $R_{load.}$

60.00% of R_{load} : 0.6*37.78
22.67 Ω

To avoid load enchroachment for the phase-earth measuring elements, the set resistive reach of any distance protection zone should not exceed 80% of the $R_{load.}$

80.00% of R_{load} : 0.8*37.78
30.22 Ω

Arc Resistance :

Arc Resistance for Ph-Ph fault (Pri) : 5.000 Ω (Assumed)

Arc Resistance for Ph-Ph fault (Sec) : 5*0.275
Rarc (Ph-Ph) : 0.740 Ω

Arc Resistance for PH-E fault (Pri) : 3.000 Ω (Assumed)

Arc Resistance for PH-E fault (Sec) : 3*0.275
Rarc (Ph-E) : 0.479 Ω

Tower Footing Resistance (Pri) : 10.000 Ω (Assumed)

R_{TF} (Sec) : 2.750 Ω

Zone 1 Reach Values:

Reactance, X reach (Z1) : 80% x X1 x N

: 0.8*3.75*0.275
: 0.825 ohm

Resistance Ph-Ph fault, R(Z1) : 80% x R1 x N + Rarc (Ph-Ph)/2

: (0.8*0.319*0.275)+0.74/2
: 0.440 ohm

Now, for Earth arc resistance shall include tower footing resistance
Resistance Ph-E fault, RE(Z1) : 80% * R1* N + Rarc(ph-E) + R_T
: (0.8*0.319*0.275)+(0.479+2.75)
: 3.299 ohm

Zone 2 Reach Values

Reactance, X reach (Z2) : 100% of X1 Protection Line +
20% of X1 Remote end Shortest Line x N
: ((1*3.75)+(0.2*7.698))*0.275
: 1.455 ohm

Resistance Ph-Ph fault, R(Z2) : 100% of R1 Protected Line + 20% of R1 of Remote end shortest Line) x N + Rarc (Ph-Ph)/2
: ((1*0.319)+(0.2*0.448))*0.275+(0.74/2)
: 0.482 ohm

Now, for Earth arc resistance shall include tower footing resistance
Resistance Ph-E fault, RE(Z2) : 100% of R1 Protected Line + 20% of R1 of Remote end Longest Line x N + Rarc (Ph-E) + R_T
: ((1*0.319)+(0.2*0.448))*0.275+(0.479+2.75)

: 3.341 ohm

Zone 3 Reach Values

Reactance, X(Z3) : 120% of X1 Protection Line +
100% of X1 Remote end Longest Line x N
: ((1.2*3.75)+(1*16.141))*0.275
: 5.676 ohm

Resistance Ph-Ph fault, R(Z3) : 120% of R1 Protected Line + 100% of R1 of Remote end Longest Line x N + Rarc (Ph-Ph)/2
: ((1.2*0.319)+(1*1.872))*0.275+(0.74/2)
: 0.990 ohm

Now, for Earth arc resistance shall include tower footing resistance

Resistance Ph-E fault, RE(Z3) : 120(% of R1 Protected Line + 100% of R1 of Remote end Longest Line) x N + Rarc (Ph-E) + R_T
: ((1.2*0.319)+(1*1.872))*0.275+(0.479+2.75)
: 3.849 ohm

Zone -4 Setting:(Reverse Reach)

Reactance, X(Z4) : 20% x X1 x N

: 0.2*3.75*0.275
: 0.206 ohm

Resistance Ph-Ph fault, R(Z4) : 20% x R1 x N + Rarc (Ph-Ph)/2

: (0.2*0.319*0.275)+0.74/2
: 0.388 ohm

Now, for Earth arc resistance shall include tower footing resistance

Resistance Ph-E fault, RE(Z4) : 20% * R1* N + Rarc(ph-E) + R_T
: (0.2*0.319*0.275)+(0.479+2.75)
: 3.247 ohm

Zone-1B Setting:

Set Zone-1B settings equal to Zone-2 value

Zone Timer setting:

ZONE 1- t1 PP	:	0.00 sec
ZONE 1- t1 PE	:	0.00 sec
ZONE 2- t1 PP	:	0.35 sec
ZONE 2- t1 PE	:	0.35 sec
ZONE 3- t1 PP	:	1.00 sec
ZONE 3- t1 PE	:	1.00 sec
ZONE 4- t1 PP	:	0.35 sec
ZONE 4- t1 PE	:	0.35 sec
ZONE 1B-t1 PP	:	0.00 sec
ZONE 1B-t1 PE	:	0.00 sec

Load Cutout

Z< Blinder Imp (90% of LR)	:	34.0	Ohm
Load/B Angle	:	37.0	Deg

TELEPROTECTION FOR DISTANCE:

The relay shall work in Permissive Over Reach(POTT) mode with the following settings:

Send with	:	Distance prot. Z1	
Operate with	:	Distance prot. Z2	
Send prolongation	:	0.05	Sec
Send delay	:	0.00	Sec
1-pole operate allowed	:	Yes	
Operate delay	:	0.00	sec

POWER SWING:

Power swing operating mode	:	All zones block	
Max.Blocking Time	:	2	Sec

50HS INSTANTANEOUS SOTF:

SOTF to be enabled for Zone-2, Zone-3

Operate delay	:	0	sec

STUB PROTECTION:

The threshold value must be higher than the maximum operational current to be expected, in order to avoid pickup without fault. Grading time above the base time of the main protection is usually sufficient.

Threshold	:	1.9	A
Operate delay	:	0.04	msec

FUSE FAIL MONITORING:

Asym.fail.DO on netw.flt	:	no	
Asym.fail.time delay	:	5	sec
3ph fail-phs.curr.release	:	0.1	A
3ph fail-phs.curr.jump	:	0.1	A
3ph fail-VA,VB,VC <	:	5	V
Switch-on 3ph.failure	:	on	
SO 3ph.fail-time delay	:	5	sec

DIR. EARTH FAULT SETTINGS :

The pickup characteristics should be more than the standing unbalance current as seen by the system and the CT's.

1Ph Fault Current	:	10500	A
IN> Pickup current in A	:	23%	of rated current
	:	0.23*1000=230A	
IN> Current Set (Is)	:	0.23 A	
Minimum setting available in Relay	:	0.23 A	

The Earth fault function has to be graded with the Zone-3 Protection

Zone-3 operating time	:	1.00	Sec
Grading margin	:	0.13	Sec
Required time (Treq)	:	1.13	Sec

Note: The IDMT curve shall saturate if the fault current more than 20 times of pickup current. 20 times of set current considered for TMS calculation.

Fault Current considered	:	4600	A
51 Time Dial	:	(Treq*(IF/Is)^0.02-1)/0.14	
	:	(1.13*(4600/230)^0.02-1)/0.14)	
	:	0.5	

BROKEN CONDUCTOR

A broken wire of the protected line or in the current transformer secondary circuit can be detected, if the minimum current PoleOpenCurrent flows via the feeder. If the minimum phase current is below this limit while the other phase currents are above this limit, an interruption of this conductor may be assumed. If current asymmetry is also detected (see margin heading “Current Symmetry”), the device issues the message Fail Conductor (No. 195).

OVERVOLTAGE PROTECTION: 59

Measuring value	:	phase-neutral		
Definite-T 1:Threshold	:	70	V	110% of Rated voltage
Definite-T 1:Operate delay	:	5	sec	
Definite-T 2:Threshold	:	89	V	140% of Rated voltage
Definite-T 2:Operate delay	:	0.1	sec	

UNDERVOLTAGE PROTECTION:27 (Alarm Only)

Measuring quantities by Uphase-phase				
Uph-ph< pickup	:	57	V	90% of Rated Voltage
T Uph-ph< time delay	:	0	sec	

Power system

General		
Number	Settings	Value
11.2311.101	Phase sequence	All: ABC

Meas.point I-3ph 1

CT 3-phase \General		
Number	Settings	Value
11.931.8881.115	CT connection	All: 3-phase
11.931.8881.127	Tracking	All: active
11.931.8881.130	Measuring-point ID	All: 1

CT 3-phase \CT phases		
Number	Settings	Value
11.931.8881.101	Rated primary current	All: 1000 A
11.931.8881.102	Rated secondary current	All: 1 A
11.931.8881.117	Current range	All: 100 x IR
11.931.8881.118	Internal CT type	All: CT protection
11.931.8881.116	Neutr.point in dir.of ref.obj	All: yes
11.931.8881.114	Inverted phases	All: none
11.931.8881.107	CT error changeover	All: 1.5
11.931.8881.108	CT error A	All: 5 %
11.931.8881.109	CT error B	All: 15 %

CT 3-phase \MP disconnection		
Number	Settings	Value
11.931.8881.173	Current check	All: active
11.931.8881.112	I< threshold	All: 0.10 A

CT 1		
Number	Settings	Value
11.931.3841.103	Magnitude correction	All: 1
11.931.3841.117	Phase	All: I A

CT 2		
Number	Settings	Value
11.931.3842.103	Magnitude correction	All: 1
11.931.3842.117	Phase	All: I B

CT 3		
Number	Settings	Value
11.931.3843.103	Magnitude correction	All: 1
11.931.3843.117	Phase	All: I C

Brk.wire det.		
Number	Settings	Value
11.931.5581.1	Mode	All: off
11.931.5581.101	Mode of blocking	All: blocking

Supv. balan. I		
Number	Settings	Value
11.931.2491.1	Mode	Settings group 1: on
11.931.2491.101	Release threshold	Settings group 1: 0.50 A
11.931.2491.102	Threshold min/max	Settings group 1: 0.5
11.931.2491.6	Delay failure indication	Settings group 1: 5 s

Supv. ph.seq.I		
Number	Settings	Value
11.931.2551.1	Mode	Settings group 1: on
11.931.2551.6	Delay failure indication	Settings group 1: 5 s
11.931.2551.102	Release threshold	Settings group 1: 0.50 A

Saturat. det.		
Number	Settings	Value
11.931.17731.101	CT saturation threshold	Settings group 1: 8.00 A

Meas.point V-3ph 1

VT 3-phase		
Number	Settings	Value
11.941.8911.101	Rated primary voltage	All: 400.000 kV
11.941.8911.102	Rated secondary voltage	All: 110 V
11.941.8911.104	VT connection	All: 3 ph-to-gnd voltages
11.941.8911.106	Inverted phases	All: none
11.941.8911.111	Tracking	All: active
11.941.8911.130	Measuring-point ID	All: 2
11.941.8911.136	Internal VT type	All: Voltage transformer

VT 1		
Number	Settings	Value
11.941.3811.103	Magnitude correction	All: 1
11.941.3811.108	Phase	All: V A

VT 2		
Number	Settings	Value
11.941.3812.103	Magnitude correction	All: 1
11.941.3812.108	Phase	All: V B

VT 3		
Number	Settings	Value
11.941.3813.103	Magnitude correction	All: 1
11.941.3813.108	Phase	All: V C

Supv. balan. V		
Number	Settings	Value
11.941.2521.1	Mode	Settings group 1: on
11.941.2521.101	Release threshold	Settings group 1: 55.0 V
11.941.2521.102	Threshold min/max	Settings group 1: 0.75
11.941.2521.6	Delay failure indication	Settings group 1: 5 s

Supv. ph.seq.V		
Number	Settings	Value
11.941.2581.1	Mode	Settings group 1: on
11.941.2581.6	Delay failure indication	Settings group 1: 5 s

Supv. sum V		
Number	Settings	Value
11.941.2461.1	Mode	Settings group 1: off
11.941.2461.3	Threshold	Settings group 1: 27.5 V
11.941.2461.6	Delay failure indication	Settings group 1: 5 s

VT miniatureCB		
Number	Settings	Value
11.941.2641.101	Response time	Settings group 1: 0 s

Meas.point I-1ph 1

General		
Number	Settings	Value
11.951.2311.101	Rated primary current	All: 1000 A
11.951.2311.102	Rated secondary current	All: 1 A
11.951.2311.103	Current range	All: 100 x IR
11.951.2311.104	Internal CT type	All: CT protection
11.951.2311.116	Term. 1,3,5,7 in dir. of obj.	All: yes
11.951.2311.105	Tracking	All: inactive
11.951.2311.130	Measuring-point ID	All: 3

CT 1		
Number	Settings	Value
11.951.3841.103	Magnitude correction	All: 1
11.951.3841.117	Phase	All: Ix

Meas.point V-1ph 1

General		
Number	Settings	Value
11.961.2311.101	Rated primary voltage	All: 400 kV
11.961.2311.102	Rated secondary voltage	All: 100 V
11.961.2311.103	Tracking	All: inactive

Number	Settings	Value
11.961.2311.130	Measuring-point ID	All: 4

VT 1		
Number	Settings	Value
11.961.3811.103	Magnitude correction	All: 1
11.961.3811.108	Phase	All: V B

VT miniatureCB		
Number	Settings	Value
11.961.2641.101	Response time	Settings group 1: 0 s

*Setting marked as favorite setting

sp Setting marked as specific setting

Table of contents

Line 1

General \Rated values		
Number	Settings	Value
21.9001.101	Rated current	All: 3000 A 952A
21.9001.102	Rated voltage	All: 400.00 kV
21.9001.103	Rated apparent power	All: 693.0 MVA

General \Line data		
Number	Settings	Value
21.9001.149	Neutral point	Settings group 1: grounded
21.9001.112	C1 per length unit	Settings group 1: 0.011900 µF/km
21.9001.148	C0 per length unit	Settings group 1: 0.011900 µF/km
21.9001.113	X per length unit	Settings group 1: 0.313000 Ω/km
21.9001.114	Line length	Settings group 1: 12 km
21.9001.108	Line angle	Settings group 1: 85.14 °
21.9001.104	Kr	Settings group 1: 1.77
21.9001.105	Kx	Settings group 1: 0.93
21.9001.106	KmR	Settings group 1: 0
21.9001.107	KmX	Settings group 1: 0
21.9001.109	Gnd.curr.ratio(MutComp)	Settings group 1: 95 %
21.9001.119	CT saturation detection	All: no
21.9001.111	Series compensation	Settings group 1: no
21.9001.110	Series capacit. reactance	Settings group 1: 0 Ω

General \Measurements		
Number	Settings	Value
21.9001.158	P, Q sign	Settings group 1: not reversed

Process monitor

Closure detec.		
Number	Settings	Value
21.1131.4681.101	Operating mode	Settings group 1: Manual close only
21.1131.4681.102	Action time after closure	Settings group 1: 0.5 s
21.1131.4681.103	Min. time feeder open	Settings group 1: 0.3 s

1pol.open det.		
Number	Settings	Value
21.1131.4711.101	Operating mode	Settings group 1: with measurement

Volt.criterion		
Number	Settings	Value
21.1131.4801.101	Threshold U open	Settings group 1: 18.15 V

Fault locator		
Number	Settings	Value
21.8671.1	Mode	Settings group 1: on
21.8671.101	Start	Settings group 1: with going pickup
21.8671.102	Parallel-line compensat.	Settings group 1: no
21.8671.103	Load compensation	All: no

Mes.v.fail.det		
Number	Settings	Value
21.2671.1	Mode	Settings group 1: on
21.2671.115	Asym.fail.-DO on netw.flt.	Settings group 1: yes
21.2671.113	Asym.fail. - time delay	Settings group 1: 5 s
21.2671.102	3ph.fail. - phs.curr.release	Settings group 1: 0.064 A
21.2671.103	3ph.fail. - phs.curr. jump	Settings group 1: 0.064 A
21.2671.101	3ph.fail. - VA,VB,VC <	Settings group 1: 3.025 V
21.2671.107	Switch-on 3ph. failure	All: on
21.2671.106	SO 3ph.fail. - time delay	Settings group 1: 0.5 s

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General		
Number	Settings	Value
21.201.2311.101	Emergency mode	Settings group 1: no

Definite-T 1 \General		
Number	Settings	Value
21.201.661.1	Mode	Settings group 1: off

Number	Settings	Value
21.201.661.2	Operate & flt.rec. blocked	Settings group 1: no
21.201.661.11	1-pole operate allowed	Settings group 1: no
21.201.661.26	Dynamic settings	All: no
21.201.661.8	Method of measurement	Settings group 1: fundamental comp.
21.201.661.3	Threshold	Settings group 1: 3.20 A
21.201.661.4	Dropout ratio	Settings group 1: 0.95
21.201.661.102	Pickup delay	Settings group 1: 0 s
21.201.661.101	Dropout delay	Settings group 1: 0 s
21.201.661.6	Operate delay	Settings group 1: 0.3 s
21.201.661.7	Operate delay mode	Settings group 1: Running dur. DO-delay

Definite-T 2 \General		
Number	Settings	Value
21.201.662.1	Mode	Settings group 1: off
21.201.662.2	Operate & flt.rec. blocked	Settings group 1: no
21.201.662.11	1-pole operate allowed	Settings group 1: yes
21.201.662.26	Dynamic settings	All: no
21.201.662.8	Method of measurement	Settings group 1: fundamental comp.
21.201.662.3	Threshold	Settings group 1: 2.00 A
21.201.662.4	Dropout ratio	Settings group 1: 0.95
21.201.662.102	Pickup delay	Settings group 1: 0 s
21.201.662.101	Dropout delay	Settings group 1: 0 s
21.201.662.6	Operate delay	Settings group 1: 0.1 s
21.201.662.7	Operate delay mode	Settings group 1: Running dur. DO-delay

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General		
Number	Settings	Value
21.211.2311.101	Emergency mode	Settings group 1: caused by main prot.
21.211.2311.9	Measured value	All: 3I0 calculated

Definite-T 1 \General		
Number	Settings	Value
21.211.751.1	Mode	Settings group 1: off
21.211.751.2	Operate & flt.rec. blocked	Settings group 1: no
21.211.751.26	Dynamic settings	All: no
21.211.751.102	Blk. w. 2nd harm. gnd. det.	Settings group 1: no
21.211.751.8	Method of measurement	Settings group 1: fundamental comp.
21.211.751.3	Threshold	Settings group 1: 2.133 A
21.211.751.4	Dropout ratio	Settings group 1: 0.95
21.211.751.101	Dropout delay	Settings group 1: 0 s
21.211.751.6	Operate delay	Settings group 1: 0.3 s
21.211.751.7	Operate delay mode	Settings group 1: Running dur. DO-delay

Definite-T 2 \General		
Number	Settings	Value
21.211.752.1	Mode	Settings group 1: off
21.211.752.2	Operate & flt.rec. blocked	Settings group 1: no
21.211.752.26	Dynamic settings	All: no
21.211.752.102	Blk. w. 2nd harm. gnd. det.	Settings group 1: no
21.211.752.8	Method of measurement	Settings group 1: fundamental comp.
21.211.752.3	Threshold	Settings group 1: 1.20 A
21.211.752.4	Dropout ratio	Settings group 1: 0.95
21.211.752.101	Dropout delay	Settings group 1: 0 s
21.211.752.6	Operate delay	Settings group 1: 0.3 s
21.211.752.7	Operate delay mode	Settings group 1: Running dur. DO-delay

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General		
Number	Settings	Value
21.1111.2311.114	Direct. determination with	All: V0 + IY (neutral pt.)
21.1111.2311.101	Angle forward α	Settings group 1: 315 °
21.1111.2311.102	Angle forward β	Settings group 1: 135 °
21.1111.2311.103	Min. zero-seq. voltage V0	Settings group 1: 0.919 V
21.1111.2311.115	Dir.reslt=forw.at V0<min	Settings group 1: no
21.1111.2311.104	Min.3I0 f.increas.dir.sens.	Settings group 1: 0.064 A
21.1111.2311.116	Dir.corr.at ser.comp.lines	Settings group 1: no

Definite-T 1 \Blocking by		
Number	Settings	Value
21.1111.4861.140	21 Distance prot. 1.Z 1	true
21.1111.4861.140	21 Distance prot. 1.Z 2	true
21.1111.4861.140	21 Distance prot. 1.Z 3	true
21.1111.4861.140	21 Distance prot. 1.Z 4	false
21.1111.4861.140	87 Line diff. prot..Group indicat.	false

Number	Settings	Value
21.1111.4861.140	87 Stub diff. prot. 1.Group indicat.	false

Definite-T 1 \General		
Number	Settings	Value
21.1111.4861.1	Mode	Settings group 1: off
21.1111.4861.2	Operate & flt.rec. blocked	Settings group 1: no
21.1111.4861.114	Directional mode	Settings group 1: forward
21.1111.4861.11	1-pole operate allowed	Settings group 1: no
21.1111.4861.8	Method of measurement	Settings group 1: 1-cycle filter
21.1111.4861.131	Blk. w. 2nd harm. gnd. det.	Settings group 1: no
21.1111.4861.130	Blocking by prot. pickup	Settings group 1: every pickup
21.1111.4861.129	Op.mode at 1p dead time	Settings group 1: blocked
21.1111.4861.112	Hold mode 1p dead time	Settings group 1: 0.04 s
21.1111.4861.115	Dynamic settings	All: no
21.1111.4861.111	Stabiliz. w. phase current	Settings group 1: 10 %
21.1111.4861.3	Threshold	Settings group 1: 0.32 A
21.1111.4861.6	Operate delay	Settings group 1: 1 s

Definite-T 2 \Blocking by		
Number	Settings	Value
21.1111.4862.140	21 Distance prot. 1.Z 1	true
21.1111.4862.140	21 Distance prot. 1.Z 2	true
21.1111.4862.140	21 Distance prot. 1.Z 3	true
21.1111.4862.140	21 Distance prot. 1.Z 4	true
21.1111.4862.140	87 Line diff. prot..Group indicat.	false
21.1111.4862.140	87 Stub diff. prot. 1.Group indicat.	false

Definite-T 2 \General		
Number	Settings	Value
21.1111.4862.1	Mode	Settings group 1: off
21.1111.4862.2	Operate & flt.rec. blocked	Settings group 1: no
21.1111.4862.114	Directional mode	Settings group 1: forward
21.1111.4862.11	1-pole operate allowed	Settings group 1: no
21.1111.4862.8	Method of measurement	Settings group 1: 1-cycle filter
21.1111.4862.131	Blk. w. 2nd harm. gnd. det.	Settings group 1: no
21.1111.4862.130	Blocking by prot. pickup	Settings group 1: every pickup
21.1111.4862.129	Op.mode at 1p dead time	Settings group 1: blocked
21.1111.4862.112	Hold mode 1p dead time	Settings group 1: 1.5 s
21.1111.4862.115	Dynamic settings	All: no
21.1111.4862.111	Stabiliz. w. phase current	Settings group 1: 10 %
21.1111.4862.3	Threshold	Settings group 1: 0.32 A
21.1111.4862.6	Operate delay	Settings group 1: 1 s

Inverse-T 1 \Blocking by		
Number	Settings	Value
21.1111.4891.140	21 Distance prot. 1.Z 1	true
21.1111.4891.140	21 Distance prot. 1.Z 2	true
21.1111.4891.140	21 Distance prot. 1.Z 3	true
21.1111.4891.140	21 Distance prot. 1.Z 4	true
21.1111.4891.140	87 Line diff. prot..Group indicat.	false
21.1111.4891.140	87 Stub diff. prot. 1.Group indicat.	false

Inverse-T 1 \General		
Number	Settings	Value
21.1111.4891.1	Mode	Settings group 1: on
21.1111.4891.2	Operate & flt.rec. blocked	Settings group 1: no
21.1111.4891.115	Directional mode	Settings group 1: forward
21.1111.4891.11	1-pole operate allowed	Settings group 1: no
21.1111.4891.8	Method of measurement	Settings group 1: 1-cycle filter
21.1111.4891.135	Blk. w. 2nd harm. gnd. det.	Settings group 1: no
21.1111.4891.131	Blocking by prot. pickup	Settings group 1: every pickup
21.1111.4891.130	Op.mode at 1p dead time	Settings group 1: non-directional
21.1111.4891.113	Hold mode 1p dead time	Settings group 1: 0.04 s
21.1111.4891.116	Dynamic settings	All: no
21.1111.4891.112	Stabiliz. w. phase current	Settings group 1: 10 %
21.1111.4891.3	Threshold	Settings group 1: 0.23 A
21.1111.4891.133	Type of character. curve	Settings group 1: IEC normal inverse
21.1111.4891.106	Time dial	Settings group 1: 0.5
21.1111.4891.132	Additional time delay	Settings group 1: 0 s
21.1111.4891.134	Reset	Settings group 1: instantaneous

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General		
Number	Settings	Value
21.1461.2311.101	Emergency mode	Settings group 1: no
21.1461.2311.102	Rotation angle of ref. volt.	Settings group 1: 45 °

Definite-T 1 \General		
Number	Settings	Value
21.1461.8131.1	Mode	Settings group 1: off
21.1461.8131.2	Operate & flt.rec. blocked	Settings group 1: no
21.1461.8131.105	Directional mode	Settings group 1: forward
21.1461.8131.8	Method of measurement	Settings group 1: fundamental comp.
21.1461.8131.107	Non-directional pickup	Settings group 1: no
21.1461.8131.104	Directional comparison	Settings group 1: yes
21.1461.8131.106	Release via input signal	Settings group 1: no
21.1461.8131.10	Blk. by meas.-volt. failure	Settings group 1: yes
21.1461.8131.26	Dynamic settings	All: no
21.1461.8131.3	Threshold	Settings group 1: 1.92 A
21.1461.8131.4	Dropout ratio	Settings group 1: 0.95
21.1461.8131.101	Dropout delay	Settings group 1: 0 s
21.1461.8131.6	Operate delay	Settings group 1: 0.3 s

Definite-T 2 \General		
Number	Settings	Value
21.1461.8132.1	Mode	Settings group 1: off
21.1461.8132.2	Operate & flt.rec. blocked	Settings group 1: no
21.1461.8132.105	Directional mode	Settings group 1: forward
21.1461.8132.8	Method of measurement	Settings group 1: fundamental comp.
21.1461.8132.107	Non-directional pickup	Settings group 1: at volt.< & mem.empty
21.1461.8132.104	Directional comparison	Settings group 1: no
21.1461.8132.106	Release via input signal	Settings group 1: no
21.1461.8132.10	Blk. by meas.-volt. failure	Settings group 1: yes
21.1461.8132.26	Dynamic settings	All: no
21.1461.8132.3	Threshold	Settings group 1: 2.00 A
21.1461.8132.4	Dropout ratio	Settings group 1: 0.95
21.1461.8132.101	Dropout delay	Settings group 1: 0 s
21.1461.8132.6	Operate delay	Settings group 1: 0.1 s

Inverse-T 1 \General		
Number	Settings	Value
21.1461.8161.1	Mode	Settings group 1: off
21.1461.8161.2	Operate & flt.rec. blocked	Settings group 1: no
21.1461.8161.111	Directional mode	Settings group 1: forward
21.1461.8161.8	Method of measurement	Settings group 1: fundamental comp.
21.1461.8161.113	Non-directional pickup	Settings group 1: no
21.1461.8161.110	Directional comparison	Settings group 1: yes
21.1461.8161.112	Release via input signal	Settings group 1: no
21.1461.8161.10	Blk. by meas.-volt. failure	Settings group 1: yes
21.1461.8161.26	Dynamic settings	All: no
21.1461.8161.3	Threshold	Settings group 1: 1.92 A
21.1461.8161.130	Type of character. curve	Settings group 1: IEC normal inverse
21.1461.8161.114	Min. time of the curve	Settings group 1: 0 s
21.1461.8161.131	Reset	Settings group 1: disk emulation
21.1461.8161.101	Time dial	Settings group 1: 1
21.1461.8161.115	Additional time delay	Settings group 1: 0 s

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General		
Number	Settings	Value
21.321.2311.106	Reference value	Settings group 1: rated current
21.321.2311.107	Current limitation Imax	All: no
21.321.2311.104	Release current	Settings group 1: 0.05 A

Definite-T 1		
Number	Settings	Value
21.321.1981.1	Mode	Settings group 1: on
21.321.1981.2	Operate & flt.rec. blocked	Settings group 1: no
21.321.1981.3	Threshold	Settings group 1: 10 %
21.321.1981.4	Dropout ratio	All: 0.95
21.321.1981.101	Dropout delay	Settings group 1: 0 s
21.321.1981.6	Operate delay	Settings group 1: 5 s

Definite-T 2		
Number	Settings	Value
21.321.1982.1	Mode	Settings group 1: off
21.321.1982.2	Operate & flt.rec. blocked	Settings group 1: no
21.321.1982.3	Threshold	Settings group 1: 65 %
21.321.1982.4	Dropout ratio	All: 0.95
21.321.1982.101	Dropout delay	Settings group 1: 0 s
21.321.1982.6	Operate delay	Settings group 1: 0.5 s

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General		
Number	Settings	Value
21.131.2311.104	Current-flow criterion	Settings group 1: on
21.131.2311.101	Threshold I>	Settings group 1: 0.05 A
21.131.2311.103	Stabilization counter	Settings group 1: 0

Definite-T 1		
Number	Settings	Value
21.131.421.1	Mode	Settings group 1: on
21.131.421.2	Operate & flt.rec. blocked	Settings group 1: no
21.131.421.10	Blk. by meas.-volt. failure	Settings group 1: yes
21.131.421.9	Measured value	Settings group 1: phase-to-ground
21.131.421.8	Method of measurement	Settings group 1: fundamental comp.
21.131.421.101	Pickup mode	Settings group 1: 1 out of 3
21.131.421.102	Pickup delay	Settings group 1: no
21.131.421.3	Threshold	Settings group 1: 57.000 V
21.131.421.4	Dropout ratio	Settings group 1: 1.05
21.131.421.6	Operate delay	Settings group 1: 0 s

Definite-T 2		
Number	Settings	Value
21.131.422.1	Mode	Settings group 1: off
21.131.422.2	Operate & flt.rec. blocked	Settings group 1: no
21.131.422.10	Blk. by meas.-volt. failure	Settings group 1: yes
21.131.422.9	Measured value	Settings group 1: phase-to-phase
21.131.422.8	Method of measurement	Settings group 1: fundamental comp.
21.131.422.101	Pickup mode	Settings group 1: 1 out of 3
21.131.422.102	Pickup delay	Settings group 1: no
21.131.422.3	Threshold	Settings group 1: 71.5 V
21.131.422.4	Dropout ratio	Settings group 1: 1.05
21.131.422.6	Operate delay	Settings group 1: 0.5 s

59 Overvolt.-3ph 1

General		
Number	Settings	Value
21.51.2311.101	Stabilization counter	Settings group 1: 0

Definite-T 1		
Number	Settings	Value
21.51.181.1	Mode	Settings group 1: on
21.51.181.2	Operate & flt.rec. blocked	Settings group 1: no
21.51.181.9	Measured value	Settings group 1: phase-to-ground
21.51.181.8	Method of measurement	Settings group 1: fundamental comp.
21.51.181.101	Pickup mode	Settings group 1: 1 out of 3
21.51.181.3	Threshold	Settings group 1: 70.000 V
21.51.181.4	Dropout ratio	Settings group 1: 0.95
21.51.181.6	Operate delay	Settings group 1: 0 s

Definite-T 2		
Number	Settings	Value
21.51.182.1	Mode	Settings group 1: on
21.51.182.2	Operate & flt.rec. blocked	Settings group 1: no
21.51.182.9	Measured value	Settings group 1: phase-to-ground
21.51.182.8	Method of measurement	Settings group 1: fundamental comp.
21.51.182.101	Pickup mode	Settings group 1: 1 out of 3
21.51.182.3	Threshold	Settings group 1: 89.000 V
21.51.182.4	Dropout ratio	Settings group 1: 0.95
21.51.182.6	Operate delay	Settings group 1: 0.1 s

21 Distance prot. 1

General		
Number	Settings	Value
21.901.2311.110	Zone timer start	Settings group 1: on dist. pickup
21.901.2311.107	Dist. characteristic angle	Settings group 1: 86.3 °
21.901.2311.105	Ground-fault detection	Settings group 1: 3I0 or V0
21.901.2311.103	3I0> threshold value	Settings group 1: 0.064 A
21.901.2311.102	V0> threshold value	Settings group 1: 1.008 V
21.901.2311.104	3I0 pickup stabilization	Settings group 1: 0.1
21.901.2311.108	Loop select. with ph-ph-g	Settings group 1: block leading phase
21.901.2311.106	Parallel-line compensat.	Settings group 1: no

Pickup Z<		
Number	Settings	Value
21.901.3661.101	Min. phase-current thresh	Settings group 1: 0.107 A
21.901.3661.102	Use ph-g load cutout	All: Yes
21.901.3661.105	Use ph-ph load cutout	All: Yes

Z 1		
Number	Settings	Value
21.901.3571.1	Mode	Settings group 1: on
21.901.3571.2	Operate & flt.rec. blocked	Settings group 1: no
21.901.3571.121	Blocked if diff.prot.active	Settings group 1: Yes
21.901.3571.11	1-pole operate allowed	Settings group 1: yes
21.901.3571.101	Function mode	Settings group 1: ph-gnd and ph-ph
21.901.3571.114	Zone-spec. residu. comp.	Settings group 1: no
21.901.3571.109	Directional mode	Settings group 1: forward
21.901.3571.102	X reach	Settings group 1: 0.825 Ω
21.901.3571.103	R (ph-g)	Settings group 1: 3.299 Ω
21.901.3571.104	R (ph-ph)	Settings group 1: 0.44 Ω
21.901.3571.113	Zone-inclination angle	Settings group 1: 0 °
21.901.3571.110	Operate delay (1-phase)	Settings group 1: 0 s
21.901.3571.112	Operate delay (multi-ph.)	Settings group 1: 0 s

Z 2		
Number	Settings	Value
21.901.3572.1	Mode	Settings group 1: on
21.901.3572.2	Operate & flt.rec. blocked	Settings group 1: no
21.901.3572.121	Blocked if diff.prot.active	Settings group 1: no
21.901.3572.11	1-pole operate allowed	Settings group 1: no
21.901.3572.101	Function mode	Settings group 1: ph-gnd and ph-ph
21.901.3572.114	Zone-spec. residu. comp.	Settings group 1: no
21.901.3572.109	Directional mode	Settings group 1: forward
21.901.3572.102	X reach	Settings group 1: 1.455 Ω
21.901.3572.103	R (ph-g)	Settings group 1: 3.341 Ω
21.901.3572.104	R (ph-ph)	Settings group 1: 0.482 Ω
21.901.3572.113	Zone-inclination angle	Settings group 1: 0 °
21.901.3572.110	Operate delay (1-phase)	Settings group 1: 0.35 s
21.901.3572.112	Operate delay (multi-ph.)	Settings group 1: 0.35 s

Z 3		
Number	Settings	Value
21.901.3573.1	Mode	Settings group 1: on
21.901.3573.2	Operate & flt.rec. blocked	Settings group 1: no
21.901.3573.121	Blocked if diff.prot.active	Settings group 1: no
21.901.3573.11	1-pole operate allowed	Settings group 1: no
21.901.3573.101	Function mode	Settings group 1: ph-gnd and ph-ph
21.901.3573.114	Zone-spec. residu. comp.	Settings group 1: no
21.901.3573.109	Directional mode	Settings group 1: forward
21.901.3573.102	X reach	Settings group 1: 5.676 Ω
21.901.3573.103	R (ph-g)	Settings group 1: 3.849 Ω
21.901.3573.104	R (ph-ph)	Settings group 1: 0.99 Ω
21.901.3573.113	Zone-inclination angle	Settings group 1: 0 °
21.901.3573.110	Operate delay (1-phase)	Settings group 1: 1 s
21.901.3573.112	Operate delay (multi-ph.)	Settings group 1: 1 s

Z 4		
Number	Settings	Value
21.901.3574.1	Mode	Settings group 1: on
21.901.3574.2	Operate & flt.rec. blocked	Settings group 1: no
21.901.3574.121	Blocked if diff.prot.active	Settings group 1: no
21.901.3574.11	1-pole operate allowed	Settings group 1: no
21.901.3574.101	Function mode	Settings group 1: ph-gnd and ph-ph
21.901.3574.114	Zone-spec. residu. comp.	Settings group 1: no
21.901.3574.109	Directional mode	Settings group 1: reverse
21.901.3574.102	X reach	Settings group 1: 0.206 Ω
21.901.3574.103	R (ph-g)	Settings group 1: 3.247 Ω
21.901.3574.104	R (ph-ph)	Settings group 1: 0.388 Ω
21.901.3574.113	Zone-inclination angle	Settings group 1: 0 °
21.901.3574.110	Operate delay (1-phase)	Settings group 1: 0.35 s
21.901.3574.112	Operate delay (multi-ph.)	Settings group 1: 0.35 s

87 Line diff. prot.

General		
Number	Settings	Value
21.831.2311.1	Mode	Settings group 1: on
21.831.2311.11	1-pole operate allowed	Settings group 1: yes
21.831.2311.102	Min. current for release	Settings group 1: 0 A
21.831.2311.104	Supervision Idiff	All: yes: reporting only
21.831.2311.108	Action on Behavior = test	Settings group 1: Test loc. device autom.

Remote trip. \General		
Number	Settings	Value
21.831.5551.100	Transmitting	Settings group 1: yes
21.831.5551.101	Receiving	Settings group 1: yes

Remote trip. \Intertrip		
Number	Settings	Value
21.831.5551.103	Send delay	Settings group 1: 0.02 s
21.831.5551.104	Send prolongation	Settings group 1: 0 s

I-DIFF		
Number	Settings	Value
21.831.3451.1	Mode	Settings group 1: on
21.831.3451.2	Operate & flt.rec. blocked	Settings group 1: no
21.831.3451.3	Threshold	Settings group 1: 0.25 A
21.831.3451.101	Threshold switch on	Settings group 1: 0.30 A
21.831.3451.102	Delay 1-phase pickup	Settings group 1: 0 s
21.831.3451.6	Operate delay	Settings group 1: 0 s

I-DIFF fast 2		
Number	Settings	Value
21.831.18211.1	Mode	Settings group 1: on
21.831.18211.2	Operate & flt.rec. blocked	Settings group 1: no
21.831.18211.3	Threshold	Settings group 1: 2.00 A
21.831.18211.101	Threshold switch on	Settings group 1: 3.82 A
21.831.18211.6	Operate delay	Settings group 1: 0 s
21.831.18211.106	Delay 1-phase pickup	Settings group 1: 0 s

Transformer		
Number	Settings	Value
21.831.3541.101	Rated apparent power	Settings group 1: 693 MVA
21.831.3541.103	Voltage vector group nb.	Settings group 1: 0
21.831.3541.104	Current vector group nb.	Settings group 1: 0
21.831.3541.105	Residual curr. elimination	Settings group 1: yes

87 Stub diff. prot. 1

General		
Number	Settings	Value
21.1431.2311.1	Mode	Settings group 1: off

S-DIFF		
Number	Settings	Value
21.1431.8401.1	Mode	Settings group 1: off
21.1431.8401.2	Operate & flt.rec. blocked	Settings group 1: no
21.1431.8401.3	Threshold	Settings group 1: 0.480 A
21.1431.8401.6	Operate delay	Settings group 1: 0 s

S-DIFF fast 2		
Number	Settings	Value
21.1431.18241.1	Mode	Settings group 1: off
21.1431.18241.2	Operate & flt.rec. blocked	Settings group 1: no
21.1431.18241.3	Threshold	Settings group 1: 1.600 A

68 P.swing blk \Zones to be blocked		
Number	Settings	Value
21.5311.102	21 Distance prot. 1.Z 1	true
21.5311.102	21 Distance prot. 1.Z 2	true
21.5311.102	21 Distance prot. 1.Z 3	true
21.5311.102	21 Distance prot. 1.Z 4	true

68 P.swing blk		
Number	Settings	Value
21.5311.1	Mode	Settings group 1: on
21.5311.103	Max. blocking time	Settings group 1: 2 s

85-21Perm. Permissive Overreach

85-21Perm.unde \Send with		
Number	Settings	Value
21.1281.5671.140	21 Distance prot. 1.Z 1	true

Number	Settings	Value
21.1281.5671.140	21 Distance prot. 1.Z 2	false
21.1281.5671.140	21 Distance prot. 1.Z 3	false
21.1281.5671.140	21 Distance prot. 1.Z 4	false

85-21Perm.unde \Operate with		
Number	Settings	Value
21.1281.5671.141	21 Distance prot. 1.pickup general	false
21.1281.5671.141	21 Distance prot. 1.Z 1	false
21.1281.5671.141	21 Distance prot. 1.Z 2	true
21.1281.5671.141	21 Distance prot. 1.Z 3	false
21.1281.5671.141	21 Distance prot. 1.Z 4	false
21.1281.5671.141	receive (direct trip)	false

85-21Perm.unde Permissive Overreach		
Number	Settings	Value
21.1281.5671.1	Mode	Settings group 1: on
21.1281.5671.101	Send prolongation	Settings group 1: 0.05 s
21.1281.5671.11	1-pole operate allowed	Settings group 1: yes
21.1281.5671.102	Operate delay (1-phase)	Settings group 1: 0 s
21.1281.5671.103	Operate delay (multi-ph.)	Settings group 1: 0 s

Switch onto fault 1

Stage 1 \Configuration		
Number	Settings	Value
21.1341.5941.102	50/51 OC-3ph-A1.Definite-T 1	false
21.1341.5941.102	50/51 OC-3ph-A1.Definite-T 2	false
21.1341.5941.102	50N/51N OC-gnd-A1.Definite-T 1	false
21.1341.5941.102	50N/51N OC-gnd-A1.Definite-T 2	false
21.1341.5941.102	67N GFP gnd.sys.1.Definite-T 1	false
21.1341.5941.102	67N GFP gnd.sys.1.Definite-T 2	false
21.1341.5941.102	67N GFP gnd.sys.1.Inverse-T 1	false
21.1341.5941.102	67 Dir.OC-3ph-A1.Definite-T 1	false
21.1341.5941.102	67 Dir.OC-3ph-A1.Definite-T 2	false
21.1341.5941.102	67 Dir.OC-3ph-A1.Inverse-T 1	false
21.1341.5941.102	21 Distance prot. 1.Z 1	true
21.1341.5941.102	21 Distance prot. 1.Z 2	true
21.1341.5941.102	21 Distance prot. 1.Z 3	false
21.1341.5941.102	21 Distance prot. 1.Z 4	false
21.1341.5941.102	50 OC high-speed 1.Standard 1	false

Stage 1		
Number	Settings	Value
21.1341.5941.1	Mode	Settings group 1: on
21.1341.5941.2	Operate & flt.rec. blocked	Settings group 1: no
21.1341.5941.6	Operate delay	Settings group 1: 0 s

2.hrm.det. gnd		
Number	Settings	Value
21.22051.1	Mode	All: off
21.22051.102	2nd harmonic content	Settings group 1: 15 %

50 OC high-speed 1 **/ STUB PROTECTION**

Standard 1		
Number	Settings	Value
21.971.3901.1	Mode	Settings group 1: on
21.971.3901.101	Activation	Settings group 1: only with binary signal
21.971.3901.3	Threshold	Settings group 1: 2.00 A
21.971.3901.4	Dropout ratio	Settings group 1: 0.9

Line 1\Ciruit-breaker interaction

Protection group	Circuit-breaker group(s)
Line 1\ 50/51 OC-3ph-A1\ Definite-T 1	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 50/51 OC-3ph-A1\ Definite-T 2	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 50N/51N OC-gnd-A1\ Definite-T 1	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 50N/51N OC-gnd-A1\ Definite-T 2	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 67N GFP gnd.sys.1\ Definite-T 1	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 67N GFP gnd.sys.1\ Definite-T 2	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 67N GFP gnd.sys.1\ Inverse-T 1	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 67 Dir.OC-3ph-A1\ Definite-T 1	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 67 Dir.OC-3ph-A1\ Definite-T 2	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 67 Dir.OC-3ph-A1\ Inverse-T 1	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 46 I2 1\ Definite-T 1	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 46 I2 1\ Definite-T 2	Circuit breaker 1:Circuit breaker 1:Trip

Protection group	Circuit-breaker group(s)
Line 1\ 27 Undervolt.-3ph 1\ Definite-T 1	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 27 Undervolt.-3ph 1\ Definite-T 2	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 59 Overvolt.-3ph 1\ Definite-T 1	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 59 Overvolt.-3ph 1\ Definite-T 2	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 21 Distance prot. 1\ Z 1	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 21 Distance prot. 1\ Z 2	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 21 Distance prot. 1\ Z 3	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 21 Distance prot. 1\ Z 4	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 87 Line diff. prot.\ General	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 85-21Perm.underr.\ 85-21Perm.unde	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ Switch onto fault 1\ Stage 1	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 87 Stub diff. prot. 1\ General	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 50 OC high-speed 1\ Standard 1	Circuit breaker 1:Circuit breaker 1:Trip

*Setting marked as favorite setting

sp Setting marked as specific setting

HITACHI
Inspire the Next

ADANI GREEN ENERGY TWENTY FIVE LIMITED (ADANI RENEWABLES)

400kV BADISID SUBSTATION REMOTE END LINE PROTECTION RELAY SETTING CALCULATION

400kV BHADLA SUBSTATION

500 MW BADISID SOLAR POWER PROJECT

adani

VISHRAM Digitally signed by VISHRAM Date: 2024.09.02 17:13:33 +05'30'
Reviewer

Shaheed Patel Digitally signed by Shaheed Patel Date: 2024.09.02 18:15:46 +05'30'
Approver

Categories:

☐ Cat-I	Approved. Good for Manufacturing/Construction/Fabrication.
☑ Cat-I*	Approved with minor comments. No resubmission is required. To be incorporated in As-Built. Good for Manufacturing/ Construction/ Fabrication subject to incorporation of comments.
☐ Cat-II	Resubmission is required. Approved & Released for Manufacturing/ fabrication/ construction subjected to incorporation of comments.
☐ Cat-III	Not Approved. Revise & Resubmit for Approval
☐ Cat-IV	For Information & Records.
☐ Cat-IV*	Incorporate Comments & resubmit for Information & records.

Note: "Approval of this document does not absolve the Contractor/ Supplier/Fabricator from fulfilling Contractual obligations in any way"

Hitachi Energy

DOCUMENT	400kV BADISID SUBSTATION REMOTE END LINE PROTECTION RELAY SETTING CALCULATION
PROJECT	500 MW BADISID SOLAR POWER PROJECT
SUBSTATION	400kV BHADLA SUBSTATION
CLIENT	ADANI GREEN ENERGY TWENTY FIVE LIMITED
SUPPLIER	HITACHI ENERGY INDIA LIMITED
PO / LOA No.	IDTO-VI/ Adani Green-400 kV at Badi Sid - Rajasthan /PGGA/CRP & SAS
HEIL SO REF.	3100139976, 1MNS500950-PAAA

Revisions:

Rev.	Prep. / Appr.	Description	Date
00	SS / PN	First Submission	02-Aug-24
01	SS / PN	Revised as per the customer comments	19-Aug-24

General Data of 400 KV LINE CONTROL AND RELAY PANEL (BAY-X)

Relay Details

Type	=	Micom P546

Bay Details

Local Station:	=	RELAY SETTING REPORT FOR BADISID LINE
Bay Reference	=	BAY -
Remote Station:	=	Badisid

Network Details

Voltage	=	400	kV
Frequency	=	50	Hz
OHL length of this circuit	=	12.00	km

CT Details (Local end):

CT Ratio	=	3000/1	A
Rated Primary current	=	3000	A
Rated Secondary current	=	1	A

Information

All the settings are in Secondary values

The Relay Bias characteristics is determined by four protection settings

Is1	=	The basic differential current setting which determines the minimum pick up of the relay
Is2	=	A bias threshold setting, above which the higher percentage bias k2 is used
K1	=	The lower percentage bias setting used when the bias current is below IS2, This provides stability for small CT mismatches, whilst ensuring good sensitivity to resistive faults under heavy load conditions.
K2	=	The higher percentage bias setting used to improve relay stability under heavy through fault current conditions.

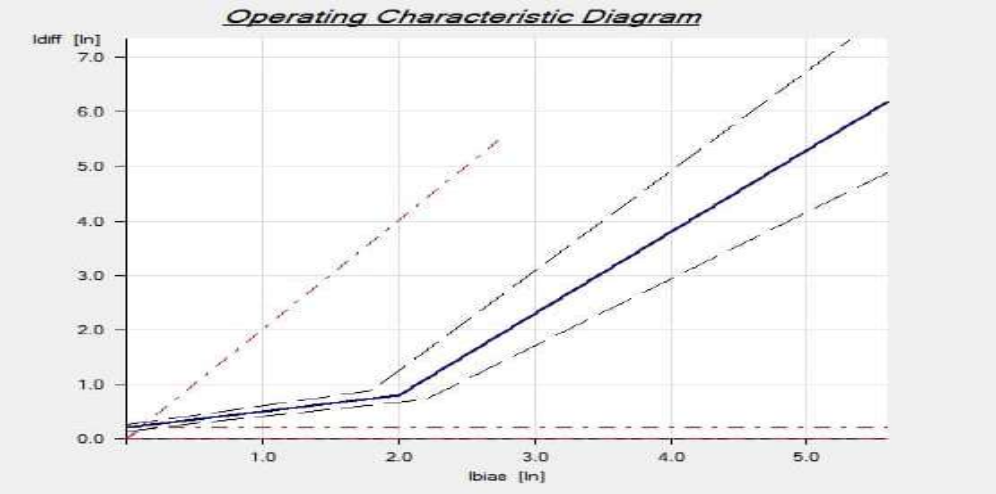
Basic Differential setting

This is basic differential current setting which determines the minimum pick up level of the relay. Where Capacitive Charging Current compensation is disabled, the setting of Is1 must be >2.5 times of total line charging current value.

The Charging current is calculated according to the following equation

I charge	=	U/ (√3 * Xc1)
Where,		
U	=	System Line Voltage
Xc1	=	Positive Sequence Line Capacitance value
I charge	=	Line charging current/kM due to Line Capacitance
Xc1	=	1/(2 * π * f * C1)
C1	=	Line Capacitance value/kM
	=	0.0119 µF/kM (Assumed)
Xc1	=	1/(2 * π * f * C1)
	=	1/(2*3.14*50 * 0.0000000119)
Xc1	=	267623 Ω
I charge	=	U/ (√3 * Xc1)
I charge	=	400/(√3*267622.97)
	=	0.86 A
Primary Charging Current of line	=	0.86*12
	=	10.32 A
Sec.Charging Current of line, Ic	=	Icharge / CTR
	=	10.32/3000
	=	0.00344 A

Hitachi Energy	PROTECTION RELAY SETTING CALCULATION	Contract No.	3100140325, IN-56424026
PGGA-2875	400 KV LINE CONTROL AND RELAY PANEL (BAY-X)	Date	19-Aug-24
Prepared: SS	RELAY SETTING REPORT FOR BADISID LINE	Doc No.	1MNS500960-PAAA
Checked: PN	MAIN-1 LINE PROTECTION RELAY, Micom P546	Rev No.	1



The below mention settting recommended As per Main-1 relay

In_Nominal current (CT secondary)	=	1	A
Is1	=	25% of In	
	=	0.25	A
k1	=	30%	
Is2	=	2*In	
	=	2.0	A
K2	=	150%	

CT Ratio Correction

Local End CT Ratio	=	3000 / 1 A
Remote End CT Ratio	=	1000 / 1 A
CT Correction factor	=	CT Primary/Min Scheme CT Primary
	=	Min Scheme CT Primary ---> Lowest CT ratio
Local end CT Correction factor	=	3.0
Remote end CT Correction factor	=	1.0

Compenstation

Compenstation	=	Cap Charging
Susceptance (B)	=	ωC
	=	Ich/V * 10^{-3}
	=	(0.86/ (400 / 1.732)) * 10^-3
	=	0.0037 mS

Setting Calculation of Distance

General Data=

Total Line length is	=	**12.00**			**km**

OHL data

Basic Line OHL parameters					
Positive sequence imp. per km	=	0.0266	+j	0.313	Ohm/km
Zero sequence imp. per km	=	0.162	+j	1.187	Ohm/km
continuous current carrying capacity for each OHL - Icon					
Considered as per Maximum power flow In the line (0 MVA)	=	953			A
Line length	=	12.00			Km

Line data= OHL

(Pos. seq. impedance of the line)	=	0.319	+j	3.750	Ohm
R1A´ + jX1A´		3.764	L	85.13	
(Zero seq. impedance of the line)	=	1.940	+j	14.244	Ohm
R0A´ + jX0A´		14.376	L	82.24	
CT Ratio (Adopted)	=	3000	/	1	A
VT ratio	=	400	/	0.11	kV
CT / VT Ratio conversion	=	CT ratio / VT ratio			
	=	(3000/1)/(400/0.11)			
	=	0.83			
Maximum load on line	=	953			A

	Zload' =	(400*0.85*1000) / (952.7*1.732*1.5)	
	Zload' =	137.4	Ohm/ph
Referred to Secondary side	=	Maximum load on line * (CT/VT ratio)	
	=	137.37 x 0.83	
	Zload =	113.33	Ohm/ph
Cosφmin	=	0.85	Minimum power factor
	=	32	Deg
Set Load Angle	=	ϕmin + 5	
(Load encroachment angle)	=	(32+5)	
	=	37	Deg
Arc Resistance Phase- Phase	Rarc p-p' =	15	Ohm/ph
Referred to Secondary side	Rarc p-p =	12.5	Ohm/ph
Arc Resistance Phase- Earth	Rarc p-e' =	15	Ohm/ph
Referred to Secondary side	Rarc p-e' =	12.5	Ohm/ph
Tower Foot Resistance	Rtower' =	10	Ohm/ph
Referred to Secondary side	Rtower' =	8.3	Ohm/ph

General settings

Protected Line Impedance

Line Impedance secondary = 3.7636 * 0.83

= **3.12** Ohm/ph

Line Angle (Deg) = **85.1** Deg

Short Line Feeder Details at Remote Station

Name of the line = -

Length of the line = 0 Km

Positive sequence imp. per km = 0.000 +j 0.000 Ohm/Km

Zero sequence imp. per km = 0.000 +j 0.000 Ohm/Km

Positive sequence imp. for total line km = 0.000 +j 0.000 Ohm

Zero sequence imp. for total line km = 0.000 +j 0.000 Ohm

Longest Line Feeder Details at Remote Station

Name of the line = -

Length of the line = 0.00 Km

Positive sequence imp. per km = 0.000 +j 0.000 Ohm/Km

Zero sequence imp. per km = 0.000 +j 0.000 Ohm/Km

Positive sequence imp. for total line km = 0.000 +j 0.000 Ohm

To find KN magnitude and KN angle for Zone 1

KZ1 Res Comp & KZ1 Angle = (Z0-Z1)/3Z1

= (14.376-3.764)/(3x3.764)

= 0.94 L -3.917

To find KN magnitude and KN angle for Zone 2, 3, 4

Positive sequence imp. for total line km = 0.383 +j 4.500 Ohm

= 4.516 L 85.14

Zero sequence imp. for total line km = 2.328 +j 17.093 Ohm

= 17.251 L 82.24

KZ2/3/4 Res Comp & KZ2/3/4 Angle = (Z0-Z1)/3Z1

= 0.94 L -3.915

Distance Zone 1 setting (Zone-1 Enabled only during communication failure)

Relay zone-1 reach shall be set to cover 80% forward direction considering the parallel line in operation

Operation direction

OperationDir = Forward **(*Fixed Direction mode as Forward for Zone-1)**

Positive sequence reactance reach

Zone 1 phase fault reach is set to **80%** of the total line reactance

Zone-1 reactance reach setting for phase faults, X1Z1'

	=	0.8 * jX1´	
	=	0.8 * 3.75	
X1Z1'	=	3.00	**Ohm/P**
The secondary setting will thus be			
	=	X1Z1' * CT ratio / VT ratio	
X1Z1	=	**2.49**	**Ohm/P**

Positive sequence resistance for zone characteristics angle

	=	0.8 * R1´	
	=	0.8 * 0.32	
R1Z1'	=	0.26	**Ohm/P**
The secondary setting will thus be			
	=	R1Z1' * CT ratio / VT ratio	
R1Z1	=	**0.21**	**Ohm/P**

Positive sequence Impedance reach

Z1'	=	3.01	
The secondary setting will thus be			
	=	Z1' * CT ratio / VT ratio	
Z1	=	**2.50**	**Ohm/P**

Fault resistance reach in Ohm/loop (Phase-Phase)

Set the resistive reach for phase faults to=			
R1ph'	=	30.00	**Ohm/l**
The secondary setting will thus be			
	=	R1ph' * CT ratio / VT ratio	
R1ph	=	**24.90**	**Ohm/l**

Fault resistance reach in Ohm/loop (Phase-Earth)

Set the resistive reach for earth faults to			
R1G'	=	25.00	**Ohm/l**
The secondary setting will thus be			
	=	R1G' * CT ratio / VT ratio	
R1G	=	**20.75**	**Ohm/l**

Time delay of trip

tZ1	=	0.00	Sec

<u>Distance Zone 2 setting</u>

Relay zone-2 reach shall be set to cover

120 % of protected line + 0 % of Remote end shortest line forward direction

Operation direction

OperationDir = Forward **(*Fixed Direction mode as Forward for Zone-2)**

Positive sequence reactance reach

Zone 2 phase fault reach is set to **120%** of the total line reactance

\+ **0%** of Remote end shortest line forward direction

Zone-2 reactance reach setting for phase faults, X1Z2

= (120% x 3.75) + (0% x 0)

= (1.2x3.75) + (0 x 0)

X1Z2' = 4.50 **Ohm/p**

The secondary setting will thus be

= X1Z2' * CT ratio / VT ratio

X1Z2 = **3.74** **Ohm/p**

Positive sequence resistance for zone characteristics angle

= (120% x 0.32) + (0% x 0)

= (1.2x0.32) + (0 x 0)

R1Z2' = 0.38 **Ohm/p**

The secondary setting will thus be

= R1Z2' * CT ratio / VT ratio

R1Z2 = **0.32** **Ohm/p**

Positive sequence Impedance reach

Z2' = 4.52

The secondary setting will thus be

= Z2' * CT ratio / VT ratio

Z2 = **3.75** **Ohm/P**

Fault resistance reach in Ohm/loop (Phase-Phase)

The resistive reach for phase to phase is set to cover a maximum expected fault resistance of 30 ohm

Considering a factor of 2 on the zone-1 resistive reach value to take care of in feed effect.

R2ph = 60

Set the resistive reach for phase faults to=

R2ph' = 60.00 **Ohm/l**

The secondary setting will thus be

= R2ph' * CT ratio / VT ratio

R2ph = **49.80** **Ohm/l**

Fault resistance reach in Ohm/loop (Phase-Earth)

Setting of the resistive reach for the underreaching zone 2 should follow the condition to minimize the risk for overreaching

Set the resistive reach for earth faults to

R2G´ = 50.00 **Ohm/l**

The secondary setting will thus be

= R2G' * CT ratio / VT ratio

R2G = **41.50** **Ohm/l**

Time delay of trip Phase-Phase loops

Setting of Zone timers=

Normal values the needed time difference can be calculated

t2 = 40ms +40ms + 40ms + 50ms = 170ms

Where,

the operation time of protection is 40 ms (Distance relay operation of other line at Remote End)

the breaker opening time is 40 ms

the resetting time of protection is 40 ms and

the additional margin is 50 ms

tZ2 = 0.35 Sec

Distance Zone 3 setting

Relay zone-3 reach shall be set to cover

200 % of protected line + 0 % of Remote end longest line forward direction

Operation direction

OperationDir = Forward

Positive sequence reactance reach

Zone 3 phase fault reach is set to **120%** of the total line reactance

\+ **100%** of Remote end longest line forward direction

Zone-3 reactance reach setting for phase faults, X1Z3

= (200% x 3.75) + (0% x 0)

= (2x3.75) + (0 x 0)

X1Z3' = 7.50 **Ohm/p**

The secondary setting will thus be

= X1Z3' * CT ratio / VT ratio

X1Z3 = **6.23** **Ohm/p**

Positive sequence resistance for zone characteristics angle

(200% x 0.32) + (0% x 0)

(2x0.32) + (0 x 0)

R1Z3' = 0.64 **Ohm/p**

The secondary setting will thus be

= R1Z3' * CT ratio / VT ratio

R1Z3 = **0.53** **Ohm/p**

Positive sequence Impedance reach

Z3' = 7.53

The secondary setting will thus be

= Z3' * CT ratio / VT ratio

Z3 = **6.25** **Ohm/P**

Fault resistance reach in Ohm/loop (Phase-Phase)

Considering a factor of 2.5 on the zone-1 resistive reach value to take care of in feed effect.

Set the resistive reach for phase faults to

R3ph' = 75.00 **Ohm/l**

The secondary setting will thus be

= R3ph' * CT ratio / VT ratio

R3ph = **62.25** **Ohm/l**

Fault resistance reach in Ohm/loop (Phase-Earth)

Setting of the resistive reach for the underreaching zone 3 should follow the condition to minimize the risk for overreaching

Set the resistive reach for earth faults to

R3G´ = 65.00 **Ohm/l**

The secondary setting will thus be

= R3G' * CT ratio / VT ratio

R3G = **53.95** **Ohm/l**

Time delay of trip

Setting of Zone timers=

Normal values the needed time difference can be calculated

t3 = 350ms + 40ms +40ms + 40ms + 50ms = 520ms

Where, Zone-2 operation is 350 ms (Distance relay operation of other line at Remote End)

the operation time of protection is 40 ms (Distance relay operation of other line at Remote End)

the breaker opening time is 100 ms

the resetting time of protection is 40 ms and

the additional margin is 50 ms

tZ3 = 1.00 Sec

Distance Zone 4 setting

Relay zone-4 reach shall be set to cover 20 % of protected line + 0 % of Remote end longest line forward direction

Operation direction

OperationDir = Reverse

Positive sequence reactance reach

Zone 4 phase fault reach is set to **20%** of the total line reactance

\+ **0%** of Remote end longest line forward direction

Zone-4 reactance reach setting for phase faults, X1Z4

= (20% x 3.75) + (0% x 0)

= (0.2x3.75) + (0 x 0)

X1Z4' = 0.75 Ohm/p

The secondary setting will thus be

= X1Z4' * CT ratio / VT ratio

X1Z4 = **0.62** **Ohm/p**

0.6

Positive sequence resistance for zone characteristics angle

= (20% x 0.32) + (0% x 0)

= (0.2x0.32) + (0 x 0)

R1Z4' = 0.06 Ohm/p

The secondary setting will thus be

= R1Z4' * CT ratio / VT ratio

R1Z4 = **0.05** **Ohm/p**

Positive sequence Impedance reach

Z4' = 0.75

The secondary setting will thus be

= Z4' * CT ratio / VT ratio

Z4 = **0.63** **Ohm/P**

Fault resistance reach in Ohm/loop (Phase-Phase)

The faults on remote lines will have in-feed of fault current through the fault resistance from other remote feeders which will make an apparent increase of the value. The setting is selected to take care of above factors. Set the resistive reach for phase faults to=

Setting the RF/X factor giving the PhF resistive coverage

Set the resistive reach for phase faults to

R4ph' = 75.00 **Ohm/l**

The secondary setting will thus be

= R4ph' * CT ratio / VT ratio

R4ph = **62.25** **Ohm/l**

Fault resistance reach in Ohm/loop (Phase-Earth)

Setting of the resistive reach for the underreaching zone 4 should follow the condition to minimize the risk for overreaching

Set the resistive reach for earth faults to

R4G´ = 65.00 **Ohm/l**

The secondary setting will thus be

= R4G' * CT ratio / VT ratio

R4G = **53.95** **Ohm/l**

Time delay of trip

Setting of Zone timers=

Normal values the needed time difference can be calculated

t4 = 40ms +40ms + 40ms + 50ms = 170ms

Where,

the operation time of protection is 40 ms (Busbar Protection relay)

the breaker opening time is 40 ms

the resetting time of protection is 40 ms and

the additional margin is 50 ms

tZ4 = 0.35 Sec

Load Blinders

Z< Blinder Imp (90% of LR) = **102.0** **Ohm**

Load/B Angle = **37.0** **Deg**

POWER SWING BLOCK=

PSB Blocking zone	=	Zone- 1, 2,3,4	
PSB Unblock delay	=	2.0 Sec	

Slow Swing Setting

R7=-R7=1.2 x Maximum Resistive reach (Zone 3)	=	1.2*53.95 64.74	Ω
Z7=-Z7=1.2 x Maximum Zone reach (Zone 3)	=	1.2*6.247 7.50	Ω
R8=R8'=>1.1*R7	=	1.1*64.74 71.21	Ω
Z8=Z8'=>1.1*Z7	=	1.1*7.4964 8.25	Ω
Alpha	=	0	deg
PSB Timer	=	50	mSec

SOTF=

SOTF Status	=	Enabled	
SOTF Tripping	=	Zone-2	
SOTF Delay	=	110	sec
TOR Status	=	Enabled	
TOR Tripping	=	Zone-2	

VT SUPERVISION=

VTS Mode	=	Measured + MCB	
VTS Status	=	Blocking	
VTS Reset Mode	=	Auto	
VTS Time Delay	=	5 Sec	
VTS I> Inhibit	=	10 A	
VTS I2> Inhibit	=	50mA	

OVERVOLTAGE PROTECTION=

V> Measur't Mode	=	V1> & V>2 Ph- N	
V> Operate Mode	=	V1> & V>2 Any Ph	
V>1 Function	=	DT	
V>1 Set	=	70	V
V>1 time delay	=	5	sec
V>2 Set	=	89	V
V>2 time delay	=	0.1	sec

UNDERVOLTAGE PROTECTION (Only DR Trigger - No Tripping)

V< Measur't Mode	=	V1< & V<2 Ph- N	
V< Operate Mode	=	V1> & V>2 Any Ph	
V<1 Function	=	DT	
V<1 Set	=	57	V
V<1 time delay	=	0	sec
V<1 Poledead Inh	=	Enabled	

DIR. EARTH FAULT SETTINGS = 67N

Pickup current should be set above the continuous residual current under normal operation.

Max Load Current	=	952.7	
IN>1 Function	=	IEC S Inverse	
IN>1 Directional	=	Directional Fwd	
IN>1 Pickup current in A	=	23	% of Maximum Load current of the Conductor

0.23*952.7=219.121A

IN>1 Current Set (Is) = 0.07 A

The Earth fault function has to be graded with the Zone-3 Protection

Required time (Treq) = 1.13 Sec

The IDMT curve shall saturate if the fault current more than 20 times of pickup current. In this case fault current more than 20 times. Hence 20 times of set current considered for TMS calculation.

Fault = 20*Pickup
Current = 4382.42 A
IN>1 TMS = (Treq*(IF/Is)^0.02-1)/0.14
= (1.13*(4382.42/219.121)^0.02-1)/0.14
= 0.50
Char Angle = -45 Deg

BROKEN CONDUCTOR: (Alarm Only)

I2/I1 Ratio = 0.2
time delay = 5

DISTURBANCE RECORDER:

Pre-Fault time = 0.5 Sec
Posr-Fault time = 2.5 Sec
Total time = 3 Sec

STUB PROTECTION: 50STUB

Max Load Current = 952.7
I>4 Function = IEC DT
I>4 Directional = Non Directional
I>4 Pickup current in A = 200 % of Maximum Load current of the Conductor
= 2*952.7=1905.4A
I>4 Current Set (Is) = 0.64 A
I>4 operating time = 0.05 Sec

TELE PROTECTION

Scheme type = Permissive OR

Settings File Report
Substation:
File: P546 remote.set
Model Number: P546?1109?552?K

Printed on: 23/08/2024 18:47:39

- SYSTEM DATA
  - 00.01: Language: English
  - 00.02: Password: ****
  - 00.03: Sys Fn Links: 0
  - 00.04: Description: Badisid line
  - 00.05: Plant Reference: Bhadla SS
  - 00.06: Model Number: P546?1109?552?K
  - 00.08: Serial Number: 12345
  - 00.09: Frequency: 50 Hz
  - 00.0A: Comms Level: 2
  - 00.0B: Relay Address: 1
  - 00.0C: Plant Status: 0000001000000010
  - 00.0D: Control Status: 0000000000000000
  - 00.0E: Active Group: 1
  - 00.10: CB Trip/Close: No Operation
  - 00.11: Software Ref. 1: P546____4__520_A
  - 00.20: Opto I/P Status: 00000000000000000000000000000000
  - 00.21: Relay O/P Status: 00000000000000000000001000
  - 00.22: Alarm Status 1: 00000010000000000000000000000000
  - 00.50: Alarm Status 1: 00000010000000000000000000000000
  - 00.51: Alarm Status 2: 00000000000000000000000000000000
  - 00.52: Alarm Status 3: 00000000000000000000000000000000
  - 00.D0: Access Level: 2
  - 00.D1: Password Control: 2
  - 00.D2: Password Level 1: ****
  - 00.D3: Password Level 2: ****
- CB CONTROL
  - 07.01: CB Control by: Disabled
  - 07.11: CB Status Input: 52B 1 pole
- DATE AND TIME
  - 08.01: Date/Time: 2007-04-08 23:39:09.855
  - 08.06: Battery Status: Healthy
  - 08.07: Battery Alarm: Enabled
  - 08.20: LocalTime Enable: Flexible
  - 08.21: LocalTime Offset: 330.0 min
  - 08.22: DST Enable: Disabled
  - 08.30: RP1 Time Zone: Local
- CONFIGURATION
  - 09.01: Restore Defaults: No Operation
  - 09.02: Setting Group: Select via Menu
  - 09.03: Active Settings: Group 1
  - 09.04: Save Changes: No Operation
  - 09.05: Copy From: Group 1
  - 09.06: Copy To: No Operation
  - 09.07: Setting Group 1: Enabled
  - 09.08: Setting Group 2: Disabled
  - 09.09: Setting Group 3: Disabled
  - 09.0A: Setting Group 4: Disabled
  - 09.0B: Distance: Enabled
  - 09.0C: Directional E/F: Disabled
  - 09.0F: Phase Diff: Enabled
  - 09.10: Overcurrent: Enabled
  - 09.11: Neg Sequence O/C: Disabled
  - 09.12: Broken Conductor: Enabled
  - 09.13: Earth Fault: Enabled
  - 09.15: Sensitive E/F: Disabled
  - 09.16: Residual O/V NVD: Disabled
  - 09.17: Thermal Overload: Disabled
  - 09.18: PowerSwing Block: Enabled
  - 09.1D: Volt Protection: Enabled
  - 09.1E: Freq Protection: Disabled
  - 09.1F: df/dt Protection: Disabled
  - 09.20: CB Fail: Disabled
  - 09.21: Supervision: Enabled
  - 09.25: Input Labels: Visible
  - 09.26: Output Labels: Visible

Settings File Report
Substation:
File: P546 remote.set
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09.28: CT & VT Ratios: Visible
09.29: Record Control: Visible
09.2A: Disturb Recorder: Visible
09.2B: Measure't Setup: Visible
09.2C: Comms Settings: Visible
09.2D: Commission Tests: Visible
09.2E: Setting Values: Secondary
09.2F: Control Inputs: Visible
09.35: Ctrl I/P Config: Visible
09.36: Ctrl I/P Labels: Visible
09.39: Direct Access: Enabled
09.50: Function Key: Visible
09.FF: LCD Contrast: 11

CT AND VT RATIOS
0A.01: Main VT Primary: 400kV
0A.02: Main VT Sec'y: 110.0 V
0A.07: Phase CT Primary: 3000 A
0A.08: Phase CT Sec'y: 1.000 A
0A.0B: SEF CT Primary: 3000 A
0A.0C: SEF CT Secondary: 1.000 A
0A.0D: MComp CT Primary: 3000 A
0A.0E: MComp CT Sec'y: 1.000 A
0A.11: CT Polarity: Standard
0A.12: CT2 Polarity: Standard
0A.13: SEF CT Polarity: Standard
0A.14: M CT Polarity: Standard
0A.18: VT Connected: Yes

RECORD CONTROL
0B.01: Clear Events: No
0B.02: Clear Faults: No
0B.03: Clear Maint: No
0B.04: Alarm Event: Enabled
0B.05: Relay O/P Event: Enabled
0B.06: Opto Input Event: Enabled
0B.07: General Event: Enabled
0B.08: Fault Rec Event: Enabled
0B.09: Maint Rec Event: Enabled
0B.0A: Protection Event: Enabled
0B.30: Clear Dist Recs: No
0B.40: DDB 31 - 0: 11111111111111111111111111111111
0B.41: DDB 63 - 32: 11111111111111111111111111111111
0B.42: DDB 95 - 64: 11111111111111111111111111111111
0B.43: DDB 127 - 96: 11111111111111111111111111111111
0B.44: DDB 159 - 128: 11111111111111111111111111111111
0B.45: DDB 191 - 160: 11111111111111111111111111111111
0B.46: DDB 223 - 192: 11111111111111111111111111111111
0B.47: DDB 255 - 224: 11111111111111111111111111111111
0B.48: DDB 287 - 256: 11111111111111111111111111111111
0B.49: DDB 319 - 288: 11111111111111111111111111111111
0B.4A: DDB 351 - 320: 11111111111111111111111111111111
0B.4B: DDB 383 - 352: 11111111111111111111111111111111
0B.4C: DDB 415 - 384: 11111111111111111111111111111111
0B.4D: DDB 447 - 416: 11111111111111111111111111111111
0B.4E: DDB 479 - 448: 11111111111111111111111111111111
0B.4F: DDB 511 - 480: 11111111111111111111111111111111
0B.50: DDB 543 - 512: 11111111111111111111111111111111
0B.51: DDB 575 - 544: 11111111111111111111111111111111
0B.52: DDB 607 - 576: 11111111111111111111111111111111
0B.53: DDB 639 - 608: 11111111111111111111111111111111
0B.54: DDB 671 - 640: 11111111111111111111111111111111
0B.55: DDB 703 - 672: 11111111111111111111111111111111
0B.56: DDB 735 - 704: 11111111111111111111111111111111
0B.57: DDB 767 - 736: 11111111111111111111111111111111
0B.58: DDB 799 - 768: 11111111111111111111111111111111
0B.59: DDB 831 - 800: 11111111111111111111111111111111
0B.5A: DDB 863 - 832: 11111111111111111111111111111111

Settings File Report
Substation:
File: P546 remote.set
Model Number: P546?1109?552?K

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0B.5B: DDB 895 - 864: 11111111111111111111111111111111
0B.5C: DDB 927 - 896: 11111111111111111111111111111111
0B.5D: DDB 959 - 928: 11111111111111111111111111111111
0B.5E: DDB 991 - 960: 11111111111111111111111111111111
0B.5F: DDB 1023 - 992: 11111111111111111111111111111111
0B.60: DDB 1055 - 1024: 11111111111111111111111111111111
0B.61: DDB 1087 - 1056: 11111111111111111111111111111111
0B.62: DDB 1119 - 1088: 11111111111111111111111111111111
0B.63: DDB 1151 - 1120: 11111111111111111111111111111111
0B.64: DDB 1183 - 1152: 11111111111111111111111111111111
0B.65: DDB 1215 - 1184: 11111111111111111111111111111111
0B.66: DDB 1247 - 1216: 11111111111111111111111111111111
0B.67: DDB 1279 - 1248: 11111111111111111111111111111111
0B.68: DDB 1311 - 1280: 11111111111111111111111111111111
0B.69: DDB 1343 - 1312: 11111111111111111111111111111111
0B.6A: DDB 1375 - 1344: 11111111111111111111111111111111
0B.6B: DDB 1407 - 1376: 11111111111111111111111111111111

DISTURB RECORDER

0C.01: Duration: 3.000 s
0C.02: Trigger Position: 16.00 %
0C.03: Trigger Mode: Extended
0C.04: Analog Channel 1: VA
0C.05: Analog Channel 2: VB
0C.06: Analog Channel 3: VC
0C.07: Analog Channel 4: IA
0C.08: Analog Channel 5: IB
0C.09: Analog Channel 6: IC
0C.0A: Analog Channel 7: IN
0C.0B: Analog Channel 8: IN Sensitive
0C.0C: Digital Input 1: Relay 1
0C.0D: Input 1 Trigger: No Trigger
0C.0E: Digital Input 2: Relay 2
0C.0F: Input 2 Trigger: No Trigger
0C.10: Digital Input 3: Relay 3
0C.11: Input 3 Trigger: Trigger L/H
0C.12: Digital Input 4: Relay 4
0C.13: Input 4 Trigger: No Trigger
0C.14: Digital Input 5: Relay 5
0C.15: Input 5 Trigger: No Trigger
0C.16: Digital Input 6: Relay 6
0C.17: Input 6 Trigger: No Trigger
0C.18: Digital Input 7: Relay 7
0C.19: Input 7 Trigger: No Trigger
0C.1A: Digital Input 8: Relay 8
0C.1B: Input 8 Trigger: No Trigger
0C.1C: Digital Input 9: Relay 9
0C.1D: Input 9 Trigger: No Trigger
0C.1E: Digital Input 10: Relay 10
0C.1F: Input 10 Trigger: No Trigger
0C.20: Digital Input 11: Relay 11
0C.21: Input 11 Trigger: No Trigger
0C.22: Digital Input 12: Relay 12
0C.23: Input 12 Trigger: No Trigger
0C.24: Digital Input 13: Relay 13
0C.25: Input 13 Trigger: No Trigger
0C.26: Digital Input 14: Relay 14
0C.27: Input 14 Trigger: No Trigger
0C.28: Digital Input 15: Relay 15
0C.29: Input 15 Trigger: No Trigger
0C.2A: Digital Input 16: Relay 16
0C.2B: Input 16 Trigger: No Trigger
0C.2C: Digital Input 17: Opto 1
0C.2D: Input 17 Trigger: No Trigger
0C.2E: Digital Input 18: Opto 2
0C.2F: Input 18 Trigger: No Trigger
0C.30: Digital Input 19: Opto 3

Settings File Report
Substation:
File: P546 remote.set
Model Number: P546?1109?552?K

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- 0C.31: Input 19 Trigger: No Trigger
- 0C.32: Digital Input 20: Opto 4
- 0C.33: Input 20 Trigger: No Trigger
- 0C.34: Digital Input 21: Opto 5
- 0C.35: Input 21 Trigger: No Trigger
- 0C.36: Digital Input 22: Opto 6
- 0C.37: Input 22 Trigger: No Trigger
- 0C.38: Digital Input 23: Opto 7
- 0C.39: Input 23 Trigger: No Trigger
- 0C.3A: Digital Input 24: Opto 8
- 0C.3B: Input 24 Trigger: No Trigger
- 0C.3C: Digital Input 25: Opto 9
- 0C.3D: Input 25 Trigger: No Trigger
- 0C.3E: Digital Input 26: Opto 10
- 0C.3F: Input 26 Trigger: No Trigger
- 0C.40: Digital Input 27: Opto 11
- 0C.41: Input 27 Trigger: No Trigger
- 0C.42: Digital Input 28: Opto 12
- 0C.43: Input 28 Trigger: No Trigger
- 0C.44: Digital Input 29: Opto 13
- 0C.45: Input 29 Trigger: No Trigger
- 0C.46: Digital Input 30: Opto 14
- 0C.47: Input 30 Trigger: No Trigger
- 0C.48: Digital Input 31: Opto 15
- 0C.49: Input 31 Trigger: No Trigger
- 0C.4A: Digital Input 32: Opto 16
- 0C.4B: Input 32 Trigger: No Trigger
- 0C.50: Analog Channel 9: IM
- 0C.51: Analog Channel10: IA2
- 0C.52: Analog Channel11: IB2
- 0C.53: Analog Channel12: IC2

MEASURE'T SETUP

- 0D.01: Default Display: Description
- 0D.02: Local Values: Primary
- 0D.03: Remote Values: Primary
- 0D.04: Measurement Ref: VA
- 0D.05: Measurement Mode: 0
- 0D.06: Fix Dem Period: 30.00 min
- 0D.07: Roll Sub Period: 30.00 min
- 0D.08: Num Sub Periods: 1
- 0D.09: Distance Unit: Kilometres
- 0D.0A: Fault Location: Distance

COMMISSION TESTS

- 0F.01: Opto I/P Status: 00000000000000000000000
- 0F.02: Relay O/P Status: 00000000000000000001010
- 0F.03: Test Port Status: 00001000
- 0F.05: Monitor Bit 1: 1060
- 0F.06: Monitor Bit 2: 1062
- 0F.07: Monitor Bit 3: 1064
- 0F.08: Monitor Bit 4: 1066
- 0F.09: Monitor Bit 5: 1068
- 0F.0A: Monitor Bit 6: 1070
- 0F.0B: Monitor Bit 7: 1072
- 0F.0C: Monitor Bit 8: 1074
- 0F.0D: Test Mode: Disabled
- 0F.0E: Test Pattern: 000000000000000000000000
- 0F.0F: Contact Test: No Operation
- 0F.10: Test LEDs: No Operation
- 0F.12: Static Test: Disabled
- 0F.13: Test Loopback: Disabled
- 0F.14: IM64 TestPattern: 0000000000000000
- 0F.15: IM64 Test Mode: Disabled
- 0F.1A: Red LED Status: 000000000000001000
- 0F.1B: Green LED Status: 000000000000001000
- 0F.20: DDB 31 - 0: 00000000000000000000000000001010
- 0F.21: DDB 63 - 32: 00000000000000000000000000000000

Settings File Report
Substation:
File: P546 remote.set
Model Number: P546?1109?552?K

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- 0F.22: DDB 95 - 64: 00000000000000000000000000000000
- 0F.23: DDB 127 - 96: 00000000000000000000000000000000
- 0F.24: DDB 159 - 128: 00000000000000000000000000001010
- 0F.25: DDB 191 - 160: 00000000000000000000000000000000
- 0F.26: DDB 223 - 192: 00000000000000000000000000000000
- 0F.27: DDB 255 - 224: 00000000000000000000000000000000
- 0F.28: DDB 287 - 256: 00000000000000000000000000000000
- 0F.29: DDB 319 - 288: 00000010100000000000000000000000
- 0F.2A: DDB 351 - 320: 00000000000000000000000000000000
- 0F.2B: DDB 383 - 352: 00000000000000000000000000000000
- 0F.2C: DDB 415 - 384: 00000000000000000000000000000000
- 0F.2D: DDB 447 - 416: 00000000001100000000000000000000
- 0F.2E: DDB 479 - 448: 00000000000000000000000000000000
- 0F.2F: DDB 511 - 480: 00000000000000000000000000000000
- 0F.30: DDB 543 - 512: 00000000001000000000000000000000
- 0F.31: DDB 575 - 544: 00000000000000000000000000000000
- 0F.32: DDB 607 - 576: 00000000000000000000000000000000
- 0F.33: DDB 639 - 608: 00000000000000000000000000000000
- 0F.34: DDB 671 - 640: 00000000000000000000000000000000
- 0F.35: DDB 703 - 672: 00000000000000000000000000000000
- 0F.36: DDB 735 - 704: 00000000000000000000000000000000
- 0F.37: DDB 767 - 736: 00000000000000000000000000000000
- 0F.38: DDB 799 - 768: 00000000000000000000000000000000
- 0F.39: DDB 831 - 800: 11100000000000000000000000000000
- 0F.3A: DDB 863 - 832: 00000000000000000000000000000000
- 0F.3B: DDB 895 - 864: 01111100001001101010001111111111
- 0F.3C: DDB 927 - 896: 00000000011100000111000000000100
- 0F.3D: DDB 959 - 928: 00000000000000000000000000000000
- 0F.3E: DDB 991 - 960: 00000000000000000000000000000000
- 0F.3F: DDB 1023 - 992: 00000000000000000000000000000000
- 0F.40: DDB 1055 - 1024: 00000000000000000000000011000000
- 0F.41: DDB 1087 - 1056: 00000000000000000000110000000000
- 0F.42: DDB 1119 - 1088: 00000000000000000000000000000000
- 0F.43: DDB 1151 - 1120: 00000100000000000000000000000001
- 0F.44: DDB 1183 - 1152: 10001010000000000000000000000000
- 0F.45: DDB 1215 - 1184: 00000000000000000000000000001000
- 0F.46: DDB 1247 - 1216: 00000000000000000000000000000000
- 0F.47: DDB 1279 - 1248: 00000000000000000000000000000000
- 0F.48: DDB 1311 - 1280: 00000000000000000000000000000000
- 0F.49: DDB 1343 - 1312: 00000001000000000000000000000000
- 0F.4A: DDB 1375 - 1344: 00000100000000000000000000000000
- 0F.4B: DDB 1407 - 1376: 00000000000000000000000000000000

OPTO CONFIG

- 11.01: Global Nominal V: 220/250V
- 11.60: Opto Filter Cntl: 111111111111011111111011
- 11.80: Characteristic: Standard 60%-80%

CONTROL INPUTS

- 12.01: Ctrl I/P Status: 00000000000000000000000000000000
- 12.02: Control Input 1: No Operation
- 12.03: Control Input 2: No Operation
- 12.04: Control Input 3: No Operation
- 12.05: Control Input 4: No Operation
- 12.06: Control Input 5: No Operation
- 12.07: Control Input 6: No Operation
- 12.08: Control Input 7: No Operation
- 12.09: Control Input 8: No Operation
- 12.0A: Control Input 9: No Operation
- 12.0B: Control Input 10: No Operation
- 12.0C: Control Input 11: No Operation
- 12.0D: Control Input 12: No Operation
- 12.0E: Control Input 13: No Operation
- 12.0F: Control Input 14: No Operation
- 12.10: Control Input 15: No Operation
- 12.11: Control Input 16: No Operation
- 12.12: Control Input 17: No Operation
- 12.13: Control Input 18: No Operation

Settings File Report
Substation:
File: P546 remote.set
Model Number: P546?1109?552?K

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- 12.14: Control Input 19: No Operation
- 12.15: Control Input 20: No Operation
- 12.16: Control Input 21: No Operation
- 12.17: Control Input 22: No Operation
- 12.18: Control Input 23: No Operation
- 12.19: Control Input 24: No Operation
- 12.1A: Control Input 25: No Operation
- 12.1B: Control Input 26: No Operation
- 12.1C: Control Input 27: No Operation
- 12.1D: Control Input 28: No Operation
- 12.1E: Control Input 29: No Operation
- 12.1F: Control Input 30: No Operation
- 12.20: Control Input 31: No Operation
- 12.21: Control Input 32: No Operation

CTRL I/P CONFIG

- 13.01: Hotkey Enabled: 11111111111111111111111111111111
- 13.10: Control Input 1: Latched
- 13.11: Ctrl Command 1: SET/RESET
- 13.14: Control Input 2: Latched
- 13.15: Ctrl Command 2: SET/RESET
- 13.18: Control Input 3: Latched
- 13.19: Ctrl Command 3: SET/RESET
- 13.1C: Control Input 4: Latched
- 13.1D: Ctrl Command 4: SET/RESET
- 13.20: Control Input 5: Latched
- 13.21: Ctrl Command 5: SET/RESET
- 13.24: Control Input 6: Latched
- 13.25: Ctrl Command 6: SET/RESET
- 13.28: Control Input 7: Latched
- 13.29: Ctrl Command 7: SET/RESET
- 13.2C: Control Input 8: Latched
- 13.2D: Ctrl Command 8: SET/RESET
- 13.30: Control Input 9: Latched
- 13.31: Ctrl Command 9: SET/RESET
- 13.34: Control Input 10: Latched
- 13.35: Ctrl Command 10: SET/RESET
- 13.38: Control Input 11: Latched
- 13.39: Ctrl Command 11: SET/RESET
- 13.3C: Control Input 12: Latched
- 13.3D: Ctrl Command 12: SET/RESET
- 13.40: Control Input 13: Latched
- 13.41: Ctrl Command 13: SET/RESET
- 13.44: Control Input 14: Latched
- 13.45: Ctrl Command 14: SET/RESET
- 13.48: Control Input 15: Latched
- 13.49: Ctrl Command 15: SET/RESET
- 13.4C: Control Input 16: Latched
- 13.4D: Ctrl Command 16: SET/RESET
- 13.50: Control Input 17: Latched
- 13.51: Ctrl Command 17: SET/RESET
- 13.54: Control Input 18: Latched
- 13.55: Ctrl Command 18: SET/RESET
- 13.58: Control Input 19: Latched
- 13.59: Ctrl Command 19: SET/RESET
- 13.5C: Control Input 20: Latched
- 13.5D: Ctrl Command 20: SET/RESET
- 13.60: Control Input 21: Latched
- 13.61: Ctrl Command 21: SET/RESET
- 13.64: Control Input 22: Latched
- 13.65: Ctrl Command 22: SET/RESET
- 13.68: Control Input 23: Latched
- 13.69: Ctrl Command 23: SET/RESET
- 13.6C: Control Input 24: Latched
- 13.6D: Ctrl Command 24: SET/RESET
- 13.70: Control Input 25: Latched
- 13.71: Ctrl Command 25: SET/RESET

Settings File Report
Substation:
File: P546 remote.set
Model Number: P546?1109?552?K

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- 13.74: Control Input 26: Latched
- 13.75: Ctrl Command 26: SET/RESET
- 13.78: Control Input 27: Latched
- 13.79: Ctrl Command 27: SET/RESET
- 13.7C: Control Input 28: Latched
- 13.7D: Ctrl Command 28: SET/RESET
- 13.80: Control Input 29: Latched
- 13.81: Ctrl Command 29: SET/RESET
- 13.84: Control Input 30: Latched
- 13.85: Ctrl Command 30: SET/RESET
- 13.88: Control Input 31: Latched
- 13.89: Ctrl Command 31: SET/RESET
- 13.8C: Control Input 32: Latched
- 13.8D: Ctrl Command 32: SET/RESET

FUNCTION KEYS

- 17.01: Fn Key Status: 0000000000
- 17.02: Fn Key 1: Unlocked
- 17.03: Fn Key 1 Mode: Normal
- 17.04: Fn Key 1 Label: Function Key 1
- 17.05: Fn Key 2: Unlocked
- 17.06: Fn Key 2 Mode: Normal
- 17.07: Fn Key 2 Label: Function Key 2
- 17.08: Fn Key 3: Unlocked
- 17.09: Fn Key 3 Mode: Normal
- 17.0A: Fn Key 3 Label: Function Key 3
- 17.0B: Fn Key 4: Unlocked
- 17.0C: Fn Key 4 Mode: Normal
- 17.0D: Fn Key 4 Label: Function Key 4
- 17.0E: Fn Key 5: Unlocked
- 17.0F: Fn Key 5 Mode: Normal
- 17.10: Fn Key 5 Label: Function Key 5
- 17.11: Fn Key 6: Unlocked
- 17.12: Fn Key 6 Mode: Normal
- 17.13: Fn Key 6 Label: Function Key 6
- 17.14: Fn Key 7: Unlocked
- 17.15: Fn Key 7 Mode: Normal
- 17.16: Fn Key 7 Label: Function Key 7
- 17.17: Fn Key 8: Unlocked
- 17.18: Fn Key 8 Mode: Normal
- 17.19: Fn Key 8 Label: Function Key 8
- 17.1A: Fn Key 9: Unlocked
- 17.1B: Fn Key 9 Mode: Normal
- 17.1C: Fn Key 9 Label: Function Key 9
- 17.1D: Fn Key 10: Unlocked
- 17.1E: Fn Key 10 Mode: Normal
- 17.1F: Fn Key 10 Label: Function Key 10

PROT COMMS/ IM64

- 20.01: Scheme Setup: 2 Terminal
- 20.03: Address: 0-0
- 20.10: Comms Mode: Standard
- 20.11: Baud Rate Ch1: 64kbits/s
- 20.13: Clock Source Ch1: Internal
- 20.17: Comm Delay Tol: 350.0 us
- 20.18: Comm Fail Timer: 10.00 s
- 20.1A: GPS Sync:Disabled
- 20.1B: Char Mod Time: 500.0 ms
- 20.1F: Alarm Level: 25.00 %
- 20.20: Prop Delay Stats: Enabled
- 20.21: MaxCh1 PropDelay: 15.00 ms
- 20.30: IM1 Cmd Type: Permissive
- 20.31: IM1 Fallbck Mode: Default
- 20.32: IM1 Default Val: 0
- 20.34: IM2 Cmd Type: Permissive
- 20.35: IM2 Fallbck Mode: Default
- 20.36: IM2 Default Val: 0
- 20.38: IM3 Cmd Type: Permissive

Settings File Report
Substation:
File: P546 remote.set
Model Number: P546?1109?552?K

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- 20.39: IM3 Fallbck Mode: Default
- 20.3A: IM3 Default Val: 0
- 20.3C: IM4 Cmd Type: Permissive
- 20.3D: IM4 Fallbck Mode: Default
- 20.3E: IM4 Default Val: 0
- 20.40: IM5 Cmd Type: Permissive
- 20.41: IM5 Fallbck Mode: Default
- 20.42: IM5 Default Val: 0
- 20.44: IM6 Cmd Type: Permissive
- 20.45: IM6 Fallbck Mode: Default
- 20.46: IM6 Default Val: 0
- 20.48: IM7 Cmd Type: Permissive
- 20.49: IM7 Fallbck Mode: Default
- 20.4A: IM7 Default Val: 0
- 20.4C: IM8 Cmd Type: Permissive
- 20.4D: IM8 Fallbck Mode: Default
- 20.4E: IM8 Default Val: 0

CTRL I/P LABELS

- 29.01: Control Input 1: Control Input 1
- 29.02: Control Input 2: Control Input 2
- 29.03: Control Input 3: Control Input 3
- 29.04: Control Input 4: Control Input 4
- 29.05: Control Input 5: Control Input 5
- 29.06: Control Input 6: Control Input 6
- 29.07: Control Input 7: Control Input 7
- 29.08: Control Input 8: Control Input 8
- 29.09: Control Input 9: Control Input 9
- 29.0A: Control Input 10: Control Input 10
- 29.0B: Control Input 11: Control Input 11
- 29.0C: Control Input 12: Control Input 12
- 29.0D: Control Input 13: Control Input 13
- 29.0E: Control Input 14: Control Input 14
- 29.0F: Control Input 15: Control Input 15
- 29.10: Control Input 16: Control Input 16
- 29.11: Control Input 17: Control Input 17
- 29.12: Control Input 18: Control Input 18
- 29.13: Control Input 19: Control Input 19
- 29.14: Control Input 20: Control Input 20
- 29.15: Control Input 21: Control Input 21
- 29.16: Control Input 22: Control Input 22
- 29.17: Control Input 23: Control Input 23
- 29.18: Control Input 24: Control Input 24
- 29.19: Control Input 25: Control Input 25
- 29.1A: Control Input 26: Control Input 26
- 29.1B: Control Input 27: Control Input 27
- 29.1C: Control Input 28: Control Input 28
- 29.1D: Control Input 29: Control Input 29
- 29.1E: Control Input 30: Control Input 30
- 29.1F: Control Input 31: Control Input 31
- 29.20: Control Input 32: Control Input 32

Group 1

GROUP 1 LINE PARAMETERS

- 30.01: Line Length: 12.00 km
- 30.03: Line Impedance: 3.120 Ohm
- 30.04: Line Angle: 85.00 deg
- 30.05: kZN Res Comp: 940.0e-3
- 30.06: kZN Res Angle: -4.000 deg
- 30.07: Mutual Comp: Disabled
- 30.0B: Phase Sequence: Standard ABC
- 30.0C: Tripping Mode: 1 Pole & 3 Pole

GROUP 1 DISTANCE SETUP

- 31.0C: Setting Mode: Advanced
- 31.10: PHASE DISTANCE:
- 31.11: Phase Chars.: Quad
- 31.20: Zone 1 Ph Status: Enabled Ch Fail
- 31.30: Zone 2 Ph Status: Enabled

Settings File Report
Substation:
File: P546 remote.set
Model Number: P546?1109?552?K

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- 31.40: Zone 3 Ph Status: Enabled
- 31.42: Zone 3 Ph Offset: Enabled
- 31.50: Zone P Ph Status: Disabled
- 31.60: Zone 4 Ph Status: Enabled
- 31.70: GROUND DISTANCE:
- 31.71: Ground Chars.: Quad
- 31.80: Zone 1 Gnd Stat.: Enabled Ch Fail
- 31.90: Zone 2 Gnd Stat.: Enabled
- 31.A0: Zone 3 Gnd Stat.: Enabled
- 31.A2: Zone3 Gnd Offset: Enabled
- 31.B0: Zone P Gnd Stat.: Disabled
- 31.C0: Zone 4 Gnd Stat.: Enabled
- 31.D0: Digital Filter: Standard
- 31.D1: CVT Filters: Disabled
- 31.D3: Load Blinders: Enabled
- 31.D4: Z< Blinder Imp: 102.0 Ohm
- 31.D5: Load/B Angle: 37.00 deg
- 31.D6: Load Blinder V<: 15.01 V
- 31.D7: Dist. Polarizing: 1.000
- 31.E0: DELTADIRECTIONAL:
- 31.E1: Dir. Status: Disabled

GROUP 1 DIST. ELEMENTS

- 32.01: PHASE DISTANCE:
- 32.02: Z1 Ph. Reach: 2.500 Ohm
- 32.03: Z1 Ph. Angle: 85.00 deg
- 32.07: R1 Ph. Resistive: 24.90 Ohm
- 32.08: Z1 Tilt Top Line: 0 deg
- 32.09: Z1 Sensit. Iph>1: 50.00 mA
- 32.10: Z2 Ph. Reach: 3.750 Ohm
- 32.11: Z2 Ph. Angle: 85.00 deg
- 32.15: R2 Ph. Resistive: 49.80 Ohm
- 32.16: Z2 Tilt Top Line: 0 deg
- 32.17: Z2 Sensit. Iph>2: 50.00 mA
- 32.20: Z3 Ph. Reach: 6.250 Ohm
- 32.21: Z3 Ph. Angle: 85.00 deg
- 32.22: Z3' Ph Rev Reach: 6.250 Ohm
- 32.25: R3 Ph. Res. Fwd.: 62.25 Ohm
- 32.26: R3' Ph. Res. Rev: 62.25 Ohm
- 32.27: Z3 Tilt Top Line: 0 deg
- 32.28: Z3 Sensit. Iph>3: 50.00 mA
- 32.40: Z4 Ph. Reach: 630.0 mOhm
- 32.41: Z4 Ph. Angle: 85.00 deg
- 32.42: R4 Ph. Resistive: 62.25 Ohm
- 32.45: Z4 Tilt Top Line: -3.000 deg
- 32.46: Z4 Sensit. Iph>4: 50.00 mA
- 32.50: GROUND DISTANCE:
- 32.51: Z1 Gnd. Reach: 2.500 Ohm
- 32.52: Z1 Gnd. Angle: 85.00 deg
- 32.53: Z1 Dynamic Tilt: Disabled
- 32.54: Z1 Tilt Top Line: -3.000 deg
- 32.55: kZN1 Res. Comp.: 940.0e-3
- 32.56: kZN1 Res. Angle: 7.000 deg
- 32.59: R1 Gnd Resistive: 20.75 Ohm
- 32.5B: Z1 Sensit Ignd>1: 50.00 mA
- 32.60: Z2 Gnd. Reach: 3.750 Ohm
- 32.61: Z2 Gnd. Angle: 85.00 deg
- 32.63: Z2 Dynamic Tilt: Disabled
- 32.64: Z2 Tilt Top Line: -3.000 deg
- 32.65: kZN2 Res. Comp.: 940.0e-3
- 32.66: kZN2 Res. Angle: -4.000 deg
- 32.69: R2 Gnd Resistive: 41.50 Ohm
- 32.6B: Z2 Sensit Ignd>2: 50.00 mA
- 32.70: Z3 Gnd. Reach: 6.250 Ohm
- 32.71: Z3 Gnd. Angle: 85.00 deg
- 32.72: Z3' Gnd Rev Rch: 6.250 Ohm
- 32.73: Z3 Dynamic Tilt: Disabled

Settings File Report
Substation:
File: P546 remote.set
Model Number: P546?1109?552?K

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- 32.74: Z3 Tilt Top Line: -3.000 deg
- 32.75: kZN3 Res. Comp.: 940.0e-3
- 32.76: kZN3 Res. Angle: -4.000 deg
- 32.79: R3 Gnd. Res. Fwd: 53.95 Ohm
- 32.7A: R3' Gnd Res. Rev: 53.95 Ohm
- 32.7C: Z3 Sensit Ignd>3: 50.00 mA
- 32.90: Z4 Gnd. Reach: 630.0 mOhm
- 32.91: Z4 Gnd. Angle: 85.00 deg
- 32.93: Z4 Dynamic Tilt: Disabled
- 32.94: Z4 Tilt Top Line: -3.000 deg
- 32.95: kZN4 Res. Comp.: 940.0e-3
- 32.96: kZN4 Res. Angle: -4.000 deg
- 32.99: R4 Gnd Resistive: 53.95 Ohm
- 32.9B: Z4 Sensit Ignd>4: 50.00 mA

GROUP 1 PHASE DIFF

- 33.01: Phase Diff: Enabled
- 33.06: Phase Is1: 250.0 mA
- 33.07: Phase Is2: 2.000 A
- 33.08: Phase k1: 30.00 %
- 33.09: Phase k2: 150.0 %
- 33.0A: Phase Char: DT
- 33.0B: Phase Time Delay: 0 s
- 33.0E: PIT Time: 200.0 ms
- 33.0F: Ph CT Corr'tion: 3.000
- 33.10: Compensation: Cap Charging
- 33.11: Susceptance: 3.700 uS
- 33.17: PIT I selection: Remote

GROUP 1 SCHEME LOGIC

- 34.01: BASIC SCHEME:
- 34.08: Zone1 Tripping: Phase And Ground
- 34.09: tZ1 Ph. Delay: 0 s
- 34.0A: tZ1 Gnd. Delay: 0 s
- 34.10: Zone2 Tripping: Phase And Ground
- 34.11: tZ2 Ph. Delay: 350.0 ms
- 34.12: tZ2 Gnd. Delay: 350.0 ms
- 34.18: Zone3 Tripping: Phase And Ground
- 34.19: tZ3 Ph. Delay: 1.000 s
- 34.1A: tZ3 Gnd. Delay: 1.000 s
- 34.20: ZoneP Tripping: Disabled
- 34.28: Zone4 Tripping: Phase And Ground
- 34.29: tZ4 Ph. Delay: 350.0 ms
- 34.2A: tZ4 Gnd. Delay: 350.0 ms
- 34.40: AIDED SCHEME 1:
- 34.41: Aid. 1 Selection: POR
- 34.42: Aid 1 Distance: Phase And Ground
- 34.43: Aid.1 Dist. Dly: 0 s
- 34.44: Aid. 1 DEF: Disabled
- 34.4A: tRev. Guard: 20.00 ms
- 34.4C: Send On Trip: Aided / Z1
- 34.50: Weak Infeed: Disabled
- 34.60: AIDED SCHEME 2:
- 34.61: Aid. 2 Selection: Disabled
- 34.80: Trip On Close:
- 34.81: SOTF Status: Enabled PoleDead +Pulse
- 34.82: SOTF Delay: 110.0 s
- 34.83: SOTF Tripping: 000010
- 34.84: TOR Status: Enabled
- 34.85: TOR Tripping: 000010
- 34.86: TOC Reset Delay: 500.0 ms
- 34.88: TOC Delay: 200.0 ms
- 34.B0: Z1 Extension:
- 34.B1: Z1 Ext Scheme: Disabled
- 34.C0: Loss Of Load:
- 34.C1: LOL Scheme: Disabled

GROUP 1 OVERCURRENT

- 35.01: I>1 Status: Disabled

Settings File Report
Substation:
File: P546 remote.set
Model Number: P546?1109?552?K

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- 35.0A: I>2 Status: Disabled
- 35.13: I>3 Status: Disabled
- 35.18: I>4 Status: Enabled
- 35.19: I>4 Directional: Non-Directional
- 35.1A: I>4 Current Set: 640.0 mA
- 35.1B: I>4 Time Delay: 50.00 ms
- 35.1C: I> Char Angle: 30.00 deg
- 35.1D: I> Blocking: 001111

GROUP 1 BROKEN CONDUCTOR
- 37.01: Broken Conductor: Enabled
- 37.02: I2/I1 Setting: 200.0e-3
- 37.03: I2/I1 Time Delay: 5.000 s

GROUP 1 EARTH FAULT
- 38.01: IN>1 Status: Enabled
- 38.25: IN>1 Function: IEC S Inverse
- 38.26: IN>1 Directional: Directional Fwd
- 38.29: IN>1 Current Set: 80.00 mA
- 38.2D: IN>1 TMS: 500.0e-3
- 38.33: IN>1 tRESET: 0 s
- 38.35: IN>2 Status: Disabled
- 38.46: IN>3 Status: Disabled
- 38.4D: IN>4 Status: Disabled
- 38.54: IN> Blocking: 001111
- 38.55: IN> DIRECTIONAL:
- 38.56: IN> Char Angle: -45.00 deg
- 38.57: IN> Polarisation: Zero Sequence
- 38.59: IN> VNpol Set: 1.000 V

GROUP 1 POWER SWING BLK.
- 3D.01: PSB Status: Blocking
- 3D.03: Zone 1 Ph. PSB: Blocking
- 3D.05: Zone 2 Ph. PSB: Blocking
- 3D.07: Zone 3 Ph. PSB: Blocking
- 3D.09: Zone P Ph. PSB: Blocking
- 3D.0B: Zone 4 Ph. PSB: Blocking
- 3D.0D: Zone 1 Gnd. PSB: Blocking
- 3D.0F: Zone 2 Gnd. PSB: Blocking
- 3D.11: Zone 3 Gnd. PSB: Blocking
- 3D.13: Zone P Gnd. PSB: Blocking
- 3D.15: Zone 4 Gnd. PSB: Blocking
- 3D.20: PSB Unblocking: Disabled
- 3D.22: PSB Reset Delay: 200.0 ms
- 3D.23: OST Mode: OST Trip
- 3D.24: Z5: 7.500 Ohm
- 3D.25: Z6: 8.250 Ohm
- 3D.26: Z5': -7.500 Ohm
- 3D.27: Z6': -8.250 Ohm
- 3D.28: R5: 64.74 Ohm
- 3D.29: R6: 71.21 Ohm
- 3D.2A: R5': -64.74 Ohm
- 3D.2B: R6': -71.21 Ohm
- 3D.2C: Blinder Angle: 20.00 deg
- 3D.2D: delta T: 40.00 ms
- 3D.2E: Tost: 0 s

GROUP 1 VOLT PROTECTION
- 42.01: UNDER VOLTAGE:
- 42.02: V< Measur't Mode: V<1 & V<2 Ph-N
- 42.03: V< Operate Mode: V<1 & V<2 Any Ph
- 42.04: V<1 Function: DT
- 42.05: V<1 Voltage Set: 57.00 V
- 42.06: V<1 Time Delay: 0 s
- 42.08: V<1 Poledead Inh: Enabled
- 42.09: V<2 Status: Disabled
- 42.0D: OVERVOLTAGE:
- 42.0E: V> Measur't Mode: V>1 & V>2 Ph-N
- 42.0F: V> Operate Mode: V>1 & V>2 Any Ph
- 42.10: V>1 Function: DT

UNDER VOLATGE - ONLY DR TRIGGERING
NO CB TRIP

Settings File Report
Substation:
File: P546 remote.set
Model Number: P546?1109?552?K

Printed on: 23/08/2024 18:47:40

- 42.11: V>1 Voltage Set: 70.01 V
- 42.12: V>1 Time Delay: 5.000 s
- 42.14: V>2 Status: Enabled
- 42.15: V>2 Voltage Set: 89.01 V
- 42.16: V>2 Time Delay: 100.0 ms

GROUP 1 CB FAIL & P.DEAD

- 45.0A: UNDER CURRENT:
- 45.0B: I< Current Set: 50.00 mA
- 45.0D: ISEF< Current: 20.00 mA
- 45.0E: POLEDEAD VOLTAGE:
- 45.10: V<: 38.11 V

GROUP 1 SUPERVISION

- 46.01: VTS Mode: Measured + MCB
- 46.02: VTS Status: Blocking
- 46.03: VTS Reset Mode: Auto
- 46.04: VTS Time Delay: 5.000 s
- 46.05: VTS I> Inhibit: 10.00 A
- 46.06: VTS I2> Inhibit: 50.00 mA
- 46.0E: INRUSH DETECTION:
- 46.0F: I>2nd Harmonic: 20.00 %
- 46.10: WEAK INFEED BLK:
- 46.11: WI Inhibit: Enabled
- 46.12: I0/I2 Setting: 3.000
- 46.30: CT SUPERVISION:
- 46.31: CTS Mode: Disabled

GROUP 1 INPUT LABELS

- 4A.01: Opto Input 1: Input L1
- 4A.02: Opto Input 2: Input L2
- 4A.03: Opto Input 3: Input L3
- 4A.04: Opto Input 4: Input L4
- 4A.05: Opto Input 5: Input L5
- 4A.06: Opto Input 6: Input L6
- 4A.07: Opto Input 7: Input L7
- 4A.08: Opto Input 8: Input L8
- 4A.09: Opto Input 9: Input L9
- 4A.0A: Opto Input 10: Input L10
- 4A.0B: Opto Input 11: Input L11
- 4A.0C: Opto Input 12: Input L12
- 4A.0D: Opto Input 13: Input L13
- 4A.0E: Opto Input 14: Input L14
- 4A.0F: Opto Input 15: Input L15
- 4A.10: Opto Input 16: Input L16
- 4A.11: Opto Input 17: Input L17
- 4A.12: Opto Input 18: Input L18
- 4A.13: Opto Input 19: Input L19
- 4A.14: Opto Input 20: Input L20
- 4A.15: Opto Input 21: Input L21
- 4A.16: Opto Input 22: Input L22
- 4A.17: Opto Input 23: Input L23
- 4A.18: Opto Input 24: Input L24

GROUP 1 OUTPUT LABELS

- 4B.01: Relay 1: Output R1
- 4B.02: Relay 2: Output R2
- 4B.03: Relay 3: Output R3
- 4B.04: Relay 4: Output R4
- 4B.05: Relay 5: Output R5
- 4B.06: Relay 6: Output R6
- 4B.07: Relay 7: Output R7
- 4B.08: Relay 8: Output R8
- 4B.09: Relay 9: Output R9
- 4B.0A: Relay 10: Output R10
- 4B.0B: Relay 11: Output R11
- 4B.0C: Relay 12: Output R12
- 4B.0D: Relay 13: Output R13
- 4B.0E: Relay 14: Output R14
- 4B.0F: Relay 15: Output R15

Settings File Report
Substation:
File: P546 remote.set
Model Number: P546?1109?552?K

Printed on: 23/08/2024 18:47:41

- 4B.10: Relay 16: Output R16
- 4B.11: Relay 17: Output R17
- 4B.12: Relay 18: Output R18
- 4B.13: Relay 19: Output R19
- 4B.14: Relay 20: Output R20
- 4B.15: Relay 21: Output R21
- 4B.16: Relay 22: Output R22
- 4B.17: Relay 23: Output R23
- 4B.18: Relay 24: Output R24

General Data

Network Details

Voltage	=	400		kV
Frequency	=	50		Hz
System X/R Ratio	=	40		
Fault Current	=	10500		A

Local End Bay Details

Station Name	=	400kV BHADLA SUBSTATION		
Object Name	=	400 KV LINE CONTROL AND RELAY PANEL		
Object Number	=	-		
Relay Type	=	7SL87		
CT Primary current (Adopted)	=	3000		A
CT Secondary current	=	1		A

Protected Line details

Line details

Line length	=	12.00			km
Rated current capacity	=	953			A
Positive sequence imp. per km	=	0.0266	+j	0.313	Ohm/km
Zero sequence imp. per km	=	0.168	+j	1.187	Ohm/km

Short Line Feeder Details at Remote Station

Remote end station name	=	-			
Length of the line	=	0			Km
Positive sequence imp. per km	=	0.000	+j	0.000	Ohm/Km
Zero sequence imp. per km	=	0.000	+j	0.000	Ohm/Km

Longest Line Feeder Details at Remote Station

Remote end station name	=	-			
Length of the line	=	0.00			Km
Positive sequence imp. per km	=	0.000	+j	0.000	Ohm/Km
Zero sequence imp. per km	=	0.000	+j	0.000	Ohm/Km

CALCULATION FOR DIFFERENTIAL FUNCTION :

If the charging current compensation is ON, the pickup value I-DIFF> can be set equal I_{charge}. Thus the residual error of the charging current compensation is considered. Without charging current compensation, this pickup value must be set to a value that is higher than the total steady-state charging current of the protected object

Charging Current Calculation:

The charging current is calculated according to the following equation,

I_{charge} : U/ (√3 * Xc1)

Where,

U : System Line Voltage
Xc1 : Positive Sequence Line Capacitive reactance value
I charge : Line charging current/kM due to Line Capacitance
Xc1 : 1/(2 * π * f * C1)
C1 : Line Capacitance value/kM

Xc1 : 1/(2 * π * f * C1)
Xc1 : 1/(2*3.14*50*0.0000000119)
: 267622.97 Ω

I_{charge} : U/ (√3 * Xc1)
I_{charge} : 400000/(√3*267622.97)
: 0.86 A

Total Primary Charging Current : 0.86*12
: 10.32 A

Total Sec.Charging Current, Ic : Icharge / CTR
: 10.32/3000
: 0.00344 A

I-DIFF:Threshold:

Considering the variations of voltage and frequency, the set value should be at least 2 to 3 times higher than the calculated charging current or 20% of the rated current of the line whichever is greater.

3 times of : 3 * Ic
: 0.01032 A

I-DIFF:Threshold : 0.25 A (As per comments)

I-DIFF Switch-on:

A setting to three to four times the steady-state charging current usually ensures the stability of the protection during switch-on of the line.

I-DIFF:Threshold Switch On : 0.30 A

I-DIFF Fast :

As per the relay Recommendation, set the pickup value is 1.0 times to 2 times of Rated Current

Rated current : 952.66 A
: 2*952.66
: 1905.32 A
Therefore, as seen by the CT : 0.64 A

I-DIFF fast:Threshold	:	1	A

I-DIFF fast Switch on :

I-DIFF fast SWITCHON should be 2 to 3 times the setting value of I-DIFF fast

I-DIFF fast:Threshold Switch	:	2*1	
	:	2.00	A

The below mentioned settting recommended,

I-DIFF:Threshold	:	0.25	A
I-DIFF:Threshold Switch On	:	0.30	A
I-DIFF:Operate delay	:	0.00	Sec
Ic-compensat.:Mode	:	ON	
Ic-stabilization/Ic-rated	:	1.00	
I-DIFF fast:Threshold	:	2	A
I-DIFF fast:Threshold Switch On	:	3.82	A
INRUSH REST.	:	On	

CT ratio correction: _:9001:101 Rated current to be same at both end of the line to compensate CT ratio

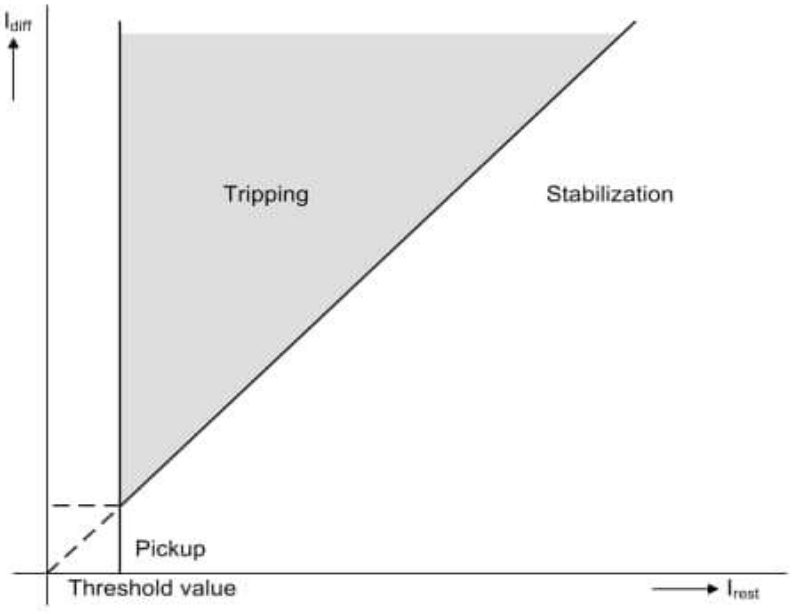

Figure 6-13 Operate Curve of the Differential Protection

CALCULATION FOR DISTANCE FUNCTION : QUADRILATERAL

Zone Reach Details

Zone 1	: 80%	of the protected Line	
Zone 2	: 120%	of the protected Line	+
	0%	of the shortest adjacent Line)	
Zone 3	: 200%	of the protected Line	+
	0%	of Remote end Longest Line	
Zone 4	: 20%	of the protected L (Reverse Zone)	
Zone 1B	: Setting same as Zone-2		
VT Ratio	: 400x1000 / 110		
	: 3636		
CT Ratio	: 3000 / 1		
	: 3000		

Transformation Ratio N
: CT Ratio / VT Ratio
: 3000/3636
: 0.825

Calculated Sec Impedance Z_{sec}
: N x Z_{prim} in ohm

Z_{prim} : Primary Impedance in ohm

Protected Line:

Line Length : 12.00 km

Line Total +VE Seq Impedance	: (R_1	+j	X_1)
	: 0.319	+j	3.75
	: 3.764 L85.14		
Line Total Zero Seq Impedance	: (R_0	+j	Xo)
	: 2.012	+j	14.244
	: 14.385 L81.96		

Zero Sequence Compensation Factor:

Resistance Ratio Kr
: $1/3((R_0/R_1)-1)$
: 1.769

Reactance Ratio Kx
: $1/3((X_0/X_1)-1)$
: 0.933

Line Angle Setting
Tan ϕ : XL/RL
: X_1/R_1
ϕ : 85.14 deg

Earth Impedance Compensation K_o Factor.
K_o : ZE / ZL
: $1/3 ((Z_0/Z_1)-1)$
Z_1 : Positive sequence Impedance of the Line
Z_0 : Zero sequence Impedance of the Line

Z_0 / Z_1 : 3.822 L -3.18
: 3.816 +j -j0.212

$1/3 ((Z_0/Z_1)-1)$: 1/3(3.82+j-0.212-1)
: 0.942 L-4.32

K_o : 0.94

ϕ_o : -4.32 deg

Load Impedance and Load Angle Calculation:

Rated Current : 952.66 A

At worst case, the maximum load current of the transmission line has been considered slightly higher than nominal loading (120%) to cover emergency loading of the protected line in case of heavy load flow.

Maximum Load Current (Imax) : 1143.00 A (120% of Load current)

Minimum Operating Voltage : 85% of rated voltage
: 0.85*400000
: 340000 V

Load Impedance R_{Load} : U_{min} / sqrt(3) x I_{max}
: 340000 / sqrt(3) x 1143

R_{Load} Primary : 171.740 ohm

R_{Load} Secondary : 171.74 x 0.825
: 141.69 ohm

The largest angle of the load impedance is given by the worst, smallest power factor. Hence,

Minimum Power Factor $Cos\phi_{min}$: 0.850 (Assumed)
ϕ_{min} : 32 deg

Set Load Angle : ϕ_{min} + 5
: 32 + 5
: 37 deg

To avoid load enchrochment for the phase-phase measuring elements, the set resistive reach of any distance protection zone should not exceed 60% of the $R_{load.}$

60.00% of R_{load} : 0.6*141.69
85.01 Ω

To avoid load enchroachment for the phase-earth measuring elements, the set resistive reach of any distance protection zone should not exceed 80% of the $R_{load.}$

80.00% of R_{load} : 0.8*141.69
113.35 Ω

Arc Resistance :

Arc Resistance for Ph-Ph fault (Pri) : 5.000 Ω (Assumed)

Arc Resistance for Ph-Ph fault (Sec) : 5*0.825
Rarc (Ph-Ph) : 2.230 Ω

Arc Resistance for PH-E fault (Pri) : 3.000 Ω (Assumed)

Arc Resistance for PH-E fault (Sec) : 3*0.825
Rarc (Ph-E) : 1.437 Ω

Tower Footing Resistance (Pri) : 10.000 Ω (Assumed)

R_{TF} (Sec) : 8.250 Ω

Zone 1 Reach Values:

Reactance, X reach (Z1) : 80% x X1 x N

: 0.8*3.75*0.825
: 2.475 ohm

Resistance Ph-Ph fault, R(Z1) : 80% x R1 x N + Rarc (Ph-Ph)/2

: (0.8*0.319*0.825)+2.23/2
: 1.326 ohm

Now, for Earth arc resistance shall include tower footing resistance

Resistance Ph-E fault, RE(Z1) : 80% * R1* N + Rarc(ph-E) + R_T
: (0.8*0.319*0.825)+(1.437+8.25)
: 9.898 ohm

Zone 2 Reach Values

Reactance, X reach (Z2) : 120% x X1 x N

: 1.2*3.75*0.825
: 3.713 ohm

Resistance Ph-Ph fault, R(Z2) : 120% x R1 x N + Rarc (Ph-Ph)/2

: (1.2*0.319*0.825)+2.23/2
: 1.431 ohm

Now, for Earth arc resistance shall include tower footing resistance

Resistance Ph-E fault, RE(Z2) : 120% * R1* N + Rarc(ph-E) + R_T
: (1.2*0.319*0.825)+(1.437+8.25)
: 10.003 ohm

Zone 3 Reach Values

Reactance, X(Z3) : 200% of X1 Protection Line +
0% of X1 Remote end Longest Line x N
: ((2*3.75)+(0*0))*0.825
: 6.188 ohm

Resistance Ph-Ph fault, R(Z3) : 200(% of R1 Protected Line + 0% of R1 of Remote end Longest Line) x N + Rarc (Ph-Ph)/2
: ((2*0.319)+(0*0))*0.825+(2.23/2)
: 1.641 ohm

Now, for Earth arc resistance shall include tower footing resistance

Resistance Ph-E fault, RE(Z3) : 200(% of R1 Protected Line + of R1 of Remote end Longest Line) x N + Rarc (Ph-E) + R_T
: ((2*0.319)+(0*0))*0.825+(1.437+8.25)
: 10.213 ohm

Zone -4 Setting:(Reverse Reach)

Reactance, X(Z4) : 20% x X1 x N

: 0.2*3.75*0.825
: 0.619 ohm

Resistance Ph-Ph fault, R(Z4) : 20% x R1 x N + Rarc (Ph-Ph)/2

: (0.2*0.319*0.825)+2.23/2
: 1.168 ohm

Now, for Earth arc resistance shall include tower footing resistance

Resistance Ph-E fault, RE(Z4) : 20% * R1* N + Rarc(ph-E) + R_T
: (0.2*0.319*0.825)+(1.437+8.25)
: 9.740 ohm

Zone-1B Setting:

Set Zone-1B settings equal to Zone-2 value

Zone Timer setting:

ZONE 1- t1 PP	:	0.00 sec
ZONE 1- t1 PE	:	0.00 sec
ZONE 2- t1 PP	:	0.35 sec
ZONE 2- t1 PE	:	0.35 sec
ZONE 3- t1 PP	:	1.00 sec
ZONE 3- t1 PE	:	1.00 sec
ZONE 4- t1 PP	:	0.35 sec
ZONE 4- t1 PE	:	0.35 sec
ZONE 1B-t1 PP	:	0.00 sec
ZONE 1B-t1 PE	:	0.00 sec

Load Cutout

Z< Blinder Imp (90% of LR)	:	102.0	Ohm
Load/B Angle	:	37.0	Deg

TELEPROTECTION FOR DISTANCE:

The relay shall work in Permissive Over Reach(POTT) mode with the following settings:

Send with	:	Distance prot. Z1	
Operate with	:	Distance prot. Z2	
Send prolongation	:	0.05	Sec
Send delay	:	0.00	Sec
1-pole operate allowed	:	Yes	
Operate delay	:	0.00	sec

POWER SWING:

Power swing operating mode	:	All zones block	
Max.Blocking Time	:	2	Sec

50HS INSTANTANEOUS SOTF:

SOTF to be enabled for Zone-2, Zone-3

Operate delay : 0 sec

STUB PROTECTION:

The threshold value must be higher than the maximum operational current to be expected, in order to avoid pickup without fault. Grading time above the base time of the main protection is usually sufficient.

Threshold	:	0.6	A
Operate delay	:	0.04	msec

FUSE FAIL MONITORING:

Asym.fail.DO on netw.flt	:	no	
Asym.fail.time delay	:	5	sec
3ph fail-phs.curr.release	:	0.1	A
3ph fail-phs.curr.jump	:	0.1	A
3ph fail-VA,VB,VC <	:	5	V
Switch-on 3ph.failure	:	on	
SO 3ph.fail-time delay	:	5	sec

DIR. EARTH FAULT SETTINGS :

The pickup characteristics should be more than the standing unbalance current as seen by the system and the CT's.

1Ph Fault Current	:	10500	A
IN> Pickup current in A	:	7.50%	of rated current
	:	0.075*3000=225A	
IN> Current Set (Is)	:	0.08 A	
Minimum setting available in Relay	:	0.08 A	

The Earth fault function has to be graded with the Zone-3 Protection

Zone-3 operating time	:	1.00	Sec
Grading margin	:	0.13	Sec
Required time (Treq)	:	1.13	Sec

Note: The IDMT curve shall saturate if the fault current more than 20 times of pickup current. 20 times of set current considered for TMS calculation.

Fault Current considered	:	4500	A
51 Time Dial	:	(Treq*(IF/Is)^0.02-1)/0.14	
	:	(1.13*(4500/225)^0.02-1)/0.14)	
	:	0.5	

BROKEN CONDUCTOR

A broken wire of the protected line or in the current transformer secondary circuit can be detected, if the minimum current PoleOpenCurrent flows via the feeder. If the minimum phase current is below this limit while the other phase currents are above this limit, an interruption of this conductor may be assumed. If current asymmetry is also detected (see margin heading “Current Symmetry”), the device issues the message Fail Conductor (No. 195).

OVERVOLTAGE PROTECTION: 59

Measuring value	:	phase-neutral		
Definite-T 1:Threshold	:	69.9	V	110% of Rated voltage
Definite-T 1:Operate delay	:	5	sec	
Definite-T 2:Threshold	:	88.9	V	140% of Rated voltage
Definite-T 2:Operate delay	:	0.1	sec	

Power system

General		
Number	**Settings**	**Value**
11.2311.101	Phase sequence	All: ABC

Meas.point I-3ph 1

CT 3-phase \General		
Number	**Settings**	**Value**
11.931.8881.115	CT connection	All: 3-phase
11.931.8881.127	Tracking	All: active
11.931.8881.130	Measuring-point ID	All: 1

CT 3-phase \CT phases		
Number	**Settings**	**Value**
11.931.8881.101	Rated primary current	All: 3000 A
11.931.8881.102	Rated secondary current	All: 1 A
11.931.8881.117	Current range	All: 100 x IR
11.931.8881.118	Internal CT type	All: CT protection
11.931.8881.116	Neutr.point in dir.of ref.obj	All: yes
11.931.8881.114	Inverted phases	All: none
11.931.8881.107	CT error changeover	All: 1.5
11.931.8881.108	CT error A	All: 5 %
11.931.8881.109	CT error B	All: 15 %

CT 3-phase \MP disconnection		
Number	**Settings**	**Value**
11.931.8881.173	Current check	All: active
11.931.8881.112	I< threshold	All: 0.10 A

CT 1		
Number	**Settings**	**Value**
11.931.3841.103	Magnitude correction	All: 1
11.931.3841.117	Phase	All: I A

CT 2		
Number	**Settings**	**Value**
11.931.3842.103	Magnitude correction	All: 1
11.931.3842.117	Phase	All: I B

CT 3		
Number	**Settings**	**Value**
11.931.3843.103	Magnitude correction	All: 1
11.931.3843.117	Phase	All: I C

Brk.wire det.		
Number	**Settings**	**Value**
11.931.5581.1	Mode	All: off
11.931.5581.101	Mode of blocking	All: blocking

Supv. balan. I		
Number	**Settings**	**Value**
11.931.2491.1	Mode	Settings group 1: on
11.931.2491.101	Release threshold	Settings group 1: 0.50 A
11.931.2491.102	Threshold min/max	Settings group 1: 0.5
11.931.2491.6	Delay failure indication	Settings group 1: 5 s

Supv. ph.seq.I		
Number	**Settings**	**Value**
11.931.2551.1	Mode	Settings group 1: on
11.931.2551.6	Delay failure indication	Settings group 1: 5 s
11.931.2551.102	Release threshold	Settings group 1: 0.50 A

Saturat. det.		
Number	**Settings**	**Value**
11.931.17731.101	CT saturation threshold	Settings group 1: 8.00 A

Meas.point V-3ph 1

VT 3-phase		
Number	**Settings**	**Value**
11.941.8911.101	Rated primary voltage	All: 400.000 kV
11.941.8911.102	Rated secondary voltage	All: 110 V
11.941.8911.104	VT connection	All: 3 ph-to-gnd voltages
11.941.8911.106	Inverted phases	All: none
11.941.8911.111	Tracking	All: active
11.941.8911.130	Measuring-point ID	All: 2
11.941.8911.136	Internal VT type	All: Voltage transformer

VT 1		
Number	**Settings**	**Value**
11.941.3811.103	Magnitude correction	All: 1
11.941.3811.108	Phase	All: V A

VT 2		
Number	**Settings**	**Value**
11.941.3812.103	Magnitude correction	All: 1
11.941.3812.108	Phase	All: V B

VT 3		
Number	**Settings**	**Value**
11.941.3813.103	Magnitude correction	All: 1
11.941.3813.108	Phase	All: V C

Supv. balan. V		
Number	**Settings**	**Value**
11.941.2521.1	Mode	Settings group 1: on
11.941.2521.101	Release threshold	Settings group 1: 55.0 V
11.941.2521.102	Threshold min/max	Settings group 1: 0.75
11.941.2521.6	Delay failure indication	Settings group 1: 5 s

Supv. ph.seq.V		
Number	**Settings**	**Value**
11.941.2581.1	Mode	Settings group 1: on
11.941.2581.6	Delay failure indication	Settings group 1: 5 s

Supv. sum V		
Number	**Settings**	**Value**
11.941.2461.1	Mode	Settings group 1: off
11.941.2461.3	Threshold	Settings group 1: 27.5 V
11.941.2461.6	Delay failure indication	Settings group 1: 5 s

VT miniatureCB		
Number	**Settings**	**Value**
11.941.2641.101	Response time	Settings group 1: 0 s

Meas.point I-1ph 1

General		
Number	**Settings**	**Value**
11.951.2311.101	Rated primary current	All: 3000 A
11.951.2311.102	Rated secondary current	All: 1 A
11.951.2311.103	Current range	All: 100 x IR
11.951.2311.104	Internal CT type	All: CT protection
11.951.2311.116	Term. 1,3,5,7 in dir. of obj.	All: yes
11.951.2311.105	Tracking	All: inactive
11.951.2311.130	Measuring-point ID	All: 3

CT 1		
Number	**Settings**	**Value**
11.951.3841.103	Magnitude correction	All: 1
11.951.3841.117	Phase	All: Ix

Meas.point V-1ph 1

General		
Number	**Settings**	**Value**
11.961.2311.101	Rated primary voltage	All: 400 kV
11.961.2311.102	Rated secondary voltage	All: 100 V 110V
11.961.2311.103	Tracking	All: inactive

Number	Settings	Value
11.961.2311.130	Measuring-point ID	All: 4

VT 1		
Number	**Settings**	**Value**
11.961.3811.103	Magnitude correction	All: 1
11.961.3811.108	Phase	All: V B

VT miniatureCB		
Number	**Settings**	**Value**
11.961.2641.101	Response time	Settings group 1: 0 s

*Setting marked as favorite setting

sp Setting marked as specific setting

Line 1

General \Rated values		
Number	**Settings**	**Value**
21.9001.101	Rated current	All: 3000 A
21.9001.102	Rated voltage	All: 400.00 kV
21.9001.103	Rated apparent power	All: 693.0 MVA

General \Line data		
Number	**Settings**	**Value**
21.9001.149	Neutral point	Settings group 1: grounded
21.9001.112	C1 per length unit	Settings group 1: 0.0119 µF/km
21.9001.148	C0 per length unit	Settings group 1: 0.0119 µF/km
21.9001.113	X per length unit	Settings group 1: 0.313 Ω/km
21.9001.114	Line length	Settings group 1: 12 km
21.9001.108	Line angle	Settings group 1: 85 °
21.9001.104	Kr	Settings group 1: 1.77
21.9001.105	Kx	Settings group 1: 0.93
21.9001.106	KmR	Settings group 1: 0
21.9001.107	KmX	Settings group 1: 0
21.9001.109	Gnd.curr.ratio(MutComp)	Settings group 1: 95 %
21.9001.119	CT saturation detection	All: no
21.9001.111	Series compensation	Settings group 1: no
21.9001.110	Series capacit. reactance	Settings group 1: 0 Ω

General \Measurements		
Number	**Settings**	**Value**
21.9001.158	P, Q sign	Settings group 1: not reversed

Process monitor

Closure detec.		
Number	**Settings**	**Value**
21.1131.4681.101	Operating mode	Settings group 1: Manual close only
21.1131.4681.102	Action time after closure	Settings group 1: 0.5 s
21.1131.4681.103	Min. time feeder open	Settings group 1: 0.3 s

1pol.open det.		
Number	**Settings**	**Value**
21.1131.4711.101	Operating mode	Settings group 1: with measurement

Volt.criterion		
Number	**Settings**	**Value**
21.1131.4801.101	Threshold U open	Settings group 1: 18.15 V

Fault locator		
Number	**Settings**	**Value**
21.8671.1	Mode	Settings group 1: on
21.8671.101	Start	Settings group 1: with going pickup
21.8671.102	Parallel-line compensat.	Settings group 1: no
21.8671.103	Load compensation	All: no

Mes.v.fail.det		
Number	**Settings**	**Value**
21.2671.1	Mode	Settings group 1: on
21.2671.115	Asym.fail.-DO on netw.flt.	Settings group 1: yes
21.2671.113	Asym.fail. - time delay	Settings group 1: 5 s
21.2671.102	3ph.fail. - phs.curr.release	Settings group 1: 0.03 A
21.2671.103	3ph.fail. - phs.curr. jump	Settings group 1: 0.03 A
21.2671.101	3ph.fail. - VA,VB,VC <	Settings group 1: 3.025 V
21.2671.107	Switch-on 3ph. failure	All: on
21.2671.106	SO 3ph.fail. - time delay	Settings group 1: 0.5 s

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General		
Number	**Settings**	**Value**
21.201.2311.101	Emergency mode	Settings group 1: no

Definite-T 1 \General		
Number	**Settings**	**Value**
21.201.661.1	Mode	Settings group 1: off

Number	Settings	Value
21.201.661.2	Operate & flt.rec. blocked	Settings group 1: no
21.201.661.11	1-pole operate allowed	Settings group 1: no
21.201.661.26	Dynamic settings	All: no
21.201.661.8	Method of measurement	Settings group 1: fundamental comp.
21.201.661.3	Threshold	Settings group 1: 1.067 A
21.201.661.4	Dropout ratio	Settings group 1: 0.95
21.201.661.102	Pickup delay	Settings group 1: 0 s
21.201.661.101	Dropout delay	Settings group 1: 0 s
21.201.661.6	Operate delay	Settings group 1: 0.3 s
21.201.661.7	Operate delay mode	Settings group 1: Running dur. DO-delay

Definite-T 2 \General		
Number	**Settings**	**Value**
21.201.662.1	Mode	Settings group 1: off
21.201.662.2	Operate & flt.rec. blocked	Settings group 1: no
21.201.662.11	1-pole operate allowed	Settings group 1: yes
21.201.662.26	Dynamic settings	All: no
21.201.662.8	Method of measurement	Settings group 1: fundamental comp.
21.201.662.3	Threshold	Settings group 1: 0.667 A
21.201.662.4	Dropout ratio	Settings group 1: 0.95
21.201.662.102	Pickup delay	Settings group 1: 0 s
21.201.662.101	Dropout delay	Settings group 1: 0 s
21.201.662.6	Operate delay	Settings group 1: 0.1 s
21.201.662.7	Operate delay mode	Settings group 1: Running dur. DO-delay

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General		
Number	**Settings**	**Value**
21.211.2311.101	Emergency mode	Settings group 1: caused by main prot.
21.211.2311.9	Measured value	All: 3I0 calculated

Definite-T 1 \General		
Number	**Settings**	**Value**
21.211.751.1	Mode	Settings group 1: off
21.211.751.2	Operate & flt.rec. blocked	Settings group 1: no
21.211.751.26	Dynamic settings	All: no
21.211.751.102	Blk. w. 2nd harm. gnd. det.	Settings group 1: no
21.211.751.8	Method of measurement	Settings group 1: fundamental comp.
21.211.751.3	Threshold	Settings group 1: 0.711 A
21.211.751.4	Dropout ratio	Settings group 1: 0.95
21.211.751.101	Dropout delay	Settings group 1: 0 s
21.211.751.6	Operate delay	Settings group 1: 0.3 s
21.211.751.7	Operate delay mode	Settings group 1: Running dur. DO-delay

Definite-T 2 \General		
Number	**Settings**	**Value**
21.211.752.1	Mode	Settings group 1: off
21.211.752.2	Operate & flt.rec. blocked	Settings group 1: no
21.211.752.26	Dynamic settings	All: no
21.211.752.102	Blk. w. 2nd harm. gnd. det.	Settings group 1: no
21.211.752.8	Method of measurement	Settings group 1: fundamental comp.
21.211.752.3	Threshold	Settings group 1: 0.40 A
21.211.752.4	Dropout ratio	Settings group 1: 0.95
21.211.752.101	Dropout delay	Settings group 1: 0 s
21.211.752.6	Operate delay	Settings group 1: 0.3 s
21.211.752.7	Operate delay mode	Settings group 1: Running dur. DO-delay

67N GFP gnd.sys.1

General		
Number	**Settings**	**Value**
21.1111.2311.114	Direct. determination with	All: V0 + IY (neutral pt.)
21.1111.2311.101	Angle forward α	Settings group 1: 315 °
21.1111.2311.102	Angle forward β	Settings group 1: 135 °
21.1111.2311.103	Min. zero-seq. voltage V0	Settings group 1: 0.919 V
21.1111.2311.115	Dir.reslt=forw.at V0<min	Settings group 1: no
21.1111.2311.104	Min.3I0 f.increas.dir.sens.	Settings group 1: 0.03 A
21.1111.2311.116	Dir.corr.at ser.comp.lines	Settings group 1: no

Definite-T 1 \Blocking by		
Number	**Settings**	**Value**
21.1111.4861.140	21 Distance prot. 1.Z 1	true
21.1111.4861.140	21 Distance prot. 1.Z 2	true
21.1111.4861.140	21 Distance prot. 1.Z 3	true
21.1111.4861.140	21 Distance prot. 1.Z 4	false
21.1111.4861.140	87 Line diff. prot..Group indicat.	false

Number	Settings	Value
21.1111.4861.140	87 Stub diff. prot. 1.Group indicat.	false

Definite-T 1 \General		
Number	**Settings**	**Value**
21.1111.4861.1	Mode	Settings group 1: off
21.1111.4861.2	Operate & flt.rec. blocked	Settings group 1: no
21.1111.4861.114	Directional mode	Settings group 1: forward
21.1111.4861.11	1-pole operate allowed	Settings group 1: no
21.1111.4861.8	Method of measurement	Settings group 1: 1-cycle filter
21.1111.4861.131	Blk. w. 2nd harm. gnd. det.	Settings group 1: no
21.1111.4861.130	Blocking by prot. pickup	Settings group 1: every pickup
21.1111.4861.129	Op.mode at 1p dead time	Settings group 1: blocked
21.1111.4861.112	Hold mode 1p dead time	Settings group 1: 0.04 s
21.1111.4861.115	Dynamic settings	All: no
21.1111.4861.111	Stabiliz. w. phase current	Settings group 1: 10 %
21.1111.4861.3	Threshold	Settings group 1: 0.107 A
21.1111.4861.6	Operate delay	Settings group 1: 1 s

Definite-T 2 \Blocking by		
Number	**Settings**	**Value**
21.1111.4862.140	21 Distance prot. 1.Z 1	true
21.1111.4862.140	21 Distance prot. 1.Z 2	true
21.1111.4862.140	21 Distance prot. 1.Z 3	true
21.1111.4862.140	21 Distance prot. 1.Z 4	true
21.1111.4862.140	87 Line diff. prot..Group indicat.	false
21.1111.4862.140	87 Stub diff. prot. 1.Group indicat.	false

Definite-T 2 \General		
Number	**Settings**	**Value**
21.1111.4862.1	Mode	Settings group 1: off
21.1111.4862.2	Operate & flt.rec. blocked	Settings group 1: no
21.1111.4862.114	Directional mode	Settings group 1: forward
21.1111.4862.11	1-pole operate allowed	Settings group 1: no
21.1111.4862.8	Method of measurement	Settings group 1: 1-cycle filter
21.1111.4862.131	Blk. w. 2nd harm. gnd. det.	Settings group 1: no
21.1111.4862.130	Blocking by prot. pickup	Settings group 1: every pickup
21.1111.4862.129	Op.mode at 1p dead time	Settings group 1: blocked
21.1111.4862.112	Hold mode 1p dead time	Settings group 1: 1.5 s
21.1111.4862.115	Dynamic settings	All: no
21.1111.4862.111	Stabiliz. w. phase current	Settings group 1: 10 %
21.1111.4862.3	Threshold	Settings group 1: 0.107 A
21.1111.4862.6	Operate delay	Settings group 1: 1 s

Inverse-T 1 \Blocking by		
Number	**Settings**	**Value**
21.1111.4891.140	21 Distance prot. 1.Z 1	true
21.1111.4891.140	21 Distance prot. 1.Z 2	true
21.1111.4891.140	21 Distance prot. 1.Z 3	true
21.1111.4891.140	21 Distance prot. 1.Z 4	true
21.1111.4891.140	87 Line diff. prot..Group indicat.	false
21.1111.4891.140	87 Stub diff. prot. 1.Group indicat.	false

Inverse-T 1 \General		
Number	**Settings**	**Value**
21.1111.4891.1	Mode	Settings group 1: on
21.1111.4891.2	Operate & flt.rec. blocked	Settings group 1: no
21.1111.4891.115	Directional mode	Settings group 1: forward
21.1111.4891.11	1-pole operate allowed	Settings group 1: no
21.1111.4891.8	Method of measurement	Settings group 1: 1-cycle filter
21.1111.4891.135	Blk. w. 2nd harm. gnd. det.	Settings group 1: no
21.1111.4891.131	Blocking by prot. pickup	Settings group 1: every pickup
21.1111.4891.130	Op.mode at 1p dead time	Settings group 1:directional forward
21.1111.4891.113	Hold mode 1p dead time	Settings group 1: 0.04 s
21.1111.4891.116	Dynamic settings	All: no
21.1111.4891.112	Stabiliz. w. phase current	Settings group 1: 10 %
21.1111.4891.3	Threshold	Settings group 1: 0.077 A
21.1111.4891.133	Type of character. curve	Settings group 1: IEC normal inverse
21.1111.4891.106	Time dial	Settings group 1: 0.5
21.1111.4891.132	Additional time delay	Settings group 1: 0 s
21.1111.4891.134	Reset	Settings group 1: instantaneous

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General		
Number	**Settings**	**Value**
21.1461.2311.101	Emergency mode	Settings group 1: no
21.1461.2311.102	Rotation angle of ref. volt.	Settings group 1: 45 °

Definite-T 1 \General		
Number	**Settings**	**Value**
21.1461.8131.1	Mode	Settings group 1: off
21.1461.8131.2	Operate & flt.rec. blocked	Settings group 1: no
21.1461.8131.105	Directional mode	Settings group 1: forward
21.1461.8131.8	Method of measurement	Settings group 1: fundamental comp.
21.1461.8131.107	Non-directional pickup	Settings group 1: no
21.1461.8131.104	Directional comparison	Settings group 1: yes
21.1461.8131.106	Release via input signal	Settings group 1: no
21.1461.8131.10	Blk. by meas.-volt. failure	Settings group 1: yes
21.1461.8131.26	Dynamic settings	All: no
21.1461.8131.3	Threshold	Settings group 1: 0.64 A
21.1461.8131.4	Dropout ratio	Settings group 1: 0.95
21.1461.8131.101	Dropout delay	Settings group 1: 0 s
21.1461.8131.6	Operate delay	Settings group 1: 0.3 s

Definite-T 2 \General		
Number	**Settings**	**Value**
21.1461.8132.1	Mode	Settings group 1: off
21.1461.8132.2	Operate & flt.rec. blocked	Settings group 1: no
21.1461.8132.105	Directional mode	Settings group 1: forward
21.1461.8132.8	Method of measurement	Settings group 1: fundamental comp.
21.1461.8132.107	Non-directional pickup	Settings group 1: at volt.< & mem.empty
21.1461.8132.104	Directional comparison	Settings group 1: no
21.1461.8132.106	Release via input signal	Settings group 1: no
21.1461.8132.10	Blk. by meas.-volt. failure	Settings group 1: yes
21.1461.8132.26	Dynamic settings	All: no
21.1461.8132.3	Threshold	Settings group 1: 0.667 A
21.1461.8132.4	Dropout ratio	Settings group 1: 0.95
21.1461.8132.101	Dropout delay	Settings group 1: 0 s
21.1461.8132.6	Operate delay	Settings group 1: 0.1 s

Inverse-T 1 \General		
Number	**Settings**	**Value**
21.1461.8161.1	Mode	Settings group 1: off
21.1461.8161.2	Operate & flt.rec. blocked	Settings group 1: no
21.1461.8161.111	Directional mode	Settings group 1: forward
21.1461.8161.8	Method of measurement	Settings group 1: fundamental comp.
21.1461.8161.113	Non-directional pickup	Settings group 1: no
21.1461.8161.110	Directional comparison	Settings group 1: yes
21.1461.8161.112	Release via input signal	Settings group 1: no
21.1461.8161.10	Blk. by meas.-volt. failure	Settings group 1: yes
21.1461.8161.26	Dynamic settings	All: no
21.1461.8161.3	Threshold	Settings group 1: 0.64 A
21.1461.8161.130	Type of character. curve	Settings group 1: IEC normal inverse
21.1461.8161.114	Min. time of the curve	Settings group 1: 0 s
21.1461.8161.131	Reset	Settings group 1: disk emulation
21.1461.8161.101	Time dial	Settings group 1: 1
21.1461.8161.115	Additional time delay	Settings group 1: 0 s

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General		
Number	**Settings**	**Value**
21.321.2311.106	Reference value	Settings group 1: rated current
21.321.2311.107	Current limitation Imax	All: no
21.321.2311.104	Release current	Settings group 1: 0.030 A

Definite-T 1		
Number	**Settings**	**Value**
21.321.1981.1	Mode	Settings group 1: off
21.321.1981.2	Operate & flt.rec. blocked	Settings group 1: no
21.321.1981.3	Threshold	Settings group 1: 10 %
21.321.1981.4	Dropout ratio	All: 0.95
21.321.1981.101	Dropout delay	Settings group 1: 0 s
21.321.1981.6	Operate delay	Settings group 1: 5 s

Definite-T 2		
Number	**Settings**	**Value**
21.321.1982.1	Mode	Settings group 1: off
21.321.1982.2	Operate & flt.rec. blocked	Settings group 1: no
21.321.1982.3	Threshold	Settings group 1: 65 %
21.321.1982.4	Dropout ratio	All: 0.95
21.321.1982.101	Dropout delay	Settings group 1: 0 s
21.321.1982.6	Operate delay	Settings group 1: 0.5 s

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General		
Number	**Settings**	**Value**
21.131.2311.104	Current-flow criterion	Settings group 1: on
21.131.2311.101	Threshold I>	Settings group 1: 0.03 A
21.131.2311.103	Stabilization counter	Settings group 1: 0

Definite-T 1		
Number	**Settings**	**Value**
21.131.421.1	Mode	Settings group 1: on
21.131.421.2	Operate & flt.rec. blocked	Settings group 1: no
21.131.421.10	Blk. by meas.-volt. failure	Settings group 1: yes
21.131.421.9	Measured value	Settings group 1: phase-to-ground
21.131.421.8	Method of measurement	Settings group 1: fundamental comp.
21.131.421.101	Pickup mode	Settings group 1: 1 out of 3
21.131.421.102	Pickup delay	Settings group 1: no
21.131.421.3	Threshold	Settings group 1: 57.000 V
21.131.421.4	Dropout ratio	Settings group 1: 1.05
21.131.421.6	Operate delay	Settings group 1: 0 s

Definite-T 2		
Number	**Settings**	**Value**
21.131.422.1	Mode	Settings group 1: off
21.131.422.2	Operate & flt.rec. blocked	Settings group 1: no
21.131.422.10	Blk. by meas.-volt. failure	Settings group 1: yes
21.131.422.9	Measured value	Settings group 1: phase-to-phase
21.131.422.8	Method of measurement	Settings group 1: fundamental comp.
21.131.422.101	Pickup mode	Settings group 1: 1 out of 3
21.131.422.102	Pickup delay	Settings group 1: no
21.131.422.3	Threshold	Settings group 1: 71.5 V
21.131.422.4	Dropout ratio	Settings group 1: 1.05
21.131.422.6	Operate delay	Settings group 1: 0.5 s

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General		
Number	**Settings**	**Value**
21.51.2311.101	Stabilization counter	Settings group 1: 0

Definite-T 1		
Number	**Settings**	**Value**
21.51.181.1	Mode	Settings group 1: on
21.51.181.2	Operate & flt.rec. blocked	Settings group 1: no
21.51.181.9	Measured value	Settings group 1: phase-to-ground
21.51.181.8	Method of measurement	Settings group 1: fundamental comp.
21.51.181.101	Pickup mode	Settings group 1: 1 out of 3
21.51.181.3	Threshold	Settings group 1: 70.000 V
21.51.181.4	Dropout ratio	Settings group 1: 0.95
21.51.181.6	Operate delay	Settings group 1: 0 s

Definite-T 2		
Number	**Settings**	**Value**
21.51.182.1	Mode	Settings group 1: on
21.51.182.2	Operate & flt.rec. blocked	Settings group 1: no
21.51.182.9	Measured value	Settings group 1: phase-to-ground
21.51.182.8	Method of measurement	Settings group 1: fundamental comp.
21.51.182.101	Pickup mode	Settings group 1: 1 out of 3
21.51.182.3	Threshold	Settings group 1: 89.000 V
21.51.182.4	Dropout ratio	Settings group 1: 0.95
21.51.182.6	Operate delay	Settings group 1: 0.1 s

21 Distance prot. 1

General		
Number	**Settings**	**Value**
21.901.2311.110	Zone timer start	Settings group 1: on dist. pickup
21.901.2311.107	Dist. characteristic angle	Settings group 1: 85 °
21.901.2311.105	Ground-fault detection	Settings group 1: 3I0 or V0
21.901.2311.103	3I0> threshold value	Settings group 1: 0.03 A
21.901.2311.102	V0> threshold value	Settings group 1: 1.008 V
21.901.2311.104	3I0 pickup stabilization	Settings group 1: 0.1
21.901.2311.108	Loop select. with ph-ph-g	Settings group 1: block leading phase
21.901.2311.106	Parallel-line compensat.	Settings group 1: no

Pickup Z<		
Number	**Settings**	**Value**
21.901.3661.101	Min. phase-current thresh	Settings group 1: 0.05 A
21.901.3661.102	Use ph-g load cutout	All: Yes
21.901.3661.105	Use ph-ph load cutout	All: Yes

Z 1		
Number	**Settings**	**Value**
21.901.3571.1	Mode	Settings group 1: on
21.901.3571.2	Operate & flt.rec. blocked	Settings group 1: no
21.901.3571.121	Blocked if diff.prot.active	Settings group 1: Yes
21.901.3571.11	1-pole operate allowed	Settings group 1: yes
21.901.3571.101	Function mode	Settings group 1: ph-gnd and ph-ph
21.901.3571.114	Zone-spec. residu. comp.	Settings group 1: no
21.901.3571.109	Directional mode	Settings group 1: forward
21.901.3571.102	X reach	Settings group 1: 2.475 Ω
21.901.3571.103	R (ph-g)	Settings group 1: 9.897 Ω
21.901.3571.104	R (ph-ph)	Settings group 1: 1.320 Ω
21.901.3571.113	Zone-inclination angle	Settings group 1: 0 °
21.901.3571.110	Operate delay (1-phase)	Settings group 1: 0 s
21.901.3571.112	Operate delay (multi-ph.)	Settings group 1: 0 s

Z 2		
Number	**Settings**	**Value**
21.901.3572.1	Mode	Settings group 1: on
21.901.3572.2	Operate & flt.rec. blocked	Settings group 1: no
21.901.3572.121	Blocked if diff.prot.active	Settings group 1: no
21.901.3572.11	1-pole operate allowed	Settings group 1: no
21.901.3572.101	Function mode	Settings group 1: ph-gnd and ph-ph
21.901.3572.114	Zone-spec. residu. comp.	Settings group 1: no
21.901.3572.109	Directional mode	Settings group 1: forward
21.901.3572.102	X reach	Settings group 1: 3.713 Ω
21.901.3572.103	R (ph-g)	Settings group 1: 10.000 Ω
21.901.3572.104	R (ph-ph)	Settings group 1: 1.431 Ω
21.901.3572.113	Zone-inclination angle	Settings group 1: 0 °
21.901.3572.110	Operate delay (1-phase)	Settings group 1: 0.35 s
21.901.3572.112	Operate delay (multi-ph.)	Settings group 1: 0.35 s

Z 3		
Number	**Settings**	**Value**
21.901.3573.1	Mode	Settings group 1: on
21.901.3573.2	Operate & flt.rec. blocked	Settings group 1: no
21.901.3573.121	Blocked if diff.prot.active	Settings group 1: no
21.901.3573.11	1-pole operate allowed	Settings group 1: no
21.901.3573.101	Function mode	Settings group 1: ph-gnd and ph-ph
21.901.3573.114	Zone-spec. residu. comp.	Settings group 1: no
21.901.3573.109	Directional mode	Settings group 1: forward
21.901.3573.102	X reach	Settings group 1: 6.188 Ω
21.901.3573.103	R (ph-g)	Settings group 1: 10.213 Ω
21.901.3573.104	R (ph-ph)	Settings group 1: 1.641 Ω
21.901.3573.113	Zone-inclination angle	Settings group 1: 0 °
21.901.3573.110	Operate delay (1-phase)	Settings group 1: 1 s
21.901.3573.112	Operate delay (multi-ph.)	Settings group 1: 1 s

Z 4		
Number	**Settings**	**Value**
21.901.3574.1	Mode	Settings group 1: on
21.901.3574.2	Operate & flt.rec. blocked	Settings group 1: no
21.901.3574.121	Blocked if diff.prot.active	Settings group 1: no
21.901.3574.11	1-pole operate allowed	Settings group 1: no
21.901.3574.101	Function mode	Settings group 1: ph-gnd and ph-ph
21.901.3574.114	Zone-spec. residu. comp.	Settings group 1: no
21.901.3574.109	Directional mode	Settings group 1: reverse
21.901.3574.102	X reach	Settings group 1: 0.618 Ω
21.901.3574.103	R (ph-g)	Settings group 1: 9.741 Ω
21.901.3574.104	R (ph-ph)	Settings group 1: 1.168 Ω
21.901.3574.113	Zone-inclination angle	Settings group 1: 0 °
21.901.3574.110	Operate delay (1-phase)	Settings group 1: 0.35 s
21.901.3574.112	Operate delay (multi-ph.)	Settings group 1: 0.35 s

87 Line diff. prot.

General		
Number	**Settings**	**Value**
21.831.2311.1	Mode	Settings group 1: on
21.831.2311.11	1-pole operate allowed	Settings group 1: yes
21.831.2311.102	Min. current for release	Settings group 1: 0 A
21.831.2311.104	Supervision Idiff	All: yes: reporting only
21.831.2311.108	Action on Behavior = test	Settings group 1: Test loc. device autom.

Remote trip. \General		
Number	**Settings**	**Value**
21.831.5551.100	Transmitting	Settings group 1: yes
21.831.5551.101	Receiving	Settings group 1: yes

Remote trip. \Intertrip		
Number	**Settings**	**Value**
21.831.5551.103	Send delay	Settings group 1: 0.02 s
21.831.5551.104	Send prolongation	Settings group 1: 0 s

I-DIFF		
Number	**Settings**	**Value**
21.831.3451.1	Mode	Settings group 1: on
21.831.3451.2	Operate & flt.rec. blocked	Settings group 1: no
21.831.3451.3	Threshold	Settings group 1: 0.083 A
21.831.3451.101	Threshold switch on	Settings group 1: 0.1 A
21.831.3451.102	Delay 1-phase pickup	Settings group 1: 0 s
21.831.3451.6	Operate delay	Settings group 1: 0 s

I-DIFF fast 2		
Number	**Settings**	**Value**
21.831.18211.1	Mode	Settings group 1: on
21.831.18211.2	Operate & flt.rec. blocked	Settings group 1: no
21.831.18211.3	Threshold	Settings group 1: 2.00 A
21.831.18211.101	Threshold switch on	Settings group 1: 3.82 A
21.831.18211.6	Operate delay	Settings group 1: 0 s
21.831.18211.106	Delay 1-phase pickup	Settings group 1: 0 s

Transformer		
Number	**Settings**	**Value**
21.831.3541.101	Rated apparent power	Settings group 1: 693 MVA
21.831.3541.103	Voltage vector group nb.	Settings group 1: 0
21.831.3541.104	Current vector group nb.	Settings group 1: 0
21.831.3541.105	Residual curr. elimination	Settings group 1: yes

87 Stub diff. prot. 1

General		
Number	**Settings**	**Value**
21.1431.2311.1	Mode	Settings group 1: off

S-DIFF		
Number	**Settings**	**Value**
21.1431.8401.1	Mode	Settings group 1: off
21.1431.8401.2	Operate & flt.rec. blocked	Settings group 1: no
21.1431.8401.3	Threshold	Settings group 1: 0.160 A
21.1431.8401.6	Operate delay	Settings group 1: 0 s

S-DIFF fast 2		
Number	**Settings**	**Value**
21.1431.18241.1	Mode	Settings group 1: off
21.1431.18241.2	Operate & flt.rec. blocked	Settings group 1: no
21.1431.18241.3	Threshold	Settings group 1: 0.533 A

68 P.swing blk \Zones to be blocked		
Number	**Settings**	**Value**
21.5311.102	21 Distance prot. 1.Z 1	true
21.5311.102	21 Distance prot. 1.Z 2	true
21.5311.102	21 Distance prot. 1.Z 3	true
21.5311.102	21 Distance prot. 1.Z 4	true

68 P.swing blk		
Number	**Settings**	**Value**
21.5311.1	Mode	Settings group 1: on
21.5311.103	Max. blocking time	Settings group 1: 2 s

85-21Perm.underr. Permissive Overreach

85-21Perm.unde \Send with		
Number	**Settings**	**Value**
21.1281.5671.140	21 Distance prot. 1.Z 1	true

Number	Settings	Value
21.1281.5671.140	21 Distance prot. 1.Z 2	false
21.1281.5671.140	21 Distance prot. 1.Z 3	false
21.1281.5671.140	21 Distance prot. 1.Z 4	false

85-21Perm.unde \Operate with		
Number	**Settings**	**Value**
21.1281.5671.141	21 Distance prot. 1.pickup general	false
21.1281.5671.141	21 Distance prot. 1.Z 1	false
21.1281.5671.141	21 Distance prot. 1.Z 2	true
21.1281.5671.141	21 Distance prot. 1.Z 3	false
21.1281.5671.141	21 Distance prot. 1.Z 4	false
21.1281.5671.141	receive (direct trip)	false

85-21Perm.unde Permissive Overreach		
Number	**Settings**	**Value**
21.1281.5671.1	Mode	Settings group 1: on
21.1281.5671.101	Send prolongation	Settings group 1: 0.05 s
21.1281.5671.11	1-pole operate allowed	Settings group 1: yes
21.1281.5671.102	Operate delay (1-phase)	Settings group 1: 0 s
21.1281.5671.103	Operate delay (multi-ph.)	Settings group 1: 0 s

Switch onto fault 1

Stage 1 \Configuration		
Number	**Settings**	**Value**
21.1341.5941.102	50/51 OC-3ph-A1.Definite-T 1	false
21.1341.5941.102	50/51 OC-3ph-A1.Definite-T 2	false
21.1341.5941.102	50N/51N OC-gnd-A1.Definite-T 1	false
21.1341.5941.102	50N/51N OC-gnd-A1.Definite-T 2	false
21.1341.5941.102	67N GFP gnd.sys.1.Definite-T 1	false
21.1341.5941.102	67N GFP gnd.sys.1.Definite-T 2	false
21.1341.5941.102	67N GFP gnd.sys.1.Inverse-T 1	false
21.1341.5941.102	67 Dir.OC-3ph-A1.Definite-T 1	false
21.1341.5941.102	67 Dir.OC-3ph-A1.Definite-T 2	false
21.1341.5941.102	67 Dir.OC-3ph-A1.Inverse-T 1	false
21.1341.5941.102	21 Distance prot. 1.Z 1	true
21.1341.5941.102	21 Distance prot. 1.Z 2	true
21.1341.5941.102	21 Distance prot. 1.Z 3	false
21.1341.5941.102	21 Distance prot. 1.Z 4	false
21.1341.5941.102	50 OC high-speed 1.Standard 1	false

Stage 1		
Number	**Settings**	**Value**
21.1341.5941.1	Mode	Settings group 1: on
21.1341.5941.2	Operate & flt.rec. blocked	Settings group 1: no
21.1341.5941.6	Operate delay	Settings group 1: 0 s

2.hrm.det. gnd		
Number	**Settings**	**Value**
21.22051.1	Mode	All: off
21.22051.102	2nd harmonic content	Settings group 1: 15 %

50 OC high-speed 1 / STUB PROTECTION

Standard 1		
Number	**Settings**	**Value**
21.971.3901.1	Mode	Settings group 1: on
21.971.3901.101	Activation	Settings group 1: only with binary signal
21.971.3901.3	Threshold	Settings group 1: 0.667 A
21.971.3901.4	Dropout ratio	Settings group 1: 0.9

Line 1\Ciruit-breaker interaction

Protection group	Circuit-breaker group(s)
Line 1\ 50/51 OC-3ph-A1\ Definite-T 1	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 50/51 OC-3ph-A1\ Definite-T 2	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 50N/51N OC-gnd-A1\ Definite-T 1	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 50N/51N OC-gnd-A1\ Definite-T 2	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 67N GFP gnd.sys.1\ Definite-T 1	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 67N GFP gnd.sys.1\ Definite-T 2	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 67N GFP gnd.sys.1\ Inverse-T 1	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 67 Dir.OC-3ph-A1\ Definite-T 1	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 67 Dir.OC-3ph-A1\ Definite-T 2	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 67 Dir.OC-3ph-A1\ Inverse-T 1	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 46 I2 1\ Definite-T 1	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 46 I2 1\ Definite-T 2	Circuit breaker 1:Circuit breaker 1:Trip

Protection group	Circuit-breaker group(s)
Line 1\ 27 Undervolt.-3ph 1\ Definite-T 1	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 27 Undervolt.-3ph 1\ Definite-T 2	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 59 Overvolt.-3ph 1\ Definite-T 1	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 59 Overvolt.-3ph 1\ Definite-T 2	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 21 Distance prot. 1\ Z 1	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 21 Distance prot. 1\ Z 2	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 21 Distance prot. 1\ Z 3	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 21 Distance prot. 1\ Z 4	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 87 Line diff. prot.\ General	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 85-21Perm.underr.\ 85-21Perm.unde	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ Switch onto fault 1\ Stage 1	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 87 Stub diff. prot. 1\ General	Circuit breaker 1:Circuit breaker 1:Trip
Line 1\ 50 OC high-speed 1\ Standard 1	Circuit breaker 1:Circuit breaker 1:Trip

*Setting marked as favorite setting

sp Setting marked as specific setting

HITACHI
Inspire the Next

ADANI GREEN ENERGY LIMITED
(ADANI RENEWABLES)
400kV BADISID SUBSTATION TRANSFORMER PROTECTION RELAY SETTING CALCULATION

400kV BHADLA SUBSTATION

ADANI GREEN ENERGY LIMITED

Hitachi Energy

DOCUMENT	400kV BADISID SUBSTATION TRANSFORMER PROTECTION RELAY SETTING CALCULATION
PROJECT	400kV BHADLA SUBSTATION
SUBSTATION	400kV BHADLA SUBSTATION
CLIENT	ADANI GREEN ENERGY LIMITED
SUPPLIER	HITACHI ENERGY INDIA LIMITED
PO / LOA No.	IDTO-VI/ Adani Green-400 kV at Badi Sid - Rajasthan /PGGA/CRP & SAS
HEIL SO REF.	3100139976, 1MNS500950-PDAA

Revisions:

Rev.	Prep. / Appr.	Description	Date
00	SS / PN	First Submission	31-May-2024
01	SS / PN	Revised as per customer comments	02-Aug-24

General data

Relay Details

Relay Model Ref	=	RET670
Relay Frequency	=	50
Ordering Code	=	670*2.2.1

Bay Details

Bay Name	=	Trafo-1, 2
Bay Reference	=	400/33/33kV TRANSFORMER C&R PANEL

Transformer Details

Rated Power	=	330.0	/	165.0	/ 165.0	MVA
Voltage Ratio	=	400	/	33	/ 33	kV
Normal Tap No Load Voltage OLTC1	=	400	kV			
Vector Group	=	YNa0yn0				
% Impedance at 75°c	=	15.0	(at 165 MVA base)			
Frequency:	=	50	Hz			

HV Winding (W1) Detail

CT ratio	=	2000-1000-500/1			
CT ratio - Adopted	=	1000	/	1	A
CT Class	=	PS			
Rated Power	=	330			MVA
Rated Voltage	=	400			kV
CTStarPoint	=	To Object			

MV Winding (W2) Detail

CT ratio	=	3150/1			
CT ratio - Adopted	=	3150	/	1	A
CT Class	=	PS			
Rated Power	=	165			MVA
Rated Voltage	=	33.00			kV
CTStarPoint	=	To Object			

LV Winding (W3) Detail

CT ratio	=	3150/1			
CT ratio - Adopted	=	3150	/	1	A
CT Class	=	PS			
Rated Power	=	165			MVA
Rated Voltage	=	33			kV
CTStarPoint	=	To Object			

Rated Current

HV	=	Rated Power / ((√3) * Rated Voltage)
	=	(330x 10^6) / ((√3) x 400 x 10^3)
	=	476 A
MV	=	Rated Power / ((√3) * Rated Voltage
	=	(165x 10^6) / ((√3) x 33 x 10^3)
	=	2887 A
LV	=	Rated Power / ((√3) * Rated Voltage
	=	(165x 10^6) / ((√3) x 33 x 10^3)
	=	2887 A

Global Base Values GBASVAL

GBASVAL:1 (HV Rated current)

Ubase	=	400	kV
Ibase	=	476	A
Sbase	=	330.0	MVA

GBASVAL:2 (LV Rated current)

Ubase	=	33	kV
Ibase	=	2886.8	A
Sbase	=	165.0	MVA

GBASVAL:3 (HV CT Ratio)

Ubase	=	400.0	kV
Ibase	=	1000	A
Sbase	=	692.8	MVA

GBASVAL:4 (LV CT Ratio)

Ubase	=	33	kV
Ibase	=	3150	A
Sbase	=	180.0	MVA

GBASVAL:5 (HV SEF)

Ubase	=	400.0	kV
Ibase	=	1000	A
Sbase	=	692.8	MVA

GBASVAL:6 (LV CT ratio- REF/SEF)

Ubase	=	33	kV
Ibase	=	4000	A
Sbase	=	228.6	MVA

Transformer differential protection:T3WPDIF 87OT(Transformer Overall Differential)

HV AIS Bkr CTR-1000/1
LV SWGR Bkr CTR-3150/1

A. Setting of minimum differential operating current

The basic setting defines the pick-up setting of the differential protection for internal faults. The lowest possible value should be chosen to enable it to detect the worst-case faults. However, there can be small differential current during normal operation, which may result in tripping.

To assure that the load current does not cause unwanted operation, IdMin is set based on the calculation below.

Differential curent error at rated load current in different tap positions

Tap Position	I_{HV}	$I_{LV}+I_{MV}$	I_{DIFF}	%Error in Ibase
9	476.3	5773.7	476.33 - (5773.68 * (33 / 400)) =0.0014	0.000
1	433.0	5773.7	433.03 - (5773.68 * (33 / 400)) =-43.2986	-9.090
17	529.3	5773.7	529.25 - (5773.68 * (33 / 400)) =52.9214	11.110

Maximum error due to OLTC (at tap 17 the Rated Current)	=	11.110	%
CT Error (HV & LV Assumed)	=	5	%
Relay Error (As per technical data of the relay)	=	1	%
Total Error (In terms of % of the rated current of the transformer)	=	11.11 + 5 + 1	
	=	17.110	%

Based on the above considered criteria the selected Idmin value as follows:

IdMin	=	**20**	**%**
IdMin	=	0.20	*Ibase
Ibase	=	476	A

B. Setting of cross-over point between slope 1 and slope 2

This section corresponds to normal load currents - upto the max. values of normal load currents. Here, the setting of diiferential current corresponds to Idmin i.e. basic differential current setting which determines the pickup of the relay. As per the recommendation of the relay manual, the same setting is selected as default - Restraint current upto 125% of the base current.

EndSection1 = 1.25 Ibase

setting is selected as default - 40%

SlopeSection2 = 40% *Ibias

D. Setting of cross-over point between slope 2 and slope 3

The section corresponds to currents above normal load currents, and to provide stability for high-resistive faults under heavy load conditions.

EndSection2	=	3	Ibase
Idiff Value at End Section 2	=	SlopeSection2 x EndSection2	
	=	0.9	

E. Setting of slope 2 stabilisation

This is higher % bias setting applied for Restraint currents above End section 2 - to provide stability for heavy through fault currents.As per recommendation of relay manual, same setting is selected as default - 80%

SlopeSection3 = 80% *Ibias

F. Unrestrained operation level

As per the Application manual(AM) Unrestrained operation level has default value of IdUnre = 10pu, which is typically acceptable for most of standard power transformer applications. Hence the considered Setting of minimum differential operating current for unrestraint step

HV Through fault current = HV Full load currrent / % Impedance

= (476.33 / (15/100))
= 3175.53 A

Considering 120% of through fault = 3175.53 x 1.2
Current = 3810.636 A
= 8

Thus I dunre setting proposed = 9 *Ibase

G. Setting the operation of Cross Blocking logic

The meaning of Cross-blocking is that the 2nd and 5th harmonic blocking in one phase will also block the differential function in other phases.

OpCrossBlock = On

H.Set the second and fifth harmonic stabilizing level when transformers are inside the zone

Setting considered as per Manual

I2/I1Ratio = 15 %
I5/I1Ratio = 25 %

I. Set the operation of Negative sequence differential protection!

NegSeqDiff - Negative sequence fault discriminator is an important compliment to the precentage restrained differential function. As it is directional, it can distinguish between external and internal faults; also at difficult conditions such as CT saturation.

OpNegSeqDiff = Off

J. Setting of minimum negative sequence differential current level

The negative seuqence currents are compared if above the set threshold value IminNegSeq. If either these sums is below the threshold, no comparision is made. Neither internal, nor external fault will be declared in this case. As per Relay manual recommendation, default value of 0.04xIbase can be used if no special account. considerations such as e.g. extremely week sources must be taken into

IMinNegSeq = 0.04 *Ibase As per Manual

K. Setting of the Relay operating angles.

This is the setting of the relay operating angle of the negative sequence Ibased internal / external fault discriminator. The directional test is made such that, the phase angle of the sum of Local negative sequence currents is compared to the phase angle of the sum of remote negative sequence currents. Ideally, the angle is 0 degree for internal faults and 180 degree for external faults.
However, considering for safety margin, because of errors caused by CT saturation as well as different phase angles of sources, we set the Relay operate angle setting to 60 degrees default.

NegSeqROA = 60 As per Manual

Restrained differential function characteristic

As per the Manual

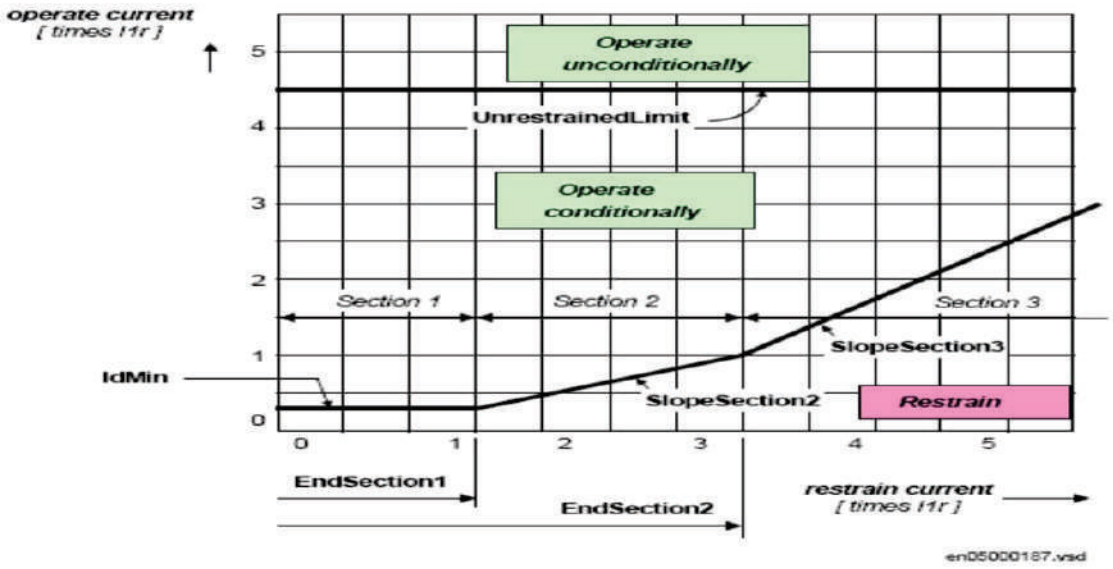
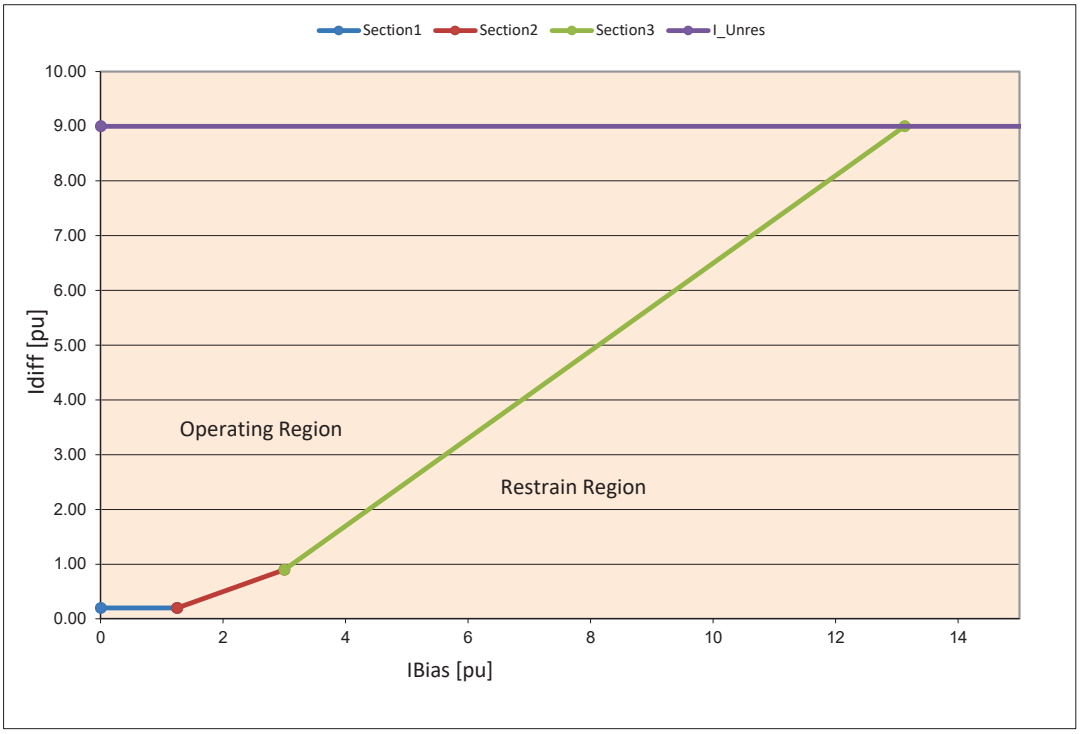


Figure 44: Description of the restrained-, and the unrestrained operate characteristics

Adopted Curve



Overexcitation protection: OEXPVPH

GlobalBaseSel: Selects the global base value group used by the function to define IBase, UBase and SBase as applicable.

GlobalBaseSel = 2

Operation: The operation of the Overexcitation protection

Operation = On

MeasuredU: The phases involved in the measurement are set here. Normally the three phase measurement measuring the positive sequence voltage should be used but when only individual VT's are used a single phase-to-phase can be used.

MeasuredU = **L1L2**

MeasuredI: The phases involved in the measurement are set here. MeasuredI: must be in accordance with MeasuredU.

MeasuredI = **L1L2**

V/Hz>: Operating level for the inverse characteristic, IEEE or tailor made. The operation is based on the relation between rated voltage and rated frequency and set as a percentage factor. Normal setting is around 108-110% depending of the capability curve for the transformer/generator.

V/Hz> = **120** **%UB/f**

V/Hz>>: Operating level for the tMin definite time delay used at high overvoltages. The operation is based on the relation between rated voltage and rated frequency and set as a percentage factor. Normal setting is around 110-180% depending of the capability curve of the transformer/generator. Setting should be above the knee-point when the characteristic starts to be straight on the high side.

0.8

V/Hz>> = **140** **%UB/f**

XLeak: The transformer leakage reactance on which the compensation of voltage measurement with load current is based. The setting shall be the transformer leak reactance in primary ohms. If no current compensation is used (mostly the case) the setting is not used.

XLeak = **0.075** **Ohm**

TrPulse: The length of the trip pulse. Normally the final trip pulse is decided by the trip function block. A typical pulse length can be 50 ms.

TrPulse = **0.1** **s**

Stand by earth fault, settings given here are only provisional. The settings are to be co-ordinated with Cu downstream relays, the settings should be corrected at site to ensure proper coordination.

sel

CureveType = **TailorMade**

If **CurveType** selected as **IEEE**, then the operating time will be calculated by following equation,

top = $$\frac{0.18 * k}{\left(\frac{M}{V/Hz >} - 1\right)^2}$$

Where:
M relative excitation
k time multiplier for inverse time function

kForIEEE: The time constant for the inverse characteristic. Select the one giving the best match to the transformer capability.

KForIEEE	=	**0**	

If **CurveType** selected as **TrailorMode**, then the operating time will be based on the setting from t1 to t6

The interval between V/Hz>> and V/Hz> is automatically divided up in five equal steps, and the time delays t2 to t5 will be allocated to these values of overexcitation. In this application, each step will be (-) /5 = 0%. The setting of time delays t1 to t6 are listed below.

t1	=	**100**	**s**
t2	=	**50**	**s**
t3	=	**30**	**s**
t4	=	**15**	**s**
t5	=	**6**	**s**
t6	=	**3**	**s**

tCooling: The cooling time constant giving the reset time when voltages drops below the set value. Shall be set above the cooling time constant of the transformer. The default value is recommended to be used if the constant is not known.

tCooling	=	**1200**	**s**

tMin: The operating times at voltages higher than the set V/Hz>>. The setting shall match capabilities on these high voltages. Typical setting can be 1-10 second.

tMin	=	**2**	**s**

tMax: For overvoltages close to the set value times can be extremely long if a high K time constant is used. A maximum time can then be set to cut the longest times. Typical settings are 1800-3600 seconds (30-60 minutes)

tMax	=	**100**	**s**

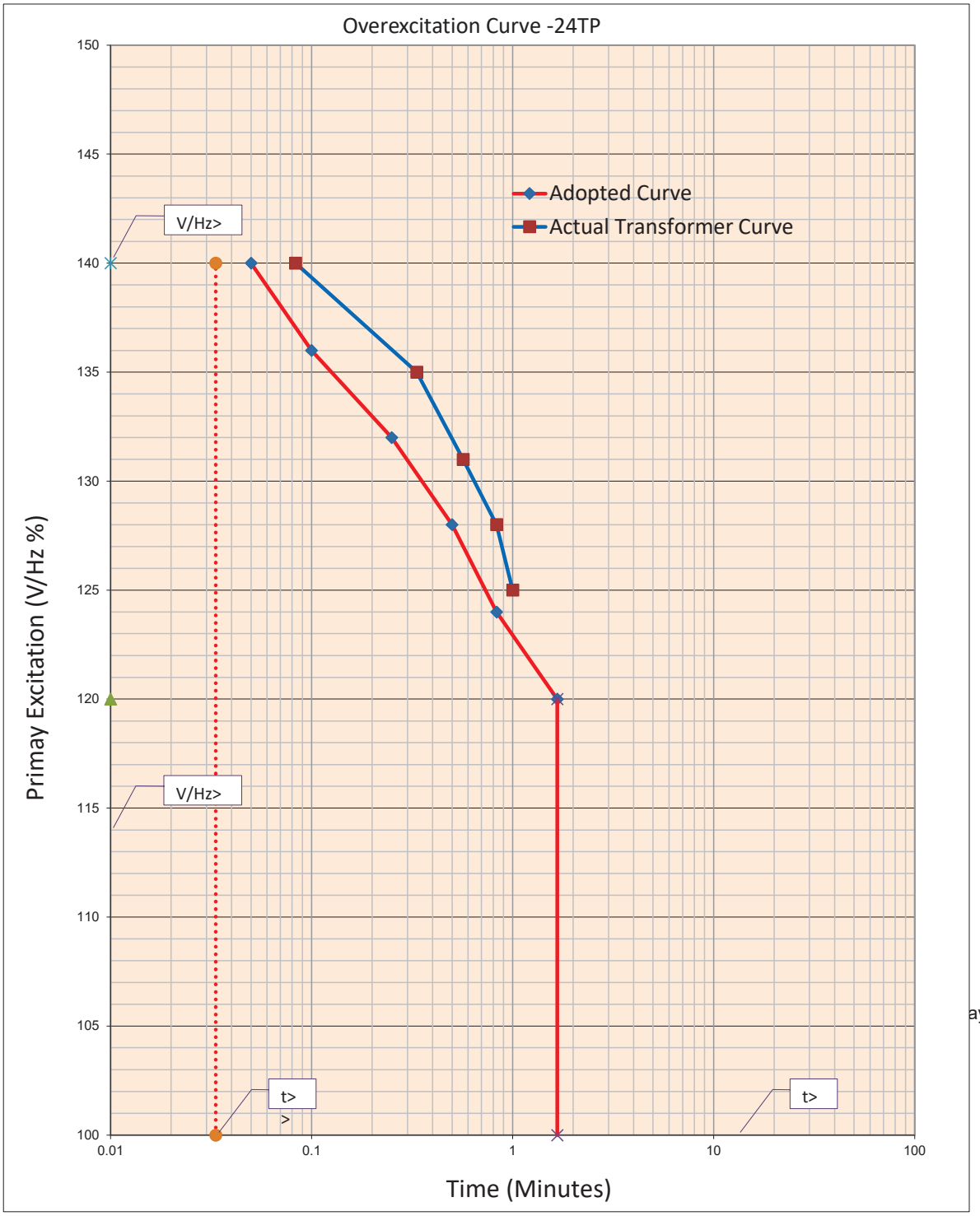
AlarmLevel: Setting of the alarm level in percentage of the set trip level. The alarm level is normally set at around 98% of the trip level.

AlarmLevel	=	**95**	**%**

tAlarm: Setting of the time to alarm is given from when the alarm level has been reached. Typical setting is 5 seconds.

tAlarm	=	**10**	**s**

Overexcitation Curve



ays,

Setting of Thermal overload protection function (THL) (Only for Alarm purpose, not for tripping)

The thermal overload in some cases is not detected by other protection functions, and the introduction of thermal overload protection (THL) allows the protected circuit to operate closer to thermal limits.

Activation of the Thermal overload protection function

Operation = **On**

Setting of the base current Ibase for the function on which the current levels are based

Ibase = **476 A**

Setting of load current (in % of Ibase) leading to Tref temperature - Iref:
As per the recommendations, this current should be set to the maximum steady state current allowed for the equipment under emergency operation (a few hours per year)

Now, maximum continous current capacity of transformer

Imax = 524 A (Assuming an allowed continuous 10% overload)

The same Iref current expressed as = 523.963 / 476.33 A

= 110%

Thus, selected setting for Iref = 110% Ibase

Thus, selected setting for Iref = 120% Ibase

Setting for End temperature rise above ambient temperature of the line when loaded with Iref - Tref:
This is reference temperature corresponding to steady state current Iref - 90 deg C.

1

Thus, Selected setting for Tref = 90 ºC

Setting of Current multiplier when function is used for two or more lines - Imult:
If the protection measures one of a number of parallel line circuits, the number of parallel line circuits is given in this setting. Since, here the relay measures only for single feeder, the same setting will be 1.

Selected setting for Imult = 1

$$t_{th} \text{ min} = \frac{1}{60} \left(\frac{\text{Permissible 1-s current}}{\text{Permissible continous curre}} \right)^{\wedge}2$$

$$= \frac{1}{60} \left(\frac{63000}{524\ \text{A}} \right)^{\wedge}2$$

Setting for temperature level for Trip - TripTemp:
This is the temperature value for trip of the protected circuit. As per cable datasheet, the same is stated as 90 deg C.

Thus, selected setting for TripTemp = 100 ºC

Setting for temeprature level for alarm - AlarmTemp:
This is the temperature value for alarm of the protected circuit. This signal is used to provide warning before the circuit is tripped. Therefore, the setting shall be lower than the trip level. It shall at the same time be higher than the maximum conductor temperature at normal operation.
As per the cable datasheet, max. permissible continous conductor temperature

= 90 ºC

Thus, selected setting for AlarmTem = 90 ºC

Setting of temperature for reset of lockout after trip - ReclTemp:
This is the temperature where lockout signal LOCKOUT from the function is released. When the thermal overload protection trips a lock-out signal is activated. This signal is intended to block switch in of the protected circuit as long as the conductor temperature is high. The signal is released when the estimated temperature is below the set value. This temperature value should be choosen below the alarm temperature.
As per the cable datasheet, temperature for normal operation

= 80 ºC

Thus, selected setting for ReclTemp = 80 ºC

Setting of trip pulse length - tpulse:
Selected setting for tpulse = 0.10 sec

Activate the external Ambient temperature measurement (when provided through mA input)
AmbSens = Off

Setting of Ambient temperature used when AmbiSens is set to Off - DefaultAmbTemp:
DefaultAmbTemp = 40 ºC

Setting of the temperature raise, from ambient, of the line to be used at start - DefaultTemp:
DefaultTemp = 50 ºC

LV1 & LV2 High Impedance Restricted Earth Fault Protection:- 33 kV

Transformer Details

Power Rating	=	165	MVA	
MV Voltage Rating	=	33	kV	
MV Neutral Grounding Type	=	Solid		
% Impedance	=	15.00	%	
Full load Current	=	2886.8	A	

LV Side CT Details:

CT Ratio	=	4000/1	A	
CT Adoptted Primary Rating	=	4000	A	
CT Secondary Rating	=	1	A	
CT Resistance	=	13.0	Ohm	
CT Knee Point Voltage	=	500	V	
CT Magnetising Current @Vk	=	30	mA	

LV Neutral Side CT Details:

CT Ratio	=	4000/1	A	
CT Adoptted Primary Rating	=	4000	A	
CT Secondary Rating	=	1	A	
CT Resistance	=	13.0	Ohm	
CT Knee Point Voltage	=	500	V	
CT Magnetising Current @Vk	=	30	mA	

LV Side Lead Resistance Details:

Lead Resistance at 75^0 C /kM	=	7	Ohm/kM	(Assumed)
Length of Lead of two path (Wire loop length across CT to Relay)	=	200	Meter	

Relay Details

Relay Type	=	RET670		
Relay Burden	=	0.02	VA	
Relay Order Code	=	-		
Relay Serial No	=	0		

REF Pickup Setting

REF Function	=	On		
Relay Pickup Setting	=	10	%	

Calculations:

Calculation of Fault MVA (**Sf**)	=	*MVA/%Impedance*		
	=	(165)/(15/100)		
	=	**1100**	MVA	
Calculation of Fault Current (**If**)	=	*(Sf*1000)/(√3*kV)*		
	=	(1100*1000)/(1.732*33)		
	=	**19245**	A	

Calculation of LV Lead Resiatance (**Rl**)	=	*Lead Resitance per kM*Length of Lead*	
	=	7*(200/1000)	
	=	**1.40** Ohm	
Calculation of LV CT Secondary Loop Resiatance (**Rloop**)	=	*Rct+Rl+Rb*	
	=	13+1.4+0.02	
	=	**14.4**	Ohm
Calculation of Stabilising Voltage(**Vstab**)	=	*Rloop*If*	
	=	14.42*(19245.01/(4000/1))	
	=	69.38	V
	≈	**70**	V
By considering a margin of 50% for Field measurements,			
Vstab	=	**105**	V

The magnetizing curve of the CT is assumed to be linear. The magnetizing current at the stabilizing voltage can be estimated as:

Calculation of Magnetising Current @Vstab (**Imstab**)	=	*(Vstab/Vk)*Im*	
	=	(105/500)*(0.03)	
	=	**6.300**	mA

To obtain adequate protection stability,of the sum of magnetizing currents of all connected CTs.
the setting current **Irs** must be at the minimum of the sum of magnetizing currents of all connected CTs

Number of CT's	=	**4**	
Calculation Sum of Magnetising Current (**Imsum**)	=	*No.of Ct's*Imstab*	
	=	4*6.3	
	=	**25.20**	mA
Relay setting should be greater than **Imsum**.			
Adopted Setting for realy (**Irs**)	=	10	% of FLC
	=	0.07	A
With safety marging	=	**0.10**	A

Selected relay setting 100mA is greater than 25.2mA

The resistance of the stabilizing resistor is calculated as follows

Calculation of Stabilising Resistor (**Rstab**)	=	*Vstab/Irs*	
	=	105/(0.1)	
	=	**1050**	Ohm

Thermal Rating of stabilising resistor:

Calculation of Power Rating of Stabilising Resistor (**Pstab**)	=	$Vk^2/(Rstab*10)$	
	=	600^2/(1050*10)	
	=	**34.286**	W
Half Second Power Rating (Phalf)	=	Vf^2/Rstab	
	=	**3362.6**	W

Residual overcurrent protection, four steps: EF4PTOC

HV STAND BY EARTH FAULT PROTECTION 51NS

CT Ratio / Base Current	=	1000	/ 1A
Full load current	=	476.33	A
Fault Current	=	3175.53	A
Direction mode of step-1	=	Non-Directional	
Pickup Current	=	200	A
Operate Level of Step-1	=	0.20	%IB
TMS	=	0.25	
Operating Characteristics of Step-1	=	IEC Normal Inverse	

LV-1 & LV-2 STAND BY EARTH FAULT PROTECTION 51NS

CT Ratio / Base Current	=	4000	/ 1A
Full load current	=	2886.84	A
Fault Current	=	19245.60	A
Direction mode of step-1	=	Non-Directional	
Pickup Current	=	1000	A
Operate Level of Step-1	=	0.25	%IB
TMS	=	0.20	
Operating Characteristics of Step-1	=	IEC Normal Inverse	

Disabled all other steps:

Stand-by earth fault settings values revised here from customer comments, HV it is coming-42% and LV- 35% of full load current of the Transformer, both are looking high and not recommended.

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
TRM_40						
NAMECH1		CH1(I)			16 characters	
ChannelType1		Off				
RatedTrans1		1.0	A	0.1	300.0	
CTStarPoint1		ToObject				
CTsec1		1	A	1	10	
CTprim1		1000	A	1	99999	
NAMECH2		CH2(I)			16 characters	
ChannelType2		Off				
RatedTrans2		1.0	A	0.1	300.0	
CTStarPoint2		ToObject				
CTsec2		1	A	1	10	
CTprim2		1000	A	1	99999	
NAMECH3		CH3(I)			16 characters	
ChannelType3		Off				
RatedTrans3		1.0	A	0.1	300.0	
CTStarPoint3		ToObject				
CTsec3		1	A	1	10	
CTprim3		1000	A	1	99999	
NAMECH4		CH4(I)			16 characters	
ChannelType4		Off				
RatedTrans4		1.0	A	0.1	300.0	
CTStarPoint4		ToObject				
CTsec4		1	A	1	10	
CTprim4		3150	A	1	99999	
NAMECH5		CH5(I)			16 characters	
ChannelType5		Off				
RatedTrans5		1.0	A	0.1	300.0	
CTStarPoint5		ToObject				
CTsec5		1	A	1	10	
CTprim5		3150	A	1	99999	
NAMECH6		CH6(I)			16 characters	
ChannelType6		Off				
RatedTrans6		1.0	A	0.1	300.0	
CTStarPoint6		ToObject				
CTsec6		1	A	1	10	
CTprim6		3150	A	1	99999	
NAMECH7		CH7(I)			16 characters	
ChannelType7		Off				
RatedTrans7		1.0	A	0.1	300.0	
CTStarPoint7		ToObject				
CTsec7		1	A	1	10	
CTprim7		3150	A	1	99999	
NAMECH8		CH8(I)			16 characters	

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
ChannelType8		Off				
RatedTrans8		1.0	A	0.1	300.0	
CTStarPoint8		ToObject				
CTsec8		1	A	1	10	
CTprim8		3150	A	1	99999	
NAMECH9		CH9(I)			16 characters	
ChannelType9		Off				
RatedTrans9		1.0	A	0.1	300.0	
CTStarPoint9		ToObject				
CTsec9		1	A	1	10	
CTprim9		3150	A	1	99999	
NAMECH10		CH10(U)			16 characters	
ChannelType10		Off				
RatedTrans10		1.0	V	0.1	300.0	
VTsec10		110.000	V	0.001	999.999	
VTprim10		33.00	kV	0.05	2000.00	
NAMECH11		CH11(U)			16 characters	
ChannelType11		Off				
RatedTrans11		1.0	V	0.1	300.0	
VTsec11		110.000	V	0.001	999.999	
VTprim11		33.00	kV	0.05	2000.00	
NAMECH12		CH12(U)			16 characters	
ChannelType12		Off				
RatedTrans12		1.0	V	0.1	300.0	
VTsec12		110.000	V	0.001	999.999	
VTprim12		33.00	kV	0.05	2000.00	

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
TRM_41						
NAMECH1		CH1(I)			16 characters	
ChannelType1		Off				
RatedTrans1		1.0	A	0.1	300.0	
CTStarPoint1		ToObject				
CTsec1		1	A	1	10	
CTprim1		3150	A	1	99999	
NAMECH2		CH2(I)			16 characters	
ChannelType2		Off				
RatedTrans2		1.0	A	0.1	300.0	
CTStarPoint2		ToObject				
CTsec2		1	A	1	10	
CTprim2		3150	A	1	99999	
NAMECH3		CH3(I)			16 characters	
ChannelType3		Off				
RatedTrans3		1.0	A	0.1	300.0	
CTStarPoint3		ToObject				
CTsec3		1	A	1	10	
CTprim3		3150	A	1	99999	
NAMECH4		CH4(I)			16 characters	
ChannelType4		Off				
RatedTrans4		1.0	A	0.1	300.0	
CTStarPoint4		ToObject				
CTsec4		1	A	1	10	
CTprim4		3150	A	1	99999	
NAMECH5		CH5(I)			16 characters	
ChannelType5		Off				
RatedTrans5		1.0	A	0.1	300.0	
CTStarPoint5		ToObject				
CTsec5		1	A	1	10	
CTprim5		3150	A	1	99999	
NAMECH6		CH6(I)			16 characters	
ChannelType6		Off				
RatedTrans6		1.0	A	0.1	300.0	
CTStarPoint6		ToObject				
CTsec6		1	A	1	10	
CTprim6		3150	A	1	99999	
NAMECH7		CH7(I)			16 characters	
ChannelType7		Off				
RatedTrans7		1.0	A	0.1	300.0	
CTStarPoint7		ToObject				
CTsec7		1	A	1	10	
CTprim7		1000	A	1	99999	
NAMECH8		CH8(I)			16 characters	

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
ChannelType8		Off				
RatedTrans8		1.0	A	0.1	300.0	
CTStarPoint8		ToObject				
CTsec8		1	A	1	10	
CTprim8		4000	A	1	99999	
NAMECH9		CH9(I)			16 characters	
ChannelType9		Off				
RatedTrans9		1.0	A	0.1	300.0	
CTStarPoint9		ToObject				
CTsec9		1	A	1	10	
CTprim9		33	A	1	99999	
NAMECH10		CH10(U)			16 characters	
ChannelType10		Off				
RatedTrans10		1.0	V	0.1	300.0	
VTsec10		110.000	V	0.001	999.999	
VTprim10		33.00	kV	0.05	2000.00	
NAMECH11		CH11(U)			16 characters	
ChannelType11		Off				
RatedTrans11		1.0	V	0.1	300.0	
VTsec11		110.000	V	0.001	999.999	
VTprim11		33.00	kV	0.05	2000.00	
NAMECH12		CH12(U)			16 characters	
ChannelType12		Off				
RatedTrans12		1.0	V	0.1	300.0	
VTsec12		110.000	V	0.001	999.999	
VTprim12		33.00	kV	0.05	2000.00	

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
Global base values						
GBASVAL: 1						
UBase		400.00	kV	0.05	2000.00	
IBase		476	A	1	99999	
SBase		330.00	MVA	1.00	200000.00	
GBASVAL: 2						
UBase		33.00	kV	0.05	2000.00	
IBase		2886	A	1	99999	
SBase		165.00	MVA	1.00	200000.00	
GBASVAL: 3						
UBase		400.00	kV	0.05	2000.00	
IBase		1000	A	1	99999	
SBase		692.80	MVA	1.00	200000.00	
GBASVAL: 4						
UBase		33.00	kV	0.05	2000.00	
IBase		3150	A	1	99999	
SBase		180.00	MVA	1.00	200000.00	
GBASVAL: 5						
UBase		400.00	kV	0.05	2000.00	
IBase		1000	A	1	99999	
SBase		692.80	MVA	1.00	200000.00	
GBASVAL: 6						
UBase		33.00	kV	0.05	2000.00	
IBase		4000	A	1	99999	
SBase		228.60	MVA	1.00	200000.00	
GBASVAL: 7						
UBase		220.00	kV	0.05	2000.00	
IBase		1000	A	1	99999	
SBase		400.00	MVA	1.00	200000.00	
GBASVAL: 8						
UBase		220.00	kV	0.05	2000.00	
IBase		1000	A	1	99999	
SBase		400.00	MVA	1.00	200000.00	
GBASVAL: 9						
UBase		220.00	kV	0.05	2000.00	
IBase		1000	A	1	99999	
SBase		400.00	MVA	1.00	200000.00	
GBASVAL: 10						
UBase		220.00	kV	0.05	2000.00	
IBase		1000	A	1	99999	
SBase		400.00	MVA	1.00	200000.00	
GBASVAL: 11						
UBase		220.00	kV	0.05	2000.00	
IBase		1000	A	1	99999	

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
SBase		400.00	MVA	1.00	200000.00	
GBASVAL: 12						
UBase		220.00	kV	0.05	2000.00	
IBase		1000	A	1	99999	
SBase		400.00	MVA	1.00	200000.00	

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
DisturbanceReport						
DRPRDRE: 1						
Operation		On				
COMTRADEFormat		2013(Float32)				
PreFaultRecT		0.50	s	0.05	9.90	
PostFaultRecT		2.5	s	0.1	10.0	
TimeLimit		3.0	s	0.5	10.0	
PostRetrig		On				
ZeroAngleRef		1	Ch	1	40	
SetInfoInDRep		Disable				
OpModeTest		Off				

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
DIFF_PROTN						
Differential protection						
TransformerDiff3Wind(87T,3Id/I>)						
TRAFO_DIFF_PROTN; T3WPDIF: 1						
GlobalBaseSelW1		1		1	12	
GlobalBaseSelW2		2		1	12	
GlobalBaseSelW3		2		1	12	
ConnectTypeW1		WYE (Y)				
ConnectTypeW2		WYE (Y)				
ConnectTypeW3		WYE (Y)				
ClockNumberW2		0 [0 deg]				
ClockNumberW3		0 [0 deg]				
ZSCurrSubtrW1		On				
ZSCurrSubtrW2		On				
ZSCurrSubtrW3		On				
TconfigForW1		Yes				
CT1RatingW1		1000	A	1	99999	
CT2RatingW1		1000	A	1	99999	
TconfigForW2		Yes				
CT1RatingW2		3150	A	1	99999	
CT2RatingW2		3150	A	1	99999	
TconfigForW3		Yes				
CT1RatingW3		3150	A	1	99999	
CT2RatingW3		3150	A	1	99999	
LocationOLTC1		Not Used				
LocationOLTC2		Not Used				
Setting Group1						
Operation		On				
SOTFMode		Off				
IDiffAlarm		0.15	IB	0.05	1.00	
tAlarmDelay		1.000	s	0.000	60.000	
IdMin		0.20	IB	0.10	0.60	
EndSection1		1.25	IB	0.20	1.50	
EndSection2		3.00	IB	1.00	10.00	
SlopeSection2		40.0	%	10.0	50.0	
SlopeSection3		80.0	%	30.0	100.0	
IdUnre		9.00	IB	1.00	100.00	
I2/I1Ratio		15.0	%	5.0	100.0	
I5/I1Ratio		25.0	%	5.0	100.0	
CrossBlockEn		On				
NegSeqDiffEn		Off				
OpenCTEnable		Off				

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
REF_PROTN						
Differential protection						
HighImpDifferential(87,I>)						
LV1_REF; HZPDIF: 1						
Setting Group1						
Operation		On				
U>Alarm		70	V	5	500	
tAlarm		5.000	s	0.000	60.000	
U>Trip		105	V	10	900	
SeriesResistor		1050	Ohm	50	20000	

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
ResidualOverCurr4Step(51N_67N,4(IN>))						
HV_SEF; EF4PTOC: 1						
General						
GlobalBaseSel		5		1	12	
SeqTypeIDir		Zero seq				
SeqTypeIPol		Zero seq				
SeqTypeUPol		Zero seq				
Setting Group1						
Operation		On				
EnDir		Disable				
2ndHarmStab		20	%	5	100	
BlkParTransf		Off				
SOTF		Off				
EnPhaseSel		Off				
Step 1						
Setting Group1						
DirMode1		Non-directional				
Characterist1		IEC Norm. inv.				
IN1>		20	%IB	1	2500	
IN1>Max		100	%IB	1	2500	
IN1>Min		10	%IB	1	2500	
t1		0.000	s	0.000	60.000	
k1		0.25		0.01	999.00	
IMin1		20.00	%IB	1.00	2000.00	
t1Min		0.000	s	0.000	60.000	
IN1Mult		1.0		1.0	10.0	
ResetTypeCrv1		Instantaneous				
tReset1		0.020	s	0.000	60.000	
HarmBlock1		On				
Step 2						
Setting Group1						
DirMode2		Off				
Step 3						
Setting Group1						
DirMode3		Off				
Step 4						
Setting Group1						
DirMode4		Off				
LV2_SEF; EF4PTOC: 2						
General						
GlobalBaseSel		6		1	12	
SeqTypeIDir		Zero seq				
SeqTypeIPol		Zero seq				

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
SeqTypeUPol		Zero seq				
Setting Group1						
Operation		On				
EnDir		Disable				
2ndHarmStab		20	%	5	100	
BlkParTransf		Off				
SOTF		Off				
EnPhaseSel		Off				
Step 1						
Setting Group1						
DirMode1		Non-directional				
Characterist1		IEC Norm. inv.				
IN1>		25	%IB	1	2500	
IN1>Max		100	%IB	1	2500	
IN1>Min		20	%IB	1	2500	
t1		0.000	s	0.000	60.000	
k1		0.20		0.01	999.00	
IMin1		25.00	%IB	1.00	2000.00	
t1Min		0.000	s	0.000	60.000	
IN1Mult		1.0		1.0	10.0	
ResetTypeCrv1		Instantaneous				
tReset1		0.020	s	0.000	60.000	
HarmBlock1		On				
Step 2						
Setting Group1						
DirMode2		Off				
Step 3						
Setting Group1						
DirMode3		Off				
Step 4						
Setting Group1						
DirMode4		Off				

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
ThermalOverload(26,θ>)						
LCPTTR: 1						
GlobalBaseSel		1		1	12	
Setting Group1						
Operation		On				
TRef		90	Deg C	0	300	
IRef		120	%IB	10	400	
IMult		1		1	5	
Tau		45	Min	1	1000	
AlarmTemp		90	Deg C	0	200	
TripTemp		100	Deg C	0	300	
ReclTemp		80	Deg C	0	300	
tPulse		0.10	s	0.05	0.30	
AmbiSens		Off				
DefaultAmbTemp		40	Deg C	-50	100	
DefaultTemp		50	Deg C	-50	300	

General data

Relay Details

Relay Model Ref	=	RET670
Relay Frequency	=	50
Ordering Code	=	670*2.2.1

Bay Details

Bay Name	=	Trafo-1, 2
Bay Reference	=	400/33/33kV TRANSFORMER C&R PANEL

Transformer Details

Rated Power	=	330.0	/	165.0	/ 165.0	MVA
Voltage Ratio	=	400	/	33	/ 33	kV
Normal Tap No Load Voltage OLTC1	=	400	kV			
Vector Group	=	YNa0yn0				
% Impedance at 75°c	=	15.0	(at 165 MVA base)			
Frequency:	=	50	Hz			

HV Winding (W1) Detail

CT ratio	=	2000-1000-500/1			
CT ratio - Adopted	=	1000	/	1	A
CT Class	=	PS			
Rated Power	=	330			MVA
Rated Voltage	=	400			kV
CTStarPoint	=	To Object			

MV Winding (W2) Detail

CT ratio	=	4000/1			
CT ratio - Adopted	=	4000	/	1	A
CT Class	=	PS			
Rated Power	=	165			MVA
Rated Voltage	=	33.00			kV
CTStarPoint	=	To Object			

LV Winding (W3) Detail

CT ratio	=	4000/1			
CT ratio - Adopted	=	4000	/	1	A
CT Class	=	PS			
Rated Power	=	165			MVA
Rated Voltage	=	33			kV
CTStarPoint	=	To Object			

Rated Current

HV	=	Rated Power / ((√3) * Rated Voltage)
	=	(330x 10^6) / ((√3) x 400 x 10^3)
	=	476 A
MV	=	Rated Power / ((√3) * Rated Voltage
	=	(330x 10^6) / ((√3) x 33 x 10^3)
	=	2887 A
LV	=	Rated Power / ((√3) * Rated Voltage
	=	(165x 10^6) / ((√3) x 33 x 10^3)
	=	2887 A

Global Base Values GBASVAL

GBASVAL:1 (HV Rated current)

Ubase	=	400	kV
Ibase	=	476	A
Sbase	=	330.0	MVA

GBASVAL:2 (LV Rated current)

Ubase	=	33	kV
Ibase	=	2886.8	A
Sbase	=	165.0	MVA

GBASVAL:3 (HV CT Ratio)

Ubase	=	400.0	kV
Ibase	=	1000	A
Sbase	=	692.8	MVA

GBASVAL:4 (LV CT Ratio)

Ubase	=	33	kV
Ibase	=	4000	A
Sbase	=	228.6	MVA

GBASVAL:5 (HV SEF)

Ubase	=	400.0	kV
Ibase	=	1000	A
Sbase	=	692.8	MVA

GBASVAL:6 (LV CT ratio- REF/SEF)

Ubase	=	33	kV
Ibase	=	4000	A
Sbase	=	228.6	MVA

Transformer differential protection:T3WPDIF 87T (Transformer Differential)

HV Bushing CTR-1000/1
LV Bushing CTR-4000/1

A. Setting of minimum differential operating current

The basic setting defines the pick-up setting of the differential protection for internal faults. The lowest possible value should be chosen to enable it to detect the worst-case faults. However, there can be small differential current during normal operation, which may result in tripping.

To assure that the load current does not cause unwanted operation, IdMin is set based on the calculation below.

Differential curent error at rated load current in different tap positions

Tap Position	I_{HV}	$I_{LV}+I_{MV}$	I_{DIFF}	%Error in Ibase
9	476.3	5773.7	476.33 - (5773.68 * (33 / 400)) =0.0014	0.000
1	433.0	5773.7	433.03 - (5773.68 * (33 / 400)) =-43.2986	-9.090
17	529.3	5773.7	529.25 - (5773.68 * (33 / 400)) =52.9214	11.110

Maximum error due to OLTC (at tap 17 the Rated Current)	=	11.110	%
CT Error (HV & LV Assumed)	=	5	%
Relay Error (As per technical data of the relay)	=	1	%
Total Error (In terms of % of the rated current of the transformer)	=	11.11 + 5 + 1	
	=	17.110	%

Based on the above considered criteria the selected Idmin value as follows:

IdMin	=	**20**	**%**
IdMin	=	0.20	*Ibase
Ibase	=	476	A

B. Setting of cross-over point between slope 1 and slope 2

This section corresponds to normal load currents - upto the max. values of normal load currents. Here, the setting of diiferential current corresponds to Idmin i.e. basic differential current setting which determines the pickup of the relay. As per the recommendation of the relay manual, the same setting is selected as default - Restraint current upto 125% of the base current.

EndSection1 = 1.25 Ibase

setting is selected as default - 40%

SlopeSection2 = 40% *Ibias

D. Setting of cross-over point between slope 2 and slope 3

The section corresponds to currents above normal load currents, and to provide stability for high-resistive faults under heavy load conditions.

EndSection2	=	3	Ibase
Idiff Value at End Section 2	=	SlopeSection2 x EndSection2	
	=	0.9	

E. Setting of slope 2 stabilisation

This is higher % bias setting applied for Restraint currents above End section 2 - to provide stability for heavy through fault currents.As per recommendation of relay manual, same setting is selected as default - 80%

SlopeSection3 = 80% *Ibias

F. Unrestrained operation level

As per the Application manual(AM) Unrestrained operation level has default value of IdUnre = 10pu, which is typically acceptable for most of standard power transformer applications. Hence the considered Setting of minimum differential operating current for unrestraint step

HV Through fault current = HV Full load currrent / % Impedance

= (476.33 / (15/100))
= 3175.53 A

Considering 120% of through fault = 3175.53 x 1.2
Current = 3810.636 A
= 8

Thus I dunre setting proposed = 9 *Ibase

G. Setting the operation of Cross Blocking logic

The meaning of Cross-blocking is that the 2nd and 5th harmonic blocking in one phase will also block the differential function in other phases.

OpCrossBlock = On

H.Set the second and fifth harmonic stabilizing level when transformers are inside the zone

Setting considered as per Manual

I2/I1Ratio = 15 %
I5/I1Ratio = 25 %

I. Set the operation of Negative sequence differential protection!

NegSeqDiff - Negative sequence fault discriminator is an important compliment to the precentage restrained differential function. As it is directional, it can distinguish between external and internal faults; also at difficult conditions such as CT saturation.

OpNegSeqDiff = Off

J. Setting of minimum negative sequence differential current level

The negative seuqence currents are compared if above the set threshold value IminNegSeq. If either these sums is below the threshold, no comparision is made. Neither internal, nor external fault will be declared in this case. As per Relay manual recommendation, default value of 0.04xIbase can be used if no special account. considerations such as e.g. extremely week sources must be taken into

IMinNegSeq = 0.04 *Ibase As per Manual

K. Setting of the Relay operating angles.

This is the setting of the relay operating angle of the negative sequence Ibased internal / external fault discriminator. The directional test is made such that, the phase angle of the sum of Local negative sequence currents is compared to the phase angle of the sum of remote negative sequence currents. Ideally, the angle is 0 degree for internal faults and 180 degree for external faults.
However, considering for safety margin, because of errors caused by CT saturation as well as different phase angles of sources, we set the Relay operate angle setting to 60 degrees default.

NegSeqROA = 60 As per Manual

Restrained differential function characteristic

As per the Manual

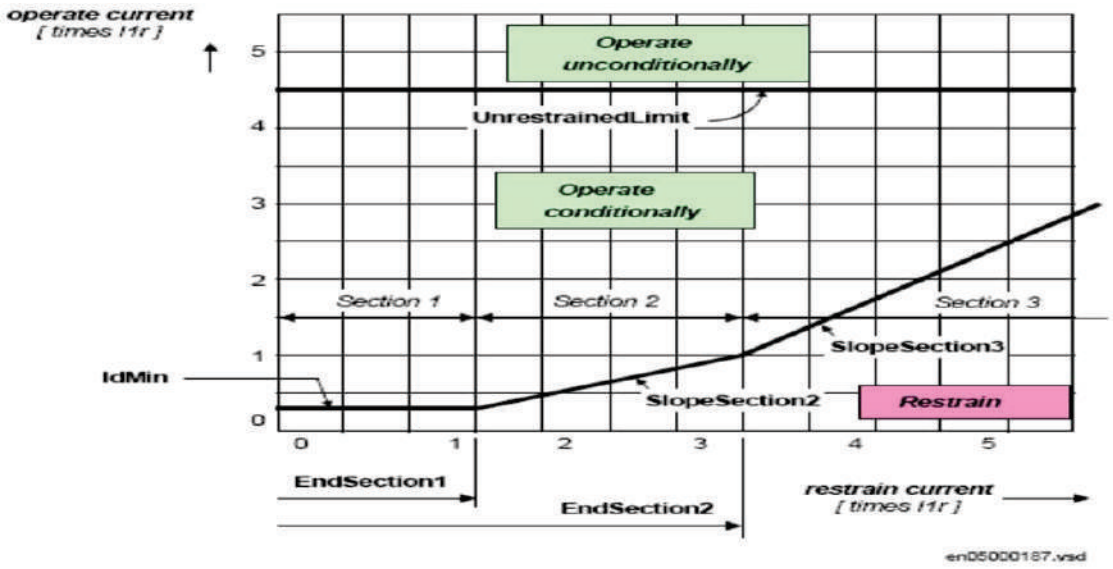
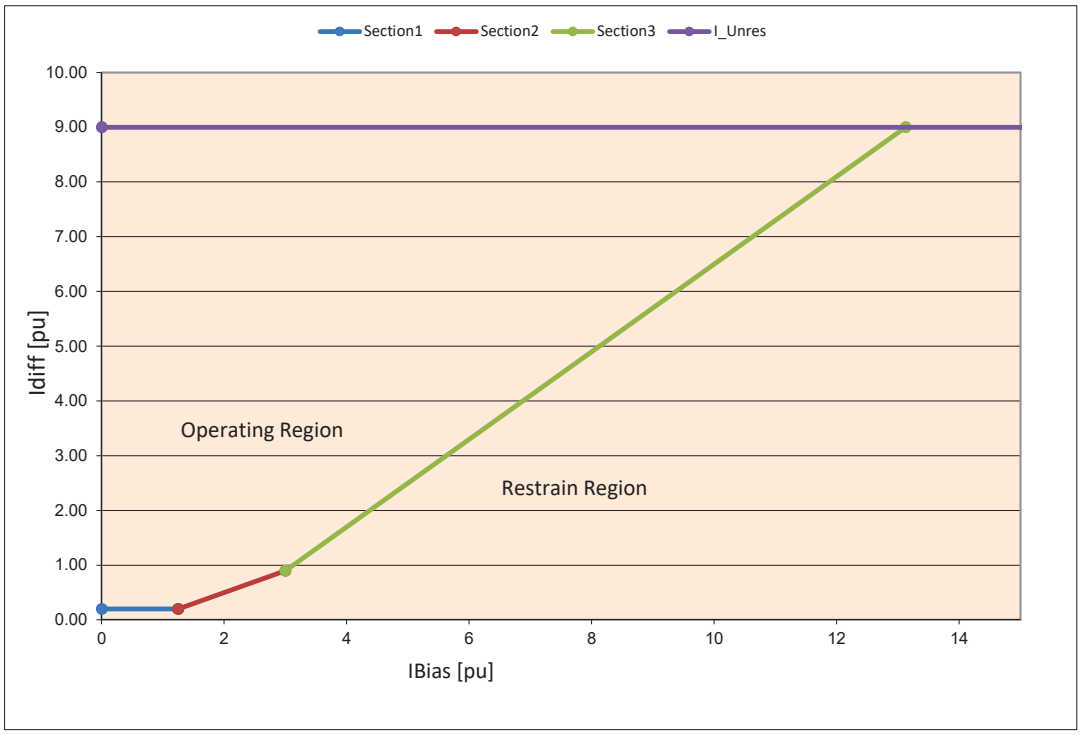


Figure 44: Description of the restrained-, and the unrestrained operate characteristics

Adopted Curve



Directional phase overcurrent protection, four steps: OC4PTOC

Settings recommended :

CT Ratio / Base Current	=	1000	/1A
Full load Current	=	476.33	A
Fault Current	=	3285.03	A
Direction mode of step-1	=	Non-Directional	
Operating Current	=	600	A
Phase Overcurrent Operate Level of Step-1	=	60	%IB
Required Operating time	=	1.00	s
Time multiplier of Step-1	=	0.25	s
Operating Characteristics of Step-1	=	IEC Normal Inverse	
Direction mode of step-2	=	Non-Directional	
Operating Current	=	3500	A
Phase Overcurrent Operate Level of Step-2	=	350	%IB
Definte Time Delay of Step-2	=	0.15	s
Operating Characteristics of Step-2	=	IEC Def. Time	
Disabled all other steps:			
Direction mode of step-3	=	Off	
Direction mode of step-4	=	Off	

Note: Operating current, TMS and trip time delay values are revised as per customer comments

Directional residual overcurrent protection, four steps: EF4PTOC

Settings recommended :

CT Ratio / Base Current	=	1000	/1A
Full load Current	=	476.33	A
Fault Current	=	3285.03	A
Direction mode of step-1	=	Non-Directional	
Operating Current	=	100	A
Phase Overcurrent Operate Level of Step-1	=	10.00	%IB
Required Operating time	=	0.57	s

Note: The IDMT curve shall saturate if the fault current more than 20 times of pickup current. 20 times of set current considered for TMS calculation.

Fault Current considered	=	1905.3	A
Time Multiplier Setting K	=	(Treq*(IF/Is)^0.02-1)/0.14	
Time multiplier of Step-1	=	0.25	s
Operating Characteristics of Step-1	=	IEC Normal Inverse	
Direction mode of step-2	=	Non-Directional	
Operating Current	=	1500	A
Residual Overcurrent Operate Level of Step-2	=	150	%IB
Definte Time Delay of Step-2	=	0.15	s
Operating Characteristics of Step-2	=	IEC Def. Time	

Disabled all other steps:

Direction mode of step-3	=	Off	
Direction mode of step-4	=	Off	

Note: Operating current, TMS and trip time delay values are revised as per customer comments

Setting of two step Under-voltage protection function (UV2PTUV) (Only for Alarm not for tripping)

The two-step Undervoltage function is used for supervision and detection of abnormal conditions.

Activation of the Under-voltage function

Operation = On

ConnType:

Sets whether the measurement shall be phase to earth fundamental value (PhG), phase to phase fundamental value (PhPh), phase to earth RMS value (PhG RMS) or phase to phase RMS value (PhPh RMS).

Selected setting for ConnType = PhN DFT

Setting of the Base voltage level on which the voltage settings are based

Ubase = 400 kV

Setting of parameters for stage1

OperationStep1	=	On	
Selected setting for Characterist1	=	Definite Time	
Selected setting for OpMode1	=	1out of 3	
Selected setting for U1<	=	90	%Ubase
Selected setting for def.time delay t1	=	0.00	Sec

Setting of two step Over-voltage protection function (OV2PTOV)

The two-step overvoltage function is used for supervision and detection of abnormal conditions.

Activation of the over-voltage function

ConnType:

Sets whether the measurement shall be phase to earth fundamental value (PhG), phase to phase fundamental value (PhPh), phase to earth RMS value (PhG RMS) or phase to phase RMS value (PhPh RMS).

Selected setting for ConnType = PhN DFT

Setting of the Base voltage level on which the voltage settings are based

Ubase = 400

Setting of parameters for stage1 (For Alarm)

OperationStep1	=	On	
Selected setting for Characterist1	=	Definite Time	
Selected setting for OpMode1	=	1out of 3	
Selected settin Fuse Failure Supervision	=	110	%Ubase
Selected setting for def.time delay t1	=	5.00	Sec

Setting of parameters for stage2 (For Trip)

OperationStep2	=	On	
Selected setting for Characterist2	=	Definite Time	
Selected setting for OpMode2	=	1out of 3	
Selected setting for U2>	=	140	%Ubase
Selected setting for def. time delay t2	=	0.10	Sec

HV High Impedance Restricted Earth Fault Protection:-

Transformer Details

Power Rating	=	330	MVA	
HV Voltage Rating	=	400	kV	
HV Neutral Grounding Type	=	Solid		
% Impedance	=	15.00	%	
Full load Current	=	476.33	A	

Phase Side CT Details:

CT Ratio	=	1000/1	A	
CT Adoptted Primary Rating	=	1000	A	
CT Secondary Rating	=	1	A	
CT Resistance	=	3.5	Ohm	
CT Knee Point Voltage	=	300	V	
CT Magnetising Current @Vk	=	30	mA	

Neutral Side CT Details:

CT Ratio	=	1000/1	A	
CT Adoptted Primary Rating	=	1000	A	
CT Secondary Rating	=	1	A	
CT Resistance	=	3.5	Ohm	
CT Knee Point Voltage	=	300	V	
CT Magnetising Current @Vk	=	30.00	mA	

HV Side Lead Resistance Details:

Lead Resistance at 75^0 C /kM	=	7	Ohm/kM	(Assumed)
Length of Lead of two path (Wire loop length across CT to Relay)	=	200	Meter	

Relay Details

Relay Type	=	RET670		
Relay Burden	=	0.02	VA	
Relay Order Code	=	-		
Relay Serial No	=	0		

REF Pickup Setting

REF Function	=	On		
Relay Pickup Setting	=	10	%	

Calculations:

Calculation of Fault MVA (**Sf**)	=	*MVA/%Impedance*		
	=	(330)/(15/100)		
	=	**2200**	MVA	
Calculation of Fault Current (**If**)	=	*(Sf*1000)/(√3*kV)*		
	=	(2200*1000)/(1.732*400)		
	=	**3175.4**	A	

Calculation of HV Lead Resiatance (**Rl**)	=	*Lead Resitance per kM*Length of Lead*	
	=	7*(200/1000)	
	=	**1.40** Ohm	
Calculation of HV CT Secondary Loop Resiatance (**Rloop**)	=	*Rct+Rl+Rb*	
	=	3.5+1.4+0.02	
	=	**4.92**	Ohm
Calculation of Stabilising Voltage(**Vstab**)	=	*Rloop*If*	
	=	4.92*(3175.43/(1000/1))	
	=	15.62	V
	≈	**16**	V
By considering a margin of 85% for Field measurements,			
Vstab	=	**30**	V

The magnetizing curve of the CT is assumed to be linear. The magnetizing current at the stabilizing voltage can be estimated as:

Calculation of Magnetising Current @Vstab (**Imstab**)	=	*(Vstab/Vk)*Im*	
	=	(30/300)*(0.03)	
	=	**3.000**	mA

To obtain adequate protection stability,of the sum of magnetizing currents of all connected CTs.
the setting current **Irs** must be at the minimum of the sum of magnetizing currents of all connected CTs

Number of CT's	=	**4**	
Calculation Sum of Magnetising Current (**Imsum**)	=	*No.of Ct's*Imstab*	
	=	4*3	
	=	**12.00**	mA

Relay setting should be greater than **Imsum**.

Adopted Setting for realy (**Irs**)	=	10	%
	=	**0.05**	A

Selected relay setting 50mA is greater than 12mA

The resistance of the stabilizing resistor is calculated as follows

Calculation of Stabilising Resistor (**Rstab**)	=	*Vstab/Irs*	
	=	30/(0.05)	
	=	**600**	Ohm

Thermal Rating of stabilising resistor:

Calculation of Power Rating of Stabilising Resistor (**Pstab**)	=	$Vk^2/(Rstab*10)$	
	=	600^2/(600*10)	
	=	**60**	W
Half Second Power Rating (Phalf)	=	Vf^2/Rstab	
	=	**1806.9**	W

LV2 High Impedance Restricted Earth Fault Protection:- 33 kV

Transformer Details

Power Rating	=	165	MVA	
MV Voltage Rating	=	33	kV	
MV Neutral Grounding Type	=	Solid		
% Impedance	=	15.00	%	
Full load Current	=	2886.8	A	

LV Side CT Details:

CT Ratio	=	4000/1	A	
CT Adoptted Primary Rating	=	4000	A	
CT Secondary Rating	=	1	A	
CT Resistance	=	13.0	Ohm	
CT Knee Point Voltage	=	500	V	
CT Magnetising Current @Vk	=	30	mA	

LV Neutral Side CT Details:

CT Ratio	=	4000/1	A	
CT Adoptted Primary Rating	=	4000	A	
CT Secondary Rating	=	1	A	
CT Resistance	=	13.0	Ohm	
CT Knee Point Voltage	=	500	V	
CT Magnetising Current @Vk	=	30	mA	

LV Side Lead Resistance Details:

Lead Resistance at 75^0 C /kM	=	7	Ohm/kM	(Assumed)
Length of Lead of two path (Wire loop length across CT to Relay)	=	200	Meter	

Relay Details

Relay Type	=	RET670		
Relay Burden	=	0.02	VA	
Relay Order Code	=	-		
Relay Serial No	=	0		

REF Pickup Setting

REF Function	=	On		
Relay Pickup Setting	=	10	%	

Calculations:

Calculation of Fault MVA (**Sf**)	=	*MVA/%Impedance*		
	=	(165)/(15/100)		
	=	**1100**	MVA	
Calculation of Fault Current (**If**)	=	*(Sf*1000)/(√3*kV)*		
	=	(1100*1000)/(1.732*33)		
	=	**19245**	A	

Calculation of LV Lead Resistance (**Rl**)	=	*Lead Resitance per kM*Length of Lead*	
	=	7*(200/1000)	
	=	**1.40** Ohm	
Calculation of LV CT Secondary Loop Resiatance (**Rloop**)	=	*Rct+Rl+Rb*	
	=	13+1.4+0.02	
	=	**14.4**	Ohm
Calculation of Stabilising Voltage(**Vstab**)	=	*Rloop*If*	
	=	14.42*(19245.01/(4000/1))	
	=	69.38	V
	≈	**70**	V
By considering a margin of 50% for Field measurements,			
Vstab	=	**105**	V

The magnetizing curve of the CT is assumed to be linear. The magnetizing current at the stabilizing voltage can be estimated as:

Calculation of Magnetising Current @Vstab (**Imstab**)	=	*(Vstab/Vk)*Im*	
	=	(105/500)*(0.03)	
	=	**6.300**	mA

To obtain adequate protection stability,of the sum of magnetizing currents of all connected CTs.
the setting current **Irs** must be at the minimum of the sum of magnetizing currents of all connected CTs

Number of CT's	=	**4**	
Calculation Sum of Magnetising Current (**Imsum**)	=	*No.of Ct's*Imstab*	
	=	4*6.3	
	=	**25.20**	mA

Relay setting should be greater than **Imsum**.

Adopted Setting for realy (**Irs**)	=	10	%
	=	**0.07**	A
with safety margine	=	**0.10**	A

Selected relay setting 100mA is greater than 25.2mA

The resistance of the stabilizing resistor is calculated as follows

Calculation of Stabilising Resistor (**Rstab**)	=	*Vstab/Irs*	
	=	105/(0.1)	
	=	**1050**	Ohm

Thermal Rating of stabilising resistor:

Calculation of Power Rating of Stabilising Resistor (**Pstab**)	=	$Vk^2/(Rstab*10)$	
	=	600^2/(1050*10)	
	=	**34.286**	W
Half Second Power Rating (Phalf)	=	Vf^2/Rstab	
	=	**3362.6**	W

Residual overcurrent protection, four steps: EF4PTOC

LV-1 STAND BY EARTH FAULT PROTECTION 51NS

CT Ratio / Base Current	=	4000	/1A
Full load Current	=	2886.84	A
Fault Current	=	19245.60	A
Direction mode of step-1	=	Non-Directional	
Operating Current	=	1000	A
Phase Overcurrent Operate Level of Step-1	=	25.00	%Ib
TMS	=	0.20	
Operating Characteristics of Step-1	=	IEC Normal Inverse	

Disabled all other steps:

Stand-by earth fault settings values revised here from customer comments, LV it is coming-35% of full load current of the Transformer, it is looking high and not recommended.

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
TRM_40						
NAMECH1		HV_MN+TIE_CT_RPH			16 characters	
ChannelType1		CurrentProtection				
RatedTrans1		1.0	A	0.1	300.0	
CTStarPoint1		ToObject				
CTsec1		1	A	1	10	
CTprim1		1000	A	1	99999	
NAMECH2		HV_MN+TIE_CT_YPH			16 characters	
ChannelType2		CurrentProtection				
RatedTrans2		1.0	A	0.1	300.0	
CTStarPoint2		ToObject				
CTsec2		1	A	1	10	
CTprim2		1000	A	1	99999	
NAMECH3		HV_MN+TIE_CT_BPH			16 characters	
ChannelType3		CurrentProtection				
RatedTrans3		1.0	A	0.1	300.0	
CTStarPoint3		ToObject				
CTsec3		1	A	1	10	
CTprim3		1000	A	1	99999	
NAMECH4		HV_NCT_64R			16 characters	
ChannelType4		CurrentProtection				
RatedTrans4		1.0	A	0.1	300.0	
CTStarPoint4		ToObject				
CTsec4		1	A	1	10	
CTprim4		1000	A	1	99999	
NAMECH5		LV2_NCT_64R			16 characters	
ChannelType5		CurrentProtection				
RatedTrans5		1.0	A	0.1	300.0	
CTStarPoint5		ToObject				
CTsec5		1	A	1	10	
CTprim5		4000	A	1	99999	
NAMECH6		LV1_NCT_SBEF			16 characters	
ChannelType6		CurrentProtection				
RatedTrans6		1.0	A	0.1	300.0	
CTStarPoint6		ToObject				
CTsec6		1	A	1	10	
CTprim6		4000	A	1	99999	
NAMECH7		HV_BCT_RPH			16 characters	
ChannelType7		CurrentProtection				
RatedTrans7		1.0	A	0.1	300.0	
CTStarPoint7		ToObject				
CTsec7		1	A	1	10	

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
CTprim7		1000	A	1	99999	
NAMECH8		HV_BCT_YPH			16 characters	
ChannelType8		CurrentProtection				
RatedTrans8		1.0	A	0.1	300.0	
CTStarPoint8		ToObject				
CTsec8		1	A	1	10	
CTprim8		1000	A	1	99999	
NAMECH9		HV_BCT_BPH			16 characters	
ChannelType9		CurrentProtection				
RatedTrans9		1.0	A	0.1	300.0	
CTStarPoint9		ToObject				
CTsec9		1	A	1	10	
CTprim9		1000	A	1	99999	
NAMECH10		HV_SEL_VT_RPH			16 characters	
ChannelType10		Voltage				
RatedTrans10		110.0	V	0.1	300.0	
VTsec10		110.000	V	0.001	999.999	
VTprim10		400.00	kV	0.05	2000.00	
NAMECH11		HV_SEL_VT_YPH			16 characters	
ChannelType11		Voltage				
RatedTrans11		110.0	V	0.1	300.0	
VTsec11		110.000	V	0.001	999.999	
VTprim11		400.00	kV	0.05	2000.00	
NAMECH12		HV_SEL_VT_BPH			16 characters	
ChannelType12		Voltage				
RatedTrans12		110.0	V	0.1	300.0	
VTsec12		110.000	V	0.001	999.999	
VTprim12		400.00	kV	0.05	2000.00	

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
TRM_41						
NAMECH1		LV1_BCT_RPH			16 characters	
ChannelType1		CurrentProtection				
RatedTrans1		1.0	A	0.1	300.0	
CTStarPoint1		ToObject				
CTsec1		1	A	1	10	
CTprim1		4000	A	1	99999	
NAMECH2		LV1_BCT_YPH			16 characters	
ChannelType2		CurrentProtection				
RatedTrans2		1.0	A	0.1	300.0	
CTStarPoint2		ToObject				
CTsec2		1	A	1	10	
CTprim2		4000	A	1	99999	
NAMECH3		LV1_BCT_BPH			16 characters	
ChannelType3		CurrentProtection				
RatedTrans3		1.0	A	0.1	300.0	
CTStarPoint3		ToObject				
CTsec3		1	A	1	10	
CTprim3		4000	A	1	99999	
NAMECH4		LV2_BCT_RPH			16 characters	
ChannelType4		CurrentProtection				
RatedTrans4		1.0	A	0.1	300.0	
CTStarPoint4		ToObject				
CTsec4		1	A	1	10	
CTprim4		4000	A	1	99999	
NAMECH5		LV2_BCT_YPH			16 characters	
ChannelType5		CurrentProtection				
RatedTrans5		1.0	A	0.1	300.0	
CTStarPoint5		ToObject				
CTsec5		1	A	1	10	
CTprim5		4000	A	1	99999	
NAMECH6		LV2_BCT_BPH			16 characters	
ChannelType6		CurrentProtection				
RatedTrans6		1.0	A	0.1	300.0	
CTStarPoint6		ToObject				
CTsec6		1	A	1	10	
CTprim6		4000	A	1	99999	
NAMECH7		CH7(I)			16 characters	
ChannelType7		CurrentProtection				
RatedTrans7		1.0	A	0.1	300.0	
CTStarPoint7		ToObject				
CTsec7		1	A	1	10	
CTprim7		3000	A	1	99999	
NAMECH8		CH8(I)			16 characters	

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
ChannelType8		CurrentProtection				
RatedTrans8		1.0	A	0.1	300.0	
CTStarPoint8		ToObject				
CTsec8		1	A	1	10	
CTprim8		4000	A	1	99999	
NAMECH9		CH9(I)			16 characters	
ChannelType9		CurrentProtection				
RatedTrans9		1.0	A	0.1	300.0	
CTStarPoint9		ToObject				
CTsec9		1	A	1	10	
CTprim9		4000	A	1	99999	
NAMECH10		CH10(U)			16 characters	
ChannelType10		Voltage				
RatedTrans10		110.0	V	0.1	300.0	
VTsec10		110.000	V	0.001	999.999	
VTprim10		400.00	kV	0.05	2000.00	
NAMECH11		CH11(U)			16 characters	
ChannelType11		Voltage				
RatedTrans11		110.0	V	0.1	300.0	
VTsec11		110.000	V	0.001	999.999	
VTprim11		400.00	kV	0.05	2000.00	
NAMECH12		CH12(U)			16 characters	
ChannelType12		Voltage				
RatedTrans12		110.0	V	0.1	300.0	
VTsec12		110.000	V	0.001	999.999	
VTprim12		400.00	kV	0.05	2000.00	

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
Global base values						
GBASVAL: 1						
UBase		400.00	kV	0.05	2000.00	
IBase		476	A	1	99999	
SBase		330.00	MVA	1.00	200000.00	
GBASVAL: 2						
UBase		33.00	kV	0.05	2000.00	
IBase		2887	A	1	99999	
SBase		165.00	MVA	1.00	200000.00	
GBASVAL: 3						
UBase		400.00	kV	0.05	2000.00	
IBase		1000	A	1	99999	
SBase		692.80	MVA	1.00	200000.00	
GBASVAL: 4						
UBase		33.00	kV	0.05	2000.00	
IBase		4000	A	1	99999	
SBase		228.60	MVA	1.00	200000.00	
GBASVAL: 5						
UBase		400.00	kV	0.05	2000.00	
IBase		1000	A	1	99999	
SBase		228.60	MVA	1.00	200000.00	
GBASVAL: 6						
UBase		33.00	kV	0.05	2000.00	
IBase		4000	A	1	99999	
SBase		228.60	MVA	1.00	200000.00	
GBASVAL: 7						
UBase		220.00	kV	0.05	2000.00	
IBase		1000	A	1	99999	
SBase		400.00	MVA	1.00	200000.00	
GBASVAL: 8						
UBase		220.00	kV	0.05	2000.00	
IBase		1000	A	1	99999	
SBase		400.00	MVA	1.00	200000.00	
GBASVAL: 9						
UBase		220.00	kV	0.05	2000.00	
IBase		1000	A	1	99999	
SBase		400.00	MVA	1.00	200000.00	
GBASVAL: 10						
UBase		220.00	kV	0.05	2000.00	
IBase		1000	A	1	99999	
SBase		400.00	MVA	1.00	200000.00	
GBASVAL: 11						
UBase		220.00	kV	0.05	2000.00	
IBase		1000	A	1	99999	

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
SBase		400.00	MVA	1.00	200000.00	
GBASVAL: 12						
UBase		220.00	kV	0.05	2000.00	
IBase		1000	A	1	99999	
SBase		400.00	MVA	1.00	200000.00	

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
DisturbanceReport						
DRPRDRE: 1						
Operation		On				
COMTRADEFormat		2013(Float32)				
PreFaultRecT		0.50	s	0.05	9.90	
PostFaultRecT		2.5	s	0.1	10.0	
TimeLimit		3.0	s	0.5	10.0	
PostRetrig		On				
ZeroAngleRef		1	Ch	1	40	
SetInfoInDRep		Disable				
OpModeTest		Off				

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
DIFF_PROTN						
Differential protection						
TransformerDiff3Wind(87T,3Id/I>)						
TRAFO_DIFF_PROTN; T3WPDIF: 1						
GlobalBaseSelW1		1		1	12	
GlobalBaseSelW2		2		1	12	
GlobalBaseSelW3		2		1	12	
ConnectTypeW1		WYE (Y)				
ConnectTypeW2		WYE (Y)				
ConnectTypeW3		WYE (Y)				
ClockNumberW2		0 [0 deg]				
ClockNumberW3		0 [0 deg]				
ZSCurrSubtrW1		On				
ZSCurrSubtrW2		On				
ZSCurrSubtrW3		On				
TconfigForW1		No				
TconfigForW2		No				
TconfigForW3		No				
LocationOLTC1		Not Used				
LocationOLTC2		Not Used				
Setting Group1						
Operation		On				
SOTFMode		Off				
IDiffAlarm		0.15	IB	0.05	1.00	
tAlarmDelay		1.000	s	0.000	60.000	
IdMin		0.20	IB	0.10	0.60	
EndSection1		1.25	IB	0.20	1.50	
EndSection2		3.00	IB	1.00	10.00	
SlopeSection2		40.0	%	10.0	50.0	
SlopeSection3		80.0	%	30.0	100.0	
IdUnre		9.00	IB	1.00	100.00	
I2/I1Ratio		15.0	%	5.0	100.0	
I5/I1Ratio		25.0	%	5.0	100.0	
CrossBlockEn		On				
NegSeqDiffEn		Off				
OpenCTEnable		On				
tOCTAlarmDelay		5.000	s	0.100	10.000	
tOCTResetDelay		0.200	s	0.100	10.000	
tOCTUnrstDelay		10.00	s	0.10	6000.00	

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
REF_PROTN						
Differential protection						
HighImpDifferential(87,I>)						
HV_REF; HZPDIF: 1						
Setting Group1						
Operation		On				
U>Alarm		16	V	5	500	
tAlarm		5.000	s	0.000	60.000	
U>Trip		27	V	10	900	
SeriesResistor		540	Ohm	50	20000	
LV2_REF; HZPDIF: 2						
Setting Group1						
Operation		On				
U>Alarm		70	V	5	500	
tAlarm		5.000	s	0.000	60.000	
U>Trip		105	V	10	900	
SeriesResistor		1050	Ohm	50	20000	

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
Voltage protection						
Overexcitation(24,U/f>)						
HV_OVERFLUX; OEXPVPH: 1						
GlobalBaseSel		1		1	12	
MeasuredU		PosSeq				
MeasuredI		PosSeq				
Setting Group1						
Operation		ON				
OverVoltage2Step(59,2(3U>))						
HV_OVER_VOLTAGE; OV2PTOV: 1						
General						
GlobalBaseSel		1		1	12	
ConnType		PhN RMS				
Setting Group1						
Operation		On				
Step 1						
Setting Group1						
OperationStep1		On				
Characterist1		Definite time				
OpMode1		1 out of 3				
U1>		110.0	%UB	1.0	200.0	
t1		5.00	s	0.00	6000.00	
tReset1		0.025	s	0.000	60.000	
t1Min		0.000	s	0.000	60.000	
ResetTypeCrv1		Instantaneous				
tIReset1		0.025	s	0.000	60.000	
k1		1.00		0.05	1.10	
ACrv1		1.000		0.005	200.000	
BCrv1		1.00		0.50	100.00	
CCrv1		1.0		0.0	1.0	
DCrv1		1.000		0.000	60.000	
PCrv1		1.000		0.000	3.000	
CrvSat1		0	%	0	100	
HystAbs1		0.1	%UB	0.0	50.0	
Step 2						
Setting Group1						
OperationStep2		On				
Characterist2		Definite time				
OpMode2		1 out of 3				
U2>		140.0	%UB	1.0	200.0	
t2		0.100	s	0.000	60.000	
tReset2		0.025	s	0.000	60.000	
t2Min		0.000	s	0.000	60.000	
ResetTypeCrv2		Instantaneous				

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
tIReset2		0.025	s	0.000	60.000	
k2		1.00		0.05	1.10	
ACrv2		1.000		0.005	200.000	
BCrv2		1.00		0.50	100.00	
CCrv2		1.0		0.0	1.0	
DCrv2		1.000		0.000	60.000	
PCrv2		1.000		0.000	3.000	
CrvSat2		1	%	0	100	
HystAbs2		0.1	%UB	0.0	50.0	
UnderVoltage2Step(27,2(3U<))						
HV_UNDER_VOLTAGE; UV2PTUV: 1						
General						
GlobalBaseSel		1		1	12	
ConnType		PhN RMS				
Setting Group1						
Operation		On				
Step 1						
Setting Group1						
OperationStep1		On				
Characterist1		Definite time				
OpMode1		1 out of 3				
U1<		90.0	%UB	1.0	100.0	
t1		0.00	s	0.00	6000.00	
tReset1		0.025	s	0.000	60.000	
t1Min		0.000	s	0.000	60.000	
ResetTypeCrv1		Instantaneous				
tIReset1		0.025	s	0.000	60.000	
k1		1.00		0.05	1.10	
ACrv1		1.000		0.005	200.000	
BCrv1		1.00		0.50	100.00	
CCrv1		1.0		0.0	1.0	
DCrv1		1.000		0.000	60.000	
PCrv1		1.000		0.000	3.000	
CrvSat1		1	%	0	100	
IntBlkSel1		Block all				
IntBlkStVal1		20	%UB	1	50	
tBlkUV1		0.000	s	0.000	60.000	
HystAbs1		0.1	%UB	0.0	50.0	
Step 2						
Setting Group1						
OperationStep2		Off				

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
I_PROTN						
Current protection						
InstPhaseOverCurrent(50,3I>>)						
HV_INST_OC; PHPIOC: 1						
GlobalBaseSel		1		1	12	
Setting Group1						
Operation		Off				
LV1_SW-1_INST_OC; PHPIOC: 2						
GlobalBaseSel		1		1	12	
Setting Group1						
Operation		Off				
LV1_SW-2_INST_OC; PHPIOC: 3						
GlobalBaseSel		1		1	12	
Setting Group1						
Operation		Off				
LV2_SW-3_INST_OC; PHPIOC: 4						
GlobalBaseSel		1		1	12	
Setting Group1						
Operation		Off				
LV2_SW-4_INST_OC; PHPIOC: 5						
GlobalBaseSel		1		1	12	
Setting Group1						
Operation		Off				
InstResidualOverCurrent(50N,IN>>)						
HV_INST_EF; EFPIOC: 1						
GlobalBaseSel		1		1	12	
Setting Group1						
Operation		Off				
LV1_SW-1_INST_EF; EFPIOC: 2						
GlobalBaseSel		2		1	12	
Setting Group1						
Operation		Off				
LV1_SW-1_INST_EF; EFPIOC: 3						
GlobalBaseSel		1		1	12	
Setting Group1						
Operation		Off				
LV1_SW-1_INST_EF; EFPIOC: 4						
GlobalBaseSel		1		1	12	
Setting Group1						
Operation		Off				
LV1_SW-1_INST_EF; EFPIOC: 5						
GlobalBaseSel		1		1	12	
Setting Group1						
Operation		Off				

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
PhaseOverCurrent4Step(51_67,4(3I>))						
HV_DIR_OC; OC4PTOC: 1						
General						
GlobalBaseSel		3		1	12	
MeasType		DFT				
Setting Group1						
Operation		On				
StartPhSel		1 out of 3				
IMinOpPhSel		7	%IB	1	100	
2ndHarmStab		20	%	5	100	
Step 1						
Setting Group1						
DirMode1		Non-directional				
Characterist1		IEC Norm. inv.				
I1>		60	%IB	5	2500	
I1>Max		2000	%IB	5	2500	
I1>Min		50	%IB	5	2500	
t1		0.000	s	0.000	60.000	
k1		0.25		0.01	999.00	
IMin1		60	%IB	1	1000	
t1Min		0.000	s	0.000	60.000	
I1Mult		1.0		1.0	10.0	
ResetTypeCrv1		Instantaneous				
tReset1		0.020	s	0.000	60.000	
HarmBlock1		On				
Step 2						
Setting Group1						
DirMode2		Non-directional				
Characterist2		IEC Def. Time				
I2>		350	%IB	5	2500	
I2>Max		2500	%IB	5	2500	
I2>Min		5	%IB	5	2500	
t2		0.150	s	0.000	60.000	
I2Mult		1.0		1.0	10.0	
tReset2		0.020	s	0.000	60.000	
HarmBlock2		Off				
Step 3						
Setting Group1						
DirMode3		Off				
Step 4						
Setting Group1						
DirMode4		Off				

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
HV_OC4PTOC; OC4PTOC: 2						
General						
GlobalBaseSel		2		1	12	
MeasType		DFT				
Setting Group1						
Operation		Off				
Not Used; OC4PTOC: 3						
General						
GlobalBaseSel		1		1	12	
MeasType		DFT				
Setting Group1						
Operation		Off				
Not Used; OC4PTOC: 4						
General						
GlobalBaseSel		1		1	12	
MeasType		DFT				
Setting Group1						
Operation		Off				
ResidualOverCurr4Step(51N_67N,4(IN>))						
HV_DIR_EF; EF4PTOC: 1						
General						
GlobalBaseSel		3		1	12	
SeqTypeIDir		Zero seq				
SeqTypeIPol		Zero seq				
SeqTypeUPol		Zero seq				
Setting Group1						
Operation		On				
EnDir		Disable				
2ndHarmStab		20	%	5	100	
BlkParTransf		Off				
SOTF		Off				
EnPhaseSel		Off				
Step 1						
Setting Group1						
DirMode1		Non-directional				
Characterist1		IEC Norm. inv.				
IN1>		10	%IB	1	2500	
IN1>Max		100	%IB	1	2500	
IN1>Min		10	%IB	1	2500	
t1		0.000	s	0.000	60.000	
k1		0.25		0.01	999.00	
IMin1		10.00	%IB	1.00	2000.00	
t1Min		0.000	s	0.000	60.000	
IN1Mult		1.0		1.0	10.0	

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
ResetTypeCrv1		Instantaneous				
tReset1		0.020	s	0.000	60.000	
HarmBlock1		On				
Step 2						
Setting Group1						
DirMode2		Non-directional				
Characterist2		IEC Def. Time				
IN2>		150	%IB	1	2500	
IN2>Max		2500	%IB	1	2500	
IN2>Min		20	%IB	1	2500	
t2		0.150	s	0.000	60.000	
IN2Mult		1.0		1.0	10.0	
tReset2		0.020	s	0.000	60.000	
HarmBlock2		On				
Step 3						
Setting Group1						
DirMode3		Off				
Step 4						
Setting Group1						
DirMode4		Off				
LV1_SEF; EF4PTOC: 2						
General						
GlobalBaseSel		6		1	12	
SeqTypeIDir		Zero seq				
SeqTypeIPol		Zero seq				
SeqTypeUPol		Zero seq				
Setting Group1						
Operation		On				
EnDir		Disable				
2ndHarmStab		20	%	5	100	
BlkParTransf		Off				
SOTF		Off				
EnPhaseSel		Off				
Step 1						
Setting Group1						
DirMode1		Non-directional				
Characterist1		IEC Norm. inv.				
IN1>		25	%IB	1	2500	
IN1>Max		100	%IB	1	2500	
IN1>Min		25	%IB	1	2500	
t1		0.000	s	0.000	60.000	
k1		0.20		0.01	999.00	

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
IMin1		10.00	%IB	1.00	2000.00	
t1Min		0.000	s	0.000	60.000	
IN1Mult		1.0		1.0	10.0	
ResetTypeCrv1		Instantaneous				
tReset1		0.020	s	0.000	60.000	
HarmBlock1		On				
Step 2						
Setting Group1						
DirMode2		Off				
Step 3						
Setting Group1						
DirMode3		Off				
Step 4						
Setting Group1						
DirMode4		Off				

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
OEXPVPH: 1						
GlobalBaseSel		1		1	12	
MeasuredU		L1L2				
MeasuredI		L1L2				
Setting Group1						
Operation		On				
V/Hz>		120.0	%UB/f	100.0	180.0	
V/Hz>>		140.0	%UB/f	100.0	200.0	
XLeak		0.075	Ohm	0.000	200.000	
TrPulse		0.100	s	0.000	60.000	
tMin		2.000	s	0.000	60.000	
tMax		9000.00	s	0.00	9000.00	
tCooling		1200.00	s	0.10	9000.00	
CurveType		Tailor made				
kForIEEE		1		1	60	
t1Tailor		100.00	s	0.00	9000.00	
t2Tailor		50.00	s	0.00	9000.00	
t3Tailor		30.00	s	0.00	9000.00	
t4Tailor		15.00	s	0.00	9000.00	
t5Tailor		6.00	s	0.00	9000.00	
t6Tailor		2.00	s	0.00	9000.00	
AlarmLevel		95.0	%	50.0	120.0	
tAlarm		5.00	s	0.00	9000.00	

1 General Data

System Details

Voltage	Un	=	400	kV
Frequency	F	=	50	Hz
Station Name		=	400kV BADISID SUBSTATION	
Feeder Name		=	400/33/33kV TRANSFORMER C&R PANEL-1, 2	
Bay No		=	BAY	
Relay Ordering Code		=	REC670	
CT Primary ratio (Adopted Tap)		=	1000	A
CT Secondary ratio		=	1	A
VT Primary ratio		=	400	kV
VT Secondary ratio		=	0.11	kV
Transformer MVA		=	330	MVA
Transformer Full Load current		=	476.3	
Maximum 3phase fault current		=	10500	A
Maximum 3phase fault current		=	10500	A

Global Base Values

GBASVAL:1

Base Voltage	**Ubase**	=	**400**	**kV**
Base Current	**Ibase**	=	**476.3**	**A**
Base Power	**Sbase**	=	**330**	**MVA**

2 Synchrocheck & Energizing check Function, SESRSYN (25)

The protection function has Synchrocheck, energizing check and synchronizing features.

Operation = On

Synchronizing function:

To allow closing of breakers between asynchronous networks, a synchronizing feature is provided.
The synchronizing feature measures the conditions across the circuit breaker and also determines the angle change occurring during the closing delay of the circuit breaker, from the measured slip frequency. The breaker close command is issued at the optimum time when conditions across the breaker are satisfied in order to avoid stress on the network and its components.

Operation = Off

Synchronism check function:

The synchrocheck mode checks that the voltages on both sides of the circuit breaker are perfectly synchronized (to perform a controlled reconnection) and gives permission to close the circuit breaker when certain conditions are simultaneously fulfilled.

Operation = On

The following conditions to be simultaneously fulfilled for Synchrocheck operation.
• The measured voltages (U-Line and U-Bus) are higher than the set values *UHighBusSC* and *UHighLineSC*.
• The difference in the voltage is smaller than the set value of *UDiffSC*.
• The difference in frequency is less than the set value of *FreqDiffM* and *FreqDiffA*.
• The frequency rate of change is less than set value for both U-Bus and U-Line.
• The difference in the phase angle is smaller than the set value of *PhaseDiffM* and *PhaseDiffA*

Settings criteria:

• UHighBusSC and UHighLineSC threshold voltages have to be set lower than the value where the network is expected to close with the synchronism check. A typical value is 80% of the rated voltage.
• UDiffSC, voltage difference between the line voltage and the bus voltage. A normal setting is 0.10-0.15 p.u.
• FreqDiffM and FreqDiffA, shall be chosen depending on the condition in the network.
At steady conditions, a low frequency difference setting is needed. Typical value for FreqDiffM is 10mHz.
At autoreclosing, a bigger frequency difference setting is preferable. Typical value for FreqDiffA is 100-200mHz.
• PhaseDiffM and PhaseDiffA, shall be chosen depending on conditions in the network.
The phase angle setting must be chosen to allow closing under maximum load condition. In most networks the maximum occurring angle is below 25 degrees.

UHighBusSC	=	**80**	**%UBB**
UHighLineSC	=	**80**	**%UBL**
UDiffSC	=	**0.1**	**pu**
FreqDiffA	=	**0.1**	**Hz**
FreqDiffM	=	**0.1**	**Hz**
PhaseDiffA	=	**20**	**Deg**
PhaseDiffM	=	**20**	**Deg**

Energizing check function:

The energizing check function checks that at least one side is dead to ensure that closing
Energizing from different directions can be different for automatic reclosing and manual closing of the circuit breaker. Two different settings can be used for automatic and manual closing of the circuit breaker.
For manual closing it is also possible to allow closing when both sides of the breaker are dead.

AutoEnerg	=	**Both**
ManEnerg	=	**Both**
ManEnergDBDL	=	**Off**

Settings criteria:

• UHighBusEnerg and UHighLineEnerg threshold voltages have to be set lower than the value at which the network is considered to be energized. A typical value can be 80% of the base voltages.
• ULowBusEnerg and ULowLineEnerg threshold voltages have to be set to a value greater than the value where the network is considered not to be energized. A typical value can be 20% of the base voltages.
• UMaxEnerg setting is used to block the closing when the voltage on the live side is above the set value.
• tAutoEnerg and tManEnerg, is to ensure that the dead side remains de-energized and that the condition is not due to a temporary interference. Circuit breaker closing is thus not permitted until the energizing condition has remained constant throughout the set delay setting time.

ULiveBusEnerg	=	**80**	**%UBB**
ULiveLineEnerg	=	**80**	**%UBL**
UDeadBusEnerg	=	**20**	**%UBB**
UDeadLineEnerg	=	**20**	**%UBL**
UMaxEnerg	=	**115**	**%UB**
tAutoEnerg	=	**0.1**	**s**
tManEnerg	=	**0.1**	**s**

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
TRM_40						
NAMECH1		MAIN+TIE_CT_RPH			16 characters	
ChannelType1		CurrentProtection				
RatedTrans1		1.0	A	0.1	300.0	
CTStarPoint1		ToObject				
CTsec1		1	A	1	10	
CTprim1		1000	A	1	99999	
NAMECH2		MAIN+TIE_CT_YPH			16 characters	
ChannelType2		CurrentProtection				
RatedTrans2		1.0	A	0.1	300.0	
CTStarPoint2		ToObject				
CTsec2		1	A	1	10	
CTprim2		1000	A	1	99999	
NAMECH3		MAIN+TIE_CT_BPH			16 characters	
ChannelType3		CurrentProtection				
RatedTrans3		1.0	A	0.1	300.0	
CTStarPoint3		ToObject				
CTsec3		1	A	1	10	
CTprim3		1000	A	1	99999	
NAMECH4		CH4(I)			16 characters	
ChannelType4		CurrentProtection				
RatedTrans4		1.0	A	0.1	300.0	
CTStarPoint4		ToObject				
CTsec4		1	A	1	10	
CTprim4		1000	A	1	99999	
NAMECH5		CH5(I)			16 characters	
ChannelType5		CurrentProtection				
RatedTrans5		1.0	A	0.1	300.0	
CTStarPoint5		ToObject				
CTsec5		1	A	1	10	
CTprim5		1000	A	1	99999	
NAMECH6		CH6(I)			16 characters	
ChannelType6		CurrentProtection				
RatedTrans6		1.0	A	0.1	300.0	
CTStarPoint6		ToObject				
CTsec6		1	A	1	10	
CTprim6		1000	A	1	99999	
NAMECH7		SELECTED_CVT_RPH			16 characters	
ChannelType7		Voltage				
RatedTrans7		110.0	V	0.1	300.0	
VTsec7		110.000	V	0.001	999.999	

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
VTprim7		1000.00	kV	0.05	2000.00	
NAMECH8		SELECTED_CVT_YPH			16 characters	
ChannelType8		Voltage				
RatedTrans8		110.0	V	0.1	300.0	
VTsec8		110.000	V	0.001	999.999	
VTprim8		400.00	kV	0.05	2000.00	
NAMECH9		SELECTED_CVT_BPH			16 characters	
ChannelType9		Voltage				
RatedTrans9		110.0	V	0.1	300.0	
VTsec9		110.000	V	0.001	999.999	
VTprim9		400.00	kV	0.05	2000.00	
NAMECH10		FOR_FUTURE_SYNCH			16 characters	
ChannelType10		Voltage				
RatedTrans10		110.0	V	0.1	300.0	
VTsec10		110.000	V	0.001	999.999	
VTprim10		400.00	kV	0.05	2000.00	
NAMECH11		400KV_BUS-1_CVT			16 characters	
ChannelType11		Voltage				
RatedTrans11		110.0	V	0.1	300.0	
VTsec11		110.000	V	0.001	999.999	
VTprim11		400.00	kV	0.05	2000.00	
NAMECH12		400KV_BUS-2_CVT			16 characters	
ChannelType12		Voltage				
RatedTrans12		110.0	V	0.1	300.0	
VTsec12		110.000	V	0.001	999.999	
VTprim12		400.00	kV	0.05	2000.00	

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
Global base values						
GBASVAL: 1						
UBase		400.00	kV	0.05	2000.00	
IBase		476	A	1	99999	
SBase		330.00	MVA	1.00	200000.00	
GBASVAL: 2						
UBase		400.00	kV	0.05	2000.00	
IBase		1000	A	1	99999	
SBase		330.00	MVA	1.00	200000.00	
GBASVAL: 3						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	
SBase		2000.00	MVA	1.00	200000.00	
GBASVAL: 4						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	
SBase		2000.00	MVA	1.00	200000.00	
GBASVAL: 5						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	
SBase		2000.00	MVA	1.00	200000.00	
GBASVAL: 6						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	
SBase		2000.00	MVA	1.00	200000.00	
GBASVAL: 7						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	
SBase		2000.00	MVA	1.00	200000.00	
GBASVAL: 8						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	
SBase		2000.00	MVA	1.00	200000.00	
GBASVAL: 9						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	
SBase		2000.00	MVA	1.00	200000.00	
GBASVAL: 10						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	
SBase		2000.00	MVA	1.00	200000.00	
GBASVAL: 11						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
SBase		2000.00	MVA	1.00	200000.00	
GBASVAL: 12						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	
SBase		2000.00	MVA	1.00	200000.00	

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
SYNC						
Control						
Synchronizing(25,SC/VC)						
SESRSYN: 1						
General						
GblBaseSelBus		1		1	12	
GblBaseSelLine		1		1	12	
SelPhaseBus1		Phase L1L2				
SelPhaseBus2		Phase L1L2				
SelPhaseLine1		Phase L1L2				
SelPhaseLine2		Phase L1L2				
CBConfig		1 1/2 bus CB				
PhaseShift		0	Deg	-180	180	
Setting Group1						
Operation		On				
Synchronizing						
Setting Group1						
OperationSynch		Off				
CloseAngleMax		15.0	Deg	15.0	30.0	
Synchrocheck						
Setting Group1						
OperationSC		On				
UHighBusSC		80.0	%UBB	50.0	120.0	
UHighLineSC		80.0	%UBL	50.0	120.0	
UDiffSC		0.10	pu	0.02	0.50	
FreqDiffA		0.100	Hz	0.003	1.000	
FreqDiffM		0.100	Hz	0.003	1.000	
PhaseDiffA		20.0	Deg	5.0	90.0	
PhaseDiffM		20.0	Deg	5.0	90.0	
tSCA		0.100	s	0.000	60.000	
tSCM		0.100	s	0.000	60.000	
Energizingcheck						
Setting Group1						
AutoEnerg		Both				
ManEnerg		Both				
ManEnergDBDL		Off				
UHighBusEnerg		80.0	%UBB	50.0	120.0	
UHighLineEnerg		80.0	%UBL	50.0	120.0	
ULowBusEnerg		20.0	%UBB	10.0	80.0	
ULowLineEnerg		20.0	%UBL	10.0	80.0	
UMaxEnerg		115.0	%UB	50.0	180.0	
tAutoEnerg		0.100	s	0.000	60.000	
tManEnerg		0.100	s	0.000	60.000	

REB670
400 kV BUSBAR PROTECTION SETTING CALCULATION

Rev	Description	Date
0	Initial submission for review and Approval	31-05-2024
1	Revised as per customer comments for Approval	28-06-2024

Hitachi Energy		ADANI GREEN ENERGY LIMITED (ADANI RENEWABLES)	Contract No.	3100139976, IN-56423232
PGGA-2875		400kV BADISID SUBSTATION	Date	30-05-2024
Prep.	SS	400 kV BUSBAR PROTECTION SETTING CALCULATION	Doc No.	1MNS500950-PAAA
Chk.	PN	BUSBAR PROTECTION - REB670	Rev No.	0

1 System Details

Type of Busbars = One and Half Breaker Scheme
No. of Bus zones 2
BBP Configuration Two zone,3 Phase Busbar Protection,87B
Relay Type = REB670
Fault Current = 10500
CT Ratio Details

330MVA Transformer-1	Bay: 401	2000/1A
330MVA Transformer-2	Bay: 404	2000/1A
Future Transformer-1	Bay: 407	2000/1A
Future Transformer-2	Bay: 410	2000/1A
400kV Line-1	Bay: 403	2000/1A
400kV TIE	Bay: 405	2000/1A
Future Line-1	Bay: 409	2000/1A
Future Line-2	Bay: 412	2000/1A

Maximum load current in any bay = 660 MVA (Line)
= 953 A

Minimum load current in any bay = 330 MVA (Trafo)
= 476 A

2 Low Impedance Busbar Differential Protection, BZNTPDIF-A & BZNTPDIF-B

The numerical and low-impedance differential protection is designed for fast and selective protection for faults within protected zones. The fast tripping time (Typically 11ms) of the low-impedance differential protection function is especially advantages for power system networks with high fault levels or where fast fault clearance is required for power system stability. Also it is stable for external faults, even with heavy CT saturation and during external fault clearance or auto-reclosing. It features two differential protection functions:

a) Bias differential protection algorithm,
b) Sensitive differential protection algorithm

The overall percentage operating characteristic of busbar differential protection is shown in Figure-1

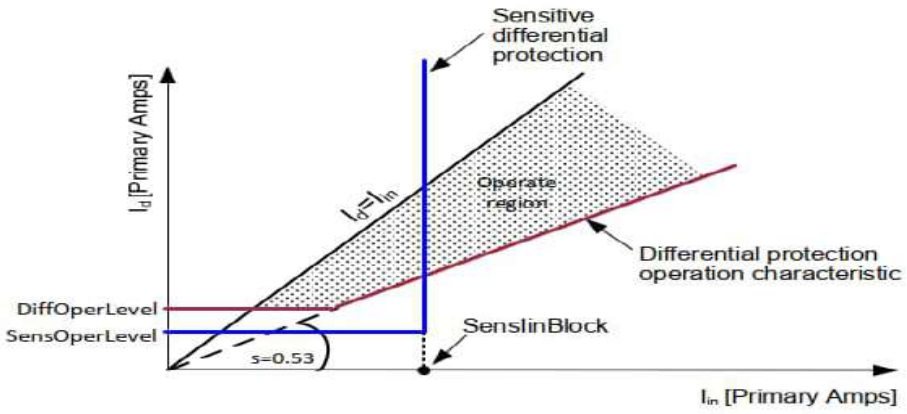


Figure-1, Differential protection Operating characteristic

Among the Operation mode(OperationBBP) of entire busbar differential protection function; One of the following two alternatives shall be selected,

• On, when this mode is selected, the entire busbar differential protection function enabled.
• Off, when this mode is selected, the entire busbar differential protection function is disabled.

Operation = On

DiffTripOut

This setting determines how the zone trip output TRIP from each differential zone shall behave. One of the following two alternatives shall be selected,

• SelfReset, when this mode is selected, the output TRIP will be reset to logical value zero after the settable time determined by the setting parameter *tTripHold* .

• Latched, when this mode is selected, the output TRIP will be latched and it requires manual reset command. This reset command can be given from local HMI or via communication link.

DiffTripOut = Self Reset

tTripHold

This setting defines the drop-off time for the output TRIP of each differential zone. If the trip output TRIP is in the SelfReset mode, Time delay can be set from 0.000s to 60.000s in step of 0.001s. Default value is 0.200s.

tTripHold = 0.200 s

2.1 Bias differential protection algorithm

DiffOperLevel:

The minimum pickup level for the bias differential feature of each differential zone. It shall be entered directly in primary amperes.

Proposed differential pickup current is 120% of maximum load current in any bay

= 1.2 * 953 A

= 1143.60 A

DiffOperLevel = 1144 A

Slope: The operating slope for the bias differential operating characteristic is fixed at 53% in the algorithm.

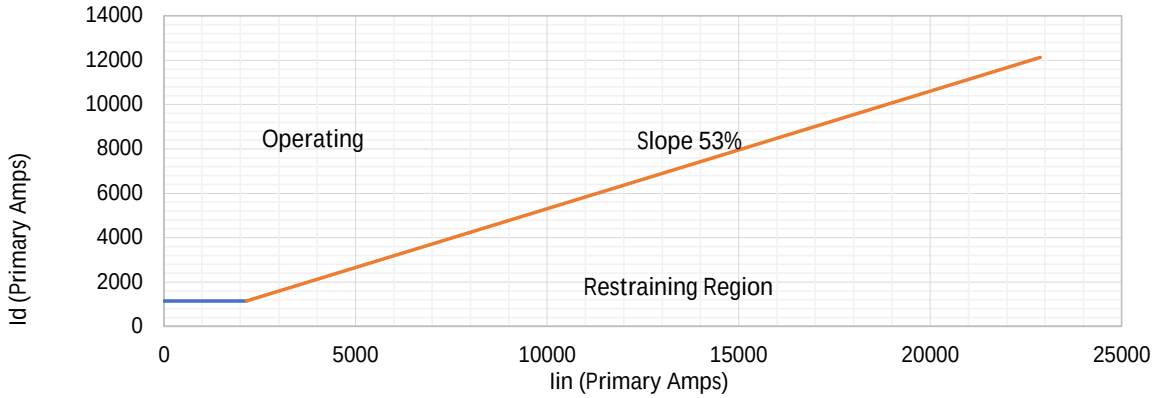


Figure-2, Bias Differential Operating characteristic

2.1.1 Open CT detection

The innovative measuring algorithm provides stability for open or short-circuited main CT secondary circuits, without any need for additional check zone. The open CT detection algorithm is completely phase-segregated.

At detection of problems in CT secondary circuits, the differential protection can be instantly blocked at the affected phase and latched alarms are provided. Alternatively, the differential protection can be automatically desensitized in order to ensure busbar differential protection stability during normal through-load condition.

There are two type of open CT detection logic available,

• Fast operating open CT detection logic

• Slow operating open CT detection logic

OCTOperLev

This setting determines the minimum pickup level for the slow and fast OCT feature for each differential zone. It shall be entered directly in primary amperes.

The setting is used to define the minimum expected through-load current drop during open CT duration. This level should be set as high as necessary to prevent spurious blocking due to the false differential current caused by CT errors, meanwhile as low as necessary to detect the open circuit condition for the smallest loaded CT connected to the differential zone. If the minimum load current is not available or if the load current is too small when compared to the differential current present due to CT

errors from the use of different types of CT in the same substation, this value may be settled in between 20% ~ 80% of the rated primary current of the CT with the smallest ratio. This built-in feature allows the protection IED to be set very sensitive, even to a level lower than the maximum CT primary rating in the station.

We propose Open CT current pickup level of 95 A (20% of transformer bay full load current -420A)

OCTOperLev = 95 A

Slow Open CT detection

Slow operating open CT detection logic will detect most abnormalities in the CT secondary circuits or in the dynamic zone selection logic, with a settable time delay. Especially such logic is capable of detecting the open CT condition when a new bay is connected to the differential zone with its CT secondary circuits being open circuited.

This setting determines operation mode of the slow OCT algorithm. One of the following three alternatives shall be selected,
• Off, when this mode is selected, the slow OCT feature is completely disabled.
• Block, when this mode is selected, the operation of the slow OCT feature completely blocks the operation of the differential protection. Note that this blocking is selective both zone and phase wise.
• Supervise, when this mode is selected, the operation of the slow OCT feature blocks the operation of the differential protection only for the integrated differential current lower than a pre-set level determined by the setting *OCTReleaseLev* .

SlowOCTOper = Supervise

This setting defined the time of the slow OCT algorithm for each differential zone.
Time delay can be set from 0.00s to 6000.00s in step of 0.01s. Default value is 20.00s. Minimum setting should always be above 1s.

tSlowOCT = 20.00 sec

Fast Open CT detection

Fast operating open CT detection logic detects instantly the moment when a healthy CT secondary circuit carrying the load current is accidently open- or short-circuited (that is, current interrupted to the differential relay). Note that this logic can only detect open CT condition when an already connected CT with the secondary load current being open circuited. It does not detect, for example, the situation when a new bay is connected to the differential zone with its CT secondary circuits being open circuited.

This setting determines operation mode of the fast OCT algorithm. One of the following three alternatives shall be selected for each differential zone function block,
• Off, when this mode is selected, the fast OCT feature is completely disabled.
• Block, when this mode is selected, the operation of the fast OCT feature always blocks the operation of the differential protection. It shall be noted that this blocking is selective both zone and phase wise.
• Supervise, when this mode is selected, the operation of the fast OCT feature blocks the operation of the differential protection only for the integrated differential current lower than a pre-set level determined by the setting *OCTReleaseLev* .

FastOCTOper = Supervise

OCTReleaseLev

This setting determines the differential current level, above which the OCT feature will again allow the differential protection operation, when in Supervise mode. It shall be entered directly in primary amperes.

Proposed setting is 125% of maximum load current

		=	1.25 x 953	
	OCTReleaseLev	=	1191	A

2.1.2 Differential zone measurement supervision

There are dual supervision of current measurements for each differential protection zone:
• Differential current supervision - The algorithm operates and issues a binary alarm output after a settable time delay *tIdAlarm* , when differential current exceeds a set level *IdAlarmLev* .
• Incoming current supervision - The algorithm operates and issues immediately a binary alarm output, when the incoming current level, that is, bus through-going current level, exceeds a set level *IinAlarmLev* .
Both supervision features are phase segregated and their binary alarm outputs can be used either for triggering disturbance recorder or for alarming purposes.

IdAlarmLev

This setting determines the differential current level, above which the differential current alarm becomes active after the settable time delay determined by the parameter setting tIdAlarm. it shall be entered directly in primary amperes.

20% of differential operating level is recommended and the same is proposed.

IdAlarmLev	=	1144 x 0.2	A
	=	229	A

tIdAlarm

This setting determines the time delay of the differential current alarm feature for each differential zone. Time delay can be set from 0.00s to 6000.00s in step of 0.01s. Default value is 30.00s.

tIdAlarm	=	5	sec

IinAlarmLev

This setting determines the incoming current level (bus thorough-going current level), above which the incoming current alarm becomes active instantaneously. It shall be entered directly in primary amperes.

The proposed setting is 115% of all Incoming current

IinAlarmLev	=	1.15 x 1906	A (Assumed 2 lines are incoming)
	=	2192	A

2.2 Sensitive differential protection algorithm

The operation and operating characteristic of the sensitive differential protection are independent from those of the bias differential protection algorithm. Sensitive differential protection algorithm is used,
• to detect internal busbar earth faults in low impedance earthed power systems, the systems where the earth-fault current is limited to a certain level, typically between 300A and 2000A primary by a neutral point reactor or resistor, or
• to be used when energizing a bus via long line, since this requires higher sensitivity from busbar differential protection.

This setting determines operation mode of the sensitive differential algorithm for each differential zone. One of the following two alternatives shall be selected,
• On, when this mode is selected, the sensitive differential algorithm is enabled. Note that the binary input ENSENS of the differential zone function block must also have logical value one, in order to get the sensitive differential algorithm operate.
• Off, when this mode is selected, the sensitive differential algorithm is disabled.

We proposed the settings to set as OFF for this station.

SensDiffOper	=	Off

3 Check Zone Protection, BCZTPDIF

When CT-circuits are switched, depending on the position of the busbar disconnectors, there is a possibility that some of the CT secondary circuits can be open circuited by a mistake. At the same time this can cause unwanted operation of the differential protection scheme. Therefore, check zone is often required for a traditional high impedance busbar protection scheme when switching in CT-circuit is done.

The check zone, will detect faults anywhere in the substation but cannot distinguish in which part of the station the fault is located. When the check zone detects a fault it gives a release signal to the busbar protection relays in all individual, discriminating zones. The busbar protection discriminating zones will then trip the part of the substation that is faulty.

The check zone has slightly different operating characteristic from the usual discriminating zones. For the check zone the resultant outgoing current is used as stabilizing current instead of total incoming current in order to guarantee the check zone operation for all possible operating conditions in the station.

For substations where traditional “CT switching” is not required (that is, single busbar station or one-and-half breaker station), a check zone must not be used. For such applications, the check zone shall be disabled.

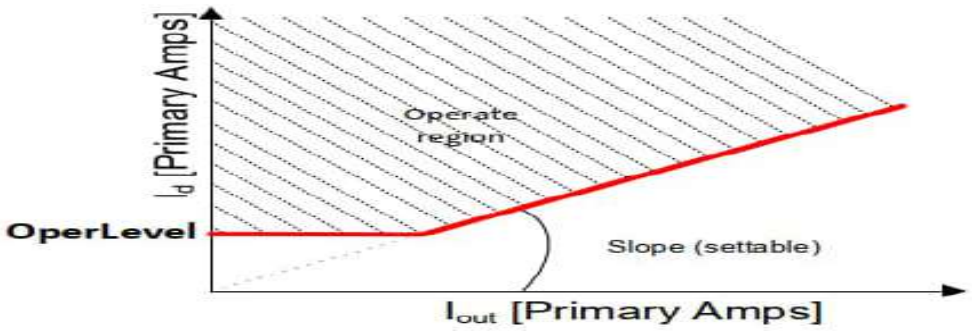


Figure-3, Check zone Operating characteristic

Fault condition/type	Check zone operated	TRIP
Differential protection algorithm operated	No	No
	Yes	Yes

Figure-4, Differential Protection Trip outputs

If both bus Zones (Zone A and Zone B) are part of one relay then Check Zone Must be enabled for one and half Breaker scheme also

This setting determined whether check zone shall be enabled or not. One of the following two alternatives shall be selected:

1. On, when this mode is selected the check zone is enabled.
2. Off, when this mode is selected the check zone is disabled.

Operation = ON

OperLevel

This setting determines the minimum start level for the check zone. It shall be entered directly in primary amperes.

Pickup: As per Application manual (Rev.K), Clause 6.1.3.3, the check zone minimum operational level shall be set equal to or less than the corresponding operating level of the usual discriminating zones. Hence we proposed the setting same as differential operating level.

OperLevel = 1144 A

Slope: This setting determines the slope of the check zone operating characteristic. It can be set from 0.10 to 0.90 in step of 0.01. Default value is 0.15.

Slope = 0.15

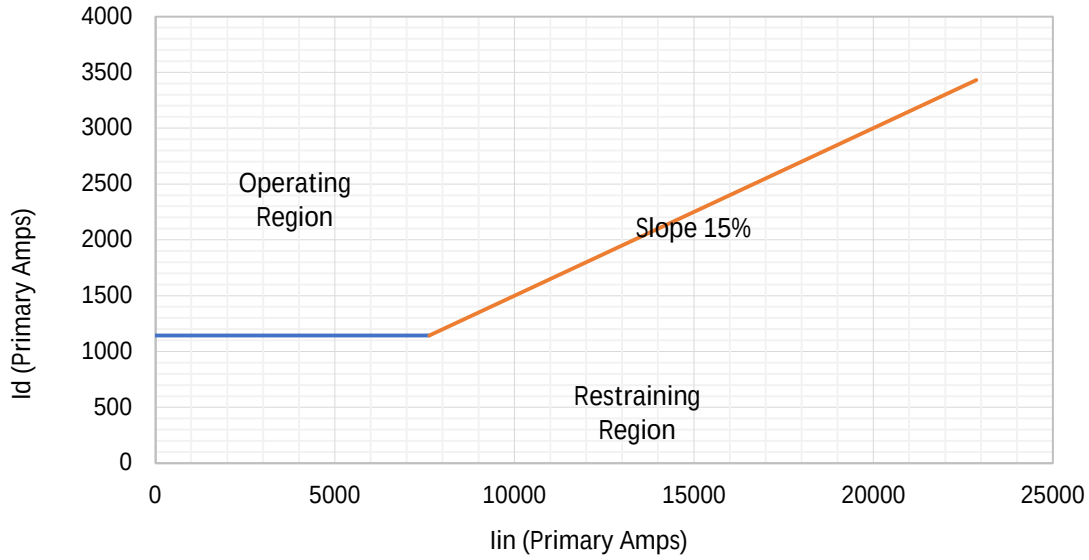


Figure-5, Check zone Differential Operating characteristic

4 Breaker Failure Protection (50BF), CCRBRF

Note: The same setting is applicable for all 400 kV Bays.

The function will issue a backup trip command to adjacent circuit breakers in case of failure to trip of the "normal" circuit breaker for the protected object. The function can also give a retrip command. This means that a second trip signal is sent to the protected object circuit breaker. The retrip function can be used to increase the probability of operation of the breaker, or it can be used to avoid backup trip of many breakers in case of mistakes during relay maintenance and test.

Operation = On

Base current can be chosen full load current of transformer for transformer bays

Base current can be chosen same as CT primary current for other bays

Function Mode

It defines the way the detection of failure of the breaker is performed.

In Current mode, compares the measured phase current magnitude to setting IPh> (operate phase current level). Criterion is active, if the measured current magnitude is higher than the set value.

In CB Pos mode, the CB auxiliary contact status is used as an indicator of the failure of the breaker.

In Current or CB Pos mode, both ways of detections can be activated.

The CB Pos mode is used in applications where the fault current through the circuit breaker is small.

FunctionMode = Current

StartMode

It is possible to select how t1 and t2 timers are run and consequently how output commands are given from the function.

In LatchedStart option ("By external start signal which is internally latched") - When function is once started by external START signal, the timers t1 and t2 will always elapse and then measurement criterion defined by parameter *FunctionMode* will be always checked in order to verify if the appropriate command shall be given out from the function.

In FollowStart option ("Follow the external start signal only") - The timers t1 and t2 will run while external START signal is present. If they elapse then measurement criterion defined by parameter *FunctionMode* will be checked in order to verify if the appropriate command shall be given out from the function

In FollowStart&Mode option ("Follow external start signal and selected FunctionMode") - The timers t1 and t2 will run while external START signal is present and in the same time the measurement criterion defined by parameter *FunctionMode* is active. If they elapse then the appropriate command will be given out from the function.

StartMode = FollowStart&Mode

tStartTimeout

When one of the two "Follow Modes" is used, there is a settable timer tStartTimeout which will block the external START input signal when it times-out. This will automatically also reset the t1 and t2 timers and consequently prevent any backup trip command

Recommended default setting is 1 sec

tStartTimeout = 1 sec

RetripMode

The setting defines how the retrip function shall operate

RetripMode	FunctionMode	Description
Off	N/A	the re-trip function is disabled
UseFunctionMode	Current	a phase current must be larger than the set operate level to allow re-trip once the t1 timer elapses
	CB Pos	Re-trip is done when breaker position indicates that breaker is still closed after re-trip time has elapsed
	Current or CB Pos	both methods are used
Always	N/A	Re-trip is always given when t1 elapses without any further checks

Figure-7, Dependencies between RetripMode and FunctionMode

RetripMode: = UseFunction Mode

IP>

It is Current level for detection of breaker failure. This parameter should be set so that faults with small fault current can be detected. The setting can be chosen in accordance with the most sensitive protection function to start the breaker failure protection.

Proposed Setting is 20% of Ibase

IP> = 20 Ibase

Time delay of the re-trip.

Time delay of the retrip. The setting can be given within the range 0 – 60s in steps of 0.001s.

t1 (Proposed) = 0.1 sec

Time delay of the back-up trip

Time delay of the backup trip. The choice of this setting is made as short as possible at the same time as unwanted operation must be avoided. Typical setting is 90 – 200ms (also dependent of retrip timer)

The minimum time delay for the backup trip can be estimated as,

t2 ≥ t1 time delay + CB open time + Relay reset time + Safety margin

Maximum CB open time (Assumed	=	60	ms
Breaker failure Relay reset time	=	15	ms
Safety margin	=	20	ms
t2 (Calculated)	=	0.195	sec
t2 (Proposed)	=	0.2	sec

Time delay for alarm

Time delay for alarm in case of indication of faulty circuit breaker. There is a binary input CBFLT from the circuit breaker. This signal is activated when internal supervision in the circuit breaker detect that the circuit breaker is unable to clear fault. This could be the case when gas pressure is low in a SF6 circuit breaker. After the set time an alarm is given, so that actions can be done to repair the circuit breaker. The time delay for back-up trip is bypassed when the CBFLT is active.

tCBAlarm = 5 sec

Trip pulse duration

This setting must be larger than the critical impulse time of circuit breakers to be tripped from the breaker failure protection. Typical setting is 200 ms.

tPulse = 0.2 sec

5 End Fault Protection using Single phase O/C protection (51), PH4SPTOC

Note: The same setting is applicable for all 400kV Bays.

The function is used as end fault protection to clear faults between current transformer and circuit breaker.

End Fault Protection is related to primary faults between main CT and CB in a feeder bay. Therefore, it is directly related to the position of the main CT in feeder bay. Three CT positions in feeder bays are typically used in power systems, as shown in Figure-8.

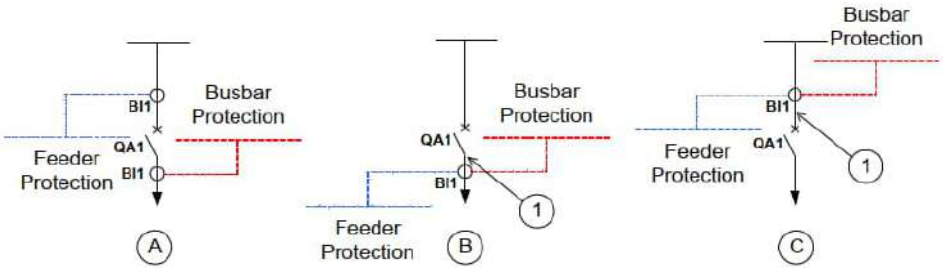


Figure-8, Typical CT locations in a feeder bay

where:

A	two CTs are available one on each side of the feeder circuit breaker
B	one CT is available on the line side of the feeder circuit breaker
C	one CT is available on the bus side of the feeder circuit breaker
1	End fault region

Our 400kV system is same as Figure-8-B. Both Busbar protection & Line protection CTs are available on the feeder side of the feeder circuit breaker, the primary fault between CT and CB will cause problems as well. Typically such fault will not be detected by feeder protection. to completely clear such fault the associated busbar protection must be tripped by end fault protection. It shall be noted that the busbar differential protection will classify such fault as external and without any additional measures the busbar protection will remain stable.

Operation	=	On	
Ibase 1	=	476	A
Ibase 2	=	2000	A

Function 1 (Transformer Bay)

OpStep 1	=	On	
Phase Overcurrent Ope	=	20	%IB
Pickup setting in Prima	=	95.2	A
Pickup setting in Secon	=	0.05	A
Operating Curve type	=	IEC Def. Time	
Operate Delay time	=	0.05	s

Function 2 (Line Bay)

OpStep 1	=	On	
Phase Overcurrent Ope	=	20	%IB
Pickup setting in Prima	=	400	A
Pickup setting in Secon	=	0.20	A
Operating Curve type	=	IEC Def. Time	
Operate Delay time	=	0.05	s

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
TRM_40						
NAMECH1		BAY401_CT_RPH			16 characters	
ChannelType1		CurrentProtection				
RatedTrans1		1.0	A	0.1	300.0	
CTStarPoint1		ToObject				
CTsec1		1	A	1	10	
CTprim1		2000	A	1	99999	
NAMECH2		BAY401_CT_YPH			16 characters	
ChannelType2		CurrentProtection				
RatedTrans2		1.0	A	0.1	300.0	
CTStarPoint2		ToObject				
CTsec2		1	A	1	10	
CTprim2		2000	A	1	99999	
NAMECH3		BAY401_CT_BPH			16 characters	
ChannelType3		CurrentProtection				
RatedTrans3		1.0	A	0.1	300.0	
CTStarPoint3		ToObject				
CTsec3		1	A	1	10	
CTprim3		2000	A	1	99999	
NAMECH4		BAY404_CT_RPH			16 characters	
ChannelType4		CurrentProtection				
RatedTrans4		1.0	A	0.1	300.0	
CTStarPoint4		ToObject				
CTsec4		1	A	1	10	
CTprim4		2000	A	1	99999	
NAMECH5		BAY404_CT_YPH			16 characters	
ChannelType5		CurrentProtection				
RatedTrans5		1.0	A	0.1	300.0	
CTStarPoint5		ToObject				
CTsec5		1	A	1	10	
CTprim5		2000	A	1	99999	
NAMECH6		BAY404_CT_BPH			16 characters	
ChannelType6		CurrentProtection				
RatedTrans6		1.0	A	0.1	300.0	
CTStarPoint6		ToObject				
CTsec6		1	A	1	10	
CTprim6		2000	A	1	99999	
NAMECH7		BAY407_CT_RPH			16 characters	
ChannelType7		CurrentProtection				
RatedTrans7		1.0	A	0.1	300.0	
CTStarPoint7		ToObject				
CTsec7		1	A	1	10	

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
CTprim7		2000	A	1	99999	
NAMECH8		BAY407_CT_YPH			16 characters	
ChannelType8		CurrentProtection				
RatedTrans8		1.0	A	0.1	300.0	
CTStarPoint8		ToObject				
CTsec8		1	A	1	10	
CTprim8		2000	A	1	99999	
NAMECH9		BAY407_CT_BPH			16 characters	
ChannelType9		CurrentProtection				
RatedTrans9		1.0	A	0.1	300.0	
CTStarPoint9		ToObject				
CTsec9		1	A	1	10	
CTprim9		2000	A	1	99999	
NAMECH10		BAY410_CT_RPH			16 characters	
ChannelType10		CurrentProtection				
RatedTrans10		1.0	A	0.1	300.0	
CTStarPoint10		ToObject				
CTsec10		1	A	1	10	
CTprim10		2000	A	1	99999	
NAMECH11		BAY410_CT_YPH			16 characters	
ChannelType11		CurrentProtection				
RatedTrans11		1.0	A	0.1	300.0	
CTStarPoint11		ToObject				
CTsec11		1	A	1	10	
CTprim11		2000	A	1	99999	
NAMECH12		BAY410_CT_BPH			16 characters	
ChannelType12		CurrentProtection				
RatedTrans12		1.0	A	0.1	300.0	
CTStarPoint12		ToObject				
CTsec12		1	A	1	10	
CTprim12		2000	A	1	99999	

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
TRM_41						
NAMECH1		BAY403_CT_RPH			16 characters	
ChannelType1		CurrentProtection				
RatedTrans1		1.0	A	0.1	300.0	
CTStarPoint1		ToObject				
CTsec1		1	A	1	10	
CTprim1		2000	A	1	99999	
NAMECH2		BAY403_CT_YPH			16 characters	
ChannelType2		CurrentProtection				
RatedTrans2		1.0	A	0.1	300.0	
CTStarPoint2		ToObject				
CTsec2		1	A	1	10	
CTprim2		2000	A	1	99999	
NAMECH3		BAY403_CT_BPH			16 characters	
ChannelType3		CurrentProtection				
RatedTrans3		1.0	A	0.1	300.0	
CTStarPoint3		ToObject				
CTsec3		1	A	1	10	
CTprim3		2000	A	1	99999	
NAMECH4		BAY405_CT_RPH			16 characters	
ChannelType4		CurrentProtection				
RatedTrans4		1.0	A	0.1	300.0	
CTStarPoint4		ToObject				
CTsec4		1	A	1	10	
CTprim4		2000	A	1	99999	
NAMECH5		BAY405_CT_YPH			16 characters	
ChannelType5		CurrentProtection				
RatedTrans5		1.0	A	0.1	300.0	
CTStarPoint5		ToObject				
CTsec5		1	A	1	10	
CTprim5		2000	A	1	99999	
NAMECH6		BAY405_CT_BPH			16 characters	
ChannelType6		CurrentProtection				
RatedTrans6		1.0	A	0.1	300.0	
CTStarPoint6		ToObject				
CTsec6		1	A	1	10	
CTprim6		2000	A	1	99999	
NAMECH7		BAY409_CT_RPH			16 characters	
ChannelType7		CurrentProtection				
RatedTrans7		1.0	A	0.1	300.0	
CTStarPoint7		ToObject				
CTsec7		1	A	1	10	

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
CTprim7		2000	A	1	99999	
NAMECH8		BAY409_CT_YPH			16 characters	
ChannelType8		CurrentProtection				
RatedTrans8		1.0	A	0.1	300.0	
CTStarPoint8		ToObject				
CTsec8		1	A	1	10	
CTprim8		2000	A	1	99999	
NAMECH9		BAY409_CT_BPH			16 characters	
ChannelType9		CurrentProtection				
RatedTrans9		1.0	A	0.1	300.0	
CTStarPoint9		ToObject				
CTsec9		1	A	1	10	
CTprim9		2000	A	1	99999	
NAMECH10		BAY412_CT_RPH			16 characters	
ChannelType10		CurrentProtection				
RatedTrans10		1.0	A	0.1	300.0	
CTStarPoint10		ToObject				
CTsec10		1	A	1	10	
CTprim10		2000	A	1	99999	
NAMECH11		BAY412_CT_YPH			16 characters	
ChannelType11		CurrentProtection				
RatedTrans11		1.0	A	0.1	300.0	
CTStarPoint11		ToObject				
CTsec11		1	A	1	10	
CTprim11		2000	A	1	99999	
NAMECH12		BAY412_CT_BPH			16 characters	
ChannelType12		CurrentProtection				
RatedTrans12		1.0	A	0.1	300.0	
CTStarPoint12		ToObject				
CTsec12		1	A	1	10	
CTprim12		2000	A	1	99999	

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
Global base values						
GBASVAL: 1						
UBase		400.00	kV	0.05	2000.00	
IBase		476	A	1	99999	
SBase		330.00	MVA	1.00	200000.00	
GBASVAL: 2						
UBase		400.00	kV	0.05	2000.00	
IBase		953	A	1	99999	
SBase		660.00	MVA	1.00	200000.00	
GBASVAL: 3						
UBase		400.00	kV	0.05	2000.00	
IBase		2000	A	1	99999	
SBase		1385.00	MVA	1.00	200000.00	
GBASVAL: 4						
UBase		400.00	kV	0.05	2000.00	
IBase		2000	A	1	99999	
SBase		1385.00	MVA	1.00	200000.00	
GBASVAL: 5						
UBase		400.00	kV	0.05	2000.00	
IBase		2000	A	1	99999	
SBase		1385.00	MVA	1.00	200000.00	
GBASVAL: 6						
UBase		400.00	kV	0.05	2000.00	
IBase		2000	A	1	99999	
SBase		1385.00	MVA	1.00	200000.00	
GBASVAL: 7						
UBase		400.00	kV	0.05	2000.00	
IBase		2000	A	1	99999	
SBase		1385.00	MVA	1.00	200000.00	
GBASVAL: 8						
UBase		400.00	kV	0.05	2000.00	
IBase		2000	A	1	99999	
SBase		1385.00	MVA	1.00	200000.00	
GBASVAL: 9						
UBase		400.00	kV	0.05	2000.00	
IBase		2000	A	1	99999	
SBase		1385.00	MVA	1.00	200000.00	
GBASVAL: 10						
UBase		400.00	kV	0.05	2000.00	
IBase		2000	A	1	99999	
SBase		1385.00	MVA	1.00	200000.00	
GBASVAL: 11						
UBase		400.00	kV	0.05	2000.00	
IBase		2000	A	1	99999	

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
SBase		1385.00	MVA	1.00	200000.00	
GBASVAL: 12						
UBase		400.00	kV	0.05	2000.00	
IBase		2000	A	1	99999	
SBase		1385.00	MVA	1.00	200000.00	

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
PROT						
Differential protection						
BBP4Z3Ph(87B,3Id/I)						
Common						
BDZS4GAPC: 1						
General						
CondBlkMode		Common				
Setting Group1						
OperationBBP		On				
DiffTripOut		SelfReset				
tTripPulse		0.20	s	0.03	60.00	
tMergALM		300	s	10	6000	
OpAutoRstFOCT		Disable				
Differential Zones						
Setting Group1						
DiffOperLev		1144	A	100	50000	
tTripHold		0.20	s	0.05	60.00	
SlowOCTOper		Supervise				
FastOCTOper		Supervise				
OCTOperLev		95	A	50	10000	
OCTReleaseLev		1191	A	100	50000	
tSlowOCT		20.0	s	1.0	600.0	
IdAlarmLev		229	A	50	20000	
tIdAlarm		5.0	s	5.0	600.0	
IinAlarmLev		2192	A	50	50000	
SensDiffOper		Off				
SlopeDZ		0.53				
tZeroI_Feeder		0.20	s	0.04	1.00	
Interconnectors						
Setting Group1						
tZeroI_BIC		0.20	s	0.04	1.00	
tInvertI_BIC		0.20	s	0.04	1.00	
ZoneOperations						
BTZNPDIF_Z1: 1						
Setting Group1						
Operation		On				
BTZNPDIF_Z2: 2						
Setting Group1						
Operation		On				
CheckZone						
CHECKZONE; BTCZPDIF: 1						
Setting Group1						
Operation		On				
OperLevel		1144	A	100	50000	

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
SlopeCZ		0.15		0.10	0.90	

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ADANI GREEN ENERGY LIMITED (ADANI RENEWABLES)

400kV BADISID SUBSTATION LINE PROTECTION RELAY SETTING CALCULATION

400kV BADISID SUBSTATION

ADANI GREEN ENERGY LIMITED

Hitachi Energy

DOCUMENT	400kV BADISID SUBSTATION LINE PROTECTION RELAY SETTING CALCULATION
PROJECT	400kV BADISID SUBSTATION
SUBSTATION	400kV BADISID SUBSTATION
CLIENT	ADANI GREEN ENERGY LIMITED
SUPPLIER	HITACHI ENERGY INDIA LIMITED
PO / LOA No.	IDTO-VI/ Adani Green-400 kV at Badi Sid - Rajasthan /PGGA/CRP & SAS
HEIL SO REF.	3100139976, 1MNS500950-PAAA

Revisions:

Rev.	Prep. / Appr.	Description	Date
00	SS / PN	First Submission	02-Aug-24

1 General Data

System Details

Voltage	Un	=	400	kV
Frequency	F	=	50	Hz
Station Name		=	400kV BADISID SUBSTATION	
Feeder Name		=	400 KV LINE CONTROL AND RELAY PANEL	
Bay No		=	BAY 403	
Relay Ordering Code		=	REC670	
CT Primary ratio (Adopted Tap		=	1000	A
CT Secondary ratio		=	1	A
VT Primary ratio		=	400	kV
VT Secondary ratio		=	0.11	kV

Global Base Values

GBASVAL:1

Base Voltage	**Ubase**	=	**400**	**kV**
Base Current	**Ibase**	=	**1000**	**A**
Base Power	**Sbase**	=	**693**	**MVA**

2 Synchrocheck & Energizing check Function, SESRSYN (25)

The protection function has Synchrocheck, energizing check and synchronizing

Operation	=	**On**

Synchronizing function:

To allow closing of breakers between asynchronous networks, a synchronizing feature is provided.
The synchronizing feature measures the conditions across the circuit breaker and also determines the angle change occurring during the closing delay of the circuit breaker, from the measured slip frequency. The breaker close command is issued at the optimum time when conditions across the breaker are satisfied in order to avoid stress on the network and its components.

Operation	=	**Off**

Synchronism check function:

The synchrocheck mode checks that the voltages on both sides of the circuit breaker are perfectly synchronized (to perform a controlled reconnection) and gives permission to close the circuit breaker when certain conditions are simultaneously fulfilled.

Operation	=	**On**

The following conditions to be simultaneously fulfilled for Synchrocheck operation.
• The measured voltages (U-Line and U-Bus) are higher than the set values *UHighBusSC* and *UHighLineSC*.
• The difference in the voltage is smaller than the set value of *UDiffSC*.
• The difference in frequency is less than the set value of *FreqDiffM* and *FreqDiffA*.
• The frequency rate of change is less than set value for both U-Bus and U-Line.
• The difference in the phase angle is smaller than the set value of *PhaseDiffM* and *PhaseDiffA*

Settings criteria:

• UHighBusSC and UHighLineSC threshold voltages have to be set lower than the value where the network is expected to close with the synchronism check. A typical value is 80% of the rated voltage.
• UDiffSC, voltage difference between the line voltage and the bus voltage. A normal setting is 0.10-0.15 p.u.
• FreqDiffM and FreqDiffA, shall be chosen depending on the condition in the network.
At steady conditions, a low frequency difference setting is needed. Typical value for FreqDiffM is 10mHz.
At autoreclosing, a bigger frequency difference setting is preferable. Typical value for FreqDiffA is 100-200mHz.
• PhaseDiffM and PhaseDiffA, shall be chosen depending on conditions in the network.
The phase angle setting must be chosen to allow closing under maximum load condition. In most networks the maximum occurring angle is below 25 degrees.

UHighBusSC	=	**80**	**%UBB**
UHighLineSC	=	**80**	**%UBL**
UDiffSC	=	**0.1**	**pu**
FreqDiffA	=	**0.1**	**Hz**
FreqDiffM	=	**0.1**	**Hz**
PhaseDiffA	=	**20**	**Deg**
PhaseDiffM	=	**20**	**Deg**

Energizing check function:

The energizing check function checks that at least one side is dead to ensure that
Energizing from different directions can be different for automatic reclosing and manual closing of the circuit breaker. Two different settings can be used for automatic and manual closing of the circuit breaker.
For manual closing it is also possible to allow closing when both sides of the breaker are dead.

AutoEnerg	=	**Both**
ManEnerg	=	**Both**
ManEnergDBDL	=	**Off**

Settings criteria:

• UHighBusEnerg and UHighLineEnerg threshold voltages have to be set lower than the value at which the network is considered to be energized. A typical value can be 80% of the base voltages.
• ULowBusEnerg and ULowLineEnerg threshold voltages have to be set to a value greater than the value where the network is considered not to be energized. A typical value can be 20% of the base voltages.
• UMaxEnerg setting is used to block the closing when the voltage on the live side is above the set value.
• tAutoEnerg and tManEnerg, is to ensure that the dead side remains de-energized and that the condition is not due to a temporary interference. Circuit breaker closing is thus not permitted until the energizing condition has remained constant throughout the set delay setting time.

ULiveBusEnerg	=	**80**	**%UBB**
ULiveLineEnerg	=	**80**	**%UBL**
UDeadBusEnerg	=	**20**	**%UBB**
UDeadLineEnerg	=	**20**	**%UBL**
UMaxEnerg	=	**115**	**%UB**
tAutoEnerg	=	**0.1**	**s**
tManEnerg	=	**0.1**	**s**

3.1 Autorecloser, SMBRREC (79)

The autoreclosing function SMBRREC (79) provides high-speed and/or delayed auto-reclosing for single breaker or multi breaker applications.

Up to five three-phase reclosing attempts can be included by parameter setting.
The autoreclosing function provides single and/or three phase auto reclosing.
The autoreclosing function is configured to co-operate with the synchronism check function.

The General Settings are Proposed for 79,

Operation	=	On	
ExternalCtrl	=	On	
ARMode	=	1/2ph	
t1 1Ph	=	1	s
t1 3Ph	=	1	s
t1 3PhHS	=	0.4	s
tReclaim	=	25	s
tSync	=	30	s
tLongStartInh	=	0.2	s
tPulse	=	0.2	s
tCBClosedMin	=	5	s
tUnsucCl	=	30	s
Priority	=	None	
tWaitForMaster	=	60	s
LongStartInhib	=	On	
NoOfShots	=	1	
StartByCBOpen	=	Off	
CBReadyType	=	CO	
t1 2Ph	=	1	s
t2 3Ph	=	1	s
t3 3Ph	=	1	s
t4 3Ph	=	1	s
t5 3Ph	=	1	s
Extended t1	=	Off	
tExtended t1	=	0.5	s
tInhibit	=	5	s
CutPulse	=	Off	
Follow CB	=	Off	
AutoContinue	=	Off	
tAutoContWait	=	2	s
UnsucClByCBChk	=	NoCBCheck	
BlockByUnsucCl	=	Off	
ZoneSeqCoord	=	Off	
tSuccessful	=	1	s
tSlaveDeadTime	=	0.4	s

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
TRM_40						
NAMECH1		MAIN+TIE_CT_RPH			16 characters	
ChannelType1		CurrentProtection				
RatedTrans1		1.0	A	0.1	300.0	
CTStarPoint1		ToObject				
CTsec1		1	A	1	10	
CTprim1		1000	A	1	99999	
NAMECH2		MAIN+TIE_CT_YPH			16 characters	
ChannelType2		CurrentProtection				
RatedTrans2		1.0	A	0.1	300.0	
CTStarPoint2		ToObject				
CTsec2		1	A	1	10	
CTprim2		1000	A	1	99999	
NAMECH3		MAIN+TIE_CT_BPH			16 characters	
ChannelType3		CurrentProtection				
RatedTrans3		1.0	A	0.1	300.0	
CTStarPoint3		ToObject				
CTsec3		1	A	1	10	
CTprim3		1000	A	1	99999	
NAMECH4		CH4(I)			16 characters	
ChannelType4		CurrentProtection				
RatedTrans4		1.0	A	0.1	300.0	
CTStarPoint4		ToObject				
CTsec4		1	A	1	10	
CTprim4		2000	A	1	99999	
NAMECH5		CH5(I)			16 characters	
ChannelType5		CurrentProtection				
RatedTrans5		1.0	A	0.1	300.0	
CTStarPoint5		ToObject				
CTsec5		1	A	1	10	
CTprim5		2000	A	1	99999	
NAMECH6		CH6(I)			16 characters	
ChannelType6		CurrentProtection				
RatedTrans6		1.0	A	0.1	300.0	
CTStarPoint6		ToObject				
CTsec6		1	A	1	10	
CTprim6		2000	A	1	99999	
NAMECH7		LINE_CVT_RPH			16 characters	
ChannelType7		Voltage				
RatedTrans7		110.0	V	0.1	300.0	
VTsec7		110.000	V	0.001	999.999	
VTprim7		400.00	kV	0.05	2000.00	

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
NAMECH8		LINE_CVT_YPH			16 characters	
ChannelType8		Voltage				
RatedTrans8		110.0	V	0.1	300.0	
VTsec8		110.000	V	0.001	999.999	
VTprim8		400.00	kV	0.05	2000.00	
NAMECH9		LINE_CVT_BPH			16 characters	
ChannelType9		Voltage				
RatedTrans9		110.0	V	0.1	300.0	
VTsec9		110.000	V	0.001	999.999	
VTprim9		400.00	kV	0.05	2000.00	
NAMECH10		400KV_BUS-1_CVT			16 characters	
ChannelType10		Voltage				
RatedTrans10		110.0	V	0.1	300.0	
VTsec10		110.000	V	0.001	999.999	
VTprim10		400.00	kV	0.05	2000.00	
NAMECH11		400KV_BUS-2_CVT			16 characters	
ChannelType11		Voltage				
RatedTrans11		110.0	V	0.1	300.0	
VTsec11		110.000	V	0.001	999.999	
VTprim11		400.00	kV	0.05	2000.00	
NAMECH12		ICT_LV_SEL_VT			16 characters	
ChannelType12		Voltage				
RatedTrans12		110.0	V	0.1	300.0	
VTsec12		110.000	V	0.001	999.999	
VTprim12		220.00	kV	0.05	2000.00	

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
AR						
Control						
AutoRecloser(79,5(0->1))						
AUTO_RECLOSE; SMBRREC: 1						
General						
Setting Group1						
Operation		On				
ExternalCtrl		On				
ARMode		1/2ph				
AutoContinue		Off				
StartByCBOpen		Off				
LongStartInhib		On				
tLongStartInh		0.200	s	0.000	60.000	
tInhibit		5.000	s	0.000	60.000	
ZoneSeqCoord		Off				
CircuitBreaker						
Setting Group1						
CBReadyType		CO				
Follow CB		Off				
UnsucClByCBChk		NoCBCheck				
BlockByUnsucCl		Off				
CutPulse		Off				
tPulse		0.200	s	0.000	60.000	
tReclaim		25.00	s	0.00	6000.00	
tSync		30.00	s	0.00	6000.00	
tCBClosedMin		5.00	s	0.00	6000.00	
tSuccessful		1.000	s	0.000	60.000	
tUnsucCl		30.00	s	0.00	6000.00	
DeadTime						
Setting Group1						
NoOfShots		1				
t1 1Ph		1.000	s	0.000	120.000	
t1 2Ph		1.000	s	0.000	120.000	
t1 3Ph		1.000	s	0.000	120.000	
Extended t1		Off				
tExtended t1		0.500	s	0.000	60.000	
t1 3PhHS		0.400	s	0.000	120.000	
MasterSlave						
Setting Group1						
Priority		None				
tSlaveDeadTime		0.400	s	0.100	60.000	
Logic						
LogicSRMemory						
SRMEMORY: 21						

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
Setting Group1						
Memory		On				

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
SYNC						
Control						
Synchronizing(25,SC/VC)						
SESRSYN: 1						
General						
GblBaseSelBus		1		1	12	
GblBaseSelLine		1		1	12	
SelPhaseBus1		Phase L1L2				
SelPhaseBus2		Phase L1L2				
SelPhaseLine1		Phase L1L2				
SelPhaseLine2		Phase L1L2				
CBConfig		1 1/2 bus CB				
PhaseShift		0	Deg	-180	180	
Setting Group1						
Operation		On				
Synchronizing						
Setting Group1						
OperationSynch		Off				
UHighBusSynch		80.0	%UBB	50.0	120.0	
UHighLineSynch		80.0	%UBL	50.0	120.0	
UDiffSynch		0.10	pu	0.02	0.50	
FreqDiffMin		0.010	Hz	0.003	0.250	
FreqDiffMax		0.200	Hz	0.050	1.000	
FreqRateChange		0.300	Hz/s	0.000	0.500	
CloseAngleMax		15.0	Deg	15.0	30.0	
tBreaker		0.080	s	0.000	1.000	
tClosePulse		0.200	s	0.050	60.000	
tMaxSynch		600.00	s	0.00	6000.00	
tMinSynch		2.000	s	0.000	60.000	
Synchrocheck						
Setting Group1						
OperationSC		On				
UHighBusSC		80.0	%UBB	50.0	120.0	
UHighLineSC		80.0	%UBL	50.0	120.0	
UDiffSC		0.10	pu	0.02	0.50	
FreqDiffA		0.100	Hz	0.003	1.000	
FreqDiffM		0.100	Hz	0.003	1.000	
PhaseDiffA		20.0	Deg	5.0	90.0	
PhaseDiffM		20.0	Deg	5.0	90.0	
tSCA		0.100	s	0.000	60.000	
tSCM		0.100	s	0.000	60.000	
Energizingcheck						
Setting Group1						
AutoEnerg		Both				

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
ManEnerg		Both				
ManEnergDBDL		Off				
UHighBusEnerg		80.0	%UBB	50.0	120.0	
UHighLineEnerg		80.0	%UBL	50.0	120.0	
ULowBusEnerg		20.0	%UBB	10.0	80.0	
ULowLineEnerg		20.0	%UBL	10.0	80.0	
UMaxEnerg		115.0	%UB	50.0	180.0	
tAutoEnerg		0.100	s	0.000	60.000	
tManEnerg		0.100	s	0.000	60.000	

TIE BAY LBB PROTECTION RELAY, REL670

TIE BAY_ (BAY 402, 405)

SETTING CALCULATION OF BREAKER FAILURE PROTECTION (50BF)

The following settings can be done for the breaker failure protection:

Operation: = On

Ibase = 1000 A

FunctionMode = Current

BuTripMode: = 1 out of 3

(It means that at least one current of the three-phase currents shall be high to indicate breaker failure)

RetripMode: = FunctionMode

If CB Pos Check has to be set,

CB Pos Check	*Current*	re-trip is done if the phase current is larger than the operate level after re-trip time has elapsed
	Contact	re-trip is done when auxiliary contact position indicates that breaker is still closed after re-trip time has elapsed
	Current/Contact	both methods according to above are used but taken into account also *I>BlkCont*

Table:Dependencies between parameters RetripMode and FunctionMode

IP>:

This parameter should be less than the minimum fault current. The setting can be chosen in accordance with the most sensitive protection function to start the breaker failure protection.

therefore The setting can be,

IP>: = 20 % of IB

I>BlkCont:

If any contact based detection of breaker failure is used, this function can be blocked if any phase current is larger than this setting level. If the FunctionMode is set Current/Contact breaker failure for high current faults are safely detected by the current measurement function. To increase security the contact based function should be disabled for high currents.

therefore The setting can be,

I>BlkCont: = 20 % of IB

t1: Time delay of the re-trip.

t1: = 100 ms

t2: Time delay of the back-up trip

t2: = 200 ms

tCBAlarm: Time delay for alarm in case of indication of faulty circuit breaker. There is a binary input CBFLT from the circuit breaker. This signal is activated when internal supervision in the circuit breaker detect that the circuit breaker is unable to clear fault. This could be the case when gas pressure is low in a SF6.circuit breaker. After the set time an alarm is given, so that actions can be done to repair the circuit breaker. The time delay for back-up trip is bypassed when the CBFLT is active.

tCBAlarm	=	5 (Default Value from Manual)	s

tPulse: Trip pulse duration. This setting must be larger than the critical impulse time of circuit breakers to be tripped from the breaker failure protection.

tPulse	=	200 (Default Value from Manual)	ms

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
TRM_40						
NAMECH1		TIE_CT_R			16 characters	
ChannelType1		CurrentProtection				
RatedTrans1		1.0	A	0.1	300.0	
CTStarPoint1		ToObject				
CTsec1		1	A	1	10	
CTprim1		1000	A	1	99999	
NAMECH2		TIE_CT_Y			16 characters	
ChannelType2		CurrentProtection				
RatedTrans2		1.0	A	0.1	300.0	
CTStarPoint2		ToObject				
CTsec2		1	A	1	10	
CTprim2		1000	A	1	99999	
NAMECH3		TIE_CT_B			16 characters	
ChannelType3		CurrentProtection				
RatedTrans3		1.0	A	0.1	300.0	
CTStarPoint3		ToObject				
CTsec3		1	A	1	10	
CTprim3		1000	A	1	99999	
NAMECH4		CH4(I)			16 characters	
ChannelType4		CurrentProtection				
RatedTrans4		1.0	A	0.1	300.0	
CTStarPoint4		ToObject				
CTsec4		1	A	1	10	
CTprim4		1000	A	1	99999	
NAMECH5		NEUTRSL_CT			16 characters	
ChannelType5		CurrentProtection				
RatedTrans5		1.0	A	0.1	300.0	
CTStarPoint5		ToObject				
CTsec5		1	A	1	10	
CTprim5		1000	A	1	99999	
NAMECH6		CH6(I)			16 characters	
ChannelType6		CurrentProtection				
RatedTrans6		1.0	A	0.1	300.0	
CTStarPoint6		ToObject				
CTsec6		1	A	1	10	
CTprim6		1000	A	1	99999	
NAMECH7		CH7(U)			16 characters	
ChannelType7		Voltage				
RatedTrans7		110.0	V	0.1	300.0	
VTsec7		110.000	V	0.001	999.999	
VTprim7		400.00	kV	0.05	2000.00	
NAMECH8		CH8(U)			16 characters	
ChannelType8		Voltage				

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
RatedTrans8		110.0	V	0.1	300.0	
VTsec8		110.000	V	0.001	999.999	
VTprim8		400.00	kV	0.05	2000.00	
NAMECH9		CH9(U)			16 characters	
ChannelType9		Voltage				
RatedTrans9		110.0	V	0.1	300.0	
VTsec9		110.000	V	0.001	999.999	
VTprim9		400.00	kV	0.05	2000.00	
NAMECH10		CH10(U)			16 characters	
ChannelType10		Voltage				
RatedTrans10		110.0	V	0.1	300.0	
VTsec10		110.000	V	0.001	999.999	
VTprim10		400.00	kV	0.05	2000.00	
NAMECH11		CH11(U)			16 characters	
ChannelType11		Voltage				
RatedTrans11		110.0	V	0.1	300.0	
VTsec11		110.000	V	0.001	999.999	
VTprim11		400.00	kV	0.05	2000.00	
NAMECH12		CH12(U)			16 characters	
ChannelType12		Voltage				
RatedTrans12		110.0	V	0.1	300.0	
VTsec12		110.000	V	0.001	999.999	
VTprim12		400.00	kV	0.05	2000.00	

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
Global base values						
GBASVAL: 1						
UBase		400.00	kV	0.05	2000.00	
IBase		1000	A	1	99999	
SBase		762.00	MVA	1.00	200000.00	
GBASVAL: 2						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	
SBase		2000.00	MVA	1.00	200000.00	
GBASVAL: 3						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	
SBase		2000.00	MVA	1.00	200000.00	
GBASVAL: 4						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	
SBase		2000.00	MVA	1.00	200000.00	
GBASVAL: 5						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	
SBase		2000.00	MVA	1.00	200000.00	
GBASVAL: 6						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	
SBase		2000.00	MVA	1.00	200000.00	
GBASVAL: 7						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	
SBase		2000.00	MVA	1.00	200000.00	
GBASVAL: 8						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	
SBase		2000.00	MVA	1.00	200000.00	
GBASVAL: 9						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	
SBase		2000.00	MVA	1.00	200000.00	
GBASVAL: 10						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	
SBase		2000.00	MVA	1.00	200000.00	
GBASVAL: 11						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
SBase		2000.00	MVA	1.00	200000.00	
GBASVAL: 12						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	
SBase		2000.00	MVA	1.00	200000.00	

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
I_PROT						
Current protection						
BreakerFailure(50BF,3I>BF)						
LBB; CCRBRF: 1						
GlobalBaseSel		1		1	12	
Setting Group1						
Operation		On				
FunctionMode		Current				
StartMode		FollowStart&Mode				
tStartTimeout		1.0	s	0.5	600.0	
BuTripMode		1 out of 3				
RetripMode		UseFunctionMode				
IPh>		20	%IB	5	200	
t1		0.100	s	0.000	60.000	
t2		0.200	s	0.000	60.000	
t2MPh		0.150	s	0.000	60.000	
t3		0.030	s	0.000	60.000	
tCBAlarm		5.000	s	0.000	60.000	
tPulse		0.200	s	0.010	60.000	

REC670
BAY CONTROL UNIT
400kV TIE BAY C&R PANEL-1, 2 (BAY -402, 405)

1 General Data

System Details

Voltage	Un	=	400	kV
Frequency	F	=	50	Hz
Station Name		=	400kV BADISID SUBSTATION	
Feeder Name		=	400kV TIE BAY C&R PANEL-1, 2	
Bay No		=	BAY -402, 405	
Relay Ordering Code		=	REC670	
CT Primary ratio (Adopted Tap)		=	1000	A
CT Secondary ratio		=	1	A
VT Primary ratio		=	400	kV
VT Secondary ratio		=	0.11	kV
Transformer MVA		=	330	MVA
Transformer Full Load current		=	476.3	
Maximum 3phase fault current		=	10500	A
Maximum 3phase fault current		=	10500	A

Global Base Values

GBASVAL:1

Base Voltage	**Ubase**	=	**400**	**kV**
Base Current	**Ibase**	=	**476.3**	**A**
Base Power	**Sbase**	=	**330**	**MVA**

2 Synchrocheck & Energizing check Function, SESRSYN (25)

The protection function has Synchrocheck, energizing check and synchronizing features.

Operation = On

Synchronizing function:

To allow closing of breakers between asynchronous networks, a synchronizing feature is provided.
The synchronizing feature measures the conditions across the circuit breaker and also determines the angle change occurring during the closing delay of the circuit breaker, from the measured slip frequency. The breaker close command is issued at the optimum time when conditions across the breaker are satisfied in order to avoid stress on the network and its components.

Operation = Off

Synchronism check function:

The synchrocheck mode checks that the voltages on both sides of the circuit breaker are perfectly synchronized (to perform a controlled reconnection) and gives permission to close the circuit breaker when certain conditions are simultaneously fulfilled.

Operation = On

The following conditions to be simultaneously fulfilled for Synchrocheck operation.
• The measured voltages (U-Line and U-Bus) are higher than the set values *UHighBusSC* and *UHighLineSC*.
• The difference in the voltage is smaller than the set value of *UDiffSC*.
• The difference in frequency is less than the set value of *FreqDiffM* and *FreqDiffA*.
• The frequency rate of change is less than set value for both U-Bus and U-Line.
• The difference in the phase angle is smaller than the set value of *PhaseDiffM* and *PhaseDiffA*

Settings criteria:

• UHighBusSC and UHighLineSC threshold voltages have to be set lower than the value where the network is expected to close with the synchronism check. A typical value is 80% of the rated voltage.
• UDiffSC, voltage difference between the line voltage and the bus voltage. A normal setting is 0.10-0.15 p.u.
• FreqDiffM and FreqDiffA, shall be chosen depending on the condition in the network.
At steady conditions, a low frequency difference setting is needed. Typical value for FreqDiffM is 10mHz.
At autoreclosing, a bigger frequency difference setting is preferable. Typical value for FreqDiffA is 100-200mHz.
• PhaseDiffM and PhaseDiffA, shall be chosen depending on conditions in the network.
The phase angle setting must be chosen to allow closing under maximum load condition. In most networks the maximum occurring angle is below 25 degrees.

UHighBusSC	=	**80**	**%UBB**
UHighLineSC	=	**80**	**%UBL**
UDiffSC	=	**0.1**	**pu**
FreqDiffA	=	**0.1**	**Hz**
FreqDiffM	=	**0.1**	**Hz**
PhaseDiffA	=	**20**	**Deg**
PhaseDiffM	=	**20**	**Deg**

Energizing check function:

The energizing check function checks that at least one side is dead to ensure that closing
Energizing from different directions can be different for automatic reclosing and manual closing of the circuit breaker. Two different settings can be used for automatic and manual closing of the circuit breaker.
For manual closing it is also possible to allow closing when both sides of the breaker are dead.

AutoEnerg	=	**Both**
ManEnerg	=	**Both**
ManEnergDBDL	=	**Off**

Settings criteria:

• UHighBusEnerg and UHighLineEnerg threshold voltages have to be set lower than the value at which the network is considered to be energized. A typical value can be 80% of the base voltages.
• ULowBusEnerg and ULowLineEnerg threshold voltages have to be set to a value greater than the value where the network is considered not to be energized. A typical value can be 20% of the base voltages.
• UMaxEnerg setting is used to block the closing when the voltage on the live side is above the set value.
• tAutoEnerg and tManEnerg, is to ensure that the dead side remains de-energized and that the condition is not due to a temporary interference. Circuit breaker closing is thus not permitted until the energizing condition has remained constant throughout the set delay setting time.

ULiveBusEnerg	=	**80**	**%UBB**
ULiveLineEnerg	=	**80**	**%UBL**
UDeadBusEnerg	=	**20**	**%UBB**
UDeadLineEnerg	=	**20**	**%UBL**
UMaxEnerg	=	**115**	**%UB**
tAutoEnerg	=	**0.1**	**s**
tManEnerg	=	**0.1**	**s**

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
TRM_40						
NAMECH1		TIE_CT_RPH			16 characters	
ChannelType1		CurrentProtection				
RatedTrans1		1.0	A	0.1	300.0	
CTStarPoint1		ToObject				
CTsec1		1	A	1	10	
CTprim1		1000	A	1	99999	
NAMECH2		TIE_CT_YPH			16 characters	
ChannelType2		CurrentProtection				
RatedTrans2		1.0	A	0.1	300.0	
CTStarPoint2		ToObject				
CTsec2		1	A	1	10	
CTprim2		1000	A	1	99999	
NAMECH3		TIE_CT_BPH			16 characters	
ChannelType3		CurrentProtection				
RatedTrans3		1.0	A	0.1	300.0	
CTStarPoint3		ToObject				
CTsec3		1	A	1	10	
CTprim3		1000	A	1	99999	
NAMECH4		SPARE			16 characters	
ChannelType4		CurrentProtection				
RatedTrans4		1.0	A	0.1	300.0	
CTStarPoint4		ToObject				
CTsec4		1	A	1	10	
CTprim4		1000	A	1	99999	
NAMECH5		CB INTRPT_YPH			16 characters	
ChannelType5		CurrentProtection				
RatedTrans5		1.0	A	0.1	300.0	
CTStarPoint5		ToObject				
CTsec5		1	A	1	10	
CTprim5		1000	A	1	99999	
NAMECH6		CB INTRPT_BPH			16 characters	
ChannelType6		CurrentProtection				
RatedTrans6		1.0	A	0.1	300.0	
CTStarPoint6		ToObject				
CTsec6		1	A	1	10	
CTprim6		1000	A	1	99999	
NAMECH7		400KV_BUS1_CVT_R			16 characters	
ChannelType7		Voltage				
RatedTrans7		110.0	V	0.1	300.0	
VTsec7		110.000	V	0.001	999.999	
VTprim7		400.00	kV	0.05	2000.00	

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
NAMECH8		400KV_BUS1_CVT_Y			16 characters	
ChannelType8		Voltage				
RatedTrans8		110.0	V	0.1	300.0	
VTsec8		110.000	V	0.001	999.999	
VTprim8		400.00	kV	0.05	2000.00	
NAMECH9		400KV_BUS1_CVT_B			16 characters	
ChannelType9		Voltage				
RatedTrans9		110.0	V	0.1	300.0	
VTsec9		110.000	V	0.001	999.999	
VTprim9		400.00	kV	0.05	2000.00	
NAMECH10		33KV_SEL_BUSPT			16 characters	
ChannelType10		Voltage				
RatedTrans10		110.0	V	0.1	300.0	
VTsec10		110.000	V	0.001	999.999	
VTprim10		33.00	kV	0.05	2000.00	
NAMECH11		BUS-2_CVT_RYPH			16 characters	
ChannelType11		Voltage				
RatedTrans11		110.0	V	0.1	300.0	
VTsec11		110.000	V	0.001	999.999	
VTprim11		400.00	kV	0.05	2000.00	
NAMECH12		LINE_CVT_RYPH			16 characters	
ChannelType12		Voltage				
RatedTrans12		110.0	V	0.1	300.0	
VTsec12		110.000	V	0.001	999.999	
VTprim12		440.00	kV	0.05	2000.00	

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
Global base values						
GBASVAL: 1						
UBase		400.00	kV	0.05	2000.00	
IBase		476	A	1	99999	
SBase		330.00	MVA	1.00	200000.00	
GBASVAL: 2						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	
SBase		2078.40	MVA	1.00	200000.00	
GBASVAL: 3						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	
SBase		2078.40	MVA	1.00	200000.00	
GBASVAL: 4						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	
SBase		2078.40	MVA	1.00	200000.00	
GBASVAL: 5						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	
SBase		2078.40	MVA	1.00	200000.00	
GBASVAL: 6						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	
SBase		2000.00	MVA	1.00	200000.00	
GBASVAL: 7						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	
SBase		2000.00	MVA	1.00	200000.00	
GBASVAL: 8						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	
SBase		2000.00	MVA	1.00	200000.00	
GBASVAL: 9						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	
SBase		2000.00	MVA	1.00	200000.00	
GBASVAL: 10						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	
SBase		2000.00	MVA	1.00	200000.00	
GBASVAL: 11						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
SBase		2000.00	MVA	1.00	200000.00	
GBASVAL: 12						
UBase		400.00	kV	0.05	2000.00	
IBase		3000	A	1	99999	
SBase		2000.00	MVA	1.00	200000.00	

Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	Format
SYNC						
Control						
Synchronizing(25,SC/VC)						
SESRSYN: 1						
General						
GblBaseSelBus		1		1	12	
GblBaseSelLine		1		1	12	
SelPhaseBus1		Phase L1L2				
SelPhaseBus2		Phase L1L2				
SelPhaseLine1		Phase L1L2				
SelPhaseLine2		Phase L1L2				
CBConfig		1 1/2 bus CB				
PhaseShift		0	Deg	-180	180	
Setting Group1						
Operation		On				
Synchronizing						
Setting Group1						
OperationSynch		Off				
CloseAngleMax		15.0	Deg	15.0	30.0	
Synchrocheck						
Setting Group1						
OperationSC		On				
UHighBusSC		80.0	%UBB	50.0	120.0	
UHighLineSC		80.0	%UBL	50.0	120.0	
UDiffSC		0.10	pu	0.02	0.50	
FreqDiffA		0.100	Hz	0.003	1.000	
FreqDiffM		0.100	Hz	0.003	1.000	
PhaseDiffA		20.0	Deg	5.0	90.0	
PhaseDiffM		20.0	Deg	5.0	90.0	
tSCA		0.100	s	0.000	60.000	
tSCM		0.100	s	0.000	60.000	
Energizingcheck						
Setting Group1						
AutoEnerg		Both				
ManEnerg		Both				
ManEnergDBDL		On				
UHighBusEnerg		80.0	%UBB	50.0	120.0	
UHighLineEnerg		80.0	%UBL	50.0	120.0	
ULowBusEnerg		20.0	%UBB	10.0	80.0	
ULowLineEnerg		20.0	%UBL	10.0	80.0	
UMaxEnerg		115.0	%UB	50.0	180.0	
tAutoEnerg		0.100	s	0.000	60.000	
tManEnerg		0.100	s	0.000	60.000	

adani Renewables	RELAY SETTING CALCULATION	Hitachi Energy

PROJECT TITLE

500MW BADI SID POWER PROJECT, RAJASTHAN

DOCUMENT TITLE

RELAY SETTING CALCULATION

1. INTRODUCTION

This document represents the Overcurrent and Earth Fault relay settings for 400 kV Switchyard, 400 / 33 kV Transformer, 33 kV Indoor & Outdoor Switchgear, and 415V AC Main Switchboard.

2. OBJECTIVE

The Relay setting and Coordination analysis is conducted to recommend the relay settings to achieve proper coordination between relays installed in 400 kV Switchyard, 400 / 33 kV Transformer, 33 kV Indoor Switchgear, and 415V AC Main Switchboard.

The Relay coordination study is performed to determine various relay settings under normal operating condition and to ensure:

A. Sensitivity to over current and earth faults under minimum and maximum fault conditions.

B. Selectivity of relays

3. SYSTEM DESCRIPTION

There are total of 26 Nos of 25 MW feeders receiving power from Solar Inverters and feeding to 4 Nos. of 33kV Indoor Switchgear. Further, the power from 33 kV Indoor Switchgear is evacuated to the 400kV Grid through 2 numbers of 198/264/330 MVA, 400/33kV Power Transformers. The Indoor Switchgear also feeds power to 1000kVA, 33/0.433kV Auxiliary Transformers for utilization at 415V Main Switchboard.

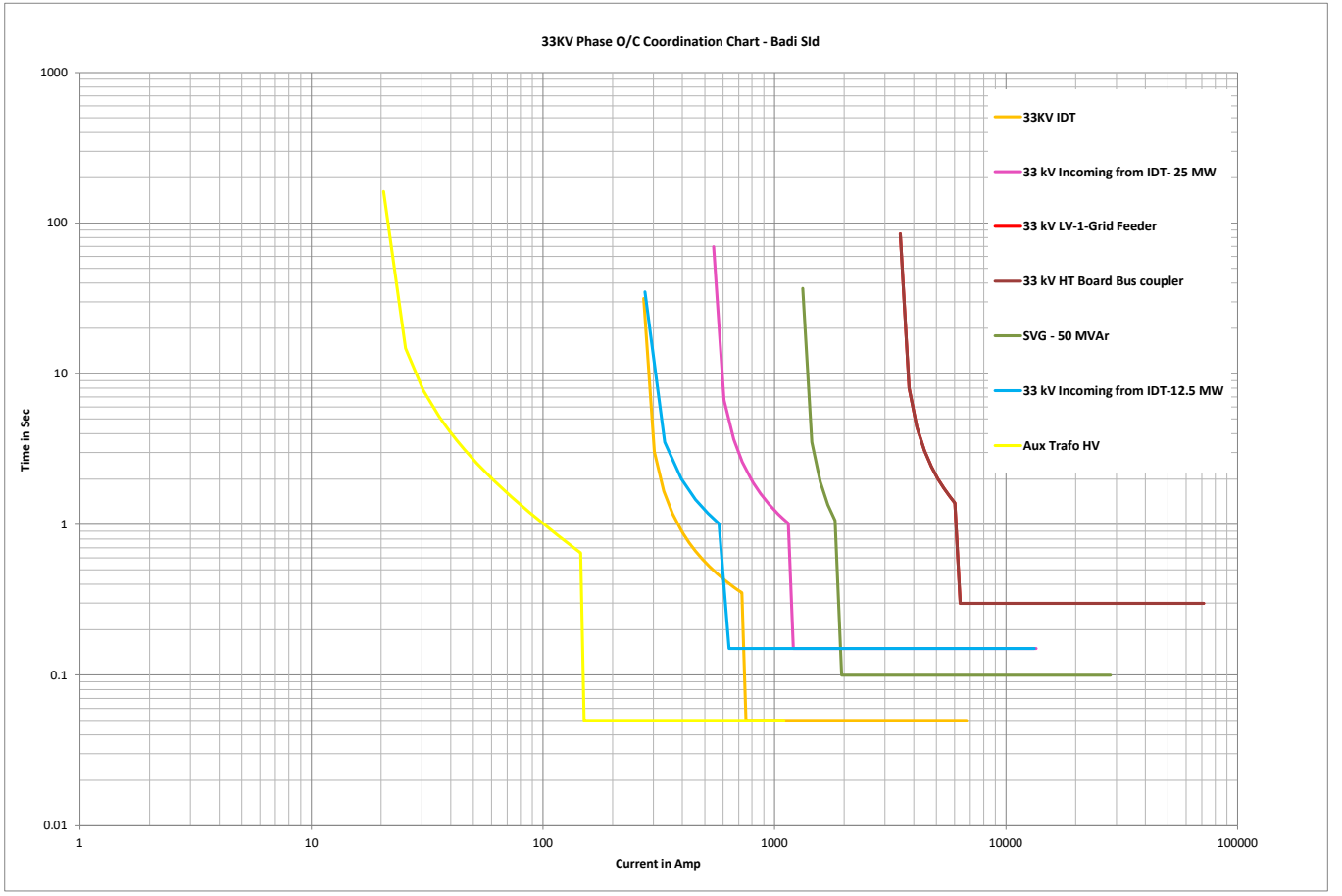
4. STUDY APPROACH / BASIS & ASSUMPTIONS

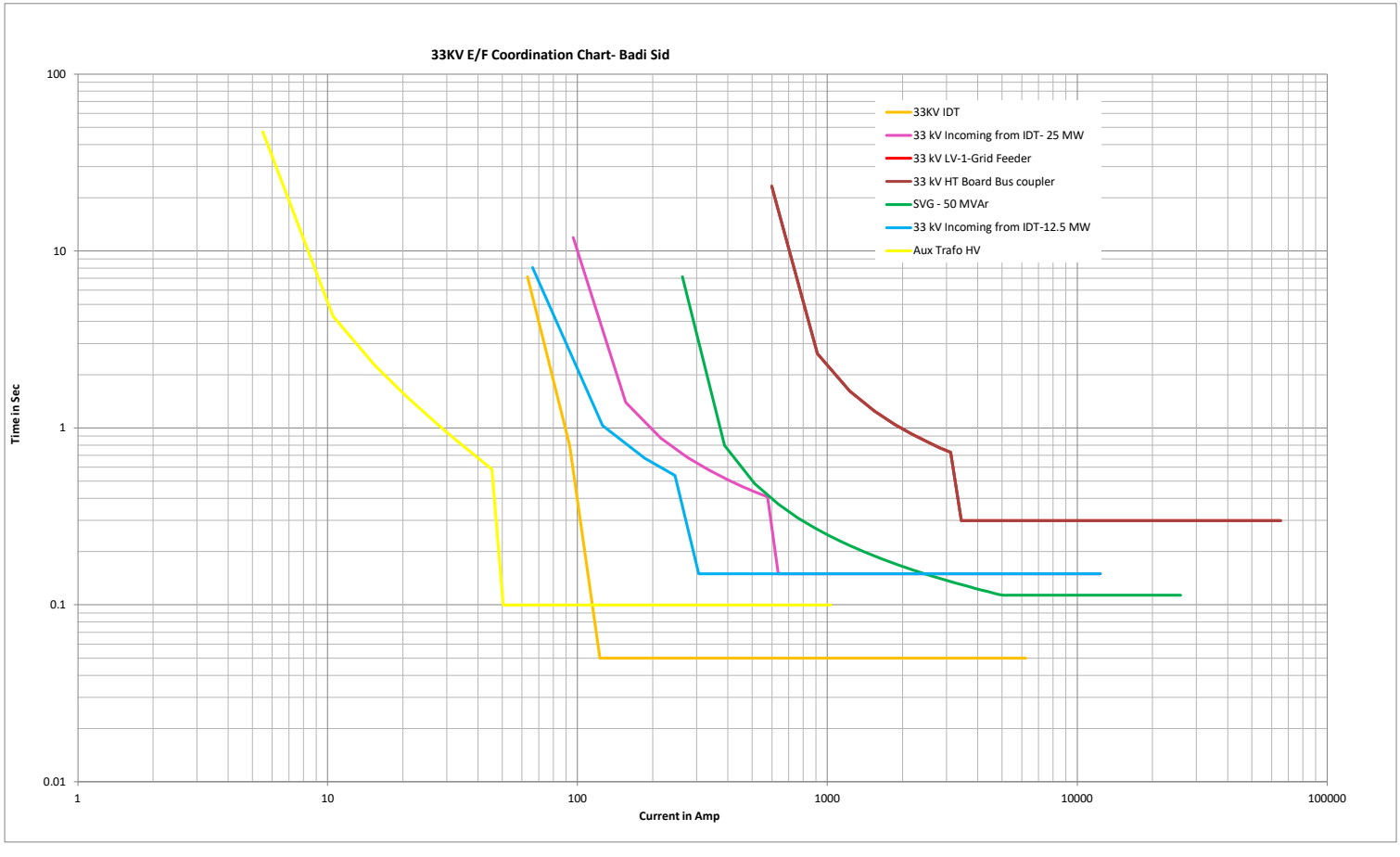
- It has been ensured that sufficient time co-ordination between up stream and downstream is maintained to take care the fault clearance and CB Operating time. This is applicable for Inverse and DT Characteristic.
- Back up protection for O/C and E/F has been considered from 33 kV Level to 400 kV level
- O/C & E/F relay co-ordination curves are shown for outgoing feeder with reference to incomer or more clarity. Since, the setting of other outgoing feeders at the same level is similar or lower.
- The curve represents the protection co-ordination of the entire switchgear, at that level.
- Pickup of Over Current is kept at minimum 120% of Rated current and for Earth fault pick up is min 20% of Rated current is selected.

33 kV Over current and Earth fault coordination - Badi Sid

Feeeder Name	33 kV LV-1-Grid Feeder			33 kV HT Board Bus coupler			SVG - 50 MVAr			33 kV Incoming from IDT- 25 MW			33 kV Incoming from IDT-12.5 MW			33KV IDT			Aux Trafo HV		
	Source MVA	165		Source MVA	165		Source MVA	165		Source MVA	165		Source MVA	165		MVA	12.5		MVA	1	
	CAPACITY	165		CAPACITY	165		CAPACITY	62		CAPACITY	25		CAPACITY	12.5		CAPACITY	12.5		CAPACITY	1	
	z in pu	0.15		z in pu	0.15		z in pu	0.15		z in pu	0.15		z in pu	0.15		z in pu	0.08		z in pu	0.05	
Voltage Ref	33	33		33	33		33	33		33	33		33	33		33	33		33	33	
	FLC	2886.8		FLC	2886.8		FLC	1084.8		FLC	437.4		FLC	218.7		FLC	218.7		FLC	17.5	
	P/U Factor	1.2		P/U Factor	1.2		P/U Factor	1.2		P/U Factor	1.2		P/U Factor	1.2		P/U Factor	1.2		P/U Factor	1.2	
RELAY	REF 615			REF 615			REF 615			REF 615			REF 615			7UT 85 / P645			REF 615		
3-Ph Fault current		19245.57352			19245.57352			19245.57352			19245.57352			19245.57352			2733.746238	2733.746		349.9195185	349.9195
Bus Fault Current		1			1			1			1			1							
Relay Current		1			1			1			1			1			1			1	
Shift Factor		1			1			1			1			1			1			1	
Phase CT Primary		3150			3150			1250			600			600			300			50	
Rated Current		2886.84	0.9165		2886.84	0.9164559		2886.84			2886.84			2886.84			218.70			17.50	
		3150	1.0997		3150	1.0997471		1250													
		Pr			Pr																
Settings description																	Pr			Pr	
PHASE-50/51N		7.94			7.94			20.02			41.70			41.70			11.85			9.10	
Phase Plug Setting	1.0997471	1.1	x In	1.0997471	1.1	x In	1.0413605	1.05	x In	0.8747988	0.9	x In	0.4373994	0.45	x In	0.874799	0.9	x In	0.419903	0.4	x In
Phase TMS		0.11			0.11			0.05			0.11			0.11			0.05			0.3	
Curve		NI			NI			NI			NI			NI			NI			VI	
Top		0.441436603			0.441436603			0.126868283			0.2494092			0.2494092			0.147714505			0.245514422	
Stage 2 (ON/OFF)		ON			ON			ON			ON			ON			ON			ON	
Stage 2 Plug Setting		2	x In		2	x In		1.5	x In		2	x In		1	x In		2.5	x In		3	x In
Stage 2 Inst Time		0.3			0.3			0.1			0.15			0.15			0.05			0.05	
Stage 3 (ON/OFF)		OFF			OFF			OFF			OFF			OFF			OFF			ON	
Phase Inst Plug Setting		5.5	x In		5.5	x In		13	x In		13	x In		13	x In		3	x In		3	x In
Phase Inst Time		0.05			0.05			0.05			0.05			0.05			0.05			0.05	
EARTH-50N/51N																					
1-Ph Fault current		19245.57352			19245.57352			19245.57352			19245.57352			19245.57352			2733.75			349.92	
Bus Fault Current		1			1			1			1			1			1			1	
Relay Current		1			1			1			1			1			1			1	
Shift Factor		1			1			1			1			1			1			1	
Earth CT Primary		3150			3150			1250			600			600			300			50	
Earth Plug Setting		0.18	x In		0.18	x In	0.1	0.2		0.1	0.15		0.1	0.1		0.1	0.2		0.1	0.1	
Earth TMS		0.18			0.18		0.3	0.05		0.3	0.11		0.3	0.11		0.1	0.05		0.1	0.35	
Curve		NI			NI		NI	NI		NI	NI		NI	NI		NI	NI		NI	VI	
Top		0.408124146			0.408124146		#DIV/0!	0.113367818		#DIV/0!	0.2494092		#DIV/0!	0.2494092		#DIV/0!	0.113367818		#DIV/0!	0.248684211	
Stage 2 (ON/OFF)		ON			ON		OFF	OFF		OFF	ON		OFF	ON		OFF	ON		OFF	ON	
Stage 2 Earth Setting		1	x In		1	x In	0.2	1	x In	0.2	1	x In	0.2	0.5	x In	1	0.4	x In	1	1	x In
Stage 2 Inst Time		0.3			0.3		0.3	0.15		0.3	0.15		0.3	0.15		1	0.05		1	0.1	
Stage 3 (ON/OFF)		OFF			OFF		OFF	OFF		OFF	OFF		OFF	OFF		OFF	OFF		OFF	OFF	
Phase Inst Plug Setting		1	x In			x In	-		x In	-		x In	-		x In	-	0.5	x In	-		x In
Phase Inst Time		1					-			-			-			-	0.1		-		

NOTE	All relay Settings proposed here is based on actual **CT RATIO** only

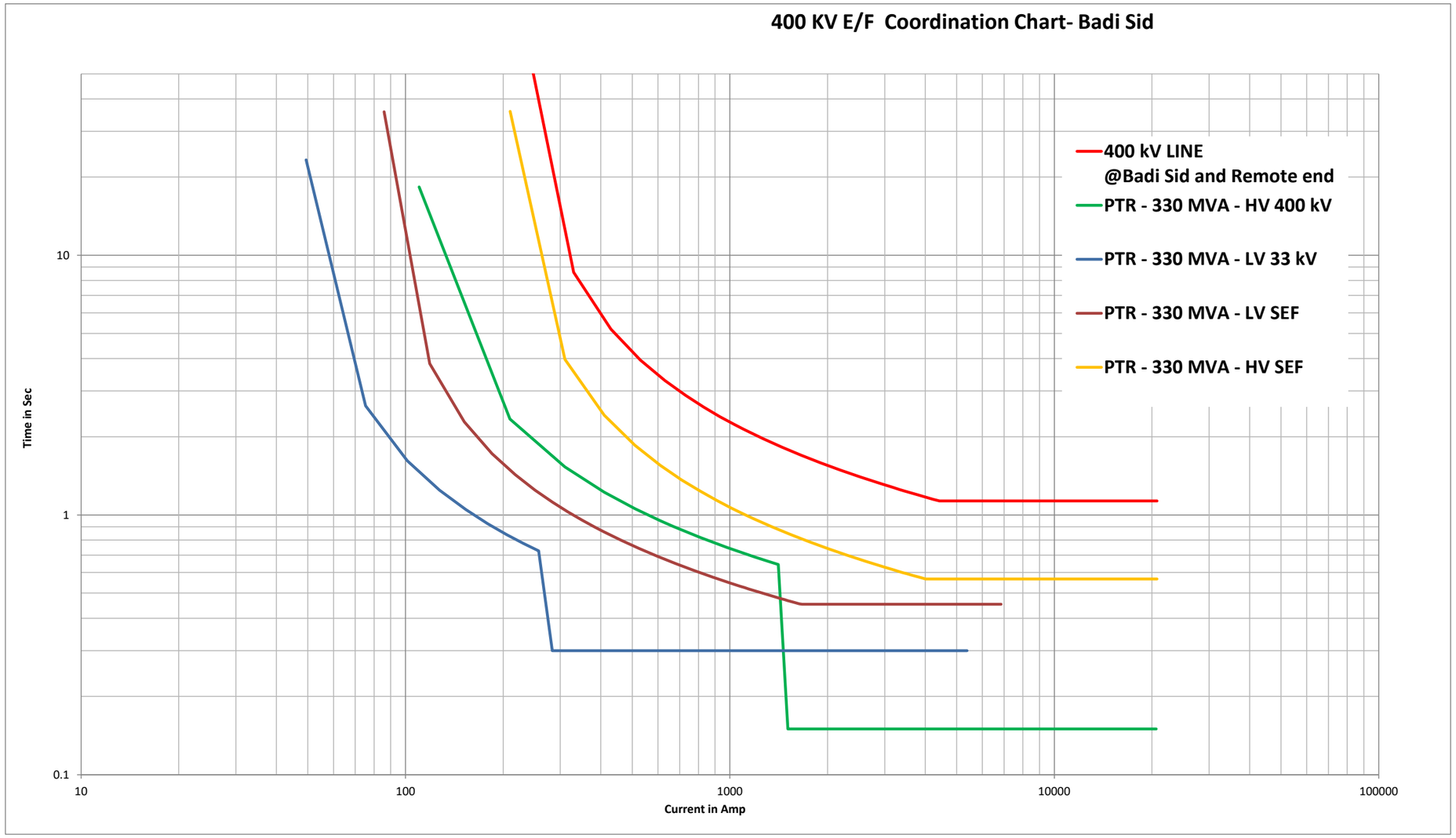

33KV Phase O/C Coordination Chart - Badi Sld
Time in Sec
1000
100
10
1
0.1
0.01
1
10
100
1000
10000
100000
Current in Amp
33KV IDT
33 kV Incoming from IDT- 25 MW
33 kV LV-1-Grid Feeder
33 kV HT Board Bus coupler
SVG - 50 MVAr
33 kV Incoming from IDT-12.5 MW
Aux Trafo HV

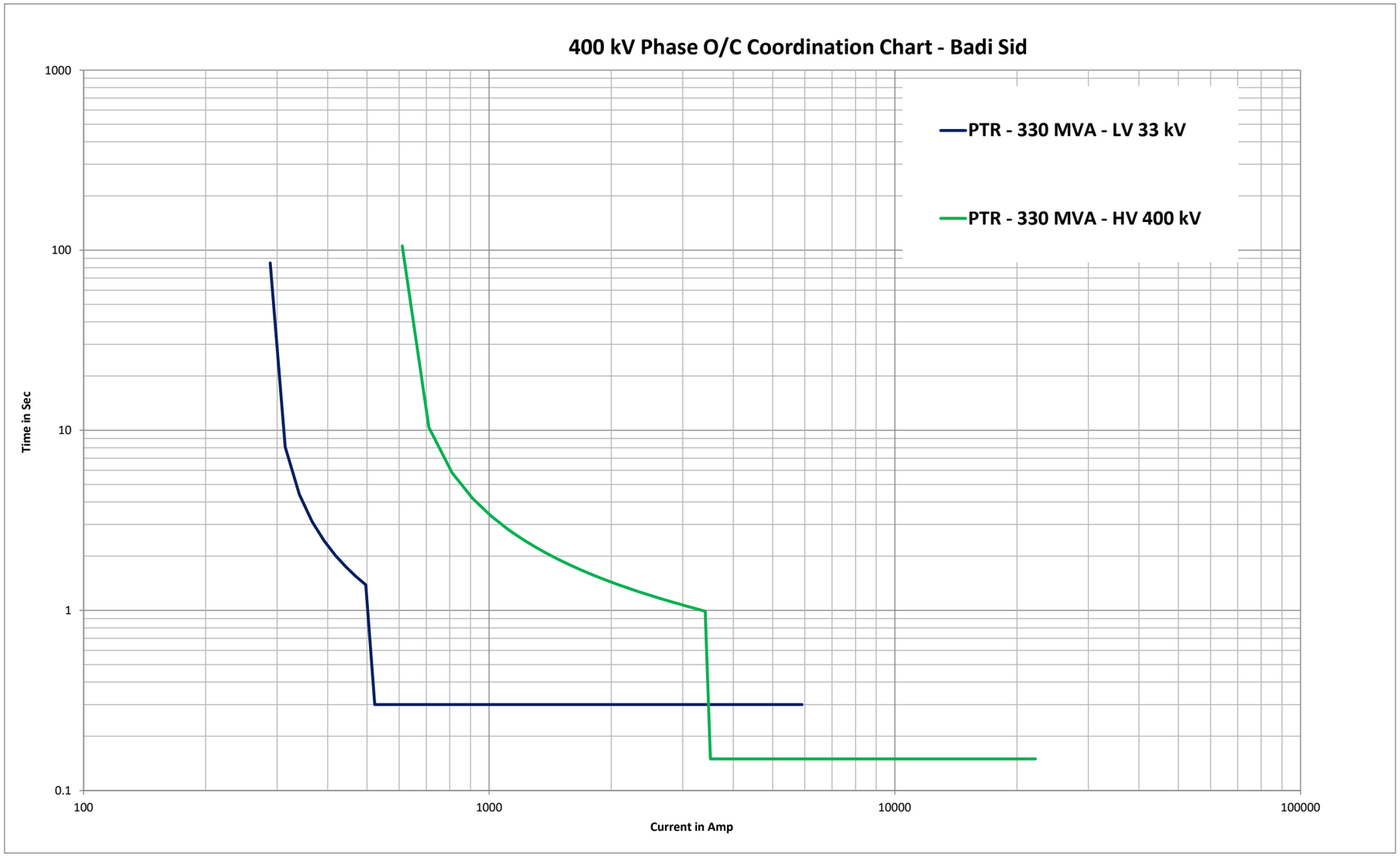

33KV E/F Coordination Chart- Badi Sid
Time in Sec
Current in Amp
100
10
1
0.1
0.01
1
10
100
1000
10000
100000
33KV IDT
33 kV Incoming from IDT- 25 MW
33 kV LV-1-Grid Feeder
33 kV HT Board Bus coupler
SVG - 50 MVAr
33 kV Incoming from IDT-12.5 MW
Aux Trafo HV

400 kV Over current and Earth fault coordination - Badi Sid

Feeeder Name	400 kV LINE @Badi Sid and Remote end			PTR - 330 MVA - HV 400 kV			PTR - 330 MVA - HV SEF			PTR - 330 MVA - LV SEF			PTR - 330 MVA - LV 33 kV		
	Source MVA	660		MVA	330		MVA	330		MVA	330		MVA	330	
	CAPACITY			CAPACITY	330		CAPACITY	330		CAPACITY	165		CAPACITY	165	
	z in pu	1		z in pu	0.15		z in pu	0.15		z in pu	0.15		z in pu	0.15	
Voltage Ref	400	400		400	400		400	400		33	400		33	400	
	FLC			FLC	476.33		FLC	476.33		FLC	2886.84	433.0254	FLC	2886.84	238.16397
	P/U Factor			P/U Factor	1.2		P/U Factor	1.2		P/U Factor	1.2		P/U Factor	1.2	
RELAY															
3-Ph Fault current		12000			3175.52	3175.52		3175.52	3175.52		3175.52	3175.52		3175.52	3175.52
Bus Fault Current		1													
Relay Current		1			1			1			1			1	
Shift Factor		1			1			1			1			1	
Phase CT Primary		1000			1000			1000			330	4000		259.875	3150
Rated Current		952.66			476.33			476.33			476.33	1		476.33	1
		1000										12.12121			12.12121
		Pr													
Settings description					Pr			Pr			Pr			Pr	
PHASE-50/51N					4.13			4.13			12.51			15.89	
Phase Plug Setting			x In	0.571594	0.6	x In	0.571594		x In	0.866051		x In	1.099747	1.1	x In
Phase TMS					0.25									0.11	
Curve					NI									NI	
Top		FALSE			1.0328302			FALSE			FALSE			0.312167004	
Stage 2 (ON/OFF)		OFF			ON			OFF			OFF			ON	
Stage 2 Plug Setting			x In	3.493072	3.5	x In			x In			x In		2	x In
Stage 2 Inst Time					0.15									0.3	
Stage 3 (ON/OFF)					OFF			OFF			OFF			OFF	
Phase Inst Plug Setting			x In			x In			x In			x In			x In
Phase Inst Time															
EARTH-50N/51N		DIRECTIONAI			NON DIRECTIONAL			NON-DIRECTIONAL			NON-DIRECTIONAL			NON-DIRECTIONAL	
1-Ph Fault current		12000			3175.52			3175.52			3175.52			3175.52	
Bus Fault Current		1			1			1			1			1	
Relay Current		1			1			1			1			1	
Shift Factor		1			1			1			1			1	
Earth CT Primary		1000			1000			1000			330			260	
Earth Plug Setting		0.22	x In	0.1	0.1		0.1	0.2		0.1	0.25		0.1	0.18	
Earth TMS		0.5		0.1	0.25		0.1	0.25		0.1	0.2		0.1	0.18	
Curve		NI		NI	NI		NI	NI		NI	NI		NI	NI	
Top		1.133678184		#DIV/0!	0.566839092		#DIV/0!	0.615593457		#DIV/0!	0.453471273		#DIV/0!	0.408124146	
Stage 2 (ON/OFF)		OFF		OFF	ON		OFF	OFF		OFF	OFF		OFF	ON	
Stage 2 Earth Setting			x In	1.58776	1.5	x In	1		x In	1		x In	1	1	x In
Stage 2 Inst Time				1	0.15		1			1			1	0.3	
Stage 3 (ON/OFF)		OFF		OFF	OFF		OFF	OFF		OFF	OFF		OFF	OFF	
Phase Inst Plug Setting			x In	-		x In	-		x In	-		x In	-		x In
Phase Inst Time				-			-			-			-		

NOTE	All relay Settings proposed here is based on actual **CT RATIO** only


400 KV E/F Coordination Chart- Badi Sid
400 kV LINE
@Badi Sid and Remote end
PTR - 330 MVA - HV 400 kV
PTR - 330 MVA - LV 33 kV
PTR - 330 MVA - LV SEF
PTR - 330 MVA - HV SEF
Time in Sec
10
1
0.1
10
100
1000
10000
100000
Current in Amp


400 kV Phase O/C Coordination Chart - Badi Sid
PTR - 330 MVA - LV 33 kV
PTR - 330 MVA - HV 400 kV
Time in Sec
1000
100
10
1
0.1
100
1000
10000
100000
Current in Amp

RELAY SETTING FOR 12.5MW IDT STATION

Document No.	Rev. No.	Date
XXXX-E-SEP-IDT-DE-C-I-001	R0	08.07.2024

SOLAR POWER PROJECT,RAJASTHAN
500MW Badi
500MW Bhimsar
534.5MW Siyamber
600MW NHPC
300MW Essel

RELAY SETTING FOR 12.5MW IDT STATION

Nilesh Patel

Digitally signed by Nilesh Patel
Date: 2024.07.10 18:41:42 +05'30'

XXXX-E-SEP-IDT-DE-C-I-001

REV	DATE	DESCRIPTION	PREPARED BY	CHECKED BY	APPROVED BY
R0	08.07.2024	HT panel relay setting of IDT station	SS	HT	NP

RELAY SETTING FOR 12.5MW IDT STATION			
1	**RELAY SETTINGS FOR 33 KV IDT FEEDER (OUTDOOR HT PANEL IN 33/4X0.80kV IDT STATION)**		
SOLAR	**IDT TRANSFORMER**		
	Rating in kVA	=	12500
	Primary Voltage (kV)	=	33
	Secondary Voltage (kV)	=	0.8
	Vector group	=	Dyn11yn11yn11yn11
1B	**INSTRUMENT TRANSFORMER & RELAY DETAILS**		
	Relay Make & Model	=	Siemens GE
	33 kV CT Primary (Amp)	=	300
	33 kV CT Secondary (Amp)	=	1
	33 kV PT Primary (Volts)	=	33000/√3
	33 kV PT Secondary (Volts)	=	110/√3
	Polarity	=	CT Secondary Star Point (Towards Protected Object)
	Transformer LV bushing CT		
	0.8kV CT Primary (Amp)	=	3200
	0.8 kV CT Secondary (Amp)	=	1
1C	**PHASE & GROUND OVERCURRENT PROTECTION (50,50N,51,51N)**		
	51 Characteristic	=	Normal Inverse
	51 Plug Setting	=	0.9* In (300 Amp)
	51 Time Multiplier Setting	=	0.05
	50 Characteristic	=	Definite Time
	50 Plug Setting	=	2.5 * In (300 Amp)
	50 Time Delay Setting	=	50 ms
	51N Characteristic	=	Normal Inverse
	51N Plug Setting	=	0.20* In (300 Amp)
	51N Time Multiplier Setting	=	0.05
	50N Characteristic	=	Definite Time
	50N Plug Setting	=	0.40* In (300 Amp)
	50N Time Delay Setting	=	50 ms
1D	**TRANSFORMER DIFFERENTIAL PROTECTION (87T)**		
	Set Mode	=	Advance
	SOTF Mode	=	ON
	Differential Current Alarm Threshold (IDiffAlarm)	=	0.2 PU
	Differential Alarm Time Delay (tAlarm)	=	0 Sec
	Differential Current Threshold (Is1)	=	0.2 PU
	Bias Current Threshold-1	=	N/A
	Percentage Differential First Slope (K1)	=	30%
	Bias Current Threshold-2 (Is1)	=	1 PU
	Percentage Differential Second Slope (K2)	=	80%
	Differential Current High Set-1 (Is-HS1)	=	10 PU
	Differential Current High Set-2 (Is-HS2)		Disabled
	Zero Sequence Filter (HV)	=	Disabled
	Zero Sequence Filter (LV)	=	Enabled
	2nd Harmonic Block	=	Enabled
	2nd Harmonic Set (IH2)	=	15%
	5th Harmonic Block	=	Enabled
	5th Harmonic Set (IH5)	=	25%
	Cross Blocking	=	Enabled
	Negative Sequence Detection	=	Disabled
	CT Saturation Detection	=	Enabled
	Circuitry Fail	=	Enabled
	Circuitry Fail Mode	=	Alarm & No block
	Circuitry Failed Differential Current Threshold (Is-cctfail)	=	0.1 PU
	Circuitry Fail Slope (K-cctfail)	=	10%
	Circuitry Fail Alarm Time Delay (t-cctfail)	=	5 Sec
	CT Supervision	=	Enabled
	CT Supervision Mode	=	Alarm & Block (Alarm latched)
	CT Supervision Differential Current High Set (Is-CTS)	=	1.5 PU
	CT Supervision Alarm Time Delay	=	0 Sec
	VT Supervision	=	Disabled

RELAY SETTING FOR 12.5MW IDT STATION			
1	**RELAY SETTINGS FOR 33 KV IDT FEEDER (OUTDOOR HT PANEL IN 33/4X0.80kV IDT STATION)**		
1E	**OVERFLUX PROTECTION (24)**		
	Set Mode	=	Advance
	V/Hz Stage Alarm Plug Setting	=	1.15PU
	V/Hz Stage Alarm Time Delay	=	5 Sec
	V/Hz Stage Alarm Reset Time	=	5 Sec
	V/Hz Stage-1 Characteristic	=	DT
	V/Hz Stage-1 Plug Setting	=	1.2PU
	V/Hz Stage-1 Time Delay	=	60 Sec
	V/Hz Stage-2 Characteristic	=	DT
	V/Hz Stage-2 Plug Setting	=	1.25PU
	V/Hz Stage-2 Time Delay	=	40 Sec
	V/Hz Stage-3 Characteristic	=	DT
	V/Hz Stage-3 Plug Setting	=	1.3PU
	V/Hz Stage-3 Time Delay	=	20 Sec
	V/Hz Stage-4 Characteristic	=	DT
	V/Hz Stage-4 Plug Setting	=	1.35PU
	V/Hz Stage-4 Time Delay	=	10Sec
	V/Hz Stage-5 Characteristic	=	DT
	V/Hz Stage-5 Plug Setting	=	1.4PU
	V/Hz Stage-5 Time Delay	=	2Sec

Note: All other protections apart from this relay chart shall be disabled.