



# Minutes of 95<sup>th</sup> PCC Meeting

**Date: 15.10.2020**  
**Eastern Regional Power Committee**  
**14, Golf Club Road, Tollygunge**  
**Kolkata: 700 033**

## **EASTERN REGIONAL POWER COMMITTEE**

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### **MINUTES OF 95<sup>TH</sup> PROTECTION SUB-COMMITTEE MEETING HELD ON 15.10.2020 AT 10:30 HOURS**

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The meeting was conducted through MS Teams online meeting platform. List of participants is enclosed at **Annexure-A**.

#### **PART – A**

##### **ITEM NO. A.1: Confirmation of minutes of 94<sup>th</sup> Protection sub-Committee Meeting held on 28<sup>th</sup> September 2020 through MS Teams.**

The minutes of 94<sup>th</sup> Protection Sub-Committee meeting held on 28.09.2020 circulated vide letter dated 09.10.2020.

Members may confirm the minutes of 94<sup>th</sup> PCC meeting.

##### **Deliberation in the meeting**

*OPTCL requested for amendment against the item no. B15 of 94<sup>th</sup> PCC minutes. It was informed that under the deliberation the incident was explained by GMR not by OPTCL.*

*Accordingly, PCC accepted the request of OPTCL and followings were amended:*

*1) Para 1 under Deliberation of PCC for the Item No. B15 shall be read as*

*“ GMR explained that.....” instead of “ OPTCL explained that.....”*

*2) Para 3 under Deliberation of PCC for the Item No. B15 shall be read as*

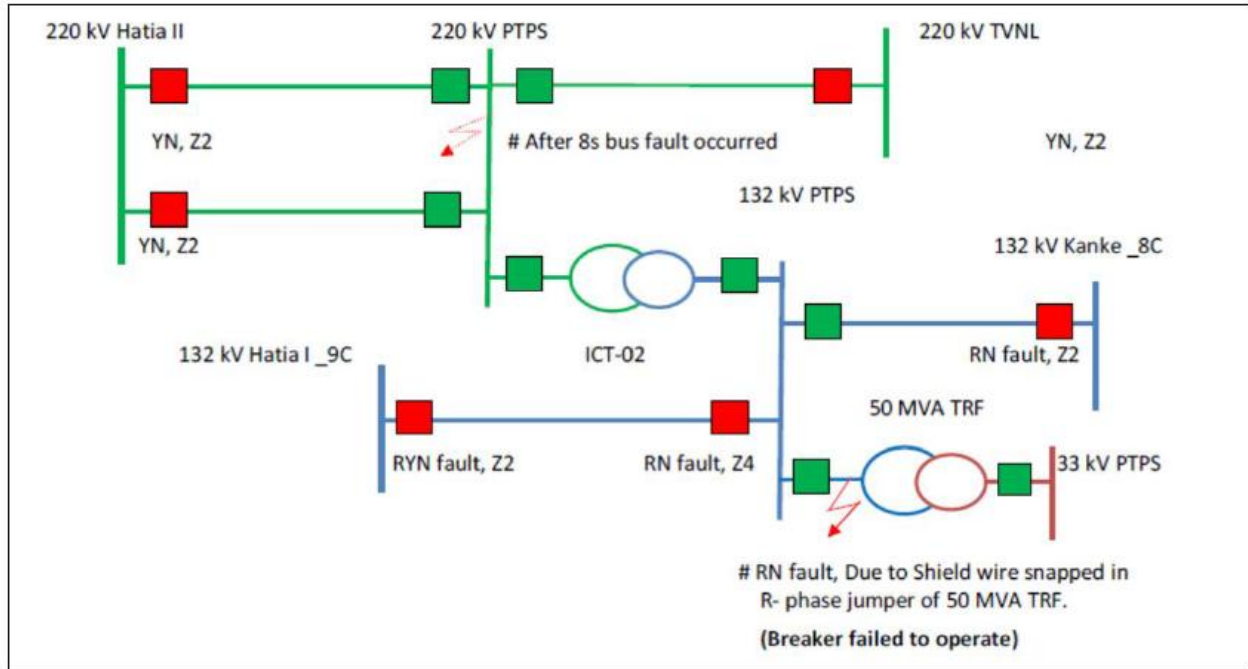
*“PCC advised GMR and OPTCL .....” instead of “PCC advised OPTCL .....”*

*Thereafter PCC accepted the minutes of the 94<sup>th</sup> PCC Meeting issued by ERPC Secretariat with the above amendment.*

#### **PART – B**

##### **ITEM NO. B.1: Disturbance at 220 kV Patratu and 220kV Tenughat Substation on 23.09.2020 at 08:45 hrs and 13:49 hrs**

At 08:45 hrs, R phase to earth fault had occurred at Patratu S/S due to snapping of Shield wire on 132 kV side R – Phase jumper of 50 MVA, 132/33 kV Power Transformer. Transformer relay sensed the fault in Differential & REF (field CT is used for Diff & REF) protection and issued trip command instantly but breaker failed to operate due to problem in mechanism. Subsequently, this fault was also not cleared from any of the remote end due to low fault current. After 8 sec (approx.) R phase to earth fault got converted into Y phase to earth fault, due to snapping of 220 kV Bus -2 jumper at Patratu. Subsequently all the 220 kV feeders connected to Patratu tripped in Zone - 2 from remote end resulting total power failure at Patratu S/S.



220 kV Tenughat - Patratu S/C was restored at 10:54 hrs. 220 kV Patratu Hatia - 2 was restored.

At 13:49 hrs 220 KV Patratu-Hatia 2 and 220 KV Tenughat-Biharshariff S/C tripped due to B phase to earth fault resulting total power failure at 220 kV Patratu S/S and 220 kV Tenughat thermal power station.

Relay indications are as follows:

समय	नाम	अंत 1 रिले संकेत	अंत 2 रिले संकेत	पीएमयू अवलोकन
08:45 Hrs	220 kV Patratu Hatia 1	Did not trip	Y-N, Zone – 2, F/C 2.44 kA, 54 km from Hatia.	Initially around 1 kV dip has been observed in all three phases at Biharshariff PMU. Dip in R phase voltage was more than other phases. Around 8 seconds after the start of the fault, dip in Y phase increased to 2.5 kV. After 500 ms, fault in all three phases got cleared.
	220 kV Patratu Hatia 2	Did not trip	Y-N, Zone – 2, F/C 2.47 kA, 54 km from Hatia.	
	220 kV Patratu Tenughat S/C	Did not trip	R-Y-N, Zone – 2, 61 km from Tenughat, I <sub>R</sub> - 1.4 kA, I <sub>Y</sub> – 3.2kA, I <sub>B</sub> – 1.3 kA	
	132 kV Patratu Hatia S/C (9C)	R-N, Zone-4, F/C- 1.8 kA,	R-Y-N, Zone - 2, 42 km from Hatia, I <sub>R</sub> - 2.05 kA, I <sub>Y</sub> – 2.11 kA, I <sub>B</sub> – 0.68 kA	
	132 kV Patratu Kanke S/C (8C)	Sensed in Zone – 4, did not trip	R-N, Zone-2, 27 km from Kanke, F/C 1.5 kA.	
	220/132 kV ICT-2 at Patratu	Both HV and LV side did not trip		
	132/ 33 kV ICT at Patratu	<b>Breaker failed to operate.</b> Differential & REF, IR diff- 20.71 PU, REF HV LoZ diff- 6.151 kA, IR-HV - 6.560kA, IY-HV - 180.6 A, IB-HV - 269.3 A,		
10:59 Hrs	220 kV Patratu Tenughat S/C	Yet to be received	Y-N, Zone – 2, F/C: 2.6 kA, 65 km from Tenughat	Fault clearing time around 350 ms
13:49 Hrs	220 kV Patratu Hatia - 2	O/C, current in all 3 phases was around 0.6 kA	Did not trip	Around 3 kV dip has been observed in PMU data. The fault clearing time was around 160 ms
	220 KV Tenughat-Biharshariff S/C	B-N, Zone – 1, 106km. F/C 0.5 kA	Yet to be received	

Detailed report is enclosed at **Annexure-B1**.

JUSNL, TVNL and BSPTCL may explain.

## **Deliberation in the meeting**

*PCC advised JUSNL to explain the disturbances in sequence.*

### ***Disturbance at 08:45 hrs:***

*JUSNL informed that at 08:45 hrs, R phase to earth fault had occurred at Patratu S/S due to snapping of Shield wire on 132 kV side, R – Phase jumper of 50 MVA, 132/33 kV Power Transformer. Differential & REF protection of the transformer sensed the fault and issued trip command instantly but the respective circuit breaker failed to operate due to problem in mechanism related to air pressure. As a result, the following elements got tripped:*

- 132 k V Patratu-Hatia s/c line got tripped from Hatia end in zone 2*
- 132 k V Patratu-Kanke s/c line got tripped from Kanke end in zone 2*

*JUSNL added that directional overcurrent protection of HV side of 220/132kV Transformer also identified the fault but failed to issue the trip command to respective CB due to problem in secondary circuit wiring.*

*JUSNL further explained that after 8 sec (approx.) RY phase to earth fault occurred at 220kV bus of Patratu S/s, due to snapping of 220 kV Bus -2 jumper at Patratu. The following elements were tripped:*

- 220 kV Patratu Hatia D/C line tripped from Hatia end on zone 2*
- 220 kV Tenughat - Patratu S/C tripped in zone 2 from Tenughat end*

*PCC opined that Air pressure alarm should come for the CB of 50 MVA, 132/33 kV Power Transformer.*

### ***Disturbance at 10:59 hrs:***

*JUSNL explained that 220 kV Patratu-Hatia – 2 and 220 kV Tenughat - Patratu S/C were restored at 10:30 hrs and 10:54 hrs respectively. However at 10:59 hrs, 220 kV Tenughat - Patratu S/C got tripped in zone 2 from Tenughat end due to Y-N fault at 65 km from Tenughat end.*

### ***Disturbance at 13:49 hrs:***

*JUSNL explained that 220 kV Tenughat - Patratu S/C line was restored at 12:05 hrs. Thereafter at 13:49 hrs, 220 KV Tenughat-Biharshariff S/C tripped due to B phase to earth fault at 106 km from Tenughat. Thereafter, 220 kV Patratu-Hatia – 2 line was tripped from Patratu end on Directional Overcurrent protection due to overload.*

*PCC opined that generation of TVNL should be limited to comply with N-1 network criterion to avoid tripping of 220 kV Patratu-Hatia – 2.*

*After detailed deliberation, PCC advised JUSNL to take the following corrective measures to avoid multiple trippings of the transmission elements:*

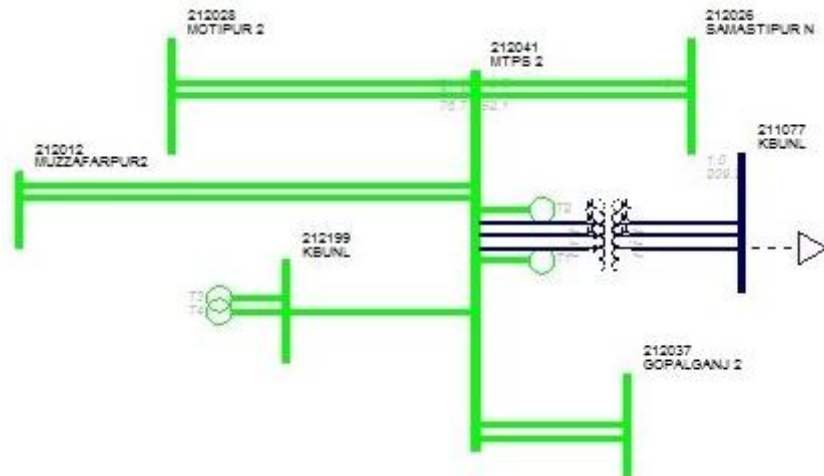
- LBB protection for 132kV system should be implemented at Patratu S/s.*
- Air pressure alarm annunciation system for 132/ 33 k V ICT circuit breaker should be implemented*
- Operation of circuit breaker of 132/ 33 k V ICT should be checked by giving a trip command from the relay.*
- Reason for non issue of trip command by backup protection of 220/ 132 k V ICT to be analyzed*
- 220 kV Patratu-Hatia – 2 line should not trip Patratu end on Directional Overcurrent protection. Settings related to direction are to be verified.*
- SLDC, Jharkhand should control the TVNL generation depending on the network*

availability in order to avoid the overloading of the transmission lines during any contingency.

- Healthiness of protection system of 220/132kV and 132/33 kV transformers at Patratu and Hatia to be tested.

**ITEM NO. B.2: Disturbance at 220 kV Gopalganj S/S on 04.09.2020 at 11:30 hrs.**

220/132 kV Gopalganj S/S is radially connected to 220 kV Muzaffarpur TPS(MTPS) through 220 kV MTPS – Gopalganj D/C. 220 kV MTPS - Gopalganj – 1 was under shutdown. At 11:02 hrs. 220 kV MTPS –Gopalganj - 2 tripped on B phase to earth fault resulting total power failure at 220kV Gopalganj and to the loads supplied radially from this s/stn. At the same time 220 kV MTPS – Samastipur – 1 tripped from MTPS end.



Load loss 202 MW

Fault clearing time as per PMU: less than 100 ms

Element Name	End 1	End 2	PMU observation
220 kV MTPS – Gopalganj - 2	B-N, Zone - 1	O/C and E/F	Around 40 kV dip has been observed in Muzaffarpur PMU data. Fault clearing time was less than 100 ms.
220 kV MTPS – Samastipur – 1	Yet to be received	Yet to be received	No appreciable frequency change has been captured in PMU data.

BSPTCL may explain.

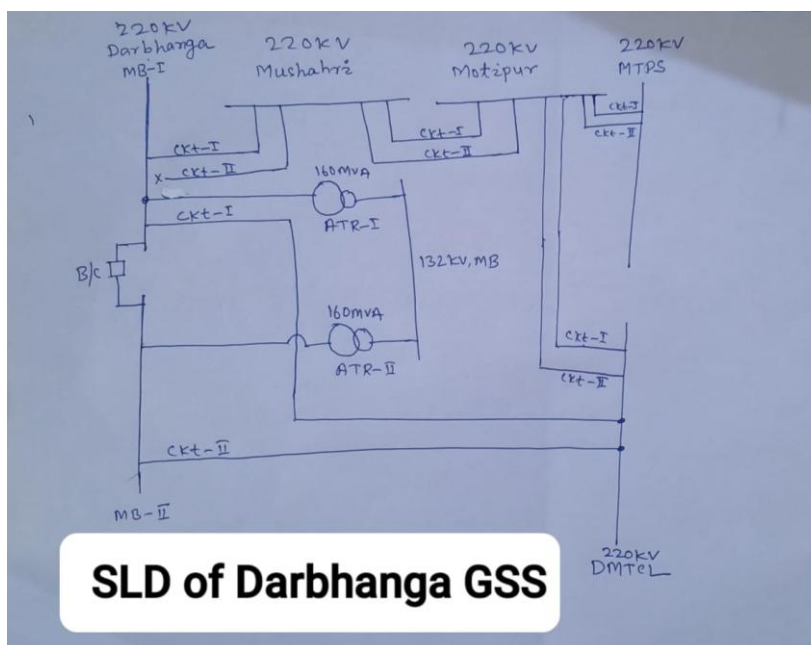
**Deliberation in the meeting:**

BSPTCL explained that 220kV MTPS-Gopalganj Ckt-I was under shutdown due to tree pruning work. At 11:30 Hrs 220kV MTPS-Gopalganj CKT-II tripped from MTPS end in Zone 1 due to B-N fault in the line. Since the line was connected radially, no tripping was initiated from Gopalganj end.

BSPTCL informed that as per the information provided by MTPS, there was sparking due to which fire caught in the switchyard and since both the MTPS-Sasmastipur Ckt-I & II was passing over that area 220kV MTPS-Samastipur Ckt-I was tripped from MTPS end under Z1, B Phase to earth fault. As a safety measure they tripped 220kV MTPS-Sasmastipur Ckt-II manually and the same has been intimated to SLDC Bihar.

To perform the main breaker timing test at BSPTCL end, 220 kV Darbhanga(DMTCL)–Darbhanga (BSPTCL) – 2 was connected via the transfer bus coupler (TBC) bay at Darbhanga (BSPTCL) S/s. At 16:37 hrs, this line tripped due to Y-phase to earth fault. At the same time, the following elements also got tripped:

Element Name	End 1	End 2	PMU observation
220 kV Darbhanga (DMTCL)-Darbhanga (BSPTCL)-2	Back up O/C in Y phase Pickup, Zone 3 pickup, F/C 8.7 kA, Distance-1.3 km. (Which Protection tripped is not clear in DR/EL)	Did not trip	Due to technical reasons, PMU data was not available at ERLDC at the time of the event.
220 kV Darbhanga (DMTCL)-Darbhanga (BSPTCL)-1	Did not trip	Tripped. Indication not shared by BSPTCL	
220 kV Darbhanga (BSPTCL)-Mushahari-D/C	Did not trip	Distance Protection	
220 kV Darbhanga (DMTCL) -Laukhai 1	Did not trip	Yet to be received	
220 kV Darbhanga (DMTCL)-Samastipur 1	Did not trip	Yet to be received	
220 kV Darbhanga (DMTCL)-Motipur 1	Did not trip	Yet to be received	
220 kV Darbhanga (DMTCL)-Motipur 2	Did not trip	Yet to be received	
400/220 kV ICT 1 & 2 at Darbhanga (DMTCL)	400 kV side Directional Earth fault from and Overcurrent protection		



Detailed report is enclosed at **Annexure-B3**.

BSPTCL and DMTCL may explain.

BSPTCL submitted that, 220 kV Darbhanga(DMTCL)– Darbhanga (BSPTCL) Ckt-II was connected via the transfer bus coupler (TBC) bay at Darbhanga (BSPTCL) S/s which was

connected to Main Bus-I, in order to perform breaker timing test the said line got tripped on backup protection within 100 ms.

220 kV Darbhanga(DMTCL)– Darbhanga (BSPTCL) Ckt-II tripped from Darbhanga (DMTCL) end and Ckt-I was manually tripped by BSPTCL from their end. Darbhanga (BSPTCL)-Musahari Ckt- I & II tripped on Z2 tripping time of 350msec, for this DR has been submitted to ERLDC by BSPTCL. 220kV Darbhanga (DMTCL) – Motipur Ckt I tripped on Z2 from BSPTCL end

DMTCL submitted that the ICT I&II tripped on backup overcurrent E/F protection within 100msec.

After detailed deliberation, PCC advised DMTCL and BSPTCL to take following corrective actions:

- For ICT I & II at Darbhanga S/S, DMTCL has to review backup overcurrent E/F protection
- For 220 kV Darbhanga(DMTCL)– Darbhanga (BSPTCL) Ckt, back up protection to be coordinated properly (as it is tripped on 100msec).
- BSPTCL to collect all the relay indications from MTPS and other sub-stations and send the same to ERPC & ERLDC along with a brief report on how the fault got cleared.

#### **ITEM NO. B.4: Disturbance at 220 kV Darbhanga S/S on 10.06.2020 at 10:54 hrs.**

On 10<sup>th</sup> June 2020, at 10:54 Hrs, 220 kV Darbhanga (DMTCL)-Darbhanga (BSPTCL) D/C tripped from BSPTCL end. At the same time 220 kV Darbhanga (BSPTCL) – Mushahari – 1 and 220 kV Darbhanga (DMTCL) – Motipur – 1 also tripped resulting in load loss at Darbhanga, Madhubani and Pandaul.

In 94<sup>th</sup> PCC, BSPTCL and DMTCL were advised to implement the following:

- As the line length is 2.98 km, Differential protection for 220 kV Darbhanga (DMTCL)-Darbhanga (BSPTCL) D/C line may be implemented to improve the reliability.
- Implement POTT inter trip scheme along with current reversal guard in the distance protection to improve the reliability.
- Directional overcurrent E/F protection is to be coordinated with distance protection and adjacent line back up protection

DMTCL and BSPTCL may give their action plan.

#### **Deliberation in the meeting:**

DMTCL informed that POTT inter trip scheme along with current reversal scheme has been implemented at DMTCL. BSPTCL submitted that the same would be implemented at BSPTCL end by 16<sup>th</sup> Oct'2020.

PCC advised DMTCL and BSPTCL to coordinate and implement the scheme simultaneously at both the ends to avoid maloperation.

DMTCL submitted that settings of Directional Overcurrent E/F protection have been submitted to ERLDC for their review and observation.

BSPTCL requested DMTCL to provide their 220kV Relay settings so that the same could be coordinated with the downstream network.

PCC advised DMTCL and BSPTCL to coordinate and review the settings at the earliest.

#### **ITEM NO. B.5: Repeated trippings of 400 kV Barh – Motihari – 2 in September 2020**

1. **Tripping of 400 kV Barh – Motihari – 2 at 00:20 hrs on 02-09-2020:** 400 kV Barh – Motihari – 2 tripped due to R phase to earth fault. The tripping led to total power failure at Motihari 400kV s/stn besides loss of supply to Betiya, Raxaul, Ramnagar and Narktiaganj;

being the single source of supply. Load loss 280 MW. Restoration time: 00:59 hrs on 02-09-2020

2. **Tripping of 400 kV Barh – Motihari – 2 at 01:33 hrs on 24-09-2020:** 400 kV Barh- Motihari - 2 tripped due to R phase to earth fault resulting total power failure at 400/132 kV S/S along with interruption of power supply to downstream areas. Load loss 230 MW. It was restored at 01:58 hrs on 24-09-2020
3. **Tripping of 400 kV Barh – Motihari – 2 at 14:19 hrs on 24-09-2020:** 400 kV Barh- Motihari - 2 tripped due to R phase to earth fault resulting total power failure at 400/132 kV S/S along with interruption of power supply to downstream areas. Load loss 125 MW. It was restored at 15:12 hrs on 24-09-2020

DMTCL, NTPC and Powergrid may explain.

**Deliberation in the meeting:**

*DMTCL informed that the fault was cleared from their end in zone 1 for all the three cases.*

*PCC opined that exact fault distance could be computed as per the IEEE standard using both end DRs. The fault distance computed from the both end DRs is given below:*

Tripping date and Time	Fault distance obtained from both end DRs
02/09/20 00:20:00	218 km from Barh end
24/09/20 01:36:00	215 km from Barh end
24/09/20 14:19:00	196 km from Barh end

*PCC advised Powergrid and DMTCL to carry out proper line patrolling to ensure healthiness of the line so that unwanted tripping can be avoided in future.*

**ITEM NO. B.6: Tripping of 132 kV bus at 400/132 kV Motihari at 18:54 hrs on 11<sup>th</sup> September 2020**

Due to SF<sub>6</sub> gas leakage, bus bar protection operated for 132 kV Motihari bus at 18:54 hrs on 11th September 2020 resulting in tripping of 400/132 kV ICT at Motihari (from 132 kV side) and all out going feeders connected to 132 kV bus at Motihari. Around 350 MW load loss occurred at Bettiah (7 MW traction), Ramnagar, Narkatiaganj, Raxaul, Areraj, Motihari and Dhaka.

DMTCL may explain.

**Deliberation in the meeting:**

*DMTCL submitted that Bus 1 was under shutdown as Bus extension work of PGCIL was under process. At the time of system normalization, during refilling of the SF<sub>6</sub> gas line isolator section the GD monitor had sensed the pressure to zero and makes the connecting breaker comes into lockout mode resulting into outage of Bus-II.*

*DMTCL informed that they had interacted with OEM and they suggested to open the density monitor of bus-1 during maintenance to avoid maloperation of busbar protection.*

**ITEM NO. B.7: Disturbance at 400 kV Motihari Substation on 22.08.2020 at 16:46 hrs**

At 16:46 hrs 400 kV Barh – Motihari – 2 tripped due to Y to B phase short circuit fault. Other 400kV lines connected to Motihari(DMTCL) are under breakdown since August 2019. The tripping led to loss of supply to 400kV Motihari (DMTCL), Bettiah/Raxaul/Motihari (Bihar), being the only source of supply.



In 94<sup>th</sup> PCC, ERLDC informed that Motihari end relay should pick up the fault in the line and placed the following observations related to protection settings at 400kV Motihari (DMTCL) S/S:

- Weak infeed protection may be enabled till the restoration of remaining lines for better detection of the faults in the transmission lines.
- The resistive reach settings of the distance protection are to be reviewed for reliable detection of high resistance faults in the transmission system.
- 400/132 kV ICT backup overcurrent E/F protection settings is at 100 ms which needs to be reviewed.

PCC advised DMTCL to review the above protection settings in coordination with ERLDC.

DMTCL may update.

**Deliberation in the meeting:**

*DMTCL submitted that weak infeed protection is to be reviewed in coordination with Barh, NTPC*

*DMTCL informed that resistive reach settings of distance protection and back up protection of 400/132kV ICT have been implemented.*

*PCC advised DMTCL to submit the details of resistive reach settings to ERPC & ERLDC for further analysis, and also to send the revised 400/132 kV ICT backup overcurrent E/F protection settings to ERPC so that the same could be updated in PDMS.*

**ITEM NO. B.8: Disturbance at 220 kV Begusarai , 220 kV Khagaria and 220 kV Barauni Substation on 03.08.2020 at 11:05 hrs**

In 94<sup>th</sup> PCC, BSPTCL was advised to take following corrective actions:

- Proper line patrolling is to be done to avoid faults in the transmission system.
- Tripping of 220kV BTPS-Hazipur D/C line from Hazipur to be verified. BSPTCL advised to check the relay settings of main and backup protection.
- PLCC system, inter tripping and auto recloser should be in service to minimise the fault clearing time.

BSPTCL may update.

**Deliberation in the meeting:**

*BSPTCL submitted that line patrolling of the related transmission lines has been carried out and thereafter no faults were appeared in the lines.*

*BSPTCL added that checking of relay settings of main and backup protection of 220kV BTPS-Hajipur D/C line would be completed by 16<sup>th</sup> Oct'2020.*

*Further, BSPTCL informed that PLCC frequency settings of 220kV Begusarai-Khagaria line were not as per Purnea (PG), but the same has been rectified and coordinated with Purnea (PG).*

*PLCC of 220kV Begusarai-BTPS D/C Ckt is to be checked, which will be completed at the earliest.*

*PCC advised BSPTCL to complete the pending works regarding checking of settings of main and backup protection of 220kV BTPS-Hajipur D/C line without delay.*

**ITEM NO. B.9: Disturbance at 220 kV Biharsharif Substation on 14.08.2020 at 20:23 hrs**

*In 94<sup>th</sup> PCC, PCC observed the following and advised BSPTCL to take the corrective action:*

- *BSPTCL should carry out proper maintenance of the transmission system to avoid snapping of conductors.*
- *400/220 kV ICT 2 & 3 at Biharsharif should not trip from backup overcurrent protection of LV side as the fault got cleared within 400 ms. BSPTCL review the relay settings in coordination with Powergrid.*
- *Healthiness of the transformers 220/132 kV ICT 1, 2 & 3 should be checked as the transformers tripped on Oil Surge Relay protection.*

BSPTCL may update.

**Deliberation in the meeting:**

*BSPTCL informed that the relevant work is in progress.*

**ITEM NO. B.10: Tripping of 400 kV bus at Kahalgaon at 09:56 hrs on 28th September 2020**

On 28<sup>th</sup> September 2020 at 09:56 hrs Direct trip signal received for 400 kV Kahalgaon – Lakhisarai – 1 at Kahalgaon end. Due to non-opening of R pole of main braker at Kahalgaon end of 400 kV Kahalgaon – Lakhisarai – 1, LBB protection operated at Kahalgaon end and tripped all the breakers connected to 400 kV bus 1 at Kahalgaon end. No generation loss reported during this event.

**NTPC Kahalgaon and POWERGRID may explain:**

- Reason for DT receipt at Kahalgaon end for 400 kV Kahalgaon – Lakhisarai – 1.
- Reason for non-opening of R pole of main braker at Kahalgaon end of 400 kV Kahalgaon – Lakhisarai – 1

**Deliberation in the meeting**

*Powergrid informed that DT signal was not sent from Lakhisarai end and the DT might be received at Kahalgaon end due to maloperation of BPL make PLCC system.*

*NTPC informed that DT signal was received at Kahalgaon end, however due to non-opening of R pole of main breaker at Kahalgaon end of 400 kV Kahalgaon – Lakhisarai – 1, LBB protection operated at Kahalgaon end and tripped all the breakers connected to 400 kV bus 1 at Kahalgaon end.*

*PCC advised NTPC to take necessary action to ensure correct operation of CB at Kahalgaon. PCC also advised NTPC and Powergrid to check the PLCC of 400 kV Kahalgaon – Lakhisarai line -1 to find out the reason for getting DT at Kahalgaon end.*

**ITEM NO. B.11: Repeated tripping of 220 kV Jorethang(JLHEP)-New Melli – D/C line on 30.09.2020**

1. **Tripping of 220 kV Jorethang(JLHEP)-New Melli – D/C line at 10:50 hrs:** 220 KV Jorethang-New Melli - 2 tripped due to B phase to earth fault. 220 KV Jorethang-New Melli - 1 tripped at the same time from Jorethang end only. As a result, both the running units of

Jorethang tripped due to loss of evacuation path and total power failure occurred at Jorethang Plant. Generation loss: 100 MW.

2. **Tripping of 220 kV Jorethang(JLHEP)-New Melli line-I at 11:40 hrs:** After tripping of 220 KV Jorethang-New Melli - D/C at 10:50 hrs, circuit-1 was restored at 11:00 hrs and JLHEP resumed generation from 11:06 Hrs. However, this circuit tripped again at 11:40 hrs resulting in tripping of both the running units and total power failure at Jorethang hydro power plant. Generation loss: 100 MW.

समय	नाम	अंत 1 रिले संकेत	अंत 2 रिले संकेत	पीएमयू पर्यवेक्षण
10:50 Hrs	220 kV Jorethang – New Melli - 1	O/C protection, current in all three phases: 300 A	Did not trip	Around 8 kV dip has been observed in B phase voltage at Rangpo PMU data. As per PMU data, the fault was evolving in nature. Fault clearing time around 300 ms.
	220 kV Jorethang – New Melli - 2	B phase Distance protection trip; Zone 2 and Zone 3 picked up. F/C 1.7kA	Did not trip	
11:40 Hrs	220 kV Jorethang – New Melli - 1	B phase overcurrent protection; F/C 1.13 kA	B-N, Zone-2, F/C 1.3 kA, 14 km from New Melli.	Around 3 kV dip has been observed in B phase voltage at Rangpo PMU data. Fault clearing time was around 500 ms.

Jorethang and Powergrid may explain.

### Deliberation in the meeting

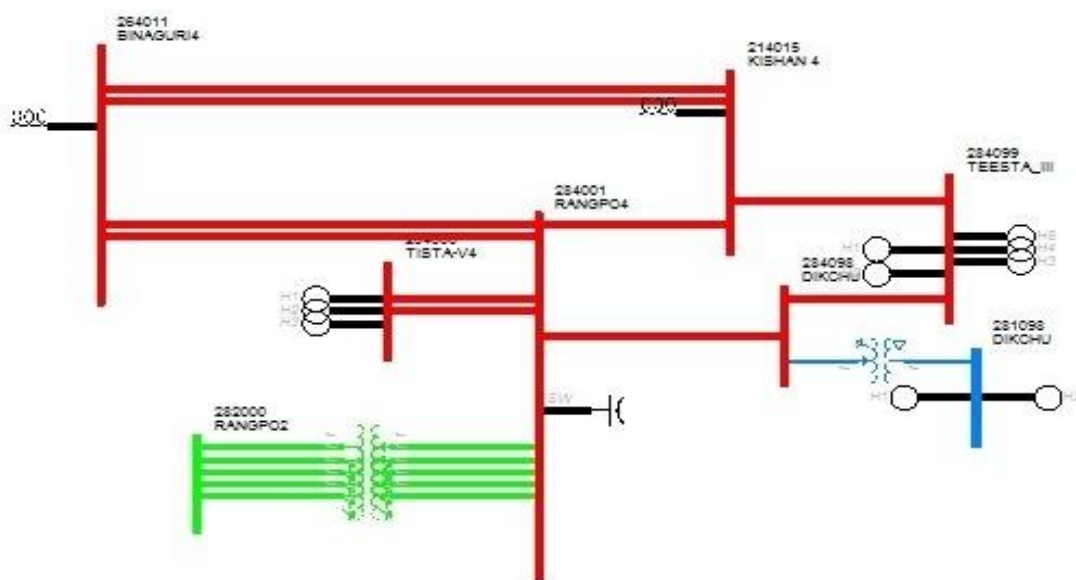
*DANS Energy informed that 220 kV Jorethang – New Melli D/C line tripped from Jorethang end due to B-N fault. Line patrolling was done and clearance issues were resolved after the tripping.*

*Powergrid informed that 220 kV Jorethang – New Melli line 2 was only tripped from New Melli end on zone 2, B-N fault.*

*ERLDC added that as per the DR there was a B-N fault in 220kV Jorethang – New Melli line 2 only. 220kV Jorethang – New Melli line 1 was tripped from Jorethang end due to improper overcurrent settings at Jorethang end.*

*PCC advised DANS Energy to review the over current settings as per the line current carrying capacity in coordination with Powergrid and ERLDC.*

### **ITEM NO. B.12: Grid event at Teesta III and Dikchu HEP at 18:06 hrs on 13<sup>th</sup> Sep 2020**



400 kV Teesta III Hydroelectric Plant is connected to the rest of the grid through 400 kV Teesta III – Dikchu-Rangpo S/C and 400 kV Teesta III - Kishangunj S/C.

- Prior to the event, unit # 1, 3 and 5 were connected to 400 kV bus 1 at Teesta III. Other units i.e. unit # 2, 4 and 6 were connected to 400 kV bus 2 at Teesta III and bus coupler were in closed condition. 400 kV Teesta III – Dikchu S/C were connected 400 kV bus 1 at Teesta III.
- Unit #3, 6, 5 and 1 at Teesta III were synchronized at 17:53 hrs, 17:56 hrs, 18:03 hrs and 18:05 hrs respectively. Unit #2 and 4 were being run at turbine operation.
- At 18:05 hrs bus bar operated for 400 kV bus 1 at Teesta III resulting in tripping of units # 1, 3 & 5, 400 kV bus coupler and 400 kV Teesta III – Dikchu S/C at Teesta III. DT signal was sent to Dikchu end. After analysis, it was found that SO<sub>2</sub> gas concentration was above the limit at W phase (B phase) breaker cubicle of Unit 3 at Teesta III leading to B phase to earth fault (Observed as B phase voltage dip in PMU plot).

TUL may explain.

- At Dikchu end on receipt of the DT signal, 400 kV Teesta III – Dikchu S/C tripped. At the same time, both units at Dikchu HEP tripped due to the operation of differential protection. In the DR output shared by Dikchu HEP, rise in operating current has been observed in R phase. But in Rangpo PMU data, no such dip has been observed in R phase at the time of the fault. Units at Dikchu were also revived after the event.

Dikchu may explain any actual fault in the system.

### **Deliberation in the meeting**

*TUL representative was not present in the meeting.*

*Dikchu informed that on receipt of the DT signal from Teesta III, 400 kV Teesta III – Dikchu S/C tripped from Dikchu. At the same time, both units at Dikchu HEP tripped due to the operation of cable differential protection of 132 kV Generator Transformer-132kV Substation.*

*Dikchu added that cable differential protection was operated due to malfunction of one phase CT core.*

*PCC advised Dikchu to take necessary action to avoid unwanted tripping of the cable differential protection.*

### **ITEM NO. B.13: Tripping of both units of 400 kV Dikchu Generating Stations on 01.08.2020 at 11:47 hrs**

In 94<sup>th</sup> PCC, Dikchu informed that there was a B phase to earth fault in 400 kV Dikchu Rangpo S/C at 31 km from Rangpo end. Dikchu end identified the fault in zone 1 and auto reclose operation attempted but tripped on permanent fault. Rangpo end identified the fault in zone 2 and successfully cleared the fault. At the same time, Dikchu end breaker of 400 kV Teesta III – Dikchu S/C tripped on SOTF trip signal generated from Main-2 relay (ABB REL 670).

ERLDC informed that from the analysis, it was observed that SOTF setting was at 1 sec and the same has to be revised from 1 sec to 500 ms.

PCC advised Dikchu to review the SOTF settings in coordination with ERLDC.

Dikchu may update.

### **Deliberation in the meeting**

*Dikchu informed that SOTF setting was changed to 500 ms from 1 sec.*

#### **ITEM NO. B.14: Backup Overcurrent Relay coordination of Sikkim Complex**

In 93<sup>rd</sup> PCC, It was opined that proper coordination of backup protection of these 400kV lines is required keeping IDMT characteristics.

*In 94<sup>th</sup> PCC, PRDC informed that they had computed the backup overcurrent E/F settings considering the IDMT characteristics. The details are enclosed at **Annexure-B14**.*

*PCC advised all the concerned utilities to study the revised settings done by PRDC and provide their comments within one week.*

Members may discuss.

### **Deliberation in the meeting**

*Powergrid and Dikchu informed that generating unit fault current contribution and fault level at the substation were not given in the study.*

*ERLDC informed that star-star should be considered for the ICTs instead of star-delta.*

*PCC advised all utilities to send their comments to ERPC and ERLDC. Revised study would be carried out as per the comments received from the constituents.*

#### **ITEM NO. B.15: Tripping Incidences in month of September 2020**

Other tripping incidences occurred in the month of September 2020 which needs explanation from constituents of either of the end would be circulated in the meeting.

In 36<sup>th</sup> TCC, all the constituents were advised to use the PDMS on-line portal for uploading the single line tripping details along with DR (comtrade files), EL and other relevant files for all trippings of August 2017 onwards. Otherwise, it will be considered as violation of compliance of clause 5.2(r) & 5.9 of IEGC.

In 74<sup>th</sup> PCC, all the constituents were requested to submit the disturbance report along with DR through the new version of on-line portal which was implemented from 01st Jan. 2019.

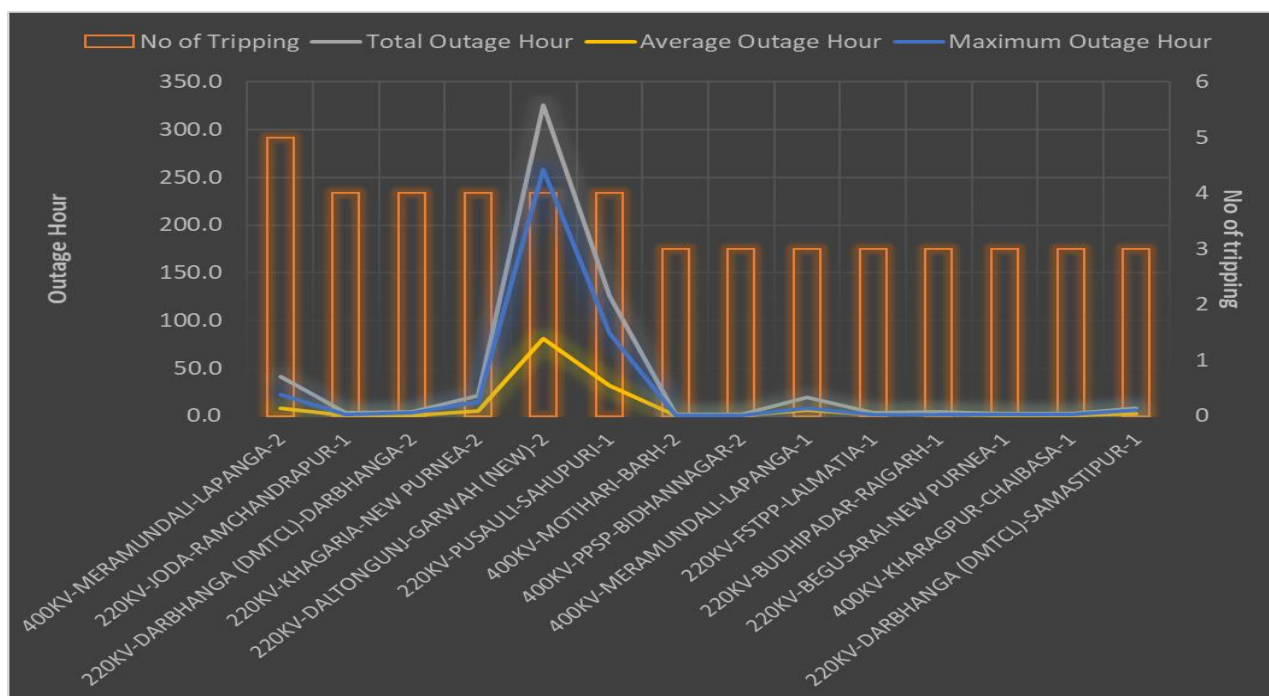
Members may discuss.

### **Deliberation in the meeting**

*All concerned utilities updated status which is enclosed at **Annexure B15**.*

#### **ITEM NO. B.16: Repeated tripping of transmission lines in September 2020**

During September 2020, repeated tripping has been observed in few of the transmission lines. List of these transmission lines along with number of tripping in September 2020 and outage duration for each line in September 2020 are shown below:



Transmission utilities are advised to share the remedial actions taken to reduce the number of such tripping of these transmission lines (list given below).

Name of the line	Remarks	No of tripping	Utility to respond
400KV-MERAMUNDALI-LAPANGA-2	R phase to earth fault at 30 km from Lapanga in case of 3 faults. Vide letter dated on 06-05-2020, 09-09-2020 and 06-10-2020, ERLDC has requested OPTCL to maintain healthiness of 400 kV Meramundali – Lapanga D/C	5	OPTCL/GRIDCO SLDC
220KV-JODA-RAMCHANDRAPUR-1	In 2 cases, successful auto-reclose at Ramchandrapur end. But no auto-reclose at Joda end.	4	OPTCL/GRIDCO SLDC and Jharkhand SLDC/JUSNL
220KV-DARBHANGA (DMTCL)-DARBHANGA-2	Tripped sensing the fault at adjacent line	4	DMTCL and Bihar SLDC/BSPTCL
220KV-KHAGARIA-NEW PURNEA-2	In 2 cases, successful auto-reclose at Purnea end. But no auto-reclose at Khagaria end.	4	Bihar SLDC/BSPTCL
220KV-DALTONGUNJ-GARWAH (NEW)-2	B phase to earth fault at same location	4	Jharkhand SLDC/JUSNL
400KV-MOTIHARI-BARH-2	R phase to earth fault at 24 km from Motihari	3	DMTCL
400KV-PPSP-BIDHANNAGAR-2	R phase to earth fault at 40-50 km from Bidhannagar	3	WB SLDC/WBSECL
220KV-FSTPP-LALMATIA-1	Repeated tripping due to poor maintenance	3	Jharkhand SLDC/JUSNL
220KV-BUDHIPADAR-RAIGARH-1	In 2 cases, R phase to earth fault at 1.2 km from Budhipadar	3	OPTCL/GRIDCO SLDC
220KV-DARBHANGA (DMTCL)-SAMASTIPUR-1	B phase to earth fault at same location	3	DMTCL and Bihar SLDC/BSPTCL
400KV-KHARAGPUR-CHAIBASA-1	R phase to earth fault at 150-160 km from Chaibasa	3	POWERGRID ER- 1

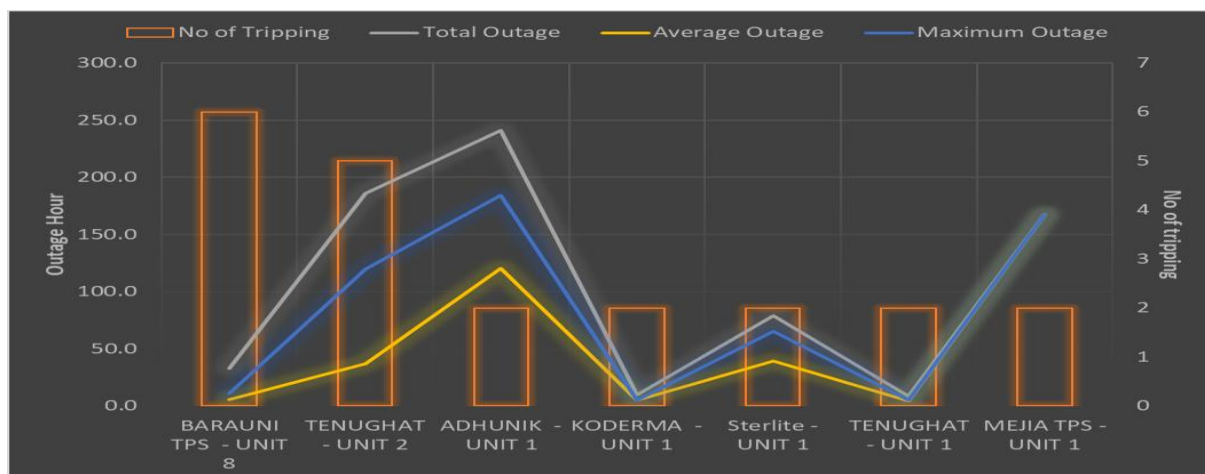
Members may explain.

## Deliberation in the meeting

PCC advised all concerned utilities to take necessary action to avoid repeated tripping of the transmission lines.

### **ITEM NO. B.17: Repeated tripping of generating units in September 2020**

During September 2020, repeated tripping has been observed for few generating units. List of such generating units along with number of tripping occurred in September 2020 and outage duration for each line in September 2020 are shown below.



Element Name	Tripping Date	Tripping Time	Reason shared	Utility to share DR/EL
BARAUNI TPS - UNIT 8	07-09-2020	15:37	Electrical Fault	Bihar SLDC/BSPHCL
FSTPP - UNIT 2	14-09-2020	18:26	Generator Electrical Protection	NTPC
KODERMA - UNIT 1	21-09-2020	01:09	Generator Electrical Protection	DVC
KODERMA - UNIT 1	23-09-2020	18:55	Generator Class-B Protection Trip	DVC
BARAUNI TPS - UNIT 8	24-09-2020	12:41	Generator Electrical Protection	Bihar SLDC/BSPHCL
JITPL - UNIT 2	25-09-2020	10:14	Generator Electrical Protection	JITPL

Members may explain.

## Deliberation in the meeting

Concerned members explained the trippings as follows:

- Bihar SLDC informed that Barauni TPS unit 8 was tripped due to fault in DC supply of auxiliary unit on 07/09/2020.
- DVC informed that tripping on 21/09/2020 was due to flashover in panel resulting in damage of circuit breaker that lead to tripping of feeder and ultimately tripping of generating unit. DVC added that tripping on 23/09/2020 was due to fault on 11 k V auxiliary side which was not cleared by feeder protection and resulted in tripping of auxiliary board which ultimately resulted in tripping of generating unit.
- NTPC told that there was stator fault in Farakka unit 2 that resulted in tripping of unit and already shutdown was taken to rectify this issue.

PCC advised all concerned utilities to send a report with relay indications to ERPC and ERLDC immediately after tripping of the unit.

**ITEM NO. B.18: Repeated tripping of 220 kV Bolangir Sadaipalli D/C in the months of August and September 2020**

Name of the Element	Tripping Date	Time (Hrs.)	Reason	Remarks
220KV-BOLANGIR(PG)-SADEIPALI-1	19-08-2020	18:29	Tripped from OPTCL end only at the time of successful A/r of 400 kV Jeypore - Bolangir	Tripped encroaching the next level fault of 400 kV Jeypore - Bolangir. Tripping time is less than 100 ms.
220KV-BOLANGIR(PG)-SADEIPALI-2	19-08-2020	18:29	Tripped from OPTCL end only at the time of successful A/r of 400 kV Jeypore - Bolangir	Tripped encroaching the next level fault of 400 kV Jeypore - Bolangir. Tripping time is less than 100 ms.
220KV-BOLANGIR(PG)-SADEIPALI-2	19-08-2020	15:40	B-N, Z-3, 1.22 KA ,110.3 Km FROM GRIDCO	Fault in Z-3, Tripping time is less than 100 ms.
220KV-BOLANGIR(PG)-SADEIPALI-2	28-08-2020	09:54	Tripped from overcurrent from Sadeipalli end	O/C operated overreaching the fault of 400 kv meramundali bolangir . Tripping time is less than 100 ms.
220KV-BOLANGIR(PG)-SADEIPALI-2	27/09/2020	10:02	Sadeipalli : B ph Back up O/C	No tripping at Bolangir(PG) end
220KV-BOLANGIR(PG)-SADEIPALI-1	27/09/2020	10:02	SADEIPALLI : B-N,FC 3.96KA .B-phase LA burst for ckt -1 at Sadeipalli end	Bolangir : B-ph FD 1.8Km, Fc 6.98KA

**Following discrepancies have been observed:**

- In all the tripping events of August there was no fault in the line, all tripping's occurred from OPTCL end on operation of overcurrent earth fault sensing the faults of 400 kV lines emanating from 400 kV Bolangir substation, although faults of 400 kV level were being cleared within 100 ms.
- It is suggested to check for Directional overcurrent earth fault setting, which should be coordinated with zone-3 time. In any case overcurrent earth fault should not operate instantaneously, so current setting as well as time co-ordination is required from OPTCL end.
- As the mentioned line is very short, **POTT (Permissive overreach) schemes** will be preferably giving better performance. If these lines are having POTT schemes then **Current reversal guard** needs to be implemented to avoid unwanted tripping of both lines for the fault in single line, due to current reversal in cases of sequential fault clearing.

OPTCL may explain.

**Deliberation in the meeting**

*OPTCL informed that tripping on 19/08/2020 was due to operation of high set overcurrent protection. OPTCL added that high set pick up setting was changed to 8 times from 5 times and time settings was modified to 500 ms from instantaneous.*

*OPTCL informed that the tripping on 27/09/2020 was due to LA burst at Sadeipalli.*



*PCC advised OPTCL to implement differential protection scheme in 220kV Bolangir- Sadeipali double circuit line as it is a short line with line length of 2.73 km.*

*PCC advised OPTCL to implement the ERLDC suggestions given in the agenda.*

## **PART- C:: OTHER ITEMS**

### **ITEM NO. C.1: Collection of substation data by PRDC**

PRDC is collecting the substation data and maintaining the database for the Eastern Region. The data for following new substations are to be collected:

**New Substation List**

Sl No	SS Name	Data Collection	Owner	State
1	Bagmundi		WBSETCL	West Bengal
2	Gajole	Collected	WBSETCL	West Bengal
3	Dinahata		WBSETCL	West Bengal
4	Rejinagar		WBSETCL	West Bengal
5	Jhalda		WBSETCL	West Bengal
6	Goghat		WBSETCL	West Bengal
7	Saltlake Stadium		WBSETCL	West Bengal
8	Kashipur		OPTCL	Odisha
9	Betanati		OPTCL	Odisha
10	Aska New		OPTCL	Odisha
11	Udala		OPTCL	Odisha
12	Narashinghpur		OPTCL	Odisha
13	IBTPS		OPGC	Odisha
14	Mancheswar		OPTCL	Odisha
15	Govindpur	Collected	JUSNL	Jharkhand
16	North Karanpura		NTPC	Jharkhand
17	Mangdhechu		MHPA	Sikkim
18	TingTing		....	Sikkim
19	Lethang		....	Sikkim
20	Rongichu		....	Sikkim

In view of COVID-19 pandemic the data is being collected through online. All the constituents may note and submit the relevant data to PRDC for maintaining the database.

*In 93<sup>rd</sup> PCC, all the concerned utilities were advised to submit the relevant data to PRDC for maintaining the database.*

Members may note and comply.

### **Deliberation in the meeting**

*PCC advised all concerned utilities to submit relevant data to PRDC for maintaining the database.*

### **ITEM NO. C.2: Submission of protection settings in PDMS**

Relay settings of many transmission elements are not available in the protection database. The list has been prepared and forwarded to all the concerned utilities.

All the utilities are advised to upload the relay settings in PDMS or send the relay settings to [erpcprotection@gmail.com](mailto:erpcprotection@gmail.com).

Members may note and comply.

#### **Deliberation in the meeting**

*PCC advised all utilities to upload the relay settings in PDMS or send the relay settings to [erpcprotection@gmail.com](mailto:erpcprotection@gmail.com).*

#### **ITEM NO. C.3: Protection coordination of the new transmission elements to be charged in Eastern Region**

<b>Elements Name</b>	<b>S/S to be affected</b>	<b>Remarks</b>
400/220 kV ICT – 1 and associated tie bay at DSTPS, Andal	DSTPS	
132 kV LILO line on Rihand-Sonenagar ckt-I along with 132/25 kV T/S/S Nagar Untari	Sonenagar, Aurangabad, Chandauti, Rafignj, Sonenagar New, Dehri, Japla	Distance protection is to be coordinated with modified line length ( <b>136 km; original line length was 190 km</b> ) of 132 kV Nagar Untari – Sonenagar

Members may note.

#### **Deliberation in the meeting**

*All concerned utilities noted.*

#### **ITEM NO. C.4: Any additional agenda – with permission of the Chair.**

\*\*\*\*\*

S.No	Name	Designation	Organisation	Contact No.	Email Id
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15.	Pankaj Mishra		BSPTCL , CRITL		
16.	S M S SAHOO	AGM	Meramunduli, OPTCL		
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21.	Yallaji Reddy R				
22.	Saibal Ghosh		ERLDC	8584072079	saibal@posoco.in
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	Kumar				
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30.	Arindam Choudhary	AEE	BSPTCL	9572324275	ari010689@gmail.com; esecritil@gmail.com
31.	Rahul Anand	Senior Manager (O & M)	NTPC	9425823430	rahulanand@ntpc.co.in
32.	P K Patro,	DGM	EMR (Guest)		
33.	SURAJIT BANERJEE	SR. GM	ERLDC	9433041823	Surajit.benerjee@posoco.in

# पावर सिस्टम ऑपरेशन करपोरेशन लिमिटेड

(भारत सरकार का उद्यम)

## POWER SYSTEM OPERATION CORPORATION LIMITED

(A Government of India Enterprise)



Eastern Regional Load Despatch Centre: 14, Golf Club Road, Tollygunge, Kolkata-700 033.

CIN: U40105DL2009GOI188682

फ़ोन: 033- 24235755, 24174049 फ़ैक्स : 033-24235809/5029 Website: [www.erldc.org](http://www.erldc.org), Email ID- [erldc@posoco.in](mailto:erldc@posoco.in)

घटना संख्या: 23-09-2020/1 & 2

दिनांक: 29-09-2020

### Report on the grid event in Eastern Region (पूर्वी क्षेत्र में ग्रिड घटना पर रिपोर्ट)

#### Summary of the event (घटना का सारांश):

On 23<sup>rd</sup> September 2020 at 08:45 hrs, R phase to earth fault had occurred at Patratu S/S due to the snapping of Shield wire on 132 kV side R – Phase jumper of 50 MVA, 132/33 kV Power Transformer. Transformer relay sensed the fault in Differential & REF (field CT is used for Diff & REF) protection and issued trip command instantly but breaker failed to operate due to problem in mechanism. This fault was not cleared from all remote ends due to low fault current. After 8 sec (approx.) R phase to earth fault got converted into Y phase to earth fault, due to snapping of 220 kV Bus -2 jumper at Patratu. Subsequently all the 220 kV feeders connected to Patratu tripped in Zone - 2 from remote end resulting total power failure at Patratu S/S.

220 kV Tenughat - Patratu S/C was restored at 10:54 hrs. 220 kV Patratu Hatia - 2 was restored. At 13:49 hrs 220 KV Patratu-Hatia 2 and 220 KV Tenughat-Biharshariff S/C tripped due to B phase to earth fault resulting total power failure at 220 kV Patratu S/S and 220 kV Tenughat thermal power station.

- **Date / Time of disturbance:** 23-09-2020 at 08:45 hrs (**Event 1**) and 13:49 hrs (**Event 2**)
- **Event type:** Both the events are GD - 1
- **Systems/ Subsystems affected:** 220 kV Patratu S/S and 220 kV Tenughat generating station.
- **Load and Generation loss.** During the first event, no generation or load loss was reported by SLDC Jharkhand. During the second event around 280 MW generation loss occurred at Tenughat. No-load was reported during this event by the SLDC.

#### Major elements tripped (प्रमुख ट्रिपिंग):

- 220 kV Hatia Patratu D/C and 220 kV Tenughat Patratu S/C (**During event 1**)
- 220 KV Patratu-Hatia 2, 220 KV Tenughat-Biharshariff S/C & Tenughat Unit 1 & 2 (**During event 2**)

#### Network across the affected area (प्रभावित क्षेत्र का नक्शा)



Figure 1: Network across the affected area

## Relay indication and PMU observation (रिले संकेत और पीएमयू अवलोकन):

समय	नाम	अंत 1 रिले संकेत	अंत 2 रिले संकेत	पीएमयू अवलोकन
08:45 Hrs	220 kV Patratu Hatia 1	Did not trip	Y-N, Zone – 2, F/C 2.44 kA, 54 km from Hatia.	Initially around 1 kV dip has been observed in all three phases at Biharshariff PMU. Dip in R phase voltage was more than other phases. Around 8 seconds after the start of the fault, dip in Y phase increased to 2.5 kV. After 500 ms, fault in all three phases got cleared.
	220 kV Patratu Hatia 2	Did not trip	Y-N, Zone – 2, F/C 2.47 kA, 54 km from Hatia.	
	220 kV Patratu Tenughat S/C	Did not trip	R-Y-N, Zone – 2, 61 km from Tenughat, I <sub>R</sub> - 1.4 kA, I <sub>Y</sub> – 3.2kA, I <sub>B</sub> – 1.3 kA	
	132 kV Patratu Hatia S/C (9C)	R-N, Zone-4, F/C- 1.8 kA,	R-Y-N, Zone - 2, 42 km from Hatia, I <sub>R</sub> - 2.05 kA, I <sub>Y</sub> – 2.11 kA, I <sub>B</sub> – 0.68 kA	
	132 kV Patratu Kanke S/C (8C)	Sensed in Zone – 4, did not trip	R-N, Zone-2, 27 km from Kanke, F/C 1.5 kA.	
	220/132 kV ICT-2 at Patratu	Both HV and LV side did not trip		
	132/ 33 kV ICT at Patratu	<b>Breaker failed to operate.</b> Differential & REF, IR diff- 20.71 PU, REF HV LoZ diff- 6.151 kA, IR-HV - 6.560kA, IY-HV - 180.6 A, IB-HV - 269.3 A,		
10:59 Hrs	220 kV Patratu Tenughat S/C	Yet to be received	Y-N, Zone – 2, F/C: 2.6 kA, 65 km from Tenughat	Fault clearing time around 350 ms
13:49 Hrs	220 kV Patratu Hatia - 2	O/C, current in all 3 phases was around 0.6 kA	Did not trip	Around 3 kV dip has been observed in PMU data. The fault clearing time was around 160 ms
	220 KV Tenughat-Biharshariff S/C	B-N, Zone – 1, 106km. F/C 0.5 kA	Yet to be received	

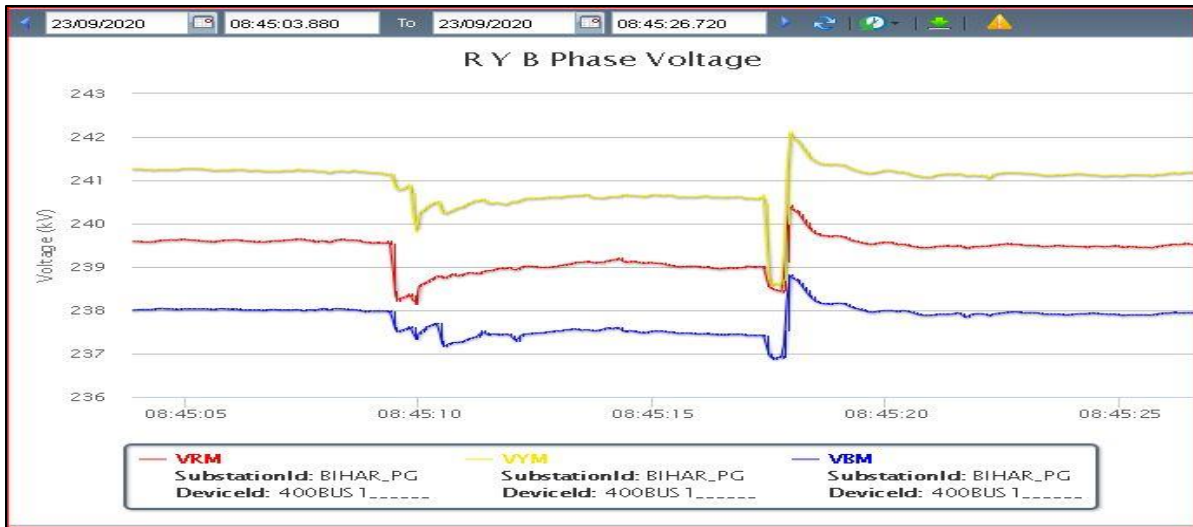


Figure 2: Initially around 1 kV dip has been observed in all three phases at Biharshariff PMU. Dip in R phase voltage was more than other phases. Around 8 seconds after the start of the fault, the dip in the Y phase increased to 2.5 kV. After 500 ms, fault in all three phases got cleared.

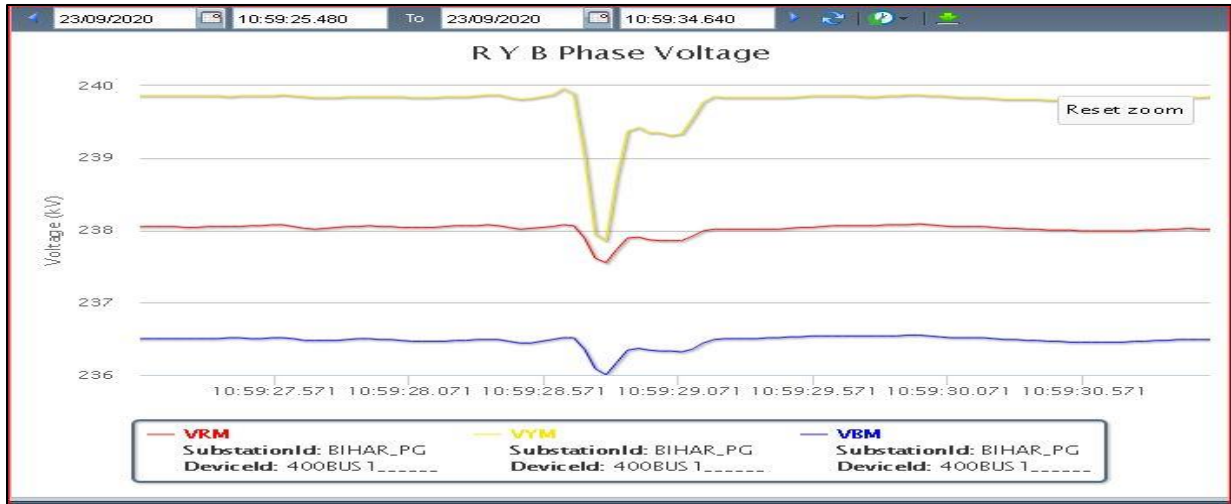


Figure 3: Three phase PMU recorded at 10:59 hrs at Biharshariff shows the existence of Y phase to earth fault at the time of the event. The fault clearing time was around 350 ms.



Figure 4: Three phase PMU recorded at 13:49 hrs at Biharshariff shows the existence of B phase to earth fault. The fault clearing time was less than 160 ms.

### Restoration (पूर्वावस्था की प्रप्ति):

- 220 kV Patratu – Hatia – 02 was restored at 10:30 hrs.
- After the first event, 220 kV Tenughat - Patratu S/C was restored at 10:54 hrs. But it tripped again at 10:59 hrs due to Y phase to earth fault. It was restored at 12:05 hrs.
- 132 kV Patratu – Hatia S/C (9C) and 132 kV Patratu – Kanke S/C (8C) restored at 11:49 hrs and 11:50 hrs respectively.
- 220 KV Tenughat-Biharshariff S/C charged at 14:19 hrs.
- After the event 2, 220 KV Patratu-Hatia 2 charged at 14:35 hrs.

## Analysis of the event (घटना का विश्लेषण):

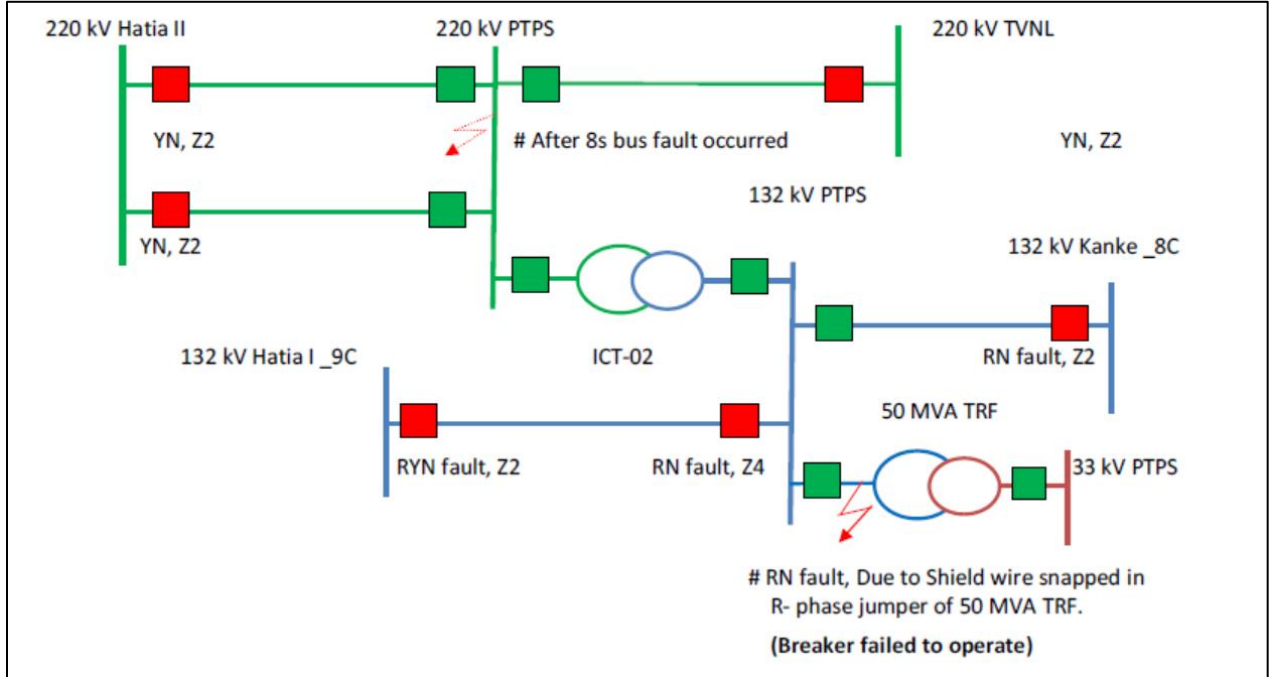


Figure 5: Status of the network of affected area after event 1

- At 08:45 hrs R phase to earth fault occurred at Patratu S/S due to snapping of the shield wire on 132 kV side R – Phase jumper of 50 MVA, 132/33 kV ICT. Differential & REF (field CT is used for Diff & REF) protection of affected ICT sensed the fault and issued trip command instantly to the breaker. But the breaker failed to operate due to the problem in its mechanism. The air pressure lock mechanism was found in the open condition during the investigation.
- There was no LBB protection available for the 132 kV side breaker at Patratu S/s. Kanke side relay of 132 kV Patratu – Kanke S/C (8C) sensed the fault in zone – 2 and tripped the line in from Kanke end.
- Hatia and Patratu side relay of 132 kV Patratu – Hatia S/C (9C) sensed the fault in Zone – 2 and Zone – 4 protection respectively and tripped breaker from Hatia and Patratu end in 480 ms and 580 ms respectively. **JUSNL may explain the reason for the tripping of the breaker at Patratu end of 132 kV Patratu – Hatia S/C as the line got already tripped from Hatia end. (Directional nature of distance protection may be checked by JUSNL)**
- 220/132 kV ICTs at Patratu S/s did not trip. So, the fault was being fed from 220 kV side via 220 kV Hatia Patratu D/C and 220 kV Tenughat Patratu S/C. Directional earth fault protection at Hatia end of 220 kV Hatia Patratu D/C sensed the fault. But the breaker did not trip as the fault current was below the pick-up setting (15% of 800/1). O/C and E/F protection of 220/132 kV ICT - 2 at Patratu failed to sense the fault. **JUSNL may share O/C and E/F protection setting of 220/132 kV ICT - 2 at Patratu.**
- After 8 sec (approx.) from the fault inception point, R phase to earth fault got converted into Y phase to earth fault, due to the snapping of 220 kV Bus -2 jumper at Patratu. Subsequently, 220



kV Hatia Patratu D/C and 220 kV Tenughat Patratu S/C tripped in Zone - 2 protection from Hatia and Tenughat end respectively. As a result, a total power failure occurred at Patratu S/S.

- After the first event, 220 kV Tenughat - Patratu S/C and 220 kV Patratu Hatia - 2 were restored at 10:54 hrs and 10:30 hrs. respectively. But 220 kV Tenughat - Patratu S/C tripped again at 10:59 hrs due to Y phase to earth fault. It was restored at 12:05 hrs.

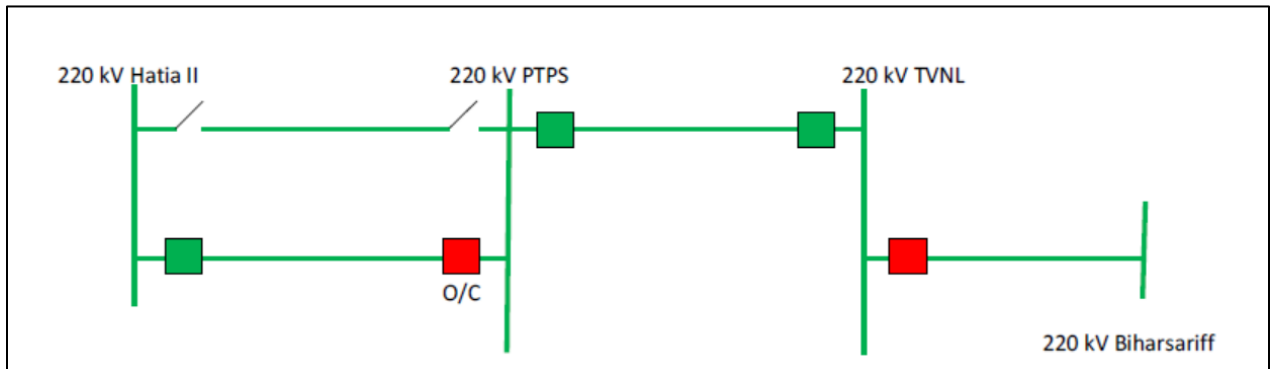


Figure 6: Status of the network of affected area after event 2

- During event 2, 220 kV Patratu – Hatia – 1 was not in service. At 13:49 hrs 220 KV Tenughat-Biharshariff S/C tripped due to B phase to earth fault at 106 km from Tenughat.
- After the tripping of 220 KV Tenughat-Biharshariff S/C, the whole generation of 220 kV Tenughat generating station was being evacuated through 220 kV Tenughat – Patratu S/C and 220 kV Patratu – Hatia – 2. As a result, Overcurrent protection operated at Hatia end. Current in all three phases at Hatia end for this line was around 600 A. Overcurrent protection setting was Pick up – 100%, TMS - 0.600 CT ratio -600/1. As per transmission planning criteria, the ampacity of 220 kV single zebra conductor is around 550 A for the maximum temperature at 75° C and ambient temperature at 45° C. Hence tripping of power flow through 220 kV Patratu – Hatia – 2 was more than its thermal limit prior to the tripping. **JUSNL may check the directional setting of this line at Hatia end.** As power was flowing towards Hatia, the line should not trip from Hatia end.

### Operational issues observed (प्रचालन समस्या):

- Prior to the event 2, N-1 criteria did not satisfy for the tripping of 220 kV Tenughat – Biharshariff S/C. Therefore, tripping of 220 kV Tenughat – Biharshariff S/C resulted in power flow through 220 kV Patratu – Hatia – 2 more than its thermal capacity. Reduction of generation at Tenughat after event 1 (as circuit 1 could not be restored) might prevent the occurrence of event 2. **(Jharkhand SLDC to study and share their views)**
- No sequence of events has been recorded at ERLDC SCADA data at the time of the event. **(Jharkhand SLDC, TVNL, PTPS to update).**

### Protection issues observed (सुरक्षा समस्या):

- Breaker of 50 MVA 132/33 kV ICT at Patratu failed to trip due to problem in the air pressure lock mechanism. JUSNL may share the remedial action taken after this event. The healthiness of the breaker at Patratu may be checked by JUSNL. **(JUSNL to update)**

- JUSNL may share O/C and E/F protection setting of 220/132 kV ICT - 2 at Patraru. JUSNL informed separate back up relay are not available for 220/132 kV ICT - 2 at Patraru. JUSNL may share the action plan for the installation of a separate backup relay. If the protection of this ICT acted properly total power failure at Patraru might have been avoided. **(JUSNL to update)**
- The directional setting of 220 kV Hatia – Patraru – D/C at Hatia end may be checked. Directional overcurrent protection operated at Hatia end for 220 kV Hatia – Patraru – 2 during event 2. Power was flowing towards Hatia at the time of the tripping. **(JUSNL to update)**
- The setting of DR output at Patraru station may be configured as per PCC's recommendation.

### Non-compliance observed (विनियमन का गैर-अनुपालन):

Issues	Regulation Non-Compliance	Utility
<b>Non-Availability DR/ Event logger at Sub-station</b>	1. Indian Electricity Grid Code 4.6.3 2. CEA Technical Standard for Construction of Electrical Plants and Electric Lines: 43.4.D. 3. CEA (Technical standards for connectivity to the Grid) Regulation, 2007: Schedule Part 1.7	JUSNL/Jharkhand SLDC
<b>Incorrect/ mis-operation / unwanted operation of Protection system</b>	1. CEA Technical Standard for Construction of Electrical Plants and Electric Lines: 43.4.A. 2. CEA (Technical standards for connectivity to the Grid) Regulation, 2007: Schedule Part 1. (6.1, 6.2, 6.3)	JUSNL/Jharkhand SLDC
<b>SCADA data Non-Availability for the station</b>	1. IEGC 4.6.2 Data and Communication Facilities 1. 2. IEGC 5.2.q	JUSNL/Jharkhand SLDC

### Status of Reporting (रिपोर्टिंग की स्थिति):

- Report and DR/EL have been from Tenughat generating station
- Report and DR/EL have been received from Jharkhand SLDC/JUSNL.

# पावर सिस्टम ऑपरेशन करपोरेशन लिमिटेड

(भारत सरकार का उद्यम)

**POWER SYSTEM OPERATION CORPORATION LIMITED**

(A Government of India Enterprise)



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CIN: U40105DL2009GOI188682

फ़ोन: 033- 24235755, 24174049 फ़ैक्स : 033-24235809/5029 Website: [www.erldc.org](http://www.erldc.org), Email ID- [erldc@posoco.in](mailto:erldc@posoco.in)

Event No: 19-09-2020/1

Dtd: 23-09-2020

## Report on the grid event in Eastern Region (पूर्वी क्षेत्र में ग्रिड घटना पर रिपोर्ट)

### Summary of the event (घटना का सारांश):

To perform the main breaker timing test at BSPTCL end, 220 kV Darbhanga – Darbhanga – 2 was connected via the transfer bus coupler (TBC) bay at Darbhanga (BSPTCL) S/S. At 16:37 hrs, the above-mentioned line tripped due to Y phase to earth fault. At the same time, 400/220 kV 500 MVA ICT 1 & 2 at Darbhanga (DMTCL) also got tripped on directional earth fault protection from 400 kV side and 220 kV Darbhanga (DMTCL) Mushari D/C tripped on the operation of distance protection from Mushari end. 220 kV Darbhanga (DMTCL)-Darbhanga(BSPTCL) 1 also tripped from BSPTCL end sensing this fault as per preliminary information. This had led to a total power failure at 220/132 kV Darbhanga (BSPTCL) S/s causing load loss of around 380 MW. On investigation, BPI of Y-phase of TBC at Darbhanga (BSPTCL) was found in the flashed conditions at Darbhanga (BSPTCL) substation.

- **Date / Time of disturbance:** 19-09-2020 at 16:37 hrs
- **Event type:** GD - 1
- **Systems/ Subsystems affected:** 220/132 kV Darbhanga (BSPTCL)
- **Antecedent grid frequency:** 49.87 Hz
- **Antecedent Bihar demand:** 4341 MW
- **Load and Generation loss.** Around 380 MW load loss was reported at the time of the event. No generation loss was reported.

### Major elements tripped (प्रमुख ट्रिपिंग):

- 220 kV Darbhanga (DMTCL)-Darbhanga (BSPTCL) D/C
- 220 kV Darbhanga (BSPTCL)-Mushahari-D/C
- 220 kV Darbhanga (DMTCL)-Motipur D/C
- 220 kV Darbhanga (DMTCL) -Laukhai 1
- 220 kV Darbhanga (DMTCL)-Samastipur 1
- 400/220 kV 500 MVA ICT 1 & 2 at Darbhanga (DMTCL)

## Network across the affected area (प्रभावित क्षेत्र का नक्शा)

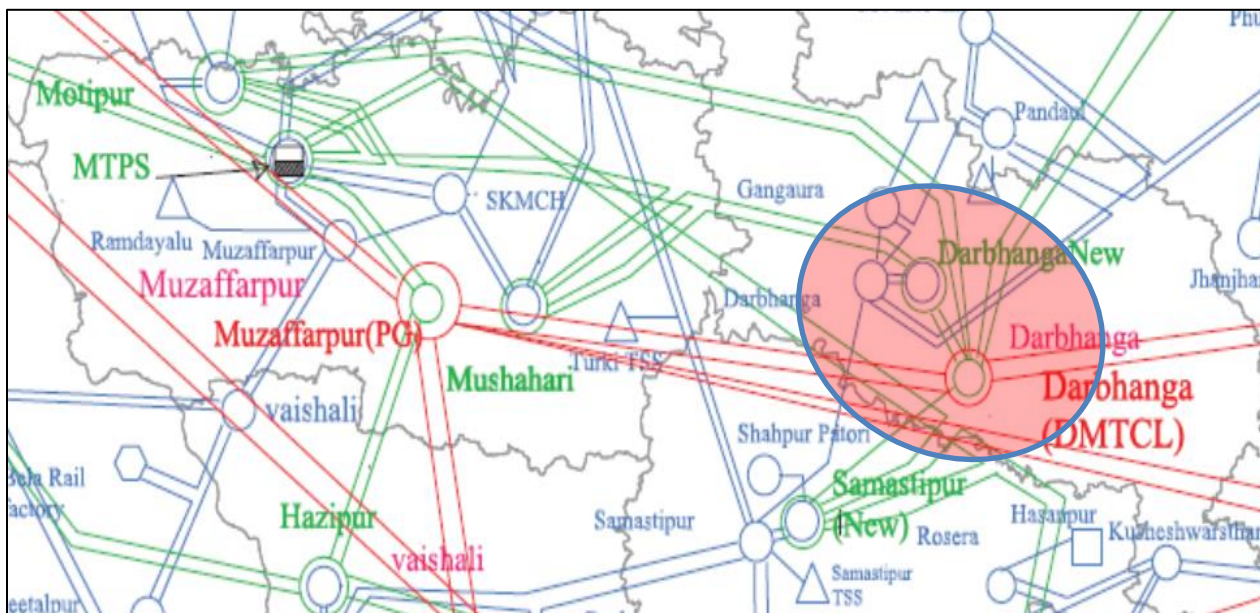


Figure 1: Network across the affected area

## Relay indication and PMU observation (रिले संकेत और PMU अवलोकन):

Table 1: Relay Indication as shared by substations and as per the analysis of DR recorded at the time of the event

Element Name	End 1	End 2	PMU observation
220 kV Darbhanga (DMTCL)-Darbhanga (BSPTCL)-2	Back up O/C in Y phase Pickup, Zone 3 pickup, F/C 8.7 kA, Distance-1.3 km. (Which Protection tripped is not clear in DR/EL)	Did not trip	Due to technical reasons, PMU data was not available at ERLDC at the time of the event.
220 kV Darbhanga (DMTCL)-Darbhanga (BSPTCL)-1	Did not trip	Tripped. Indication not shared by BSPTCL	
220 kV Darbhanga (BSPTCL)-Mushahari-D/C	Did not trip	Distance Protection	
220 kV Darbhanga (DMTCL) -Laukhai 1	Did not trip	Yet to be received	
220 kV Darbhanga (DMTCL)-Samastipur 1	Did not trip	Yet to be received	
220 kV Darbhanga (DMTCL)-Motipur 1	Did not trip	Yet to be received	
220 kV Darbhanga (DMTCL)-Motipur 2	Did not trip	Yet to be received	
400/220 kV ICT 1 & 2 at Darbhanga (DMTCL)	400 kV side Directional Earth fault from and Overcurrent protection		

## Restoration (पूर्वावस्था की प्रप्ति):

- 400/220 KV ICT-1 & 2 at Darbhanga (DMTCL) were restored at 17:46 hrs and 18:33 hrs respectively

- 220 KV Darbhanga-Darbhanga - 1 line was restored at 18:06 hrs
- 220 KV Darbhanga-Motipur- D/C were restored at 18:15 hrs and 18:27 hrs respectively
- 220 KV Darbhanga-Samastipur-1 was line restored at 18:16 hrs
- 220 KV Darbhanga-Laukahi-1 line was restored at 18:18 hrs

### Analysis of the event (घटना का विश्लेषण):

- Multiple issues were observed at 220 kV Darbhanga BSPTCL substation in the previous months due to which PCC forum of Eastern Region advised BSPTCL to carryout testing of all its breakers.
- For the purpose of performing the main breaker timing test at BSPTCL end, 220 kV Darbhanga – Darbhanga – 2 was connected to transfer bus coupler (TBC) bay at Darbhanga (BSPTCL) S/S. 220 kV Darbhanga – Darbhanga – 1 was connected to its main bay at BSPTCL end.
- At 16:27 hrs, 220 kV Darbhanga (DMTCL)-Darbhanga (Bihar)-2 tripped from DMTCL end due to operation of B phase Back up overcurrent protection (DR only showing pickup). At the same time, 400/220 kV 500 MVA ICT 1 & 2 at Darbhanga (DMTCL) tripped due to the operation of overcurrent and earth fault protection from 400 kV side. 220 kV Darbhanga-Mushahari-D/C tripped at the same time from Mushahari end due to distance protection. In addition, 220 kV Darbhanga(DMTCL)-Motipr D/C, 220 kV Darbhanga(DMTCL)-Samastipur 1, 220 kV Darbhanga (DMTCL)-Laukhai 1 has also tripped however the tripping details reason has not been shared.
- TBC breaker tripped at Darbhanga (BSPTCL) S/S on earth fault protection. BSPTCL informed that DR output could not be retrieved for this tripping incident due to the non-availability of the DR facility in TBC Relay which is Eassun MIT 114. BSPTCL has shared that they would replace all old relays with numerical relays having DR/EL facility. **(BSPTCL may share the timelines for replacing the old relays.)**
- During the field investigation BPI of Y-phase of TBC at Darbhanga (BSPTCL) was found flashed at Darbhanga BSPTCL S/S. The IR value of BPI in all three phases was checked during the investigation and found unsatisfactory. BSPTCL has intimated that they have planned to replace all BPIs. **(BSPTCL may share the timelines for replacement works. BSPTCL may also share the status of the bus bar protection system at Darbhanga (BSPTCL) GIS.)**
- As per the DR recorded at DMTCL end for 220 kV Darbhanga – Darbhanga – 2, There was y phase fault (Fault current: 8.7 kA). The fault was cleared within 100 ms with tripping of all the three poles of the beraker and outage of circuit from Darbhanga (DMTCL) S/s. DR also shows that from Darbhanga (BSPTCL) S/s the breaker has not tripped as voltage in faulty phase as well as healthy phases persisted for around 500 ms. From the DR/EL , it is not clear on which protection Darbhanga (DMTCL) end breaker had initiated the trip command. The DR/EL file of Darbhanga (DMTCL)end needs further improvement. Digital channel flag shows single phase tripping however all the three phases have tripped is also not clear. DMTCL (Darbhanga) may clarify the event.
- As per DR recorded for tripping of ICT-1 at DMTCL, tripping command for directional earth fault was given within 150 ms. **DMTCL may check the time setting of directional earth fault protection of both ICTs. Such immediate tripping indicates higher setting of ICTs encroaching the next voltage level.**

- With the tripping of the 400/220 kV ICTs at Darbhanga(DMTCL) and Lines due to non-clearance of 220 kV Y phase fault on TBC at Darbhanga (BSPTCL) TBC, there was a complete blackout in 220 kV Darbhanga (DMTCL) Downstream network of Bihar leading to 380 MW load loss.
- BSPTCL and Bihar SLDC have so far not shared the complete details of the event. BSPTCL is advised to share DR/EL recorded at 220 kV Darbhanga(BSPTCL), Mushahari, Motipur, Samastipur and Laukhai end.

### Operational issues observed (प्रचालन समस्या):

- No sequence of events has been recorded at ERLDC SCADA data at the time of the event. **(Bihar SLDC and DMTCL to update).**

### Protection issues observed (सुरक्षा समस्या):

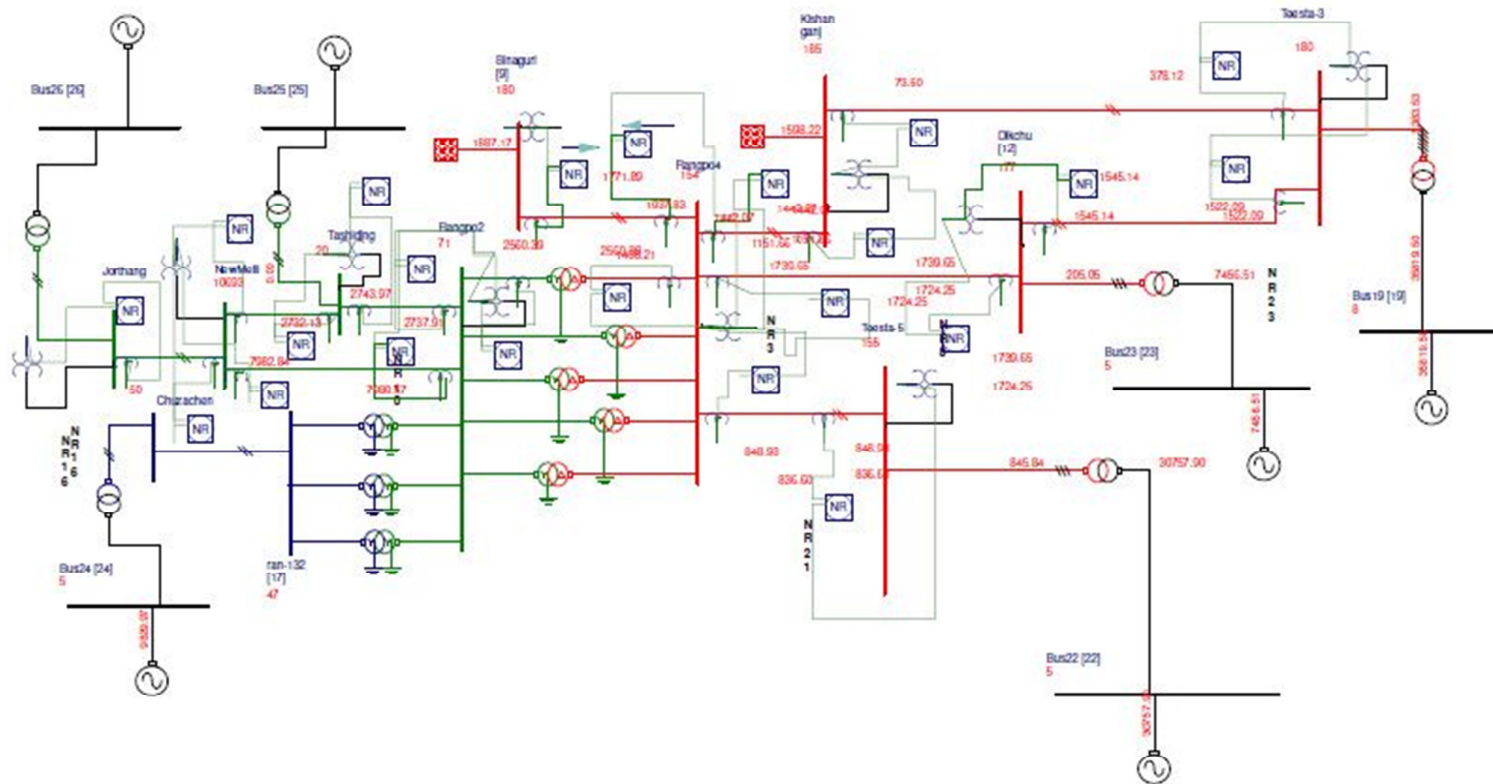
- Why the bus bar protection has not operated for this fault at Bihar (BSPTCL) end. Whether any bus bar protection is in service at the substation may be clarified by BSPTCL. **(BSPTCL to update)**
- All breakers in Darbhanga (BSPTCL) are required to be tested starting from the initiation of trip command from the relay to tripping of breaker poles. A detailed protection audit and protection review of all substations (BSPTCL) in that area also is required to be carried out by BSPTCL in coordination with DMTCL. **(BSPTCL to update)**
- Time setting of Directional Earth Fault relays of 400/220 kV ICTs at Darbhanga (DMTCL) may be checked. **(DMTCL to update)**
- DR/EL configuration may be properly checked and configured at DMTCL end as per the issues observed in event analysis. **(DMTCL to update)**
- BSPTCL may share the timelines for replacement works of BPI and installation of numerical relays at Darbhanga (BSPTCL). BSPTCL may share the status of bus bar protection at Darbhanga (BSPTCL) end. **(Bihar SLDC/BSPTCL to update).**
- BSPTCL may share the DR/EL recorded at 220 kV Darbhanga(BSPTCL), Mushahari, Motipur, Samastipur and Laukhai end. Detailed relay indication from these substations also to be shared by BSPTCL. **(Bihar SLDC/BSPTCL to update).**

### Non-compliance observed (विनियमन का गैर-अनुपालन):

Issues	Regulation Non-Compliance	Utility
<b>Non-Availability DR/ Event logger at Sub-station</b>	1. Indian Electricity Grid Code 4.6.3 2. CEA Technical Standard for Construction of Electrical Plants and Electric Lines: 43.4 .D. 3. CEA (Technical standards for connectivity to the Grid) Regulation, 2007: Schedule Part 1.7	BSPTCL/Bihar SLDC
<b>Incorrect/ mis-operation / unwanted operation of Protection system</b>	1. CEA Technical Standard for Construction of Electrical Plants and Electric Lines: 43.4.A. 2. CEA (Technical standards for connectivity to the Grid) Regulation, 2007: Schedule Part 1. (6.1, 6.2, 6.3)	DMTCL



**Network:**



Line	Relay Connected at	CT Ratio in A	Fault Location	Fault Current seen by the Relay	Existing				Proposed			
					Ie> in A (Primary)	Characteristics	TMS/ Time Delay	Top (sec)	Ie> in A (Primary)	Characteristics	TMS	Top in sec
Binaguri-Rangpo	Rangpo end	2000/1	Binaguri	4526	200	IEC NI	0.34	0.776	400	IEC NI	0.36	1
Binaguri-Rangpo	Binaguri end	2000/1	Rangpo	2716	200	IEC NI	0.34	0.889	400	IEC NI	0.28	1
Kishangunj-Rangpo	Rangpo end	3000/1	Kishangunj	2933	1200	IEC NI	0.34	2.639	600	IEC NI	0.25	1
Kishangunj-Rangpo	Kishangunj end	3000/1	Rangpo	2200.46	400	IEC NI	0.28	1.13	400	IEC NI	0.25	1
Rangpo- Dikchu	Rangpo end	3000/1	Dikchu	5213.64	-	-	-	-	600	IEC NI	0.32	1
Rangpo- Dikchu	Dikchu end	3000/1	Rangpo	3440	600	DT	1.5	1.5	600	IEC NI	0.38	1.5
Rangpo- TeesthaV	Rangpo end	2000/1	Teestha V	6531.16	200	IEC NI	0.375	0.85	400	IEC NI	0.42	1
Rangpo- TeesthaV	TeesthaV end	2000/1	Rangpo	6909.83	-	-	-	-	400	IEC NI	0.42	1
Kishangunj-Teestha III	Kishangunj end	2000/1	Teestha III	1381	400	IEC NI	0.28	1.562	400	IEC NI	0.18	1
Kishangunj-Teestha III	Teestha III end	2000/1	Kishangunj	2859.84	-	-	-	-	400	IEC NI	0.3s	1
Dikchu-Teestha III	Dickchu end	3000/1	Teestha III	2482.1	400	DT	1.5	1.5	400	IEC NI	0.40	1.5
Dikchu-Teestha III	Teestha III end	3000/1	Dikchu	5264.25	-	-	-	-	600	IEC NI	0.32	1
Rangpo 220Kv Bus												
Rangpo-Tasheding	Rangpo end	1600/1	Tasheding	2241.47	320	IEC NI	0.35	1.23	320	IEC NI	0.34	1.2
Rangpo-Tasheding	Tasheding end	800/1	Rangpo	361	160	DT	1.2	1.2	160	IEC NI	0.14	1.2
Rangpo- Newmelli	Rangpo end	1600/1	Newmelli	4600.56	320	IEC NI	0.35	0.895	320	IEC NI	0.47	1.2
Rangpo- Newmelli	Newmelli end	1600/1	Rangpo	635.22	320	IEC NI	0.5	5.07	320	IEC NI	0.12	1.2
Tasheding-Newmelli	Tasheding end	800/1	Newmelli	2714.22	160	IEC NI	0.24	0.577	160	IEC NI	0.50	1.2
Tasheding-Newmelli	Newmelli end	1600/1	Tasheding	3200.38	320	IEC NI	0.5	1.485	320	IEC NI	0.40	1.2
Newmelli-Jorethang	Newmelli end	400/1	Jorethang	4170.46	-	-	-	-	100	IEC NI	0.66	1.2
Newmelli-Jorethang	Jorethang end	400/1	Newmelli	2467.65	100	DT	0.6	0.6	100	IEC NI	0.57	1.2



Line	Relay Connected at	CT Ratio in A	Fault Location	Fault Current seen by the Relay	Existing				Proposed			
					I> in A (Primary)	Characte ristics	TMS/ Time Delay	Top (sec)	I> in A (Primar y)	Characte ristics	TMS	Top (sec)
Newmelli-Jorethang	Jorethang end	400/1	Newmelli	650	-	-	-	-	300	IEC NI	0.09	0.8

### Case Studies:

By creating a SLG fault at Jorethang(220kV) Bus

Line	Relay connected at	Fault Location	Fault Current Seen in A	Existing		
				Pick up in A (Primary)	TMS	top in sec
Newmelli-Jorethang	Newmelli end	Jorethang Bus	4203.82	-	-	-
Newmelli-Rangpo	Rangpo end		2653.89	320	0.35	1.133813
ICT 315MVA 220kV	315 MVA T/F 220kV end		816.39	160	0.33	1.394448
Line	Relay connected at	Fault Location	Fault Current Seen in A	After Relay Coordination		
				Pick up in A (Primary)	TMS	top in sec
Newmelli-Jorethang	Newmelli end	Jorethang Bus	4203.82	100	0.66	1.190139
Newmelli-Rangpo	Rangpo end		2653.89	320	0.47	1.522549
ICT 315MVA 220kV	315 MVA T/F 220kV end		816.39	160	0.69	2.915665

By creating a SLG fault at Newmelli(220kV) Bus

Line	Relay connected at	Fault Location	Fault Current Seen in A	Existing		
				Pick up in A (Primary)	TMS	top in sec
Newmelli-Tasheding	Tasheding end	Newmelli Bus	2733.14	160	0.24	0.575318
Newmelli-Rangpo	Rangpo end		4666.73	320	0.35	0.889934
Tasheding-Rangpo	Rangpo end		1158.26	320	0.35	1.880214
ICT 315MVA 220kV	315 MVA T/F 220kV end		1435.57	160	0.33	1.029872

Line	Relay connected at	Fault Location	Fault Current Seen in A	After Relay Coordination		
				Pick up in A (Primary)	TMS	top in sec
Newmelli-Tasheding	Tasheding end	Newmelli Bus	2733.14	160	0.5	1.19858
Newmelli-Rangpo	Rangpo end		4666.73	320	0.47	1.195055
Tasheding-Rangpo	Rangpo end		1158.26	320	0.34	1.826494
ICT 315MVA 220kV	315 MVA T/F 220kV end		1435.57	160	0.69	2.153368

By creating a SLG fault at Tasheding(220kV) Bus

Line	Relay connected at	Fault Location	Fault Current Seen in A	Existing		
				Pick up in A (Primary)	TMS	top in sec
Tasheding-Rangpo	Rangpo end	Tasheding Bus	2267.85	320	0.35	1.226766
ICT 315MVA 220kV	315 MVA T/F 220kV end		1073.75	160	0.33	1.190448

Line	Relay connected at	Fault Location	Fault Current Seen in A	After Relay Coordination		
				Pick up in A (Primary)	TMS	top in sec
Tasheding-Rangpo	Rangpo end	Tasheding Bus	2267.85	320	0.34	1.191716
ICT 315MVA 220kV	315 MVA T/F 220kV end		1073.75	160	0.69	2.489119

By creating a SLG fault at Teestha III(400kV) Bus

Line	Relay connected at	Fault Location	Fault Current Seen in A	Existing			Remarks
				Pick up in A (Primary)	TMS	top in sec	
Teestha III-kishangunj	Kishangunj end	Teestha III Bus	1373.94	400	0.28	1.568846	Dickhu end DT charactersetics is used
Teestha III-Dikchu	Dikchu end		2432	400	1.5	1.5	
Dikchu- Rangpo	Rangpo end		1332.24			#DIV/0!	

Line	Relay connected at	Fault Location	Fault Current Seen in A	After Relay Coordination			Remarks
				Pick up in A (Primary)	TMS	top in sec	
Teestha III-kishangunj	Kishangunj end	Teestha III Bus	1373.94	400	0.18	1.008544	Dickhu end Relay from DT to IDMTcharactersetics was changed
Teestha III-Dikchu	Dikchu end		2432	400	0.4	1.523411	
Dikchu- Rangpo	Rangpo end		1332.24	600	0.32	2.785777	

By creating a SLG fault at Dikchu (400kV) Bus

Line	Relay connected at	Fault Location	Fault Current Seen in A	Existing		
				Pick up in A (Primary)	TMS	top in sec
Dikchu- Rangpo	Rangpo end	Dickhu Bus	5096.94	-	-	
Rangpo-Binaguri	Binaguri end		1218.69	200	0.34	1.293287

Line	Relay connected at	Fault Location	Fault Current Seen in A	After Relay Coordination		
				Pick up in A (Primary)	TMS	top in sec
Dikchu- Rangpo	Rangpo end	Dikchu Bus	5096.94	600	0.32	1.02475
Rangpo-Binaguri	Binaguri end		1218.69	400	0.28	1.739792

By creating a SLG fault at Kishangunj (400kV) Bus

Line	Relay connected at	Fault Location	Fault Current Seen in A	Existing		
				Pick up in A (Primary)	TMS	top in sec
Kishangunj-Rangpo	Rangpo end	Kishangunj Bus	2950	1200	0.34	2.622234
Rangpo-Binaguri	Binaguri end		679.37	200	0.34	1.922572

Line	Relay connected at	Fault Location	Fault Current Seen in A	After Relay Coordination		
				Pick up in A (Primary)	TMS	top in sec
Kishangunj-Rangpo	Rangpo end	Kishangunj Bus	2950	600	0.23	0.994891
Rangpo-Binaguri	Binaguri end		679.37	400	0.28	3.680633
Line	Relay connected at	Fault Location	Fault Current Seen in A	Existing		
				Pick up in A (Primary)	TMS	top in sec
Teestha V- Rangpo	Rangpo	Teestha V Bus	6263.51	200	0.375	0.736207
Rangpo-Binaguri	Binaguri end		2155.05	200	0.34	0.977545

Line	Relay connected at	Fault Location	Fault Current	After Relay Coordination
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			Seen in A	Pick up in A (Primary)	TMS	top in sec
Teestha V- Rangpo	Rangpo	Teestha V Bus	6263.51	400	0.41	1.014808
Rangpo-Binaguri	Binaguri end		2155.05	400	0.28	1.144333