Minutes
of
96th PCC Meeting

Date: 12.11.2020
Eastern Regional Power Committee
14, Golf Club Road, Tollygunge
Kolkata: 700 033

EASTERN REGIONAL POWER COMMITTEE

MINUTES OF 96TH PROTECTION SUB-COMMITTEE MEETING HELD ON 12.11.2020 AT 10:30 HOURS

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 95th Protection sub-Committee Meeting held on 15th October 2020 through MS Teams.

The minutes of 95th Protection Sub-Committee meeting held on 15.10.2020 circulated vide letter dated 06.11.2020.

Members may confirm the minutes of 95th PCC meeting.

Deliberation in the meeting

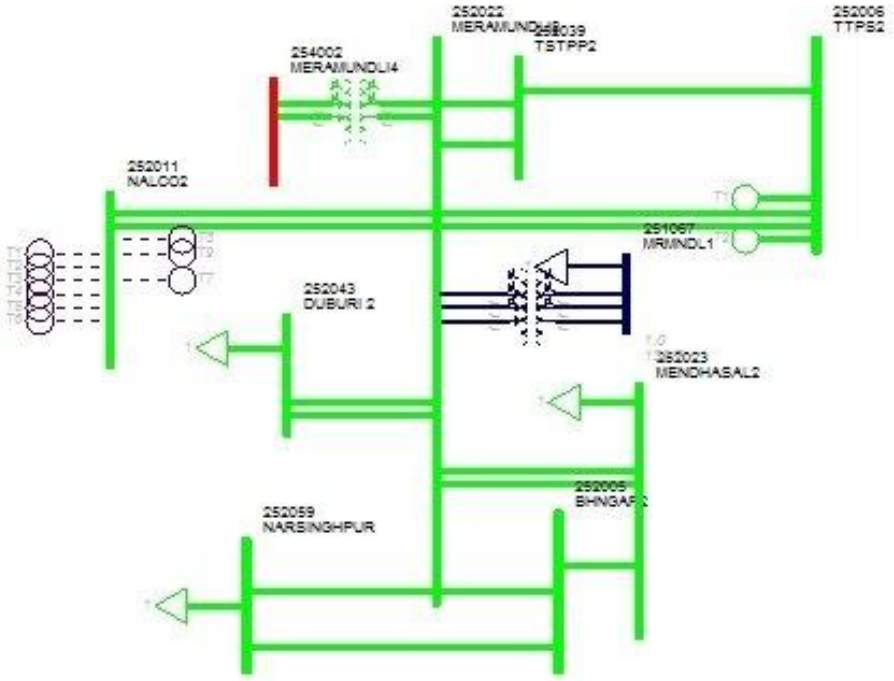
Members confirmed the minutes of 95th PCC Meeting.

PART – B

ITEM NO. B.1: Disturbance at 220 kV Meramundali Substation on 01.10.2020 at 04:07 hrs

On 30th September 2020 at 22:36 hrs, 220 kV Meramundali – NALCO - 1 was tripped on overcurrent protection. The line was charged at 00:05 hrs on 01st October 2020. At 01:35 hrs, sparking was noticed on this circuit at Meramundali end switchyard due to which GRIDCO SLDC advised NALCO to reduce the loading of the circuit.

At 04:07 hrs, line side pipe at Meramundali end of the above-mentioned circuit got broken and fell on the ground along with the breaker jumper causing line fault at Meramundali S/s. Bus jumper of 220 kV bus 1 at Meramundali also got damaged at several places which led to bus fault at 220 kV bus 1 at Meramundali. All the elements connected with 220 kV bus 1 along with the bus coupler tripped at Meramundali.



Relay Indications:

Time	Name	End 1	End 2	PMU Observation
04:07 hrs	220 kV Meramundali NALCO - 1	B-N, Zone-4, F/C =2.3 kA, 511ms	Yet to be received	Around 20 kV dip has been observed in all three phase voltages at Meramundali PMU data during the fault at 22:36 hrs on previous day. The fault clearing time was around 900 ms. During this event, around 200 kV dip has been observed in Y phase voltage at Meramundali PMU data. But as per Talcher PMU, fault was in B phase. Same has been observed in DR output recorded at Meramundali. The fault clearing time was around 500 ms. Around 70 – 200 kV rise has been captured in
	220 kV Meramundali NALCO - 2	B-N, Zone-4, F/C =2.4 kA, 516ms	Yet to be received	
	220 kV Meramundali TTPS - 1	B-N, F/C =5.3 kA, Distance: 1km, 526 ms	Did not trip	
	220 kV Meramundali TTPS - 2	B-N, F/C =5.1 kA, Distance: 1km, 522 ms	Did not trip	
	220 kV Meramundali Narsinghapur S/C	Did not trip, only zone – 4 picked up	B-N, Zone-2, F/C =0.9 kA, 357 ms, Dist. 75 km	
	220 kV Meramundali Duburi S/C	Did not trip, only zone – 4 picked up	B-N, Zone-2, F/C =3.1 kA, 397 ms, Dist. 83 km	
	220 kV Meramundali Bhanjangar S/C	Did not trip, only zone – 4 picked up	B-N, Zone-2, F/C =1.2 kA, 350 ms, Dist. 166.7 km	
	220 kV Meramundali Tata Steel - 1	Did not trip	B/U relay operated, IR=1.1 kA, IY=1.8kA, IB=5.17 kA	
	220 kV Meramundali Tata	Tripped on E/F	B/U relay	

	Steel - 2	protection	operated, IR=2.3kA, IY=2.7kA, IB=7.8kA	healthy phases of Meramundali PMU data during the fault.
	220/132 kV ICT – 1 at Meramundali	67N, IB=6.4KA, 494ms	NA	
	220 kV Bus coupler at Meramundali	E/F tripped	NA	

Load Loss : 280 MW

The following issues need to be explained by the concerned utilities:

1. OPTCL may explain the tripping of 220 kV Meramundali – NALCO – 1 on 30th September 2020 at 22:36 hrs,
2. Status of Bus bar protection of 220kV level at Meramundali S/S.
3. The reason for non-operation of 220 kV Meramundali NALCO D/C and 220 kV Meramundali TTPS D/C in the zone – 2 protection from NALCO and TTPS ends respectively may be clarified.
4. 220 kV Meramundali-Tata Steel D/C tripped from Tata Steel end in back up protection. Details of back up protection operation may be shared by OPTCL and Odisha SLDC.
5. Plan for the installation of carrier protection at 220 kV Meramundali Narsinghapur S/C, 220 kV Meramundali Duburi S/C and 220 kV Meramundali Bhanjangar S/C may be shared.
6. As per PMU data, around 70 – 200 kV rise has been observed in healthy phases during the fault at 04:07 hrs. OPTCL may share the reason for so high voltage in healthy phases during single line to ground fault.

OPTCL may explain.

Deliberation in the meeting

OPTCL informed that on 30th Sep 2020, at 22:36 hrs, 220 kV Meramundali – NALCO - 1 was tripped from Meramundali end on overcurrent protection within 900 ms as the voltage dip was very less to pickup by the distance protection. OPTCL explained that as per the information received from NALCO, Bucholz relay was operated at NALCO end and NALCO is yet to share the details of the tripping.

OPTCL explained that at 01:35 hrs on 1st Oct 2020, 160 MW power was flowing in both circuit 1 and circuit 2 of 220 kV Meramundali – NALCO D/C line which resulted in sparking at Meramundali end switchyard. SLDC, Odisha advised NALCO to reduce the loading of the circuit. At 04:07 hrs, due to heavy load, the line side pipe at Meramundali end of the above-mentioned circuit got broken as the pipes were 20-21 years old, and fell on the ground along with the breaker jumper causing Bus fault at 220kV Bus-1 of Meramundali S/s. All the elements connected with 220 kV bus-1 along with the bus coupler tripped from either remote end or Meramundali end as per the relay indications given in the agenda.

OPTCL submitted the following:

- *Bus Bar Protection at 220kV level of Meramundali S/s was not in service. OEM Siemens visited the site recently and it would be rectified soon.*
- *OPTCL informed that 220 kV Meramundali - NALCO D/C was tripped from NALCO end on zone 2. OPTCL added that they are yet to receive tripping details of 220 kV Meramundali TTPS D/C from NTPC.*
- *220 kV Meramundali-Tata Steel D/C line tripped from Tata Steel on backup O/C, E/F*

protection. Since the line is 3 km long so they are in process of implementing differential protection for this line.

- *OPGW work is in progress related to installation of carrier protection at 220 kV Meramundali- Narsinghapur S/C, 220 kV Meramundali -Duburi S/C and 220 kV Meramundali -Bhanjangar S/C.*

ERLDC informed that high voltage in healthy phases were observed in PMU plot during the fault and it may be due to neutral shifting.

PCC advised OPTCL to reduce the zone-4 time settings till restoration of the Busbar protection at 220 kV Meramundali and analyze the reason for rise in healthy phase voltage at Meramundali S/s during single phase to ground fault. PCC advised OPTCL and SLDC, Odisha to collect the tripping details from NALCO & TTPS, NTPC and submit a report to ERLDC and ERPC.

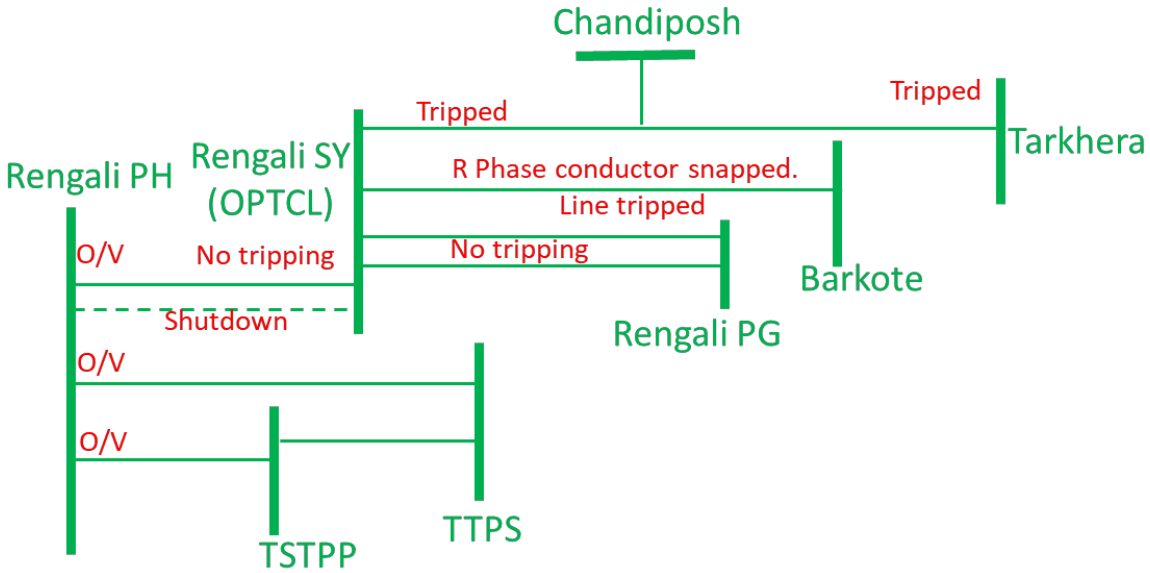
PCC also advised OPTCL to carry out proper maintenance of transmission line and substation equipment to avoid failure of any component and prepare a plan for replacement of old equipment to avoid major disturbances.

ITEM NO. B.2: Disturbance at 220 kV Rengali Substation on 10.10.2020 at 16:10 hrs

220 kV Rengali Power House (PH) – Rengali Switchyard (OPTCL) – 2 was under shutdown.

On 10th October 2020 at 16:08 hrs, 220 kV Rengali Switchyard (OPTCL) - Barkote S/C and 220 kV Rengali Switchyard (OPTCL)-Tarkera S/C tripped due to R phase to earth fault and B phase to earth fault respectively. It was reported that top conductor (R phase) of 220 kV Rengali Switchyard (OPTCL) - Barkote S/C snapped at location no 336.

Thereafter, 220 kV Rengali PH – TSTPP S/C and 220 kV Rengali PH – TTPS S/C and 220 kV Rengali PH – Rengali Switchyard (OPTCL) – 1 tripped on overvoltage from Rengali PH end. Subsequently all the running units at Rengali PH tripped. 220 kV Rengali Switchyard remained connected to rest of grid through 220 kV Rengali PG – Rengali SY D/C.



Relay Indications :

Time	Name	End 1	End 2	PMU Observation
16:10 Hrs	220 kV Rengali SY – Tarkera S/C	B-N, Zone 2, 75 km from Rengali, F/C 5.2 kA	B-N, Zone 1, 65 km from Tarkera, F/C 2.3 kA	Around 10 kV dip has been observed in B

	220 kV Rengali S/Y - Barkote S/C	D/P, Zone 1, 34 km from Rengali, F/C 8 kA	R-N, Zone 1, 13 km from Barkote, F/C 2.3 kA	phase voltage and around 9 kV dip has been observed in R phase simultaneously in 400 kV bus voltage of Talcher. The fault clearing time was around 350 ms.
	220 kV Rengali (PH) – Rengali SY - 1	Tripped on overvoltage	Did not trip	
	220 kV Rengali PH – TSTPP S/C	Tripped on overvoltage	Yet to be received	
	220 kV Rengali PH – TTPP S/C	Tripped on overvoltage	Yet to be received	
	Unit # 1, 2, & 3 at Rengali PH	instantaneous O/V. 115% over speed trip. 86 KLM operated.		
	Unit # 5 at Rengali PH	Tripped on solenoid trip circuit faulty. 86 LM operated.		

Gen Loss : 190 MW

The following issues need to be explained by concerned utilities:

1. 220 kV Rengali Switchyard (OPTCL)-Tarkera S/C has been tripped within zone 2 time (350 ms). The status of carrier-based protection scheme may be placed.
2. 220 kV Rengali PH – TSTPP S/C and 220 kV Rengali PH – TTPS S/C and 220 kV Rengali PH – Rengali Switchyard (OPTCL) – 1 tripped on overvoltage from Rengali PH end. GRIDCO SLDC/OHPC may share voltage at Rengali PH at this time along with DR recorded at Rengali PH.

OPTCL, OHPC and SLDC Odisha may explain.

Deliberation in the meeting

OPTCL informed that there were multiple faults in Rengali due to heavy rain and wind. First R-N fault was occurred in 220 kV Rengali Switchyard (OPTCL) - Barkote S/C line due to snapping of R-ph conductor (top conductor) at location no 336. The line was tripped from both the ends in zone 1. Thereafter, B-N fault was initiated in 220 kV Rengali Switchyard (OPTCL)-Tarkera S/C due to lightening. The line was tripped in zone 2 from Rengali SY end and zone 1 from Tarkera end.

OPTCL further explained that 220 kV Rengali PH – TSTPP S/C, 220 kV Rengali PH – TTPS S/C and 220 kV Rengali PH – Rengali Switchyard (OPTCL) – 1 tripped on overvoltage from Rengali PH end. Subsequently all the running units at Rengali PH tripped on overvoltage and overspeed. 220 kV Rengali Switchyard was remained connected to rest of grid through 220 kV Rengali PG – Rengali SY D/C.

OPTCL informed that electromechanical relays are installed at Rengali PH end so DR is not available. Reason for overvoltage could not be concluded in the meeting.

PCC advised SLDC, Odisha to coordinate with OHPC and provide a detailed report on overvoltage tripping at Rengali PH.

PCC opined that overvoltage protection may not be required at 220kV level. If the overvoltage protection is being used at 220kV level, the settings may be kept higher than the 400kV level settings to avoid unwanted tripping of transmission lines.

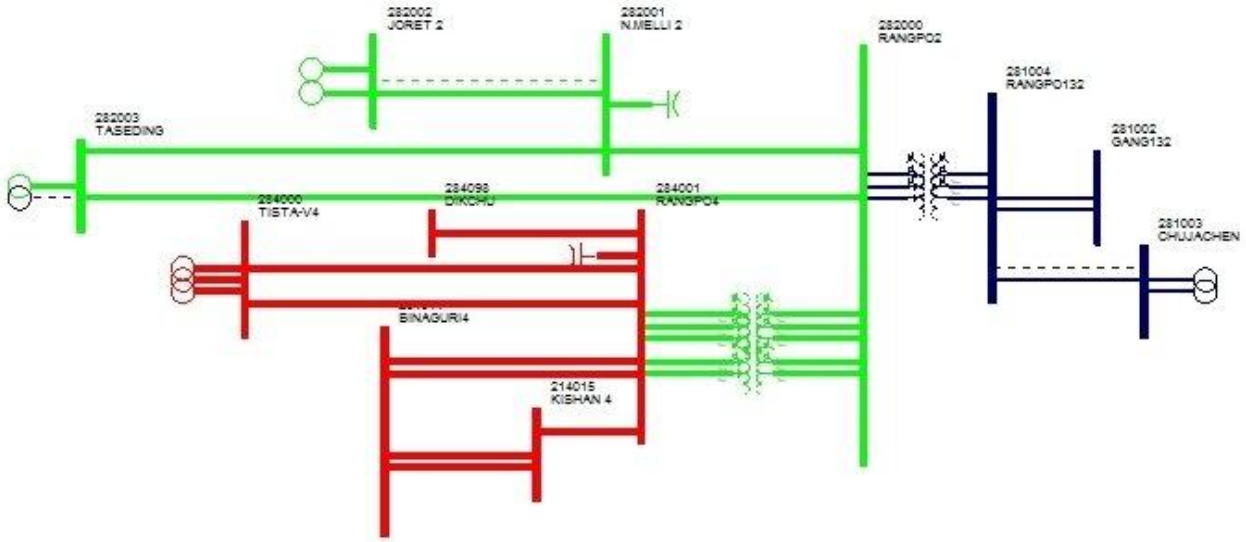
OPTCL told that carrier based protection scheme implementation in 220 kV Rengali Switchyard (OPTCL)-Tarkera S/C is in progress.

PCC advised OPTCL to submit the status of implementation of carrier protection in Odisha system to ERPC and ERLDC.

ITEM NO. B.3: Total power failure at Jorethang and Chuzachen HEP on 01.10.2020 at 14:47 hrs

On 1st Oct 2020 at 14:03 hrs, 132 kV Rangpo-Chuzachen - 1 tripped due to B phase to earth fault. Charging was attempted at 14:32 hrs but the line could not be charged. Chuzachen HEP was connected to the rest of the grid via 132 kV Rangpo-Chuzachen – 2. 220 kV Jorethang – New Melli – 1 was under emergency shutdown. Hence, Jorethang HEP was connected to the rest of grid via 220 kV Jorethang – New Melli – 2.

At 14:47 Hrs, 400 kV Rangpo-Dikchu S/C tripped due to B phase to earth fault. Tripping of 400 kV Rangpo – Dikchu S/C (only outgoing feeder connected to 400 kV bus 1 at Dikchu), resulted in the isolation of both units from the grid leading to tripping of both running units at Dikchu HEP. At the same time, 220 kV Jorethang – New Melli – 2 and 132 kV Rangpo-Chuzachen – 2 also got tripped resulting in total power failure at Jorethang and Chuzachen HEP also.



Gen Loss : 269 MW

Dikchu, Jorethang Chuzachen and Powergrid may explain.

Deliberation in the meeting

Dikchu informed that on 1st Oct 2020 at 14:47 Hrs, 400 kV Rangpo-Dikchu S/C tripped due to B phase to earth fault. Dikchu added that fault was high resistive in nature so the line tripped from both ends in directional overcurrent earth fault protection and fault clearing time was 1.5 second. Tripping of 400 kV Rangpo – Dikchu S/C (only outgoing feeder connected to 400 kV bus 1 at Dikchu), resulted in the isolation of both units from the grid leading to tripping of both running units at Dikchu HEP. 400 kV Dikchu – Teesta III was in service via Bus 2 however due to problem in GIS, units were only connected to Bus 1.

Dikchu informed that issues related to GIS would be resolved by February 2021. Thereafter the units could be connected with both the buses.

ERLDC informed that Dikchu end auto-recloser of tie circuit breaker is operational however main circuit breaker auto-reclose is not working. The same was observed on 19th October 2020 tripping.

Dikchu informed that there was a problem related to BCU logic for main circuit breaker auto-reclose. The same would be rectified and verified during line shutdown.

Chuzachen informed that 132 k V Rangpo-Chuzachen – 2 got tripped from Chuzachen end in zone 2.

Jorethang informed that 220 kV Jorethang – New Melli – 2 got tripped from Jorethang end in backup overcurrent earth fault protection in 800 ms.

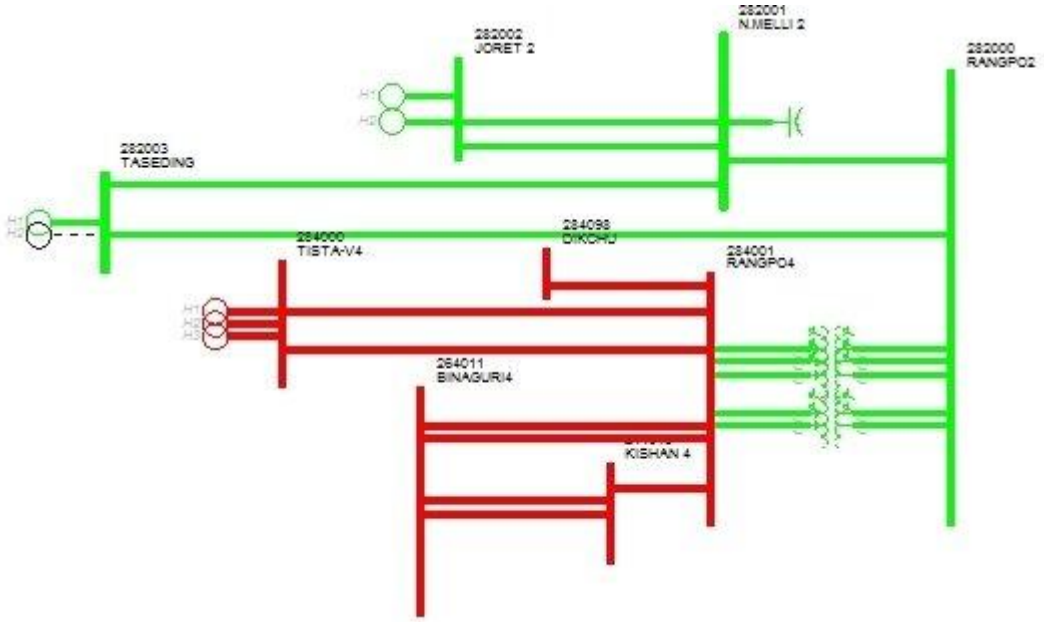
Powergrid informed that there was no pickup observed in relay at Rangpo end for 132 k V Rangpo-Chuzachen – 2 and relay at New Melli end for 220 kV Jorethang – New Melli – 2.

PCC observed that 132 k V Rangpo-Chuzachen – 2 and 220 kV Jorethang – New Melli – 2 should not trip in this case. PCC advised Chuzachen to send the relay settings of distance protection to ERPC and ERLDC for review. It was informed that backup overcurrent earth fault protection relay settings of Jorethang are being reviewed.

ITEM NO. B.4: Total Power failure at Jorethang HEP on 30.10.2020 at 13:15 hrs

At 13:15 hrs on 30-10-2020, 400 kV TEESTA V - Rangpo line- 1 tripped. At the same time, 220 KV Jorethang- New Melli D/C tripped at Jorethang end only resulting in total power failure at Jorethang HEP.

As per PMU data, initially there was a high resistance fault in R phase. After around 800 ms, this fault got converted to R and B phase fault.



Relay Indications:

Time	Name	End 1	End 2	PMU Observation
13:15 hrs	400 kV Teesta V – Rangpo – 1	R-B, Zone 1, 1.9 Km from Teesta V	R-B, IR = 5.9 kA, IY = 6.5 kA, 10 km from Rangpo	As per voltage measurement by Rangpo PMU data, initially the fault was evolving nature in R phase. After around 700 ms, it converted to R and B phase to earth fault. Around 120 kV dip in R and B phase voltage has been observed at Rangpo PMU data. The fault clearing time was around 800 ms
	220 kV Jorethang New Melli – 1	R phase O/C and E/F. 110 km from Jorethang end	Did not trip	
	220 kV Jorethang New Melli – 2	R phase O/C and E/F. 110 km from Jorethang end.	Did not trip	
	Unit 1 at Jorethang HEP	Loss of evacuation path		

Gen Loss : 48 MW

The following issues need to be explained by concerned utilities:

1. Delayed clearance of fault has been observed in PMU data for 400 kV Rangpo-Teesta V circuit 1. The same may explained.
2. Uncoordinated tripping of 220kV Jorethang- New Melli – D/C lines to be explained.
3. DR recorded for MICOM P141 relay at Jorethang end has not been configured as per ERPC's guideline.
4. DR output at Teesta V has not been configured as per ERPC's guideline. It has been observed turn ratio has not been properly incorporated in DR. Same may be checked by Teesta V HEP.

DANS Energy , NHPC, Jorethang and Powergrid may explain

Deliberation in the meeting

Powergrid explained that initially the fault in 400 kV Teesta V – Rangpo – 1 was high resistive R-N fault which converted to R and B phase to earth fault after around 700 ms. Rangpo observed RB-N fault in zone 1 and the line was tripped from both the ends on zone 1.

PCC observed that 220 kV Jorethang- New Melli D/C line got tripped on backup O/C, E/F protection due to DT settings. The same is in process of review with IDMT characteristics.

PCC advised NHPC and Jorethang to review the DR configuration as per ERPC guidelines.

ITEM NO. B.5: Disturbance at Teesta V on 20.10.2020 at 12:12 hrs

400 kV Teesta V Hydroelectric Plant is connected to the rest of the grid through 400 kV Teesta V – Rangpo D/C. Prior to the event 400 kV Teesta V – Rangpo - 2 and units 1 & 3 at Teesta V HEP were connected to 400 kV bus 2 at Teesta V while remaining elements (Circuit 1 and unit 2) were on 400 kV Bus 1 with Bus coupler closed.

On 20th October 2020 at 12:12 hrs, 400 kV Teesta V – Rangpo – 2 and 400 kV bus coupler at Teesta V HEP tripped due to Y phase to earth fault resulting in tripping of units 1 & 3 at Teesta V HEP due to loss of evacuation path.

Relay indications:

<table>
<tr><th>समय</th><th>नाम</th><th>उप केंद्र 1 रिले संकेत</th><th>उप केंद्र 2 रिले संकेत</th><th>पीएमयू पर्यवेक्षण</th></tr>
<tr><td rowspan="4">12:12 Hrs.</td><td>400 kV Bus coupler at Teesta V</td><td>Earth fault protection operation.</td><td>--</td><td rowspan="4">As per current measurement by Rangpo PMU data for 400 kV Teesta V Rangpo – 2, initially the fault was of resistive nature. Later it converted to Y phase to earth fault. Fault current increased to around 7 kA at Rangpo end. Around 100 kV dip in Y phase voltage has been observed at Rangpo PMU data. The fault clearing time was around 1600 ms.</td></tr>
<tr><td>400 kV Teesta V – Rangpo – 2</td><td>Y-N, Zone – 1, F/C 2.4 kA, A/R successful, DT received from Rangpo</td><td>Y-N, Zone – 2, F/C 13.08 kA, 12 km from Rangpo</td></tr>
<tr><td>Units 1 & 3 at Teesta V HEP</td><td colspan="2">Loss of evacuation path</td></tr>
<tr><td>400 kV B/C at Teesta V HEP</td><td colspan="2">Over current & E/F protection</td></tr>
</table>

NHPC and Powergrid may explain.

Deliberation in the meeting

Powergrid informed that on 20th October 2020 at 12:12 hrs, 400 kV Teesta V – Rangpo – 2 and

400 kV bus coupler at Teesta V HEP tripped due to Y phase to earth fault at 12 km from Rangpo end resulting in tripping of units 1 & 3 at Teesta V HEP due to loss of evacuation path.

Powergrid explained that initially the fault was high resistive nature later the fault current was increased to 7 kA due to Y-N fault in 400 kV Teesta V – Rangpo – 2. Rangpo end seen the fault in zone 2 and issued DT to other end.

PCC observed that 400kV bus coupler at Teesta V end should not be tripped on backup O/C, E/F protection in this case.

It was informed that 400 kV Bus coupler was tripped at Teesta V end before the tripping of 400 kV Teesta V – Rangpo – 2 due to un-coordinated relay settings. The same have been reviewed after the disturbance.

PCC advised NHPC to review the weak infeed protection settings of 400 kV Teesta V – Rangpo – 2 at Teesta V end as suggested by ERLDC.

Powergrid informed that patrolling of the line had been carried out and the vegetation had been cleared to avoid occurrence of faults in the line.

ITEM NO. B.6: Backup Overcurrent Relay coordination of Sikkim Complex

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

In 94th PCC, PRDC informed that they had computed the backup overcurrent E/F settings considering the IDMT characteristics.

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

In 95th PCC, 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.

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Members may discuss.

Deliberation in the meeting

Powergrid informed that fault level considered in the study is needed to be reviewed as per the recent connectivity.

PCC decided to implement the backup over current settings with IDMT characteristics at Jorethang and Tashiding as per the report in order to avoid unwanted tripping of the lines due to existing DT characteristics.

PCC advised all the concerned constituents to submit their comments, if any to ERPC so that revised study could be carried out.

ITEM NO. B.7: Resistive reach setting guidelines and model calculation for distance protection--ERLDC

1. **Proposed Criteria for Phase-earth fault:**

    a. Calculation of minimum load impedance should be as per Ramkrishna Committee Recommendation:
        - Maximum load current (Imax) may be considered as 1.5 times the thermal rating of the line or 1.5 times the associated bay equipment current rating (the minimum of the bay equipment individual rating) whichever is lower.
        - Minimum voltage (Vmin) to be considered as 0.85pu (85%).
    b. Minimum setting for resistive reach should be such that it must cover fault resistance, arc resistance and the tower footing resistance.
    c. Generally Maximum reach setting should be 80% of the minimum load impedance.
    d. Resistive reach setting < 4.5 times the zone reactive reach setting.

    Resistive reach should be the maximum of the value determined by the above three rules.

2. **Proposed Criteria for Phase-Phase fault:**

    a. Calculation of minimum load impedance as per the same method mentioned above.
    b. Minimum setting for resistive reach should be such that it must cover fault resistance and arc resistance.
    c. Generally, the resistive reach of zone-3 is set less than 80% of minimum load impedance. For power swing consideration, a margin of DR is given. Therefore, it is essential that load should not encroach this DR. In view of this, R3ph – R4ph is set 60% of minimum load impedance. R2ph and R1ph are set 80% of R3ph-R4ph respectively.
    d. Resistive reach setting < 3 times the zone reactive reach setting.

    Resistive reach should be the maximum of the value determined by the above three rules.

    Another important point is consideration of remote end in feed for zone-2 and 3 reach calculations.

Members may discuss.

Deliberation in the meeting

Powergrid informed that the specifications in point d) may change with the OEM therefore this condition may not be applicable for all manufacturers.

DVC informed that consideration of thermal loading value (75° or 85°) for the settings to be discussed and finalized.

PCC advised all the constituents to go through the guidelines and submit their comments to ERPC and ERLDC.

ITEM NO. B.8: Other disturbances in October 2020

1. **Tripping of 220 kV Bus bar – 1 at 400/220/132 kV Rangpo S/S on 08 – 10 – 2020 at 12:10 hrs.**

220 kV Bus bar – 1 at 400/220/132 kV Rangpo S/S tripped on 08 –10 –2020 at 12:10 hrs. It has been reported that 220KV Bay up-gradation/construction work was being carried out by M/s MBPCL at Rangpo on behalf of Govt. of Sikkim under Sikkim Consultancy Work during the time of the event. The reason for the tripping of the bus bar at Rangpo may be shared by POWERGRID along with relevant details.

POWERGRID may explain.

Deliberation in the meeting

Powergrid informed that 220KV Bay up-gradation/construction work was being carried out by M/s MBPCL at Rangpo on behalf of Govt. of Sikkim under Sikkim Consultancy Work. The trip command was extended to LBB protection and all the elements connected to 220 kV Bus – 1 at 400/220/132 kV Rangpo S/S got tripped.

PCC advised Powergrid to take proper measures to avoid such unwanted trippings during up-gradation/construction work.

2. Distrbance at 400/132 kV Dikchu S/S on 18-10-2020 at 13:11 hrs

On 18th October 2020 at 13:11 hrs, 400 kV Teesta III - Dikchu S/C got tripped due to B phase to earth fault resulting in tripping of 400 kV bus – 2 at Dikchu HEP. At the same time, overall differential protection of 400/132 kV ICT at Dikchu also operated leading to its tripping and isolation of both running units at Dikchu HEP from the system and their tripping. 400 kV bus – 1 at Dikchu HEP remained energized through 400 kV Rangpo – Teesta III S/C.

Operational issues Observed:

- The prolonged outage of tie bay at Dikchu is becoming a serious issue for the reliability of the grid as well as the generating power plant (Teesta 3 as well as Dikchu).
- 400 kV Dikchu-Teesta III circuit has observed similar nature fault in the past as discussed in the previous few PCC meeting. Such, resistive nature fault causing uncoordinated tripping is not desirable for system security and reliability.

Protection issues observed:

- Delayed clearance of fault has been observed in PMU data.
- Reason for the operation of overall differential protection of 400/132 kV Dikchu end may be shared. It has been observed that differential protection for units or ICT had operated repeatedly for through fault in several events in the past. **(Dikchu HEP to update)**
- Dikchu HEP may check the reason for non-auto reclose operation of main breaker and dead time for tie-breaker at Dikchu HEP for 400 kV Teesta III – Dikchu S/C. **(Dikchu HEP to update)**
- Teesta III may share the reason for the non-auto reclose operation of 400 kV Teesta III – Dikchu S/C at Teesta III end. **(Teesta III HEP to update)**

Dikchu and Teesta III may explain.

Deliberation in the meeting

Dikchu informed that on 18th October 2020 at 13:11 hrs, 400 kV Teesta III - Dikchu S/C got tripped due to B phase to earth fault at 8.7 km from Dikchu end. At the same time, overall differential protection of 400/132 kV ICT at Dikchu also operated leading to its tripping and

isolation of both the running units at Dikchu HEP from the system. 400 kV bus – 1 at Dikchu HEP was remained energized through 400 kV Rangpo – Teesta III S/C.

Dikchu added that they had reviewed the vector group and tertiary MVA settings of overall differential protection of 400/132 kV ICT at Dikchu. The relay has been tested and found okay. Dikchu agreed to resolve the auto reclose issues of 400 kV Teesta III – Dikchu S/C.

PCC advised Dikchu and Teesta III to comply the ERLDC observations given in the agenda and submit the action taken report to ERLDC and ERPC.

3. Tripping of 220 kV bus 2 at Indravati on 06-10-2020 at 13:30 hrs

On 06-10-2020 at 13:30 hrs, 220 kV bus 2 at Indravati tripped due to the operation of bus bar protection. As per the GRIDCO SLDC report, a transient fault occurred at the station. As per PMU data no-fault had been observed. DR/EL is yet to be received from Orissa SLDC.

OHPC and OPTCL may explain.

Deliberation in the meeting

OHPC representative was not present in the meeting.

PCC advised Orrisa SLDC to coordinate with OHPC and send a detailed report of this event to ERPC and ERLDC mentioning cause and remedial measures taken.

4. Tripping of 220 kV bus 2 at Jaynagar on 06-10-2020 at 18:36 hrs

On 06-10-2020 at 13:30 hrs, 220 kV bus 2 at Jaynagar tripped. OPTCL informed that during charging of 220 kV Balimela- Jaynagar 2 at 18:36Hrs (which had earlier tripped at 18:24hrs) the R phase (Top) suspension string of the said feeder at Loc no-1469 got detached from tower structure and during its free fall it came in contact with both Y and B phase of the said line. The fault current as recorded by Busbar protection relay: R-phase-11.2 kA, Y-phase-15.9 kA,B- phase -13.8 kA.

As the magnitude of the fault current is too high that exceeded the stability limit of the bus bar, it actuated trip command despite the fault being of external nature. Hence 220 kV bus bar 2 at Jaynagar got tripped.

OPTCL may explain.

Deliberation in the meeting

OPTCL informed that during charging of 220 kV Balimela- Jaynagar 2 at 18:36Hrs (which was tripped earlier at 18:24hrs) the R phase (Top) suspension string of the said feeder at Loc no-1469 got detached from tower structure and during its free fall it came in contact with both Y and B phase of the said line causing three phase fault. As the magnitude of the fault current is too high that exceeded the stability limit of the bus bar, it actuated trip command despite the fault was of external nature. Hence 220 kV bus bar 2 at Jaynagar got tripped. *OPTCL added that OEM Siemens was already contacted for necessary corrective action.*

PCC advised OPTCL to carry out proper maintenance of transmission line and substation equipment to avoid such type of failures.

5. Disturbance at 220/132 kV Kalyaneswari (DVC) S/S on 13-10-2020 at 20:30 hrs.

On 13 – 10 – 2020 at about 20:30 Hrs. 220 kV Main Bus# 2 of 220kV Kalyaneshwari Sub-station tripped due to tripping of all the 220 kV Lines from other end and tie bus breaker.

DVC may explain.

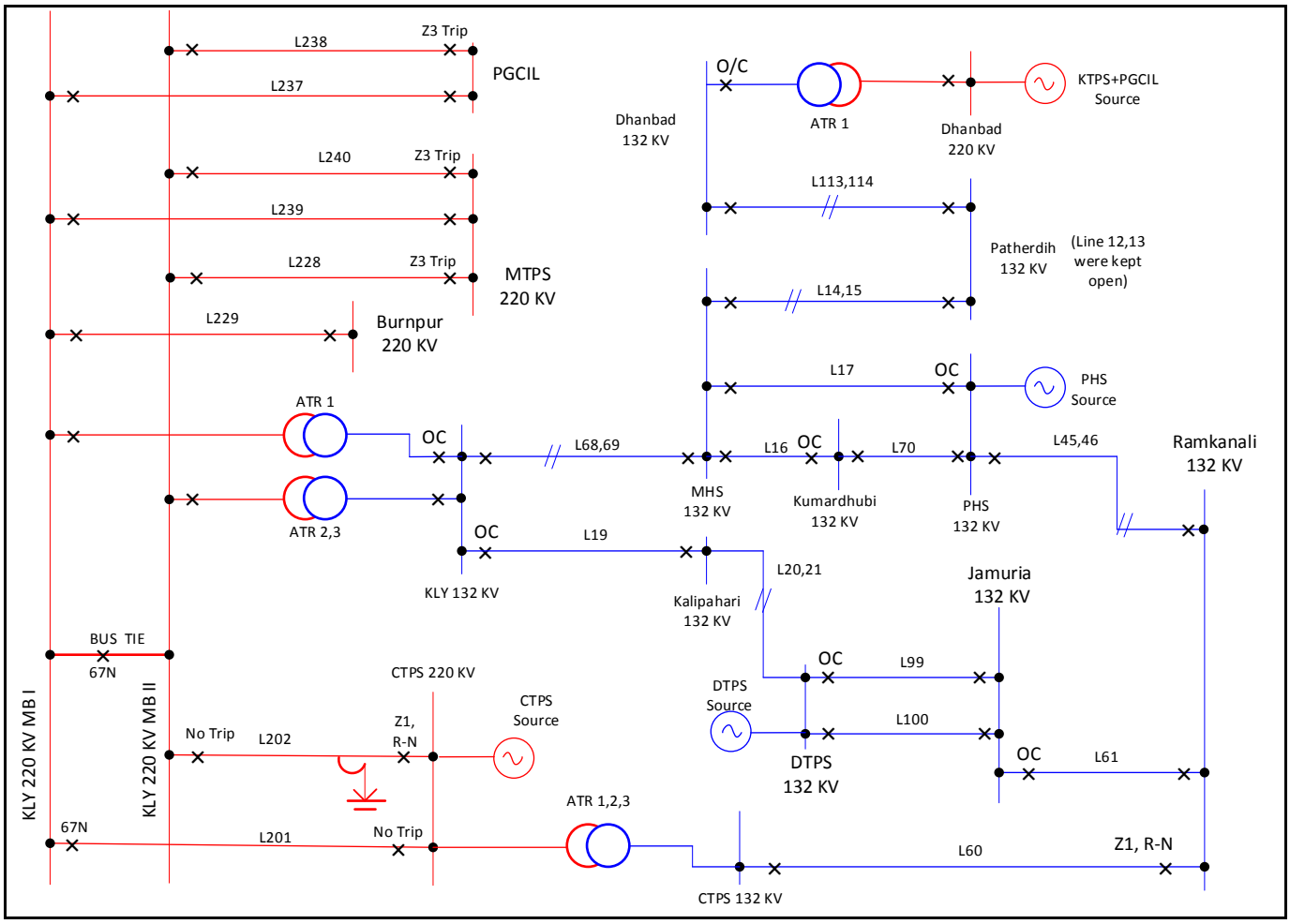
Deliberation in the meeting

*DVC submitted a detailed report which is enclosed at **Annexure B8.5.***

DVC explained that at 20:30 hrs on 13-10-2020, there was a R-N fault in 220 kV Kalyaneshwari – Chandrapura line 2 at 5-6 km from Chandrapura end and the line was tripped from Chandrapura end on zone 1 protection. However, the protection system (both main and back-up) did not operate at Kalyaneshwari end

As the line fault was not cleared from 220 kV Kalyaneshwari, all the Lines connected to Main Bus2 tripped from remote end on Zone-3 protection. 220kV Bus Tie also tripped through Directional earth fault Protection and thereby separated Bus1 from the faulty section. Further, 220/132kV ATR 2 & 3 which were in the Bus 2 were tripped as a result all the corresponding Load was transferred to 220/132kV ATR 1 and the transformer got tripped on LV side O/C protection. Total load of three ATRs was around 360-390 MVA prior to the disturbance. Thereafter, loading of single 220/132kV ATR of Dhanbad increased due to sharing of the additional load of Kalyaneshwari Sub-station and the ATR tripped through over current protection as the load current exceeded 800 A (pickup value).

DVC added that PHS Unit#2 running with 31 MW load, tripped in under frequency and Unit #1 and Unit # 2 of MHS collectively generating around 32 MW also tripped with auxiliary power failure/under voltage.



DVC informed that healthiness of Distance Protection SHPM101 and back-up protection CDD relay of 220 kV Kalyaneshwari – Chandrapura line 2 at Kalyaneswari has been checked by panel injection method and found okay.

PCC observed that protection system at 220/132kV Kalyaneswari S/s is very old and it needed to be upgraded immediately to avoid wrong operation of the protection system.

DVC informed that upgradation of protection system at 220 kV Kalyaneshwari S/S is in process. CT and PT were already changed and old relays would be replaced by new numerical relays within 3-4 months.

PCC also observed that one more 220/132kV ATR at 220kV Dhanbad S/S would improve the reliability of DVC system. PCC advised DVC to explore for installation of one more 220/132kV ATR at 220kV Dhanbad S/S.

6. Grid event at 132/33 kV Malda S/S on 01-10-2020 at 08:51 hrs

On 01st October 2020 at 08:51 hrs, bus fault occurred at 33 kV bus of 132/33 kV Malda (WBSETCL) S/S. To clear the fault, 132 kV Malda (PG) - Malda (WBSETCL) D/C tripped from PG end on zone – 3 protection. At the same time, 160 MVA 220/132 KV ICT 1 & 2 at Gazole S/S also got tripped. As a result, there was a total power failure at 132/33 kV Malda S/S (WBSETCL). DC power failure was reported at 132/33 kV Malda (WBSETCL) S/S at the time of the event which led to no protection operation.

WBSETCL and Powergrid may explain.

Deliberation in the meeting

WBSETCL explained that on 1st October 2020 at 08:51 hrs, bus fault was occurred at 33 kV bus of 132/33 kV Malda (WBSETCL) S/S due to snapping of 33 kV line conductor at 33 kV transfer bus. The protection system at 132/33 kV Malda (WBSETCL) S/S did not operate due to problem in DC supply (Battery System). 132 kV Malda (PG) - Malda (WBSETCL) D/C tripped from PG end on zone – 3 protection. Other 132kV lines also tripped from remote end on backup O/C, E/F protection. But 160 MVA 220/132 KV ICT 1 & 2 at Gazole S/S also got tripped on backup O/C, E/F protection due to improper coordination of the relay settings with line settings.

WBSETCL informed that second set of 220 V DC supply has been commissioned and issues related to first set of 220 V DC supply have been resolved at 132/33 kV Malda (WBSETCL) S/S. Further, backup O/C, E/F protection settings of 160 MVA 220/132 KV ICT 1 & 2 at Gazole S/S have been coordinated with backup settings of transmission lines.

PCC advised WBSETCL to carryout proper maintenance of the substation equipment to avoid bus faults and extra care should be taken to maintain the reliable DC supply to protection system at 132/33 kV Malda (WBSETCL) S/S.

ITEM NO. B.9: Disturbance at 220 kV Patratu and 220kV Tenughat Substation on 23.09.2020 at 08:45 hrs and 13:49 hrs

In 95th PCC, 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.

JUSNL may update.

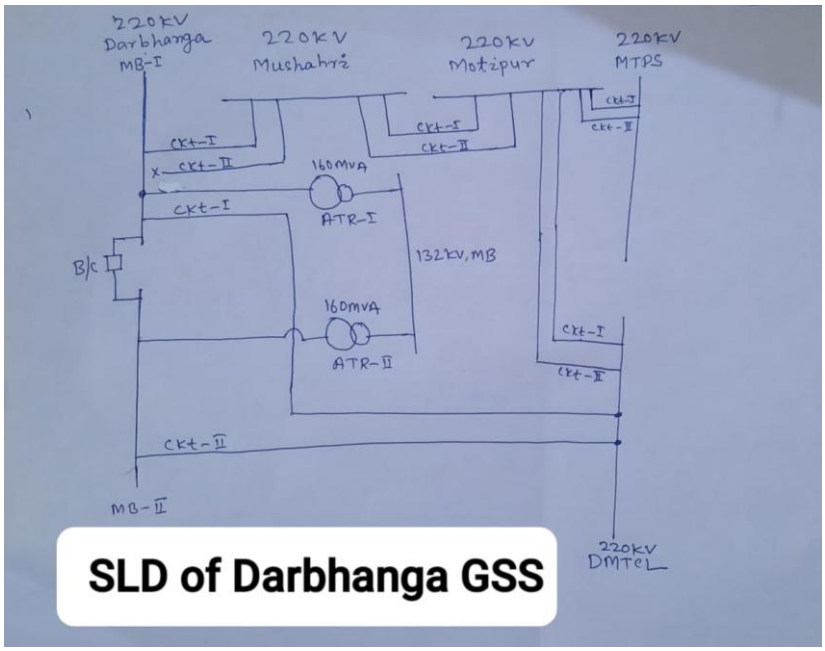
Deliberation in the meeting

JUSNL updated the status as follows:

- *LBB protection for 132kV system would be implemented at Patratu S/s after completion of panel shifting work.*
- *Air pressure alarm annunciation system for 132/ 33 kV ICT circuit breaker has been implemented*
- *Operation of circuit breaker of 132/ 33 kV ICT was checked by giving a trip command from the relay.*
- *Non issue of trip command by backup protection of 220/ 132 k V ICT was caused due to problem in trip control circuit and the same has been rectified .*
- *JUSNL informed that 220 kV Patratu-Hatia – 1 line was under shutdown hence 220 kV Patratu-Hatia – 2 line got overloaded and tripped on Overcurrent protection. The tripping was in order.*
- *Healthiness of differential protection of 220/132kV and 132/33 kV transformers at Patratu was tested and found in order. The same is pending at Hatia end.*

PCC advised JUSNL to check the backup overcurrent settings of 220/132kV and 132/33 kV transformers at Patratu and Hatia.

ITEM NO. B.10: Disturbance at 220 kV Darbhanga S/S on 19-09-2020 at 16:37 hrs



In 95th PCC, 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.

BSPTCL may update.

Deliberation in the meeting

DMTCL and BSPTCL updated the status as follows:

- *For ICT I & II at Darbhanga S/S, DMTCL has to review backup overcurrent E/F protection Settings have been reviewed*
- *For 220 kV Darbhanga(DMTCL)– Darbhanga (BSPTCL) Ckt, back up protection to be coordinated properly (as it is tripped on 100msec).: It is in process*

SLDC Bihar informed that MTPS is not sending relay indications at their end hence a letter regarding this concern has been sent to higher level of MTPS.

ITEM NO. B.11: Disturbance at 220 kV Darbhanga S/S on 10.06.2020 at 10:54 hrs.

In 95th PCC, 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 16th 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.

BSPTCL and DMTCL may update.

Deliberation in the meeting

BSPTCL informed that POTT inter trip scheme along with current reversal scheme would be implemented by tomorrow and it was delayed due to Bihar election.

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

ITEM NO. B.12: Disturbance at 220 kV Begusarai , 220 kV Khagaria and 220 kV Barauni Substation on 03.08.2020 at 11:05 hrs

In 94th PCC, BSPTCL was advised to take following corrective actions:

- 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.

In 95th PCC, BSPTCL added that checking of relay settings of main and backup protection of 220kV BTPS-Hajipur D/C line would be completed by 16th Oct'2020.

Further, BSPCTL 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.

BSPTCL may update.

Deliberation in the meeting

BSPTCL informed that relay settings of main and backup protection of 220kV BTPS-Hajipur D/C line were verified and tested.

PCC advised BSPTCL to send a report of testing of relays of main and backup protection of 220kV BTPS-Hajipur D/C to ERPC and ERLDC.

ITEM NO. B.13: Disturbance at 220 kV Biharsharif Substation on 14.08.2020 at 20:23 hrs

In 94th 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.

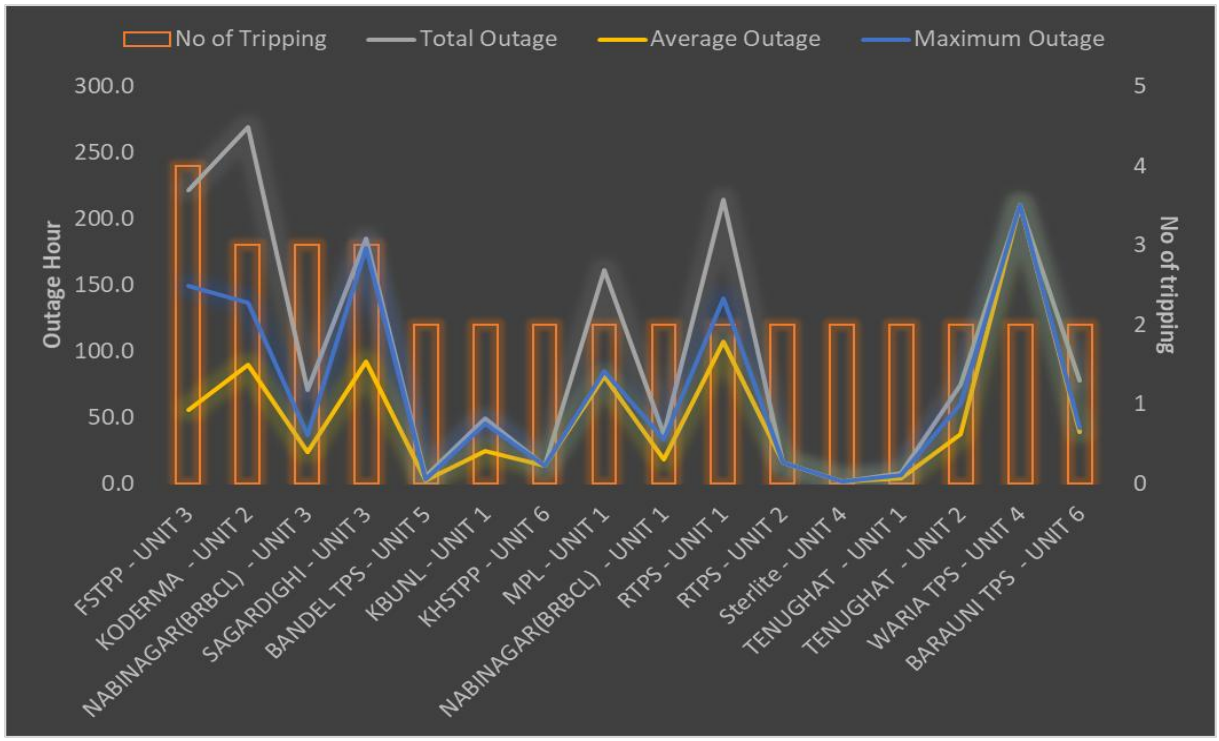
Deliberation in the meeting

BSPTCL informed that electromechanical relays are being used for ICTs protection. Tendering for replacement of EM relays with numerical relays has been completed. BSPTCL added that oil testing of the transformer would be done during winter maintenance after Chat Puja.

PCC advised BSPTCL to comply the PCC observations at the earliest.

ITEM NO. B.14: Repeated tripping of generating units in October 2020

During October 2020, repeated tripping of following generators has been observed:



Reasons for multiple tripping is given in below table:

Name of generating units	Reason for tripping	No of tripping	Utility to respond
Farakka Unit 3	Boiler Tube leakage, High Furnace Pressure, Cooling water system problem	3	NTPC
Koderma Unit 2	Boiler Tube Leakage	3	DVC
BRBCL Unit 3	Boiler Tube leakage, High Furnace Pressure, High Primary Air Pressure	3	BRBCL
Sagardighi Unit 3	High Turbine vibration, Rotor Earth fault System checking	2	WBPDCL

Following tripping incidents of generating units has been reported due to electrical fault or operation of generator protection. But DR/EL outputs are yet to be received from generating stations.

Element Name	Tripping Date	Tripping Time	Reason shared	Utility to share DR/EL
KHSTPP - UNIT 6	01-10-2020	15:26	Operation of GT differential protection	NTPC
RTPS - UNIT 1	04-10-2020	21:30	Electrical Fault	DVC
TENUGHAT - UNIT 2	10-10-2020	06:28	Tripping of station transformer	Jharkhand SLDC/ TVNL
TENUGHAT - UNIT 1	10-10-2020	06:28	Tripping of station transformer	Jharkhand SLDC/ TVNL
RTPS - UNIT 2	13-10-2020	00:09	Electrical Fault	DVC
KHSTPP - UNIT 2	15-10-2020	14:30	Tripping of UAT	NTPC
BARAUNI TPS -	31-10-2020	08:45	Operation of Generator protection	Bihar SLDC/NTPC

Element Name	Tripping Date	Tripping Time	Reason shared	Utility to share DR/EL
UNIT 6				

Concerned Generating stations may update.

Deliberation in the meeting

PCC advised all concerned utilities to send a detailed report to ERPC and ERLDC mentioning the reason for tripping generating units and remedial measures taken.

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 93rd 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 the concerned utilities to submit the relevant data to PRDC for maintaining the protection 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.

Members may note and comply.

Deliberation in the meeting

PCC advised all concerned utilities to upload the relay settings in PDMS or send the relay settings to erpcprotection@gmail.com.

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

Elements Name	S/S may be affected	Remarks
Upgradation of 220 kV Muzaffarpur Dhalkebar D/C to 400 kV voltage level.	At 220 kV voltage level: Hazipur (BSPTCL) and MTPS (KBUNL/BSPTCL)	Longest line connected to 220 kV Muzaffarpur (PG) bus will change from 220 kV Muzaffarpur Dhalkebar D/C to 220 kV Muzaffarpur Hazipur D/C (51 km). Distance protection is to be coordinated at affected s/s
	At 400 kV voltage level: Bihar Sharif, Purnea New, Gorakhpur (POWERGRID) Darbhanga (DMTCL)	Details of 400 kV Muzaffarpur Dhalkebar D/C (as per ERLDC data) Conductor type: Tripple Snow Bird and line length: 140 km. Distance protection is to be coordinated at affected s/s.

Members may note.

Deliberation in the meeting

ERLDC informed that the following line details of 400 kV Muzaffarpur-Dhalkebar D/C are to be corrected:

- *Conductor type: Twin Moose*
- *Line length: 127 km.*

PCC advised all the concerned constituents to review the protection settings at their end during the charging of 220 kV Muzaffarpur Dhalkebar D/C line at 400 kV voltage level.

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

Meeting ended with vote of thanks to the chair.

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Annexure A

S.No.	Name	Designation	Organisation	Contact No.	Email Id
1.	N.S. Mondal	Member Secretary	ERPC	9958389967	nsmondal34@gmail.com
2.	D.K.Jain	Executive Director	ERLDC	9910344127	dk.jain@posoco.in
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4.	J.G.rao	EE	ERPC	9547891353	ereb_cea@yahoo.co.in
5.	K. Satyam	AE	ERPC	7355225072	satyam24365@gmail.com
6.	S.R.Swain	AE	ERPC	9337791451	saswatrj123@gmail.com
7.	A. Malick	CGM	ERLDC	9436302720	amreshmalick@posoco.in
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9.	Rajendra Prasad		TUVNL	9031049936	rp.ttps@gmail.com
10.	Abhinaba Basu	AE	BSPTCL	7033091492	abasu.14bsptcl@gmail.com
11.	Alok Pratap Singh		ERLDC	9007285390	apsingh@posoco.in
12.	Ch. Mohan Rao		Powergrid	9437962193	mohan.rao@powergridindia.com
13.	Pallavi Kansal		TVTPL	9898596883	pallavi.k@tvptl.com
14.	Rajdeep Bhattacharjee		BSPHCL		
15.	Pankaj Mishra		BSPTCL , CRITL		
16.	S M S SAHOO	AGM	Meramundul i, OPTCL		
17.	DEEPAK THAKUR	AEE	BSPTCL	7033092545	deepak.aashish@gmail.com
18.	Dilshad Alam	AEE	BSPTCL	7763818081	
19.	Nishant Kumar Shankwar		DMTCL	79872 10324	Nishant.Kumar@sekura.in
20.	Satya Deep Tangudu		Dikchu HEP		makarandprakash.j@greenkogroup.com
21.	Yallaji Reddy R				
22.	Saibal Ghosh		ERLDC	8584072079	saibal@posoco.in
23.	Chandan	Manager	ERLDC	9869251460	chandan@posoco.in

	Kumar				
29.	Raj Protim Kundu	Dy. Manager	ERLDC	9903329591	rajprotim@posoco.in
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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
34.	Jayanata Kanjilal	ACE	WBSETCL	9434910189	jayanta.kanjilal@wbsetcl.in
35.	Saurav Sahay	Ch. Manager	ERLDC		
36.	Debdas Mukherjee	Manager	WBPDCL		
37.	Sukhdev Pal				sukdev123@gmail.com

Annexure B8.5

DAMODAR VALLEY CORPORATION

OFFICE OF THE SUPERINTENDING ENGINEER
CENTRAL RELAY AND INSTRUMENT TESTING LABORATORY
MAITHON

REPORT ON MAIN BUS#2 AND ASSOCIATED OUTAGE AT KALYANESHWARI SUB-STATION

Brief History and sequence of events: On 13.10.20 at about 20.31HrsTPF occurred at only Main Bus#2 of 220kV Kalyaneshwari Sub-Station due to tripping of all the 220kV Lines from other end and tripping of Bus Tie Breaker. Bus arrangement at that time was as follows:

Main Bus 1 : L#201,L#229,L#237,L#239 and ATR#1
Main Bus 2 : L#202 (Diverted through Bus Coupler #1), L#228, L#238 , L#240, ATR#2,ATR#3

As soon as TPF occurred at Main Bus#2, all the 132kV load catered byATR# 2 and 3 (around 120-130 MVA each) transferred to ATR#1 causing tripping of ATR#1 through O/C protection due to overload. Outage of all the three ATRs caused huge overloading at various source node causing cascading tripping and TPF at various Sub-stations at 132kV system. In this context, it is worth to mention that a special Protection Scheme was implemented by CTC on 20.04.18to safe guard ATRs of DTPS from overloadingin the event of full /partial outage of the ATRs at Kalyaneshwariand also Vice versa after happening of similar incident on 19.01.18 when outage of three ATRs at Kalyaneshwari leads to outage of all the ATRs and Unit#4 at DTPS. Timely tripping of L#19 at Kalyaneswari Sub-station saved DTPS ATRs from overloading and tripping of ATRs & DTPS U#4.
Refer Annexure-1 for SLD of the disturbed system.

Analysis of the event:
220 kV System:
1. At about 20.31Hrs on 13.10.20 a fault occurred at Line#202 around 5km away from CTPS. Line#202 tripped at CTPS with Zone-1 Protection. However, the protection system (both main and back-up) did not operate at Kalyaneshwari end (as reported). As the fault is not cleared, all the Lines connected to Main Bus#2 tripped from remote end with Zone-3 protection. 220kV Bus Tie which was also feeding the fault sourced by the Lines connected to main Bus#1 also tripped through Directional earth fault Protection and thereby separated Bus#1 fromthe faulty section. As no protection operated for Line#202, LBB protection was not initiated.

2. CRITL team visited Kalyaneshwari Sub-station on 14.10.20 and the healthiness of the Protection relays (Distance Protection SHPM101 and back-up protection CDD relay) of Line #202 was checked by panel injection method and found o.k. Trip test of Bus coupler#1 Breaker was also checked and found o.k.

3. As SHPM Relay (old static Relay) does not have the provision of DR/event record facility it is not possible to pin point the exact reason for such non operation of Protection Relay. However mal-functioning of Isolator contact is a very probable cause of such non operation in SHPM relayas well as directional back up O/C & E/F (CDD Relay) relay protection scheme. As the Relay auxiliary DC and the PT potential gets through the operation of 75A/B voltage selection Relay which in turn operates with the 89a contact of Isolator. During any B/C diversion, due to any mal operation of Isolator contact (any bus side isolator of bus coupler bay), 75A/B relay would get de–energized and the SHPM relay would become non functional due to DC outage.**(Refer Annexure-2)**
The back-up Relays would also not operate in this case due to loss of potential.
However, during simulation checking with Bus Coupler Isolator #1 and #2 with NITswitch operation, no discrepancy was found.

4."VT Fuse Fail/Distance Relay in-operative"annunciation was found non functioning for Line 202. During checking,a wiring from relay watchdog contact to lamp was found to be disconnected. The problem wasrectified.
5. During further checking "VT Fuse Fail/Distance Relay in-operative" annunciation lamp of L#201 was found to be defective. The same was replaced by a healthy lamp and the respective annunciation was found to be properly functioning.

5. All the trippings associated with 220kV system was in order except additional tripping of Line#201 which also tripped through Directional earth fault protection (Old CDD Relay). The Relay was tested through injection and operation was found to be o.k.

132 kVSystem:
1. Outage of Main Bus #2 lead to outage of ATR #2 & 3. As soon as all the Load was transferred to ATR#1, it tripped with LV O/C protection. Total load of three ATRs was around 360-390 MVA prior to the Bus failure.

2. With the outage of three ATRs all the load catered by these ATRs was started to be fed from various other source connected to the network.
The single ATR of Dhanbad (having a load around 60 MVA) started to share the additional load of Kalyaneshwari Sub-station through Line #14,15 and Line #68,69 via Patherdih S/S (L#113 & 114). It tripped through over current as load current exceed 800 A. As these load divided through Line #113 & 114(O/C setting 600A), the Dhanbad ATR tripped before the tripping of the Lines #113,114.Putki - Patherdih (L#12 & 13) loop was kept in open condition as per CLD.

3. With the outage of Dhanbad source, DTPS and CTPS started to share more the load of the Kalyaneshwari. Overloading of Line# 60 lead to jumper failure and the Line tripped through Distance protection and thereby separating CTPS source.
DTPS source was disconnected through Over current tripping of Line #19 (at Kalyaneshwari end), Line #61 (at Jamuria end).
Line #17 at PHS end Line #16 at Kumardhubi end also tripped with O/C protection.

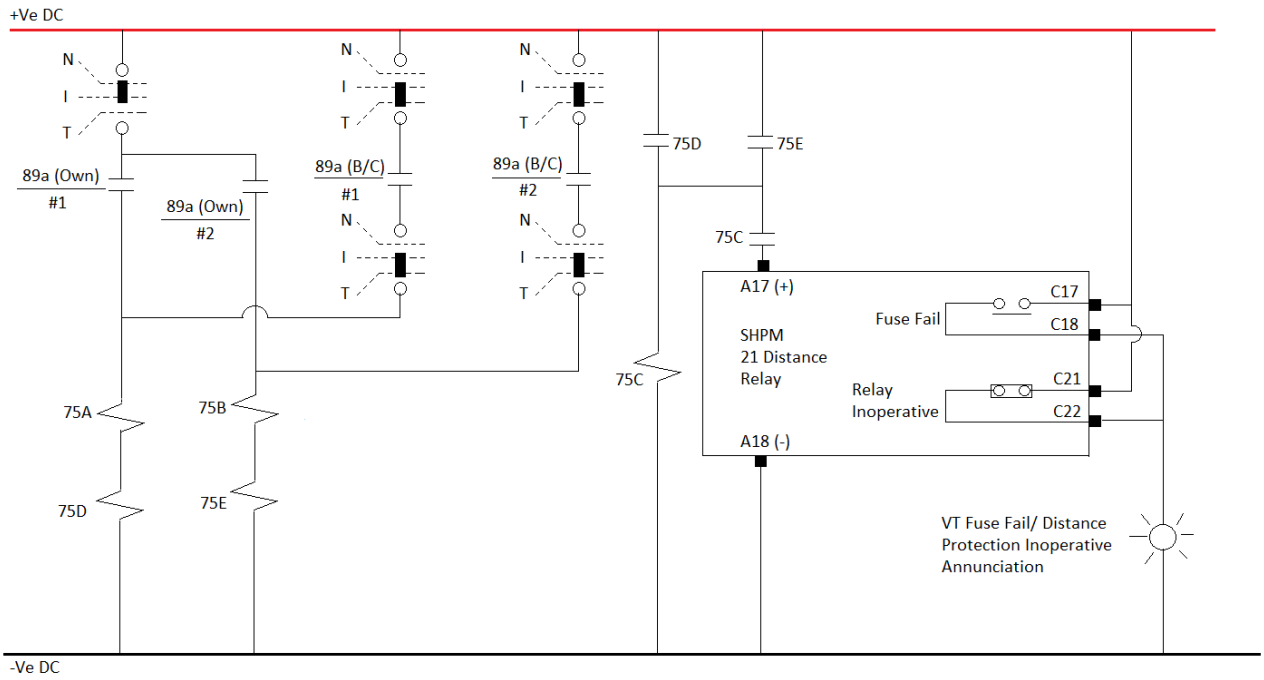
4. PHS Unit#2 running with 31 MW load, tripped in under frequency and Unit #1 and Unit # 2 of MHS collectively generating around 32 MW also tripped with auxiliary power failure/under voltage.

Remedial Measures:

1. Checking of Voltage Selection Relay, CT Switching Relay, Relay Heathy Status before and after any Bus coupler diversion (Diversion of bay from own breaker to bus coupler breaker and vice versa) /Bus diversion (Diversion of bay from main bus-I to main bus-II and vice versa) process.
2. Checking of Relay healthy indication/annunciation at specified interval (at least once per shift).
3. Checking of Annunciator system/Indication lamp during maintenance activities and at suitable opportunities.
4. Timely Replacement of Static /electro-mechanical relays with numerical relays under PSDF.
5. All electromechanical / static relays of DVC System (up to 33 kV) required to be replaced by numerical relay with time synchronization through GPS. It will be helpful for root cause analysis of any tripping / disturbance.
6. Commissioning of 2nd ATR at Dhanbad may help to cater the load of Kalyneshwari (specially in case of single ATR outage at Kalyaneshwari) without further overloading the DTPS ATRs and would also increase the system stability in the region.
7. Commissioning of Remote access system of numerical Relays at CTC, DVC, Maithon for fast and effective root cause analysis in such widespread disturbance in the system.

DC CIRCUIT INVOLVED

Annexure 2



SLD OF AFFECTED SYSTEM