Minutes
of
56th PCC meeting

Date: 10.07.2017
Eastern Regional Power Committee
14, Golf Club Road, Tollygunge
Kolkata: 700 033

EASTERN REGIONAL POWER COMMITTEE

MINUTES OF 56TH PROTECTION SUB-COMMITTEE MEETING HELD AT ERPC, KOLKATA ON 22.06.2017 (THURSDAY) AT 11:00 HOURS

List of participants is enclosed at **Annexure-A.**

PART – A

ITEM NO. A.1: Confirmation of minutes of 55th Protection sub-Committee Meeting held on 25th May, 2017 at ERPC, Kolkata.

The minutes of 55th Protection Sub-Committee meeting held on 25.05.17 circulated vide letter dated 05.06.17.

Members may confirm the minutes of 55th PCC meeting.

Deliberation in the meeting

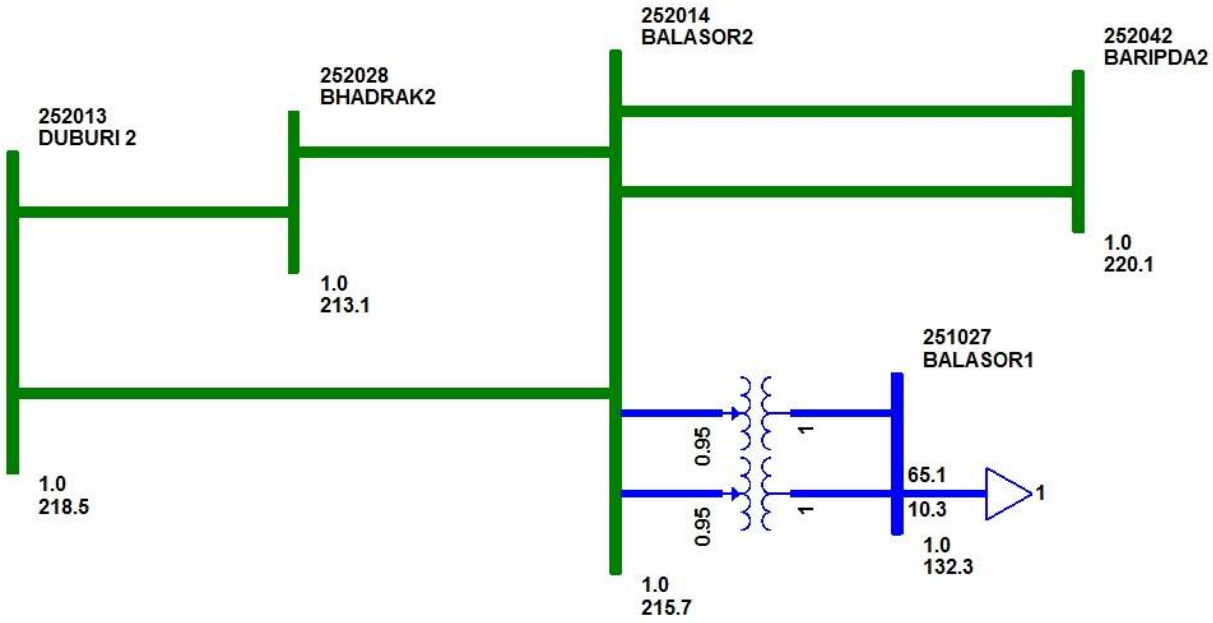
Members confirmed the minutes of 55th PCC meeting.

PART – B

ANALYSIS & DISCUSSION ON GRID INCIDENCES OCCURRED IN MAY, 2017

ITEM NO. B.1: Disturbance at 220 kV Balasore S/s (OPTCL) on 03-05-17 at 17:15 hrs.

1. **Single line diagram:** Submitted



2. **Detailed analysis of tripping incident:** Submitted

At 17:14 hrs, B-N fault occurred at 220 kV Balasore – Baripada – II, the line got tripped from Baripada end on zone 1. The Balasore end identified the fault and issued trip command but CB failed

to clear the fault. As a result, 220 kV Balasore – Baripada – I (from Baripada), 220 kV Balasore – New Duburi S/C (from New Duburi) and 220 kV Balasore – Bhadrak S/C (from Balasore) tripped to clear the fault.

Simultaneously, 220/132KV 160MVA AUTO transformers I &II tripped from 132kV end on E/F due to disturbances in 132 KV side as there was heavy rain and lightning in Balasore.
The relay Indications are as follows:

Time (Hrs)	**Name of the element**	**Relay at Balasore end**	**Relay at remote end**
17:14 hrs	220 kV Balasore – Baripada – II	B-N, O/C, timer LBB relay operated. But breaker did not open. F/C 3 kA, F/D 25 km	B-N, Z-I, 50.27 km from Baripada, F/C 2.993 kA.
	220 kV Balasore – Baripada – I	Did not trip Zone 3 start	B-N, Z-II, F/C 3 kA, 108.6 km from Baripada
	220 kV Balasore – New Duburi S/C	Did not trip	B-N, 241.8 km from N. Duburi, F/C 0.95 kA Zone 3
	220 kV Balasore – Bhadrak S/C	B-N on reverse zone	Did not trip
	220/132 kV ATR I & II	E/F at 132 kV side	

3. **Disturbance record:** Received Balasore end DR of 220 kV Balasore – Baripada D/C line

4. **Remedial action taken :** Not Submitted

Analysis of PMU plots:

- In Rengali PMU data, B – N Fault (15 kV voltage dip) has been observed.
- Fault clearance time is 400 ms

Status of Reporting:

- Detail tripping report from OPTCL is received on 12-05-17

OPTCL may explain the following:

- Reason for non-operation of ckt breaker of 220 Baripada – Balasore S/C at Baripada end
- As per PMU data, fault clearing time is 450 ms.
- How 220 kV Balasore – Bhadrak S/C tripped from Balasore on reverse zone within 400 ms?
- How New Dubri end tripped on zone 3 within 400 ms?

Deliberation in the meeting

ERPC explained the tripping incident with a presentation. ERPC explained that B-N fault occurred in 220 kV Balasore – Baripada line- II, the line got tripped from Baripada end on zone 1. The Balasore end identified the fault and issued trip command to CB. However, the CB failed to clear the fault. As a result, the following lines were tripped to clear the fault:

- *220 kV Balasore – Baripada line- I tripped from Baripada end on zone 2*
- *220 kV Balasore – New Duburi S/C tripped from New Duburi end on zone 3*
- *220 kV Balasore – Bhadrak S/C tripped from Balasore end on reverse zone*

220/132KV 160MVA AUTO transformers I &II also tripped from 132kV end on E/F due to disturbances in 132 KV side as there was heavy rain and lightning at Balasore.

OPTCL informed that they are taking the following corrective actions:

- *The circuit breaker contactor of 220 Baripada – Balasore S/C at Baripada end is found defective and the contactor has been replaced with new one.*
- *The Balasore end relay REL 100 of 220 kV Balasore – Bhadrak S/C line is old and not functioning properly. OPTCL informed that they will replace the relay.*
- *They will test the New Dubri end relay of 220 kV Balasore – New Duburi S/C line and verify the time setting of zone 3.*
- *132kV side Overcurrent relay of 220/132 kV ATR I & II are old EM, non directional relays and they will replace the relays.*

PCC felt that DR of following line tripping were not submitted by OPTCL:

- *220 kV Balasore – Bhadrak S/C line at Balasore end*
- *220/132 kV ATR I & II tripping*
- *220 kV Balasore – New Duburi S/C line at New Dubri end*

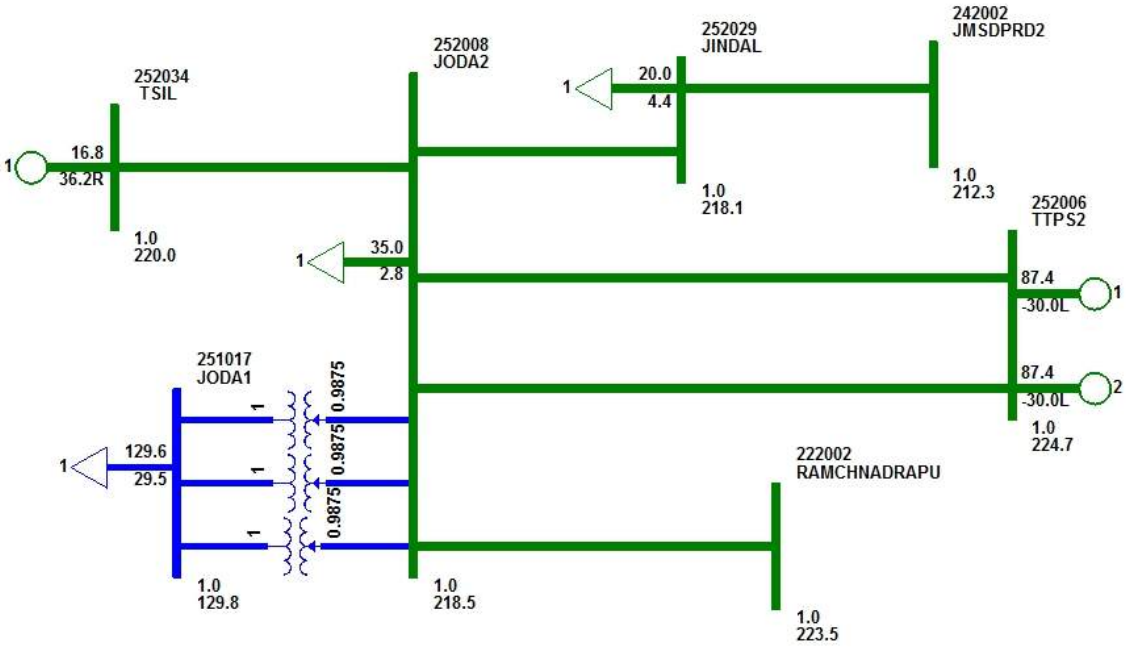
OPTCL informed that REL 100 relays at New Dubri end relay of 220 kV Balasore – New Duburi S/C line and REL 100 of 220 kV Balasore – Bhadrak S/C line are old and they don't have facility to download the DR. 132kV side Overcurrent relays of 220/132 kV ATR I & II are old EM relays.

ITEM NO. B.2: Disturbance at 220 kV Joda and Ramchandrapur S/s on 13-05-17 at 22:08 hrs.

1. **Single line diagram:** Submitted

2. **Pre fault conditions:** Submitted

1. Auto-1 -45.17MW
2. Auto-2 -46.11MW
3. Aut0-3 -45.19MW
4. Joda-Jindal Feeder -20.4MW
5. SML (TRF) -0.41MW
6. Ramchandrapur 71.939 MW
7. TTPS-1 27.9MW
8. TTPS-2 29.9MW
9. TSIL 18.4 MW



3. **Detailed analysis of tripping incident:** Submitted

At 22:08 hrs there was a inter ckt R-N fault in 220 kV Joda – TTPS D/C line, both the lines tripped from both ends on distance protection (Z-I at TTPS end and Z-II at Joda end). At same time, the following elements tripped:

- 220 kV Ramchandrapur – Joda S/C tripped from Ramchandrapur end on O/C, E/F protection due to incorrect settings (OC, DT, 1 A, 100 ms, CT 600/1 and EF, DT, 0.2 A, 200 ms)
- 220KV Joda-TSIL line tripped from TSIL end on Vector shift Relay
- The Joda load of 132 MW was shifted to 220 kV Jamshedpur (DVC) – Jindal S/C line. The line tripped from Jamshedpur end on O/C protection due to over load.

The relay Indications are as follows:

Time (Hrs)	Name of the element	Relay at Joda end	Relay at remote end
22:08 hrs	220 kV Joda – TTPS - I	R-N, Z-II, 147.8 km, 0.83 kA	Z-I, 41.8 km from TTPS
	220 kV Joda – TTPS - II	R-N, Z-II, 151.8 km, 0.78 kA	Z-I, 42 km from TTPS
	220 kV Joda Ramchandrapur S/C	Did not trip	R-N, O/C, E/F protection, (DR could not be retrieved due to overlapping of new DR file)
	220 kV Jamshedpur (DVC) – JSPL S/C	O/C	Did not trip at JSPL end
	220KV Joda-TSIL	Did not trip	Tripped at TSIL end with Vector shift Relay

4. **Disturbance record:** Received Joda end DR of 220 kV Joda – TTPS – D/C line

5. **Remedial action taken :** Not Submitted

Analysis of PMU plots:

- In Jamshedpur PMU data, R – N Fault (3 kV voltage dip) has been observed.
- Fault clearance time is 450 ms approximately.

Status of Reporting:

- Detail tripping report from OPTCL is received on 19-05-17.
- Detail tripping report from JUSNL is received on 22-05-17.

OPTCL, JUSNL and DVC may explain the following:

- As per PMU data, fault clearing time is 450 ms.
- Tripping of 220 kV Ramchandrapur – Joda S/C from Ramchandrapur end
- Operation of O/C protection of 220 kV Jamshedpur (DVC) – JSPL S/c from Jamshedpur end may be explained. As per SCADA data, power flow through this line was well under maximum loading limit.
- Tripping of 220KV Joda-TSIL line from TSIL on vector shift relay

Deliberation in the meeting

ERPC explained the tripping incident with a presentation. ERPC explained that there was a R-N inter circuit fault in 220 kV Joda – TTPS D/C line and both the lines tripped from both ends on

distance protection (Z-I at TTPS end and Z-II at Joda end).

- *At same time, 220 kV Ramchandrapur – Joda S/C tripped from Ramchandrapur end on O/C, E/F protection due to incorrect settings (OC, DT, 1 A, 100 ms, CT 600/1 and EF, DT, 0.2 A, 200 ms)*
- *Due to tripping of 220 kV Joda – TTPS D/C & 220 kV Ramchandrapur – Joda S/C lines, the Joda load of 132 MW was shifted to 220KV Joda-TSIL S/c and 220 kV Jamshedpur (DVC) – Jindal S/C lines*
- *220KV Joda-TSIL line tripped from TSIL end on Vector shift Relay*
- *220 kV Jamshedpur (DVC) – Jindal S/C line tripped from Jamshedpur end on O/C protection due to over load.*

After detailed deliberation, PCC felt that the tripping was in order except tripping of 220 kV Ramchandrapur – Joda S/C line. The line should not trip from Ramchandrapur end on overcurrent protection. It was informed that during the recent Third Party Protection Audit of 220 kV Ramchandrapur, it was observed that the overcurrent settings of 220 kV Ramchandrapur – Joda S/C line is OC, DT, 1 A, 100 ms, CT 600/1 and EF, DT, 0.2 A, 200 ms.

PCC took serious note of non-implementation of ERPC recommended settings and felt that with such overcurrent settings (OC, DT, 1 A, 100 ms, CT 600/1 and EF, DT, 0.2 A, 200 ms) for a 220kV transmission line it is difficult to coordinate with the adjacent line relays.

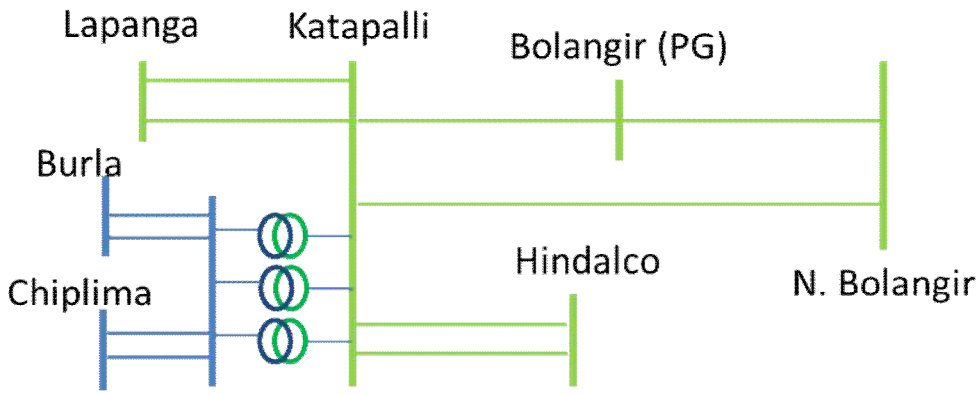
JUSNL informed that they have given a consultancy to M/s Areva for computation of relay settings for proper relay coordination. The settings received from M/s Areva have been incorporated.

JUSNL added that after receiving the ERPC letter dated 9th June 2017, they have implemented the ERPC recommended settings on 11th June 2017.

PCC advised JUSNL to send the soft copy of the relay setting files implemented in the relays as per the ERPC recommended settings.

ITEM NO. B.3: Disturbance at 220 kV Katapalli, Bolangir and Lapanga S/s on 18-05-17 at 23:48 hrs.

1. **Single line diagram:** Submitted



2. **Detailed analysis of tripping incident:** Submitted

On 18.05.2017 there was huge lightning and thunder at Katapalli. Due to voltage, jerk AC MCB of charger tripped causing DC failure at 220/132/33 kV Katapalli S/S. In mean time there was another lightening occurred which caused the failure of 6 Nos. of Cts and the insulators of cross bus of 132/33KV 20MVA Transformer-1 failure. The fault was not cleared from Katapalli due to unavailability of DC. As a result the fault got cleared from remote end resulting loss of power supply at Katapalli S/S.

Relay Indications:

Time (Hrs)	Name of the element	Relay at local end	Relay at remote end
23:48 hrs	220 kV Katapalli – Lapanga D/C	Tripped	Did not trip
	220 kV Katapalli – Bolangir (PG) S/C	Did not trip	R-B, Z-III, F/C 0.63kA, 0.79kA, 0.74 kA, 350 km(263%) from Bolangir
	220 kV New Bolangir – Bolangir (PG) S/C	Did not trip	Y-N, Z-III, F/C 0.2 kA
	220 kV Katapalli – Hindalco D/C	Tripped	Did not trip
	132 kV Katapalli – Burla D/C	Did not trip	Tripped
	132 kV Katapalli – Chiplima D/C	Did not trip	Tripped
	132/33 kV ATR II & III at Katapalli	Tripped from 132 kV side	

3. **Disturbance record:** Submitted

4. **Remedial action taken :** Not Submitted

Analysis of PMU plots:

- As per PMU data, fault was cleared in more than 3000 m sec.
- During first 1000 m sec, gradual fall in voltage has been observed in all three phases.

Status of Reporting:

- Detail tripping report from OPTCL & POWERGRID is received on 29-05-17.
- DR has been received from Bolangir (PG) S/S.

OPTCL and Powergrid may explain the following:

- Reason for non-clearing of fault at Katapalli S/S may be explained by OPTCL.
- Fault was at 33 kV level but it was cleared from Bolangir (PG) after tripping of 220 kV New Bolangir and Katapalli feeder.
- Fault clearing time is more than 3000 m sec. Remedial measures may be taken to prevent delayed clearance of these types of fault.
- If d.c. control supply failed at katapalli GSS then how 40MVA trf no. 3 got tripped.

Deliberation in the meeting

OPTCL informed that there was a fault in 33kV system and 132/33 kV ATR II & III at Katapalli tripped from 132kV side on overcurrent protection. Simultaneously there was a DC supply failure at Katapalli as a result the Katpalli end relays failed to clear the fault. The relays at remote end operated to clear the fault.

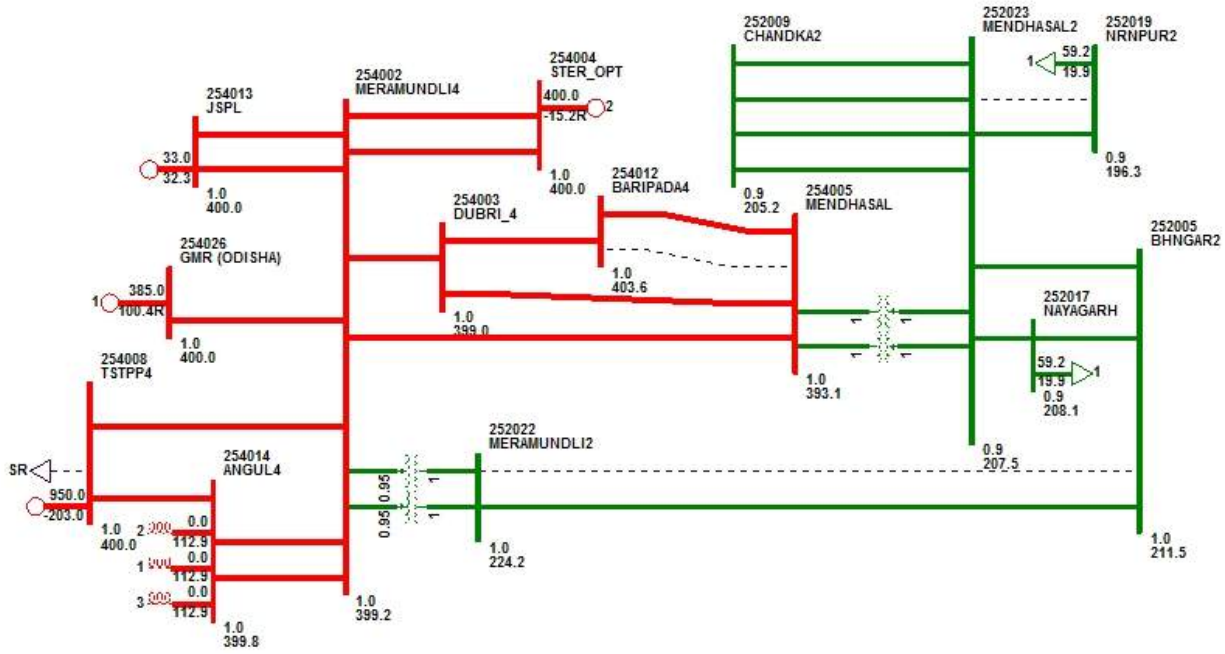
OPTCL added that the DC battery bank was not fully charged due to some problem in battery charger.

PCC felt that the fault in 33kV level getting cleared from 220kV side is not acceptable and advised OPTCL to take care in future. PCC advised OPTCL to send the DR and log files of Hindalco, Burla 1& 2, Chiplima end tripping for further analysis.

OPTCL informed that new battery bank has reached the site and will be in service in parallel with old DC battery bank which will provide redundancy.

ITEM NO. B.4: Disturbance at 400 kV Meramundali S/s on 12-05-17 at 12:07 hrs.

1. **Single line diagram:** Submitted



2. **Pre fault conditions:** Submitted

- 400 kV Meramundali – Angul II was taken shutdown at 12:05 hrs (2 min before the incident)

400 kV Bus configuration of Meramundali S/S

Bus I	Bus II	Tie-Breaker ON
Vedanta-II	Angul-I	401-ON
Mendhsal-I	Duburi-II	402-ON
Angul-II	Vedanta-I	403-ON
Duburi-I	Mendhasal-II(Not in Service)	404-not in service
JSPL-I	KANIHA	405-ON
ICT-I (B/D)	Future	406- not in service
Future-7	ICT-II	407-OFF
GKEL	JSPL-II	408-ON

3. **Detailed analysis of tripping incident:** Submitted

400 kV Meramundali – SEL – II was hand tripped from Vedanta end while taking shutdown. The breakers at Meramundali end were not open. LBB operated for bus – I and tripped all main breakers connected to bus – I.

As per ERLDC SCADA data, power flow through 400 kV Mendasal – I, Angul – II, N. Duburi – I and SEL - II feeder along with 400/220 kV ICT – I at Meramundali (was connected to Bus – I through main breaker) became zero (data was not available for 400 kV GKEL & JSPL-I feeder) after the tripping of main breakers.

4. **Remedial action taken :** Not Submitted

Analysis of PMU plots:

- No fault has been observed

Status of Reporting:

- Detail tripping report from OPTCL is received on 17-05-17

OPTCL may explain the following:

- Reason for non-opening breakers of 400 kV SEL-Meramundali –II at Meramundali end
- LBB operation at 400kV Meramundali, how the current was greater than the set value as the line was already opened from Vedanta end
- Reason for zero power flow through 400 kV Mendasal – I, Angul – II, N. Duburi – I and SEL - II feeder along with 400/220 kV ICT – I at Meramundali after tripping of main breaker may be explained as there was no reporting of tie breakers.

Deliberation in the meeting

OPTCL informed that it is a maloperation of LBB protection at 400kV Meeramundali S/s due to fault in control cables. OPTCL added that the control cables are very old and they are replacing the cables one by one in phased manner.

Regarding zero power flow through 400 kV Mendasal – I, Angul – II, N. Duburi – I and SEL - II feeder along with 400/220 kV ICT – I at Meramundali, OPTCL informed that ICT-I and Angul-II were not in service, N. Dubri –I tie breaker was not in service and Mendhasal tie breaker was tripped along with main breaker.

ITEM NO. B.5: Disturbance at 400 kV New Dubri S/s on 26-05-17 at 10:20 hrs.

400 kV Meramundali - New Duburi - I & 400/220 kV ICT - I at New Duburi tripped due to operation of LBB protection of bus I at New Duburi.

OPTCL may explain.

Deliberation in the meeting

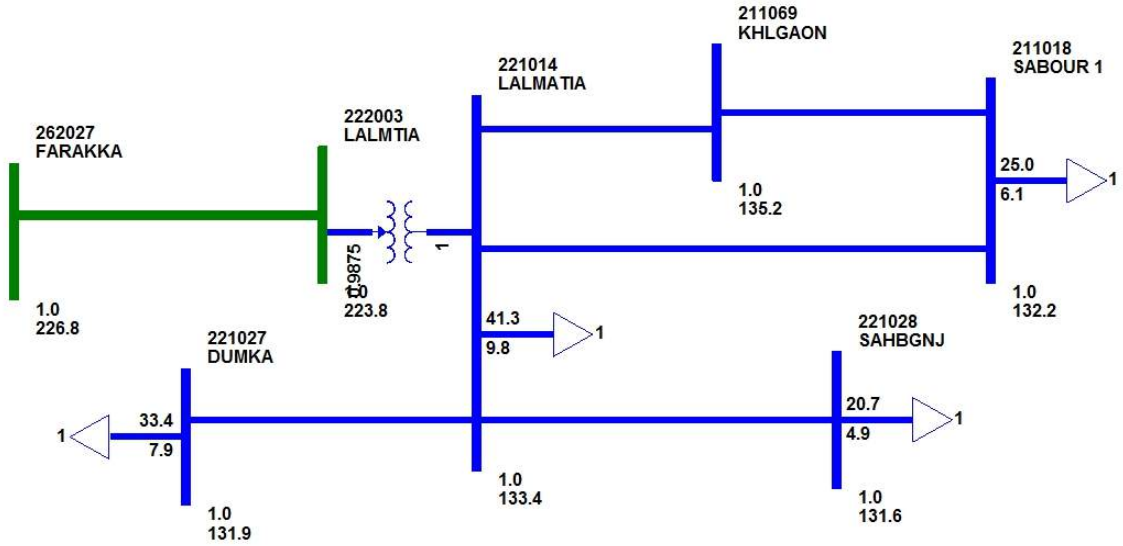
*OPTCL explained the disturbance with a presentation. The presentation is enclosed at **Annexure-B.5**. New Dubri received direct trip command from Meramundali end and main breaker tripped but B-ph of tie breaker got stuck. As a result the LBB protection operated at New Dubri.*

PCC felt that there is no fault in the line and LBB should not get activated without any fault current. PCC advised OPTCL to check the LBB settings.

ITEM NO. B.6: Disturbance at 220 kV Lalmatia S/s(JUSNL) on 21-05-17 at 16:39 hrs.

At 16:39 hrs 220 kV Farakka Lalmatia S/C line tripped from Farakka end on O/C E/F protection F/C 4.68 kA in B phase at Farakka.

132 KV Kahalgaon(BSPTCL) - Lalmatia S/C & 132 KV Kahalgaon(NTPC)-Lalmatia S/C were also tripped resulting total loss of power supply at Lalmatia & Sahebgunj. Load at Dumka got survived as it was radially fed from Maithon.



JUSNL and NTPC may explain the following:

- Location of fault
- Tripping of 220 kV Farakka Lalmatia S/C line
- Tripping of 132 KV Kahalgaon(BSPTCL) - Lalmatia S/C & 132 KV Kahalgaon(NTPC)-Lalmatia S/C

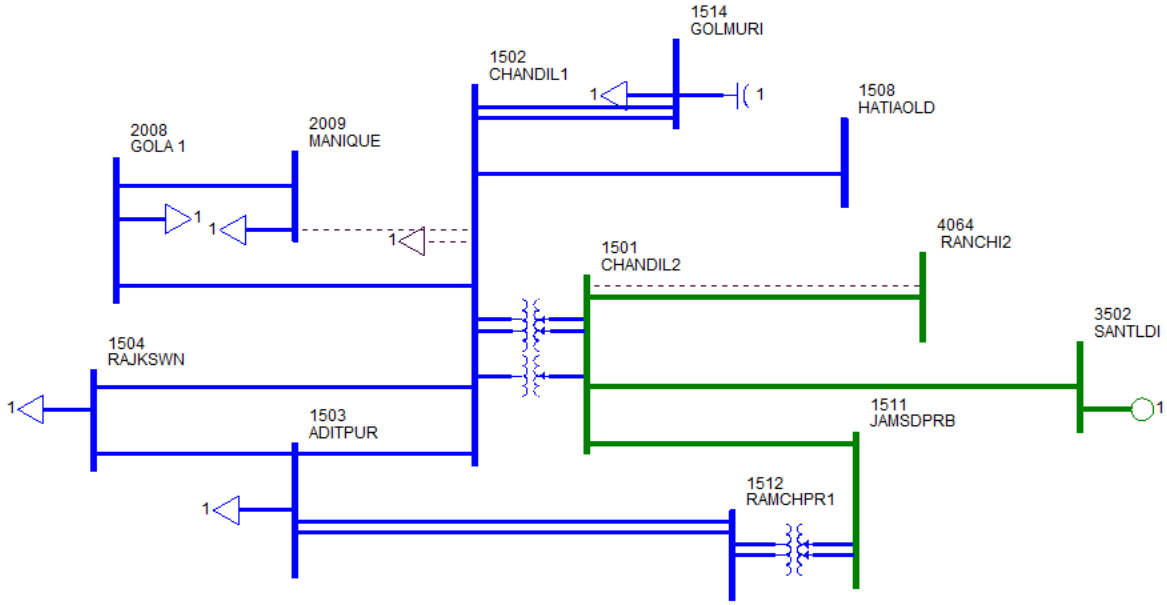
Deliberation in the meeting

NTPC informed that 220kV Farakka-Lalmatia line tripped from Farakka end on B-N fault, the fault distance was 59 km. 132 KV Lalmatia- Kahalgaon line didn't trip from Kahalgaon end. However DR recorded in relay of this line indicates that aforesaid line tripped at Lalmatia end.

PCC advised NTPC to collect tripping details of 220kV Farakka-Lalmatia line at Lalmatia end and submit to ERLDC and ERPC.

ITEM NO. B.7: Disturbance at 220 kV Chandil S/s on 26-05-17 at 15:34 hrs.

1. **Single line diagram:** Not submitted



2. **Pre fault conditions:** Not Submitted

3. **Detailed analysis of tripping incident:** Submitted

Due to inclement weather condition, total loss of power supply at Chandil occurred with tripping of following lines:

- 220 kV Ranchi Chandil S/C tripped on R-N fault at 14:37 hrs
- 220 kV STPS – Chandil S/C tripped on Y-N fault at 15:04 hrs.
- 220 kV Ramchandrapur – Chandil S/C from Ramchandrapur end on R phase O/C at 15:34 hrs.

Y phase conductor at location no. 308 of 220 kV Chandil – STPS line have snapped and fallen on the ground due to heavy lightning.

Relay Indications:

Time (Hrs)	Name of the element	Relay at Chandil end	Relay at remote end	PMU Observation
14:37	220 kV Chandil - Ranchi S/C	Master trip, Z-I	R-N, F/C 7.3 kA, 11 km from Ranchi	35 kV voltage dip in R phase (Ranchi PMU) Fault duration <100 ms
15:04	220 kV Chandil - STPS S/C	Y-N, D/P, Z-I, F/C 4.6 kA	Y-N, Z-II, 100.3 km from STPS, F/C 1.34 kA)	3 kV voltage dip in Y phase (Ranchi PMU) Fault duration <100 ms
15:34	220 kV Chandil - Ramchandrapur S/C	Did not trip	R phase O/C, F/C 1.5kA	3 kV voltage dip in R phase (Ranchi PMU) Fault duration <100 ms

4. **Disturbance record:** Submitted

5. **Remedial action taken :** Not Submitted

Status of Reporting:

- Detail report along with DR has been received from JUSNL on 29-05-17.

JUSNL may explain the following:

- Time synchronization of DR installed at Ramchandrapur & Chandil may be reviewed.

Deliberation in the meeting

JUSNL explained the tripping incidences.

PCC felt that all the trippings were in order.

ITEM NO. B.8: Disturbance at 132 kV Chandil and Adityapur S/s (JUSNL) on 13-05-17 at 13:37 hrs.

132 kV Adityapur - Rajkarswan S/C and 132 kV Chandil - Rajkarswan S/C tripped due to Y-B fault resulting total loss of power supply at Rajkarswan.

JUSNL may explain the following:

- Location of fault
- Tripping of 132 kV Adityapur - Rajkarswan S/C and 132 kV Chandil - Rajkarswan S/C

Deliberation in the meeting

JUSNL explained that one line from 132kV Chandil is directly connected to Rajakarswan and other line is connected via Adityapur through 132kV Tie bus.

There was Y-B fault in 132kV Chandil-Rajkaswan line but 132kV Adityapur-Rajkaswan line tripped from Rajkaswan end on over current protection before tripping of 132kV Chandil-Rajkaswan line from Chandil end on zone 1.

PCC felt that Rajkaswan end of 132kV Chandil-Rajkaswan line should also trip in this case. PCC advised to check the relay settings at Rajkaswan end settings of both 132kV Chandil-Rajkaswan line and 132kV Adityapur-Rajkaswan line.

It was informed that no DR was received from JUSNL. PCC advised JUNL to send the relevant DRs of this disturbance.

ITEM NO. B.9: Disturbance at 400 kV Sasaram S/s on 29-05-17 at 13:38 hrs.

At 13:38 hrs, 400 kV Biharshariff – Sasaram D/C tripped due to R-N fault resulting pole-block of Sasaram HVDC link (On SPS operation). Due to no connectivity at 400 kV & 765 kV level, 400 kV & 765 kV bus were charged from 220 kV level through ICTs. Load at Arrah & Nandokhar was being fed from Patna (Patna – Sipara – Khagul – Arrah link).

- 765 kV Sasaram – Fatehpur S/C was under S/D

Analysis of PMU plots: As per PMU data, voltage at Sasaram became as low as 130 kV.

Time (Hrs)	PMU at Biharshariff	PMU at Patna	PMU at Sasaram	Remarks
13:30:40	30 kV Voltage dip in R phase	6 kV Voltage dip in R phase	60 kV Voltage dip in R phase	Fault at 400 kV Biharshariff – Sasaram – II (A/R started)
13:30:41	10 kV Voltage dip in R phase. After 250 ms another 50 kV voltage dip observed in R phase	3 kV Voltage dip in R phase. After 250 ms another 6 kV voltage dip observed in R phase	Phase voltage in all three phases became 180 kV due to low fault level	Tripping of 400 kV Biharshariff – Sasaram – II(Permanent fault). Reason for second voltage dip at Biharshariff & Patna yet to be found out.
13:30:47	No significant voltage change	Per phase voltage at Sasaram got lowered by 3 kV	Voltage at Sasaram became 130 kV per phase	Reason yet to be found

Status of Reporting:

- Report from POWERGRID is yet to be received.

Powergrid may explain the following:

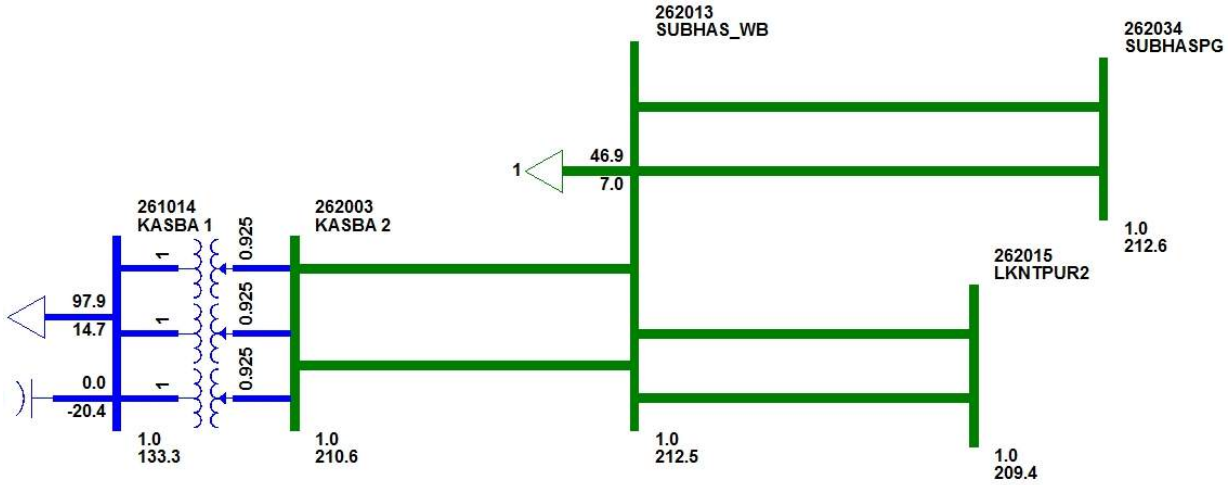
- Time & reason for tripping of 400 kV Biharshariff – Sasaram – I may be shared.
- As per SCADA data, Circuit I tripped 50 sec after tripping of circuit II. But as per PMU data, voltage at Sasaram & Patna became low at 7 sec after the tripping of Circuit II (But Biharshariff PMU voltage was unchanged).

<u>Deliberation in the meeting</u>

Powergrid informed that 400 kV Sasaram-Biharsharif Line -1 tripped during A/R operation as the fault was not cleared during dead time, however 400 kV Sasaram-Biharsharif Line-2 tripped only from Biharsharif end due to some PSL logic issue in Relay which has been rectified now.

ITEM NO. B.10: Disturbance at 220 kV Subashgram S/s (WB) on 17-05-17 at 06:28 hrs.

1. **Single line diagram:** Submitted



2. **Detailed analysis of tripping incident:** Submitted

At 06:28 hrs 220 kV Subhasgram(PG) – Subhasgram line-II tripped from Subhasgram(PG) end due to Y phase LA failure (of Circuit II) at Subhasgram(PG) end. But Subhasgram(WB) end failed to clear the fault. As result 220 kV Subhasgram(PG) – Subhasgram line-I tripped from Subhasgram(PG) end on Z-II. At the same time, 220 kV Kasba – Subhasgram (WB) tripped from Kasba end on Z-II.

Due to loss of both supply (Subhasgram (PG) and Kasba), 220/132 kV Subhasgram (WB) s/s became dead and load loss occurred at Lakhikantapur, Sirakol, Falta & Kakdeep.

3. **Disturbance record:** Submitted

4. **Remedial action taken :** Not Submitted

Analysis of PMU plots:

- Y – N fault has been observed at 06:28 hrs.
- Fault clearing time is 200 ms

Status of Reporting:

- Report from WBSETCL & POWERGRID is yet to be received

WBSETCL and Powergrid may explain the following:

- Reason for not clearing the fault from Subhasgram(WB)
- Differential protection may be implemented for 220 kV Subhasgram (PG) – Subhasgram(WB) D/C line

Deliberation in the meeting

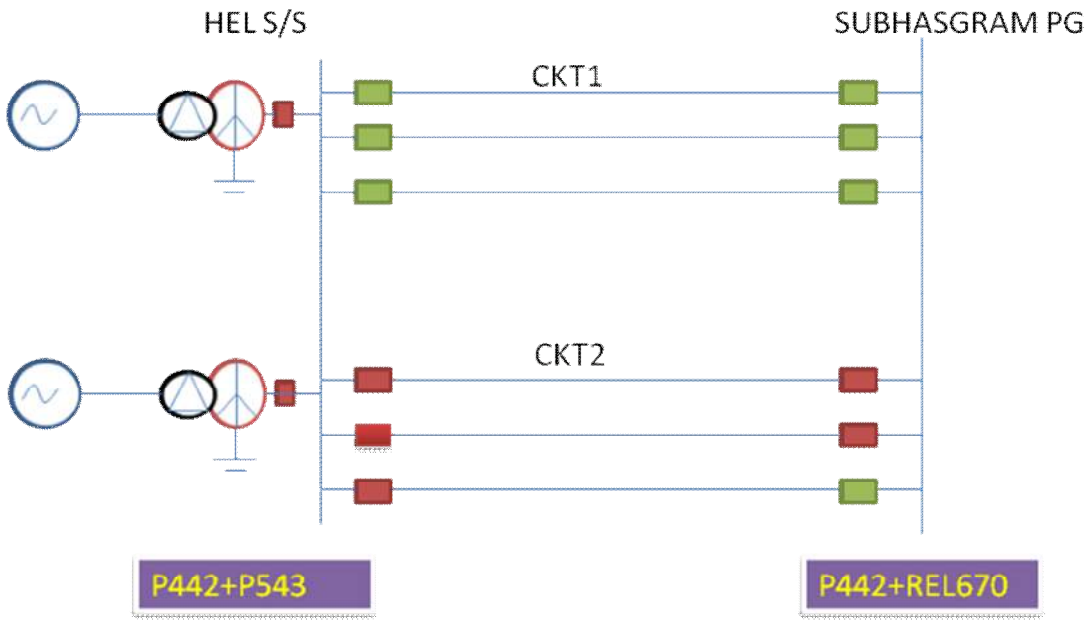
WBSETCL informed that the relay at 220 kV Subhasgram (WB) end of 220 kV Subhasgram (PG) – Subhasgram(WB) line-II failed to identify the fault. The relay has been replaced with new relay.

PCC felt that 220 kV Subhasgram (PG) – Subhasgram(WB) D/C line length is 600 meters and it is difficult to provide relay coordination using distance relays and advised Powergrid and WBSETCL to implement differential protection at the earliest as per the previous decision of PCC.

WBSETCL informed that OPGW is already available and they have included the implementation of differential protection scheme in DPR for funding from PSDF.

ITEM NO. B.11: Tripping of 400 kV HEL – Subhasgram D/C line on 13-05-17 at 16:29 hrs.

1. **Single line diagram:** Submitted



2. **Detailed analysis of tripping incident:** Submitted

At 16:29 hrs 400 kV HEL - Subhasgram - I tripped due to B-N fault. At same time, 400 kV HEL - Subhasgram - II tripped on O/V at HEL (DT received at Subhasgram). Both the running units at HEL tripped due to loss of evacuation path.

Analysis of breaker operation of 400 kV Subhasgram – HEL – I at Subhasgram end:

At 16:31:39.856 hrs, B pole opened due to Z-I fault (F/C 9.9 kA). As fault was in permanent nature, unsuccessful A/R attempt took place and all three phase breakers opened at 16:31:41.022 hrs.

Analysis of breaker operation of 400 kV Subhasgram – HEL – II at Subhasgram end:

At 16:28:51.343 hrs, B phase main breaker and all three phase tie breakers (It is mentioned as 31-52 breaker in DR file) opened at Subhasgram end (No distance protection picked up, F/C 3.3 kA) and current in R & Y phases increased to more than 1 kA. It remained high till 16:28:52.813 hrs and then it reduced to 100 A. At 16:28:53.930 hrs R & Y phase main breakers tripped (Probable reason is pole discrepancy as only B pole remained open for 2.5 sec approx.) and current became zero. At 16:32:05.809 hrs DT received from remote end but line was already opened from Subhasgram end. It is suspected line was not opened at HEL end at 16:28 hrs and line was idle charge from HEL end. So O/V picked up at HEL end and DT was sent to Subhasgram end.

3. **Disturbance record:** Submitted

4. **Remedial action taken :** Not Submitted

Analysis of PMU plots:

- No fault has been observed in PMU data at 16:28 hrs and 16:31 hrs.
- Unsuccessful A/R operation of a B phase fault has been observed at 16:29:50 hrs (Fault was at 16:29:49 hrs).
- It is suspected both the circuits tripped due to same fault and DR installed at Subhasgram is not properly time synchronized.

Status of Reporting:

- DR data from POWERGRID has been received on 19-05-17

HEL and Powergrid may explain the following:

- Time synchronization of DR installed at Subhasgram may be checked as no fault has been observed at 16:29 & 16:31 hrs in PMU data.
- Opening of B pole of 400 kV HEL – Subhasgram – II at Subhasgram end may be explained. Reason for non – auto – reclose of B phase pole may be checked. As a result, 2.5 sec (approx.) after opening of B pole other two phase main breakers opened at Subhasgram end due to pole discrepancy.
- Reason for O/V at HEL end may be explained.

Deliberation in the meeting

*ERLDC has given a presentation, which is enclosed at **Annexure-B11**.*

PRDC added that over current, E/f protection settings of GT is lower than the line setting as a result GTs are tripping earlier than transmission line for a fault in transmission line.

Representative from HEL, CESC was not available in the meeting.

PCC advised Powergrid to check the auto reclose feature at Subashgram end.

ITEM NO. B.12: Disturbance at 132 kV Kasba S/s (CESC) on 31-05-17 at 15:53 hrs

1. **Pre fault conditions:** Submitted

- CESC was synchronized at kasba point
- CESC was importing around 180 MW from WB. And load of East calcutta was around 140 MW
- PATULI, PARK CRCKS PARK LANE THESE S/S was radially fed from Subhasgram PG source.

2. **Detailed analysis of tripping incident:** Submitted

- AT 15:53 hrs there was a R phase fault in 132 KV Kasba-saltlake-II line in west bengal system and there was delayed fault clearance (more than 350 ms) as recorded in PMU.
- Now to avoid fault feeding in Grid out side CESC , CESC implemented a protection logic at kasba . BC between main 1 bus and reserve bus will open on directional overcurrent operation plus under voltage. With the following setting :

500 Amp towards grid from CESC And 83% under voltage this is the setting and there is a time 300 ms delay to allow z1 line protection(or other primary protection) to operate.

- Today after the fault in 132 KV Kasba-saltlake-II there was 750 Amp current following towards wb and voltage dip upto 77% that's why bus coupler got opened and then on reserve bus at CESC kasba there was 3 in comer of wb and load of East calcutta GIS(140 MW)
- Main bus 1 along with jadavpur got seperated.
- As previously import from wb was around 180 MW of which 140 was consumed by East Calcutta and rest 40 MW was flowing through BC.
- Hence a net imbalance of 40 MW took place when CESC got separated .
- Hence under frequency occurred in CESC system and frequency goes upto 49.2 Hz when there UFR at chakmir S/s oerated and tripped 33/6 KV transformer supplying load of majerhat and budge-budge area.A load relief of around 40 MW is achieved and CESC

sustain the disturbance .

- Then at 15:59 hrs they synchronized at Howrah point and increase the load.

WBSETCL and CESC may explain the following:

- Reason for delayed fault clearing for 132 KV Kasba-saltlake-II .

Deliberation in the meeting

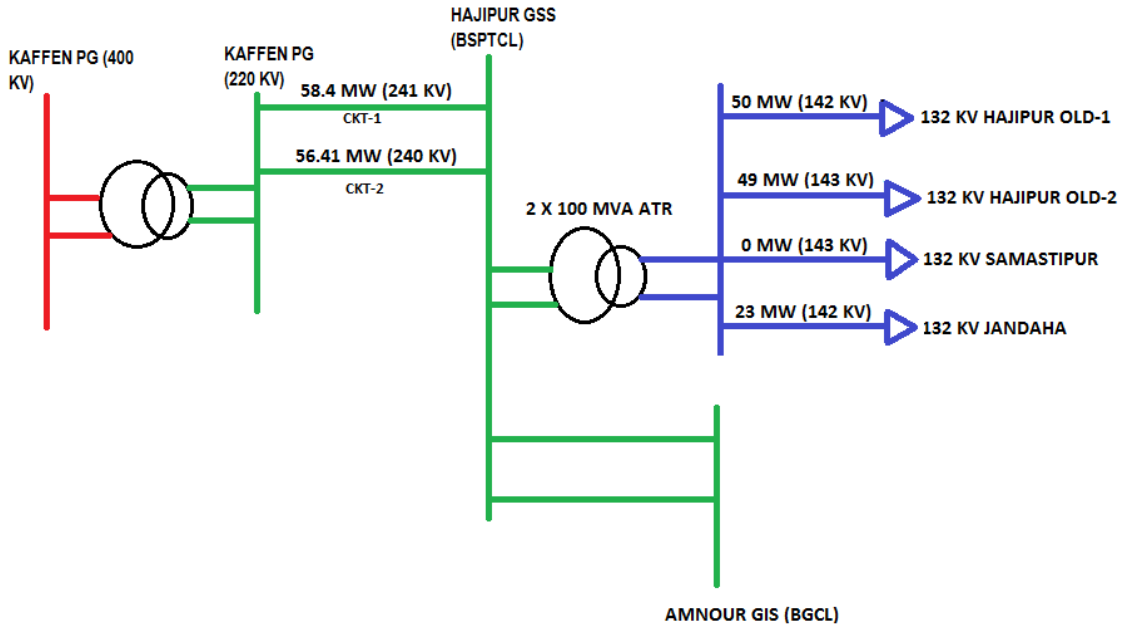
WBSETCL informed that Salt lake end seen the fault in zone 2 and cleared the fault in 350 ms as per the setting.

CESC representative was not available in the meeting. The details submitted by CESC are enclosed at Annexure-B12.

PCC felt that time setting of special protection scheme at Kasba end needs to be coordinated with zone 2 time setting of Salt lake end of 132 KV Kasba-saltlake-II line to avoid unwanted trippings.

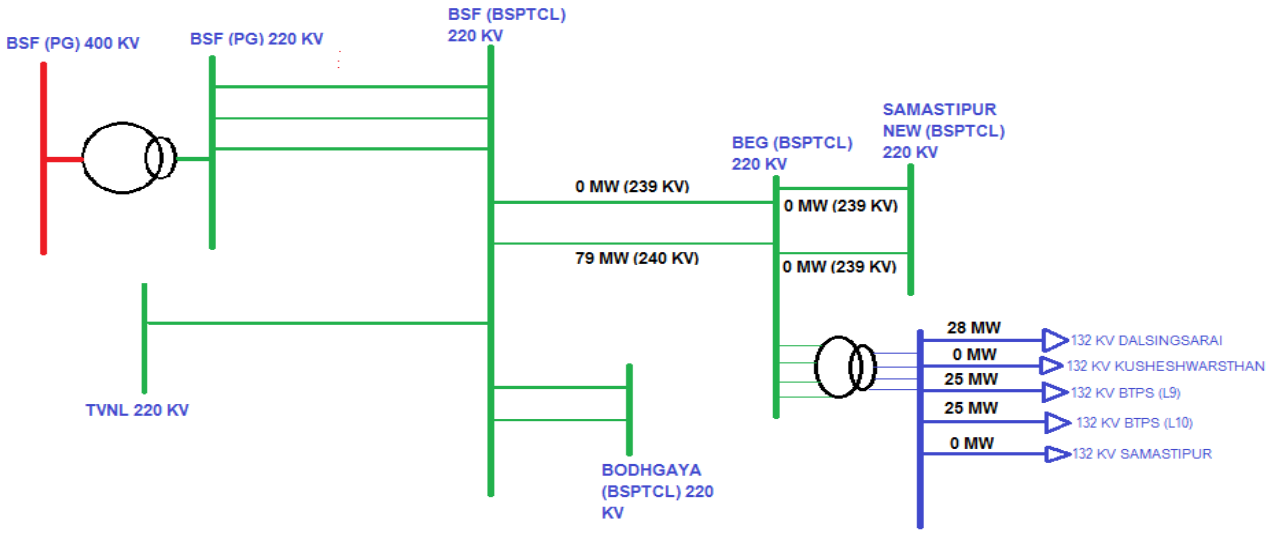
ITEM NO. B.13: Disturbance at 220 kV Hazipur, Begusarai and Madhepura S/s on 09-05-17 at 04:30 hrs

On 9/5/17 From 04:30 hrs to 06:30 hrs on 09.05.17 a heavy storm reported in Bihar at Muzaffarpur ,Hazipur, Darbhanga, Dehri, Purnea, Samastipur etc. which resulted load loss of around 2000 MW. After the load throw off, high voltage reported at Arrah, Muzaffarpur Gaya etc. Further, 3x50MVA 132/33 KV ICT at Arrah and ICT at Dumraon and Jagdishpur tripped on over flux at 05:20 hrs. Power failure occurred at 220 KV S/stn. Hazipur, Gopalgunja, Motipur, Musari, Samastipur, Begusarai ,Darbhanga & Madhepura s/stn. Traction power interrupted at siwan, Chapra, Sonepur, Samastipur etc.



Sl.No.	Name of Bay / Line	Time of tripping	Local End Relay Indications	Remote End Relay Indications
1	220 KV Hajipur- Kaffen (PG) Ckt-1	05:40hrs	Circuit was manullay made off	
2	220 KV Hajipur- Kaffen (PG) Ckt-2	05:49 hrs	Over Voltage	

CONDITION PRIOR TO OUTAGE CAUSED BY HEAVY RAIN AND STORM AT 220/132/33 KV GSS BEGUSARAI ON 09.05.2017 AT 06:00 HRS



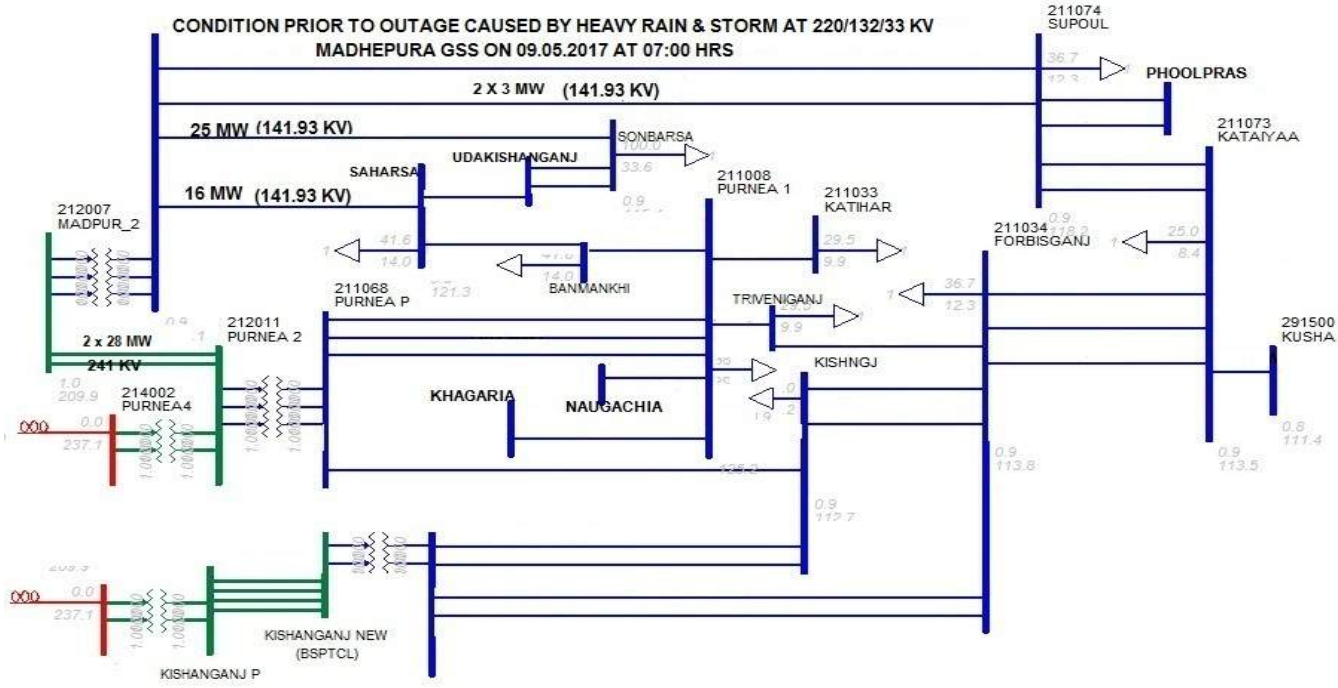
- As per SLDC message no-240, dated 09.05.2017, 220 kv biharshariff ckt-I and 220 kv Samastipur New ckt- I & were manually made off at 05:05 hrs due to high voltage during heavy rain and storms.
- At 06:50 hrs, all 100 MVA ICT- 1, 2, 3 & 4 and 220 kv Biharsharif ckt-2,220kv samastipur new ckt-2 tripped on overflux relay. 50 MVA Trafo- 1, 2 & 3 were also tripped on overflux relay at the same time.

Sl. No.	Line / ATR / Unit	Outage	Restoration	Duration	Analysis
1.	220 Kv BSF ckt-I	05:05 hrs	14:35 hrs (10.05.2017)	33:30 hrs	OVER VOLTAGE
2.	220 Kv BSF ckt-II	06:50 hrs	08:50 hrs	02:00 hrs	OVER VOLTAGE
3.	100 MVA ATR-1	06:50 hrs	08:55 hrs	02:05 hrs	OVER VOLTAGE
4.	100 MVA ATR-2	06:50 hrs	12:40 hrs	05:50 hrs	OVER VOLTAGE
5.	100 MVA ATR-3	06:50 hrs	16:20 hrs	09:30 hrs	OVER VOLTAGE
6.	100 MVA ATR-4	06:50 hrs	16:25 hrs	09:35 hrs	OVER VOLTAGE
7.	132 Kv Kusheshwarsthan	06:50 hrs	09:40 hrs	02:50 hrs	OVER VOLTAGE
8.	132 Kv Dalsingsarai	06:50 hrs	10:45 hrs	03:55 hrs	OVER VOLTAGE
9.	132 Kv BTPS L9	06:50 hrs	09:45 hrs	02:55 hrs	OVER VOLTAGE
10.	132 Kv BTPS L10	06:50 hrs	09:48 hrs	02:58 hrs	OVER VOLTAGE

- Due to heavy rain and storm, the 132 KV lines from Madhepura GSS's were manually made OFF as the bus voltage increased to 145 KV.
- Due to unavailability of over voltage relay in 132 KV lines and 132 KV side of 100 MVA ATR's- 1, 2 & 4, these were manually made OFF.
- Over Flux Relay is available in the 220 KV sides of 100 MVA ATR's.
- 220 KV PG Purnea lines and HV side of 100 MVA ATR's neither tripped nor manually made OFF at voltage remained 241 KV.

Sl. No.	Line / ATR / Unit	Outage	Restoration	Duration	Analysis
1.	132 Kv Supaul CKT – I	07:50 hrs	11:05 hrs	03:15 hrs	OVER VOLTAGE
2.	132 Kv Supaul CKT – II	07:50 hrs	09:03 hrs	01:13 hrs	OVER VOLTAGE
3.	132 KV Saharsa line	07:50 hrs	09:22 hrs	01:32 hrs	OVER VOLTAGE
4.	132 KV Sonbarsa line	07:50 hrs	10:25 hrs	02:35 hrs	OVER VOLTAGE
5.	132 Kv sides of 100 MVA ATR's- 1	07:50 hrs	10:35 hrs	02:45 hrs	OVER VOLTAGE
6.	132 Kv sides of 100 MVA ATR's- 2	07:50 hrs	10:50 hrs	03:00 hrs	OVER VOLTAGE
7.	132 Kv sides of 100 MVA ATR's- 4	07:50 hrs	12:25 hrs	04:35 hrs	OVER VOLTAGE

- Transformers at GSS ARA T3 , T4 made off manually at BSPTCL end , at that time T1 was on no load (not in service).
- At 05:05 hrs on 09/05/17 , 132 KV Ara (PG)-Ara Transmission line tripped from ARA (PG) end.
- At 05:15 hrs on 09/05/17 , 132 KV Ara(PG)-Jagdispur Transmission line tripped from PG end.Transformers T1and T2 were made off manually due to high voltage at BSPTCL end.
- At 4:55 hrs on 09/05/17 Transformers T1and T2 tripped on overflux at Dumraon ,BSPTCL end and there was no tripping in 132kv Ara (PG)-Dumraon Transmission line.
- On 09/05/2017 in 132 kv Ara(PG)-Ara Transmission line relay operated at Ara (PG) end was as follows:In distance relay at 1.9km from Ara (PG) R-N fault found and the fault current was 4 KA.
- There was no relay indication at Ara, BSPTCL end.
- On 09/05/2017 in 132 kv Ara(PG)-Jagdishpur Transmission line relay operated at Ara(PG) end was as follows:In distance relay at 1.0 km from Ara (PG) B-N fault found and the fault current was 4.1KA.
- There was no relay indication at Jagdishpur, BSPTCL end.
- On 09 /05/2017 there was no relay on either end of 132 kv Ara (PG)-Dumraon transmission line.



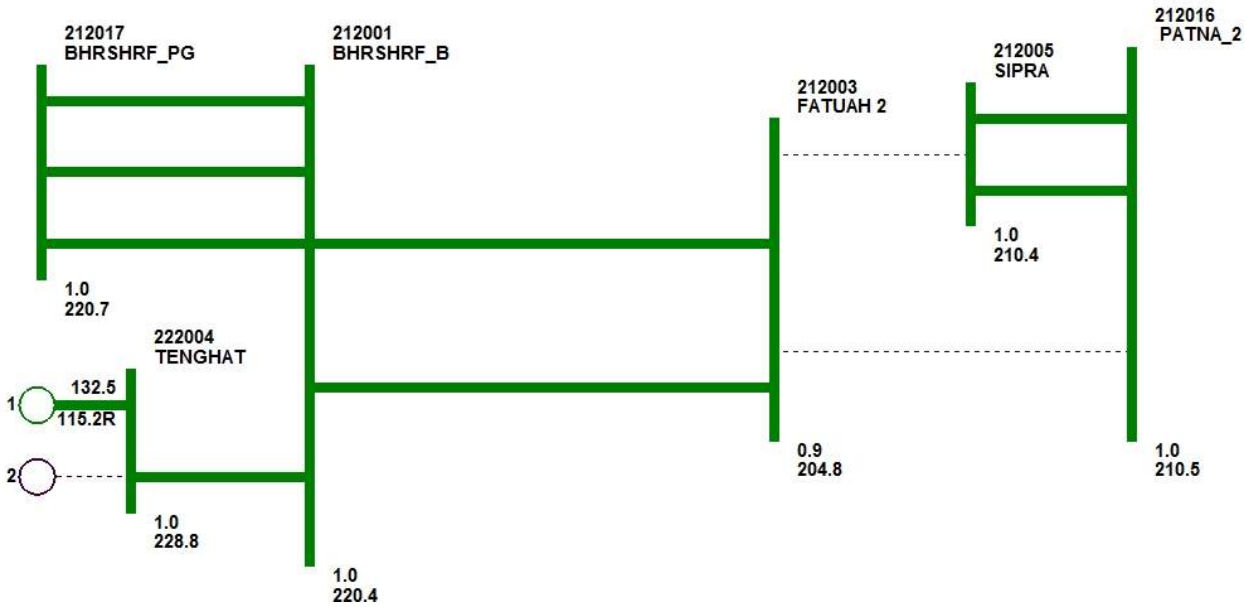
BSPTCL may explain the following:

- Reason for load loss of 2000 MW in Bihar system.
- Reason for overvoltage in Bihar system

Deliberation in the meeting

Due to heavy rain and storm the load of approximately 2000 MW was disconnected from 33 kV end. As a result severe over voltage was observed in Bihar system and transmission lines and ATRs were tripped on over voltage and over flux protection.

ITEM NO. B.14: Tripping of 220 kV Biharshariff - Fatuah D/C line on 03-05-17 at 11:45 hrs



220 kV Patna - Fatuah S/C and 220 kV Fatuah - Sipara S/C were not in service. Fatuah was radially supplied from Biharshariff.

At 11:45 hrs, 220 kV Biharshariff - Fatuah D/C line tripped from Biharshariff end on zone 1, Y-B fault. Radial connected load at Gaighat, Mithapur, Harnaut, Baripahari etc. was shed due to lost of power supply.

DR of Biharshariff end received.

BSPTCL may explain the following:

- Location of fault

Deliberation in the meeting

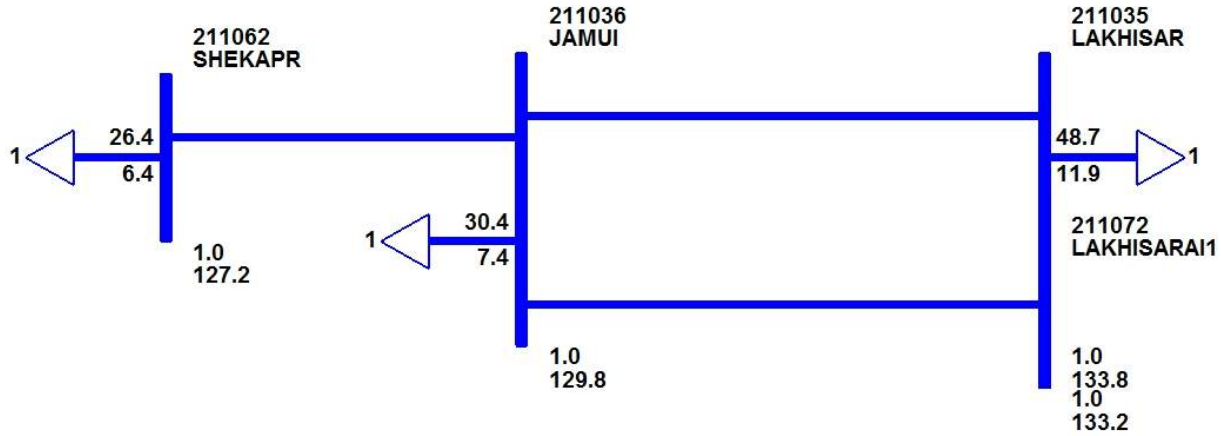
BSPTCL informed that Y-B fault was observed in both the ckts of 220 kV Biharshariff - Fatuah D/C line and both the lines tripped from Biharshariff end on zone 1. Fatua end did not tripped as the line was radially connected to Biharshariff.

ITEM NO. B.15: Disturbance at 132 kV Jamui (BSPTCL) on 25-05-17 at 13:28 hrs.

At 13:20 hrs, 132 KV Jamui-Seikhpur S/C tripped from both ends (At Seikhpur it tripped at 13:22 hrs).
During Charging of 132 KV Jamui-Seikhpur S/C at 13:28 hrs, 132 KV Lakhisarai(PG) –Jamui D/C tripped from Jamui end on zone 2.

At 13:36 hrs 132 KV Lakhisarai(PG) –Jamui D/C were charged. During second charging attempt of 132 KV Jamui-Seikhpur S/C at 13:56 hrs, 132 kV Lakhisarai - Jamui D/C tripped again from Jamui end on zone 3.

At 14:25 hrs 132 kV Lakhisarai - Jamui D/C were charged again. 132 kV Jamui - Seikhpur S/C was charged at 19:19 hrs on 29-05-17.



BSPTCL may explain the following:

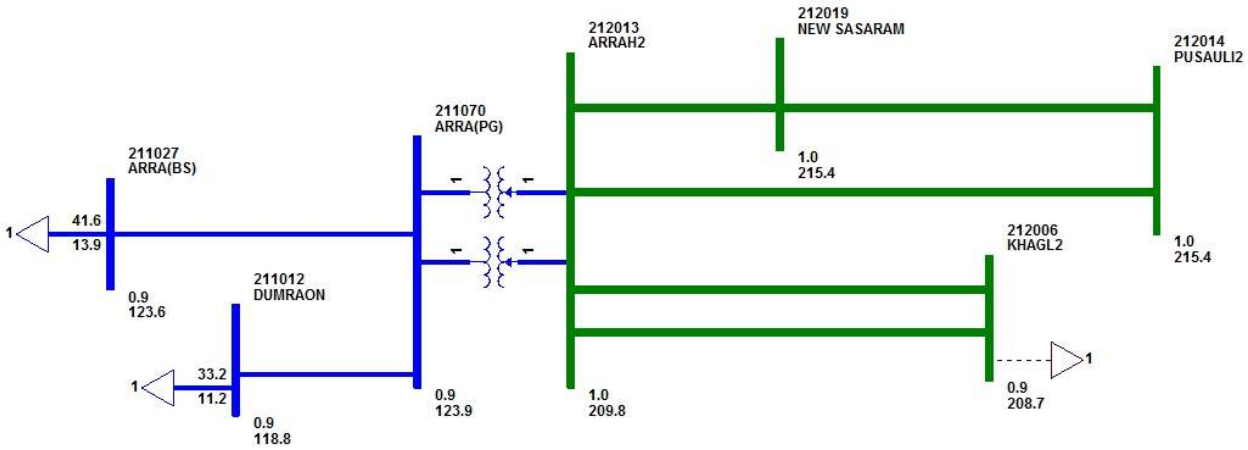
- Tripping of 132kV Jamui-Lakhisarai D/C line from Jamui end
- CT polarity of Jamui end needs to be verified

Deliberation in the meeting

PRDC presented the disturbance analysis and informed that the distance relay of 132kV Jamui-Lakhisarai D/C line at Jamui end is seeing the faults in reverse direction so there may be reverse CT polarity. PRDC analysis are enclosed at Annexure-B15.

BSPTCL informed that they have verified and corrected the CT polarity at Jamui end of 132kV Jamui-Lakhisarai D/C line.

ITEM NO. B.16: Tripping of 132kV Arrah(PG)-Arrah(BSPTCL) on 13-05-17 at 09:20 hrs.



At 09:20 hrs tripping of 132 kV Arrah(PG) – Arrah(BSPTCL) S/C line tripped due to R-N fault (Z-I from PG end) during heavy storm resulted load loss at radially fed areas. Arrah(BSPTCL) did not trip as no other source is connected.

Powergrid and BSPTCL may explain.

Deliberation in the meeting

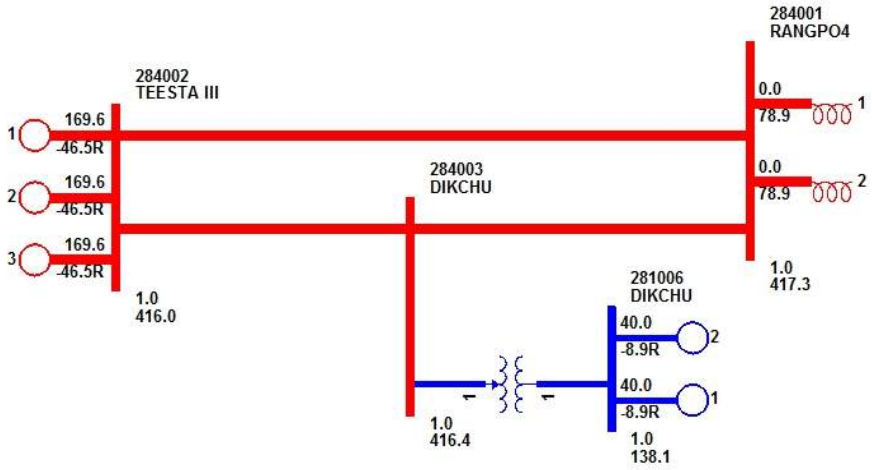
BSPTCL and Powergrid informed that there was R-N fault in 132 kV Arrah(PG) – Arrah(BSPTCL) S/C line and Arrah(PG) end cleared the fault in zone 1. No tripping was initiated from Arrah(BSPTCL) end as Arrah(BSPTCL) is radially connected to 132 kV Arrah(PG).

ITEM NO. B.17: Tripping of 400kV Teesta III – Rangpo line on 11-05-17 at 08:28 hrs and 15-05-17 at 16:09 hrs.

1. 11-05-17 at 08:28 hrs

400 kV Teesta III – Rangpo S/C tripped due to operation of differential protection (87C) at Teesta III end. Breakers at Rangpo end opened at 08:28.21.410 hrs after receiving DT from Teesta III end. In PMU data, R-N fault has been observed. Fault clearing time is less than 100 ms. Distance protection at Rangpo end did not sense any type of fault at the time of incident.

Before the incident, Teesta unit #2, #3 & #6 were in the service. All running units at Teesta III tripped due to loss of evacuation path.



Status of Reporting: DR from Teesta III and POWERGRID has been received by 12-05-17

Teesta-III & Powergrid may explain the following:

- 400 kV Teesta III – Rangpo S/C tripped due to operation of 87C at Teesta IIII end. But distance relay at Rangpo end failed to sense the fault. POWERGRID & Teesta III may explain. R – N fault has been observed in PMU data at the time of disturbance.
- Teesta – III may send DR in comtrade format.

2. 15-05-17 at 16:09 hrs

400 kV Rangpo – Teesta III S/C tripped from both ends (Teesta III end: O/C, E/F Ir = 0.9 kA, Iy = 1.3 kA, Ib = 1.2 kA; Rangpo end: DT received) resulting in tripping of all running units (Unit #I, #III, #IV, #V & #VI) at Teesta III due to loss of evacuation path.

In PMU data, B phase fault has been observed and fault clearing time is less than 100 ms.

Outage of 800 MW generation at Teesta III caused oscillation in MW, MVAR flow in various 400 kV & 765 kV lines and voltage angle difference between various buses in all over the India.

In 765 kV Sholapur – Raichur D/C (Inter-regional line between SR & WR), 95 MW (Instantaneous Peak to Peak) oscillation was observed for 12 seconds. 14 degree (Instantaneous Peak to Peak) oscillation in voltage angle was observed at Bongaigaon PMU for 3 minute.

Status of Reporting: DR from Teesta III and POWERGRID has been received by 15-05-17

Teesta-III & Powergrid may explain the following:

- Location of the fault
- 800 MW generation loss at Teesta III resulted oscillation in Voltage angle and MW flow between various nodes at all regions.

Deliberation in the meeting

Teesta-III explained the tripping incident with a presentation. Presentation is enclosed at Annexure-B17. Teesta –III informed that the backup overcurrent relay settings of 400 kV Rangpo – Teesta III S/C line at Teesta –III end were not properly coordinated with differential and distance protection as a result the relay initiating the tripping for any transient fault in around Teesta-III.

Teesta-III added that they have modified the overcurrent relay settings and thereafter no unwanted tripping were reported.

PCC enquired about the protection system available for 400 kV Rangpo – Teesta III S/C line.

Teesta-III informed that some portion (approx. 1.2 km) of 400 kV Rangpo – Teesta III S/C line is cable and differential protection is implemented for cable portion. The distance protection is also available to protect the line and requested Powergrid to enable the Autoreclose scheme to avoid complete line outage.

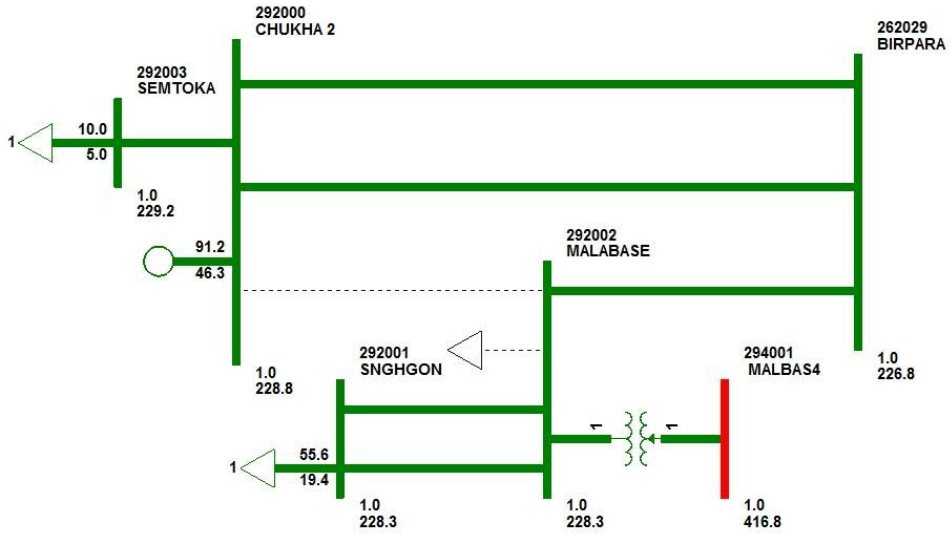
Powergrid agreed to implement the Autoreclose feature, if Teesta-III is willing to implement.

ITEM NO. B.18: Disturbance at 220 kV Chuka and Birpara S/s on 06-05-17 at 15:39 hrs.

At 15:39hrs, 220 kV Chukha-Birpara-D/C tripped on R-Y phase fault (dist. 46.8km & 45.5km respectively from Birpara) which resulted tripping of all running units at Chukha due to loss of evacuation path. At same time, 220kv Birpara-Malbase S/C also tripped from Malbase end.

220 kV Chukha - Malbase S/C was under shutdown.

Disturbance record: Received Birpara (PG) end DR of 220 kV Chuka – Birpara D/C lines



Chuka and Malbase may explain the following:

- Place the details of Chuka end tripping
- Reason for tripping of 220kV Birpara-Malbase S/C from Malbase end

Deliberation in the meeting

Powergrid explained that there was a inter circuit R-Y phase fault in 220 kV Chukha-Birpara-D/C line and the line tripped from Birpara end on zone 1.

Representative form Chuka was not available in the meeting.

ITEM NO. B.19: Disturbance at 132 kV NBU S/s on 29-05-17 at 17:12 hrs.

Due to Y phase CT and CB burst at NBU end of 132 kV NBU - Rammam, all 132 kV feeders connected at NBU tripped due to operation of bus bar protection. AT NJP (PG) end B/U O/C E/F relay also tripped for 132 kV NBU - NJP (PG) S/C.

Powergrid and WBSETCL may explain.

Deliberation in the meeting

WBSETCL informed that no busbar protection operated at NBU. WBSETCL explained that total power failed at NBU due to burst out of Y-ph CT and damaging other CTs with B-ph & Y-ph pole of Breakers of 132kV NBU-Rammam line bay. WBSETCL placed the following details:

Sl. No.	Line	Time of tripping	Local end	Remote end
1.	132 KV NBU-Darjeeling	07:13 hrs	Zone 4 dist 378 meters	Zone 3, Dist 63.81 km
2.	132 KV NBU-Rammam	07:13 hrs	Zone 1 Dist 0 km	Zone 1 Dist 50.17 km
3.	132 KV NBU-Ujanu	07:13 hrs	Did not trip	Zone 1 Dist 4.5 km
4.	132 KV NBU-PGCIL	07:13 hrs	Did not trip	Back up E/F
5.	132 KV NBU-NJP	07:13 hrs	Did not trip	Zone 1 Dist 36 km
6.	132 KV NBU-TCF PS1	07:13 hrs	Did not trip	Zone 2

PCC felt that the 132kV lines connected to NBU should trip from remote end on zone 2 and advised WBSETCL to verify the distance relay settings at remote end of following lines:

- *132 KV NBU-Darjeeling*
- *132 KV NBU-Rammam*
- *132 KV NBU-Ujanu*
- *132 KV NBU-NJP*

ITEM NO. B.20: Disturbance at 220 kV Birpara on 22-05-17 at 16:32 hrs.

Due to operation of differential protection at bus - II at Birpara all elements connected to bus II i.e. 220 kV Chukha - Birpara - II, 220 kV Birpara - Malbase S/C, 220 kV Birpara - Alipurduar - II, 220 kV Birpara - Siliguri - I, 220/132 kV ATR at Birpara tripped from Birpara end.

Powergrid may explain.

Deliberation in the meeting

Powergrid explained that bus bar protection operated at 220 kV Birpara on bus fault and tripped all the lines.

ERLDC informed that as per PMU data the fault clearing time was 500 ms.

PCC advised Powergrid to verify the tripping and report to ERPC and ERLDC.

ITEM NO. B.21: Disturbance at 400 kV Darbanga S/s on 21-05-17 at 11:23 hrs.

At 11:23 hrs bus differential protection of 400 kV main bus I & II at Darbhanga operated due to operation of gas compartment zone trip signal generated due to problem in hard wiring. As a result 400 kV Darbhanga - Muzaffarpur D/C and 400/220 kV ICT - II at Darbhanga (ICT - I under s/d) tripped resulting total loss of supply at Darbhanga.

Darbanga may explain.

Deliberation in the meeting

DMTCL, Darbanga informed that bus differential protection of 400 kV main bus I & II at Darbhanga operated due to problem in wiring. The problem has been rectified and no unwanted tripping was reported thereafter.

ITEM NO. B.22: Disturbance at DSTPS (DVC) on 12-05-17 at 13:00 hrs.

At 13:00 hrs on 12.05.17 total power failed at 400 KV DSTPS substation (DVC) due to Bus Bar Protection operation. The following elements connected to Bus-I & II tripped:

- 400 KV DSTPS-RTPS-I&II
- 400 KV DSTPS-Jamshedpur-I&II
- Running units I &II

DVC may explain.

Deliberation in the meeting

DVC explained that the bus bar protection operated due to operational mistake. The details are given in Annexure-B22.

PCC advised DVC to take care in future.

ITEM NO. B.23: Disturbance at 132 kV CTPS (DVC) S/s on 23-05-17 at 14:50 hrs.

On 23rd May 2017 at about 14:51 hrs total power failed in CTPS 132KV Bus due to tripping of all lines which had sources on remote bus and all three ATRs. The weather conditions prevailing around CTPS Switchyard during the tripping was extremely stormy with very high wind velocity along with heavy rain, thunder and lightning.

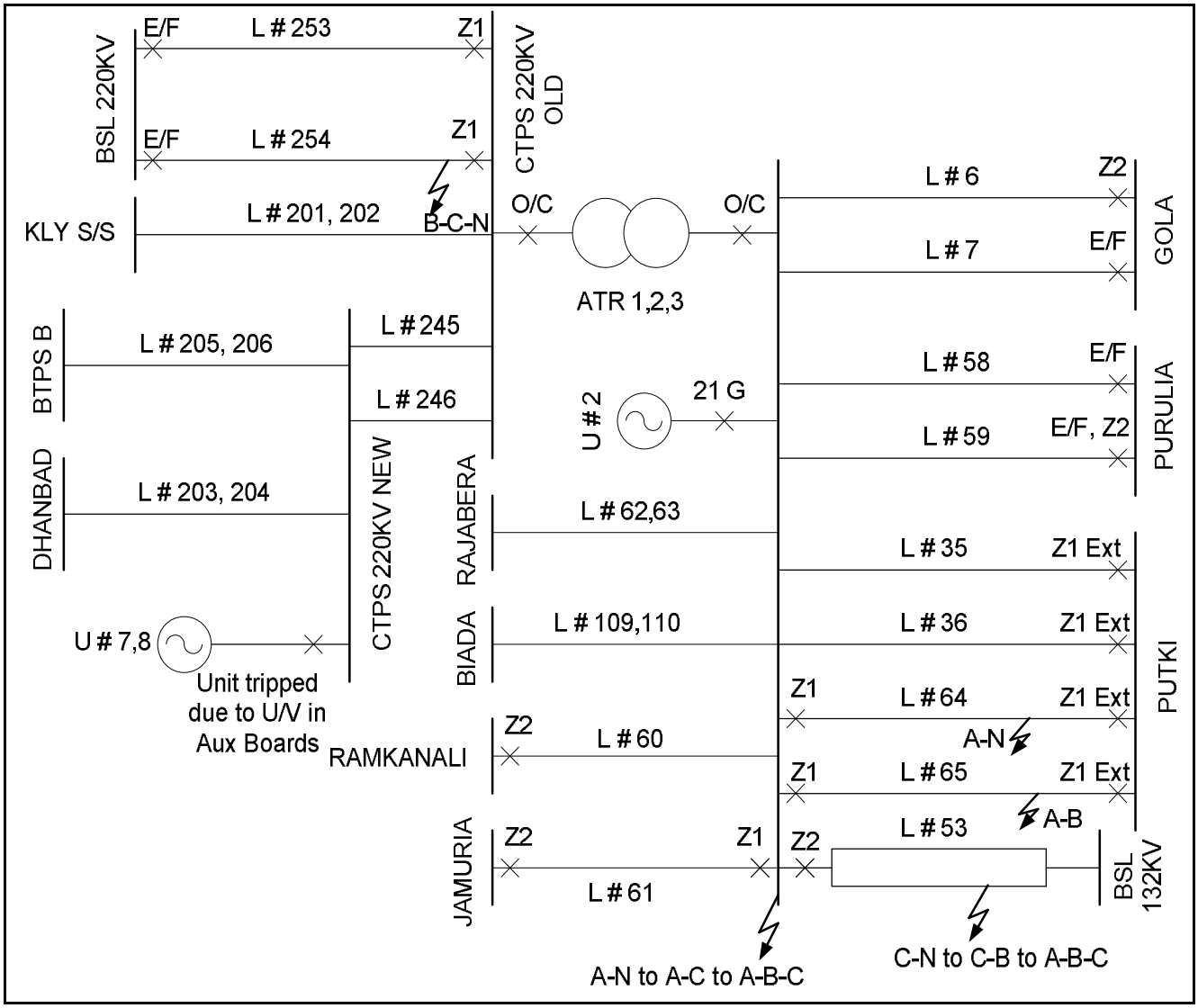
PHYSICAL DAMAGE REPORTED:

- Line # 53 tower had collapsed at location no. 19.
- C Phase LA had burst in Line # 254.

PRE FAULT LOAD FLOW:

Equipment	KV Level	Current in Amps
ATR#3	220 KV	250
ATR#1		240
ATR#2		280
L#245		460
L#246		360
L#253		137

L#254		137
L#202		120
L#201		120
L#6	132 KV	160
L#7		130
L#36		120
L#35		120
L#65		120
L#64		120
L#53		Kept charge from CTPS end only
L#54		Kept charge from CTPS end only
L#57		Kept charge from CTPS end only
L#58		100
L#59		100
G#2	14.5 KV	4700



TRIPPING DETAILS:

LINE NO.	TIME OF FAULT		RELAY INDICATIONS	
	Absolute	Relative	CTPS END	OTHER END
53	14.51.58.374	0ms	Z2	--
64	14.52.34.509	46s 135ms	Z1	Z1 Extension
65	14.52.34.689	46s 315ms	Z1	Z1 Extension

35	14.52.52.820	1m 4s 446ms	NO TRIP	Z1 Extension
36			NO TRIP	Z1 Extension
58			NO TRIP	D/E/F
59			NO TRIP	D/E/F , Z2
6			NO TRIP	Z2
7			NO TRIP	D/E/F
60			NO TRIP	Z2
61			Z1	Z2
109,110			By Hand	--
62,63			By Hand	--
253			Z1	O/C, E/F
254			Z1	O/C, E/F
ATR#1			HV, LV O/C	--
ATR#2			HV, LV O/C	--
ATR#3			HV, LV O/C	--
Gen # 2			B/U Impedance	

Note: The absolute time has been taken as the time of fault pickup by the ATR # 1 Differential relay and relative time has been calculated considering the Line # 53 fault as the first fault (timed at 0m 0s 0ms).

TRIPPING ANALYSIS:

1. From the downloaded fault records of the various numerical relays at CTPS and Putki end relays the following chronology of faults and subsequent line trippings could be established.
2. **First Fault:**
   a. Collapsing of Line # 53 tower at location no. 19.
   b. As Line Differential Protection of the said line was out of service due to appearance of COM FAIL ALARM, the fault was cleared by Distance Zone 2 from CTPS end.
   c. The distance of tower collapse was around 6 km from CTPS bus which was within 80% of physical line length but as this is a dual conductor line (2 conductors sharing the current but only one CT), the fault was correctly seen by the relay within its in Zone 2 reach.
   d. It is seen from the DR that initially for about 105ms the fault was seen within Zone 3 reach due to its initial higher ground resistance. However, after 105 ms the CG fault transforms to BC fault and the effect of higher fault resistance dies out, then Zone 2 Start operates and issues trip pulse within another 300ms.
   e. The fault is finally cleared in around 489ms and no other lines trip due to this fault.
3. **Second Fault:** [46s after 1st fault]
   a. Probable lightning strike / tree touching on L # 64.
   b. L # 64 shows A Phase fault with If = 18.5 kA. Magnitude of Fault Current suggest fault was closer to CTPS Bus i.e. beyond Z1 from Putki end.
   c. L # 64 trips at CTPS end through Distance Zone 1 and through Distance Zone 1 extension from Putki end correctly as per Carrier Blocking Scheme.
   d. Fault cleared within 100ms from CTPS end.
4. **Third Fault:** [after 180ms of 2nd fault]
   a. Again probable lightning strike / tree touching on common tower of L # 65 and L # 64.
   b. L # 65 shows AB fault with If = 24.6 kA again suggesting fault closer to CTPS end.
   c. L # 65 tripped at CTPS end through Distance Zone 1 and through Distance Zone 1 extension from Putki end correctly.
5. **Fourth Fault:**
   a. This was an isolated fault in 220KV level where both lines tripped from CTPS end in Distance Zone 1 and through D/E/F from BSL end.
   b. Probable cause: Lightning strike on both the lines(both lines travel on the same tower) evidenced by :
      i. Total collapse of B Phase Voltage, no substantial change in C Phase voltage but current increase in only C phase(to about 4.5kA).

ii. Increment of A Phase voltage to 205KV (from normal 127KV)
iii. Bursting of LA in C Phase in L # 254.

6. **Fifth Fault:**
   a. Occurs on CTPS 132 KV bus and remains uncleared till all three ATRs trip. It is during this fault all the remaining lines trip from the respective remote ends as follows:
   b. L # 6 [CTPS Gola] trips through Distance Zone 2.
   c. L # 7 [CTPS Gola] trips through D/E/F as Gola End Distance relay is out of service.
   d. L # 58 & 59 [CTPS Purulia] trips through D/E/F Protection.
   e. L # 60 & 61 [CTPS Ramkanali & CTPS Jamuria] trips through Distance Zone 2.
   f. L # 61 Siemens make distance relay 7SA511 trips from CTPS end almost at the same time through Distance Zone 1 which was unusual.
      i. It has been seen in previous incidences also that for very close in bus faults the relay suddenly issues a tripping signal in Zone 1 although the fault is read by the relay as a reverse fault till that point.
      ii. Downloaded DR reveals during changeover of the fault loop from AC to ABC and upon total collapse of all three phase voltages the relay trips.
   g. L # 35 & 36 [CTPS Putki] trips through Extended Zone 1 after Z2 time as Carrier is received in reverse fault.
   h. All the three ATRs trip through both HV & LV O/C relays as the fault was hanging till at least 1 sec as shown in the DR picked up in numerical differential relay of ATR # 1. It is seen that this fault starts as AN fault, gets transformed to AC phase to phase fault in 355ms and finally evolves to a three phase fault in another 55ms and continues as a three phase fault till the end of record (1sec)
   i. Unit # 2 trips through 86GG whose initiating relay was Back Up impedance which had operated correctly for the sustained bus fault causing total power fail in CTPS 132KV switchyard.
   j. Probably some instant before all three ATR trips Unit # 7 & 8 trip due to Auxiliary board failure due to sustained U/V.

REMEDIAL MEASURES:

1. FO Communication for L # 53 needs to be re-established.
2. Line # 7 Distance relay at Gola end needs to be reinstalled at the earliest.

Settings of Purulia CTPS lines at Purulia end has been revised to coordinate with Distance Zone 2.

DVC may explain.

Deliberation in the meeting

DVC informed that there were multiple faults in around CTPS due to extremely stormy weather with very high wind velocity, heavy rain, thunder and lightning. The presentation is enclosed at Annexure-B23.

ITEM NO. B.24: Repeated tripping 400 kV IBEUL Jharsuguda – II

Sl. No	Tripping Date	Tripping Time	Restoration Date	Restoration Time	Reason
1	18-04-17	16:22	18-04-17	16:22	At location no 2/0 jumper to tower body clearance was found less in R & B phase and Pilot insulator found missing
2	11-05-17	11:08	11-05-17	17:06	DT received from IBEUL end
3	13-05-17	19:12	15-05-17	13:13	Tree infringement found in R phase at Location No. - 18/8 and 18/9 (28 km from Jharsuguda end

4	21-05-17	11:42	22-05-17	14:41	Tree infringement found in R phase at Tower no 137 & 138 in R phase
5	22-05-17	21:13	24-05-17	12:57	Tree infringement in R phase
6	24-05-17	12:57	24-05-17	18:54	R-N FAULT
7	26-05-17	19:50	27-05-17	21:46	Y-N FAULT

Analysis of the tripping incident at 19:50 hrs on 26-05-17 is given in **Annexure-B24**.

IBEUL & POWERGRID may explain.

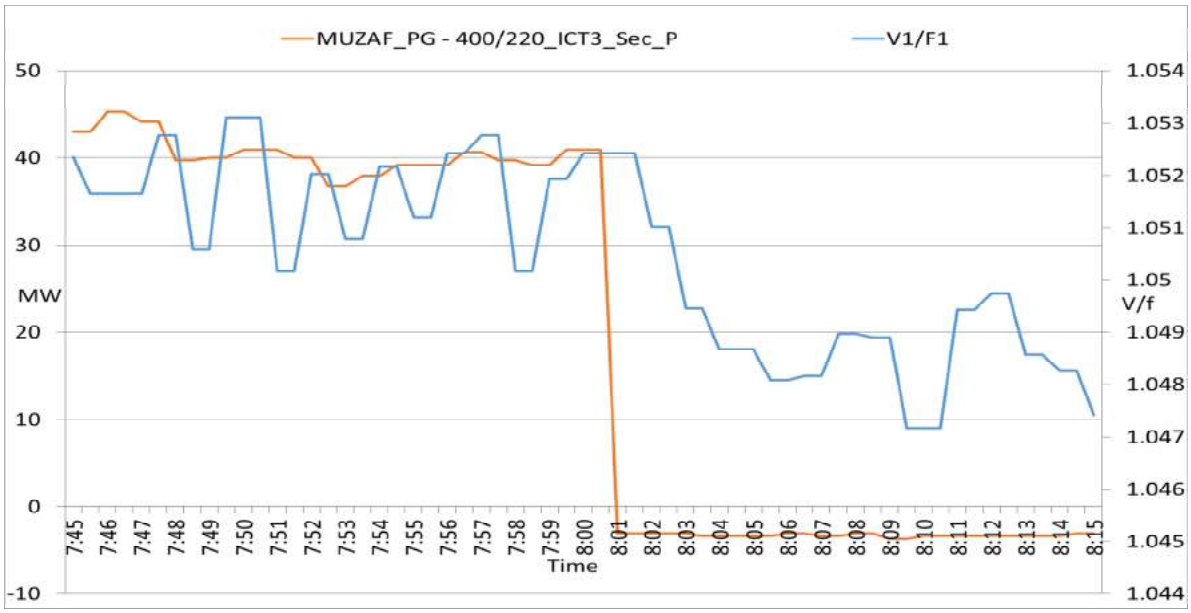
Deliberation in the meeting

IBUEL representative was not available in the meeting.

Powergrid informed that proper tree cutting is required to avoid such faults and IBEUL is not taking any corrective action.

ITEM NO. B.25: Tripping of 400/220 kV ICT – III at Muzaffarpur at 07:59 hrs on 27-05-17

400/220 kV ICT – III at Muzaffarpur tripped due to operation of overflux protection. As per SCADA data, V/f ratio was 1.052 at Muzaffarpur at the time of tripping. POWERGRID may check overflux protection of ICT – III.



POWERGRID may explain.

Deliberation in the meeting

Powergrid explained the tripping with DR and informed that the over flux relay setting is 1.1.

ITEM NO. B.26: Repeated pole blocking at HVDC Sasaram

S. No.	Tripping Date	Tripping Time	Brief Reason/Relay Indication	Restoration Date	Restoration Time	Duration
1	29-05-17	00:15	System failure alarm	29-05-17	01:24	1:09:00
2	25-04-17	06:03	Auxiliary supply failure	25-04-17	07:14	1:11:00

3	01-04-17	09:15	Tripped due to Valve cooling system problem	01-04-17	12:56	3:41:00
4	11-04-17	23:32	System failure alarm	12-04-17	00:17	0:45:00
5	30-04-17	03:24	Due to tripping of filters on eastern side	30-04-17	16:13	12:49:00
6	12-01-17	13:36	Blocked due to unbalanced auxiliary system	12-01-17	15:06	1:30:00
7	14-01-17	05:03	Tripped due to system failure alarm	14-01-17	08:57	3:54:00
8	10-01-17	13:23	Filter problem at Sasaram	12-01-17	11:24	46:01:00
9	03-01-17	11:00	To take pole in service in HVDC mode	10-01-17	07:42	164:42:00
10	03-12-16	12:15	Converter control protection operated	03-12-16	13:22	1:07:00
11	06-12-16	19:12	Tripped due to CCP east side M1, M2 major alarm and observed sys fail in East side	06-12-16	20:55	1:43:00
12	19-12-16	12:43	Due to tripping of 400 kv Biharshariff-Sasaram-II	19-12-16	13:35	0:52:00
13	05-11-16	04:51	System fail alarm	05-11-16	06:57	2:06:00
14	22-11-16	12:12	CCP Main-2 major alarm	22-11-16	13:35	1:23:00
15	26-11-16	09:36	CB of filter bank burst	27-11-16	11:31	25:55:00

Detail report is not yet to be received from POWERGRID. Regarding pole block on 25-05-17, there is back up in the station in the following form:

132/33 KV Pusauli	315 MVA ICT-2 tertiary	01 No. DG set of 1500 KVA	Battery available for valve cooling system only. It can provide auxiliary supply for at max 2 minutes.

Powergrid may explain.

Deliberation in the meeting

PCC advised Powergrid to submit the details to ERLDC and ERPC.

ITEM NO. B.27: Unbalanced loading in 400 kV PPSP - Bidhannagar - I with no or minimum flow in B phase from 28-05-17 night to 29-05-17

There was unbalanced loading in 400 kV PPSP - Bidhannagar - I with no or minimum flow in B phase from 28-05-17 night to 29-05-17 morning due to broken conductor. Protection setting of 400 kV PPSP - Bidhannagar - I and PPSP machines may be shared. Possibility of enabling A/R feature at PPSP end may be explored.

WBSETCL may explain.

Deliberation in the meeting

WBSETCL informed that broken conductor alarm appeared but no such incidence reported.

PART- C:: OTHER ITEMS

FOLLOW-UP OF DECISIONS OF THE PREVIOUS PROTECTION SUB-COMMITTEE MEETING(S)

(The status on the follow up actions is to be furnished by respective constituents)

ITEM NO. C.1: Disturbance at 400/220 kV Biharsharff S/s on 28-04-17 at 00:02 Hrs.

At 00:02 hrs, bursting of Y Phase CT of 132 kV side of 220/132 kV ATR - III at Fatua resulted in tripping of all 315*3 MVA 400/220 kV ICTs at Biharshariff in back up O/C. At same time, 220 kV Biharshariff - Fatua line-1 tripped from Biharshariff end on zone 3 (fault distance 104.1 km).

There was continuous power flow through 220KV TTPS line incomer source to BSPTCL , BSF and hence there was no total power failure here.

In PMU data, fault has been observed in all three phases. Fault clearing time is 700 ms. Prior to tripping of ICTs, power flow through 400/220 kV ICTs was almost 510 MW. After tripping of ICTs, power flow in 220 kV Tenughat – Biharshariff S/C increased from 90 MW to 190 MW to feed local load at Biharshariff and Begusarai.

The relay Indications are as follows:

Time (Hrs)	**Details of tripping**	**Relay at local end**
00:02 hrs	400/220 kV ICT – I, II & III	O/C at 400 kV side
00:02 hrs	220 KV Biharsharif-Fatuha I	Distance protection P442-Active group-01,started phaseABC,Trip phase ABC,Z3,fault location-104.1km from BSF.

In 55th PCC, BSPTCL informed that there was Y-N fault in 132kV bus at Fatua due to bursting of Y Phase CT of 132 kV side of 220/132 kV ATR – III. Since the IDMT characteristics for over current E/F protection for 220/132 kV ATRs have been implemented to coordinate with downstream network, the protection relay took more time to operate. In the mean time, 220 KV Biharsharif-Fatuha-I tripped from Biharshariff end on zone 3 and 400/220 kV ICT – I, II & III at Biharsharif tripped from HV end on Over current protection.

PCC felt that in this case the fault should be cleared from 220/132 kV Fatua ATR and advised BSPTCL to implement the following:

- High set over current tripping should be implemented for 220/132 kV ATRs immediately within 2 days and report to ERPC and ERLDC.
- The directional over current E/F protection settings of transmission lines should be coordinated with 400/220 kV ICT – I, II & III settings so that for any fault in 220kV transmission line and downstream system, the 220kV lines should trip first and then 400/220 kV ICT – I, II & III. The time should be greater than zone 2 timing of the distance relay for better coordination. BSPTCL was advised to change the settings accordingly in coordination with Powergrid.

PCC felt that over current setting of 400/220 KV ICTs at Biharshariff S/s with 600A, 600 ms(DMT) is low and it is difficult to coordinate downstream relays with this setting and advised Powergrid to review the time setting for proper time coordination with BSPTCL system.

Powergrid and BSPTCL may update.

Deliberation in the meeting

BSPTCL informed that high set over current protection has been activated in the hv and lv side of the power transformers and the tms of the 220 kV lines have been modified to meet the definite time settings at PGCIL end. The revised settings are enclosed at Annexure-C1.

Powergrid informed that they have increased the time setting of over current protection 400/220 KV ICTs at Biharshariff S/s to 700 ms(DMT) with 600A.

ITEM NO. C.2: Disturbance at 220 kV Ramchandrapur S/s (JUSNL) on 02-04-17 at 19:01 hrs.

At 19:01 hrs, 132 kV Ramchandrapur – Adityapur D/C along with 220/132 kV ATR II & III and 220 kV B/C at Ramchandrapur tripped due to B-N fault at 132 kV Adityapur – Ramchandrapur – I (B phase insulator string was completely broken). At the same time, 132 kV Adityapur – Chandil S/C, 132 kV Adityapur – Rajkarswan S/C & 132 kV Chandil – Rajkarswan S/C tripped resulting load loss of 250 MW.

In PMU data, delayed fault clearance has been observed.

- As per the relay flags, there was a B-N fault in 132 kV Ramchandrapur – Adityapur line-I at 50% of the line and Ramchandrapur end cleared the fault in zone 1 but Adityapur end failed to clear the fault.
- As a result the fault got feed from 132 kV Ramchandrapur – Adityapur line-II and Ramchandrapur end failed/delayed fault clearing hence the 220/132 kV ATR II & III tripped from 132kV end.
- The other fault feeding lines 132 kV Adityapur – Chandil S/C, 132 kV Adityapur – Rajkarswan S/C & 132 kV Chandil – Rajkarswan S/C also tripped to clear the fault.

The relay Indications at 132kV Ramchandrapur S/s are as follows:

S.No.	NAME OF FEEDER	TRIPPING TIME	CLOSING TIME	RELAY [RCP End]	RELAY [Remote End]	REMARKS
1.	132KV Adityapur – Circuit 1	19:02 Hrs.	10:28 Hrs. 03.04.17	B phase faiult,power swing, Zone 1, 4.424KM, 5.461KA in B phase		Due to fault in Adityapur circuit-1
2.	132KV Adityapur – Circuit 2	19:02 Hrs.	19:37Hrs.	O/C start I>1 ,O/V start V>1 ,power swing		
3.	220/132KV Transformer No. II	19:02 Hrs.	19:27 Hrs.	O/C in B-phase LV side		
4.	220/132KV Transformer No. III	19:02 Hrs.	19:36 Hrs.	O/C in B-phase LV side		
5.	220KV Bar coupler	19:34 Hrs.	20:42 Hrs.	None directional O/C and E/F ,master trip		
6.	220/132KV Transformer No. II	19:34 Hrs.	19:46 Hrs.	O/C in B-phase LV side		

In 55th PCC, JUSNL explained that

- There was a B-N fault at 132 kV Adityapur – Ramchandrapur line– I and Ramchandrapur end cleared the fault in zone 1 but Adityapur end failed to clear the fault.

- As a result the fault got feed from 132 kV Ramchandrapur – Adityapur line-II and Ramchandrapur end failed/delayed fault clearing hence the 220/132 kV ATR II & III tripped from 132kV end on over current protection.
- 132 kV Adityapur – Chandil S/C line tripped from Chandil on zone 3 and 132 kV Chandil – Rajkarswan S/C line tripped from Chandil end on Over current E/F protection
- 132 kV Adityapur – Rajkarswan S/C was not tripped

PCC felt that the fault should be cleared from 132 kV Adityapur S/s and advised JUSNL to carry out the following:

- Test the protection relays of 132 kV Adityapur – Ramchandrapur line– I at 132 kV Adityapur S/s
- Check the zone 3 time setting of 132 kV Adityapur – Chandil S/C at Chandil end as the line tripped within 350 ms.

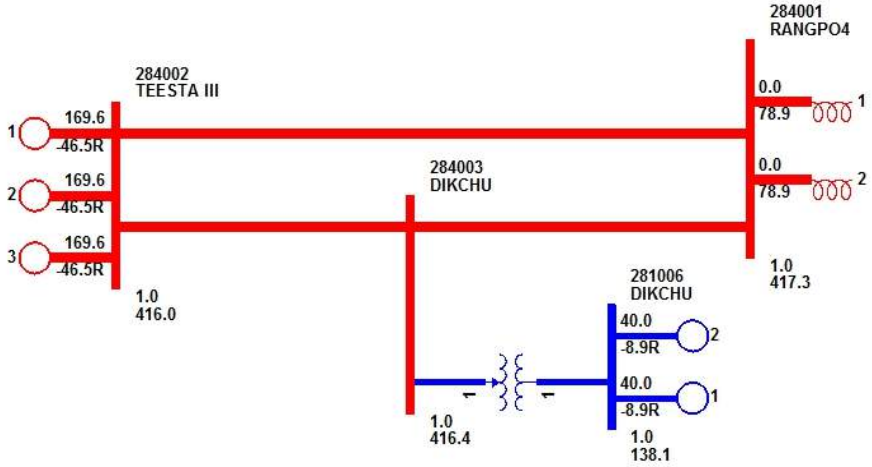
JUSNL may update.

Deliberation in the meeting

PCC advised JUSNL to comply the observations at the earliest.

ITEM NO. C.3: Tripping of 400 kV Teesta III - Dikchu S/C and 400 kV Teesta III - Rangpo S/C on 29-04-2017 at 15:57 Hrs.

1. **Single line diagram:** Submitted



2. **Pre fault conditions:** Not Submitted

3. **Detailed analysis of tripping incident:** Submitted

At 15:57 hrs, 400 kV Teesta III – Rangpo S/C and 400 kV Teesta – III – Dikchu S/C tripped along with 400/132 kV ATR at Dikchu resulting tripping of all running units at Teesta 3 and Dikchu due to loss of evacuation path.. At the same time, 400 kV Rangpo – Binaguri – II successfully auto reclosed at both ends.

Analysis of the tripping at Dikchu: 400/132 kV ATR at Dikchu tripped at 15:57 hrs due to REF protection on HV side. 400 kV Teesta III – Dikchu S/C tripped at 16:04 hrs (As per DR and EL data). Reason for tripping of Teesta III feeder is not recorded in DR. This feeder tripped from Teesta III end in differential protection (87C) at 15:57 hrs.

Analysis of the tripping at Teesta III: Both 400 kV Teesta III – Rangpo S/C and 400 kV Teesta III – Dikchu S/C tripped at 15:57 hrs due to differential protection (87C). In case of Teesta III – Dikchu S/C digital status of opening of only R and Y phase breaker is available in DR recorded at Teesta III

end. Same line tripped from remote end at 16:04 hrs. In case of Rangpo feeder, Picking up of Z-II (15:57:08.862 hrs) and sending DT signal (15:57:08.862 hrs) is recorded before picking up of Z-III (15:57:08.887 hrs) (though line tripped on 87C at 15:57:08.890 hrs)

Analysis of the tripping at Rangpo: 400 kV Teesta III – Rangpo S/C tripped at 15:57:09.446 hrs on receipt of DT signal at 15:57:09.417 hrs from remote end. Before receiving of DT signal, carrier signal was also received at 15:57:09.345 hrs. At 15:57:09.320 hrs, Z-IV was picked up. At the same time (15:57:09.318 hrs), R phase breaker of 400 kV Rangpo – Binaguri -II opened due to operation of Z-I protection. After 1 sec, 400 kV Rangpo – Binaguri –II successfully auto-reclosed at both ends.

4. **Disturbance record:** Submitted

Analysis of PMU plots:

- R-N fault has been observed at 15:57:09 hrs.
- Fault clearing time is less than 100 ms.
- No fault has been observed at 15:57:08 hrs.

Status of Reporting:

- DR from Dikchu, Teesta III and POWERGRID has been received by 01-05-17

Teesta 3, Dikchu and Powergrid may explain the following:

- As per DR, there were three different faults at same time (REF at 400/132 kV ATR at Dikchu, 87C at Teesta III, Transient fault at 400 kV Rangpo – Binaguri – II). As per PMU data, there was only one R-N fault at 15:57:09 hrs (Transient fault at 400 kV Rangpo – Binaguri – II). So reason for operation of REF protection at Dikchu and Differential protection (87C) at Teesta III may be explained.
- 400 kV Teesta III – Dikchu tripped at Teesta III end at 15:57 hrs and Dikchu end at 16:04 hrs. Teesta III and Dikchu may explain.
- Dikchu may explain the reason for opening of breakers of Teesta III feeder as it was not recorded in DR.
- Reason for non-opening of B phase breaker (As per digital status of DR) of 400 kV Teesta – III – Dikchu – S/C at Teesta – III end may be explained by Teesta III.
- Reason for sending DT signal and picking up Z-II before Z-III for 400 kV Teesta III – Rangpo S/C at Teesta - III end may be explained by Teesta – III.

Deliberation in the meeting

Teesta –III informed that the overcurrent relay settings of 400 kV Rangpo – Teesta III S/C line at Teesta –III end were not properly coordinated with differential and distance protection as a result the relay initiating the tripping for any transient fault in around Teesta-III.

Teesta-III added that they have modified the overcurrent relay settings and no unwanted tripping was reported thereafter.

ITEM NO. C.4: Disturbance at 400kV Vedanta S/s on 17-03-17 at 10:22 Hrs.

- All the three 400 kV SEL internal smelter feeders tripped on E/F resulting increase in 400 kV SEL – Raigarh S/C flow to 1400 MW.
- Though SPS has been implemented to limit the MW flow through 400 kV SEL – Raigarh S/C to 650 MW, more than 800 MW power was flowing through 400 kV SEL – Raigarh S/C for the duration of 17 minutes as per ERLDC SCADA data.
- Reason for non-operation of SPS of 400 kV SEL-Raigarh should be reviewed.

In 54th PCC, members felt that SPS scheme should operate as and when power flow in any of the

400 kV SEL-Raigarh or 400 kV SEL-Rourkela line is greater than 650 MW as per the designed SPS scheme and generation backing down of Vedanta units should be initiated in this case.

Vedanta informed that as per the present setting the SPS will be initiated if power flow in 400 kV line exceeds 800 MW. After this disturbance, SPS scheme at Vedanta end has been modified from summation logic to Individual line loading logic.

CE, NPC opined that the SPS settings should not be changed without detail discussion in PCC forum.

PCC took serious note of modifying the SPS settings without intimating ERPC /ERLDC and advised OPTCL & Vedanta to submit present SPS details immediately for further discussion in OCC/PCC meetings.

OPTCL may update.

Deliberation in the meeting

PCC advised OPTCL to submit the SPS settings at the earliest.

ITEM NO. C.5: Multiple elements tripping at 220/132 kV Lalmatia (JUSNL) S/s on 06-02-17 at 16:40 Hrs.

At 16:40hrs, blasting of 132 kV Y & B phase CTs of 132 kV bus sectionalizer at 220/132kV Lalmatia S/s resulted in following events:

- 132 kV Lalmatia - Kahalgaon and 132 kV Lalmatia - Dumka – II tripped from Lalmatia end on zone IV protection.
- 132 kV Lalmatia -Dumka – I feeder tripped from both end.
- Farakka end of 220 kV Farakka Lalmatia line, remain picked up the fault in zone 1 for 880 ms but no line breaker was tripped.

The relay Indications are as follows:

Time	Name of the element	Relay at Lalmatia	Relay at remote end
16:40 hrs	220 kV Lalmatia - Farakka feeder	Did not trip	R-Y-B phase Z-I started, B phase relay picked at 16:40:28.504 hrs, Y phase relay picked at 16:40:28.664 hrs, R phase relay picked at 16:40:28.905 hrs, F/C 1.5 kA in all three phases. All the relay were in picked condition till the end of time frame captured by NTPC end DR (DR is attached)
	132 kV Lalmatia - KhSTPP feeder	B-N, Z-IV, O/C, IA 0.7kA, IB – 0.9 kA, IC – 3kA, Fault duration 183.8 ms.	Did not trip
	132 kV Lalmatia Dumka – I	E/F	D/P
	132 kV Lalmatia Dumka – II	E/F, Z-IV	Did not trip
	220/132 KV ATR, 132/33 KV ATR – I & II at Lalmatia	E/F protection at Lalmatia	

Analysis of PMU plots:

- At 16:40 hrs, 4 kV voltage dip observed in all three phases.
- Fault clearance time is 700 ms. Though the voltage fully recovered to pre-fault value after 600 ms of the fault.

In 53rd PCC, NTPC informed that 132 kV Y & B phase CTs of 132 kV bus sectionalizer were busted at 220/132kV Lalmatia S/s and Bus bar protection was failed to operate. One 220/132kV ATR at Lalmatia (under NTPC control area) tripped on backup E/F protection other ATR which is under JUSNL control area was failed to clear the fault. As a result, 220kV Lalmatia-Farakka line tripped from Farakka end on directional E/F protection.

JUSNL informed that 132kV Lalmatia-Dumka D/C line and 132kV Lalmatia-Khahalgaon S/C line tripped from Lalmatia end on non directional over current protection. The 220/132kV ATR at Lalmatia under their control area also tripped on over current E/F protection.

PCC observed that 220kV Lalmatia-Farakka line tripped from Farakka end after 6 sec which is not acceptable and tripping of 220/132kV ATRs is not clear.

PCC advised the following:

- NTPC should check the reason for non-operation of busbar protection at 132kV Lalmatia S/s.
- NTPC and JUSNL should jointly test the healthiness of the busbar protection at 132kV Lalmatia S/s
- NTPC and JUSNL should place the details of ATR tripping along the relevant DR.
- JUSNL should disable the non-directional over current protection feature in all 132kV lines and enable directional over current protection with proper relay coordination.

PCC advised JUSNL and NTPC to submit the action taken report to ERPC and ERLDC within a week.

In 54th PCC, NTPC and JUSNL informed that they will test the healthiness of the busbar protection at 132kV Lalmatia S/s in May 2017.

JUSNL informed they have not yet disabled the non-directional over current protection feature in all 132kV lines.

NTPC and JUSNL may update.

Deliberation in the meeting

PCC advised JUSNL and NTPC to comply the observations at the earliest.

ITEM NO. C.6: Third Party Protection Audit

1. Status of 1st Third Party Protection Audit:

The compliance status of 1st Third Party Protection Audit observations is as follows:

Name of Constituents	Total Observations	Complied	% of Compliance
Powergrid	54*	46	85.19
NTPC	16	14	87.50
NHPC	1	1	100.00
DVC	40	26	65.00
WB	68	27	39.71
Odisha	59	38	64.41
JUSNL	34	16	47.06
BSPTCL	16	5	31.25
IPP (GMR, Sterlite and MPL)	5	5	100.00

** Pending observations of Powergrid are related to PLCC problems at other end.*

The substation wise status of compliance are available at ERPC website (Observations include PLCC rectification/activation which needs a comprehensive plan).

Members may update.

Deliberation in the meeting

PCC advised all the constituents to comply the pending observations at the earliest.

2. Schedule for 2nd Third Party Protection Audit:

The latest status of 2nd Third Party Protection audit is as follows:

1)	Jeerat (PG)	Completed on 15th July 2015
2)	Subashgram (PG)	Completed on 16th July 2015
3)	Kolaghat TPS (WBPDCL)-	Completed on 7th August 2015
4)	Kharagpur (WBSETCL) 400/220kV -	Completed on 7th August 2015
5)	Bidhannagar (WBSETCL) 400 &220kV	Completed on 8th September, 2015
6)	Durgapur (PG) 400kV S/s	Completed on 10th September, 2015
7)	DSTPS(DVC) 400/220kV	Completed on 9th September, 2015
8)	Mejia (DVC) TPS 400/220kV	Completed on 11th September, 2015
9)	400/220/132kV Mendhasal (OPTCL)	Completed on 2nd November, 2015
10)	400/220kV Talcher STPS (NTPC)	Completed on 3rd November, 2015
11)	765/400kV Angul (PG)	Completed on 4th November, 2015
12)	400kV JITPL	Completed on 5th November, 2015
13)	400kV GMR	Completed on 5th November, 2015
14)	400kV Malda (PG)	Completed on 23rd February, 2016
15)	400kV Farakka (NTPC)	Completed on 24th February, 2016
16)	400kV Behrampur(PG)	Completed on 25th February, 2016
17)	400kV Sagardighi (WBPDCL)	Completed on 25th February, 2016
18)	400kV Bakreswar (WBPDCL)	Completed on 26th February, 2016
19)	765kV Gaya(PG)	Completed on 1st November, 2016
20)	400kV Biharshariff(PG)	Completed on 3rd November, 2016
21)	220kV Biharshariff(BSPTCL)	Completed on 3rd November, 2016
22)	400kV Maithon (PG)	Completed on 18th May, 2017
23)	132kV Gola (DVC)	Completed on 17th May, 2017
24)	132kV Barhi (DVC)	Completed on 18th May, 2017
25)	132kV Koderma (DVC)	Completed on 18th May, 2017
26)	132kV Kumardhubi (DVC)	Completed on 19th May, 2017
27)	132kV Ramkanali (DVC)	Completed on 19th May, 2017
28)	220kV Ramchandrapur	Completed on 1st June, 2017
29)	400kV Jamshedpur (PG)	Completed on 1st June, 2017
30)	132kV Patherdih (DVC)	Completed on 31st May, 2017
31)	132kV Kalipahari (DVC)	Completed on 30th May, 2017
32)	132kV Putki (DVC)	Completed on 31st May, 2017
33)	132kV ASP (DVC)	Completed on 30th May, 2017
34)	132kV Mosabani (DVC)	Completed on 2nd June, 2017
35)	132kV Purulia (DVC)	Completed on 1st June, 2017

It was informed that the third party protection audit observations are available in the ERPC website in important documents.
PCC advised all the constituents to comply the observations at the earliest.

Members may update.

Deliberation in the meeting

Members noted.

ITEM NO. C.7: Zone-2 setting of long line followed by short line

As per ERPC/CEA protection guidelines Zone-2 time setting of two adjacent lines needs to be properly co-ordinated to avoid undesirable trippings on account of racing between relays. In the past major disturbances occurred due to lack of proper coordination in Zone-2 time setting.

For proper coordination of operation of Zone-2 Distance Protection, an effort has been made to list out the adjacent shortest line for 400 kV transmission lines, and all the lines whose Zone-2 reach is overlapping with that of adjacent lines have been highlighted. The details are given in **Annexure-C7**.

Concerned transmission utilities are requested to review the same and share the present Zone-2 time setting and update in case of mismatch.

In 48th PCC, all the constituents were advised to go through the Annexure and review the settings with intimation to ERPC and ERLDC.

In 54th PCC, Powergrid ER-I, ER-II and Powergrid-Odisha have submitted the details.

Members may update.

Deliberation in the meeting

Members noted.

ITEM NO. C.8: Line over voltage protection settings for 400 kV and 765 kV Lines in Eastern Region

Last year over voltage protection setting for all 400 kV and above lines was collected from the constituents. However, in the meantime many changes took place in the system, which includes commissioning of new lines as well as LILO of existing line.

Further CEA guidelines suggest that the following should be considered while setting over voltage protection in transmission line.

FOR 400kV LINES: *Low set stage (Stage-I) may be set in the range of 110% - 112% (typically 110%) with a time delay of 5 seconds. High set stage (Stage-II) may be set in the range 140% - 150% with a time delay of 100milliseconds.*

FOR 765kV LINES*: Low set stage (Stage-I) may be set in the range of 106% - 109% (typically 108%) with a time delay of 5 seconds. High set stage (Stage-II) may be set in the range 140% - 150% with a time delay of 100milliseconds.*

However, for over voltage Stage-I protection, a time grading of 1 to 3 seconds may be provided between overvoltage relays of double circuit lines. Grading on overvoltage tripping for various lines emanating from a station may be considered and same can be achieved using voltage as well as time grading. Longest timed delay should be checked with expected operating time of Over-fluxing relay of the transformer to ensure disconnection of line before tripping of transformer.

It is desirable to have Drop-off to pick-up ratio of overvoltage relay better than 97% (Considering limitation of various manufacturers relay on this aspect).

Present overvoltage setting record available at ERLDC is given in **Annexure-C8**. Concerned transmission utilities are requested to provide the missing information and updated the exiting one (if any).

In 48th PCC, all the constituents were advised to go through the Annexure and update the settings, if any.

In 52nd PCC, Powergrid ER-I has submitted the over voltage settings. PCC advised all other

constituents to update the settings.

In 54th PCC, Powergrid ER-I, ER-II and Powergrid-Odisha have submitted the details.

Members may update.

Deliberation in the meeting

Members noted.

ITEM NO. C.9: Implementation of Protection Database Management System Project.

ERPC proposal for "Creation & Maintenance of web based protection database management system and desktop based protection calculation tool for Eastern Regional Grid" has been approved by the Ministry of Power for funding from Power System Development Fund (PSDF) vide No-10/1/2014-OM dated 07.03.2016.

In 49th PCC, PRDC informed that data collection for West Bengal is in progress and it will be completed by December, 2016.

In 50th PCC, It was informed that Software Acceptance Tests are in progress.

In 51st PCC, PRDC informed that data collection of Odisha and Jharkhand has been completed. Data collection in West Bengal and Bihar is in progress. Data collection of Eastern Region will be completed by 15th February 2017.

PRDC added that software acceptance trails of PSCT phase-I have been completed and phase-II will be done from 19th to 21st January 2017. Software acceptance trails of web based PDMS system have been completed and observations will be implemented at the earliest.

It was informed that a format for on-line reporting of tripping incidence has been prepared in PDMS and PRDC will present details in next PCC meeting.

In 52nd PCC, PRDC explained the format for on-line reporting of tripping incidence.

PCC suggested PRDC to include details of the elements under shutdown before the disturbance.

In 53rd PCC, PRDC informed that data survey and modeling has been completed and PDMS will be operational by 31st March 2017. The login id will be provided soon.

PRDC presented the format for on-line reporting of tripping incidence.

PCC in principle agreed with the format and advised PRDC to include a summery sheet for the each tripping incidence.

In 54th PCC, PRDC informed that summery sheet for on-line tripping incidence reporting has been prepared. The PDMS is operational and constituents can access the data. Login credentials were given to all the constituents.

It was decided that a separate meeting will be convened in May 2017 to finalize the procedure for on-line reporting and data updation.

In 55th PCC, PRDC informed that collection of relay settings 97 out of 112 substations were completed in Bihar. Rest are in progress.

Pending relay setting file collection of JUSNL substations are in progress. Relay setting file collection of Sikkim substations are pending.

PRDC may update.

Deliberation in the meeting

PRDC informed that relay setting file collection of BSPTCL and Sikkim substations are in progress.

ITEM NO. C.10: Non-commissioning of PLCC / OPGW and non-implementation of carrier aided tripping in 220kV and above lines.

According to CEA technical standard for construction of electric plants and electric lines -Clause 43(4) (c), transmission line of 220 KV and above should have single-phase auto-reclosing facility for improving the availability of the lines. However, from the tripping details attached June-August, 2016 it is evident that the some of 220kV above Inter & Intra-Regional lines do not having auto-reclose facility either at one end or at both ends. Out of these for some of the lines even PLCC/OPGW is not yet installed and carrier aided protection including Autorecloser facility is not yet implemented. Based on the trippings of June- August, 2016 and PMU analysis a list of such lines has been prepared and as given below:

List of line where auto reclose facility is not available(Information based on PMU data analysis)

S. No	Transmission Lines name	Date of Tripping	Reason of Tripping	Owner Detail		Present Status	
				End-1	End-2	OPGW/PLCC Link available	AR facility functional
10	400KV PATNA-BALIA-II	21.06.16	B-N FAULT	PGCIL	PGCIL		
12	400KV PATNA-BALIA-I	21.06.16	R-N FAULT	PGCIL	PGCIL	PLCC available	
13	220KV BUDIPADAR-KORBA-II	23.06.16	Y-N FAULT	OPTCL	CSEB	PLCC available	will be activated in consultation with Korba
14	400 KV ARAMBAGH - BIDHANNAGAR	02.07.16	Y-N FAULT	WBSETCL	WBSETCL	PLCC available	AR in service but some problem in y-ph pole
16	400 KV NEW RANCHI - CHANDWA - I	13.07.16	B-N FAULT	PGCIL	PGCIL	PLCC available	
17	220 KV TSTPP-RENGALI	17.07.16	EARTH FAULT	NTPC	OPTCL		
18	220KV BUDIPADAR-RAIGARH	21.07.16	EARTH FAULT	OPTCL	PGCIL	PLCC defective	
19	400 KV KOLAGHAT-KHARAGPUR	03.08.16	Y-N FAULT	WBPDCL	WBSETCL		
20	220 KV FARAKKA-LALMATIA	03.08.16	B-N FAULT .	NTPC	JUNSL	Yes	Old Relay and not functional. 7-8 months required for auto re-close relay procurement.
21	400 KV PURNEA-MUZAFARPUR-I	03.08.16	R-N FAULT	PGCIL	PGCIL	PLCC available	
23	220 KV MUZAFFARPUR - HAZIPUR - II	10.08.16	B-N FAULT	PGCIL	BSPTCL		Voice established.

							For carrier required shutdown
24	220 KV ROURKELA - TARKERA-II	11.08.16	B-N FAULT	PGCIL	OPTCL	OPGW available	Expected to install protection coupler by Jan 17
25	220 KV CHANDIL-SANTALDIH	25.08.16	R-N FAULT	JUSNL	WBPDCL	not available	
26	400 KV MPL-RANCHI-II	02.09.16	R-N FAULT	MPL	PGCIL	PLCC available	
27	220 KV BIHARSARIF-TENUGHAT	07.09.16	B-N FAULT	BSPTCL	TVNL		
29	220 KV RAMCHANDRAPUR - CHANDIL	22.09.16	B-N FAULT	JUSNL	JUNSL		
31	400 KV KOLAGHAT - CHAIBASA	28.09.16	B-N FAULT	WBPDCL	PGCIL	PLCC available	

34th TCC advised all the respective members to update the above list along with the last tripping status in next PCC meeting.

TCC further advised all the constituents to give the latest status of PLCC of other 220kV and above lines under respective control area.

TCC advised to review the status of above in lower forums report back in next TCC.

Members may update the status.

Deliberation in the meeting

Members noted.

ITEM NO. C.11: Non-commissioning / non-functional status of bus-bar protection at important 220 kV Sub-stations.

It has been observed that at many 220 kV substations particularly that of STU, bus-bar protection is either not commissioned or non-functional. The non-availability / non-functionality of bus bar protection, results in delayed, multiple and uncoordinated tripping, in the event of a bus fault.This in turn not only results in partial local black out but also jeopardises the security of interconnected national grid as a whole. The matter was also pointed out during the third party protection audit which is being carried out regularly. Constituents are required to meet the audit compliance and commission or made bus –bar protection functional where ever it is not available. A list of such important 220 kV sub-stations as per the first third party audit is placed in the meeting.

In 34th TCC, members updated the status as follows:

Bus Bar Protection not availble (reccord as per third party protection audit)

Bihar				
Sl No	**Name of Substation**	**Bus Bar protection status**	**Date of audit**	**Present Status**
1	220 kV Bodhgaya	Not available	28-Dec-12	*Single bus and there is no space available for*

				busbar protection
Jharkhand				
1	220 kV Chandil	Not available	29-Jan-13	*LBB available*
2	220 kV Tenughat	Not available	12-Apr-13	
DVC				
1	220 kV Jamsedpur	Not available	10-Apr-13	*Single bus. Bus bar will be commissioned under PSDF.*
West Bengal				
1	220 kV Arambah	Not available	24-Jan-13	*Available in alarm mode. Planning to replace with numerical relay*
2	220 kV Jeerat	Not available	20-Dec-12	*Relays have been received at site. Installation is in progress.*

TCC further advised all the constituents to give the latest status of Bus Bar protection of other 220KV S/S under respective control area.

TCC advised to review the status of above in lower forums report back in next TCC.

Members may update.

Deliberation in the meeting

Members noted.

PART- D

Item No D.1 Tripping incidences in the month of May, 2017

Other tripping incidences occurred in the month of May 2017 which needs explanation from constituents of either of the end is given at **Annexure- D1**.

Members may discuss.

Deliberation in the meeting

Respective constituent members explained the tripping incidences. Updated status is given at **Annexure- D1**.

Item No D.2 Any other issues.

Meeting ended with vote of thanks to the chair.

****

Annexuse – A

Participants in 56th PCC Meeting of ERPC

Venue: ERPC Conference Room, Kolkata Time: 11:00 hrs Date: 22.06.2017 (Thursday)

Sl No	Name	Designation/ Organization	Contact Number	Email	Signature
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20	D. K. DAS	ACE, WBSETCL	9434910544	cectdwbsetcl@gmail.com	

"Coming together is a beginning, staying together is progress, and working together is success." –Henry Ford

Participants in 56th PCC Meeting of ERPC

Venue: ERPC Conference Room, Kolkata Time: 11:00 hrs Date: 22.06.2017 (Thursday)

Sl No	Name	Designation/ Organization	Contact Number	Email	Signature
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Participants in 56th PCC Meeting of ERPC

Venue: ERPC Conference Room, Kolkata Time: 11:00 hrs Date: 22.06.2017 (Thursday)

Sl No	Name	Designation/ Organization	Contact Number	Email	Signature
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Annexure-B5

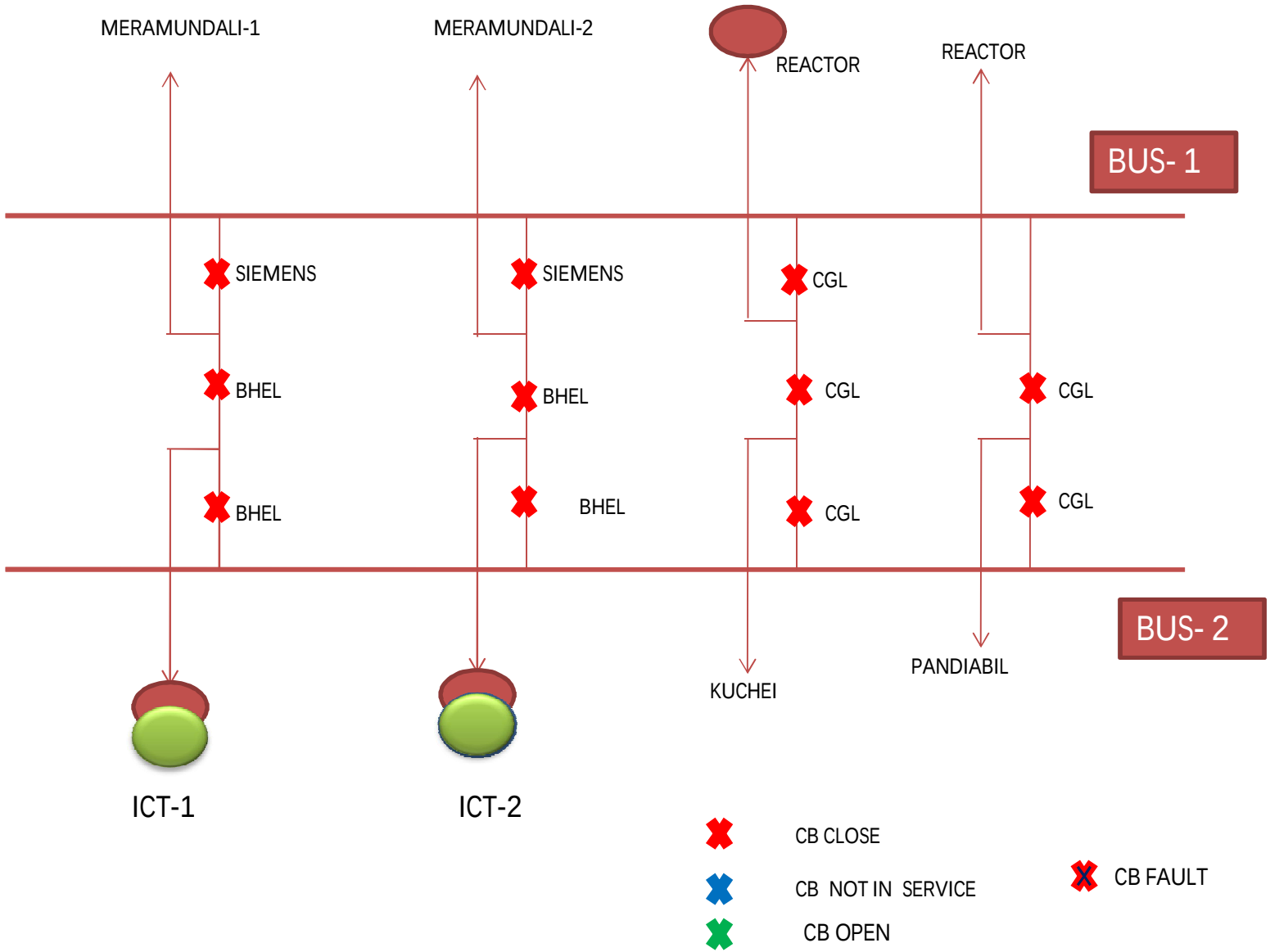
Tripping Details of 400 kV Feeders at New Duburi end.

Date	Time	Name of Feeder	Tripping details at New Duburi end	Tripping details at other end	
26.05.17	12.53 Hrs	400 KV New Duburi-Meramundali-1	DTT & LBB (BUS-1& TIE)Trip	DTT Trip	DR attached

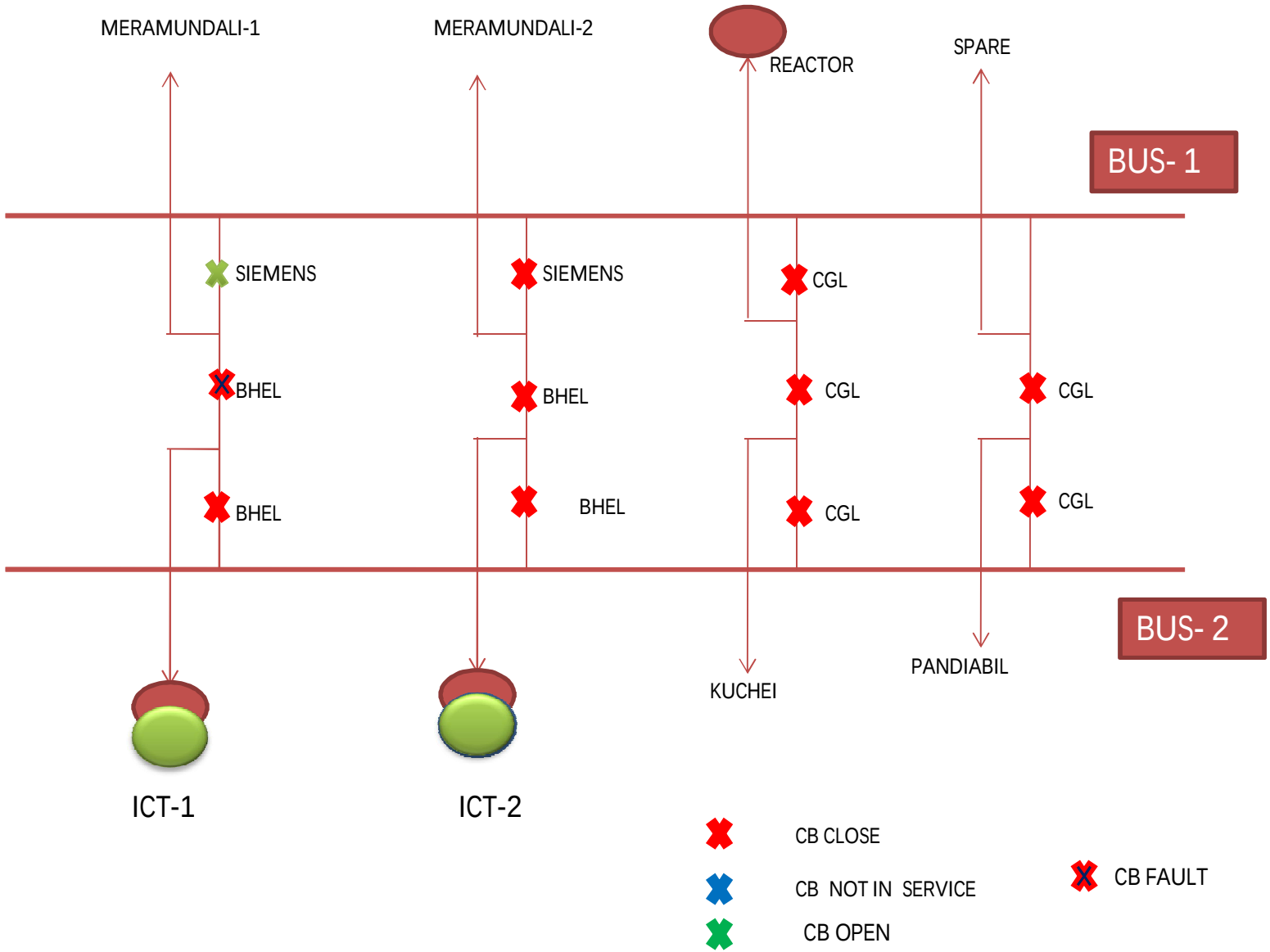
LOAD FLOW AT 400KV NEW DUBURI PRIOR TO DISTURBANCE

CIRCUTS	LOAD
1. 400 KV Meramundali ckt-1	-205 MW
2. 400 KV Meramundali ckt-2	-205 MW
3. 400 KV ICT-1	+160MW
4. 400 KV ICT-2	+160MW
5. 400 KV Pandiabil	+120MW
6. 400 KV Baripada	-30 MW
7. 400 KV Reactor	79 MVAR

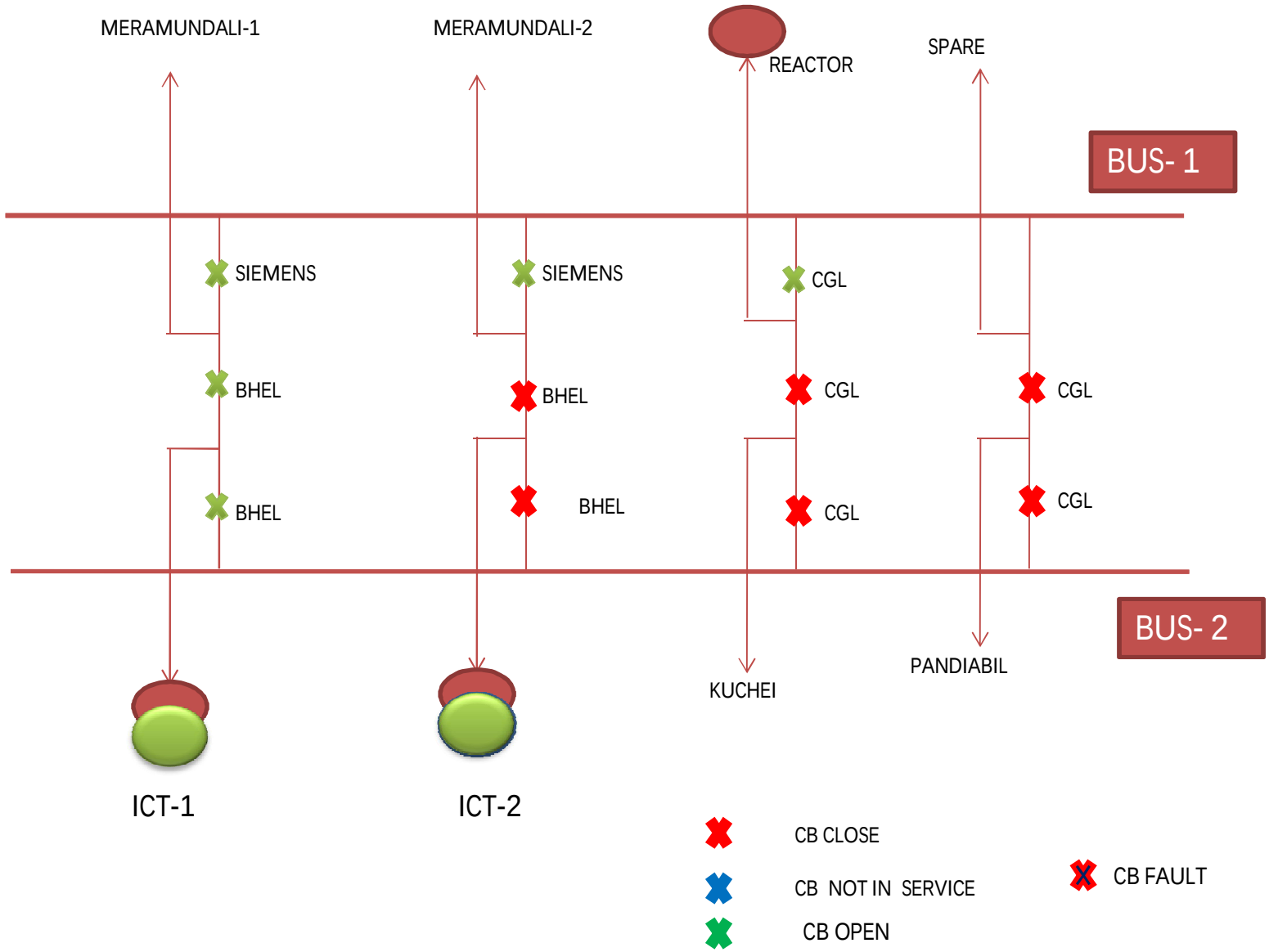
400KV NEW DUBURI GSS BEFORE FAULT ON 26.05.2017



400KV NEW DUBURI GSS DURING FAULT ON 26.05.2017



400KV NEW DUBURI GSS AFTER FAULT ON 26.05.2017



INCIDENT & ANALYSIS

- After receiving DT from Meramundali end on dated 26.05.17 at 12:53 hrs , Meramundali-1 (bus-1)& Tie CB tripped at New Duburi end but due to delay in tripping of B phase limb of Tie CB(BHEL Make) of 400 KV Meramundali-1 ,The Tie LBB operated of the said feeder.

- Though the Bus-1 CB had tripped , the digital input of CB status to its LBB relay was missing. The current was in the circuit due to non tripping of B phase limb of Tie CB. Hence, the Bus-I LBB was also actuated and tripped all the Bus-I circuit Breakers.

- The hydraulic mechanism of the Tie CB of BHEL make at Dia 405 (400 KV New Duburi- Meramundali-1) is not working properly.

REMEDIAL ACTION

- It is suggested to replace the Tie CB of BHEL make at Dia 405 (400 KV New Duburi- Meramundali-1).

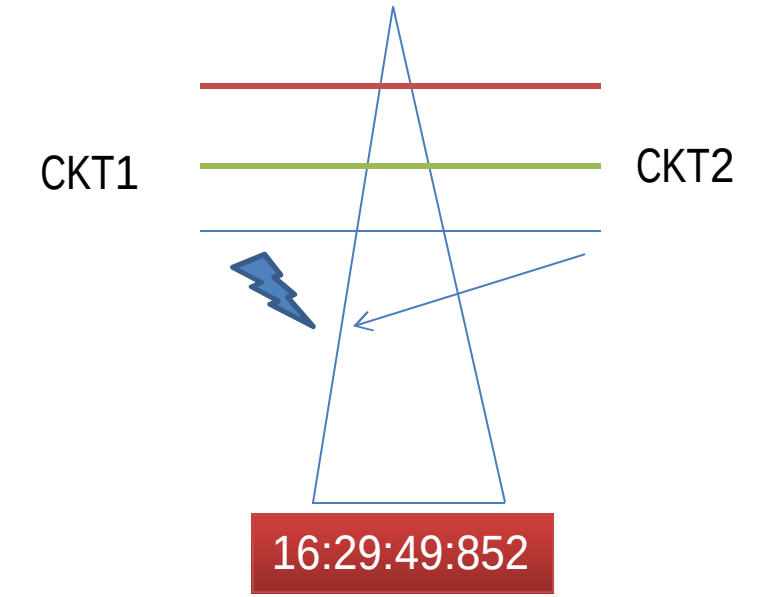
- The Bus-1 LBB relay input (CB status) circuit has been checked & found problem at BMK 405 & rectified.

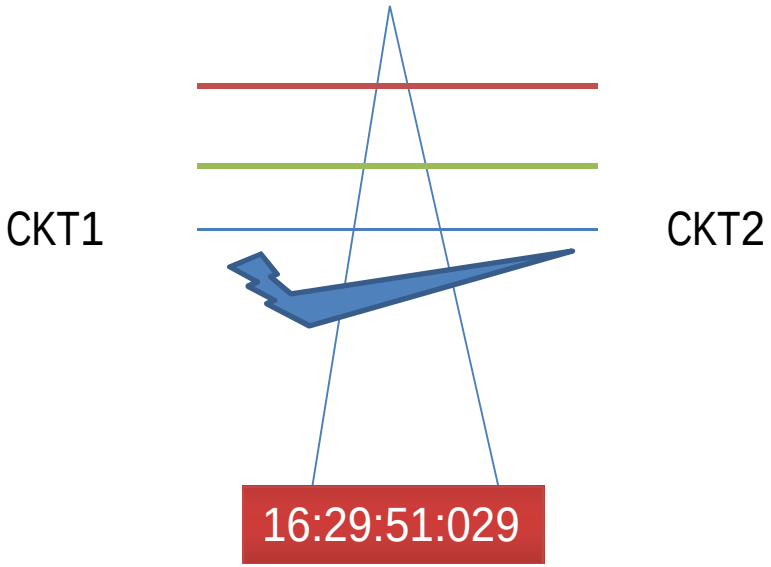
- The DT & Permissive circuit of 400 KV New Duburi-Meramundali-1 has been checked on 28.05.17 from this end and found healthy.

Annexure-B11

Disturbance Analysis Of HEL-Subhasgram tripping on 13.05.17

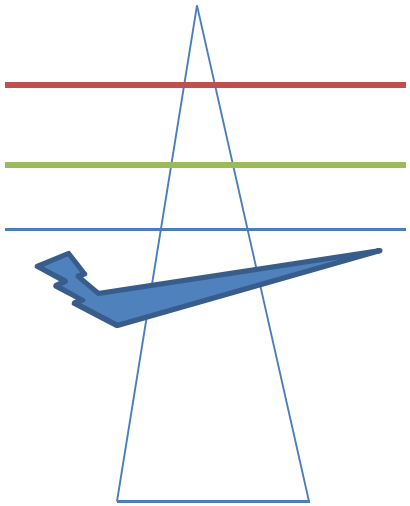
Saibal Ghosh
ERLDC,SS



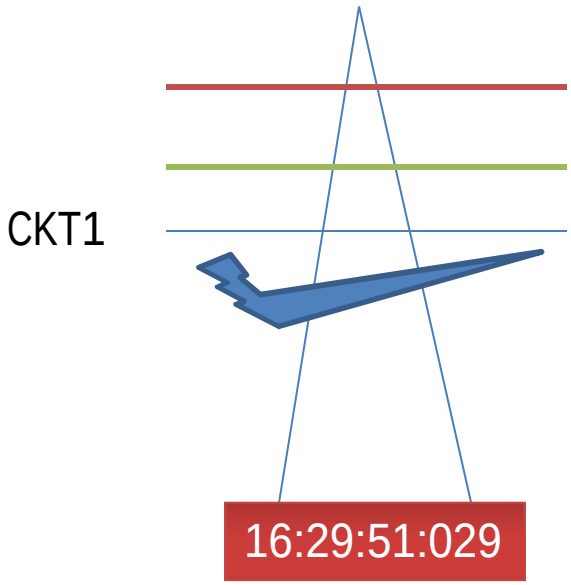


At 16:29:49:852 hrs HEL-SUBHASGRM LINE 1 SENSE FAULT IN B PHASE FROM BOTH END AND SINGLE POLE TRIPPING OCCUR. PG END Z1 , BOTH REL AND MICOM RELAY OPERATED .AT HEL END T1 TIMER START AND Z2 PICK UP IN P442 RELAY AND TRIP COMAND ISSUED BY P543 LINE DIFFERENTIAL RELAY . CARRIER RECEIVED FROM PG END HAS A DELAY OF 85 ms THAT'S WHY P442 DID NOT ISSUE PERMISSIVE TRIP Command AT HEL END. Also at the same time due to mutual coupling and via remote end and reverse direction line 2 sense the fault , that's why at both end for line 2 phase starter started but no tripping. Signature captured in DR of line 2.

Then at 16:29:51:029 AR attempt taken at HEL end and P442 picked up in z2 and T1 started and differential relay tripped and send inter trip to PG end. At PG end it tripped on TOR. Now again at both end the tripping is independent and both end are receiving signal sent from opposite end after the tripping

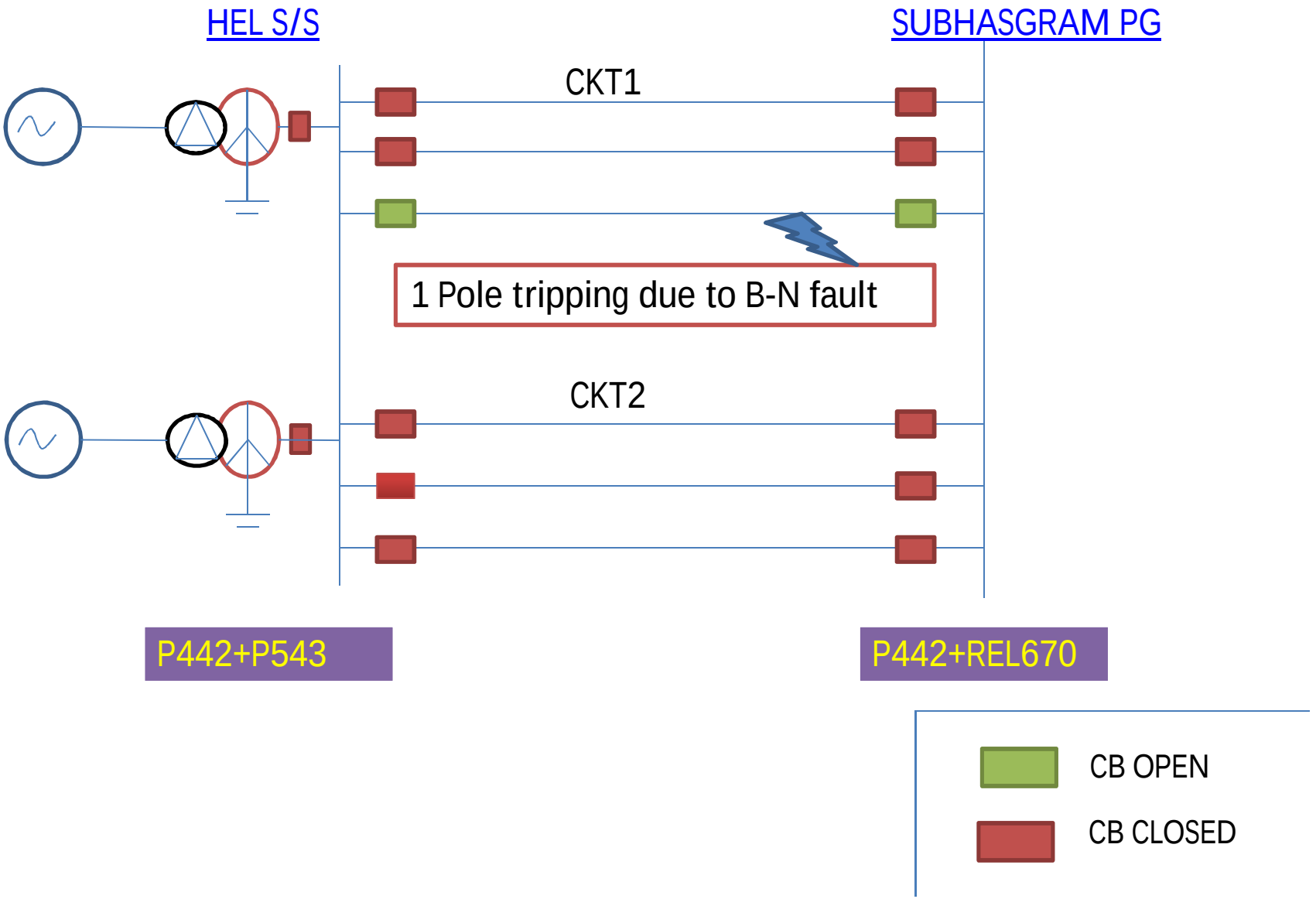


A time mapping is done and it is seen that even at the time of AR attempt taken at both end almost at the same time so this also indicates the delay may be due to communication problem

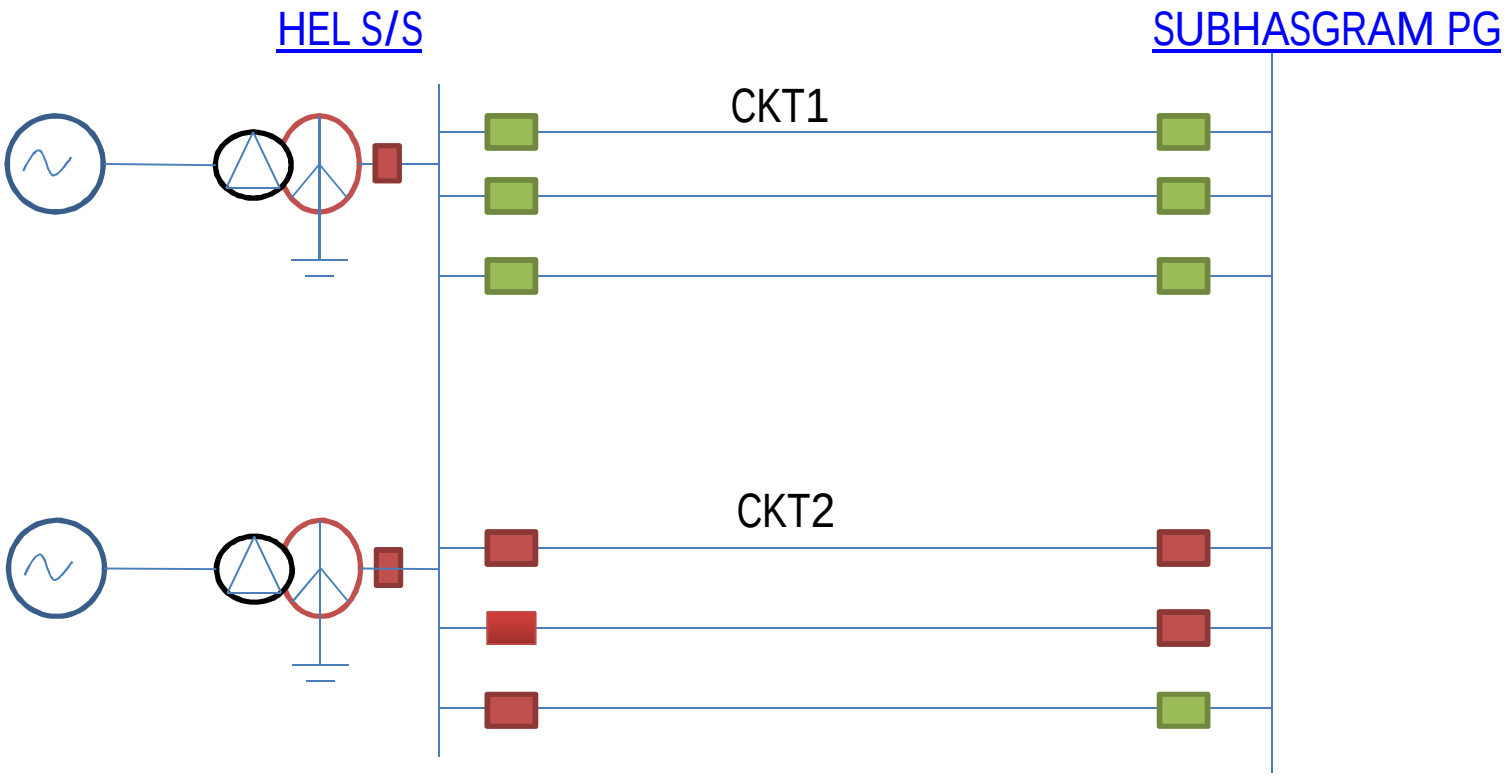


At 16:29:51:029 hrs during AR attempt on the 1st line there may be a fault developed on the other line (CKT 2) momentarily . Now both the relay(P442 & P543) at HEL end did not pick up only T1 timer started. Of P442. At PG end various starter zone picked up but no tripping by REL670 but P442 at PG end issued tripped command for B phase sensing FW Z1 fault . But no carrier send recorded in digital channel or nothing received at other end . And after 1sec from this point there was no A/R on open B phase at PG end or and after 1.5 sec from this point Stand by earth fault relay of GT operated at HEL and unit tripped

16:29:49:852 hrs



16:29:51:029 hrs

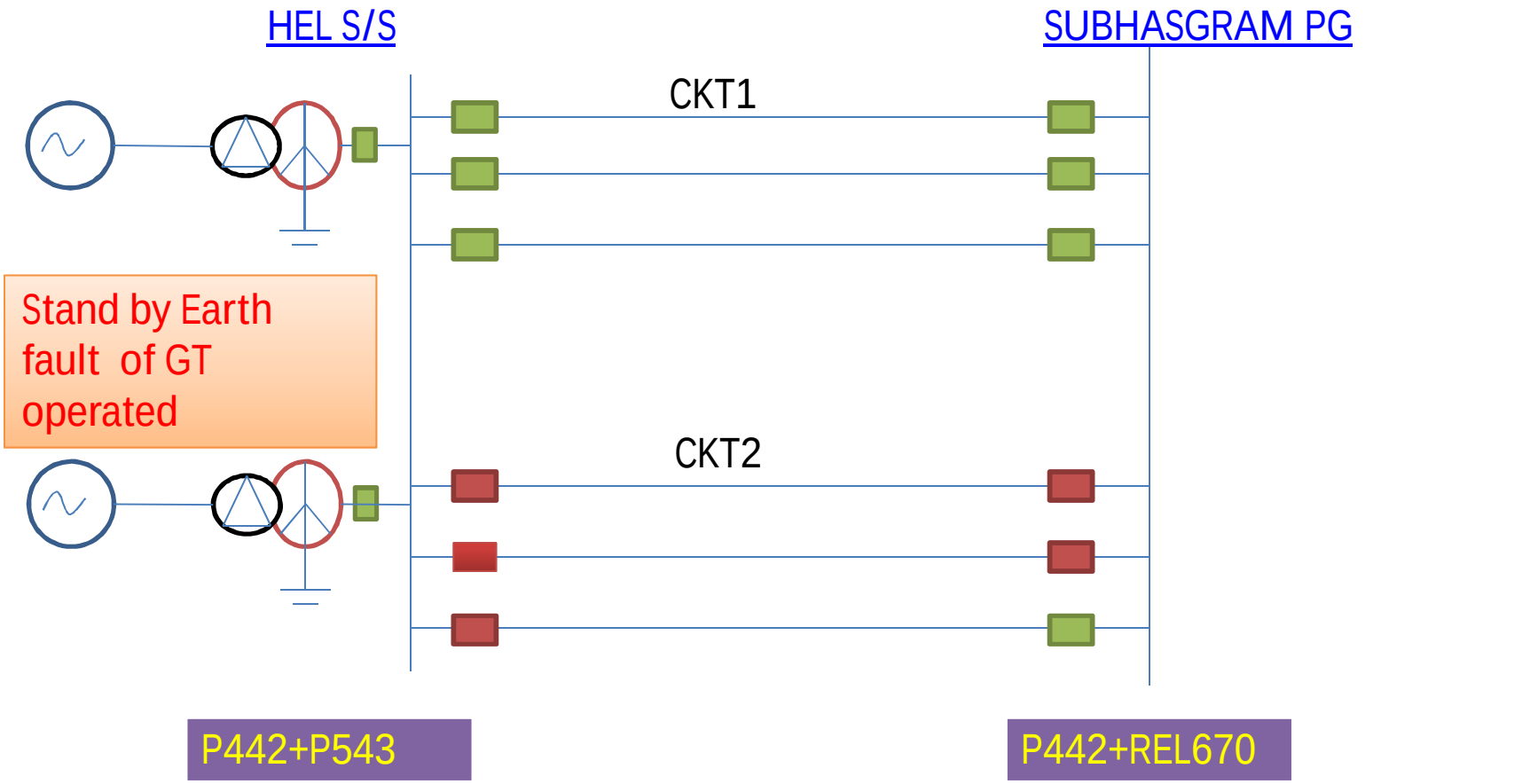


Current of C phase reduced and angle of Vc and Ic is 90 at HEL end (i.e charging current) this imply that CB did not opened from HEL end

CB OPEN

CB CLOSED

16:29:52:565 hrs



Summary

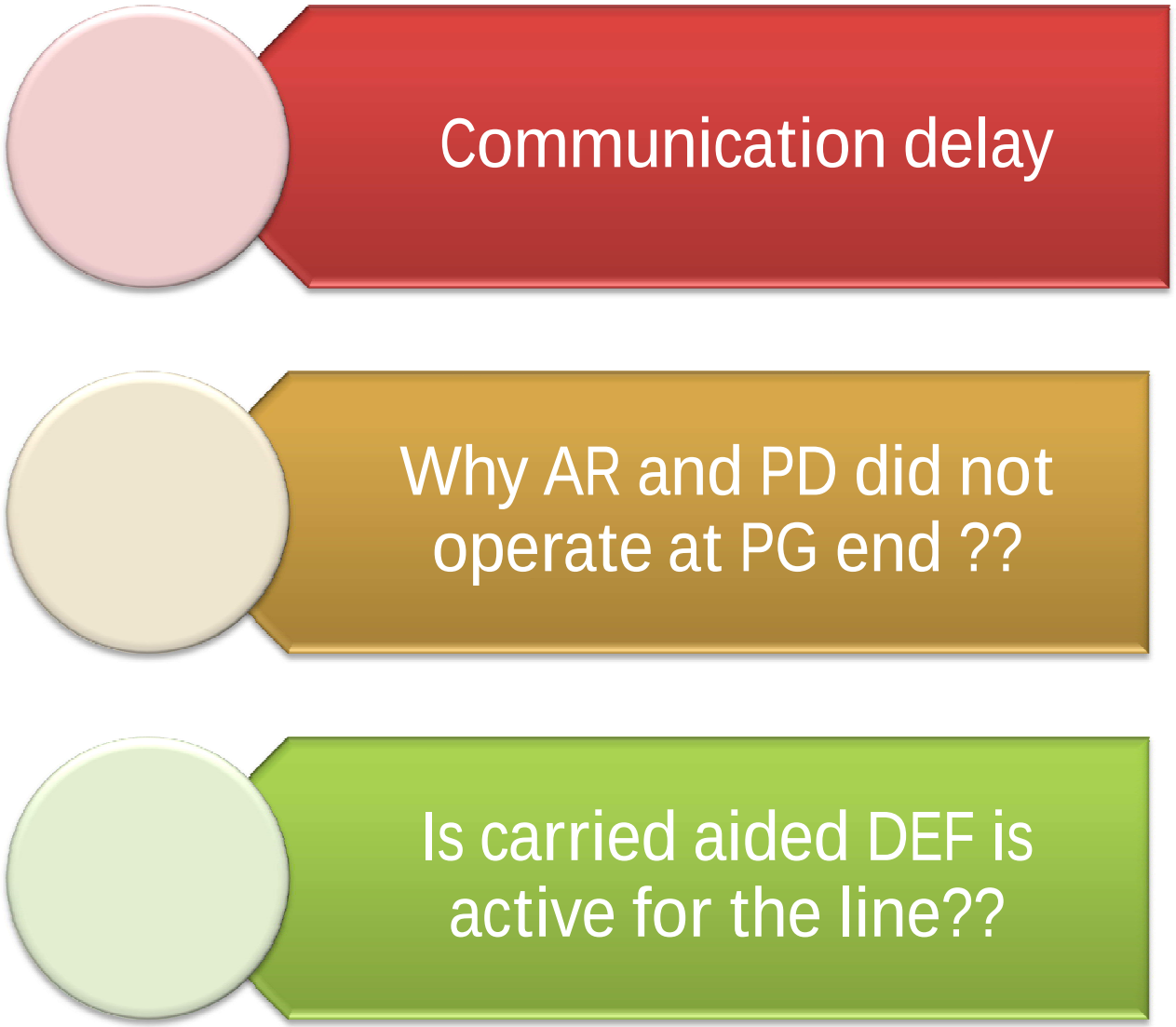
At 16:29:49:852 hrs line-1 B phase tripping + fault sensed by line -2 relay but no starter zone started only no action

At 16:29:51:029 hrs AR of line 1 and 3 phase tripping on TOR from PG end and Differential from other end + B phase tripping of line 2 from PG end only by p442

16:29:52:565 hrs stand by earth fault relay operated at HEL end and GT tripped

16:33:05:557 hrs line manually opened from HEL and DT sent to PG

Discrepancy



Annexure-B12

CESC DISTURBANCE AT 15:53 HRS

Islanding of CESC system due to fault in WB system

BUS TOPOLOGY

- Bus topology in CESC EMSS and Jadavpur S/s is attached in the next two slide.

220/ 132 KV EM BYPASS CESC SS TOPOLOGY

Sl No	Bay No.	Bay description (Feeder/element name)	Bay Type*	Nominal Voltage (kV)
1	Main 1	JADAVPUR	Feeder	132
2		160MVA T-4	Transformer	132
3		160MVA T-3	Transformer	132
4	Main 2	160MVA T-5	Transformer	132
5		160MVA T-1	Transformer	132
6		160MVA T-2	Transformer	132
7		PARK LANE	Feeder	132
8		PATULI	Feeder	132
9		50 & 30MVAR Cap Bank	Capacitor	132
10		PR ST T-3 Via Gantry at PRS		
11		PARK CIRCUS S/S	Feeder	132
12	Reserve	WBSEB 1	Feeder	132
13		ECAL GIS F.2	Feeder	132
14		ECAL GIS F.1		
15		WBSEB 2	Feeder	132
16		WBSEB 3	Feeder	132
17	Main 2	160MVA T-1	Transformer	220
18		160MVA T-2	Transformer	220
19		160MVA T-5	Transformer	220
20		SUBHASGRAM 1	Feeder	220
21		SUBHASGRAM 2	Feeder	220
22		NEW COSSIPORE-1	Feeder	220 KEPT OPEN
23		WBSETCL KASBA S/S	Feeder	220
24	Main 1	BBGS 1	Feeder	220
25		BBGS 2	Feeder	220
26		160MVA T-3	Transformer	220
27		160MVA T-4	Transformer	220
Remarks	132kV M-1 and Reserve bus lying coupled(synchronised with WBSETCL Kasba S/S). 132kV Main 2 bus lying separate(on Subhasgram S/S import). 220kV M-1 and M-2 bus lying separate.			

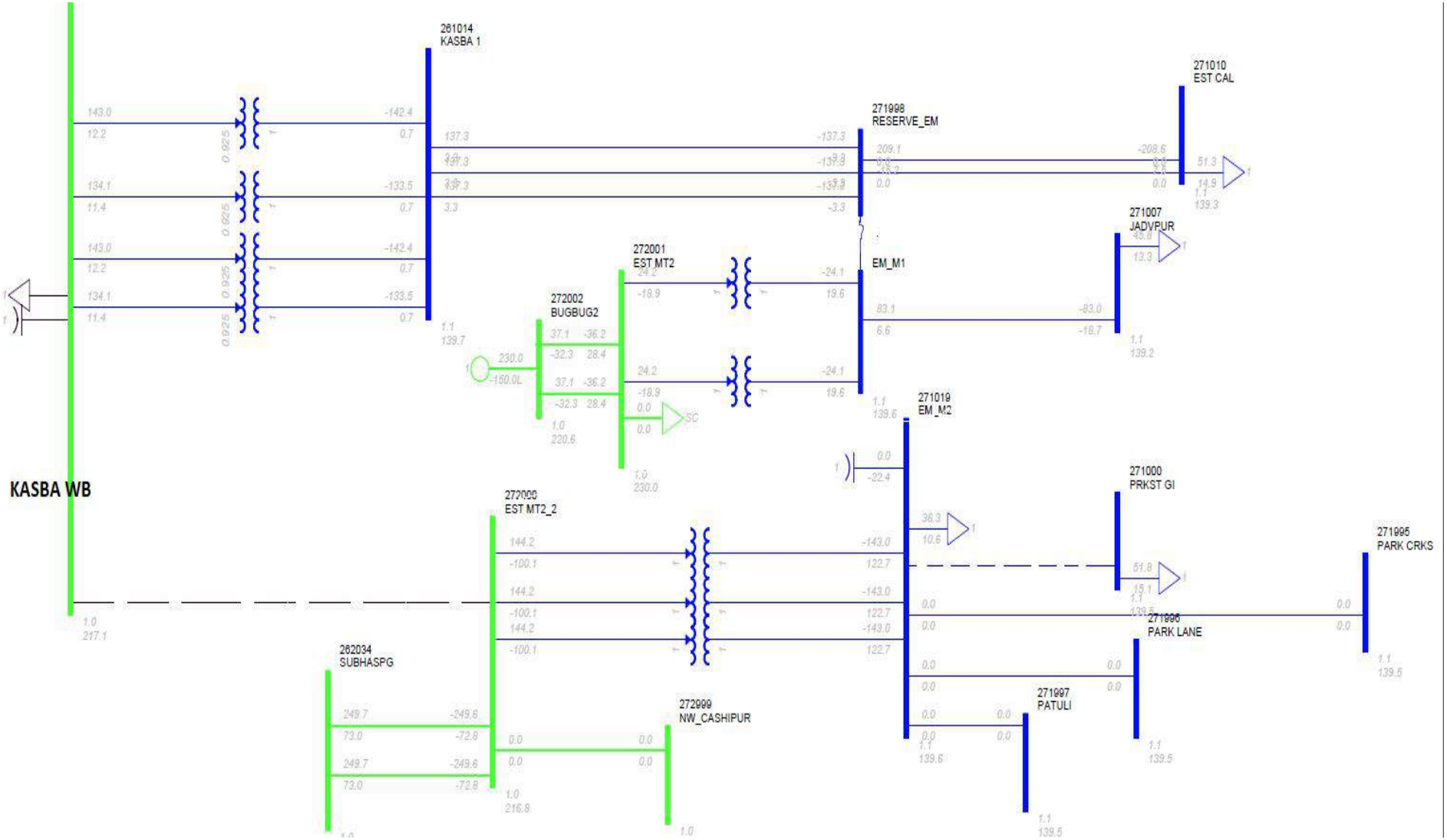
JADAVPUR SS BUS TOPOLOGY

Sl No	Bay No.	Bay description (Feeder/element name)	Bay Type*	Nominal Voltage (kV)
1	Main 1	75MVA T-1	Transformer	132
2		MAJ	Feeder	132
3	Main 2	EMSS	Feeder	132
4		75MVA T-2	Transformer	132
5		75MVA T-3	Transformer	132
Remarks	132kV Main 1 and Main 2 bus lying separate. Transfer bus lying coupled with Main 1 bus. No feeder at transfer bus			

PRE-CONDITION

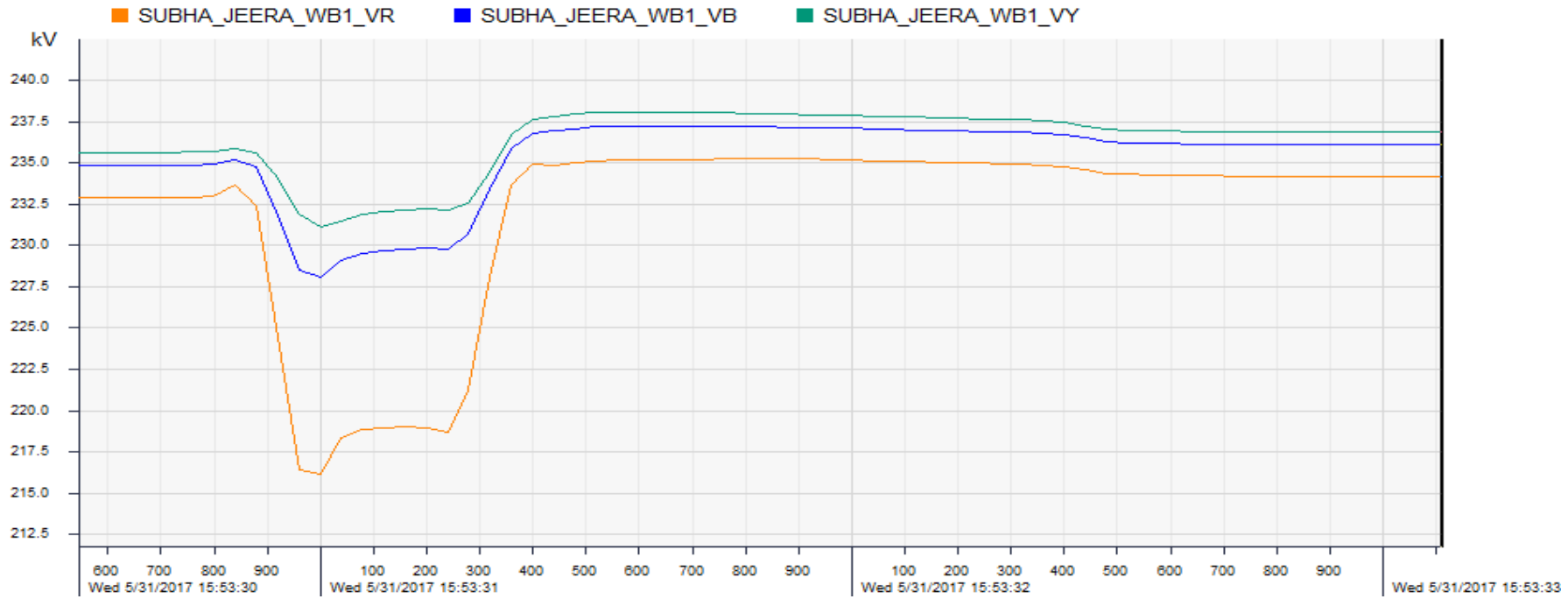
- CESC was synchronized at kasba point with the bus configuration as mentioned in the previous slide.
- CESC was importing around 180 MW from WB. And load of East calcutta was around 140 MW
- PATULI, PARK CRCKS PARK LANE THESE S/S was radially fed from Subhasgram PG source.
- Jadavpur and East calcutta GIS was fed in synchronized mode before disturbance
- SLD of pre fault condition attached attached next .

SLD OF EMSS


261014
KASBA 1
271010
EST CAL
271998
RESERVE_EM
271007
JADVPUR
272001
EST MT2
EM_M1
272002
BUGBUG2
271019
EM_M2
KASBA WB
272000
EST MT2_2
271000
PRKST GI
271995
PARK CRKS
271996
PARK LANE
262034
SUBHASPG
272999
NW_CASHIPUR
271997
PATULI

DISTURBANCE

- AT 15:53 hrs there was a R phase fault in 132 KV Kasba-saltlake-II line in west bengal system and there was delyed fault clearance(more than 350 ms) as recorded in PMU.



Continued..

- Now to avoid fault feeding in Grid out side CESC , they have put a protection logic at kasba . That is: BC between main 1 bus and reserve bus will open on directional overcurrent operation plus under voltage. With the following setting :

500 Amp towards grid from CESC And 83% under voltage this is the setting and there is a time 300 ms delay to allow z1 line protection(or other primary protection) to operate.

Continued..

- Today after the fault in 132 KV Kasba-saltlake-II there was 750 Amp current following towards wb and voltage dip upto 77% that's why bus coupler got opened and then on reserve bus at CESC kasba there was 3 in comer of wb and load of East calcutta GIS(140 MW)
- Main bus 1 along with jadavpur got seperated.

Continued..

- As previously import from wb was around 180 MW of which 140 was consumed by East calcutta and rest 40 MW was flowing through BC.
- Hence a net imbalance of 40 MW took place when CESC got separated .
- Hence under frequency occurred in CESC system and frequency goes upto 49.2 Hz when there UFR at chakmir S/s oerated and tripped 33/6 KV transformer supplying load of majerhat and budge-budge area.A load relief of around 40 MW is achieved and CESC sustain the disturbance .
- Then at 15:59 hrs they synchronized at Howrah point and increase the load.

ANNEXURE-B15

Tripping Analysis for Jamui-Sheikhpura-Lakhisarai incident

25 May 2017

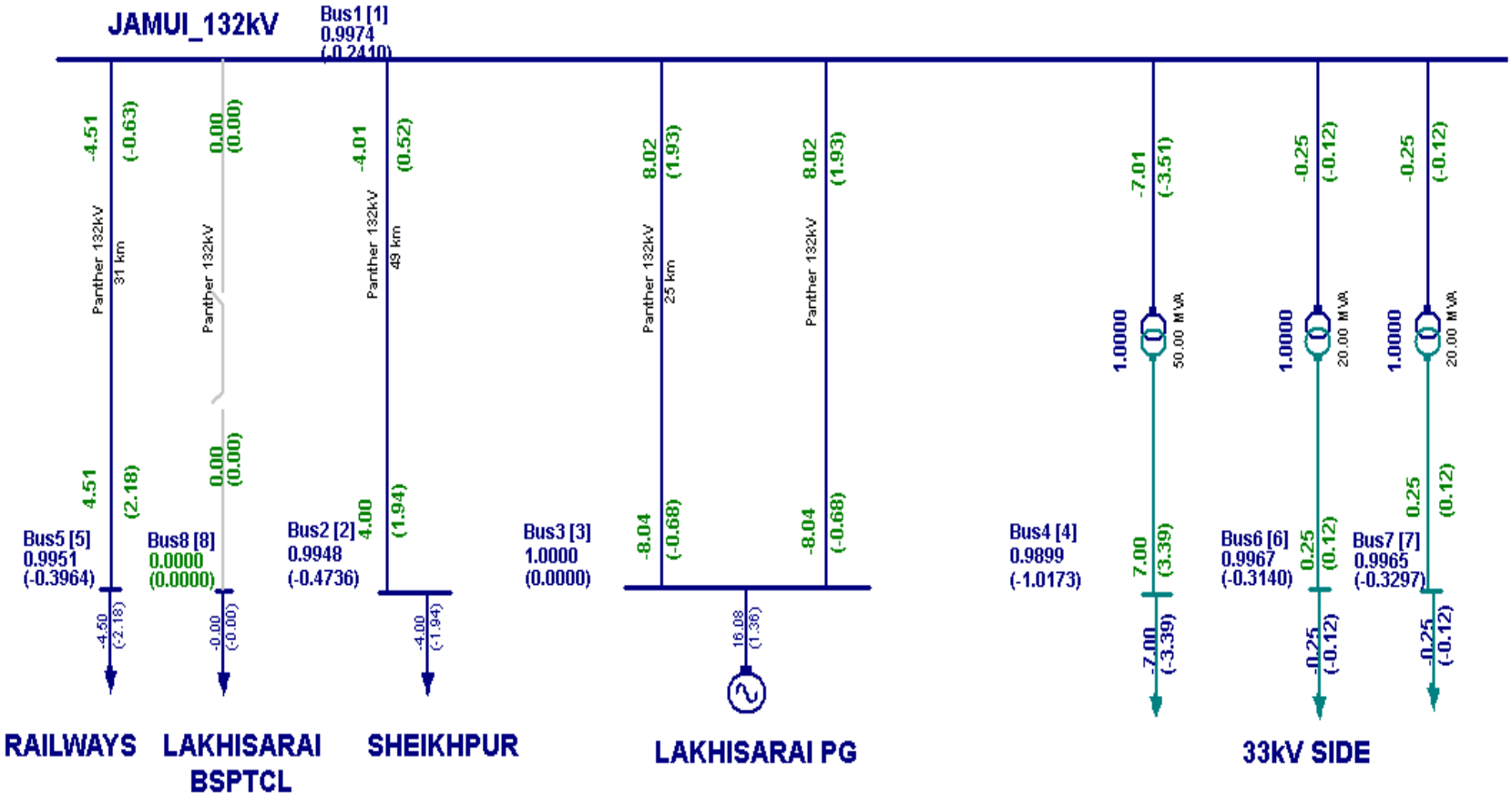
INCIDENT OVERVIEW

This report discusses about the details of tripping incident which occurred at Jamui substation on 25th May 2017 around 13.20 hours.

Phase to phase faults occurred between Jamui- Sheikhpura lines causing this line to trip in Z1. During charging again, the line did not hold and both the Jamui- Lakhisarai lines tripped. The latter lines were charged again and they hold. But when Jamui-Sheikhpura line was charged again , both Jamui- Lakhisarai feeders again tripped.

Affected system is modeled in MiP-PSCT™ software to understand the tripping incident and analyze sequence of events

MODELLED SLD WITH POWER FLOWS



Acts as an infeed to JAMUI

MAJOR OBSERVATIONS

- **Major observations obtained from the power flow study are**:

- No overloading was prevalent in any of the lines
- Jamui- Lakhisarai (BSPTCL) was OUT OF SERVICE.
- All the station voltages and line loadings were found within acceptable limits
- Jamui- Lakhisarai feeder act as a infeed to the substation.
- Power flow observed in all the connected lines is given in Table 1.

MAJOR OBSERVATIONS

Line details	Flow in MW as per study	Flow in MW as per BSPTCL data
LKR(PG)- Jamui-1	8.02	8.00
LKR(PG)- Jamui-2	8.02	8.00
Jamui- Sheikhpura	4.01	4.00
Jamui- Traction	4.51	4.50

FAULT SIMULATION STUDY

- Short circuit study is conducted to determine the total fault current for the tripping and validating the simulation model.
- A phase to phase fault is created on the Jamui-Sheikhpura 132kV line at 55% from Joda end.
- The total fault current flowing was found to be 1341 A (rms) which is comparable with the output of shared disturbance recorder.

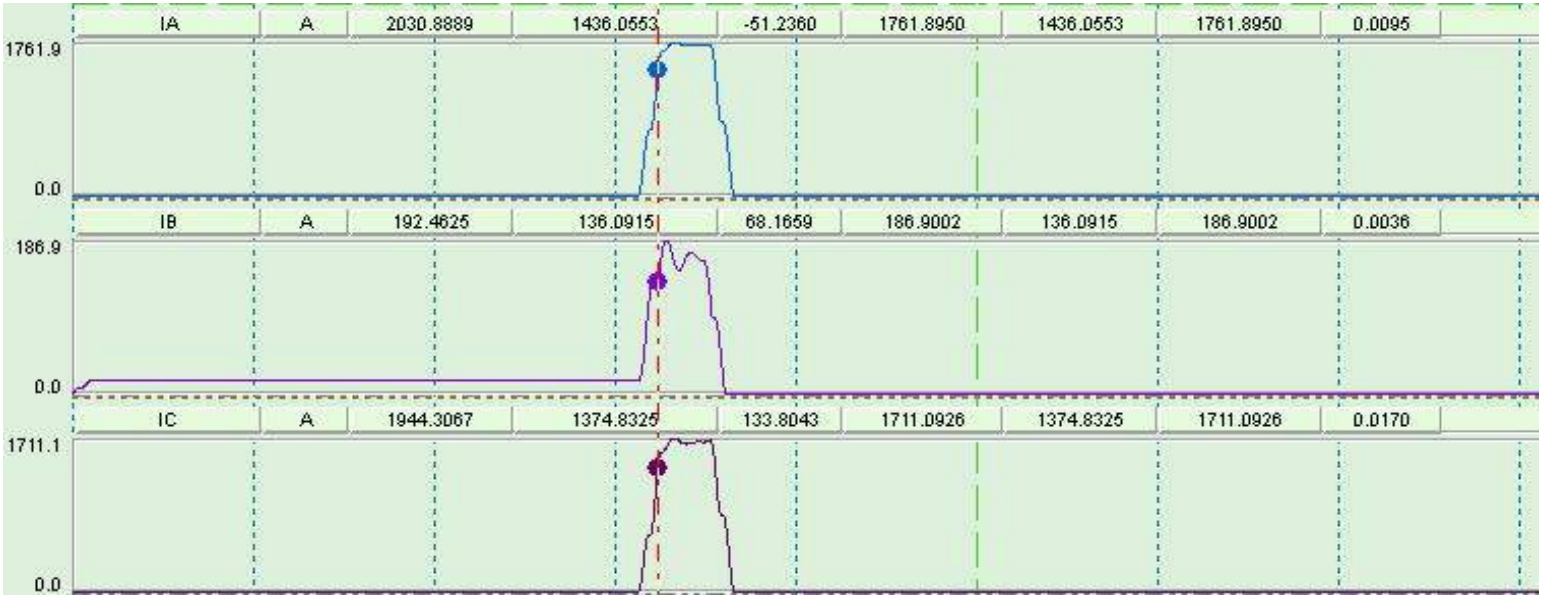


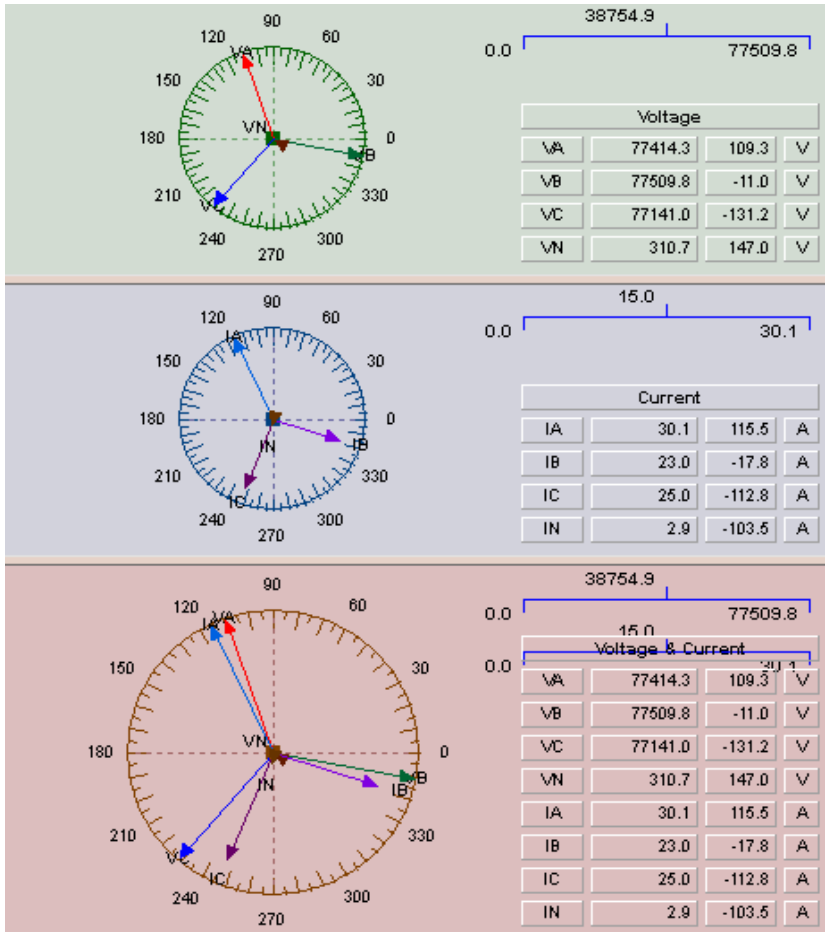
FIG-2: R Phase Current from Joda End from DR-1

BASIC ANALYSIS

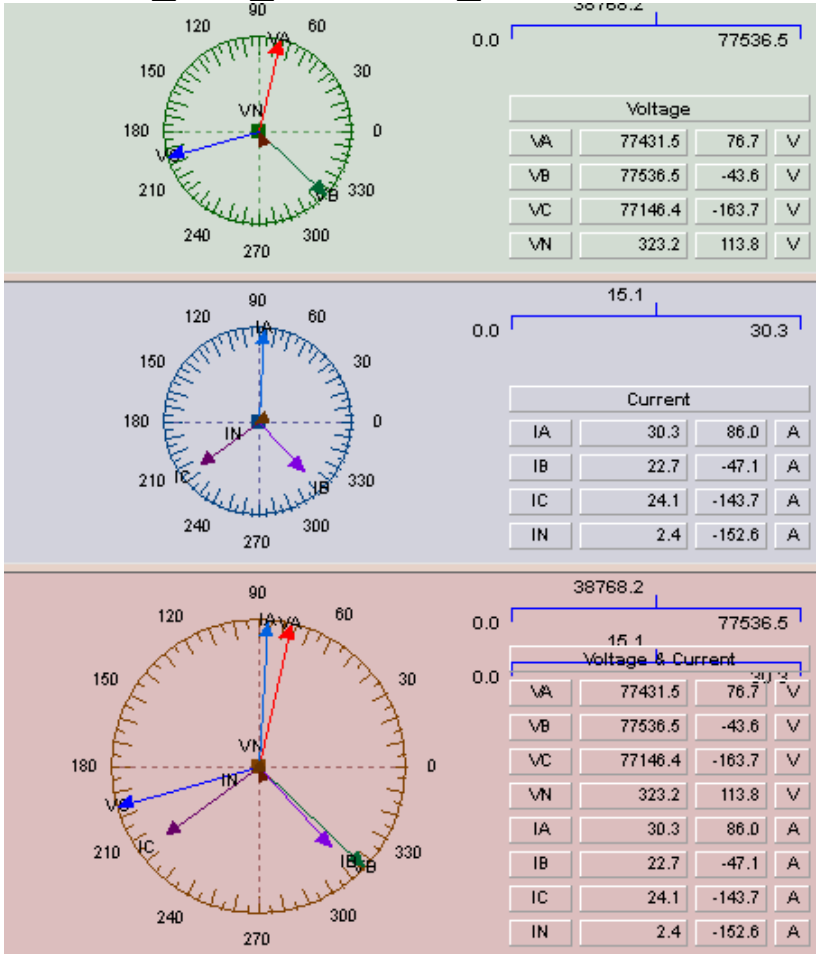
- An phase to phase fault occurred on Jamui-Sheikhpura feeder at 13:16:04:702 hrs, causing tripping of the circuit from JAMUI end.(zone1)
- When the line was charged again, it did not hold due to permanent fault and the Jamui-Lakhisarai lines tripped (zone:2) at JAMUI END. DR details during charging is yet to be furnished. So the reason of tripping of Jamui- Sheikhpura Line failed to trip during charging. Fault can only be fed through jamui-lakhisarai line.
- Assuming that the fault not cleared by Jamui- Sheikhpura Line. Then relay of Jamui-Lakhisarai lines at Lakhisarai should trip in Zone 3 but Jamui end tripped in Forward Zone (Zone-2).
- Jamui-Lakhisarai line jamui end relays should not see the fault in reverse direction as fault is at 55% of line from jamui end. DR shows the pick up of relay Zone-2 & 3.

DR ANALYSIS at Jamui

PG_CKT_01 at PRE_FAULT



PG_CKT_02 at PRE_FAULT



Vector at Jamui end of Jamui – Lakhisari Ckt 1 & 2

BASIC ANALYSIS

- As Jamui is importing power from Lakhisarai vector angle between Voltage and Current of respective phase should be out of phase.
- From DR it is sure that vector angle between Voltage and Current of respective phase are IN-Phase.
- Probable reason may be wrong connection of CT.

CONCLUSION

- Phase to phase fault on Jamui-Sheikhpura was cleared in Zone:1.
- During charging of that line, relays of Jamui-lakhisarai at Jamui end tripped. The reason behind its tripping can be analyzed if we receive the DR files of jamui - sheikipura line during charging.
- The relays of Jamui- Lakhisarai feeder saw the fault in forward direction which is verified from Jamui end Jamui – Lakhisarai DR shows the pick up of Zone-2 & 3. This is due to reversal of the CT Direction.

DATA

Data Received:

- Disturbance Records at Jamui end for jamui and Lakhisarai feeders.
- Pre fault network condition of Jamui substation from BSPTCL

Further Data Required:

- DR details of jamui - Shekipura during charging of the Jamui - Sheikhpura line.

Data Discrepancy:

- Mismatch of time stamping between reported incident time and DR.
- No DR of remote end of the affected line is received.


Thank You

Annexure-B17

TeesTa-III HEP

TRIPPING ANALYSIS REPORT
(11th & 15th May-2017)

Teesta Stage – III (6 x 200MW)
Tripping Analysis Report

Feeder / Unit : Line-1, Unit-3 & 6 Date:.11.05.2017 Time 08:28hrs

Pre-Condition:

- Teesta-III – Rangpo Ckt-1 (Line-1) charge condition.
- Unit-3 running at 150MW and Unit-6 running at 150MW

Tripping:

- Line-1 400kV CB tripped at both end, on indication Cable E/F operated.
- Unit- 3 & 6 400kV CB opened & still running at No Load operation.

Observation:

Line-1:

- **On P442 relay:** Current observed Ir-872A, Iy-223.6A & Ib-668.2A, Voltage Vrn-176kV, Vyn-220kV & Vbn-220kV. The relay tripped on 87C operated and indication was cable relay operated.
  Setting: Earth Fault O/C: 0.1 Amp, TMS 0.7 with Normal Inverse.

- **On 7SD611** (SIEMENS): E/F pickup observed (Not Trip).
- **Setting:** For Earth Fault: 0.1 & TMS 0.7, with Normal Inverse and additional time delay 1.0sec

Analysis :

As per the DR of 7SD611 cable relay, E/F pickup observed, which initiated the tripping of 400kV CB of feeder, but as per TMS setting it should trip after 3.5sec but tripped instantaneous. This signal connected to relay P442 (as 87C), which is again linked to tripping circuit.

The complete setting reviewed & checked the drawings.

1. In the relay 7SD611, at masking setting logic found binary output BO1, BO2 is linked with E/F pickup (Figure-1)
2. The above binary output BO1 & BO2 is connected with K14 & K15 trip relays (drawing no TU3-01-PR-4844, sheet-16).

Recommendation:

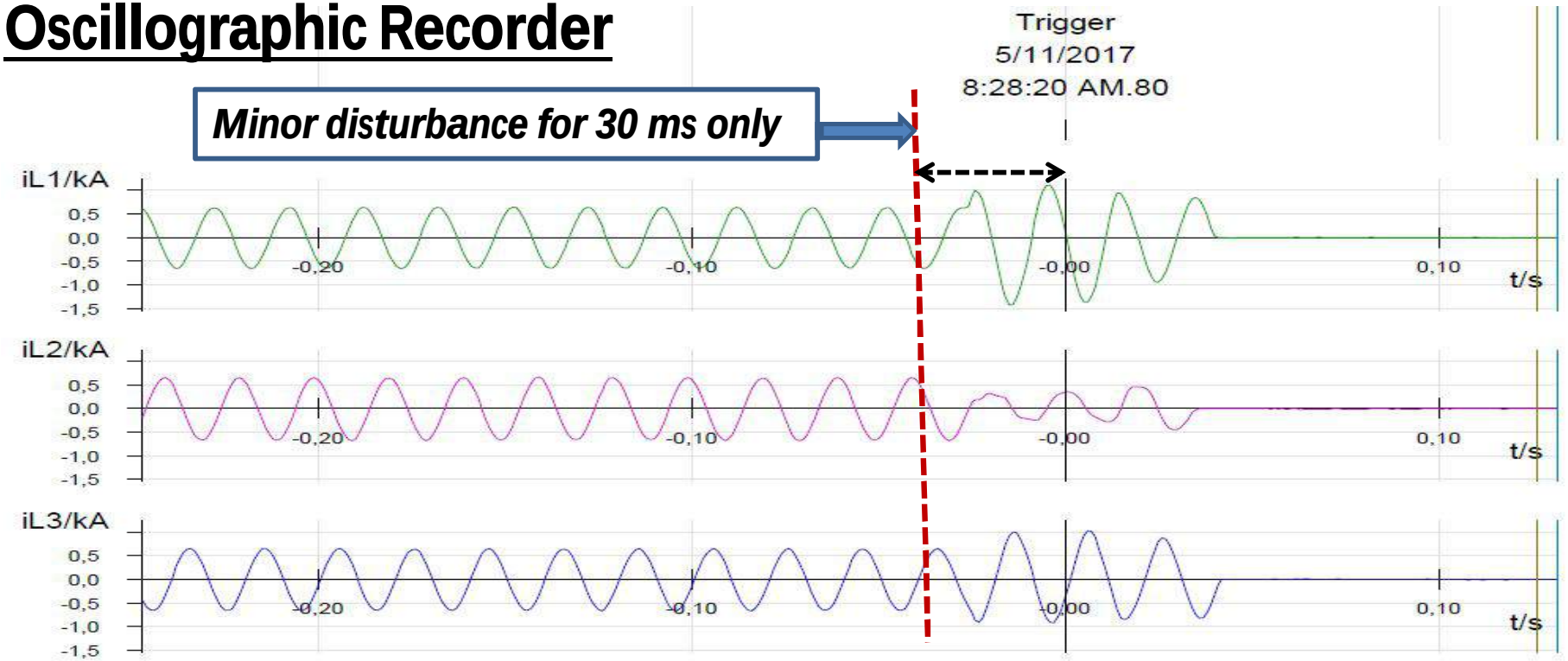
1. As above the tripping coil connected from the E/F pickup signal, which initiating unwanted tripping of the feeder. This can be avoided by configuring the E/F Trip signal in place of E/F pickup signal to the BO1 & BO2 contacts of relay 7SD611.

Disturbance Recorder

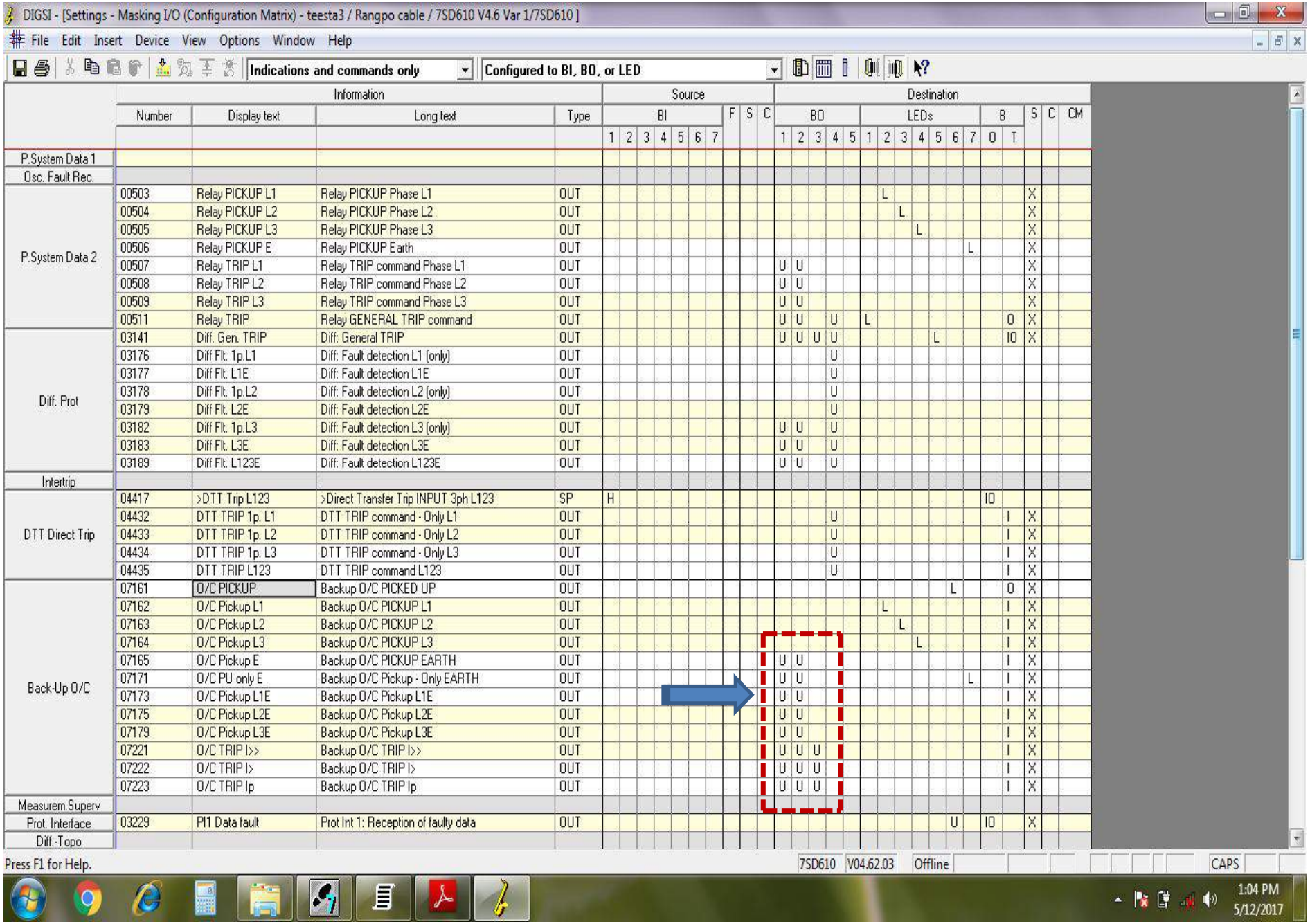
Trip Log - 000057 / 5/11/2017 8:28:20.804 AM - teesta3 / Rangpo cable / 7SD610 V4.6 Var/7SD610 V04.63.01

Number	Indication	Value	Date and time	Cause	State
00301	Power System fault	57 - ON	11.05.2017 08:28:20.804		
00302	Fault Event	57 - ON	11.05.2017 08:28:20.804		
07165	Backup O/C PICKUP EARTH	ON	0 ms		
07171	Backup O/C Pickup - Only EARTH	ON	0 ms		
07193	Backup O/C Pickup Ip	ON	0 ms		
07161	Backup O/C PICKED UP	OFF	30 ms		

Oscillographic Recorder



MASKING LOGIC of the Cable Diff. Relay



Annexure-B22

DSTPS 400KV BUS FAILURE ON 12.05.17

On 12.05.17 at around 13.20 Hrs TPF occurred at DSTPS through operation of 96 Relays during testing work by DSTPS O&M along with PGCIL representative to attend a problem related to DT Signal send Ckt. of DSTPS-JSR L#1.

SEQUENCE OF EVENTS

1. PGCIL representative arrived at DSTPS on 11.05.17 in connection with undesirable DT signal send related problem (DSTPS-JSR L#1) associated with PLCC panels maintained by PGCIL.
2. During checking, a cable related to DT send Ckt. found earthed. The wire was associated with Peripheral Units which is also used for Busbar and LBB protections.
3. It was decided to make the Busbar protection 'Out of Service' through Bus Bar switch provided at Busbar panel.
4. As soon as the switch was put to 'M1 OUT' position, TPF occurred at DSTPS 400kV S/Y with operation of 96 Relays for both buses.

ANALYSIS OF EVENTS

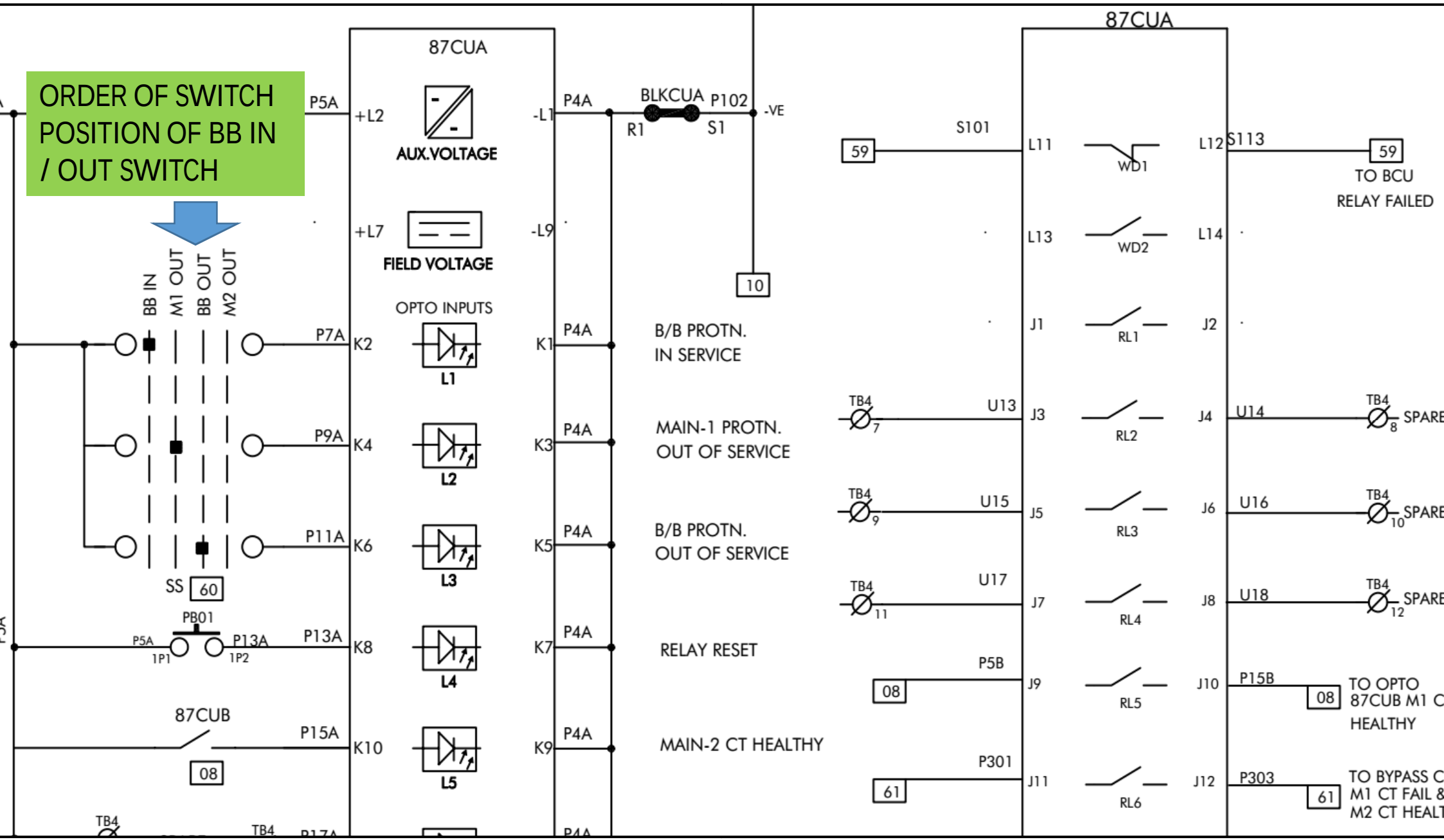
- In DSTPS 400kV S/Y two sets of Busbar protection is being used as Main-1 and Main-2 Protection. For Busbar operation, M1(Main-1) and M2(Main-2) contacts are connected in series and for LBB operation M1 and M2 contacts are connected in parallel.
- As both the M1 and M2 are standalone protection and not dependent on each other; in the event of failure of M1/M2, the other one will remain in service. However for doing so, a Switch is being provided to keep M1 or M2 ‘Out of Service’ to bypass the tripping contacts of M1/M2 Relays. A separate auxiliary Relay (M10X1/X2 for M1 and M20X1/X2 for M2) contacts is being used for this purpose (See Scheme Drawing next page).

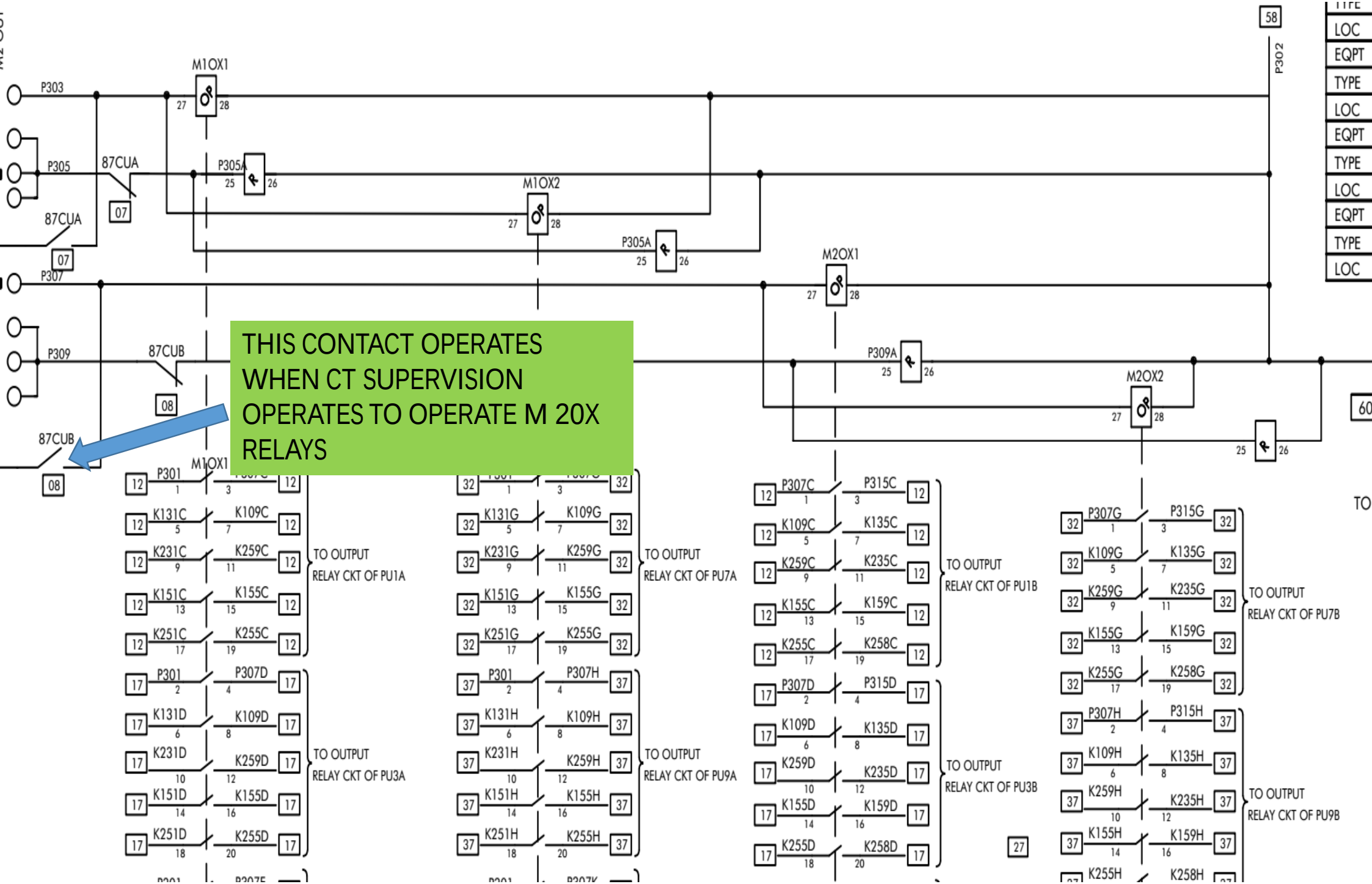
ANALYSIS OF EVENTS

- On 12.05.17 prior to the TPF, CT Ckt. supervision appeared for M2 Busbar protection. Under such condition Busbar protection is automatically gets blocked by the Busbar Relay and all the Busbar tripping contacts got bypassed through M20X1/X2.
- With M20X1/X2 in operated condition, as soon as the Busbar Switch was put into M1 OUT position before putting it to BB OUT condition all 96 relays got DC and operated.
- Now the sequence of switch is ‘BB IN’ to ‘M1 OUT’ to ‘BB OUT’ to ‘M2 OUT’. So there is no way by which switch can be made ‘BB OUT’ without going through ‘M1 OUT’.

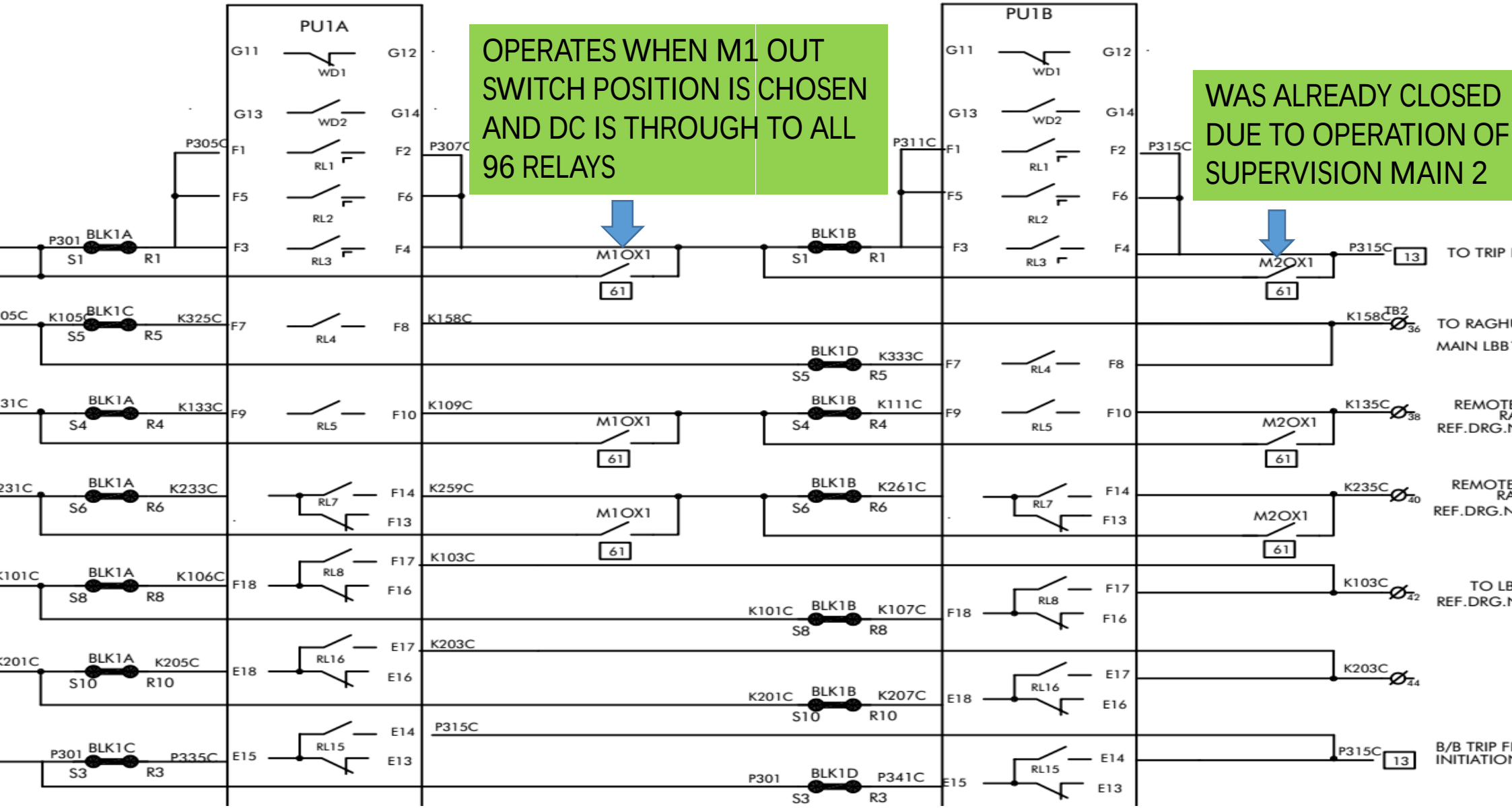
ANALYSIS OF EVENTS

- Now if M2 is previously OUT due to any pre-existing condition [viz. CT Supervision error / FO communication error etc.] and under such circumstances if anyone tries to make BB OUT through switch he has to put the switch to M1 OUT position which will operate all 96 relays of both buses.
- Operator / Shift In Charge was unaware of the consequences of changing the BusBar Switch position. It was an unintentional operational mistake that caused the tripping.


ORDER OF SWITCH POSITION OF BB IN / OUT SWITCH
BB IN
M1 OUT
BB OUT
M2 OUT
SS
60
87CUA
+L2
AUX.VOLTAGE
+L7
FIELD VOLTAGE
OPTO INPUTS
P5A
P7A
P9A
P11A
P13A
K2
K4
K6
K8
K10
L1
L2
L3
L4
L5
PB01
P5A
1P1
1P2
P13A
87CUB
08
P15A
TB4
-L1
-L9
P4A
K1
K3
K5
K7
K9
BLKCUA
P102
R1
S1
-VE
10
B/B PROTN.
IN SERVICE
MAIN-1 PROTN.
OUT OF SERVICE
B/B PROTN.
OUT OF SERVICE
RELAY RESET
MAIN-2 CT HEALTHY
87CUA
S101
59
L11
WD1
L12
S113
59
TO BCU
RELAY FAILED
L13
WD2
L14
J1
RL1
J2
TB4
7
U13
J3
RL2
J4
U14
TB4
8
SPARE
TB4
9
U15
J5
RL3
J6
U16
TB4
10
SPARE
TB4
11
U17
J7
RL4
J8
U18
TB4
12
SPARE
P5B
08
J9
RL5
J10
P15B
08
TO OPTO
87CUB M1 C
HEALTHY
P301
61
J11
RL6
J12
P303
61
TO BYPASS C
M1 CT FAIL &
M2 CT HEALT


THIS CONTACT OPERATES WHEN CT SUPERVISION OPERATES TO OPERATE M 20X RELAYS
P303
P305
87CUA
07
P307
P309
87CUB
08
M1OX1
M1OX2
M2OX1
M2OX2
P305A
P309A
P302
58
60
LOC
EQPT
TYPE
TO OUTPUT RELAY CKT OF PU1A
TO OUTPUT RELAY CKT OF PU3A
TO OUTPUT RELAY CKT OF PU7A
TO OUTPUT RELAY CKT OF PU9A
TO OUTPUT RELAY CKT OF PU1B
TO OUTPUT RELAY CKT OF PU3B
TO OUTPUT RELAY CKT OF PU7B
TO OUTPUT RELAY CKT OF PU9B
27

PERIPHERAL UNIT TRIPPING SCHEME



CORRECTIVE ACTION / REMEDIAL MEASURES

- If in exigency, it is felt absolutely essential to make Busbar/LBB out under such typical condition, removal of Busbar DC fuse is the ONLY option.
- An annunciation in the SAS may be given from M10X1/X2 and M20X1/X2 Relays in addition with the Relay internal CT supervision Alarm to double ensure the status of the Busbar protection.
- The reason for appearance of CT Supervision (which initiated M20 X1/X2 relay) function could not be analyzed as it appeared intermittently and got reset and did not re appear since then.
- Inspection of all the Busbar CTJB to search for multiple earthing in CT Circuits was carried out but nothing could be found.

SAS EVENT RECORDS

	ORIGIN	Object Name	Event Message
2017 13:14:42.869	DURGAPUR / 400KV / P741_87CUB / SYSTEM	MAIN-1 CT CIRCUIT	HEALTHY
2017 13:14:42.857	DURGAPUR / 400KV / P741_87CUA / SYSTEM	PU_ALM_ZONE 1	RESET
2017 13:14:42.857	DURGAPUR / 400KV / P741_87CUA / SYSTEM	PU_ALM_ZONE 1	RESET
2017 13:14:42.857	DURGAPUR / 400KV / P741_87CUA / SYSTEM	PU_ALM_ZONE 2	RESET
2017 13:14:41.811	DURGAPUR / 400KV / P741_87CUB / GOOSE	BUS-2 96 RELAYS	RESET
2017 13:14:41.811	DURGAPUR / 400KV / P741_87CUB / GOOSE	BUS-2 96 RELAYS	RESET
2017 13:14:41.801	DURGAPUR / 400KV / P741_87CUB / GOOSE	ZONE-2 BB PROT	RESET
2017 13:14:41.801	DURGAPUR / 400KV / P741_87CUB / GOOSE	ZONE-2 BB PROT	RESET
2017 13:14:41.794	DURGAPUR / 400KV / P741_87CUA / GOOSE	BUS-1 96 RELAYS	RESET
2017 13:14:41.794	DURGAPUR / 400KV / P741_87CUA / GOOSE	BUS-1 96 RELAYS	RESET
2017 13:14:41.792	DURGAPUR / 400KV / P741_87CUA / GOOSE	ZONE-2 BB PROT	RESET
2017 13:14:41.792	DURGAPUR / 400KV / P741_87CUA / GOOSE	ZONE-2 BB PROT	RESET
2017 13:14:41.765	DURGAPUR / 400KV / P741_87CUA / SYSTEM	MAIN-2 CT CIRCUIT	HEALTHY
2017 13:14:41.765	DURGAPUR / 400KV / P741_87CUA / SYSTEM	MAIN-2 CT CIRCUIT	HEALTHY
2017 13:14:41.754	DURGAPUR / 400KV / P741_87CUB / SYSTEM	PU_ALM_ZONE 2	RESET
2017 13:14:41.754	DURGAPUR / 400KV / P741_87CUB / SYSTEM	PU_ALM_ZONE 2	RESET
2017 12:59:16.557	DURGAPUR / 400KV / P741_87CUA / SYSTEM	MAIN-1	IN SERVICE
2017 12:59:16.557	DURGAPUR / 400KV / P741_87CUA / SYSTEM	MAIN-1	IN SERVICE
2017 12:59:15.685	DURGAPUR / 400KV / P741_87CUA / SYSTEM	MAIN-1	OUT OF SERVICE
2017 12:59:15.631	DURGAPUR / 400KV / P741_87CUB / SYSTEM	MAIN-2 BB PROTECTION	IN SERVICE
2017 12:59:15.631	DURGAPUR / 400KV / P741_87CUB / SYSTEM	MAIN-2 BB PROTECTION	IN SERVICE
2017 12:59:15.583	DURGAPUR / 400KV / P741_87CUA / SYSTEM	MAIN-1 BB PROTECTION	IN SERVICE
2017 12:59:15.583	DURGAPUR / 400KV / P741_87CUA / SYSTEM	MAIN-1 BB PROTECTION	IN SERVICE
2017 12:58:10.500	DURGAPUR / 400KV / P741_87CUA / SYSTEM	MAIN-1 BB PROTECTION	OUT OF SERVICE
2017 12:58:10.499	DURGAPUR / 400KV / P741_87CUB / SYSTEM	MAIN-2 BB PROTECTION	OUT OF SERVICE
2017 12:58:10.159	DURGAPUR / 400KV / P741_87CUA / SYSTEM	MAIN-1	IN SERVICE
2017 12:58:08.638	DURGAPUR / 400KV / P741_87CUA / GOOSE	BUS-1 96 RELAYS	OPERATED
2017 12:58:08.638	DURGAPUR / 400KV / P741_87CUB / GOOSE	ZONE-2 BB PROT	OPERATED
2017 12:58:08.636	DURGAPUR / 400KV / P741_87CUA / GOOSE	ZONE-2 BB PROT	OPERATED
2017 12:58:08.636	DURGAPUR / 400KV / P741_87CUB / GOOSE	BUS-2 96 RELAYS	OPERATED
2017 12:58:08.618	DURGAPUR / 400KV / P741_87CUA / SYSTEM	MAIN-1	OUT OF SERVICE
2017 15:50:22.270	DURGAPUR / 400KV / P741_87CUB / GOOSE	ZONE-2 BB PROT	Acknowledged [OISERVM - OPER
2017 15:50:22.270	DURGAPUR / 400KV / P741_87CUB / GOOSE	BUS-2 96 RELAYS	Acknowledged [OISERVM - OPER
2017 15:50:22.270	DURGAPUR / 400KV / P741_87CUA / SYSTEM	PU_ALM_ZONE 1	Acknowledged [OISERVM - OPER
2017 15:50:22.270	DURGAPUR / 400KV / P741_87CUB / SYSTEM	PU_ALM_ZONE 2	Acknowledged [OISERVM - OPER
2017 15:50:22.254	DURGAPUR / 400KV / P741_87CUA / SYSTEM	PU_ALM_ZONE 2	Acknowledged [OISERVM - OPER
2017 15:50:22.254	DURGAPUR / 400KV / P741_87CUA / SYSTEM	MAIN-2 CT CIRCUIT	Acknowledged [OISERVM - OPER
2017 15:50:22.254	DURGAPUR / 400KV / P741_87CUB / SYSTEM	MAIN-1 CT CIRCUIT	Acknowledged [OISERVM - OPER

SAS EVENT RECORDS

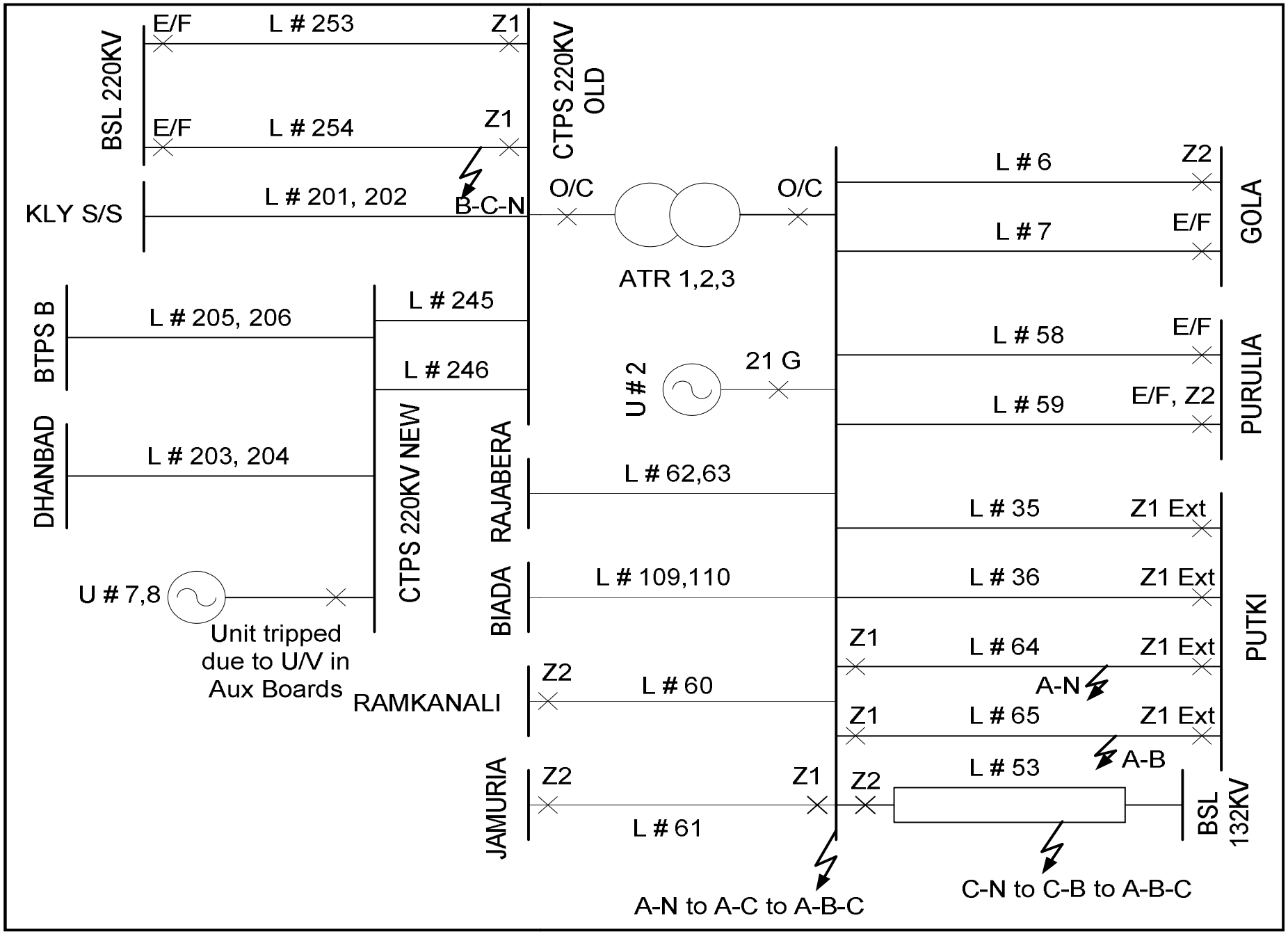
- SAS records show appearance of PU Alarm [highlighted in Yellow] from Central Unit 2 on 11.05.17.
- As per logic as PU Alarm Zone 2 (M2 error) had appeared, CU2 had become Out of Service i.e. M20X had operated.
- As the Alarm is seen to have RESET after both buses had tripped M20X had remained in operated condition.
- No DR picked up in CUs as there was no BB fault in reality.

Annexure-B23

CTPS 132KV TOTAL POWER FAILURE ON 23.05.17

On 23rd May 2017 at about 14:51 hrs total power failed in CTPS 132KV Bus due to tripping of all lines which had sources on remote bus and all three ATRs.

RELEVANT SLD



PRE FAULT CONDITIONS AND DAMAGES

- The weather conditions prevailing around CTPS Switchyard during the tripping was extremely stormy with very high wind velocity along with heavy rain, thunder and lightning.
- Physical damage Reported:
  - Line # 53 tower had collapsed at location no. 19.
  - C Phase LA had burst in Line # 254.
- CTPS BOKARO STEEL[BSL] 132KV Lines were charged from CTPS End only. All other lines at all voltage levels were in service.
- Unit 7,8 [250MW each] were in service at 220KV level and Unit # 2 was on bar at 132KV Voltage level.

PRE FAULT LOAD FLOW:

Equipment	KV Level	Current in Amps
ATR#3	220 KV	250
ATR#1		240
ATR#2		280
L#245		460
L#246		360
L#253		137
L#254		137
L#202		120
L#201		120
L#6	132 KV	160
L#7		130
L#36		120
L#35		120
L#65		120
L#64		120
L#53, 54, 57		Kept charge from CTPS end only
L#58		100
L#59		100
G#2	14.5 KV	4700

TRIPPING DETAILS

LINE NO.	TIME OF FAULT		RELAY INDICATIONS	
	Absolute	Relative	CTPS END	OTHER END
53	14.51.58.374	0ms	Z2	--
64	14.52.34.509	46s 135ms	Z1	Z1 Extension
65	14.52.34.689	46s 315ms	Z1	Z1 Extension
35	14.52.52.820	1m 4s 446ms	NO TRIP	Z1 Extension
36			NO TRIP	Z1 Extension
58			NO TRIP	D/E/F
59			NO TRIP	D/E/F , Z2
6			NO TRIP	Z2
7			NO TRIP	D/E/F
60			NO TRIP	Z2
61			Z1	Z2
109,110			By Hand	--
62,63			By Hand	--
253			Z1	O/C, E/F
254			Z1	O/C, E/F
ATR#1			HV, LV O/C	--
ATR#2			HV, LV O/C	--
ATR#3			HV, LV O/C	--
Gen # 2			B/U Impedance	

FIRST FAULT – IN LINE # 53 – 0ms relative time

- Collapsing of Line # 53 tower around 6 km from CTPS end.
- As Line Differential Protection of the said line was out of service due to appearance of COM FAIL ALARM, the fault was cleared by Distance Zone 2 from CTPS end.
- The distance of tower collapse was within 80% of physical line length but as this is a dual conductor line (2 conductors sharing the current but only one CT), the fault was correctly seen by the relay within its in Zone 2 reach.
- It is seen from the DR that initially for about 105ms the fault was seen within Zone 3 reach due to its initial higher ground resistance. However, after 105 ms the CG fault transforms to BC fault and the effect of higher fault resistance dies out, then Zone 2 Start operates and issues trip pulse within another 300ms.
- The fault is finally cleared in around 489ms and no other lines trip due to this fault.

SECOND FAULT – L # 64 – 46ms relative time

- Probable lightning strike / tree touching on L # 64.
- L # 64 shows A Phase fault with If = 18.5 kA. Magnitude of Fault Current suggest fault was closer to CTPS Bus i.e. beyond Z1 from Putki end.
- L # 64 trips at CTPS end through Distance Zone 1 and through Distance Zone 1 extension from Putki end correctly as per Carrier Blocking Scheme correctly[fault within 80 to 100% of line from Putki End].
- Fault cleared within 100ms from CTPS end.

THIRD FAULT – L # 64 – 180ms relative time

- Again probable lightning strike / tree touching on common tower of L # 65 and L # 64.
- L # 65 shows AB fault with If = 24.6 kA again suggesting fault closer to CTPS end.
- L # 65 tripped at CTPS end through Distance Zone 1 and through Distance Zone 1 extension from Putki end correctly[fault within 80 to 100% of line from Putki End].
- Fault cleared within 100ms from CTPS End.

FOURTH FAULT – L # 253 & 254 LA BURST

- This was an isolated fault in 220KV level where both lines tripped from CTPS end in Distance Zone 1 and through D/E/F from BSL end.
- Probable cause: Lightning strike on both the lines(both lines travel on the same tower) evidenced by :
  - Total collapse of B Phase Voltage, no substantial change in C Phase voltage but current increase in only C phase(to about 4.5kA) and no current increase in B Phase.
  - Increment of A Phase voltage to 205KV (from normal 127KV)
  - Bursting of LA in C Phase in L # 254.
- We think lightning strike was the original fault, LA Bursting was a consequence otherwise both lines would not have tripped simultaneously.

FIFTH FAULT – CTPS BUS – 1m 4s relative time

- Occurs on CTPS 132 KV bus and remains uncleared till all three ATRs trip. It is during this fault all the remaining lines trip from the respective remote ends as follows:
  - L # 6 [CTPS Gola] trips through Distance Zone 2.
  - L # 7 [CTPS Gola] trips through D/E/F as Gola End Distance relay is out of service.
  - L # 58 & 59 [CTPS Purulia] trips through D/E/F Protection.
  - L # 60 & 61 [CTPS Ramkanali & CTPS Jamuria] trips through Distance Zone 2.
  - L # 35 & 36 [CTPS Putki] trips through Extended Zone 1.
- L # 61 Siemens make distance relay 7SA511 trips from CTPS end almost at the same time. It has been seen in previous incidences also that for very close in bus faults the relay suddenly issues a tripping signal in Zone 1 although the fault is read by the relay as a reverse fault till that point. Downloaded DR reveals similar behaviour here.

FIFTH FAULT – CTPS BUS FAULT

- All the three ATRs trip through both HV & LV O/C relays as the fault was hanging till at least 1 sec as shown in the DR picked up in numerical differential relay of ATR # 1.
- It is seen that this fault starts as AN fault, gets transformed to AC phase to phase fault in 355ms and finally evolves to a three phase fault in another 55ms and continues as a three phase fault till the end of record (1sec).
- Unit # 2 trips through 86GG whose initiating relay was Back Up impedance which had operated correctly for the sustained bus fault causing total power fail in CTPS 132KV switchyard.

FIFTH FAULT – CTPS BUS FAULT

- Some time before all 3 ATRs tripped, Unit # 7 & 8 had tripped through Auxiliary Board U/V.
- There were no Line tripping in 220KV side due to this sustained fault.
- No physical damage was could be visibly found during switchyard inspection after the storm.

REMEDIAL MEASURE / CORRECTIVE ACTIONS

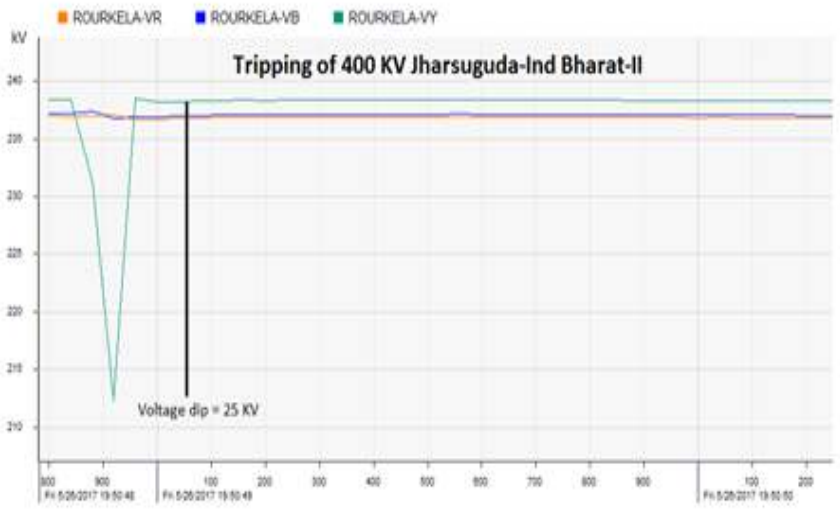
- L # 7 Distance relay need to be recommissioned.
- Settings at Purulia End of Purulia CTPS lines were revised to coordinate with Distance Zone 2.

Analysis of the tripping of 400 kV Jharsuguda – IBEUL - II at 19:50 hrs on 26-05-17

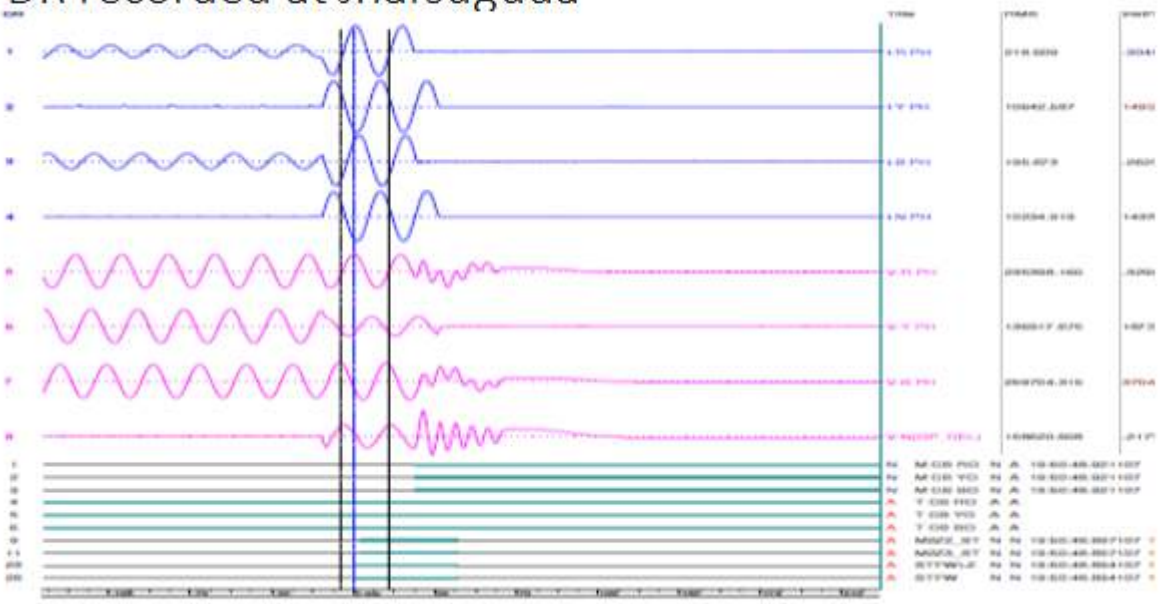
Summary

- In PMU data, Y-N fault has been observed.
- Relay indication at Jharsuguda:
  - Y-N, Z-II, 21 km from Jharsuguda, F/C 10.5 kA, A/R not attempted
    - At Jharsuguda end, whole line is being protected in Z-II with zero time delay.
  - Pre-fault current: 55-60A in each phase; Post fault current: 200 A in R & B phases and 10.5 kA in Y phase
- Relay indication at IBEUL:
  - R-Y-B tripped
  - Pre-fault current: 1.5 - 2A in each phase; Post fault current: 305-320A in each phase
- In PMU & Jharsuguda end DR, only Y-N fault has been observed. But IBEUL end DR has detected current rise in all three phases.
- Pre fault & Post fault current are not matching at both ends.

PMU data

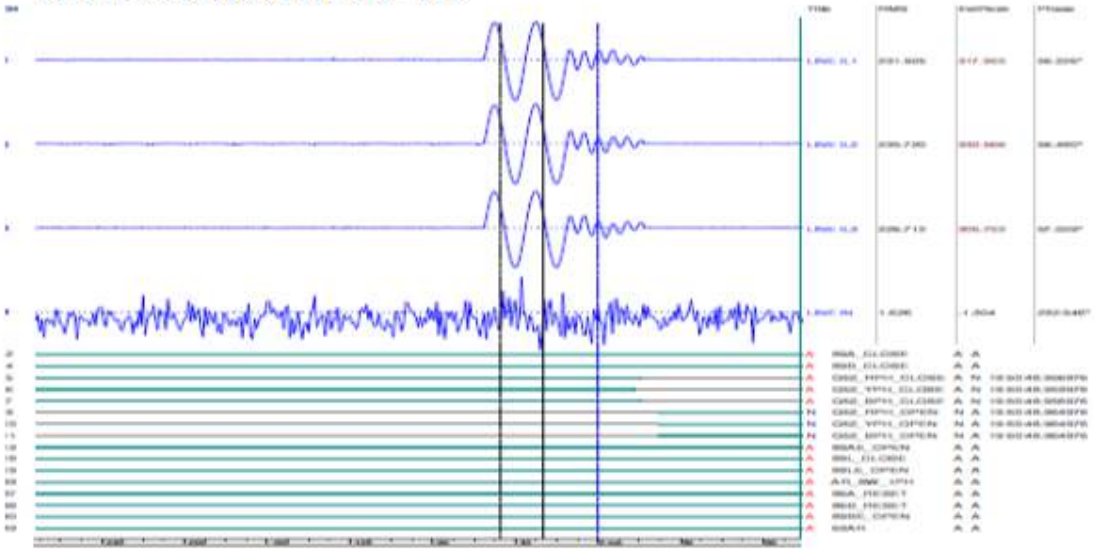


DR recorded at Jharsuguda



Pre-fault current: 55-60A in each phase; Post fault current: 200 A in R & B phases and 10.5 kA in Y phase

DR recorded at IBEUL



Pre-fault current: 1.5 - 2A in each phase; Post fault current: 305-320A in each phase

Annexure-C1

Activation of the high set in over current and earth fault relays in 05 nos. of 100 MVA Power Transformers at 220 KV GSS Fatuha on dated 26 may 2017.

S,No.	Power Trf.	Relay make	HV CTR	High set HV O/C	High set HV E/F	LV CTR	High set LV O/C	High Set LV E/F
01.	100 MVA T1	Alstom P142(hv&lv)	300/1	6.4A/150 msec	5.0/150msec	600/1	5.32A/100 msec	4.0A/100 msec
02	100 MVA T2	Alstom P142(hv&lv)	600/1	3.2A/150 msec	2.4A/150 msec	600/1	5.32A/ 100 msec	4.0A/100 msec
03	100 MVA T3	Alstom P142(hv&lv)	600/1	3.2A/150 msec	2.4A/150 msec	600/1	5.32A/ 100 msec	4.0A/100 msec
04	100 MVA T4	Alstom P142(hv&lv)	300/1	6.4A/150 msec	4.8 A/150 msec	800/1	4.0A/100 msec	3.0A/100 msec
05	100 MVA T5	Ge Multilin 650	300/1	6.4 A/150 msec	4.8A/150 msec	600/1	5.32A/100 msec	4.0 A/100 msec

Note:

1. All the high set are Non directional and definite time.
2. The PSL logics of the relays have been also modified to activate, record and indicate the tripings.
3. The decision to do so was concluded in the 55 PCC Meeting at ERPC Kolkata on 25 may 2017 to avoid Tripping of ICTs 1,2&3 at PGCIL Biharsharif.

   The activation of Highset in The 150 MVA ATRs of 220 KV GSS Biharsharif and modification of the TMS of E/F in 220 KV Lines at GSS Biharsharif to match with PGCIL ICT Settings will be done this week.

As instructed by ESE,CRITL,Patna via email dated 05.06.2017,following relay settings have been modified at 220/132/33 kV GSS Biharsharif :

(A) 150 MVA Transformer-1 & 2 220 kV side

Relay	Connected CTR	Description	Modified parameter	Modified setting
MiCOM P141 Make-Schneider (Backup protection)	1200/1 A for Tr-1 600/1 A for Tr-2	Overcurrent protection	I>1	384 A
			I>3(Highset)	3072 A (8 times of 384 A)
			I>3 Direction	Non-directional
			I>3 TMS	150 ms
		Earth fault protection	IN1>3(Highset)	2304 A (6 times of 384 A)
			IN1>3 Direction	Non-directional
			IN>3 TMS	150 ms

(B) 150 MVA Transformer-1 & 2 132 kV side

Relay	Connected CTR	Description	Modified parameter	Modified setting
MiCOM P141 Make-Schneider (Backup protection)	800/1 A for both Tr-1 & 2	Overcurrent protection	I>3(Highset)	5248 A (8 times of 656 A)
			I>3 Direction	Non-directional
			I>3 TMS	100 ms
		Earth fault protection	IN1>3(Highset)	3936 A (6 times of 656 A)
			IN1>3 Direction	Non-directional
			IN>3 TMS	100 ms

(C) 150 MVA Transformer-3 220 & 132 kV sides

Relay	Connected CTR	Description	Modified parameter	Modified setting
Siemens Siprotec/7SJ62 (Backup protection)	600/ 1 A in 220 kV side	Overcurrent protection	Ip >	0.64
			I>>	5.12 (8 times of 384 A)
			T I>>	0.15 s
		Earth fault protection	I_E >>	3.84 (6 times of 384 A)
			T I_E >>	0.15 s
	800/ 1 A in 132 kV side	Overcurrent protection	I>>	6.56 (8 times of 656 A)
			T I>>	0.10 s
		Earth fault protection	I_E >>	4.92 (6 times of 656 A)
			T I_E >>	0.10 s

(D) 220 kV Fatuha-1 & 2,Begusarai-1 & 2 and Bodhgaya-1 & 2 lines

Relay	Connected CTR	Description	Modified parameter	Modified setting
Schneider MiCOM P442	1200/1 A	Overcurrent protection	I>1 TMS	0.2 s
		Earth fault protection	IN1>TMS	0.2 s

(E) 220 kV Bodhgaya-1 & 2

Relay	Connected CTR	Description	Modified parameter	Modified setting
Areva MiCOM P442 in Main-1 protection Schneider MiCOM P442 in Main-2 protection	1200/1 A	Distance protection	Line length	94 km
			Line impedance	22.91 Ω
			Z1	18.33 Ω
			Z2	24.62 Ω
			Z3	60.48 Ω
			Z4	5.73 Ω

Annexure-C7

SL No	Zone-2 timer setting at	For line	No of circuits	Length (km)	Zone-2 Reach in %	Zone-2 reach of protected line length (km)	Shortest line at remote end	Length (km)	Considering Ideal Zone-1 reach i.e Upto 80%			Considering Zone-1 under reaches by 30% i.e. Zone -1 reach is only upto 50% (as per ERPC/CEA philosophy)		
									Zone-2 reach (Beyound 80% upto 120/150%) of the shortest line Starts at (km)	Zone -2 Overlap ?	Zone-2 Time setting	Zone-2 reach (Beyound 50% upto 120/150%) of the shortest line Starts at (km)	Zone -2 Overlap ?	Zone-2 Time setting
1	Muzaffarpur	Gorakhpur	D/C	261	150%	392	Gorakhpur-Gorakhpur-UP D/C	46	37	Y	0.5 to 0.6	23	Y	0.5 to 0.6
		Biharshariff	D/C	133	150%	200	Biharsariff Lakhisarai D/C	89	71	N	0.35	45	Y	0.5 to 0.6
		Purnea	D/C	242	150%	363	Purnea-Kishanganj D/C	71	57	Y	0.5 to 0.6	36	Y	0.5 to 0.6
2	Purnea	Muzzafarpur	D/C	242	150%	363	Muzzafarpur-Biharsariff D/C	133	107	Y	0.5 to 0.6	67	Y	0.5 to 0.6
		Kishanganj	D/C	71	150%	107	Kishangaj-Purnea other ckt	71	57	N	0.35	36	N	0.35
		Biharsariff	D/C	231	150%	347	Biharsaiff-Lakhisarai D/C	89	71	Y	0.5 to 0.6	45	Y	0.5 to 0.6
		Malda	D/C	167	150%	251	Malda-Farraka D/C	40	32	Y	0.5 to 0.6	20	Y	0.5 to 0.6
		Binaguri	D/C	168	150%	252	Binaguri-Kishanhanj D/C	98	78	Y	0.5 to 0.6	49	Y	0.5 to 0.6
3	Kishanganj	Purnea	D/C	71	150%	107	Purnea Kishangaj other ckt	71	57	N	0.35	36	N	0.35
		Patna	D/C	348	150%	521	Patna-Barh D/C	69	55	Y	0.5 to 0.6	34	Y	0.5 to 0.6
		Binaguri	D/C	98	150%	147	Binaguri-Kishanhanj other ckt	98	78	N	0.35	49	N	0.35
4	Barh	Patna	D/C	93	150%	140	Patna-Barh D/C	69	55	N	0.35	34	Y	0.5 to 0.6
		Patna	D/C	69	150%	103	Patna-Barh other ckt	69	55	N	0.35	34	N	0.35
		Gorakhpur	D/C	349	150%	524	Gorakhpur-Gorakhpur-UP D/C	46	37	Y	0.5 to 0.6	23	Y	0.5 to 0.6
		Kahalgaon	D/C	217	150%	326	Khalgaon-BankaD/C	48	38	Y	0.5 to 0.6	24	Y	0.5 to 0.6
5	Patna	Kishanganj	D/C	348	150%	521	Kishangaj-Purnea D/C	71	57	Y	0.5 to 0.6	36	Y	0.5 to 0.6
		Barh	D/C	93	150%	140	Barh-Patna D/C	69	55	N	0.35	34	Y	0.5 to 0.6
		Barh	D/C	69	150%	103	Barh-Patna other ckt	69	55	N	0.35	34	N	0.35
		Balia	D/C	185	150%	278	Balia-Mau D/C	9	7	Y	0.5 to 0.6	5	Y	0.5 to 0.6
		Balia	D/C	195	150%	293	Balia-Mau D/C	9	7	Y	0.5 to 0.6	5	Y	0.5 to 0.6
6	Sasaram	Biharsariff	D/C	210	150%	315	Biharsaiff-Lakhisarai D/C	89	71	Y	0.5 to 0.6	45	Y	0.5 to 0.6
		Nabinagar	D/C	82	150%	123	Sasaram-Nabinagar D/C	82	66	N	0.35	41	N	0.35
		Varanasi	S/C	143	120%	172	Varansi-Saranathi S/C	70	56	N	0.35	35	N	0.35
		Allahabad	S/C	212	120%	254	Allahabad-Varanasi S/C	98	78	N	0.35	49	N	0.35
7	Gaya	Maithon	D/C	276	150%	414	Maithon-MPL D/C	32	25	Y	0.5 to 0.6	16	Y	0.5 to 0.6
		Chandwa	D/C	117	150%	176	Chandwa-N.Ranchi D/C	68	54	Y	0.5 to 0.6	34	Y	0.5 to 0.6
		Koderma	D/C	125	150%	188	Koderma-Bokaro D/C	100	80	N	0.35	50	Y	0.5 to 0.6
8	Biharsariff	Muzzafarpur	D/C	133	150%	200	Muzzafarpur-Biharsariff D/C	133	107	N	0.35	67	N	0.35
		Purnea	D/C	231	150%	347	Purnea Kishangaj D/C	71	57	Y	0.5 to 0.6	36	Y	0.5 to 0.6
		Sasaram	D/C	210	150%	315	Sasaram-Nabinagar D/C	82	65	Y	0.5 to 0.6	41	Y	0.5 to 0.6
		Lakhisari	D/C	89	150%	134	Lakhisarai-Biharsaiff Other ckt	89	71	N	0.35	45	N	0.35
		Banka	D/C	185	150%	277	Banka-Khalgaon D/C	48	38	Y	0.5 to 0.6	24	Y	0.5 to 0.6
		Koderma	D/C	111	150%	166	Koderma-Bokaro D/C	100	80	N	0.35	50	Y	0.5 to 0.6
		Balia	D/C	241	150%	362	Balia-Mau D/C	9	7	Y	0.5 to 0.6	5	Y	0.5 to 0.6
9	Lakhisari	Biharsariff	D/C	89	150%	134	Biharsaiff-Lakhisarai D/C	89	71	N	0.35	45	N	0.35
		Kahalgaon	D/C	145	150%	218	Khalgaon-BankaD/C	48	38	Y	0.5 to 0.6	24	Y	0.5 to 0.6
10	Banka	Biharsariff	D/C	185	150%	277	Biharsaiff-Lakhisarai D/C	89	71	Y	0.5 to 0.6	45	Y	0.5 to 0.6
		Kahalgaon	D/C	48	150%	72	Khalgaon-BankaD/C	48	38	N	0.35	24	N	0.35
		Lakhisari	D/C	145	150%	218	Lakhisarai-Biharsaiff D/C	89	71	Y	0.5 to 0.6	45	Y	0.5 to 0.6
		Banka	D/C	48	150%	72	Banka-Khalgaon Other ckt	48	38	N	0.35	24	N	0.35

11	Kahalgaon	Farraka	D/C	95	150%	143	Farraka -Malda D/C	40	32	Y	0.5 to 0.6	20	Y	0.5 to 0.6
		Farraka	D/C	95	150%	143	Farraka -Malda D/C	40	32	Y	0.5 to 0.6	20	Y	0.5 to 0.6
		Maithon	D/C	172	150%	258	Maithon-MPL D/C	32	25	Y	0.5 to 0.6	16	Y	0.5 to 0.6
12	Farraka	Kahalgaon	D/C	95	150%	143	Khalgaon-BankaD/C	48	38	Y	0.5 to 0.6	24	Y	0.5 to 0.6
		Kahalgaon	D/C	95	150%	143	Khalgaon-BankaD/C	48	38	Y	0.5 to 0.6	24	Y	0.5 to 0.6
		Malda	D/C	40	150%	60	Malda-Farraka D/C	40	32	N	0.35	20	N	0.35
		Bahrampur	S/C	71	120%	85	Bahrampur-Sagardighi D/C	26	21	N	0.35	13	Y	0.5 to 0.6
		Sagardighi	S/C	72	120%	86	Sagardighi-Bahrampur D/C	26	21	N	0.35	13	Y	0.5 to 0.6
		Durgapur	D/C	146	150%	219	Durgapur-Bidhannagar D/C	11	9	Y	0.5 to 0.6	6	Y	0.5 to 0.6
13	Malda	Purnea	D/C	167	150%	251	Purnea Kishangaj D/C	71	57	Y	0.5 to 0.6	36	Y	0.5 to 0.6
		Farraka	D/C	40	150%	60	Farraka -Malda D/C	40	32	N	0.35	20	N	0.35
14	Binaguri	Purnea	D/C	168	150%	252	Purnea Kishangaj D/C	71	57	Y	0.5 to 0.6	36	Y	0.5 to 0.6
		Kishanganj	D/C	98	150%	147	Kishangaj-Purnea D/C	71	57	N	0.35	36	Y	0.5 to 0.6
		Rangpo	D/C	12	150%	18	Rangpo-Binaguri D/C	12	9	N	0.35	6	N	0.35
		Bongaigaon	D/C	218	150%	327	Bongaigaon-BTPS D/C	3.12	2	Y	0.5 to 0.6	2	Y	0.5 to 0.6
		Bongaigaon	D/C	221	150%	332	Bongaigaon-BTPS D/C	3.12	2	Y	0.5 to 0.6	2	Y	0.5 to 0.6
		Tala	D/C	145	150%	218	Tala -Malbase S/C	24	19	Y	0.5 to 0.6	12	Y	0.5 to 0.6
		Tala	S/C	140	120%	168	Tala -Malbase S/C	24	19	Y	0.5 to 0.6	12	Y	0.5 to 0.6
		Malbase	S/C	125	120%	150	Malbase -Tala S/C	24	19	Y	0.5 to 0.6	12	Y	0.5 to 0.6
15	Bahrampur	Farraka	S/C	71	120%	85	Farraka -Malda D/C	40	32	N	0.35	20	N	0.35
		Sagardighi	D/C	26	150%	39	Sagardighi-Bahrampur D/C	26	21	N	0.35	13	N	0.35
		Jeerat	S/C	165	120%	198	Jeerat-Subhasgram S/C	63	50	N	0.35	32	Y	0.5 to 0.6
		Bheramara	D/C	100	150%	150	Bheremara-Bahrampur other ckt	100	80	N	0.35	50	N	0.35
16	Sagardighi	Farraka	S/C	72	120%	86	Farraka -Malda D/C	40	32	N	0.35	20	N	0.35
		Bahrampur	D/C	26	150%	39	Bahrampur-Sagardighi D/C	26	21	N	0.35	13	N	0.35
		Durgapur	D/C	128	150%	192	Durgapur-Bidhannagar D/C	11	9	Y	0.5 to 0.6	6	Y	0.5 to 0.6
		Subhasgram	S/C	246	120%	295	Subhasgram-Jeerat S/C	63	50	N	0.35	32	Y	0.5 to 0.6
17	Durgapur	Farraka	D/C	146	150%	219	Farraka -Malda D/C	40	32	Y	0.5 to 0.6	20	Y	0.5 to 0.6
		Sagardighi	D/C	128	150%	192	Sagardighi-Bahrampur D/C	26	21	Y	0.5 to 0.6	13	Y	0.5 to 0.6
		Bidhannagar	D/C	11	150%	17	Bidhannagar-Durgapur D/C	11	9	N	0.35	6	N	0.35
		Jamsedpur	S/C	177	120%	212	Jamsedpur - Adhunilk D/C	1	0	Y	0.5 to 0.6	0	Y	0.5 to 0.6
		Maithon	D/C	71	150%	106	Maithon-MPL D/C	32	25	Y	0.5 to 0.6	16	Y	0.5 to 0.6
18	Bidhannagar	Durgapur	D/C	11	150%	17	Durgapur-Bidhannagar D/C	11	9	N	0.35	6	N	0.35
		PPSP	D/C	185	150%	278	PPSP-Bidhannagar D/C	185	148	N	0.35	93	N	0.35
		Arambagh	S/C	114	120%	137	Arambag-Kolaghat S/C	64	51	N	0.35	32	N	0.35
19	PPSP	Bidhannagar	D/C	185	150%	278	Bidhannagar-Durgapur D/C	11	9	Y	0.5 to 0.6	6	Y	0.5 to 0.6
		Arambagh	D/C	210	150%	315	Arambag-Kolaghat S/C	64	51	Y	0.5 to 0.6	32	Y	0.5 to 0.6
20	Arambagh	Bidhannagar	S/C	114	120%	137	Bidhannagar-Durgapur D/C	11	9	Y	0.5 to 0.6	6	Y	0.5 to 0.6
		PPSP	D/C	210	150%	315	PPSP-Bidhannagar D/C	185	148	N	0.35	93	Y	0.5 to 0.6
		Bakreswar TPS	S/C	130	120%	156	Arambag-Bakreswar S/C	130	104	N	0.35	65	N	0.35
		Kolaghat TPS	S/C	64	120%	77	Kolaghat-Arambagh S/C	64	51	N	0.35	32	N	0.35
21	Bakreswar TPS	Arambagh	S/C	130	120%	156	Arambag-Kolaghat S/C	64	51	N	0.35	32	N	0.35
		Jeerat	S/C	162	120%	194	Jeerat-Subhasgram S/C	63	50	N	0.35	32	Y	0.5 to 0.6
22	Jeerat	Bahrampur	S/C	165	120%	198	Bahrampur-Sagardighi D/C	26	21	Y	0.5 to 0.6	13	Y	0.5 to 0.6
		Bakreswar TPS	S/C	162	120%	194	Arambag-Bakreswar S/C	130	104	N	0.35	65	N	0.35
		Subhasgram	S/C	63	120%	76	Subhasgram-Jeerat S/C	63	50	N	0.35	32	N	0.35
		Kolaghat TPS	S/C	134	120%	161	Kolaghat-Arambagh S/C	64	51	N	0.35	32	N	0.35
23	Subhasgram	Sagardighi	S/C	246	120%	295	Sagardighi-Bahrampur D/C	26	21	Y	0.5 to 0.6	13	Y	0.5 to 0.6
		Jeerat	S/C	63	120%	76	Jeerat-Subhasgram S/C	63	50	N	0.35	32	N	0.35
		Haldia TPS	D/C	90	150%	135	Haldia-Subhasrgram other ckt	90	72	N	0.35	45	N	0.35
24	Kolaghat TPS	Arambagh	S/C	64	120%	77	Arambag-Kolaghat S/C	64	51	N	0.35	32	N	0.35
		Jeerat	S/C	134	120%	161	Jeerat-Subhasgram S/C	63	50	N	0.35	32	N	0.35

24	Kolaghat TPS	Kharagpur	S/C	98	120%	118	Kharagpur-Baripada S/C	98	78	N	0.35	49	N	0.35
		Chaibasa	S/C	240	120%	288	Chaibasa-Jamsedpur S/C	46	37	Y	0.5 to 0.6	23	Y	0.5 to 0.6
25	Kharagpur	Kolaghat TPS	S/C	98	120%	118	Kolaghat-Arambagh S/C	64	51	N	0.35	32	N	0.35
		Baripada	S/C	98	120%	118	Baripada-Kharagpur S/C	98	78	N	0.35	49	N	0.35
		Chaibasa	S/C	161	120%	193	Chaibasa-Jamsedpur S/C	46	37	N	0.35	23	Y	0.5 to 0.6
26	Baripada	Kharagpur	S/C	98	120%	118	Kharagpur-Baripada S/C	98	78	N	0.35	49	N	0.35
		N. Duburi	S/C	190	120%	228	N. Duburi-Meeramandali D/C	90	72	N	0.35	45	N	0.35
		Pandiabilli	S/C	302	120%	362	Pandiabilli-Mendasal D/C	28	22	Y	0.5 to 0.6	14	Y	0.5 to 0.6
		Keonjhar	S/C	156	120%	187	Keonjhar-Rengali S/C	100	80	N	0.35	50	N	0.35
		Jamsedpur	S/C	108	120%	130	Jamsedpur - Adhunilk D/C	1	0	Y	0.5 to 0.6	0	Y	0.5 to 0.6
		TISCO	S/C	140	120%	168	TISCO-Baripada S/C	33	26	Y	0.5 to 0.6	16	Y	0.5 to 0.6
27	N. Duburi	Baripada	S/C	190	120%	228	Baripada-Kharagpur S/C	98	78	N	0.35	49	N	0.35
		Pandiabilli	S/C	143	120%	172	Pandiabilli-Mendasal D/C	28	22	Y	0.5 to 0.6	14	Y	0.5 to 0.6
		Meramandali	D/C	90	150%	135	Meramandali-GMR S/C	8	6	Y	0.5 to 0.6	4	Y	0.5 to 0.6
28	Pandiabilli	Baripada	S/C	302	120%	362	Baripada-Kharagpur S/C	98	78	N	0.35	49	Y	0.5 to 0.6
		N. Duburi	S/C	143	120%	172	N. Duburi-Meeramandali D/C	90	72	N	0.35	45	N	0.35
		Mendasal	D/C	28	150%	42	Mendasal Pandiabilli D/C	28	22	N	0.35	14	N	0.35
29	Mendasal	Pandiabilli	D/C	28	150%	42	Pandiabilli-Mendasal D/C	28	22	N	0.35	14	N	0.35
		Meramandali	S/C	98	120%	118	Meramandali-GMR S/C	8	6	Y	0.5 to 0.6	4	Y	0.5 to 0.6
30	Meramandali	Mendasal	S/C	98	120%	118	Mendasal Pandiabilli D/C	28	22	N	0.35	14	Y	0.5 to 0.6
		Angul	S/C	25	120%	30	Angul-Mermandali S/C	19	15	N	0.35	9	N	0.35
		Angul	S/C	19	120%	22	Angul-Mermandali S/C	19	15	N	0.35	9	N	0.35
		TSTPS	S/C	51	120%	61	TSTPS-Rengali D/C	24	19	N	0.35	12	N	0.35
		JSPL	D/C	38	150%	57	JSPL-Meramandali Other ckt	38	30	N	0.35	19	N	0.35
		GMR	S/C	8	120%	10		999	799	N	0.35	500	N	0.35
		SEL	D/C	220	150%	330	SEL-Meramandali Other ckt	220	176	N	0.35	110	N	0.35
31	Angul	Meramandali	S/C	25	120%	30	Meramandali-GMR S/C	8	6	N	0.35	4	Y	0.5 to 0.6
		Meramandali	S/C	19	120%	22	Meramandali-GMR S/C	8	6	N	0.35	4	N	0.35
		Bolangir	S/C	196	120%	235	Bolangir-Angul S/C	196	157	N	0.35	98	N	0.35
		TSTPS	S/C	68	120%	82	TSTPS-Rengali D/C	24	19	N	0.35	12	Y	0.5 to 0.6
		JITPL	D/C	80	150%	120	JITPL-Angul Other Ckt	80	64	N	0.35	40	N	0.35
		GMR	D/C	31	150%	47	GMR-Angul Other Ckt	31	25	N	0.35	16	N	0.35
32	Bolangir	Angul	S/C	196	120%	235	Angul-Mermandali S/C	19	15	Y	0.5 to 0.6	9	Y	0.5 to 0.6
		Jeypore	S/C	287	120%	344	Jeypore-Indravati S/C	71	57	Y	0.5 to 0.6	36	Y	0.5 to 0.6
33	Jeypore	Bolangir	S/C	287	120%	344	Bolangir-Angul S/C	196	157	N	0.35	98	N	0.35
		Indravati	S/C	71	120%	85	Indravati-Indravti (O) S/C	4	3	Y	0.5 to 0.6	2	Y	0.5 to 0.6
		Gazuwaka	D/C	220	150%	330	Gazuwaka-Jeypore other ckt	220	176	N	0.35	110	N	0.35
34	Indravati	Jeypore	S/C	71	120%	85	Jeypore-Indravati S/C	71	57	N	0.35	36	N	0.35
		Rengali	S/C	356	120%	427	Rengali-TSTPS D/C	24	19	Y	0.5 to 0.6	12	Y	0.5 to 0.6
		Indravati (o)	S/C	4	120%	4		999	799	N	0.35	500	N	0.35
35	Indravati (o)	Indravati	S/C	4	120%	4	Jeypore-Indravati S/C	71	57	N	0.35	36	N	0.35
36	Rengali	Indravati	S/C	356	120%	427	Indravati-Indravti (O) S/C	4	3	Y	0.5 to 0.6	2	Y	0.5 to 0.6
		Keonjhar	S/C	100	120%	120	Keonjhar-Rengali S/C	100	80	N	0.35	50	N	0.35
		TSTPS	D/C	24	150%	36	TSTPS-Rengali D/C	24	19	N	0.35	12	N	0.35
37	Keonjhar	Baripada	S/C	156	120%	187	Baripada-Kharagpur S/C	98	78	N	0.35	49	N	0.35
		Rengali	S/C	100	120%	120	Rengali-TSTPS D/C	24	19	Y	0.5 to 0.6	12	Y	0.5 to 0.6
38	TSTPS	Meramandali	S/C	51	120%	61	Meramandali-GMR S/C	8	6	Y	0.5 to 0.6	4	Y	0.5 to 0.6
		Angul	S/C	68	120%	82	Angul-Mermandali S/C	19	15	N	0.35	9	Y	0.5 to 0.6
		Rengali	D/C	24	150%	36	Rengali-TSTPS D/C	24	19	N	0.35	12	N	0.35
		Rourkela	D/C	171	150%	257	Rourkela-Chaibasa D/C	131	105	N	0.35	66	Y	0.5 to 0.6
		TSTPS	D/C	171	150%	257	TSTPS-Rengali D/C	24	19	Y	0.5 to 0.6	12	Y	0.5 to 0.6
		Jharsuguda	D/C	145	150%	218	Jharsuguda-Rourkela S/C	63	50	Y	0.5 to 0.6	31	Y	0.5 to 0.6

39	Rourkela	SEL	S/C	135	120%	162	SEL-Rourkela S/C	135	108	N	0.35	68	N	0.35
		Chaibasa	S/C	131	120%	158	Chaibasa-Jamsedpur S/C	46	37	N	0.35	23	Y	0.5 to 0.6
		Jamsedpur	S/C	182	120%	218	Jamsedpur - Adhunilk D/C	1	0	Y	0.5 to 0.6	0	Y	0.5 to 0.6
		Ranchi	D/C	144	150%	217	Ranchi-N.Ranchi D/C	79	63	Y	0.5 to 0.6	39	Y	0.5 to 0.6
		Raigarh	S/C	139	120%	167	Raigarh-Raigarg Polling D/C	6	5	Y	0.5 to 0.6	3	Y	0.5 to 0.6
40	Jharsuguda	Rourkela	D/C	145	150%	218	Rourkela-Chaibasa D/C	131	105	N	0.35	66	Y	0.5 to 0.6
		Raigarh	S/C	115	120%	137	Raigarh-Raigarh Polling D/C	6	5	Y	0.5 to 0.6	3	Y	0.5 to 0.6
		IBEUL	S/C	63	120%	75	IBEUL-Raigrah S/C	63	50	N	0.35	31	N	0.35
41	IBEUL	Jharsuguda	S/C	63	120%	75	Jharsuguda-Raigarh S/C	115	92	N	0.35	58	N	0.35
		Raigarh	S/C	91	120%	109	Raigarh-Raigarg Polling D/C	6	5	Y	0.5 to 0.6	3	Y	0.5 to 0.6
42	SEL	Raigarh	S/C	147	120%	176	Raigarh-Raigarg Polling D/C	6	5	Y	0.5 to 0.6	3	Y	0.5 to 0.6
		Rourkela	S/C	135	120%	162	Rourkela-Chaibasa S/C	131	105	N	0.35	66	N	0.35
43	Chaibasa	Kolaghat TPS	S/C	240	120%	288	Kolaghat-Arambagh S/C	64	51	N	0.35	32	Y	0.5 to 0.6
		Kharagpur	S/C	161	120%	193	Kharagpur-Baripada S/C	98	78	N	0.35	49	N	0.35
		Rourkela	S/C	131	120%	158	Rourkela-Chaibasa S/C	131	105	N	0.35	66	N	0.35
		Jamsedpur	S/C	46	120%	55	Jamsedpur - Adhunilk D/C	1	0	Y	0.5 to 0.6	0	Y	0.5 to 0.6
44	Jamsedpur	Durgapur	S/C	177	120%	212	Durgapur-Bidhannagar D/C	11	9	Y	0.5 to 0.6	6	Y	0.5 to 0.6
		Baripada	S/C	108	120%	130	Baripada-Kharagpur S/C	98	78	N	0.35	49	N	0.35
		Rourkela	S/C	182	120%	218	Rourkela-Chaibasa D/C	131	105	N	0.35	66	N	0.35
		Chaibasa	S/C	46	120%	55	Chaibasa-Jamsedpur S/C	46	37	N	0.35	23	N	0.35
		Mejia B	S/C	168	120%	201	Mejia B- Maithon D/C	59	47	N	0.35	30	Y	0.5 to 0.6
		Maithon	S/C	153	120%	184	Maithon-MPL D/C	32	25	Y	0.5 to 0.6	16	Y	0.5 to 0.6
		DSTPS	D/C	157	150%	235	DSTPS-Jamsedpur D/C	69	55	Y	0.5 to 0.6	35	Y	0.5 to 0.6
		TISCO	S/C	33	120%	39	TISCO-Baripada S/C	33	26	N	0.35	16	N	0.35
		Adhunik	D/C	1	150%	2	Jamsedpur - Adhunilk D/C	1	0	Y	0.5 to 0.6	0	Y	0.5 to 0.6
45	Mejia B	Jamsedpur	S/C	168	120%	201	Jamsedpur - Adhunilk D/C	1	0	Y	0.5 to 0.6	0	Y	0.5 to 0.6
		Maithon	S/C	84	120%	100	Maithon-MPL D/C	32	25	N	0.35	16	Y	0.5 to 0.6
		Maithon	D/C	59	150%	89	Maithon-MPL D/C	32	25	Y	0.5 to 0.6	16	Y	0.5 to 0.6
46	Maithon	Gaya	D/C	276	150%	414	Gaya-Chandwa D/C	117	94	Y	0.5 to 0.6	59	Y	0.5 to 0.6
		Kahalgaon	D/C	172	150%	258	Khalgaon-BankaD/C	48	38	Y	0.5 to 0.6	24	Y	0.5 to 0.6
		Durgapur	D/C	71	150%	106	Durgapur-Bidhannagar D/C	11	9	Y	0.5 to 0.6	6	Y	0.5 to 0.6
		Jamsedpur	S/C	153	120%	184	Jamsedpur - Adhunilk D/C	1	0	Y	0.5 to 0.6	0	Y	0.5 to 0.6
		Mejia B	S/C	84	120%	100	Mejia B- Maithon D/C	59	47	N	0.35	30	N	0.35
		Mejia B	D/C	59	150%	89	Mejia B- Maithon D/C	59	47	N	0.35	30	N	0.35
		MPL	D/C	32	150%	47	MPL-Maithon D/C	32	25	N	0.35	16	N	0.35
		Raghunatpur	S/C	55	120%	65	Raghunathpur-Maithon S/C	55	44	N	0.35	27	N	0.35
		Ranchi	S/C	200	120%	240	Ranchi-N.Ranchi D/C	79	63	N	0.35	39	Y	0.5 to 0.6
47	MPL	Maithon	D/C	32	150%	47	Maithon-MPL D/C	32	25	N	0.35	16	N	0.35
		Ranchi	D/C	188	150%	281	Ranchi-N.Ranchi D/C	79	63	Y	0.5 to 0.6	39	Y	0.5 to 0.6
48	DSTPS	Jamsedpur	D/C	157	150%	235	Jamsedpur - Adhunilk D/C	1	0	Y	0.5 to 0.6	0	Y	0.5 to 0.6
		Raghunatpur	D/C	69	150%	104	Raghunathpur-Maithon S/C	55	44	N	0.35	27	Y	0.5 to 0.6
49	Raghunathpur	Maithon	S/C	55	120%	65	Maithon-MPL D/C	32	25	N	0.35	16	N	0.35
		DSTPS	D/C	69	150%	104	DSTPS-Jamsedpur D/C	69	55	N	0.35	35	N	0.35
		Ranchi	S/C	166	120%	199	Ranchi-N.Ranchi D/C	79	63	N	0.35	39	N	0.35
50	Ranchi	Rourkela	D/C	144	150%	217	Rourkela-Chaibasa D/C	131	105	N	0.35	66	Y	0.5 to 0.6
		Maithon	S/C	200	120%	240	Maithon-MPL D/C	32	25	Y	0.5 to 0.6	16	Y	0.5 to 0.6
		MPL	D/C	188	150%	281	MPL-Maithon D/C	32	25	Y	0.5 to 0.6	16	Y	0.5 to 0.6
		Raghunatpur	S/C	166	120%	199	Raghunathpur-Maithon S/C	55	44	N	0.35	27	Y	0.5 to 0.6
		N. Ranchi	D/C	79	150%	118	N. Ranchi-Chandwa D/C	68	54	N	0.35	34	Y	0.5 to 0.6
		N. Ranchi	D/C	79	150%	118	N. Ranchi-Chandwa D/C	68	54	N	0.35	34	Y	0.5 to 0.6
		Sipat	D/C	405	150%	608	Sipat-Korba S/C	100	80	Y	0.5 to 0.6	50	Y	0.5 to 0.6
		Ranchi	D/C	79	150%	118	Ranchi-N.Ranchi D/C	79	63	N	0.35	39	Y	0.5 to 0.6

51	N. Ranchi	Ranchi	D/C	79	150%	118	Ranchi-N.Ranchi D/C	79	63	N	0.35	39	N	0.35
		Chandwa	D/C	68	150%	102	Chandwa-N.Ranchi D/C	68	54	N	0.35	34	N	0.35
52	Chandwa	Gaya	D/C	117	150%	176	Gaya-Chandwa D/C	117	94	N	0.35	59	N	0.35
		N. Ranchi	D/C	68	150%	102	N. Ranchi-Chandwa D/C	68	54	N	0.35	34	N	0.35
53	Koderma	Gaya	D/C	125	150%	188	Gaya-Chandwa D/C	117	94	N	0.35	59	Y	0.5 to 0.6
		Biharsariff	D/C	111	150%	166	Biharsaiff-Lakhisarai D/C	89	71	N	0.35	45	Y	0.5 to 0.6
		Bokaro	D/C	100	150%	150	Koderma-Bokaro D/C	100	80	N	0.35	50	N	0.35
54	Bokaro	Koderma	D/C	100	150%	150	Koderma-Bokaro D/C	100	80	N	0.35	50	N	0.35
55	Rangpo	Binaguri	D/C	110	150%	165	Binaguri-Kishanhanj D/C	98	78	N	0.35	49	Y	0.5 to 0.6
		Teesta V	D/C	12	150%	18	Rangpo-Teesta D/C	12	10	N	0.35	6	N	0.35
56	TISCO	Baripada	S/C	140	120%	168	Baripada-Kharagpur S/C	98	78	N	0.35	49	N	0.35
		Jamsedpur	S/C	33	120%	39	Jamsedpur - Adhunilk D/C	1	0	Y	0.5 to 0.6	0	Y	0.5 to 0.6
57	Teesta V	Rangpo	D/C	12	150%	18	Rangpo-Teesta D/C	12	10	N	0.35	6	N	0.35
58	GMR	Angul	D/C	31	150%	47	Angul-Meramandali S/C	19	15	Y	0.5 to 0.6	10	Y	0.5 to 0.6
59	GMR(0)	Meramandali	S/C	8	120%	10	Meramandali-Angul S/C	19	15	N	0.35	10	N	0.35
60	JITPL	Angul	D/C	80	150%	120	Angul-Meramandali S/C	19	15	Y	0.5 to 0.6	10	Y	0.5 to 0.6

Annexure-C8

Name of the substation	NAME OF LINE	OVERVOLTAGE % SETTING						REMARK
		LOCAL END(STAGE-I)			REMOTE END(STAGE-I)			
		VOLTAGE GARDIENT(% setting)	TIME DELAY(sec)	Drop Off to Pickup ratio	VOLTAGE GARDIENT(% setting)	TIME DELAY(sec)	Drop Off to Pickup ratio	
Binaguri	400KV BINAGURI-RANGPO-I	110	5		112	7		
	400KV BINAGURI-RANGPO-II	112	5		112	7		
	400KV BINAGURI-TALA-I	110	5		105	5		
	400KV BINAGURI-TALA-II	112	5		105	5		
	400KV BINAGURI-MALABASE-III	110	5		105	5		
	400KV BINAGURI-TALA-IV	112	5		105	5		
	400 KV BINAGURI-PURNEA- I	110	5		112	5		
	400 KV BINAGURI-PURNEA- II	112	5		110	5		
	400 KV BINAGURI-KISHANGANJ- I	110	5		112	5		Need to be updated after LILO at Kishanganj
	400 KV BINAGURI-KISHANGANJ- II	112	5		110	7		
	400KV BINAGURI-BONGAIGAON-I	110	5		OTHER REGION			May be submitted by ER - II, Powergrid
	400KV BINAGURI-BONGAIGAON-II	110	6					
	400KV BINAGURI-BONGAIGAON-III	110	5					
	400KV BINAGURI-BONGAIGAON-IV	110	6					
Kishanganj	400 KV KISHANGANJ-PURNEA-I							
	400 KV KISHANGANJ-PURNEA-II							
	400 KV KISHANGANJ-BINAGURI-I							
	400 KV KISHANGANJ-BINAGURI-II							
	400 KV KISHANGANJ-PATNA-I							
	400 KV KISHANGANJ-PATNA-II							
Rangpo	400KV RANGPO-TEESTA-I	112	7		110	7		
	400KV RANGPO-TEESTA-II	112	7		112	5		
	400KV RANGPO-BINAGURI-I	112	7		110	5		
	400KV RANGPO-BINAGURI-II	112	7		112	5		
Tala	400KV TALA-BINAGURI-I	105	5		110	5		
	400KV TALA-BINAGURI-II	105	5		112	5		
	400KV TALA-MALABASE-III	105	5		110	5		
	400KV TALA-BINAGURI-IV	105	5		112	5		
Teesta	400KV TEESTA-RANGPO-I	110	7		112	7		
	400KV TEESTA-RANGPO-II	112	5		112	7		
PURNEA	400 KV PURNEA - MALDA - I	110	7		110	5		
	400 KV PURNEA - MALDA - II	112	5		110	6		
	400 KV PURNEA- BINAGURI - I	112	5		110	5		
	400 KV PURNEA- BINAGURI - II	110	5		112	5		
	400 KV PURNEA- KISHANGANJ - I	112	5		110	5		Need to be updated after LILO at Kishanganj
	400 KV PURNEA- KISHANGANJ - II	112	5		112	5		
	400 KV PURNEA-MUZAFFARPUR-I	110	7		110	7		
	400 KV PURNEA-MUZAFFARPUR-II	112	7		112	7		
	400 KV PURNEA-BIHARSHARIFF-I	110	5		110	5		
	400 KV PURNEA-BIHARSHARIFF-II	110	7		110	7		
MALDA	400 KV MALDA - PURNEA - I	110	5		110	7		
	400 KV MALDA - PURNEA - II	110	6		112	5		
	400 KV MALDA - FARAKKA - I	110	5		110	5		
	400 KV MALDA - FARAKKA - II	110	6		110	5		
	400 KV FSTPP-MALDA-I	110	5		110	5		
	400 KV FSTPP-MALDA-II	110	5		110	6		
	400 KV FSTPP-DURGAPUR-I	112	7		110	5		

FARAKKA	400 KV FSTPP-DURGAPUR-II	110	5		112	5		
	400 KV FSTPP-KhSTPP-I	110	5		110	5		
	400 KV FSTPP-KhSTPP-II	112	5		112	5		
	400 KV FSTPP-KhSTPP-III	110	7		110	7		
	400 KV FSTPP-KhSTPP-IV	112	7		112	7		
	400 KV FSTPP-BEHRAMPUR	110	12		110	6		
	400 KV FSTPP-SAGARDIGHI	112	7		140	0.1		
Behrampur	400 KV BEHRAMPUR-BHERAMARA -I	110	5		110	4		
	400 KV BEHRAMPUR-BHERAMARA -II	110	10		110	5		
	400 KV BEHRAMPUR - FARAKKA	110	6		110	12		
	400KV BERHAMPORE-SAGARDIGHI-I	110	5		110	5		
	400KV BERHAMPORE-SAGARDIGHI-II	110	6		110	7		
	400 KV BEHRAMPUR - JEERAT	110	7		110	7		
Jeerat	400KV JEERAT-SUBHASHGRAM	112	5		112	5		
	400 KV JERAT - BERHAMPUR	110	7		110	7		
	400 KV Jeerat-Bakreswar	110	5		110	5		
	400 KV Jeerat-Kolaghat	NOT INSTALLED AT BOTH ENDS						Present status may be updated
Subhashgram	400 KV SUBHASHSHGRAM-SAGARDIGHI	112	5		112	5		
	400KV SUBHASHGRAM-HALDIA-I	110	5		110	3		
	400KV SUBHASHGRAM-HALDIA-II	110	6		110	5		
	400 KV SUBHASHGRAM-JEERAT	112	5		112	5		
HALDIA	400KV HALDIA-SUBHASHGARM-I	110	3		110	5		
	400KV HALDIA-SUBHASHGRAM-II	110	5		110	6		
SAGARDIGHI	400 KV SAGARDIGHI - FARAKKA	140	0.1		112	7		
	400 KV SAGARDIGHI - DURGAPUR-I	110	5		110	5		
	400 KV SAGARDIGHI - DURGAPUR-II	110	6		110	6		
	400KV SAGARDIGHI-BERHAMPORE-I	110	5		110	5		
	400KV SAGARDIGHI-BERHAMPORE-II	110	7		110	6		
	400 KV SAGARDIGHI - SUBHASHGRAM	112	5		112	5		
Durgapur	400 KV DURGAPUR - SAGARDIGHI-I	110	5		110	5		
	400 KV DURGAPUR - SAGARDIGHI-II	110	6		110	6		
	400 KV DURGAPUR-FSTPP-I	110	5		112	7		
	400 KV DURGAPUR-FSTPP-II	112	5		110	5		
	400 KV DURGAPUR-MAITHON-I	110	5		110	5		
	400 KV DURGAPUR-MAITHON-II	110	6		110	6		
	400 KV DURGAPUR-JAMSHEDPUR	110	5		112	5		
	400 KV DURGAPUR - BIDHANNAGAR-I	110	5		110	5		
	400 KV DURGAPUR - BIDHANNAGAR-II	110	5		110	5		
BIDHANNAGAR	400 KV BIDHANNAGAR-PPSP-I	110	5		110	5		
	400 KV BIDHANNAGAR-PPSP-II	110	5		110	5		
	400 KV BIDHANNAGAR - DURGAPUR-I	110	5		110	5		
	400 KV BIDHANNAGAR - DURGAPUR-II	110	5		110	5		
	400 KV BIDHANNAGAR-ARAMBAG	110	5		110	5		
PPSP	400 KV PPSP-BIDHAN NAGAR-I	110	5		110	5		
	400 KV PPSP-BIDHAN NAGAR-II	110	5		110	5		
	400 KV PPSP-ARAMBAG-I	110	5		110	5		
	400 KV PPSP-ARAMBAG-II	110	5		110	5		
Arambag	400 KVARAMBAG-PPSP-I	110	5		110	5		
	400 KV ARAMBAG-PPSP-II	110	5		110	5		
	400 KV ARAMBAG -KOLAGHAT	110	5		NOT INSTALLED AT KOLAGHAT END			Present status may be updated
	400 KV ARAMBAG-BAKRESWAR	110	5		110	5		
	400 KV ARAMBAG-BIDHANNAGAR	110	5		110	5		
BAKRESWAR	400 KV BAKRESWAR-JEERAT	110	5		110	5		
	400 KV BAKRESWAR-ARAMBAG	110	5		110	5		

KOLAGHAT	400 KV KOLAGHAT-JEERAT	NOT INSTALLED AT BOTH ENDS						Present status may be updated
	400 KV KOLAGHAT-ARAMBAG	NOT INSTALLED TA KOLAGHAT END			110	5		Present status may be updated
	400 KV KOLAGHAT-KHARAGPUR-I	110	5		110	5		
	401 KV KOLAGHAT-CHAIBASA-I	110	5		110	5		Need to be updated after Chaibasa connectivity
KHARAGPUR	400 KV KHARAGPUR-KOLAGHAT-I	110	5		110	5		
	400 KV KHARAGPUR-CHAIBASA-I	110	5		110	5		Need to be updated after Chaibasa connectivity
	400KV KHARAGPUR-BARIPADA	110	5		112	7		
BARIPADA	400 KV BARIPADA-KEONJHAR	110	3		110	5		
	400 KV BARIPADA- TISCO(JAMSHEDPUR)	111	5		110	4		
	400 KV BARIPADA-N. DUBURI -I	112	6		110	5		Needs to be upgated after LILO at N. Duburi
	400 KV BARIPADA-PANDAIABILLI-I	112	6		110	5		Needs to be updated after LILO at Pandiabilli
	400 KV BARIPADA-KHARAGPUR	112	7		110	5		
	400 KV BARIPADA-JAMSHEDPUR	111	5		110	4		
Jamshedpur	400 KV JAMSHEDPUR-CHAIBASA - I	112	5		112	5		
	400 KV JAMSHEDPUR-CHAIBASA- II	110	7		110	6		
	400 KV JAMSHEDPUR - MEJIA	112	5		117	2.5		
	400 KV JAMSHEDPUR - DSTPS(ANDAL)-I	110	5		117	2.5		
	400 KV JAMSHEDPUR - DSTPS(ANDAL)-II	112	5		117	2.5		
	400KV JAMSHEDPUR - APNRL-I	110	5		115	5		
	400KV JAMSHEDPUR - APNRL-II	110	5		115	5		
	400 KV JAMSHEDPUR - DURGAPUR	112	5		110	5		
	400 KV JAMSHEDPUR - TISCO	112	7		112	7		
	400 KV JAMSHEDPUR-MAITHON	110	5		110	5		
	400 KV JAMSHEDPUR-BARIPADA	110	4		111	5		
CHAIBASA	400KV CHAIBASA-JAMSHEDPUR-I	112	5		112	5		
	400KV CHAIBASA-JAMSHEDPUR-II	110	6		110	7		
	400KV CHAIBASA-KHARAGPUR-II							Need to be updated after Chaibasa connectivity
	400KV CHAIBASA-KOLAGHAT-II							Need to be updated after Chaibasa connectivity
	400KV CHAIBASA-ROURKELA-I	112	7		110	5		
	400KV CHAIBASA-ROURKELA-II				110	6		
APNRL	400 KV APNRL-JAMSHEDPUR-I	115	5		110	5		
	400 KV APNRL-JAMSHEDPUR -II	115	5		110	5		
TISCO	400 KV TISCO-JAMSHEDPUR	112	7		112	7		
	400 KV TISCO-BIRPADA	110	4		111	5		
Maithon	400 KV MAITHON-RANCHI	112	5		112	5		
	400 KV MAITHON-KAHALGAON-I	110	5		112	5		
	400 KV MAITHON-KAHALGAON-II	110	6		110	5		
	400 KV MAITHON -MAITHON RB-I	110	5		110	7		
	400 KV MAITHON -MAITHON RB-II	112	5		112	7		
	400 KV MAITHON -GAYA - I	110	5		110	5		
	400 KV MAITHON -GAYA-II	110	6		110	5		
	400 KV MAITHON-JAMSHEDPUR	110	5		110	5		
	400 KV MAITHON -MEJIA- I	110	5		117	2.5		
	400 KV MAITHON -MEJIA- II	112	5		117	2.5		
	401 KV MAITHON -MEJIA- III	110	5		117	2.5		
	400 KV MAITHON - DURGAPURR - I	110	5		110	5		
	400 KV MAITHON - DURGAPURR - II	110	6		110	6		
	400 KV MAITHON -RAGHUNATHPUR	112	6		113	5		
Ranchi	400 KV RANCHI-MAITHON	112	5		112	5		
	400 KV RANCHI-NEW RANCHI-I	110	5		110	5		
	400 KV RANCHI-NEW RANCHI-II	110	5		110	5		
	400 KV RANCHI-NEW RANCHI-III	110	5		110	5		
	400 KV RANCHI-NEW RANCHI-IV	110	5		110	5		
	400 KV RANCHI-RAGHUNATHPUR	110	5		113	5		
	400 KV RANCHI-MAITHON RB-I	112	7		112	7		
	400 KV RANCHI-MAITHON RB-II	110	7		110	7		

	400 KV RANCHI - SIPAT - I	110	7		OTHER REGION			May be submitted by ER - I, Powergrid
	400 KV RANCHI - SIPAT - II	112	5					
	400 KV RANCHI-ROURKELA- I	110	5		110	5		
	400 KV RANCHI-ROURKELA - II	112	7		110	6		
765/400 KV NEW RANCHI S/S	400 KV NEW RANCHI- RANCHI-I	110	5		110	5		
	400 KV NEW RANCHI- RANCHI-II	110	5		110	5		
	400 KV NEW RANCHI- RANCHI-III	110	5		110	5		
	400 KV NEW RANCHI- RANCHI-IV	110	5		110	5		
	400 KV NEW RANCHI- CHANDWA-I							
	400 KV NEW RANCHI- CHANDWA-II							
	765 KV KV NEW RANCHI-DHARMJAYGARH-I	107	5		OTHER REGION			May be submitted by ER - I, Powergrid
	765 KV KV NEW RANCHI-DHARMJAYGARH-II							
CHANDWA	400 KV CHANDWA-N.RANCHI-I							
	400 KV CHANDWA-N.RANCHI-II							
	400 KV CHANDWA-GAYA-I							
	400 KV CHANDWA-GAYA-II							
MAITHON RIGHT BANK	400 KV MAITHON RB-RANCHI-I	112	7		112	7		
	400 KV MAITHON RB-RANCHI-II	110	7		110	7		
	400 KV MAITHON RB-MAITHON-I	110	7		110	5		
	400 KV MAITHON RB-MAITHON-II	112	7		112	5		
DSTPS	400 KV DSTPS-JAMSHEDPUR-I	117	2.5		110	5		
	400 KV DSTPS-JAMSHEDPUR-II	117	2.5		112	5		
	400 KV DSTPS-RAGHUNATHPUR-I	117	2.5		113	5		
	400 KV DSTPS-RAGHUNATHPUR-II	117	2.5		113	5		
KODERMA	400 KV KODERMA-GAYA-I	113	5		110	5		
	400 KV KODERMA-GAYA-II	113	5		110	5		
	400 KV KODERMA-BIHARSHARIFF-I	113	5		112	7		
	400 KV KODERMA-BIHARSHARIFF-II	113	5		110	5		
	400KV KODERMA-BOKARO-A-I	113	5		110	6		
	400KV KODERMA-BOKARO-A-II	113	5		110	6		
BOKARO-A	400KV BOKARO-A-KODERMA-I	110	6		113	5		
	400KV BOKARO-A-KODERMA-II	110	6		113	5		
Mejia	400 KV MEJIA-MAITHON -I	117	2.5		110	5		
	400 KV MEJIA-MAITHON -II	117	2.5		112	5		
	400 KV MEJIA-MAITHON -III	117	2.5		110	5		
	400 KV MEJIA-JAMSHEDPUR	117	2.5		112	5		
RAGHUNATHPUR	400 KV RAGHUNATHPUR-MAITHON	113	5		112	6		
	400 KV RAGHUNATHPUR-RANCHI	113	5		110	5		
	400 KV RAGHUNATHPUR-DSTPS-I	113	5		117	2.5		
	400 KV RAGHUNATHPUR-DSTPS-II	113	5		117	2.5		
MENDHASAL	400 KV MENDHASAL-PANDIABILLI-I	110	5		112	6		Needs to be updated after LILO at Pandiabilli
	400 KV MENDHASAL-PANDIABILLI-II	110	5		112	6		Needs to be updated after LILO at Pandiabilli
	400 KV MENDHASAL-MEERAMUNDALI	110	5		110	5		
PANDIABILLI	400 KV PANDIABILLI-MENDASAL-I							
	400 KV PANDIABILLI-MENDASAL-II							
	400 KV PANDIABILLI-N.DUBURI							
	400 KV PANDIABILLI - BARIPADA							
N. DUBURI	400 KV N.DUBURI-PANDIABILLI							
	4OO KV N.DUBURI-BARIPADA							
	400 KV N.DUBURI-MERAMANDALI-I							
	400 KV N.DUBURI-MERAMANDALI-II							
	400 KV MEERAMUNDALI-TALCHER	110	5		110	5		
	400 KV MEERAMUNDALI-ANGUL-II	112	5		110	5		
	400 KV MEERAMUNDALI-JINDAL-I	110	5		110	5		
	400 KV MEERAMUNDALI-JINDAL-II	110	5		110	5		
	400 KV MEERAMUNDALI-ANGUL-I	112	5		110	5		

MEERAMUNDALI	400 KV MEERAMUNDALI-MENDHASAL	110	5		110	5		
	400KV MERAMUNDALI-GMR	110	5		110	5		
	400 KV MERAMUNDALI-STERLITE -I							
	400 KV MERAMUNDALI-STERLITE -II							
	400 KV MERAMUNDALI-N.DUBURI -I							
	400 KV MERAMUNDALI-N.DUBURI -I							
JINDAL	400 KV JINDAL-MEERAMUNDALI-I	110	5		110	5		
	400 KV JINDAL-MEERAMUNDALI-II	110	5		110	5		
GMR	400 KV GMR-ANGUL-I	110	2		110	5		
	400 KV GMR-ANGUL-II	110	2		110	6		
	400KV GMR-MERAMUNDALI	110	5		110	5		
ANGUL	400 KV ANGUL-MEERAMUNDALI-I	110	5		112	5		
	400KV ANGUL-BOLANGIR	110	5		110	5		
	400KV ANGUL-TSTPP	110	5		110	5		
	400 KV ANGUL-MERAMUNDALI-II	110	5		112	5		
	400 KV ANGUL-JITPL-II	110	5		110	5		
	400 KV ANGUL-JITPL-I	110	5		110	5		
	400KV ANGUL-GMR-I	110	5		110	2		
	400KV ANGUL-GMR-II	110	6		110	2		
	765kV Angul-Jharsuguda-I	110	4		110	4		
	765kV Angul-Jharsuguda-II	110	4		110	4		
JITPL	400 KV JITPL-ANGUL-I	110	5		110	5		
	400 KV JITPL-ANGUL-II	110	5		110	5		
BOLANGIR	400 KV BOLANGIR-ANGUL	110	5		110	5		
	400 KV BOLANGIR-JEYPORE	112	5		112	5		
Jeypore	400 KV JEYPORE-BOLANGIR	112	5		112	5		
	400 KV JEYPORE-GAZUWAKA-I	110	5		110	9		
	400 KV JEYPORE-GAZUWAKA-II	110	10		110	10		
	400KV JEYPORE-INDRAVATI	112	5		110	5		
INDRAVATI(PG)	400 KV INDRAVATI-JEYPORE	110	5		112	5		
	400 KV INDRAVATI-INDRAVATI	115	5		115	5		
	400 KV INDRAVATI-RENGALI	113	5		110	5		
INDRAVATI(GR)	400 KV INDRAVTI(GR)-INDRAVATI(PG)	115	5		115	5		
Rengali	400 KV RENGALI-INDRAVATI(PG)	110	5		113	5		
	400 KV RENGALI-KEONJHAR	110	5		110	5		
	400 KV RENGALI-TALCHER-I	110	5		110	5		
	400 KV RENGALI-TALCHER-II	110	6		112	5		
KEONJHOR	400 KV KEONJHAR-RENGALI	110	5		110	5		
	400 KV KEONJHAR-BIRPADA	110	3		110	5		
Talcher	400 KV Talcher-Rourkela-I	110	5		110	5		
	400 KV Talcher-Rourkela-II	112	5		110	6		
	400 KV Talcher-Rengali-I	110	5		110	5		
	400 KV Talcher-Rengali-II	112	5		110	6		
	400 KV Talcher-MERAMUNDALI	110	5		110	5		
	400 KV Talcher-ANGUL	110	5		110	5		
Rourkela	400 KV ROURKELLA-JHARSHUGUDA-I	110	5		110	10		
	400 KV ROURKELLA-JHARSHUGUDA-II	110	6		110	6		
	400 KV ROURKELLA-RAIGARH	112	5		OTHER REGION			May be submitted by Odisha Project, Powergrid
	400 KV ROURKELLA-STERLITE-II	110	6		115	5		
	400 KV ROURKELA-TALCHER-I	110	5		110	5		
	400 KV ROURKELA-TALCHER-II	110	6		112	5		
	400 KV ROURKELA-CHAIBASA-I	110	5		112	7		
	400 KV ROURKELA-CHAIBASA-II	110	6					
	400 KV ROURKELA-RANCHI-I	110	5		110	5		
	400 KV ROURKELA-RANCHI-II	110	6		112	7		
	400 KV STERLITE - ROURKELA - II	115	5		110	6		

STERLITE	400 KV STERLITE - RAIGARH - II	115	5		OTHER REGION			May be submitted by Odisha Project, Powergrid
	400 KV STERLITE-MERAMANDALI-I							
	400 KV STERLITE-MERAMANDALI-II							
Jharshuguda	400KV JHSUGUDA-ROURKELA-I	110	10		110	5		
	400KV JHSUGUDA-ROURKELA-II	110	6		110	6		
	400 KV JHARSHUGUDA-IBEUL	110	10		110	5		
	765kV Jharsuguda-ANGUL-I	110	4		110	4		
	765kV Jharsuguda-ANGUL-II	110	4		110	4		
	400 KV JHARSHUGUDA-RAIGARH -II	110	6		111	7		
Jharsguda 765KV S/s	765kv Jharsuguda-Dharmjaygarh-I	108	5		OTHER REGION			May be submitted by Odisha Project, Powergrid
	765kv Jharsuguda-Dharmjaygarh-II	108	7		OTHER REGION			May be submitted by Odisha Project, Powergrid
	765kV Jharsuguda-Angul-I	110	4		110	4		
	765kV Jharsuguda-Angul-II	110	4		110	4		
IBEUL	400kV IBEUL-Raigarh	110	5		OTHER REGION			May be submitted by Odisha Project, Powergrid
	400kV IBEUL-Jharsuguda	110	5		110	10		
APNRL	400 KV APNRL-JAMSHEDPUR-I	115	5		110	5		
	400 KV APNRL-JAMSHEDPUR -II	115	5		110	5		
BIHARSHARIFF	400 KV BIHARSHARIFF-BANKA-I	112	7		112	7		
	400 KV BIHARSHARIFF-BANKA-II	110	6		110	6		
	400 KV BIHARSHARIFF - PUSAULI - I	110	5		110	5		
	400 KV BIHARSHARIFF - PUSAULI- II	112	5		112	5		
	400 KV BIHARSHARIFF - VARANASI- I	112	7		112	7		
	400 KV BIHARSHARIFF - VARANASI- II	110	7		110	7		
	400 KV BIHARSHARIFF - BALIA - I	110	5		OTHER REGION			May be submitted by ER-I, Powergrid
	400 KV BIHARSHARIFF - BALIA - II	112	5					
	400 KV BIHARSHARIFF-KODERMA-I	112	7		113	5		
	400 KV BIHARSHARIFF-KODERMA-II	110	5		113	5		
	400 KV BIHARSHARIFF-PURNEA-I	110	5		110	5		
	400 KV BIHARSHARIFF-PURNEA-II	110	7		110	7		
	400 KV BIHARSHARIFF-LAKHISARAI-I	110	7		110	5		
	400 KV BIHARSHARIFF-LAKHISARAI-II	112	5		110	5		
	400 KV BIHARSHARIFF-MUZAFFARPUR-I	110	5		110	5		
	400 KV BIHARSHARIFF-MUZAFFARPUR-II	112	5		112	5		
Kahalgaon	400 KV KhSTPP-BANKA -I	110	6		110	6		
	400 KV KhSTPP-BANKA - II	112	7		112	7		
	400 KV KhSTPP - LAKHISARAI- I	110	7		110	7		
	400 KV KhSTPP - LAKHISARAI- II	112	5		112	5		
	400 KV KhSTPP-MAITHON -I	112	5		110	5		
	400 KV KhSTPP-MAITHON -II	110	5		110	6		
	400 KV KhSTPP-BARH - I	112	6		112	6		
	400 KV KhSTPP-BARH- II	112	6		112	6		
	400 KV KHSTPP-FSTPP-I	110	5		110	5		
	400 KV KHSTPP-FSTPP-II	112	5		112	5		
	400 KV KHSTPP-FSTPP-III	110	7		110	7		
	400 KV KHSTPP-FSTPP-IV	112	7		112	7		
Barh	400 KV BARH-KAHALGAON-I	112	6		112	6		
	400 KV BARH-KAHALGAON-II	112	6		112	6		
	400 KV BARH - PATNA-I	112	6		112	6		
	400 KV BARH - PATNA-II	112	7		112	7		
	400 KV BARH - PATNA-IIII	110	4		110	4		
	400 KV BARH - PATNA-IV	110	5		110	5		
	400 KV BARH - GORAKHPUR-I							
	400 KV BARH - GORAKHPUR-II							
	400 KV PATNA-BARH-I	112	6		112	6		
	400 KV PATNA-BARH-II	112	7		112	7		
	400 KV PATNA-BARH-III	110	4		110	4		

PATNA	400 KV PATNA-BARH-IV	110	5		110	5		
	400 KV PATNA-KISHANGANJ-I							
	400 KV PATNA-KISHANGANJ-II							
	400 KV PATNA - BALIA - I	110	4		OTHER REGION			May be submitted by ER-I, Powergrid
	400 KV PATNA - BALIA - II	110	5					
	400 KV PATNA - BALIA - III	112	6					
	400 KV PATNA- BALIA - IV	112	7					
Sasaram	765KV SASARAM-FATEHPUR	108	5		108	5		
	400 KV PUSAULI - VARANASI	112	5		OTHER REGION			May be submitted by ER-I, Powergrid
	400 KV PUSAULI - ALLAHABAD	112	7					
	400 KV PASAULI-BIHARSHARIFF-I	110	5		110	5		
	400 KV PASAULI-BIHARSHARIFF-II	112	5		112	5		
	400KV PUSAULI-NABINAGAR-I	110	5					
	400KV PUSAULI-NABINAGAR-II	110	6					
Gaya	400 KV GAYA-KODERMA-I	110	5		113	5		
	400KV GAYA-KODERMA-II	110	5		113	5		
	400KV GAYA-MAITHON-I	110	5		110	5		
	400KV GAYA-MAITHON-II	110	5		110	6		
	765 KV GAYA-VARANASI-I							
	765 KV GAYA-VARANASI-II							
	765 KV GAYA-BALIA	110	5		OTHER REGION			May be submitted by ER-I, Powergrid
BANKA	400 KV BANKA-BIHARSHARIFF-I	112	7		112	7		
	400 KV BANKA-BIHARSHARIFF-II	110	6		110	6		
	400 KV BANKA-KAHALGAON-I	110	6		110	6		
	400 KV BANKA-KAHALGAON-II	112	7		112	7		
Muzaffarpur	400 KV MUZAFFARPUR - NEW PURNEA - I	110	7		110	7		
	400 KV MUZAFFARPUR - NEW PURNEA - II	112	7		112	7		
	400 KV MUZAFFARPUR - GORAKHPUR - I	110	7		OTHER REGION			May be submitted by ER-I, Powergrid
	400 KV MUZAFFARPUR - GORAKHPUR - II	112	5					
	400 KV MUZAFFARPUR - BIHARSHARIFF - I	110	5		110	5		
	400 KV MUZAFFARPUR - BIHARSHARIFF - II	112	5		112	5		
LAKHISARAI	400 KV LAKHISARI-BIHARSHARIFF-I	110	5		110	7		
	400 KV LAKHISARI-BIHARSHARIFF-II	110	5		112	5		
	400 KV LAKHISARAI-KAHALGAON-I	110	5		110	7		
	400 KV LAKHISARI-KAHALGAON-II	110	5		112	5		

Annexure-D1

S.NO	LINE NAME	TRIP DATE	TRIP TIME	RESTORATION DATE	RESTORATION TIME	Reason	Fault Clearance time in msec	Relay Indication LOCAL END	Relay Indication REMOTE END	Auto Recloser status	DR/EL received within 24 Hrs	DR/EL received after 24 Hrs	Remarks
Fault clearing time is violating protection standard (As per PMU data)													
1	400 KV SUBHASHGRAM - SAGARDIGHI S/C	05.05.17	05:22	05.05.17	06:09	Y-N FAULT	360 ms approx.	Y-N, Z-I, F/C 7.16 KA, 20.5 km from Subhasgram, A/R successful at Subhasgram end	Y-N, Z-II, F/C 2.12 kA, 222.8 km from Sagardighi	No autoreclose operation observed in PMU data	Yes	No	
2	220 KV TENUGHAT - BIHARSHARIFF	05.05.17	13:02	05.05.17	13:47	R-N FAULT	1200 ms approx.	R-N, Z-I, 137.1 km from Tenughat	R-N, Master trip	--	Yes	No	*Backup O/C protection from Biharshariff end.*
3	220KV TALCHER-RENGALI	05.05.17	15:32	05.05.17	17:38	R-N FAULT	500 ms approx.	R-B, Z-I, 21 km from Talcher	Dir, O/C	No autoreclose operation observed in PMU data	Yes	No	
4	220KV CHUKHA-BIRPARA- I & II	05.05.17	16:59	05.05.17	17:29	R-Y FAULT	1100 ms approx.	Information yet to be received	Y-N, Z-II, F/C 0.669 KA, 104 km from Birpara	--	No	Yes	*High resistance fault*
5	400 KV LAKHISARAI-KAHALGAON-II	15.05.17	20:41	15.05.17	21:06	R-N FAULT	400 ms approx.	A/R successful	Information yet to be received	No autoreclose operation observed in PMU data	No	No	*Kh end should be checked*
6	220 KV PATNA - KHAGUL	17.05.17	14:16	17.05.17	14:33	Y-N FAULT	350 ms approx.	Zone 1	Did not trip	No autoreclose operation observed in PMU data	No	--	
7	400 KV JAMSHEDPUR-DSTPS - II	22.05.17	16:24	22.05.17	16:48	B-N FAULT	500 ms approx.	Information yet to be received	Zone 2, no carrier recieved	No autoreclose operation observed in PMU data	No	No	OPGW snapped
8	220KV THERUBALI-INDRAVATI-II	29.05.17	00:04	29.05.17	00:22	EARTH FAULT	350 ms approx.	Information yet to be received	Information yet to be received	No autoreclose operation observed in PMU data	No	No	*PLCC not working*
Multiple tripping at same time													
1	220 KV MUZZAFFARPUR - HAZIPUR - II	17.05.17	13:50	17.05.17	14:55	B-N FAULT	<100	1.95 km	Information yet to be received	Unsuccessful auto-reclose operation observed in PMU data	No	No	
2	220 KV MUZZAFFARPUR - HAZIPUR - I			17.05.17	19:05	B-N FAULT	<100	1.48 km	Information yet to be received	Unsuccessful auto-reclose operation observed in PMU data	No	No	
3	400 KV JEERAT - BEHRAMPUR	17.05.17	18:24	17.05.17	18:44	Y-N FAULT	<100	Y-N, Z-II, 149 km from Jeerat, F/C 2.5 kA	Y-N, F/C 15.268 kA, Z-I	Unsuccessful auto-reclose operation observed in PMU data	No	Yes	
4	400 KV FARAKKA - BEHRAMPUR			17.05.17	19:01	Y-N FAULT	<100	Y-N, Z-III, 73.7 km	Information yet to be received	Unsuccessful auto-reclose operation observed in PMU data	Yes	No	*Zone 3 timing should be checked.*
5	400KV MERAMUNDALI - SEL - I	20.05.17	14:54	20.05.17	18:12	R-N FAULT	<100	R-N , Z-I, F/D - 186 Km, F/C - 2.2 KA	R-N , Z-I, F/D - 2.2 KM from SEL, F/C - 21 KA	No autoreclose operation observed in PMU data	No	Yes	
6	400KV MERAMUNDALI - SEL - II			20.05.17	15:29	R-N FAULT	<100	R-N , Z-II, F/D - 237 Km from MMND, F/C - 1.3 KA	R-N , Z-I, F/D - 7.2 KM from SEL, F/C - 2 KA	No autoreclose operation observed in PMU data	No	Yes	

S.NO	LINE NAME	TRIP DATE	TRIP TIME	RESTORATION DATE	RESTORATION TIME	Reason	Fault Clearance time in msec	Relay Indication LOCAL END	Relay Indication REMOTE END	Auto Recloser status	DR/EL received within 24 Hrs	DR/EL received after 24 Hrs	Remarks
7	400KV MERAMUNDALI - ANGUL - I	[illegible]	[illegible]	20.05.17	15:13	DUE TO TRIPPING OF 400 KV MERAMUNDALI - SEL - II THROUGH WHICH LINE WAS CHARGED	--	--	--	--	--	--	
8	400 FARAKKA-GOKARNO-I	23.05.17	17:35	23.05.17	18:17	VT FUSE FAIL AT FARAKKA END	<100	VT Fuse fail	Information yet to be received	A/R successful at both end but line tripped due to fault in reclaim time	No	No	*VT fuse failure has been observed at Farakka end*
9	400 FARAKKA-GOKARNO-II			23.05.17	18:23	TRIPPED ALONG WITH CIRCUIT I AS MAIN BAY IS NOT AVAILABLE AT FARAKKA	--	--	--	--	--	--	
10	400 KV ROURKELA - RAIGARH	30.05.17	07:02	30.05.17	17:36	R-N FAULT	<100	R Phase TEED Protection, DT sent	Information yet to be received	--	No	No	400/220 kV ICT - II at Rourkela also tripped at same time due to operation of R phase back up O/C. As fault was in 400 kV side ICT should not trip from 400 kV side on O/C., Relay is old and non directional.
Fault Not observed in PMU data													
1	220KV BALASORE – BARIPADA - II	04.05.17	11:45	04.05.17	12:20	SPURIOUS TRIPPING	--	Information yet to be received	Information yet to be received	--	No	No	
2	220KV BIDHANNAGAR-WARIA-I	04.05.17	20:30	04.05.17	21:22	SPURIOUS TRIPPING	--	Did not trip	DPO, Z-III	--	--	No	
3	220KV RENGALI (GR) - RENGALI (PG)	09.05.17	22:27	09.05.17	00:04	SPURIOUS TRIPPING	--	Information yet to be received	DT Received	--	No	No	
4	132 KV RIHAND-GARWA	10.05.17	13:49	10.05.17	14:07	PROBLEM AT RIHAND END	--	Information yet to be received	Information yet to be received	--	No	No	
5	400KV ANDAL- JAMSHEDPUR - I	13.05.17	04:35	13.05.17	05:24	SPURIOUS TRIPPING	--	Information yet to be received	DT received	--	No	No	
6	220 KV PATNA - KHAGUL	17.05.17	16:48	17.05.17	17:30	SPURIOUS TRIPPING	--	Information yet to be received	Did not trip	--	No	--	*Patna end Aux relay failed*
7	400 KV SAGARDIGHI - BEHRAMPUR - II	18.05.17	07:39	18.05.17	08:04	SPURIOUS TRIPPING	--	LBB operated	Did not trip	--	Yes	--	
8	400 KV NEW RACHIS - PPSP	23.05.17	15:37	23.05.17	16:05	SPURIOUS TRIPPING	--	Master trip relay operated	Did not trip	--	No	--	*DC mixing at New Ranchi*
9	400 KV NEW RANCHI - ARAMBAG	23.05.17	15:37	23.05.17	16:07	SPURIOUS TRIPPING	--	Master trip relay operated	Did not trip	--	No	--	*DC mixing at New Ranchi*
10	400 KV NEW RANCHI-PPSP	25.05.17	12:42	25.05.17	13:39	SPURIOUS TRIPPING	--	Information yet to be received	Did not trip	--	No	--	*DC mixing at New Ranchi*
11	400 KV NEW RANCHI-ARAMBAG	25.05.17	12:42	25.05.17	13:38	SPURIOUS TRIPPING	--	Information yet to be received	Did not trip	--	No	--	*DC mixing at New Ranchi*
12	400KV GAYA-KODARMA-II	28.05.17	14:59	28.05.17	15:17	SPURIOUS TRIPPING	--	DT Received	Information yet to be received	--	No	No	*Koderma end DT send counter did not increase*
13	400KV MALDA-PURNEA-II	29.05.17	19:51	29.05.17	20:55	SPURIOUS TRIPPING	--	DT Received	Information yet to be received	--	No	No	
14	400KV RANCHI-MPL	30.05.17	10:57	30.05.17	11:14	SPURIOUS TRIPPING	--	DT Received	Information yet to be received	--	No	No	*Ranchi end DT send*

S.NO	LINE NAME	TRIP DATE	TRIP TIME	RESTORATION DATE	RESTORATION TIME	Reason	Fault Clearance time in msec	Relay Indication LOCAL END	Relay Indication REMOTE END	Auto Recloser status	DR/EL received within 24 Hrs	DR/EL received after 24 Hrs	Remarks
No autorecloser operation observed in PMU data													
1	400 KV BARIPADA - KEONJHAR	01.05.17	14:31	01.05.17	15:03	Y-N FAULT	<100	Y-N, Z-I, 147.4 km from Baripada, F/C 2.9 kA, DT received from Keonjhar end	Information yet to be received	No autoreclose operation observed in PMU data	Yes	No	*Three phase breaker opened at Baripada end due to DT received from Keonjhar end. Relay problem at Baripada*
2	400 KV FARAKKA - MALDA - II	01.05.17	16:24	01.05.17	18:12	B-N FAULT	<100	B-N, Z-I, F/C 23 kA, unsuccessful	B-N, 28.5 km from Malda, F/C 3.8 kA, A/R successful at Malda end	No autoreclose operation observed in PMU data	Yes	Yes	A/R successful at Malda end
3	400KV KHARAGPUR-BARIPADA	05.05.17	16:30	05.05.17	16:52	R-N FAULT	<100	R-N, Z-II, F/C 2.6 kA, 67 km from KGP, SOTF, A/R lock out	Did not trip	No autoreclose operation observed in PMU data	Yes	--	Reason for no-alarm at Baripada may be analysed
4	400KV JEYPORE-INDRAVATI	06.05.17	17:01	06.05.17	17:39	R-N FAULT	<100	R-N, 1.75 km from Jeypore, F/C 4kA, A/R successful at Jeypore end	R-N, 71 km from Indravati, F/C 1.7kA	No autoreclose operation observed in PMU data	No	No	A/R problem at Indravati the relay has been changed
5	400KV FARAKKA-GOKARNO -II	08.05.17	14:59	08.05.17	15:34	R-N FAULT	<100	DT received	Information yet to be received	No autoreclose operation observed in PMU data	No	No	PLCC problem
6	400KV JAMSHEDPUR-ADHUNIK - II	08.05.17	16:01	08.05.17	19:06	R-N FAULT	<100	B-N, F/C 18 kA, Differential protection operated	Information yet to be received	No autoreclose operation observed in PMU data	No	No	
7	400KV KHARAGPUR - CHAIBASA - I	08.05.18	16:34	08.05.17	16:56	B-N FAULT	<100	B-N, F/C: 2.6 kA, 96.8 KM from Kharagpur	B-N, F/C: 2.46 kA, 59.46 KM from Chaibasa	No autoreclose operation observed in PMU data	No	No	Chaibasa end needs to be checked
8	400 KV BARIPADA-KHARAGPUR	09.05.17	10:25	09.05.17	10:44	B-N FAULT	<100	Information yet to be received	SOTF, Z-III, Fault duration < 100 ms	No autoreclose operation observed in PMU data	No	Yes	
9	400KV FSTPP - GOKORNA-I	11.05.17	17:08	11.05.17	17:37	R-N FAULT	<100	R-N , Z-I, F/D - 106 Km , F/c - 8.1 kA	Information yet to be received	No autoreclose operation observed in PMU data	No	No	Inclement weather condition
10	400KV FSTPP - GOKORNA-II	11.05.17	17:08	11.05.17	19:58	R-N FAULT	<100	R-N , Z-I, F/D - 106 Km , F/c - 8.1 kA	Information yet to be received	No autoreclose operation observed in PMU data	No	No	Inclement weather condition
11	400 KV TALCHER-MERAMUNDALI	11.05.17	21:44	11.05.17	22:08	R-N FAULT	<100	R-N, Z-I, 24.58 km from Talcher, A/R successful at Talcher end	R-N, Z-I, F/D - 28.3 KM, F/C - 10.2 KM, unsuccessful	No autoreclose operation observed in PMU data	Yes	No	
12	400KV KODARMA-BOKARO-I	13.05.17	12:39	31.05.17	12:20	R-N FAULT	<100	R-N , Z-I, 45.298 KM from Koderma, F/C 2.4 KA	Information yet to be received	No autoreclose operation observed in PMU data	No	No	Tower collapsed between tower location 172 & 173, Line 2 tripped on R-N fault then went for A/R after 1 sec then tripped on Y-N fault. Line -1 tripped on B-N fault first then tripped on R-N fault.
13	400KV KODARMA-BOKARO-II	13.05.17	12:39	31.05.17	12:21	Y-N FAULT	<100	Y-N, Z-I,F/C 0.944 KA	Information yet to be received	No autoreclose operation observed in PMU data	No	No	
14	400 KV JHARSUGUDA - IBEUL S/C	15.05.17	13:13			R-N FAULT	<100	R-N, 28.4 km from JHG	Information yet to be received	No autoreclose operation observed in PMU data	No	No	
15	400 KV CHAIBASA-KHARAGPUR-II	15.05.17	14:22	15.05.17	15:06	Y-N FAULT	<100	Y-N, Z-I, 3.8 km from Chaibasa, F/C 12.28 kA, A/R successful at KGP end	Y-N, Z-I, 127.1KM from KGP, F/C 1.415KA	No autoreclose operation observed in PMU data	No	Yes	A/R successful at KGP end

S.NO	LINE NAME	TRIP DATE	TRIP TIME	RESTORATION DATE	RESTORATION TIME	Reason	Fault Clearance time in msec	Relay Indication LOCAL END	Relay Indication REMOTE END	Auto Recloser status	DR/EL received within 24 Hrs	DR/EL received after 24 Hrs	Remarks
16	400 KV BARIPADA-KEONJHAR	15.05.17	15:29	15.05.17	16:42	B-N FAULT	<100	B-N, Z-I, 84 km from BPD, F/C 3.6 kA, DT received	B-N, Z-I, F/C-1.85KA, Dist-99.9KM,63.9%	No autoreclose operation observed in PMU data	Yes	No	Reason for DT receipt at Baripada may be explained. Y phase breaker at Baripada opened before DT receipt.
17	400 KV CHAIBASA-KHARAGPUR-I	15.05.17	15:30	15.05.17	15:52	B-N FAULT	<100	B-N, Z-I, 58.7 km from Chaibasa, F/C 2.5 kA	B-N, Z-III, F/C 2.4 kA, 129.7 km from KGP	No autoreclose operation observed in PMU data	No	Yes	A/R successful at KGP end, Only Z-III picked up at Kharagpur end.
18	400 KV BARH - KAHALGAON - II	17.05.17	16:20	17.05.17	16:39	B-N FAULT	<100	Information yet to be received	Did not trip	No autoreclose operation observed in PMU data	No	--	
19	400 KV KAHALGAON - MAITHON - I	17.05.17	17:09	17.05.17	17:21	Y-N FAULT	<100	A/R successful at Kahalgaon end	Y-N, 65.5 km from Maithon, F/C 3.3 kA	No autoreclose operation observed in PMU data	No	No	
20	400 KV BARIPADA - KEONJHAR	18.05.17	17:26	18.05.17	18:00	Y-N FAULT	<100	Information yet to be received	Y-N, 70.4 km from Keonjhar, 1.94 kA	No autoreclose operation observed in PMU data	No	No	
21	400 KV ARAMBAG - NEW RANCHI S/C	19.05.17	17:44	19.05.17	18:10	B-N FAULT	<100	B-N , Z-I F/D- 60 KM from Arambag, F/C-4KA	B-N , Z-1 F/D- 201 KM from New Ranchi, F/C-1.5KA	No autoreclose operation observed in PMU data	No	No	OPGW work is in progress and carrier kept out of service
22	400KV MERAMUNDALI - MENDHASAL	20.05.17	17:26	20.05.17	18:42	R-N FAULT	<100	R-N , Z-I, F/D - 1.5 KM from Meramundali, F/C - 31.8 KA	R-N , Z-II, F/D - 99 KM from Mendasal, F/C - 2.3 KA	No autoreclose operation observed in PMU data	No	No	
23	400 KV DURGAPUR-SAGARDIGHI-II	23.05.17	17:32	23.05.17	18:00	Y-N FAULT	<100	A/R successful at Durgapur end	Information yet to be received	No autoreclose operation observed in PMU data	Yes	No	A/R successful at Durgapur end
24	400 KV JHARSUGUDA - IBEUL - II	24.05.17	12:57	24.05.17	18:54	R-N FAULT	<100	R-N, Z-II, 48 km from Jharsuguda, F/C 5.6 kA	Information yet to be received	No autoreclose operation observed in PMU data	No	No	
25	400 KV RANCHI - ROURKELA - II	26.05.17	16:34	26.05.17	17:07	Y-N FAULT	<100	Y-N, 94.21 km from Ranchi, F/C 3.3 kA	Y-N, 49.35 km from RKL, F/C 5.722 kA, A/R successful at RKL	No autoreclose operation observed in PMU data	No	Yes	
26	400 KV RANCHI - ROURKELA - I	26.05.17	17:08	26.05.17	18:36	R-N FAULT	<100	R-N, 105 km from Ranchi, 2.09 kA	R-N, 2.65 km from RKL, F/C 17.02 kA, A/R started but within 30 ms A/R lock out operated	No autoreclose operation observed in PMU data	No	Yes	Reason for A/R L/O at Rourkela may be explained
27	400 KV JHARSUGUDA - IBEUL - II	26.05.17	19:50	27.05.17	21:46	Y-N FAULT	<100	Y-N, Z-II, 21 km from Jharsuguda, F/C 10.5 kA, A/R not attempted	R-Y-B	No autoreclose operation observed in PMU data	Yes	Yes	Z-II is instantaneous at Jharsuguda end. Even fault at Z-I will be cleared in Z-II with Zero time delay.
28	400 KV MERAMUNDALI-STERLITE-I	31.05.17	19:56	31.05.17	21:29	Y-N FAULT	<100	Information yet to be received	Information yet to be received	No autoreclose operation observed in PMU data	No	No	CB Aux contact problem, the same has been replaced