Report of ERPC Protection Team

on

Un-coordinated trippings in

JUSNL SYSTEM

July, 2016

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

FOREWORD

The primary focus of this Technical Report is the root cause analysis as well as remedial action needed for un-coordinated trippings around 220/132 kV Chandil, Ramchandrapur and 132 kV Adityapur substations of JUSNL system.

The report has been prepared after detailed study and scrutiny of JUSNL sub-stations data (as provided by JUSNL) and site visit of JUSNL sub-stations by the ERPC Protection team (i.e. the Committee) as constituted by 31st TCC/ERPC.

The committee has also recommended the protection settings for all the 220 kV & 132 kV lines and 220/132 kV transformers of the affected sub-stations.

It is important to acknowledge that this report is a collaborative achievement of ERPC. Special thanks are due to the members of ERPC protection team for their sincere efforts. I express appreciation to representatives of JUSNL as this report is only possible because for their hard work and dedication.

Place: Kolkata
Date: 29.07.2016

(A. K. Bandyopadhyaya)
Member Secretary

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1.0 Preface :

Frequent Tripping of 220KV/132KV Lines of JUSNL and BSPTCL system leading to cascading effects and loss of Power on different occasions prompted TCC and ERPC to constitute a core group comprising experts from WBSETCL, OPTCL, DVC, PGCIL, ERLDC and ERPC Secretariat to look into the deficiencies around Chandil, Ramchandrapur & Adityapur substations in JUSNL system and in BSPTCL system and identify suitable remedial measures to prevent recurrence of such incidents. The names of the members of the core group under the auspices of Member Secretary, ERPC, was concurred by ERPC Board in the 31st TCC & ERPC meet on 13th and 14th of November 2015.

Although the committee was constituted for selective Substations where the frequency of outage was high for both BSPTCL and JUSNL system, however firstly the report of four Substations of JUSNL system is hereby submitted.

1.1 COMMITTEE MEMBERS:

1) Shri A.K. Bandyopadhyaya, Member Secretary, ERPC.
2) Shri Sabyasachi Roy, CE, SLDC, WBSETCL
2) Shri L. Nayak, GM, OPTCL.
3) Shri Jayanta Dutta, SE, DVC,
4) Shri Surajit Banerjee, AGM, ERLDC.
5) Shri S.K.Singh, DGM, PGCIL.
6) Shri S.B.Prasad, ESE, BSPTCL.
7) Shri Vidyasagar Singh, ESE, JUSNL.
8) Shri D. K. Bauri, EE, ERPC.

1.2 TERMS & REFERENCE:

1) In- depth study to ascertain the cause of tripping and Cascading tripping of 220KV/132KV Chandil, Ramcharapur, Adityapur, & Hatia S/Stns of JUSNL.

2) Recommending the corrective measures for non occurrence of similar incidence in future.

1.3 METHODOLOGY:-

From the history of tripping discussed in 34th, 35th, 36th and 37th PCC which is also highlighted in the Salient History, the members of the committee decided to adopt the following methodology towards the submission of the Final Report.

1. Collection of all relevant data's related to Chandil, Ramchandrapur and Adityapur S/Stn's of JUSNL.

2. Scrutiny of the data's submitted to ascertain deficiencies at a preliminary level.

3. Convene a meeting between the authorities of JUSNL and Committee members to propagate the preliminary deficiencies observed.

4. Visit to the Chandil, Ramchandrapur and Adityapur S/Stn's to ascertaining the actual deficiencies by checking the sub-station system of operation, inspect Outdoor Equipment's like CT, PT, Breaker, Transformer etc, Control and Relay Panels including the Protective Relays used and its relevant settings and schematics, D.C. system, Operation and maintenance practices followed etc.

5. Submission of the report along with suggestions and conclusions.

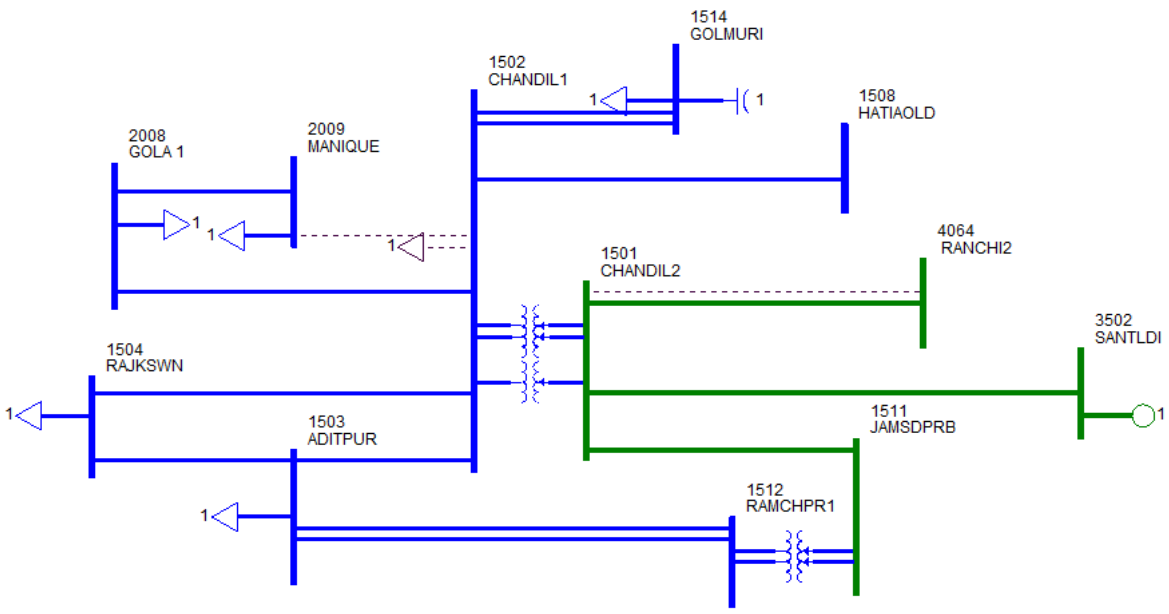
2.0 Salient History:

2.1 Excerpts of minutes of 34th PCC

Total power failure at 220kV Chandil S/s in JSEB system on 29/07/15 at 16:53 Hrs.

At 16:53hrs, total power failed at 220kV Chandil S/s in JUSNL system due to fault in 132kV Chandil-Hatia line. Following feeders from Chandil tripped:

Time (Hrs)	Details of tripping	Relay at local end	Relay at remote end
16:53 hrs	132kV Chandil-Hatia	At Chandil Did not trip	At Hatia Dir. E/F & O/C, trip phase ABC,
	132kV Ramchandrapur-Adityapur-D/C	At Ramchandrapur Power swing trip relay VAJ, O/C, E/F start	
	220kV Chandil-Ranchi	At Chandil Master trip relay 86, contact multi trip relay 86x	At Ranchi Did not trip
	220kV Chandil-Santaldih	At Chandil Master trip relay 86	At Santaldih Did not trip
	220kV Chandil-Ramchandrapur	At Chandil Z-III, LBB relay, tripping relay type VAJ, loc-35.6kM	At Ramchandrapur Z-III, Master trip relay



Points to be discussed:

i. Reason for non-operation of the primary protection of 132kV Chandil-Hatia line from Chandil end.

ii. The fault in 132kV system should have been cleared by DEF / DOC protection of the 220/132kV ATRs at Chandil, which needs to be explaned.

iii. Tripping of 220kV Chandil – Ranchi, 220kV Chandil-STPS and 220kV Chandil-Ramchandrapur lines from Chandil end needs to be explained.

iv. JUSNL may please enlighten the house the reasons for such unexplained tripping with further supporting records like DR, EL etc. despite implementing corrective measures as recommended during last audit.

JUSNL may explain.

Deliberation in the meeting

JUSNL informed that—

- *The fault was in 220kV Chandil-Ramchandrapur line and the fault got cleared from both the ends.*
- *It was informed that the relays of 220kV Chandil-Ramchandrapur at both the end are very old and are under replacement.*
- *JUSNL apprehended that the LBB has operated at Chandil due to mal functioning.*

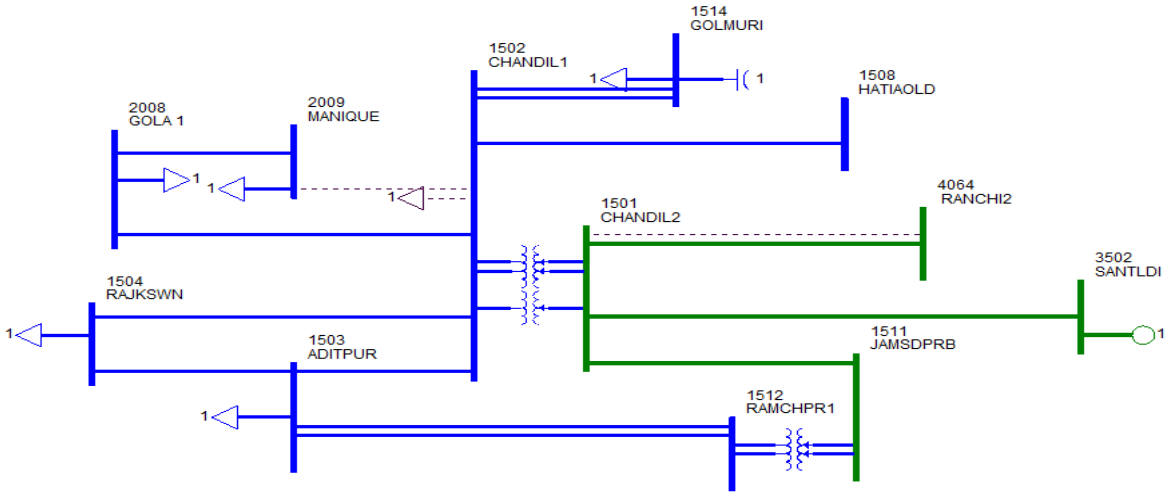
ERLDC informed that as per the PMU plot, the fault was cleared in 120ms.

PCC felt that on several previous occasions the LBB at 220kV Chandil was mal-operated and tripped all connected lines.

PCC advised JUSNL to check the LBB at 220kV Chandil S/s. JUSNL agreed.

2.2 Excerpts of 35th PCC

2.2.1 Total power failure at 220kV Chandil S/s of JUSNL system on 14/08/15 at 10:10hrs.



At 10:10hrs, total power failed at 220kV Chandil S/s in JUSNL system due to mal-operation of LBB relay. Following feeders from Chandil end got tripped:

Time (Hrs)	Details of tripping	Relay at local end	Relay at remote end
10:10 hrs	220kV Chandil-Ranchi	At Chandil Master trip relay 86	At Ranchi Did not trip
	220kV Chandil-Santaldih	At Chandil Master trip relay 86	At Santaldih Did not trip
	220kV Chandil-Ramchandrapur	At Chandil LBB relay, 86, 86X, Supervision relay	At Ramchandrapur NA
	132kV Ramchandrapur-Adityapur-D/C	At Ramchandrapur O/C, E/F	
	132kV Chandil-Hatia	At Chandil Did not trip	At Hatia Dir. E/F & O/C, trip phase ABC

- The sequences of events were initiated due to mal-operation of LBB relay at Chandil end (there was no voltage dip observed in PMU data of Ranchi S/s).
- Due to which all the other 220kV feeders i.e 220kV Chandil-Ranchi and 220kV Chandil-Santaldih line got tripped from Chandil end.
- With the tripping of all the 220kV feeders, 132kV Chandil-Hatia and 132kV Ramchandrapur-Adityapur-D/C got over loaded and tripped on actuation of Dir. E/F & O/C relay.

Points to be discussed:

i. LBB operation at 220kV Chandil S/s.

ii. Testing of LBB at 220kV Chandil S/s needs to be done.

iii. Tripping of 132kV Chandil-Hatia line from Hatia end to be explained.

JUSNL may explain.

Deliberation in the meeting

JUSNL informed that

- *220kV Chandil-Ramchandrapur line was tripped from both ends at 09:55 hrs due to B-ph jumper snapping at location no 42.*
- *The LBB at 220kV Chandil S/s was triggered while trying to charge the 220kV Chandil-Ramchandrapur line from Chandil end.*
- *The LBB was checked by T&C-Alstom and found it correct.*
- *Old relays are being replaced at both ends of 220kV Chandil-Ramchandrapur line with new Micom P442 relays. The work is expected to be completed by 30th September, 2015.*

PCC felt that LBB at 220kV Chandil S/s had been maloperated during several incidences in the past and advised JUSNL to check the LBB at 220kV Chandil S/s after the installation of new relays.

JUSNL agreed.

2.2.2 Total power failure at 220kV Chandil S/s of JUSNL system on 28/08/15 at 16:05hrs.

At 16:05 hrs, total power failed at 220kV Chandil S/s in JUSNL system due to mal-operation of LBB relay. Following feeders from Chandil end got tripped:

SL No	Name of Bay/Line	Tripping Time	Closing Time	Local End Relay	Remote end Relay
1	220KV Chandil-STPS	16:05Hrs	17:33Hrs	Master Trip 86, Contact multiplier relay 86	Not Tripped

2	220KV Chandil-Ramchandrapur	16:05Hrs	17:41Hrs	Zone-4, LBB Relay	Not Tripped
3	220Kv Chandil - PGCIL	16:05Hrs	16:51Hrs	Master Trip 86	Not Tripped
4	132KV Chandil-Adityapur Ckt-I	16:05Hrs	17:48 Hrs		o/c, Zone-I, 5.9Km, Fault current B Phase 673.4Amp.Y Phase 3.185Kamp
5	132Kv Chandil-Hatia	16:05Hrs	16:33Hrs	Not Tripped	Overcurrent,86
6	132KV Ramchandrapur-Adityapur Ckt-I	16:05Hrs	16:35Hrs	Not Tripped	Overcurrent,87
7	132KV Ramchandrapur-Adityapur Ckt-II	16:05Hrs	16:45Hrs	Not Tripped	Y Phase, Zone-I, 2.978Km, fault Current R Phase 201.8Amp, Y Phase 6.522 Kamp, B Phase 359.2 Amp
8	220kv Bus Coupler at RCP	16:05Hrs	16:48 Hrs	Non directional E/F,O/C,LBB,86	

JUSNL informed that the relay at Chandil & Ramchandrapur of 220KV Chandil-Ramchandrapur Transmission line are very old (Micom P430C). Purchase order has been placed for its replacement.

Points to be discussed:

i. LBB operation at 220kV Chandil S/s.

ii. Tripping of 132kV lines from remote end.

JUSNL may explain.

<u>Deliberation in the meeting</u>

JUSNL informed that

- *There was a fault in 132 kV side in Ramchandrapur/Adityapur area.*
- *Due to which the 132KV Ramchandrapur-Adityapur Ckt-II and 132 kV Chandil-Adityapur-I tripped on zone-1 from Adityapur end.*
- *132KV Ramchandrapur-Adityapur Ckt-I tripped on over current protection due to overloading.*
- *Subsequently, the LBB at Chandil operated due to LBB initiation from 220 kV Chandil-Ramchandrapur line.*

On enquiry, JUSNL informed that LBB time setting is 400 ms.

JUSNL could not explain the reason for LBB operation at 220kV Chandil S/s.

PCC advised the following:

- *Send the DR output files to ERPC/ERLDC within 2 days for proper analysis of the incident.*
- *Thorough checking of LBB protection at 220kV Chandil S/s.*
- *Revise the LBB time setting to standard time setting i.e.200 ms.*

2.3 Excerpts of 36th PCC

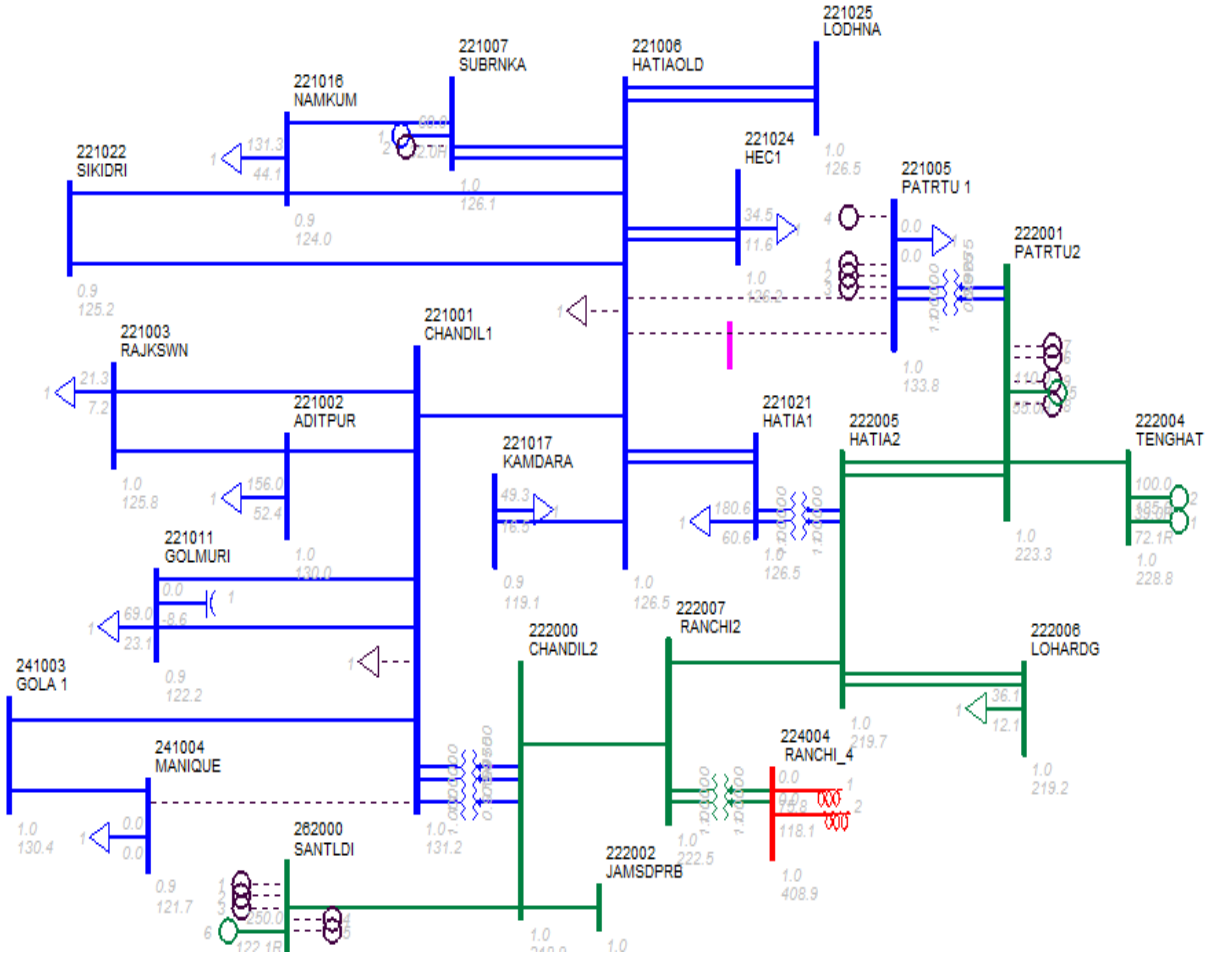
Total power failure at 220/132 kV Hatia S/s (JUSNL) on 14/09/15 at 11:38hrs.

As per information received from JUSNL---

- The event was initiated at 11:38 hrs, due to occurrence of SLG fault (i.e Y-N) on 220kV Ranchi- Hatia S/c line which tripped from Ranchi end only.
- After tripping of the said line load at Hatia, Namkun, Gumla, Lohardanga, Daltonganj, Latehar etc. were started to being fed from Chandil & PTPS S/s through 132kV Chandil- Hatia S/C & 220kV PTPS-Hatia D/c line.
- This caused the tripping of 132kV Chandil- Hatia S/c line on operation of O/C protection.
- 220kV PTPS- Hatia D/c tripped from PTPS end on indication of earth fault.
- This led to tripping of 220kV Tenughat-PTPS S/C on overvoltage.
- It is suspected that prior to tripping of 220kV Tenughat-PTPS S/C line, fault was also being fed from 132kV PTPS- Hatia D/C (ckt-II via Kanke) caused the tripping of ckt-I on DP, Zn-II from PTPS end while 132kV Kanke- Hatia tripped from Hatia end on Z-I, DP.
- 220/132kV, 150 MVA transformer-II & III at Hatia tripped on operation of master trip and non-directional E/F relay respectively from both side.

- Thus, after tripping of existing 220kV & 132kV lines emanating from PTPS & Hatia S/s, running unit of PTPS & TTPS tripped due to loss of evacuation path.

- Due to non-availability of all 220/132kV lines from Hatia & PTPS S/s approx. 370 MW load loss along with traction power of around 30 MW was interrupted at Namkun, Gumla, Lohardanga, Daltonganj, Latehar.



The following lines got tripped during the incidence:

Time (Hrs)	Details of tripping	Relay at local end	Relay at remote end
11:38 Hrs	220kV Hatia-Ranchi S/C	At Hatia Did Not trip	At Ranchi Y-N, F.D- 133.4KM, F.C- 1.42 KA
	220kV PTPS- Hatia –I	At PTPS E/f	At Hatia Did Not Trip

	220kV PTPS- Hatia –II	At PTPS E/f	At Hatia Did Not Trip
	220kV PTPS- TTPS S/c	At PTPS O/V	At TTPS Did Not Trip
	132kV Hatia-Chandil S/C	At Hatia Start ABC Phase, Tripped ABC Phase start element, O/C, E/F	At Chandil Did Not Trip
	132kV Hatia- PTPS - I	At Hatia Did Not Trip	At PTPS Zone-II, F.D- 33.71 KM, F.C- Ir= 377 A, Iy= 1.389 KA, Ib= 1.95 KA
	132kV Kanke-Hatia	At Kanke Did Not Trip	At Hatia Active Gr-I, Start Phase B-N, Tripped ABC start element, E/F, Z-I, Loc- XY, F.D- 10.55 KM, Fault Duration- 240.6 ms
	150 MVA T/F-II	Trip relay 86 A	
	150 MVA T/F-III	Non directional E/F	
	50 MVA T/F-I at Hatia	Trip relay 86	
	50 MVA T/F-II at Hatia	REF protection relay, HV, Trip 86, Differential Protection 87, Directional E/F, Protection 50/51 N	
	50 MVA T/F-III at Hatia	LV Trip ckt, Supervision relay, 195 ABC, LV, Relay 80 C, $HV side 96 HV, Multiplication relay 4 HV side	
	TTPS U# 2	Electrical Jerk	
	PTPS U# 10	Electrical Jerk	
	Inland Power Ltd	Electrical Jerk	

Analysis of PMU plots:

- 10kV voltage dip has been observed in Y-Ph at 11:38:44:100hrs from the Ranchi PMU plot.
- 60A & 40A rise in Y-Ph line current of 400kV Ranchi- Sipat-I & 400kV Ranchi- Maithon-I have been observed during the said period.
- Fault clearance time was approximately 1080 ms.

JUSNL may explain the following:

- Reason for non-operation of primary and backup protection at 220 kV Hatia.

- JUSNL in their report, have mentioned that 132kV Chandil- Hatia S/c tripped from Hatia end on operation of over current protection. JUSNL may confirm whether the o/c relay installed at Hatia end are non-directional in nature. Reason for non-operation of O/C protection from Chandil end may be explained.

- Tripping of 132kV Kanke- Hatia S/c from Hatia end on indication DP, Z-I is not understood as the fault was in reverse direction from Hatia S/s. Reason for non-operation of O/C protection from Kanke end may be explained.

- After tripping of lines at Hatia, PTPS & TVNL got islanded. This could have caused tripping of 220 kV PTPS-TVNL on O/V. JUSNL may confirm furnish the stage I & II O/V settings at PTPS.

Deliberation in the meeting

JUSNL explained that—

- *There was a fault in 132kV Hatia-Kanke line due to dislocation of earth wire which came in the vicinity of R-ph at location no 13-14.*

- *The fault was identified in zone-1 distance protection from Hatia end but Kanke end failed to identify the fault.*
- *Though the fault was identified at Hatia end, the CB failed to clear the fault in time which resulted in tripping of two 220/132 kV ICTs.*

- *The ICTs would have cleared the fault but one of the ICT (i.e. 150 MVA T/F-I) failed to trip which led to tripping of 220 kV lines from remote end.*

- *JUSNL explained the following:*

Sl. No.	***Details of tripping***	***Reason for Tripping***
1.	*132kV Patratu-Hatia line was tripped from Patratu end on zone 2 distance protection.*	*It was understood that even the fault in 132kV Hatia-Kanke line was identified in zone 1 from Hatia end, the CB was failed to clear the fault*

		immediately. There may be delayed CB operation at Hatia end which resulted in tripping of 132kV Patratu-Hatia line from Patratu end on zone 2.
2.	*132kV Chandil-Hatia S/C line was tripped from Hatia end on O/C protection.*	*JUSNL informed that P442 relay is installed at both ends of the line and the time setting at Chandil end is 1.5 sec and Hatia end is 1.2 sec. The line was overloaded and tripped from Hatia end as the time setting is less than Chandil end.* *PCC felt that Hatia end should not be tripped as the power flow was in reverse direction.*
3.	• *220kV Hatia- Ranchi S/C tripped from Ranchi end* • *220kV PTPS- Hatia –I & II tripped from PTPS end*	*JUSNL explained that two 220/132kV ICTs were tripped at Hatia but third ICT failed to trip, which resulted in tripping of these 220kV lines from Remote end.*
4.	*220kV PTPS- TTPS tripped from PTPS on O/V protection.*	*JUSNL explained that since no evacuation path was available for PTPS and TTPS generators, over voltage build up and the line got tripped on O/V protection.*

After detailed deliberation, PCC advised JUSNL to check the following and report to ERPC/ERLDC:

1. *The main and backup protection of 132kV Hatia-Kanke line at 132kV Kanke end needs to be tested and JUSNL should find out why the fault was not detected from Kanke end.*

2. *CB of 132kV Hatia-Kanke line at 132kV Hatia end should be tested.*

3. *Protection system of 220/132kV, 150 MVA T/F-I at 220 kV Hatia to be tested.*

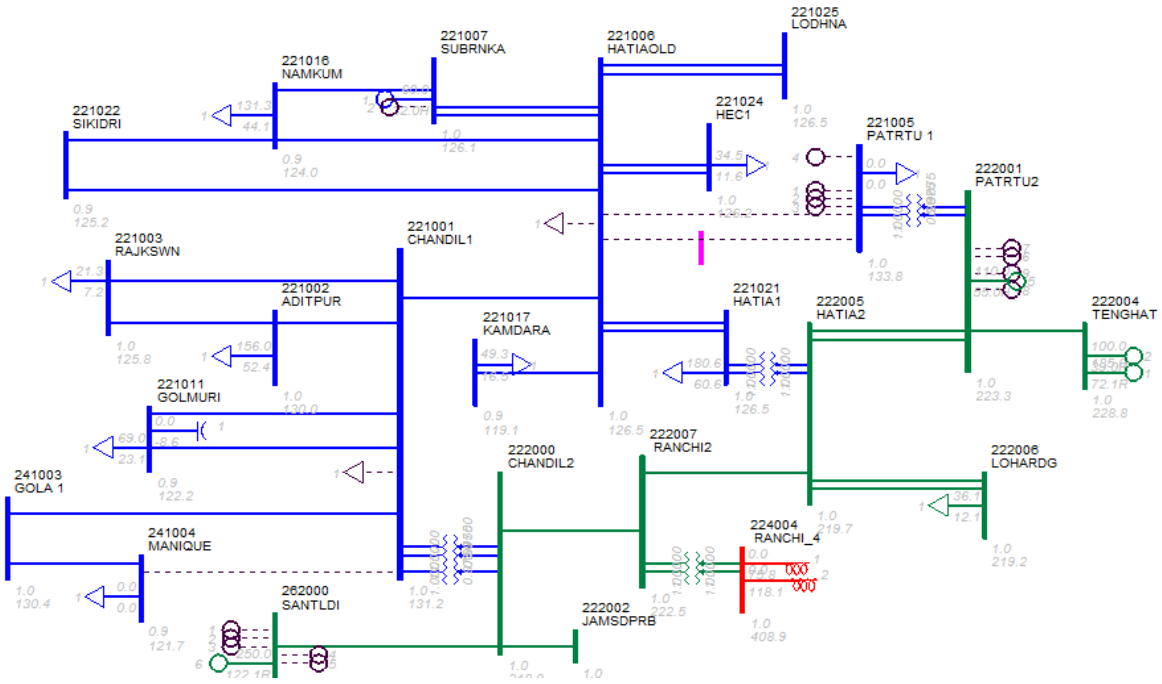
4. *The directional feature of over current protection of 132kV Chandil-Hatia S/C at both end to be verified.*

5. *JUSNL was advised to collect the tripping details of ICTs and generators at PTPS.*

2.4 Excerpts of minutes of 37th PCC

2.4.1 Repeated Disturbances at 220kV Chandil S/s of JUSNL System.

1. Total power failure at 220kV Chandil S/s of JUSNL system on 01/10/15 at 10:50hrs



Total power failed at 220kV Chandil S/s on 01/10/15 at 10:50 hrs, due to tripping of 4x100MVA ICTs on O/C, B-Ph from LV side. The following elements got tripped:

- 4x100MVA ICT on O/C, B-Ph , Trip on LV side
- 220kV Chandil-Santaldih (tripped from Chandil end only by Master Trip Relay, Supervision 85/86)
- 132 kV Chandil- Rajkharsawan
- 132 kV Chandil -Adityapur – Rajkharsawan
- 132 KV Chandil-Hatia
- 132 kV Ramchandrapur- Adityapur D/C

Analysis of PMU plots:

- An observation of PMU plot of Ranchi Shows, there was a 6kV dip in Y-Ph voltage and 4 kV dip in B phase voltage during the incident.
- 20 A rise in B-Ph line current of 400kV Ranchi- Maithon has been observed during the said period.
- Fault persistence time was approx. 1000 ms.

Due to non-availability detail tripping report along with DR and EL records from JUSNL, the exact sequence/reason of the above tripping cannot be established.

JUSNL may explain.

Deliberation in the meeting

JUSNL explained with the given diagram that---

- *The above tripping occurred due to B-Ø conductor snapping between location no 2 & 3 of 132kV Adityapur – Ushamartin circuit-I.*

- *Though the 132kV Adityapur – Ushamartin circuit-I tripped from both the end, the fault got extended due to delayed tripping/clearance.*

- *Subsequently, the following elements tripped:*

At Adityapur GSS:

a) 132 KV Adityapur – Ushamartin circuit –I tripped both end.
b) 132 KV Adityapur – Ushamartin circuit –II tripped at Adityapur end.
c) 132/33KV 50 MVA Transformer I & II tripped.

At Ramchandrapur GSS:

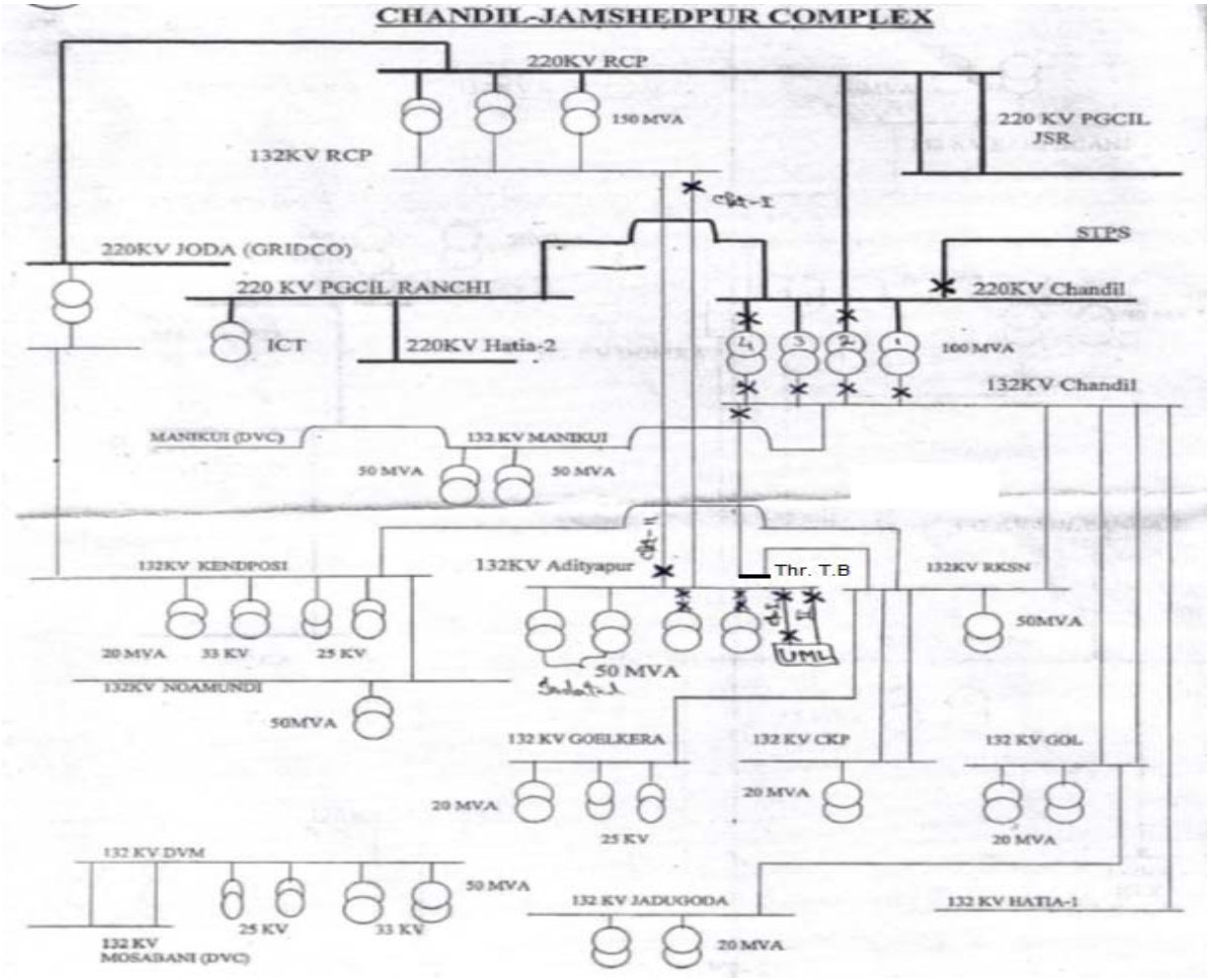
a) 132KV Ramchandrapur-Adityapur circuit-1 tripped at Ramchandrapur end.
b) 132 KV Ramchandra-Adiyapur circuit-2 tripped at Adityapur end.

At Chandil GSS:

a) 220KV Chandil –STPS T/L Tripped at chandil end.
b) 132kv Chandil-Adityapur Tripped at Chandil end.
c)220/132kv 100MVA transformer I, II, III &IV all are triped.

- *The details of relay indications as furnished by JUSNL are as follows:*

Sl.No.	Name of Line	Local end relay	Remote End relay	Remarks
1.	220kV Chandil- STPS T/L	86,95/86	Not tripped	Chandil end- SEL 311C STPS-P442
2.	220kV Chandil-Ramchandrapur	Normal	Normal	Chandil end- Micom P430C RCP end-P430C
3.	220KV Chandil-PGCIL Ranchi.	Normal	Normal	Chandil-SEL 311C
4	132KV Chandil-Adiyapur.	Tripping relay 186	Not tripped	Chandil-P430C Adpur-P441
5	100MVA, 220/132 KvTr.I at Chandil	B Ø , O/C (LV side trip)		
6	100MVA, 220/132 KvTr.II at Chandil	B Ø , O/C (Both side trip)		
7	100MVA, 220/132 KvTr.III at Chandil	B Ø , O/C (LV side trip)		
8	100MVA , 220/132 KvTr.IV at Chandil	Master trip relay 86HV, Diff.operated LV-O/C (Both side trip)		
5	132KV Ramchandrapur-AdityapurCkt-I	12km,Z-III	Not tripped	RCP- P442 Adpur-P442
6	132KV Ramchandrapur-AdityapurCkt-II	Not tripped	O/C & E/F	RCP-P442 Adpur-P442
7	132kv Adityapur-Ushamartinckt.- I	86,O/C,E/F,A/R relay lock out	O/C & E/F Fault this line BØ	Adpur-Eusion Reyrolle UML- Eusion Reyrolle
8	132kv Adityapur-Ushamartinckt.-II	O/C & E/F	Not tripped	Adpur-P441 UML-P441
9	50 MVA,132/33Kv Tr.no - I at Adpur	O/C,86 (HV & LV both side triped)		
10	50 MVA, 132/33 Kv Tr.no - II at Adpur	O/C, 86 (HV & LV both side triped)		



However, JUSNL failed to explain the tripping sequence & exact cause for un-coordinated trippings in proper manner and also the protection available for each element involved in the said disturbance.

Regarding submission of DR/EL, JUSNL informed that the DR of the relays could not be downloaded as the relays were old and interfacing software is also not available with them. It was further informed that the old relays of Chandil S/s have been replaced with new relays.

After detailed deliberation, PCC felt that JUSNL should carry out the detailed analysis for such un-coordinated trippings (element-wise) and place the report along with DR/EL inputs.

2.4.2 Total power failure at 220kV Chandil S/s of JUSNL system on 02/10/15 at 12:44hrs

At 12:42hrs, total power failed at 220kV Chandil S/s due to bursting of B-Ph Jumper of wave trap of 132kV Chandil- Rajkharsawn S/C at Chandil end. The following elements were tripped:

Time (Hrs)	Details of tripping	Relay at local end	Relay at remote end
12:42hrs	132kV Chandil-Rajkharswan S/C	At Chandil Tripping relay Start, O/C start, E/F start	At Rajkharswan Did Not Trip
	100 MVA, 220/132 kV ICT - I at Chandil	Tripped on O/C from LV side	
	100 MVA, 220/132 kV ICT-II at Chandil	Tripped on O/C from HV side	
	100 MVA, 220/132 kV ICT-III at Chandil	Tripped on O/C from LV side	
	100 MVA, 220/132 kV ICT-IV at Chandil	Master Trip relay, Trip ckt supervision relay, LV side, Non directional E/F	

Analysis of PMU plots:

- An observation of PMU plot of Ranchi Shows that there was a 10kV dip in B-Ph voltage during the incident.
- 40 A rise in B-Ph line current of 400kV Ranchi- Sipat- I have been observed during the said period.

- Fault persistence time was approx. 380 ms.

Detailed Analysis:

It is suspected that non opening/delayed opening of the breaker at Chandil end for 132kV Chandil- Rajkharsawn S/c line could have caused the tripping of all the four 220/132kV, 100 MVA ATRs at Chandil end on operation of Overcurrent protection. Thus after tripping of all the 220/132kV, 100MVA, ATRs at Chandil approx. 190MW load loss occurred at Chandil S/s including traction power of 50 MW at Golmuri and Manique.

JUSNL may explain.

Deliberation in the meeting

JUSNL informed that---

- *Total power failed at 220 kV Chandil S/S due to bursting of B-phase Jumper of wave trap of 132 kV Chandil-Rajkharsawn S/C at Chandil end.*

- *Relay indication for tripping was there but Circuit breaker of 132 kV Chandil-Rajkharsawn S/C line failed to trip at Chandil end.*

- *This led to tripping of all the four 220/132 kV ICTs at Chandil S/s.*

- *Breaker tripping of 132 kV Chandil-Rajkharsawn S/C line was checked and now it is all right.*

2.4.3 Total power failure at 220kV Chandil S/s of JUSNL system on 21/10/15 at 00:15hrs

Total power failed at 220kV Chandil S/s at 00:15 hrs, due to bursting of R-Ph CT of 220/132kV ATR-I at Chandil on 132kV side. The following elements were tripped:

Time (Hrs)	Details of tripping	Relay at local end	Relay at remote end
00:15 hrs	220 KV Chandil -Santaldih S/C	AT Chandil Did not Trip	At Santaldih R-Ph, O/C, E/F
	220 KV Chandil -Ranchi S/C	AT Chandil Master Trip Relay	At Ranchi NA
	220 KV Chandil – Ramchandrapur S/C	AT Chandil Master Trip Relay	At Ramchandrapur E/f , O/C, Tripping relay VAJ
	132kV Ramchandrapur-Adityapur--I	At Ramchandrapur Power Swing, E/F, O/C, Tripping relay type VAJ	At Adityapur Did not Trip
	132kV Ramchandrapur-Adityapur--II	At Ramchandrapur Did not Trip	At Adityapur E/f , O/C
	132 KV Chandil – Adityapur S/C	AT Chandil Did not Trip	At Adityapur E/f , O/C
	132 KV Chandil – Rajkharswan S/C	AT Chandil Did not Trip	AT Rajkharswan O/C
	220/132kV , 100 MVA ATR-I	At HV E/F	At LV E/F, O/C
	220/132kV , 100 MVA ATR-II	At HV E/F	At LV O/C
	220/132kV , 100 MVA ATR-IV	At HV Did not Trip	At LV E/F, Master trip

Analysis of PMU plots:

- An observation of PMU plot of Ranchi Shows, there was a 8kV dip in R-Ph voltage and 6 kV dip in Y phase voltage during the incident.

- 70 A rise in R-Ph line current of 400kV Ranchi- Maithon has been observed during the said period.

- Fault persistence time was approx. 540 ms.

Detailed analysis:

It is suspected that there was a delayed opening of the breaker either at HV or LV side for ATR-I and it caused the tripping of other elements. Due to above mentioned tripping approx. 320 MW load loss occurred at Chandil & their surrounded area including traction loss of 50 MW at Rajkharswan, Goelkera, Kendposi, Chakardharpur, Golmuri, and Manique.

JUSNL may explain the following:

- Any delayed operation of CB of 220/132kV ATR-I.

- Tripping of 132kV Ramchandrapur- Adityapur—II from Adityapur on E/F, O/C

<u>Deliberation in the meeting</u>

JUSNL informed that---

- *There was a fault at 220kV Chandil S/s due to bursting of R-Ph CT of 220/132 kV ATR-I on 132kV side.*

- *Due to delayed clearance of fault by ATR-I the two other 220/132 kV ATRs got tripped at Chandil S/s.*

- *220 kV as well as 132 kV feeders of Chandil and other 132 kV feeders also got tripped.*

However, JUSNL failed to explain the tripping sequence & exact cause for un-coordinated trippings in proper manner and also the protection available for each element involved in the said disturbance.

Regarding submission of DR/EL, JUSNL informed that the DR of the relays could not be downloaded as the relays were old and interfacing software is also not available. It was further informed that the old relays of Chandil S/s have been replaced with new relays.

After detailed deliberation, PCC felt that JUSNL should carry out the detailed analysis for such un-coordinated trippings (element-wise) and place the report along with DR/EL inputs.

2.4.4 Disturbance at 220kV Ramchandrapur S/s on 20/10/15 at 05:38hrs

At 05:38 hrs, 400/220KV, 315 MVA ICT-I & II tripped at Ramchandrapur due to busting of R-phase CT of 220KV Ramchandrapur-Chandil line at Ramchandrapur end. The Following lines tripped:

Time (Hrs)	Details of tripping	Relay at local end	Relay at remote end
05:36 hrs	220 KV Ramchandrapur - Chandil S/C	At Ramchandrapur Zone-III	At Chandil Zone-III, Master trip relay
	220kV Ramchandrapur- Joda S/c	At Ramchandrapur NA	At Joda NA
	400/220kV ICT-I at Jamshedpur	At Jamshedpur O/c	At Ramchandrapur Master Trip
	400/220kV ICT- II at Jamshedpur	At Jamshedpur Back up O/c, R-ph	At Ramchandrapur Master Trip
	132kV Chandil-Adityapur	At Chandil Trip relay 186	At Adityapur Did Not Trip
	132kV Chandil-Rajkharswan S/c	At Chandil Back up E/F, O/C	At Rajkharswan Did Not Trip
	132kV Ramchandrapur-Adityapur-I	At Ramchandrapur Did Not Trip	At Adityapur E/F, O/C
	132kV Ramchandrapur-Adityapur-II	At Ramchandrapur Did Not Trip	At Adityapur E/F, O/C
	220/132kV , 150 MVA ATR-I at RCP	O/C	

Analysis of PMU plots:

- An observation of PMU plot of Jamshedpur Shows, there was a 50kV dip in R-Ph voltage during the incident.

- 540 A rise in R-Ph line current of 400kV Jamshedpur- Chaibasa has been observed during the said period.

- Fault persistence time was approx. 40 ms.

Detailed analysis:

Fault was in 220KV Ramchandrapur-Chandil line close to Ramchandrapur end. Due delayed fault clearance from Ramchandrapur end, 400/220kV ICTs at Jamshedpur, 220/132kV , 150 MVA ATR-I at RCP and 132kV Ramchandrapur- Adityapur-I & II got tripped.

JUSNL may explain the following:

- Tripping of 220 KV Ramchandrapur -Chandil S/C line from both ends on zone 3 distance protection
- Tripping details of 220kV Ramchandrapur- Joda S/c
- Tripping of 132kV Chandil- Adityapur and 132kV Chandil- Rajkharswan S/c

<u>Deliberation in the meeting</u>

JUSNL informed that---

- *There was a fault at 220kV Ramchandrapur S/S due to bursting of R-phase CT of 220kV Ramchandrapur-Chandil line.*

- *Due to delayed fault clearance from Ramchandrapur end, 400/220kV ICTs at Jamshedpur, 220/132kV , 150 MVA ATR-I at Ramchandrapur and 132kV Ramchandrapur- Adityapur-I & II got tripped.*

However, JUSNL failed to explain the tripping sequence & exact cause for un-coordinated trippings in proper manner and also the protection available for each element involved in the said disturbance.

Regarding submission of DR/EL, JUSNL informed that the DR of the relays could not be downloaded as the relays were old and interfacing software is also not available.

After detailed deliberation, PCC felt that JUSNL should carry out the detailed analysis for such un-coordinated trippings (element-wise) and place the report along with DR/EL inputs.

For the disturbances in JUSNL system as given under Item No B.1 (1 to 3) & B.2, PCC took serious note of the non compliance of clause 5.2 (r) of IEGC as no details were made available to ERPC/ERLDC.

It was informed that the issue was also discussed in 31st TCC/ERPC wherein the board with a serious note formed a committee of following protection engineers to review the situation:

- *Shri Sabyasachi Roy, CE, WBSETCL,*
- *Shri L Nayak, GM, OPTCL*
- *Shri Jayanta Datta, SE, DVC*
- *Shri Surajit Bannerjee, DGM, ERLDC,*
- *Shri Jiten Das, Asst GM, PGCIL (Later replaced by Mr. S.K.Singh, AGM, PGCIL)*
- *Shri S. B. Prasad, ESE, BSPTCL*
- *Shri Vidyasagar Singh, ESE, JUSNL*

Board further advised JUSNL to attend the PCC with all details. But unfortunately details were not submitted and members from JUSNL for the committee formed as above failed to attend the PCC.

PCC took serious note of this and advised JUSNL to clarify their position of not submitting DR/EL/SOE for the disturbances mentioned above. Further, PCC also needs the following information in respect of Chandil, Ramchandrapur, Adityapur and adjoining substations in Jharkhand.

3.0 Sequence of Events adopted by the Committee:

3.1 AS PER PONT NO. :- 1 OF METHEDOLOGY

ERPC convened a special meeting of Committee members on 8.12.2015 and the following information's in respect of Chandil, Ramchandrapur and Adityapur and adjoining substations in Jharkhand were requested to be submitted by JUSNL at ERPC secretariat :

(i) SLD of all Sub-Stations (with CT).

(ii) Year of manufacture of all equipment's.

(iii)Comprehensive CT details along with name plate (with connected/ adopted ratio)

(iv) VT details.

(v) Fault Level 3-phase as well as 1-phase (line length, conductor details and transformer details for computing the fault level).

(vi) Transformer details (Rating and % impedance)

(vii) Availability of Auto – Reclose scheme.

(viii) Availability of Carrier Protection.

(ix) Availability of Bus- Differential and LBB Protection.

(x) Junction Box details.

(xi) Cable details used for CT connections (Cross section/core of cable, Junction Box details and length of cable between JB and Control Room)

(xii) Grid Earthing Resistance (With latest Test Report).

(xiii) Breaker details (operating Time).

(xiv) CT/PT earthing details.

(xv) Relay details (Relay type, model, settings, manufacturing, and basis of settings).

(xvi) Scheme adopted for protection settings for lines and transformers.

(xvii) DC system details with charger and Battery.

The relevant data's for Chandil Ramchandrapur and Adityapur S/Stns of JUSNL were submitted to ERPC after which members of the committee scrutinised the data's. Discrepancies and missing data's were pointed out to the JUSNL members attending PCC meetings and subsequently they complied.

3.2 AS PER POINT NO. :- 2 OF METHEDOLOGY

Finally the complete and corrected data was available for scrutiny and the same was compiled individually by the members of the committee.

3.3 AS PER POINT NO. :- 3 OF METHEDOLOGY

On the basis of scrutinised data's a Special Protection Co-ordination Meeting "To review the data submitted by JUSNL and BSPTCL and also to discuss the roadmap for site visit" was convened at ERPC, Kolkata on 29.03.2016. Threadbare discussions took place between the members and representatives of JUSNL and BSPTCL.

Suggestions, Deliberations and recommendations against individual substations are recorded against individual sub-stations as given below.

3.4 AS PER PONT NO. :- 4 OF METHEDOLOGY

Members of the Committee visited the following Sub-Stations of JUSNL to have a detailed review their system and practices followed :-

(i) 220KV Ramchandrapur and 132KV Adityapur GSS on 11.05.15.

(ii) 220KV Chandil GSS on 12.05.16.

4.0 FINDINGS OF THE COMMITTEE.

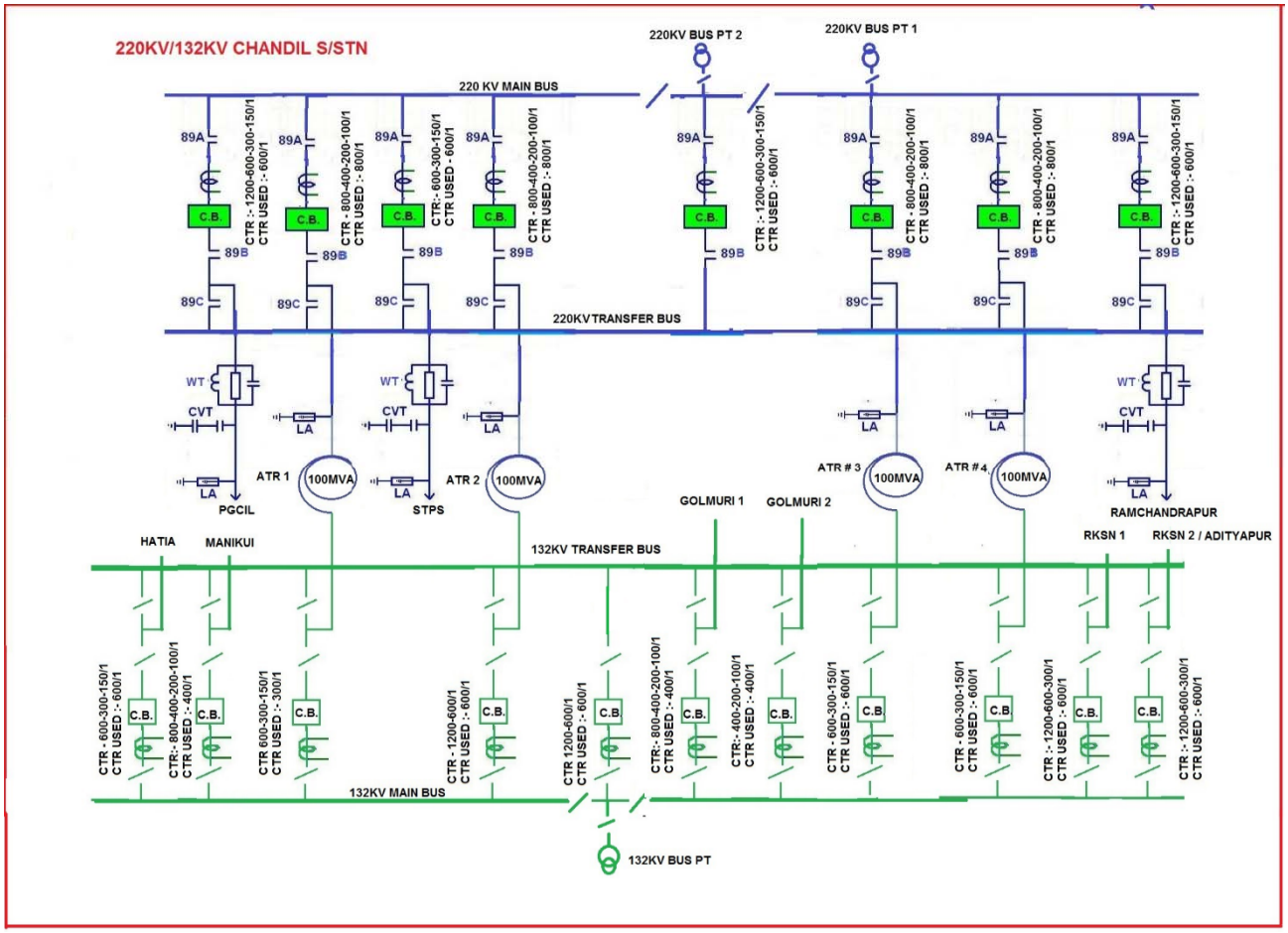
A. Scrutiny of the Submitted data's discussed in the Special Protection Co-ordination Meeting at ERPC, Kolkata on 29.03.2016. in a composite way at Sub-station/ Bay level.

AND

B. Findings of other aspects related to healthy protection system during the visits to the Sub-Stations

4.1 Findings of 220KV / 132KV CHANDIL S/STN

4.1.1 SINGLE LINE DIAGRAM



A. Scrutiny of the submitted data and deliberation of JUSNL in the meeting on 29.03.16

i. Study of CT details reveal that there are many bays of 220kV & 132 kV bay where the CTs are more than 25 years old.

ii. Tan delta & characteristics of the CTs are required to be re-checked.
BREAKERS HAVE ALREADY BEEN CHANGED

iii. 220kV & 132 kV BUS PT is also more than 25 years old and the accuracy class of 132kV PT is 5 while one of the 220kV PT is 1/5.

iv. DP setting not as per ERPC philosophy.

v. Differential relay not numerical.

vi. Earth resistance high: 2Ω

vii. DC positive earthed.

Deliberation in the meeting

JUSNL clarified that—

- *There are many C.Ts which are more than 25 years old and Tan delta characteristics is also not satisfactory as such these C.T's will be replaced after its procurement.*
- *However tan delta test & characteristics of the other C.Ts will be carried out by outsourcing.*
- *One set of 220 kV P.T (accuracy class-0.2) has already been replaced and other sets of 220 kV P.T will be replaced after procurement. One set 132 kV P.T will be also replaced after procurement.*
- *At present only ICT-IV is having REF protection and rest old ICT- I, II & III are not incorporated with REF protection.*
- *DGA test for ICTs had been carried out 4-5 years back and Transformer oil was also replaced once.*

- *Work for relay coordination as per the revised philosophy of ERPC has been awarded to AREVA and it will be carried out soon.*

- *Supply of Second DC supply source is awaited.*

During discussion it was emerged that the in JUSNL system CTs are in bus side instead which should be on line side as per regular practice.

JUSNL informed that in their sub-stations are following these design since inception and this is being taken care by transferring the protection from line CB to the Bus-coupler CB. But their transformers need not to be transferred as they have adequate number of ICTs.

B. Findings during the visit. (Dated :- 12.05.16)

i. One Number Numerical Distance Protection Relay has been used for all 220KV and 132KV Feeders.

ii. The Over current and Earth fault protection has been provided in the same Numerical Distance Protection relay for these 220KV Feeders. This is not as per the PART 3 OF CEA (TECHNICAL STANDARDS FOR CONNECTIVITY OF THE GRID) REGULATION, 2007, wherein it is clearly mentioned that 220KV Transmission Lines should have both MAIN 1 and MAIN 2 Distance Protection Schemes applicable for New Sub-Stations and for the Old Sub-Stations, it should be implemented in a reasonable time frame.

iii. For O/C protection, the Definite Time Delay (100-150mSecs) has been incorporated for a Pick up value > 2 amps(secondary). The Non-Directional feature has been used in this relay.

iv. The Overcurrent and Earth Fault Protection has been provided in the same Numerical Distance Relay for 132KV Feeders. As per the standard practice, the Distance Protection and the Directional O/C and Earth Fault protection should be two separate relays as main and back-up.

v. ICT protection is not adequate. Old relays need to be replaced. REF protection needs to be provided.

vi. No bus bar protection is available. The LBB relays are provided for bays but detail scheme could not be traced. No separate trip relay found for LBB protection (This may cause unwanted/un-coordinated tripping. Which happened in some earlier cases also). Total LBB protection scheme need to be reviewed.

vii. CTJB AND PTJB are in very poor condition with Terminal Blocks weird in different occasions. Replacement of the CTJB and PTJB are to be carried out and proper earthing of the boxes are to be ensured.

viii. The D.C. Negative Earth was persisting and the measured value during the visits are as follows:-

D.C. +ve to –ve :-	218 Volt.
D.C. +ve to earth :-	185 volts.
D.C. –ve to earth :-	29 volts

The above results indicate that D.C. system is not healthy.

ix. Annunciations / Indication system is not up to the mark of any important Grid elements. Many of them are not functioning properly.

x. Electromagnetic relays for Over current/ Earth fault protection for some of the 220kV,132kV lines and transformers are present in the Panel where the only NUMERICAL RELAY has been installed and connected.

DUE TO NON-AVAILABILITY OF CONTROL AND PROTECTION DRAWINGS OF THE EXISTING SCHEME IN THE SUB-STATION, THE USAGE OF THESE RELAYS COULD NOT BE ASCERTAINED.

PROPER SCHEMES WITH REMOVAL OF REDUNDANT RELAYS AND PROPER WIRING AS PER THE EXISTING SCHEME SHOULD BE IMPLEMENTED TO MITIGATE THE ISSUE.

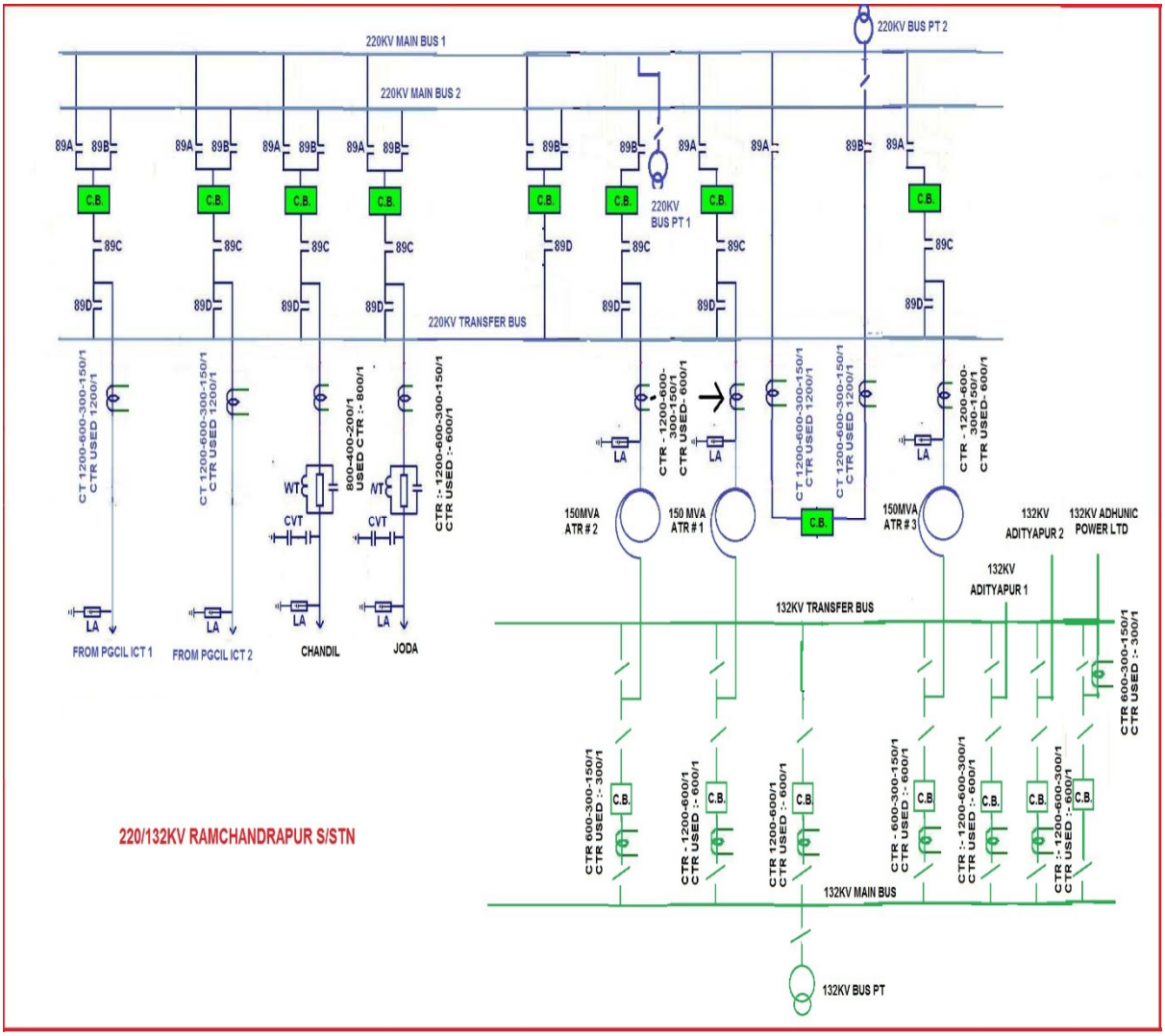
xi. Absence of certain basic functions as PT FUSE FAILURE for numerical Distance Protection Relay.

xii. Absence of Functional Demarcation of LED in the Numerical Relay.

xiii. The DC supply to CR panels of 220KV Chandil GSS is only from one source. Two source of DC may be provided to CR panels for 220kV and above system for security and redundancy.

4.2 Findings of 220KV/132KV RAMCHANDRAPUR S/STN

4.2.1 SINGLE LINE DIAGRAM



A. Scrutiny of the submitted data and deliberation of JUSNL in the meeting on 29.03.16

i. The CT rating of 132kV side of 150 MVA transformer is set at 600/ 1 which seems on the lower side. It requires further analysis and review

ii. There are only single trip coil in the breakers as seen from the results of Closing and Tripping time in 220kV breakers. However it was latter clarified that Double trip coils are available for the 220KV breakers.

iii. Provision of two separate DC as Main DC#1 and Main DC#2 for individual bays are to be studied for redundancy.

iv. Breaker trip time of ICT 220kV Breaker: Y pole- 589 ms, B Pole-589 ms which is very high.

v. Here also the bay CTs which are more than 25 years requires the characteristics of the CT to be analysed.

vi. DP setting not as per ERPC philosophy.

vii. Differential relay not numerical.

viii. Earth resistance high: 2Ω

ix. DC positive earthed.

Deliberation in the meeting

JUSNL submitted the SLD of Ramchandrapur GSS and updated the following:

- *220 kV Breaker of Ramchandrapur G/S/S will be checked for operation timing of trip coil-1 trip coil-2 by suitable agency.*

- *Purchase order for second set of sub-station batteries set with charger has already been placed and it will be commissioned after delivery.*

- *Breaker trip time of ICT 220 kV breaker will be rechecked and corrective measures to be taken if required.*

- *There are some C.Ts which are 25 years old their tan delta characteristics and other specifications like knee voltage and ratio errors will be checked very soon with the help of suitable agency.*
- *There are two trip-coil in the breakers but during testing the agency missed to test the second coil as they could not trace the contact of second coil. The same will be traced and tested*

B. Findings during the visit (DATED 11.05.16)

i. One Number Numerical Distance Protection Relay has been used for 220KV and 132KV Feeders.

ii. The Over current and Earth fault protection has been provided in the same Numerical Distance Protection relay for these 220KV Feeders. This is not as per the PART 3 OF CEA (TECHNICAL STANDARDS FOR CONNECTIVITY OF THE GRID) REGULATION, 2007, wherein it is clearly mentioned that 220KV Transmission Lines should have both MAIN 1 and MAIN 2 Distance Protection Schemes applicable for New Sub-Stations and for the Old Sub-Stations, it should be implemented in a reasonable time frame.

iii. For O/C protection, the Definite Time Delay (100-150mSecs) has been incorporated for a Pick up value > 2 amps(secondary). The Non-Directional feature has been used in this relay.

iv. The Overcurrent and Earth Fault Protection has been provided in the same Numerical Distance Relay for 132KV Feeders. As per the standard practice, the Distance Protection and the Directional O/C and Earth Fault protection should be two separate relays as main and back-up.

v. Non-directional O/C relay has been used for 220/132 kV ICT- I&II which needs to be replaced with directional relays. ICT protection needs to be reviewed. Old relays need to be replaced.

vi. GE make Numerical centralised bus bar system with LBB, DR & Event recording facilities are available. **However the complete scheme drawings were not available by which it could be adjudged as to which protections are used and in service.**

vii. P122-Non-directional O/C has been used for LBB but the same needs to be put in service after testing. No scheme drawings were available.

viii. Trip coil supervision and its healthy indications was found only for Bus-coupler (Out of six only one is healthy).

ix. The D.C. Negative Earth was persisting and the measured value during the visits are as follows:-

D.C. +ve to –ve :-	217 Volt.
D.C. +ve to earth :-	141 volts.
D.C. –ve to earth :-	76 volts

The above results indicate that D.C. –ve is resistively earthed.

x. Although provided, indications in the CONTROL PANEL for isolator, breaker, CB spring charge, gas pressure, Trip transfer etc. was not glowing in some of the Line Bays.

xi. Annunciations in most of the cases were out of order.

xii. Electromagnetic relays for Over current/ Earth fault protection for some of the 220kV,132kV lines and transformers are present in the Panel where the only NUMERICAL RELAY has been installed and connected.

DUE TO NON-AVAILABILITY OF CONTROL AND PROTECTION DRAWINGS OF THE EXISTING SCHEME IN THE SUB-STATION, THE USAGE OF THESE RELAYS COULD NOT BE ASCERTAINED.

PROPER SCHEMES WITH REMOVAL OF REDUNDANT RELAYS AND PROPER WIRING AS PER THE EXISTING SCHEME SHOULD BE IMPLEMENTED TO MITIGATE THE ISSUE.

xiii. Absence of certain basic functions as PT FUSE FAILURE for numerical Distance Protection Relay.

xiv. Absence of Functional Demarcation of LED in the Numerical Relay.

xv. CTJB AND PTJB OF 132KV Switchyard are in very poor condition with Terminal Blocks weird in different occasions. Replacement of the CTJB and PTJB are to be carried out and proper earthing of the boxes are to be ensured.

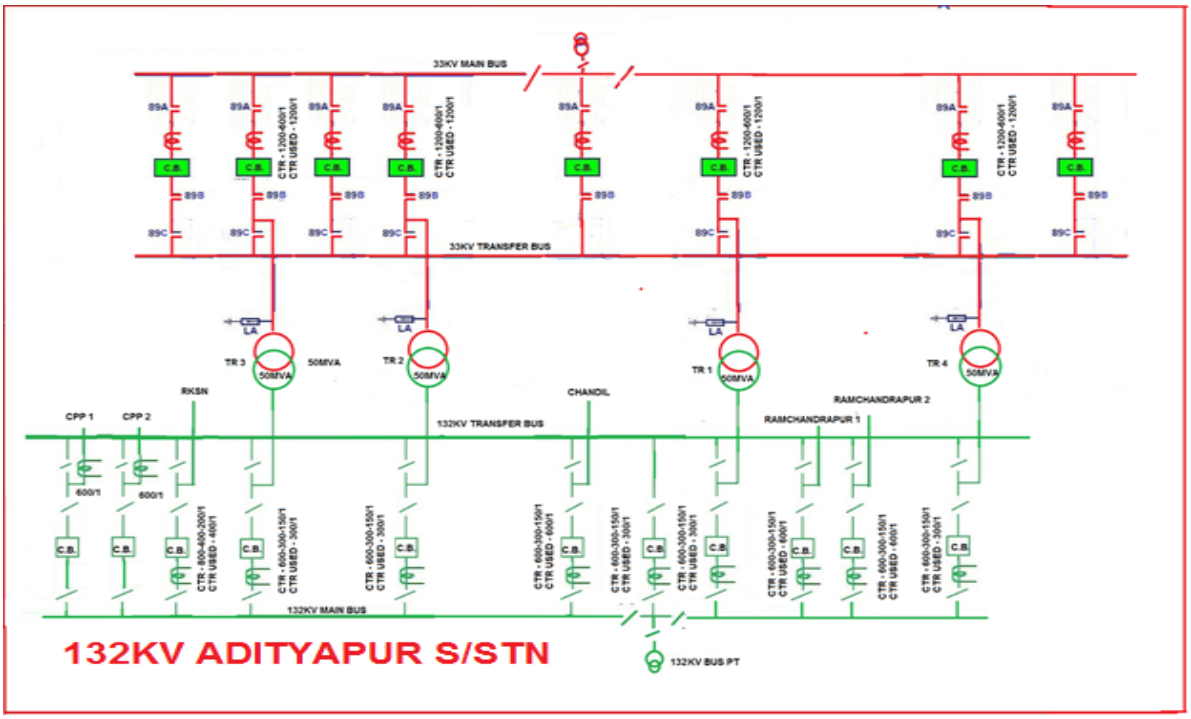
xvi. The DC supply to CR panels of 220KV Ramchandrapur GSS is only from one source. Two source of DC may be provided to CR panels for 220kV and above system for security and redundancy.

xvii. The Control Room cooling for Ramchandrapur GSS was found inadequate. The Air conditioning system may be made available in the Substation control rooms for temperature and dust control which will improve the operation of protective relays and meters.

xviii. The transformer differential protection in ATR # 1 and ATR # 2 are DTH 31 (electromechanical) while in Transformer # 3 it is numerical based Duo – Bias relay.

4.3 Findings of 132KV ADITYAPUR S/STN

4.3.1 SINGLE LINE DIAGRAM



A. Scrutiny of the submitted data and deliberation of JUSNL in the meeting on 29.03.16

i. Breaker time test result not provided.

ii. Distance Protection with O/C & E/F used in AREVA make P441 relay. Separate back up protection relay was suggested.

iii. Distance Protection setting not as per ERPC philosophy.

iv. Differential relay used for Transformers were not of Numerical type.

v. DC negative is earthed.

vi. Only One trip coil time test results have been provided for 132kV CB.

vii. JUSNL *submitted the Breaker time test result during the meeting*

- *There are two trip-coil in the breakers but during testing the agency missed to test the second coil as they could not trace the contact of second coil. The same will be traced and tested.*

B. Findings during the visit (DATED 11.05.16)

i. One Number Numerical Distance Protection Relay has been used for 132KV Feeders.

ii. For O/C protection, the Definite Time Delay (200-250mSecs) has been incorporated for a Pick up value > 1.3 -1.5. The Non-Directional feature has been used in this relay.

iii. The Overcurrent and Earth Fault Protection has been provided in the same Numerical Distance Relay for 132KV Feeders. As per the standard practice, the Distance Protection and the Directional O/C and Earth Fault protection should be two separate relays as main and back-up.

iv. Regarding Transformer Protection :-

a. 50 MVA Transformer I&II- No REF on either HV or LV side
b. Transformer -III- UE make very old relay which needs to be replaced.
c. Transformer IV:- only LV REF is not available

v. The D.C. Negative Earth was persisting and the measured value during the visits are as follows:-

D.C. +ve to –ve :-	250 Volt.
D.C. +ve to earth :-	246 volts.
D.C. –ve to earth :-	3 volts

The above results indicate that D.C. –ve is earthed.

vi. Although provided, indications in the CONTROL PANEL for isolator, breaker, CB spring charge, gas pressure, Trip transfer etc. was not glowing in some of the Line Bays.

vii. Annunciations in most of the cases were out of order.

viii. Except Transformer –IV, provision of Trip Coil Supervision could not be ascertained as there was no schematic drawing available in the Sub-Station.

ix. Electromagnetic relays for Over current/ Earth fault protection for some of the 132kV lines and transformers are present in the Panel where the only NUMERICAL RELAY has been installed and connected.

DUE TO NON-AVAILABILITY OF CONTROL AND PROTECTION DRAWINGS OF THE EXISTING SCHEME IN THE SUB-STATION, THE USAGE OF THESE RELAYS COULD NOT BE ASCERTAINED.

PROPER SCHEMES WITH REMOVAL OF REDUNDANT RELAYS AND PROPER WIRING AS PER THE EXISTING SCHEME SHOULD BE IMPLEMENTED TO MITIGATE THE ISSUE.

x. Absence of certain basic functions as PT FUSE FAILURE for numerical Distance Protection Relay.

xi. Absence of Functional Demarcation of LED in the Numerical Relay.

xii. CTJB AND PTJB OF 132KV Switchyard are in very poor condition with Terminal Blocks weird in different occasions. Replacement of the CTJB and PTJB are to be carried out and proper earthing of the boxes are to be ensured.

4.4 COMMON ISSUES (KNEE PT VOLTAGE and RCT not provided) discussed in the meeting on 29.03.16

i. Earth resistance values provided have been found to be 2 ohm.
--Improvement of these values and the values more than 1 have to be reduced to less than 1 ohm.

ii. DC system of all the three sub-stations are to be reviewed

Results signifies that –ve is more or less earthed.

DC earthing is the root of many mal-operation and mal-tripping which has to be addressed.

iii. Auto reclosure and carrier is not active. This has to be brought to service.

Deliberation in the meeting

JUSNL informed that following actions are being taken to resolve the above common issues:

- *D.C system of all three sub-stations will be reviewed and necessary rectification work will be carried out.*
- *Auto reclose of 220 kV Chandil-Ramchandrapur, 220 Kv Chandil-PGCIL had been make active and it is in service.*
- *Auto reclose of 220 kV Chandil-STPS has done at Chandil end PLCC panel has also checked and terminated.*
- *Auto reclose of 220 kV Ramchandrapur-JODA has done at Ramchandrapur end and PLCC panel has also checked and terminated at RCP end. Both will be enabled in service after installation of CVT and PLCC panel at remote end i.e. STPS end and JODA end. Hence they requested to take up the issue with consultation of ULDC, JUSNL and with the coordinator STPS and JODA for restoring the PLCC scheme of both transmission lines.*

4.5 GENERAL OBSERVATION DURING THE VISIT TO THE SUB-STATIONS

4.5.1 CT ARRENGEMENT:

In many of the Sub-Stations the CT's are placed in the BUS SIDE. While diverting any line through the Bus Coupler, proper setting of the Relays are to be implemented in Distance Protection Relay of Bus Coupler(with selectable group setting through switch) so that isolation in same coordinated manner is assured. Protection Transfer during Diversion of Transformer through Bus coupler also need to be taken care. The relocation of CTs may be considered for security & availability.

4.5.2 CTJB, PTJB, ISOLATOR CONTROL CUBICLE:-

The Junction Boxes should be repaired, with proper gasket arrangement in the cover to avoid ingress of water and dust. The Junction box earthing & CT PT star point earthing should be made with the earth flat instead of the structure.

4.5.3 OTHER OBSERVATIONS:-

1. Grid Earth Resistance value should be reduced in Adityapur & Ramchandrapur S/Stn.

2. DC earth fault observed in all the substations need to be traced and removed.

3. Adityapur switchyard need to be cleaned and weeds to be cleared to avoid fire hazard.

4. Auto reclosure and carrier is not in service for 220KV Transmission Line at Chandil and Ramchandrapur S/Stn. This has to be brought to service.

5.0 Root Cause Analysis:

Apparently the cause of such types of tripping could be attributed to the following :-

(I) Absence of appropriate setting philosophy for the 220KV/132KV lines wherein Non-Directional O/C protection has been used with improper characteristics which definitely lead to un-coordinated trippings in system.

(ii) In many of the cases absence of basic functions as PT fuse failure for distance Protection Relay may be enabled, but indication and annunciation was not available. So such serious events may be unnoticed during real time operation. This was observed in one of the Fault records of a line provided wherein the FUSE FAILURE condition was persisting in the pre-fault condition also.

(iii) Since only one (1) Numerical based Distance Protection Relay is used for transmission lines for both Distance and Back-up function, non-availability of this relay may keep the line un-protected which may cause such types of mal-tripping.

(iv) DC earthing is a menace to Protection system and on many occasions spurious tripping have occurred due to this earthing. Hence this has to be removed at the very first instant.

(v) Auto – reclose and Carrier is not available for 220KV system for better protection management.

(vi) Certain intricate Operational procedures like hooking a Transmission line through the TRANSFER BUS, BUS PT shutdown of a Sub-Station, Transformer transferred through 220/132KV Bus Coupler where LINE SIDE CT is not available etc. require certain modifications in relay settings and scheme which are to be implemented before the commencement of the process. Any shortcoming in these may also lead to cascaded tripping in case of a Fault in the transmission lines during such period of time.

(vii) Electromagnetic relays for Overcurrent and Earth Fault protection for 220KV and 132KV Lines have been used. Annual testing of these relays to ascertain its proper operation should be carried out. However TEST TAGS indicating the last date of testing of the all the RELAYS including the Numerical ones may be followed as better practice.

(viii) Non-availability of Proper Indications in the Relay and annunciations/ indication sometimes deter the Operation personals from taking corrective actions at a proper juncture leading to subsequent cascaded tripping during actual faults.

6.0 Recommendations:-

6.1 During the meeting on 29.03.16

6.1.1 220KV/132KV CHANDIL S/STN

i. *Carry out Tan-delta measurement of all CTs and replace the CTs which are violating Tan-delta characteristics.*

ii. *Identify and connect the proper protection core of PT for protection purpose.*

iii. *All old PTs may be replaced with proper ratings, core and class of PTs.*

iv. *JUSNL should incorporate REF protection for other ICTs (ICT- I, II & III) and if required external neutral CTs may be mounted for the purpose.*

v. *To carry out DGA analysis of ICTs once in every 2 years.*

vi. *Take suitable measure for detection and rectification of the DC earth fault.*

vii. *While commissioning of second set of Battery Bank, proper measures to be taken for proper connection & segregation of DC#1 & DC#2 for redundancy & segregation as per the standard practices followed.*

6.1.2 220KV/132KV RAMCHANDRAPUR S/STN

i. *Carry out Tan-delta measurement of all CTs and replace the CTs which are violating Tan-delta characteristics.*

ii. *Identify and connect the proper protection core of PT for protection purpose.*

iii. *All old PTs may be replaced with proper ratings, core and class.*

iv. *Old EM relays are to be replaced with Numerical relay for ICT-I&II.*

v. *Circuit Breakers are to be tested with both the trip-coils and results to be submitted.*

vi. *Circuit Breaker of ICT-I may be checked as the CB trip time is very high (589 ms).*

vii. *Take suitable measure for detection and rectification of the DC earth fault.*

viii. *While commissioning of second set of Battery Bank, proper measures to be taken for proper connection & segregation of DC#1 & DC#2 for redundancy & segregation as per the standard practices followed.*

During discussion it was informed that usually JUSNL is keeping two ICTs in service as per their load requirement and one ICT in standby mode under charged condition.

It was advised to JUSNL that all the three ICTs may be kept in service during peak hours for meeting the n-1 criterion and during off-peak hours they may keep any of the two ICTs in service.

6.1.3 132KV ADITYAPUR S/STN

i. *Circuit Breakers are to be tested with both the trip-coils and results to be submitted.*

ii. *The breaker timings of ASEA make breakers need to be checked and if possible may be reduced.*

iii. *Take suitable measure for detection and rectification of the DC earth fault.*

6.1.4 COMMON ISSUES DISCUSSED IN THE MEETING

i. *Take suitable measure for detection and rectification of the DC earth fault.*

ii. *To carry out relay coordination as per the revised protection philosophy of ERPC.*

iii. *To complete the DPR for PSDF funding towards improvement/development of JUSNL protection system at the earliest.*

As agreed in the 41st PCC & 119th OCC meetings, JUSNL to share their standby PLCC panels (BPL make) with WBPDCL (for remote end of 220 kV Chandil -Santaldih) and OPTCL (for remote end of 220 kV Ramchandrapur -Joda) to complete the PLCC schemes of both the lines

6.2 Recommendations after the visit of the Sub-Stations

i. As per PART 3 OF CEA (TECHNICAL STANDARDS FOR CONNECTIVITY OF THE GRID) REGULATION, 2007, wherein it is clearly mentioned that 220KV Transmission Lines should have both MAIN 1 and MAIN 2 Distance Protection Schemes applicable for New Sub-Stations and for the Old Sub-Stations, it should be implemented in a reasonable time frame. **The same should be implemented.**

ii. One Number Numerical Distance Protection Relay has been used for 132KV Feeders. One Numerical Distance Protection Relay and another Back-up O/C and E/F protection relay (Two separate units) should be used.

iii. In order to provide protection in case of high resistive fault, directional earth fault protection may be used where Main 1 and Main 2 protection is suggested i.e. for 220KV Transmission Lines. The characteristics should be IDMT (Normal Inverse). The ground over current threshold should be set to ensure detection of all ground faults, but above any continuous residual current under normal system operation. The timing should be coordinated with the Zone-3 timing for a remote end bus fault.

iv. Availability of Carrier Protection and Single Phase Auto-reclosure for all 220KV and above transmission lines.

v. Replacement of Electromechanical Relays with Numerical Relays, wherever applicable for Transmission Lines and Transformers.

vi. Connectivity of GPRS clock in every substation with Time synchronisation facility to the Numerical Relays.

vii. As per PART 3 OF CEA (TECHNICAL STANDARDS FOR CONNECTIVITY OF THE GRID) REGULATION, 2007, wherein it is clearly mentioned that Bus bar protection shall be provided on all sub-stations at and above 220 kV levels for all new sub-stations. For existing sub-stations, this shall be implemented in a reasonable time frame.

Local Breaker Back-Up (LBB) protection shall be provided for all sub-stations with proper scheme.

The above two protections should be implemented as per the recommendations as per the approved scheme and this should be available in the Sub-Stations.

viii. Removal of D.C. earth from the Sub-stations whenever it is detected. For the same detection instruments are available by which D.C. leakage can be easily identified and remedial measures can be taken instantly.

ix. All Panel Indications wherever applicable for Isolators, Breakers, Circuit Breaker Spring Charge, Trip Circuit Healthy or any other indications as per the scheme should be made healthy.

x. Pre and Post Close Trip circuit supervision for Trip Coil 1 (TC # 1) and Trip Coil 2 (TC # 2) should be made healthy wherever applicable.

xi. Annunciation Circuitry should be made proper for all trip and non-trip functions as per the schematic.

xii. CTJB, PTJB should be changed wherever applicable and terminations of the cables should be completed with proper specification of Terminal Blocks and LUGS. The CTJB and PTJB should be earthed through Earthing Strips.

xiii. All relevant drawings required during trouble shooting should be made available in each of the Control Rooms of every sub-stations.

Updated Drawings related to Protection and control Panel of individual bays, CT's, PT's, Circuit breakers, Isolators, Transformers etc. are to be made available at sub-station level.

LOGICS and configuration of the NUMERICAL RELAYS should be made proper with the availability of relevant protection as per CEA guidelines and the same should be made available at the sub-station level.

xiv. Redundant relays which are not in use should be removed from the Protection Panels and the NUMERICAL RELAYS and Auxiliaries installed should be newly wired as per the approved scheme.

xv. 220KV and 132KV CT's should be tested for characteristics and proper cores should be used for proper protection purpose, i.e. PS for Differential, PS/5P (with proper ALF) for Distance/Backup protection, 0.2/0.5 for metering purpose. Kindly note that for both 220KV and 132KV CT protection schemes, separate cores should be used for separate protection purpose.

xvi. Earth Resistance of Sub-Station should be measured at regular intervals and the value should be less than 1 ohms. The Test result should be marked in the Sub-Station Earth Pit with the date of testing.

xvii. Two source of D.C may be provided to Control and Relay panels for 220kV and above system for security and redundancy. Accordingly the Bus Wire of the panel is to be segregated and scheme developed accordingly.

xviii. Meticulous Patrolling of 220KV and 132KV Transmission lines along with availability of Earth Wires should be ensured to reduce transient faults.

xix. Individual Tower Earthing should also be ensured to provide earth paths to lightning strikes through the shortest path.

xx. CONDITION MONITORING OF SUB-STATION EQUIPMENTS

Regular conditioning monitoring of substation equipment (Transformer, CT, CVT, PT, LA, CB etc.) may be done as per CEA recommendation and proper record may be maintained.

The types of tests on the substation equipment's along with the technology used with its duration is provided and the same should be meticulously followed for all 220KV and 132KV sub-station. (**Annexure – 6.2**: Equipment Technology Matrix).

7.0 Protection Settings of JUSNL System

In the special meeting with JUSNL held on 08.06.16 to discuss the observations of the site visit, it was emphasized that the distance protection along with the back-up protection of JUSNL system (comprising of 220kV Ramchandrapur, Chandil & Hatia-II and 132 kV Adityapur & Hatia-I) needs to be reviewed for proper protection co-ordination. It was decided that the Protection team will carry out the setting calculations for all the 220 kV & 132 kV lines along with the 220/132 kV ICTs based on the data provided by JUSNL which shall be implemented by JUSNL. The same was ratified by 33rd TCC/ERPC also.

Subsequently after getting all the authenticated information from JUSNL, a special meeting was convened on 28.07.16 and the committee members finalized the distance protection settings along with the back-up over-current settings of all the 220 kV & 132 kV feeders of following Sub-stations:

1. 220/132 kV Chandil S/s,
2. 220/132 kV Ramchandrapur S/s,
3. 220/132 kV Hatia-II S/s
4. 132 kV Hatia-I S/s
5. 132 kV Adityapur S/s

The details of recommended distance protection settings along with back-up Over current settings is placed at **Annexure-7.1**.

The committee also reviewed the over current settings of 220/132 kV Transformers of 220/132 kV Chandil, Ramchandrapur and Hatia-II sub-stations and recommended the new settings which is given at **Annexure-7.2**.

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Annexure- 6.2

Sub Station Equipment Technology Matrix

Equipment / Technologies	IR	Tan δ	Thermography	Op. Time. Anlyz.	Static Cont. Res.	BDV	3rd Harmonic Res. Cur. Analyzer	DGA	(i)Moisture Content (ii)Sp. Res (iii) D.D.F. (iv) Acidity (v)IFT (vi) Sludge content	Furan Analysis	D.C. Wdg. Res.	Partial Discharge	TTR	CT Analyzer	Magnetic Balance	Hydrometer	Earth Tester	DCRM	Relay Testing Kit	Dew point measurement kit
Transformer	Δ ϕ	Δ ϕ	ɱ ϕ								ϕ	ϕ	ϕ		ϕ					
CB	Δ ϕ		ɱ ϕ	Δ ϕ	Δ ϕ													ϕ		
CT	Δ ϕ	Δ ϕ	ɱ ϕ											ϕ						
PT	Δ ϕ	Δ ϕ	ɱ ϕ																	
LA	Δ ϕ		ɱ ϕ				Δ ϕ													
Isolator			ɱ ϕ		Δ ϕ															
Ins. Oil (Trans.)						Δ ϕ		Δ ϕ	Δ ϕ	ϕ										
Ins. Oil (CT,PT,CVT)						Δ ϕ														
Ins. Oil (Gr. Tr.)						Δ ϕ		ϕ	ϕ											
CVT	Δ ϕ	Δ ϕ	ɱ ϕ																	
Battery																ɱ ϕ				
Earth Pit																	Δ			
Protective Relays																			Δ ϕ	
Tariff Meters																				
SF6 Gas Dew point																				Ω ϕ

Periodic Glossary:- Δ :- Yearly ɱ :- Monthly ϕ :- SOS Ω:- Every 3 year

Annexure- 7.1

DISTANCE RELAY SETTING CALCULATION

SYSTEM DATA

CHANDIL-STPS

RELAY TYPE		MICOM P442			OTHERS(MHO)	
1> LINE LENGTH =	120	ZONE-1	Z1=	12.00	ZONE-1	12.00
2> SYSTEM VOLTAGE=	220		R1G=	15.00	ZONE-2	18.00
(RESISTANCE)- Per Km	0.0749		R1Ph=	7.50	ZONE-3(For)	34.66
(REACTANCE)- Per Km	0.41		tZ1=	0.00	ZONE-4(Rev)	1.50
(IMPEDANCE)- Per Km	0.41678		KZ1 Res Comp=	0.70	Time-(Z-2)	0.35
LINE ANGLE=	79		KZ1 Angle=	0.00	Time-(Z-3)	1.00
3>FAULT MVA OF THE S/S=	5403	ZONE-2	Z2=	18.00	Time-(Z-4)	0.50
4>C.T.RATIO=	600		R2G=	18.75	IMP UPTO NEXT LEVEL	23.72
5>P.T.RATIO=	2000		R2Ph=	9.38	(80% OF TR IMP)	
6>NEXT SHORTEST SECTION= (IN KM)(STPS-HURA)	48		tZ2=	0.35	Compensation	0.70
7>NEXT LONGEST SECTION= (IN KM)(STPS-N.BISHNUPUR)	111		KZ2 Res Comp=	0.70		
8>INFEED RATIO=[I(act)/I(infeed)]	0		KZ2 Angle=	0.00		
9>ARC RESISTANCE=(Pri Value)	25	ZONE-3/4	Z3=	34.66		
10>TOWER- FOOTING RESISTANCE=(Pri Value)	25		Z4(Reverse)=	1.50		
11>TRANSFORMER AT OTHER END S/S=(IN MVA)	200		KZ3/KZ4 Res Comp=	0.70		
12>MAXIMUM LOAD (110% CT)= (IN MVA)	251		KZ3/KZ4Angle=	0.00		
13>X0/X1=R0/R1=	3.1		R3G/R4G=	23.44		
14>SINGLE CKT (S) / DOUBLE CKT (D)=	S		R3Ph/R4Ph=	11.72		
15>ADDITIONAL Dir.O/C,E/F RELAY USED=(YES/NO)	NO		tZ3=	1.00		
16>In	1	Dir.O/C	Char..=	NI		
17> CT SECONDARY=	1		%PLUG SET=	100%		
18>THARMAL CAPACITY[40-75°C](MVA)=	245		TIME SET=	0.13		
19>LOAD IMP..(90% VOLTAGE & [40-75°C]THER.. RATING)	53.34	Dir.E/F	Char..=	NI		
20>MAX LOAD IMP= (Sec)[110% CT RATING with 90% VOLTAGE]	51.96		%PLUG SET=	20%		
			TIME SET=	0.27		
DERIVED VALUES		Non-Dir.O/C	Char..=	DT		
			%PLUG SET=	100%		
A) COMPENSATION (K)=	0.70		TIME SET=	2Sec		
B>MAXIMUM LOADING (IN OHM)= (Sec Value)	51.96305	Non-Dir.E/F	Char..=	DT		
C>IMPEDANCE/REACTANCE UPTO 80% OF OTHER END	8.71		%PLUG SET=	20%		
TRANSFORMER (%Z=12)= (Sec Value)			TIME SET=	2Sec		
D>ARC RESISTANCE=(Sec Value)	7.50					
E>TOWER FOOTING RESISTANCE=(Sec Value)	7.50	LINE	LENGTH=	120		
F>If/In (PHASE FAULT AT 80%OF THE LINE)=	4.32		Z=	15.00408		
G>FIRST STAGE BACK UP O/C & E/F TIME=(In Sec)	0.60		ANGLE=	79		
H>If/In (EARTH FAULT AT 80% OF THE LINE)=	21.58					
I>Time- (ZONE-2)= (In Sec)	0.35					
J>Time- (ZONE-3)= (In Sec)	1.00					
K>FAULT MVA AT 80% OF THE LINE=	988					

LINE PARAMERERS	
400 KV---"R"	FALSE
400 KV---"X"	FALSE
400 KV---"Z"	FALSE
220 KV---"R"	0.0749
220 KV---"X"	0.41
220 KV---"Z"	0.41678
132 KV---"R"	FALSE
132 KV---"X"	FALSE
132 KV---"Z"	FALSE

DISTANCE RELAY SETTING CALCULATION

SYSTEM DATA

CHANDIL-RAMCHANDAPUR

RELAY TYPE		MICOM P442			OTHERS(MHO)	
1> LINE LENGTH =	35	ZONE-1	Z1=	3.50	ZONE-1	3.50
2> SYSTEM VOLTAGE=	220		R1G=	15.00	ZONE-2	10.18
(RESISTANCE)- Per Km	0.0749		R1Ph=	7.50	ZONE-3(For)	24.76
(REACTANCE)- Per Km	0.41		tZ1=	0.00	ZONE-4(Rev)	0.88
(IMPEDANCE)- Per Km	0.41678		KZ1 Res Comp=	0.70	Time-(Z-2)	0.35
LINE ANGLE=	79		KZ1 Angle=	0.00	Time-(Z-3)	1.00
3>FAULT MVA OF THE S/S=	5403	ZONE-2	Z2=	10.18	Time-(Z-4)	0.50
4>C.T.RATIO=	600		R2G=	18.75	IMP UPTO NEXT LEVEL	10.18
5>P.T.RATIO=	2000		R2Ph=	9.38	(80% OF TR IMP)	
6>NEXT SHORTEST SECTION= (IN KM)(RAMCHANDAPUR-JODA)	130		tZ2=	0.35	Compensation	0.70
7>NEXT LONGEST SECTION= (IN KM)(RAMCHANDAPUR-JODA)	130		KZ2 Res Comp=	0.70		
8>INFEED RATIO=[I(act)/I(infeed)]	0		KZ2 Angle=	0.00		
9>ARC RESISTANCE=(Pri Value)	25	ZONE-3/4	Z3=	24.76		
10>TOWER- FOOTING RESISTANCE=(Pri Value)	25		Z4(Reverse)=	0.88		
11>TRANSFORMER AT OTHER END S/S=(IN MVA)	300		KZ3/KZ4 Res Comp=	0.70		
12>MAXIMUM LOAD (110% CT)= (IN MVA)	251		KZ3/KZ4Angle=	0.00		
13>X0/X1=R0/R1=	3.1		R3G/R4G=	23.44		
14>SINGLE CKT (S) / DOUBLE CKT (D)=	S		R3Ph/R4Ph=	11.72		
15>ADDITIONAL Dir.O/C,E/F RELAY USED=(YES/NO)	NO		tZ3=	1.00		
16>In	1	Dir.O/C	Char..=	NI		
17> CT SECONDARY=	1		%PLUG SET=	100%		
18>THARMAL CAPACITY[40-75°C](MVA)=	245		TIME SET=	0.20		
19>LOAD IMP..(90% VOLTAGE & [40-75°C]THER.. RATING)	53.34	Dir.E/F	Char..=	NI		
20>MAX LOAD IMP= (Sec)[110% CT RATING with 90% VOLTAGE]	51.96		%PLUG SET=	20%		
			TIME SET=	0.27		
DERIVED VALUES		Non-Dir.O/C	Char..=	DT		
			%PLUG SET=	100%		
A) COMPENSATION (K)=	0.70		TIME SET=	2Sec		
B>MAXIMUM LOADING (IN OHM)= (Sec Value)	51.96305	Non-Dir.E/F	Char..=	DT		
C>IMPEDANCE/REACTANCE UPTO 80% OF OTHER END	5.81		%PLUG SET=	20%		
TRANSFORMER (%Z=12)= (Sec Value)			TIME SET=	2Sec		
D>ARC RESISTANCE=(Sec Value)	7.50					
E>TOWER FOOTING RESISTANCE=(Sec Value)	7.50	LINE	LENGTH=	35		
F>If/In (PHASE FAULT AT 80%OF THE LINE)=	10.25		Z=	4.37619		
G>FIRST STAGE BACK UP O/C & E/F TIME=(In Sec)	0.60		ANGLE=	79		
H>If/In (EARTH FAULT AT 80% OF THE LINE)=	51.23					
I>Time- (ZONE-2)= (In Sec)	0.35					
J>Time- (ZONE-3)= (In Sec)	1.00					
K>FAULT MVA AT 80% OF THE LINE=	2346					

LINE PARAMERERS	
400 KV---"R"	FALSE
400 KV---"X"	FALSE
400 KV---"Z"	FALSE
220 KV---"R"	0.0749
220 KV---"X"	0.41
220 KV---"Z"	0.41678
132 KV---"R"	FALSE
132 KV---"X"	FALSE
132 KV---"Z"	FALSE

DISTANCE RELAY SETTING CALCULATION

SYSTEM DATA

CHANDIL-RANCHI

RELAY TYPE			MICOM P442			OTHERS(MHO)	
1> LINE LENGTH =	93.5		ZONE-1	Z1=	9.35	ZONE-1	9.35
2> SYSTEM VOLTAGE=	220			R1G=	15.00	ZONE-2	13.88
(RESISTANCE)- Per Km	0.0749			R1Ph=	7.50	ZONE-3(For)	19.28
(REACTANCE)- Per Km	0.41			tZ1=	0.00	ZONE-4(Rev)	2.34
(IMPEDANCE)- Per Km	0.41678			KZ1 Res Comp=	0.70	Time-(Z-2)	0.35
LINE ANGLE=	79			KZ1 Angle=	0.00	Time-(Z-3)	1.00
3>FAULT MVA OF THE S/S=	5403		ZONE-2	Z2=	13.88	Time-(Z-4)	0.50
4>C.T.RATIO=	600			R2G=	18.75	IMP UPTO NEXT LEVEL	14.46
5>P.T.RATIO=	2000			R2Ph=	9.38	(80% OF TR IMP)	
6>NEXT SHORTEST SECTION= (IN KM)(RANCHI-HATIA)	35			tZ2=	0.35	Compensation	0.70
7>NEXT LONGEST SECTION= (IN KM)(RANCHI-HATIA)	35			KZ2 Res Comp=	0.70		
8>INFEED RATIO=[I(act)/I(infeed)]	0			KZ2 Angle=	0.00		
9>ARC RESISTANCE=(Pri Value)	25		ZONE-3/4	Z3=	19.28		
10>TOWER- FOOTING RESISTANCE=(Pri Value)	25			Z4(Reverse)=	2.34		
11>TRANSFORMER AT OTHER END S/S=(IN MVA)	630			KZ3/KZ4 Res Comp=	0.70		
12>MAXIMUM LOAD (110% CT)= (IN MVA)	251			KZ3/KZ4Angle=	0.00		
13>X0/X1=R0/R1=	3.1			R3G/R4G=	23.44		
14>SINGLE CKT (S) / DOUBLE CKT (D)=	S			R3Ph/R4Ph=	11.72		
15>ADDITIONAL Dir.O/C,E/F RELAY USED=(YES/NO)	NO			tZ3=	1.00		
16>In	1		Dir.O/C	Char..=	NI		
17> CT SECONDARY=	1			%PLUG SET=	100%		
18>THARMAL CAPACITY[40-75°C](MVA)=	245			TIME SET=	0.14		
19>LOAD IMP..(90% VOLTAGE & [40-75°C]THER.. RATING)	53.34		Dir.E/F	Char..=	NI		
20>MAX LOAD IMP= (Sec)[110% CT RATING with 90% VOLTAGE]	51.96			%PLUG SET=	20%		
				TIME SET=	0.27		
DERIVED VALUES			Non-Dir.O/C	Char..=	DT		
				%PLUG SET=	100%		
A) COMPENSATION (K)=	0.70			TIME SET=	2Sec		
B>MAXIMUM LOADING (IN OHM)= (Sec Value)	51.96305		Non-Dir.E/F	Char..=	DT		
C>IMPEDANCE/REACTANCE UPTO 80% OF OTHER END	2.77			%PLUG SET=	20%		
TRANSFORMER (%Z=12)= (Sec Value)				TIME SET=	2Sec		
D>ARC RESISTANCE=(Sec Value)	7.50						
E>TOWER FOOTING RESISTANCE=(Sec Value)	7.50		LINE	LENGTH=	93.5		
F>If/In (PHASE FAULT AT 80%OF THE LINE)=	5.27			Z=	11.69068		
G>FIRST STAGE BACK UP O/C & E/F TIME=(In Sec)	0.60			ANGLE=	79		
H>If/In (EARTH FAULT AT 80% OF THE LINE)=	26.33						
I>Time- (ZONE-2)= (In Sec)	0.35						
J>Time- (ZONE-3)= (In Sec)	1.00						
K>FAULT MVA AT 80% OF THE LINE=	1206						

LINE PARAMERERS	
400 KV---"R"	FALSE
400 KV---"X"	FALSE
400 KV---"Z"	FALSE
220 KV---"R"	0.0749
220 KV---"X"	0.41
220 KV---"Z"	0.41678
132 KV---"R"	FALSE
132 KV---"X"	FALSE
132 KV---"Z"	FALSE

DISTANCE RELAY SETTING CALCULATION

SYSTEM DATA

CHANDIL-TOMAR

RELAY TYPE		MICOM P442			OTHERS(MHO)	
1> LINE LENGTH =	66	ZONE-1	Z1=	11.21	ZONE-1	11.21
2> SYSTEM VOLTAGE=	132		R1G=	22.50	ZONE-2	17.20
(RESISTANCE)- Per Km	0.1402		R1Ph=	10.00	ZONE-3(For)	24.46
(REACTANCE)- Per Km	0.401		tZ1=	0.00	ZONE-4(Rev)	2.80
(IMPEDANCE)- Per Km	0.42473		KZ1 Res Comp=	0.70	Time-(Z-2)	0.35
LINE ANGLE=	68		KZ1 Angle=	0.00	Time-(Z-3)	0.60
3>FAULT MVA OF THE S/S=	4092	ZONE-2	Z2=	17.20	Time-(Z-4)	0.50
4>C.T.RATIO=	600		R2G=	28.13	IMP UPTO NEXT LEVEL	24.47
5>P.T.RATIO=	1200		R2Ph=	12.50	(80% OF TR IMP)	
6>NEXT SHORTEST SECTION= (IN KM)(IDLE CHARGED LINE)	30		tZ2=	0.35	Compensation	0.70
7>NEXT LONGEST SECTION= (IN KM)(IDLE CHARGED LINE)	30		KZ2 Res Comp=	0.70		
8>INFEED RATIO=[I(act)/I(infeed)]	0		KZ2 Angle=	0.00		
9>ARC RESISTANCE=(Pri Value)	20	ZONE-3/4	Z3=	24.46		
10>TOWER- FOOTING RESISTANCE=(Pri Value)	25		Z4(Reverse)=	2.80		
11>TRANSFORMER AT OTHER END S/S=(IN MVA)	100		KZ3/KZ4 Res Comp=	0.70		
12>MAXIMUM LOAD (110% CT)= (IN MVA)	151		KZ3/KZ4Angle=	0.00		
13>X0/X1=R0/R1=	3.1		R3G/R4G=	35.16		
14>SINGLE CKT (S) / DOUBLE CKT (D)=	S		R3Ph/R4Ph=	15.63		
15>ADDITIONAL Dir.O/C,E/F RELAY USED=(YES/NO)	NO		tZ3=	0.60		
16>In	1	Dir.O/C	Char..=	NI		
17> CT SECONDARY=	1		%PLUG SET=	100%		
18>THARMAL CAPACITY[40-75°C](MVA)=	95		TIME SET=	0.13		
19>LOAD IMP..(90% VOLTAGE & [40-75°C]THER.. RATING)	82.53	Dir.E/F	Char..=	NI		
20>MAX LOAD IMP= (Sec)[110% CT RATING with 90% VOLTAGE]	51.96		%PLUG SET=	20%		
			TIME SET=	0.27		
DERIVED VALUES		Non-Dir.O/C	Char..=	DT		
			%PLUG SET=	100%		
A) COMPENSATION (K)=	0.70		TIME SET=	2Sec		
B>MAXIMUM LOADING (IN OHM)= (Sec Value)	51.96305	Non-Dir.E/F	Char..=	DT		
C>IMPEDANCE/REACTANCE UPTO 80% OF OTHER END	10.45		%PLUG SET=	20%		
TRANSFORMER (%Z=12)= (Sec Value)			TIME SET=	2Sec		
D>ARC RESISTANCE=(Sec Value)	10.00					
E>TOWER FOOTING RESISTANCE=(Sec Value)	12.50	LINE	LENGTH=	66		
F>If/In (PHASE FAULT AT 80%OF THE LINE)=	4.76		Z=	14.01609		
G>FIRST STAGE BACK UP O/C & E/F TIME=(In Sec)	0.60		ANGLE=	68		
H>If/In (EARTH FAULT AT 80% OF THE LINE)=	23.78					
I>Time- (ZONE-2)= (In Sec)	0.35					
J>Time- (ZONE-3)= (In Sec)	0.60					
K>FAULT MVA AT 80% OF THE LINE=	653					

LINE PARAMERERS

400 KV---"R"	FALSE
400 KV---"X"	FALSE
400 KV---"Z"	FALSE
220 KV---"R"	FALSE
220 KV---"X"	FALSE
220 KV---"Z"	FALSE
132 KV---"R"	0.1402
132 KV---"X"	0.401
132 KV---"Z"	0.42473

DISTANCE RELAY SETTING CALCULATION

SYSTEM DATA

CHANDIL-GOLMURI

RELAY TYPE		MICOM P442			OTHERS(MHO)	
1> LINE LENGTH =	30	ZONE-1	Z1=	3.37	ZONE-1	3.37
2> SYSTEM VOLTAGE=	132		R1G=	15.00	ZONE-2	5.97
(RESISTANCE)- Per Km	0.1402		R1Ph=	6.67	ZONE-3(For)	10.12
(REACTANCE)- Per Km	0.3976		tZ1=	0.00	ZONE-4(Rev)	0.84
(IMPEDANCE)- Per Km	0.42159		KZ1 Res Comp=	0.70	Time-(Z-2)	0.35
LINE ANGLE=	68		KZ1 Angle=	0.00	Time-(Z-3)	0.60
3>FAULT MVA OF THE S/S=	4092	ZONE-2	Z2=	5.97	Time-(Z-4)	0.50
4>C.T.RATIO=	400		R2G=	18.75	IMP UPTO NEXT LEVEL	11.19
5>P.T.RATIO=	1200		R2Ph=	8.33	(80% OF TR IMP)	
6>NEXT SHORTEST SECTION= (IN KM)(GOLMURI-JADUGORA)	25		tZ2=	0.35	Compensation	0.70
7>NEXT LONGEST SECTION= (IN KM)(GOLMURI-CHANDIL)	30		KZ2 Res Comp=	0.70		
8>INFEED RATIO=[I(act)/I(infeed)]	0		KZ2 Angle=	0.00		
9>ARC RESISTANCE=(Pri Value)	20	ZONE-3/4	Z3=	10.12		
10>TOWER- FOOTING RESISTANCE=(Pri Value)	25		Z4(Reverse)=	0.84		
11>TRANSFORMER AT OTHER END S/S=(IN MVA)	100		KZ3/KZ4 Res Comp=	0.70		
12>MAXIMUM LOAD (110% CT)= (IN MVA)	101		KZ3/KZ4Angle=	0.00		
13>X0/X1=R0/R1=	3.1		R3G/R4G=	23.44		
14>SINGLE CKT (S) / DOUBLE CKT (D)=	D		R3Ph/R4Ph=	10.42		
15>ADDITIONAL Dir.O/C,E/F RELAY USED=(YES/NO)	NO		tZ3=	0.60		
16>In	1	Dir.O/C	Char..=	NI		
17> CT SECONDARY=	1		%PLUG SET=	100%		
18>THARMAL CAPACITY[40-75°C](MVA)=	95		TIME SET=	0.22		
19>LOAD IMP..(90% VOLTAGE & [40-75°C]THER.. RATING)	55.02	Dir.E/F	Char..=	NI		
20>MAX LOAD IMP= (Sec)[110% CT RATING with 90% VOLTAGE]	51.96		%PLUG SET=	20%		
			TIME SET=	0.27		
DERIVED VALUES		Non-Dir.O/C	Char..=	DT		
			%PLUG SET=	100%		
A) COMPENSATION (K)=	0.70		TIME SET=	2Sec		
B>MAXIMUM LOADING (IN OHM)= (Sec Value)	51.96305	Non-Dir.E/F	Char..=	DT		
C>IMPEDANCE/REACTANCE UPTO 80% OF OTHER END	6.97		%PLUG SET=	20%		
TRANSFORMER (%Z=12)= (Sec Value)			TIME SET=	2Sec		
D>ARC RESISTANCE=(Sec Value)	6.67					
E>TOWER FOOTING RESISTANCE=(Sec Value)	8.33	LINE	LENGTH=	30		
F>If/In (PHASE FAULT AT 80%OF THE LINE)=	13.24		Z=	4.2159		
G>FIRST STAGE BACK UP O/C & E/F TIME=(In Sec)	0.60		ANGLE=	68		
H>If/In (EARTH FAULT AT 80% OF THE LINE)=	66.21					
I>Time- (ZONE-2)= (In Sec)	0.35					
J>Time- (ZONE-3)= (In Sec)	0.60					
K>FAULT MVA AT 80% OF THE LINE=	1212					

LINE PARAMERERS

400 KV---"R"	FALSE
400 KV---"X"	FALSE
400 KV---"Z"	FALSE
220 KV---"R"	FALSE
220 KV---"X"	FALSE
220 KV---"Z"	FALSE
132 KV---"R"	0.1402
132 KV---"X"	0.3976
132 KV---"Z"	0.42159

DISTANCE RELAY SETTING CALCULATION

SYSTEM DATA

CHANDIL-RKSN(DIR)

RELAY TYPE					MICOM P442			OTHERS(MHO)	
1> LINE LENGTH =	40							ZONE-1	6.80
2> SYSTEM VOLTAGE=	132							ZONE-2	10.62
(RESISTANCE)- Per Km	0.1402							ZONE-3(For)	24.97
(REACTANCE)- Per Km	0.401							ZONE-4(Rev)	1.70
(IMPEDANCE)- Per Km	0.42473							Time-(Z-2)	0.35
LINE ANGLE=	68							Time-(Z-3)	1.00
3>FAULT MVA OF THE S/S=	4092		ZONE-2	Z2=	10.62			Time-(Z-4)	0.50
4>C.T.RATIO=	600			R2G=	28.13			IMP UPTO NEXT LEVEL	23.43
5>P.T.RATIO=	1200			R2Ph=	12.50			(80% OF TR IMP)	
6>NEXT SHORTEST SECTION= (IN KM)(RKSN-CHAIBASA)	20			tZ2=	0.35			Compensation	0.70
7>NEXT LONGEST SECTION= (IN KM)(RKSN-GOELKERA)	58			KZ2 Res Comp=	0.70				
8>INFEED RATIO=[I(act)/I(infeed)]	0			KZ2 Angle=	0.00				
9>ARC RESISTANCE=(Pri Value)	20		ZONE-3/4	Z3=	24.97				
10>TOWER- FOOTING RESISTANCE=(Pri Value)	25			Z4(Reverse)=	1.70				
11>TRANSFORMER AT OTHER END S/S=(IN MVA)	70			KZ3/KZ4 Res Comp=	0.70				
12>MAXIMUM LOAD (110% CT)= (IN MVA)	151			KZ3/KZ4Angle=	0.00				
13>X0/X1=R0/R1=	3.1			R3G/R4G=	35.16				
14>SINGLE CKT (S) / DOUBLE CKT (D)=	S			R3Ph/R4Ph=	15.63				
15>ADDITIONAL Dir.O/C,E/F RELAY USED=(YES/NO)	NO			tZ3=	1.00				
16>In	1		Dir.O/C	Char..=	NI				
17> CT SECONDARY=	1			%PLUG SET=	100%				
18>THARMAL CAPACITY[40-75°C](MVA)=	95			TIME SET=	0.17				
19>LOAD IMP..(90% VOLTAGE & [40-75°C]THER.. RATING)	82.53		Dir.E/F	Char..=	NI				
20>MAX LOAD IMP= (Sec)[110% CT RATING with 90% VOLTAGE]	51.96			%PLUG SET=	20%				
				TIME SET=	0.27				
DERIVED VALUES			Non-Dir.O/C	Char..=	DT				
				%PLUG SET=	100%				
A) COMPENSATION (K)=	0.70			TIME SET=	2Sec				
B>MAXIMUM LOADING (IN OHM)= (Sec Value)	51.96305		Non-Dir.E/F	Char..=	DT				
C>IMPEDANCE/REACTANCE UPTO 80% OF OTHER END	14.93			%PLUG SET=	20%				
TRANSFORMER (%Z=12)= (Sec Value)				TIME SET=	2Sec				
D>ARC RESISTANCE=(Sec Value)	10.00								
E>TOWER FOOTING RESISTANCE=(Sec Value)	12.50		LINE	LENGTH=	40				
F>If/In (PHASE FAULT AT 80%OF THE LINE)=	7.11			Z=	8.4946				
G>FIRST STAGE BACK UP O/C & E/F TIME=(In Sec)	0.60			ANGLE=	68				
H>If/In (EARTH FAULT AT 80% OF THE LINE)=	35.55								
I>Time- (ZONE-2)= (In Sec)	0.35								
J>Time- (ZONE-3)= (In Sec)	1.00								
K>FAULT MVA AT 80% OF THE LINE=	976								

LINE PARAMERERS	
400 KV---"R"	FALSE
400 KV---"X"	FALSE
400 KV---"Z"	FALSE
220 KV---"R"	FALSE
220 KV---"X"	FALSE
220 KV---"Z"	FALSE
132 KV---"R"	0.1402
132 KV---"X"	0.401
132 KV---"Z"	0.42473

DISTANCE RELAY SETTING CALCULATION

SYSTEM DATA

CHANDIL-ADITYAPUR

RELAY TYPE		MICOM P442			OTHERS(MHO)	
1> LINE LENGTH =	19	ZONE-1	Z1=	3.23	ZONE-1	3.23
2> SYSTEM VOLTAGE=	132		R1G=	22.50	ZONE-2	4.46
(RESISTANCE)- Per Km	0.1402		R1Ph=	10.00	ZONE-3(For)	13.76
(REACTANCE)- Per Km	0.401		tZ1=	0.00	ZONE-4(Rev)	0.81
(IMPEDANCE)- Per Km	0.42473		KZ1 Res Comp=	0.70	Time-(Z-2)	0.35
LINE ANGLE=	68		KZ1 Angle=	0.00	Time-(Z-3)	1.00
3>FAULT MVA OF THE S/S=	4092	ZONE-2	Z2=	4.46	Time-(Z-4)	0.50
4>C.T.RATIO=	600		R2G=	28.13	IMP UPTO NEXT LEVEL	9.26
5>P.T.RATIO=	1200		R2Ph=	12.50	(80% OF TR IMP)	
6>NEXT SHORTEST SECTION= (IN KM)(ADITYAPUR-UM)	4		tZ2=	0.35	Compensation	0.70
7>NEXT LONGEST SECTION= (IN KM)(ADITYAPUR-RKSN)	35		KZ2 Res Comp=	0.70		
8>INFEED RATIO=[I(act)/I(infeed)]	0		KZ2 Angle=	0.00		
9>ARC RESISTANCE=(Pri Value)	20	ZONE-3/4	Z3=	13.76		
10>TOWER- FOOTING RESISTANCE=(Pri Value)	25		Z4(Reverse)=	0.81		
11>TRANSFORMER AT OTHER END S/S=(IN MVA)	200		KZ3/KZ4 Res Comp=	0.70		
12>MAXIMUM LOAD (110% CT)= (IN MVA)	151		KZ3/KZ4Angle=	0.00		
13>X0/X1=R0/R1=	3.1		R3G/R4G=	35.16		
14>SINGLE CKT (S) / DOUBLE CKT (D)=	S		R3Ph/R4Ph=	15.63		
15>ADDITIONAL Dir.O/C,E/F RELAY USED=(YES/NO)	NO		tZ3=	1.00		
16>In	1	Dir.O/C	Char..=	NI		
17> CT SECONDARY=	1		%PLUG SET=	100%		
18>THARMAL CAPACITY[40-75°C](MVA)=	95		TIME SET=	0.22		
19>LOAD IMP..(90% VOLTAGE & [40-75°C]THER.. RATING)	82.53	Dir.E/F	Char..=	NI		
20>MAX LOAD IMP= (Sec)[110% CT RATING with 90% VOLTAGE]	51.96		%PLUG SET=	20%		
			TIME SET=	0.27		
DERIVED VALUES		Non-Dir.O/C	Char..=	DT		
			%PLUG SET=	100%		
A) COMPENSATION (K)=	0.70		TIME SET=	2Sec		
B>MAXIMUM LOADING (IN OHM)= (Sec Value)	51.96305	Non-Dir.E/F	Char..=	DT		
C>IMPEDANCE/REACTANCE UPTO 80% OF OTHER END	5.23		%PLUG SET=	20%		
TRANSFORMER (%Z=12)= (Sec Value)			TIME SET=	2Sec		
D>ARC RESISTANCE=(Sec Value)	10.00					
E>TOWER FOOTING RESISTANCE=(Sec Value)	12.50	LINE	LENGTH=	19		
F>If/In (PHASE FAULT AT 80%OF THE LINE)=	11.84		Z=	4.034935		
G>FIRST STAGE BACK UP O/C & E/F TIME=(In Sec)	0.60		ANGLE=	68		
H>If/In (EARTH FAULT AT 80% OF THE LINE)=	59.22					
I>Time- (ZONE-2)= (In Sec)	0.35					
J>Time- (ZONE-3)= (In Sec)	1.00					
K>FAULT MVA AT 80% OF THE LINE=	1626					

LINE PARAMERERS

400 KV---"R"	FALSE
400 KV---"X"	FALSE
400 KV---"Z"	FALSE
220 KV---"R"	FALSE
220 KV---"X"	FALSE
220 KV---"Z"	FALSE
132 KV---"R"	0.1402
132 KV---"X"	0.401
132 KV---"Z"	0.42473

DISTANCE RELAY SETTING CALCULATION

SYSTEM DATA

CHANDIL-RKSN(ADTY)

RELAY TYPE			MICOM P442			OTHERS(MHO)	
1> LINE LENGTH =	54		ZONE-1	Z1=	9.17	ZONE-1	9.17
2> SYSTEM VOLTAGE=	132			R1G=	22.50	ZONE-2	13.59
(RESISTANCE)- Per Km	0.1402			R1Ph=	10.00	ZONE-3(For)	28.54
(REACTANCE)- Per Km	0.401			tZ1=	0.00	ZONE-4(Rev)	2.29
(IMPEDANCE)- Per Km	0.42473			KZ1 Res Comp=	0.70	Time-(Z-2)	0.35
LINE ANGLE=	68			KZ1 Angle=	0.00	Time-(Z-3)	1.00
3>FAULT MVA OF THE S/S=	4092		ZONE-2	Z2=	13.59	Time-(Z-4)	0.50
4>C.T.RATIO=	600			R2G=	28.13	IMP UPTO NEXT LEVEL	26.40
5>P.T.RATIO=	1200			R2Ph=	12.50	(80% OF TR IMP)	
6>NEXT SHORTEST SECTION= (IN KM)(RKSN-CHAIBASA)	20			tZ2=	0.35	Compensation	0.70
7>NEXT LONGEST SECTION= (IN KM)(RKSN-GOELKERA)	58			KZ2 Res Comp=	0.70		
8>INFEED RATIO=[I(act)/I(infeed)]	0			KZ2 Angle=	0.00		
9>ARC RESISTANCE=(Pri Value)	20		ZONE-3/4	Z3=	28.54		
10>TOWER- FOOTING RESISTANCE=(Pri Value)	25			Z4(Reverse)=	2.29		
11>TRANSFORMER AT OTHER END S/S=(IN MVA)	70			KZ3/KZ4 Res Comp=	0.70		
12>MAXIMUM LOAD (110% CT)= (IN MVA)	151			KZ3/KZ4Angle=	0.00		
13>X0/X1=R0/R1=	3.1			R3G/R4G=	35.16		
14>SINGLE CKT (S) / DOUBLE CKT (D)=	S			R3Ph/R4Ph=	15.63		
15>ADDITIONAL Dir.O/C,E/F RELAY USED=(YES/NO)	NO			tZ3=	1.00		
16>In	1		Dir.O/C	Char..=	NI		
17> CT SECONDARY=	1			%PLUG SET=	100%		
18>THARMAL CAPACITY[40-75°C](MVA)=	95			TIME SET=	0.15		
19>LOAD IMP..(90% VOLTAGE & [40-75°C]THER.. RATING)	82.53		Dir.E/F	Char..=	NI		
20>MAX LOAD IMP= (Sec)[110% CT RATING with 90% VOLTAGE]	51.96			%PLUG SET=	20%		
				TIME SET=	0.27		
DERIVED VALUES			Non-Dir.O/C	Char..=	DT		
				%PLUG SET=	100%		
A) COMPENSATION (K)=	0.70			TIME SET=	2Sec		
B>MAXIMUM LOADING (IN OHM)= (Sec Value)	51.96305		Non-Dir.E/F	Char..=	DT		
C>IMPEDANCE/REACTANCE UPTO 80% OF OTHER END	14.93			%PLUG SET=	20%		
TRANSFORMER (%Z=12)= (Sec Value)				TIME SET=	2Sec		
D>ARC RESISTANCE=(Sec Value)	10.00						
E>TOWER FOOTING RESISTANCE=(Sec Value)	12.50		LINE	LENGTH=	54		
F>If/In (PHASE FAULT AT 80%OF THE LINE)=	5.61			Z=	11.46771		
G>FIRST STAGE BACK UP O/C & E/F TIME=(In Sec)	0.60			ANGLE=	68		
H>If/In (EARTH FAULT AT 80% OF THE LINE)=	28.07						
I>Time- (ZONE-2)= (In Sec)	0.35						
J>Time- (ZONE-3)= (In Sec)	1.00						
K>FAULT MVA AT 80% OF THE LINE=	771						

LINE PARAMERERS	
400 KV---"R"	FALSE
400 KV---"X"	FALSE
400 KV---"Z"	FALSE
220 KV---"R"	FALSE
220 KV---"X"	FALSE
220 KV---"Z"	FALSE
132 KV---"R"	0.1402
132 KV---"X"	0.401
132 KV---"Z"	0.42473

DISTANCE RELAY SETTING CALCULATION

SYSTEM DATA

HATIA(N)-PATRATU

RELAY TYPE			MICOM P442			OTHERS(MHO)	
1> LINE LENGTH =	35		ZONE-1	Z1=	6.82	ZONE-1	6.82
2> SYSTEM VOLTAGE=	220			R1G=	30.00	ZONE-2	12.79
(RESISTANCE)- Per Km	0.0749			R1Ph=	15.00	ZONE-3(For)	30.69
(REACTANCE)- Per Km	0.3993			tZ1=	0.00	ZONE-4(Rev)	1.71
(IMPEDANCE)- Per Km	0.406			KZ1 Res Comp=	0.70	Time-(Z-2)	0.35
LINE ANGLE=	79			KZ1 Angle=	0.00	Time-(Z-3)	1.00
3>FAULT MVA OF THE S/S=	4329		ZONE-2	Z2=	12.79	Time-(Z-4)	0.50
4>C.T.RATIO=	1200			R2G=	37.50	IMP UPTO NEXT LEVEL	20.14
5>P.T.RATIO=	2000			R2Ph=	18.75	(80% OF TR IMP)	
6>NEXT SHORTEST SECTION= (IN KM)(PATRATU-HATIA)	35			tZ2=	0.35	Compensation	0.70
7>NEXT LONGEST SECTION= (IN KM)(PATRATU-TENUGHAT)	70			KZ2 Res Comp=	0.70		
8>INFEED RATIO=[I(act)/I(infeed)]	0			KZ2 Angle=	0.00		
9>ARC RESISTANCE=(Pri Value)	25		ZONE-3/4	Z3=	30.69		
10>TOWER- FOOTING RESISTANCE=(Pri Value)	25			Z4(Reverse)=	1.71		
11>TRANSFORMER AT OTHER END S/S=(IN MVA)	300			KZ3/KZ4 Res Comp=	0.70		
12>MAXIMUM LOAD (110% CT)= (IN MVA)	503			KZ3/KZ4Angle=	0.00		
13>X0/X1=R0/R1=	3.1			R3G/R4G=	41.57		
14>SINGLE CKT (S) / DOUBLE CKT (D)=	D			R3Ph/R4Ph=	23.44		
15>ADDITIONAL Dir.O/C,E/F RELAY USED=(YES/NO)	NO			tZ3=	1.00		
16>In	1		Dir.O/C	Char..=	NI		
17> CT SECONDARY=	1			%PLUG SET=	100%		
18>THARMAL CAPACITY[40-75°C](MVA)=	245			TIME SET=	0.13		
19>LOAD IMP..(90% VOLTAGE & [40-75°C]THER.. RATING)	106.68		Dir.E/F	Char..=	NI		
20>MAX LOAD IMP= (Sec)[110% CT RATING with 90% VOLTAGE]	51.96			%PLUG SET=	20%		
				TIME SET=	0.27		
DERIVED VALUES			Non-Dir.O/C	Char..=	DT		
				%PLUG SET=	100%		
A) COMPENSATION (K)=	0.70			TIME SET=	2Sec		
B>MAXIMUM LOADING (IN OHM)= (Sec Value)	51.96305		Non-Dir.E/F	Char..=	DT		
C>IMPEDANCE/REACTANCE UPTO 80% OF OTHER END	11.62			%PLUG SET=	20%		
TRANSFORMER (%Z=12)= (Sec Value)				TIME SET=	2Sec		
D>ARC RESISTANCE=(Sec Value)	15.00						
E>TOWER FOOTING RESISTANCE=(Sec Value)	15.00		LINE	LENGTH=	35		
F>If/In (PHASE FAULT AT 80%OF THE LINE)=	4.69			Z=	8.526		
G>FIRST STAGE BACK UP O/C & E/F TIME=(In Sec)	0.60			ANGLE=	79		
H>If/In (EARTH FAULT AT 80% OF THE LINE)=	23.43						
I>Time- (ZONE-2)= (In Sec)	0.35						
J>Time- (ZONE-3)= (In Sec)	1.00						
K>FAULT MVA AT 80% OF THE LINE=	2146						

LINE PARAMERERS	
400 KV---"R"	FALSE
400 KV---"X"	FALSE
400 KV---"Z"	FALSE
220 KV---"R"	0.0749
220 KV---"X"	0.3993
220 KV---"Z"	0.406
132 KV---"R"	FALSE
132 KV---"X"	FALSE
132 KV---"Z"	FALSE

DISTANCE RELAY SETTING CALCULATION

SYSTEM DATA

HATIA(N)-RANCHI

RELAY TYPE			MICOM P442			OTHERS(MHO)	
1> LINE LENGTH =	35		ZONE-1	Z1=	6.82	ZONE-1	6.82
2> SYSTEM VOLTAGE=	220			R1G=	30.00	ZONE-2	12.79
(RESISTANCE)- Per Km	0.0749			R1Ph=	15.00	ZONE-3(For)	37.56
(REACTANCE)- Per Km	0.3993			tZ1=	0.00	ZONE-4(Rev)	1.71
(IMPEDANCE)- Per Km	0.406			KZ1 Res Comp=	0.70	Time-(Z-2)	0.35
LINE ANGLE=	79			KZ1 Angle=	0.00	Time-(Z-3)	1.00
3>FAULT MVA OF THE S/S=	4329		ZONE-2	Z2=	12.79	Time-(Z-4)	0.50
4>C.T.RATIO=	1200			R2G=	37.50	IMP UPTO NEXT LEVEL	14.06
5>P.T.RATIO=	2000			R2Ph=	18.75	(80% OF TR IMP)	
6>NEXT SHORTEST SECTION= (IN KM)(RANCHI-HATIA)	35			tZ2=	0.35	Compensation	0.70
7>NEXT LONGEST SECTION= (IN KM)(RANCHI-CHANDIL)	93.5			KZ2 Res Comp=	0.70		
8>INFEED RATIO=[I(act)/I(infeed)]	0			KZ2 Angle=	0.00		
9>ARC RESISTANCE=(Pri Value)	25		ZONE-3/4	Z3=	37.56		
10>TOWER- FOOTING RESISTANCE=(Pri Value)	25			Z4(Reverse)=	1.71		
11>TRANSFORMER AT OTHER END S/S=(IN MVA)	630			KZ3/KZ4 Res Comp=	0.70		
12>MAXIMUM LOAD (110% CT)= (IN MVA)	503			KZ3/KZ4Angle=	0.00		
13>X0/X1=R0/R1=	3.1			R3G/R4G=	41.57		
14>SINGLE CKT (S) / DOUBLE CKT (D)=	D			R3Ph/R4Ph=	23.44		
15>ADDITIONAL Dir.O/C,E/F RELAY USED=(YES/NO)	NO			tZ3=	1.00		
16>In	1		Dir.O/C	Char..=	NI		
17> CT SECONDARY=	1			%PLUG SET=	100%		
18>THARMAL CAPACITY[40-75°C](MVA)=	245			TIME SET=	0.13		
19>LOAD IMP..(90% VOLTAGE & [40-75°C]THER.. RATING)	106.68		Dir.E/F	Char..=	NI		
20>MAX LOAD IMP= (Sec)[110% CT RATING with 90% VOLTAGE]	51.96			%PLUG SET=	20%		
				TIME SET=	0.27		
DERIVED VALUES			Non-Dir.O/C	Char..=	DT		
				%PLUG SET=	100%		
A) COMPENSATION (K)=	0.70			TIME SET=	2Sec		
B>MAXIMUM LOADING (IN OHM)= (Sec Value)	51.96305		Non-Dir.E/F	Char..=	DT		
C>IMPEDANCE/REACTANCE UPTO 80% OF OTHER END	5.53			%PLUG SET=	20%		
TRANSFORMER (%Z=12)= (Sec Value)				TIME SET=	2Sec		
D>ARC RESISTANCE=(Sec Value)	15.00						
E>TOWER FOOTING RESISTANCE=(Sec Value)	15.00		LINE	LENGTH=	35		
F>If/In (PHASE FAULT AT 80%OF THE LINE)=	4.69			Z=	8.526		
G>FIRST STAGE BACK UP O/C & E/F TIME=(In Sec)	0.60			ANGLE=	79		
H>If/In (EARTH FAULT AT 80% OF THE LINE)=	23.43						
I>Time- (ZONE-2)= (In Sec)	0.35						
J>Time- (ZONE-3)= (In Sec)	1.00						
K>FAULT MVA AT 80% OF THE LINE=	2146						

LINE PARAMERERS	
400 KV---"R"	FALSE
400 KV---"X"	FALSE
400 KV---"Z"	FALSE
220 KV---"R"	0.0749
220 KV---"X"	0.3993
220 KV---"Z"	0.406
132 KV---"R"	FALSE
132 KV---"X"	FALSE
132 KV---"Z"	FALSE

DISTANCE RELAY SETTING CALCULATION

SYSTEM DATA

HATIA(N)-LOHARDAGA

RELAY TYPE								
			MICOM P442			**OTHERS(MHO)**	
1> LINE LENGTH =	65		ZONE-1	Z1=	10.96	ZONE-1	10.96
2> SYSTEM VOLTAGE=	132			R1G=	22.50	ZONE-2	20.55
(RESISTANCE)- Per Km	0.1402			R1Ph=	10.00	ZONE-3(For)	33.64
(REACTANCE)- Per Km	0.3976			tZ1=	0.00	ZONE-4(Rev)	2.74
(IMPEDANCE)- Per Km	0.42159			KZ1 Res Comp=	0.70	Time-(Z-2)	0.35
LINE ANGLE=	68			KZ1 Angle=	0.00	Time-(Z-3)	1.00
3>FAULT MVA OF THE S/S=	2689		ZONE-2	Z2=	20.55	Time-(Z-4)	0.50
4>C.T.RATIO=	600			R2G=	28.13	IMP UPTO NEXT LEVEL	24.16
5>P.T.RATIO=	1200			R2Ph=	12.50	(80% OF TR IMP)	
6>NEXT SHORTEST SECTION= (IN KM)(LOHARDAGA-HATIA)	65			tZ2=	0.35	Compensation	0.70
7>NEXT LONGEST SECTION= (IN KM)(LOHARDAGA-GUMLA)	68			KZ2 Res Comp=	0.70		
8>INFEED RATIO=[I(act)/I(infeed)]	0			KZ2 Angle=	0.00		
9>ARC RESISTANCE=(Pri Value)	20		ZONE-3/4	Z3=	33.64		
10>TOWER- FOOTING RESISTANCE=(Pri Value)	25			Z4(Reverse)=	2.74		
11>TRANSFORMER AT OTHER END S/S=(IN MVA)	100			KZ3/KZ4 Res Comp=	0.70		
12>MAXIMUM LOAD (110% CT)= (IN MVA)	151			KZ3/KZ4Angle=	0.00		
13>X0/X1=R0/R1=	3.1			R3G/R4G=	35.16		
14>SINGLE CKT (S) / DOUBLE CKT (D)=	D			R3Ph/R4Ph=	15.63		
15>ADDITIONAL Dir.O/C,E/F RELAY USED=(YES/NO)	NO			tZ3=	1.00		
16>In	1		Dir.O/C	Char..=	NI		
17> CT SECONDARY=	1			%PLUG SET=	100%		
18>THARMAL CAPACITY[40-75°C](MVA)=	95			TIME SET=	0.13		
19>LOAD IMP..(90% VOLTAGE & [40-75°C]THER.. RATING)	82.53		Dir.E/F	Char..=	NI		
20>MAX LOAD IMP= (Sec)[110% CT RATING with 90% VOLTAGE]	51.96			%PLUG SET=	20%		
				TIME SET=	0.27		
DERIVED VALUES			Non-Dir.O/C	Char..=	DT		
				%PLUG SET=	100%		
A) COMPENSATION (K)=	0.70			TIME SET=	2Sec		
B>MAXIMUM LOADING (IN OHM)= (Sec Value)	51.96305		Non-Dir.E/F	Char..=	DT		
C>IMPEDANCE/REACTANCE UPTO 80% OF OTHER END	10.45			%PLUG SET=	20%		
TRANSFORMER (%Z=12)= (Sec Value)				TIME SET=	2Sec		
D>ARC RESISTANCE=(Sec Value)	10.00						
E>TOWER FOOTING RESISTANCE=(Sec Value)	12.50		LINE	LENGTH=	65		
F>If/In (PHASE FAULT AT 80%OF THE LINE)=	4.47			Z=	13.70168		
G>FIRST STAGE BACK UP O/C & E/F TIME=(In Sec)	0.60			ANGLE=	68		
H>If/In (EARTH FAULT AT 80% OF THE LINE)=	22.34						
I>Time- (ZONE-2)= (In Sec)	0.35						
J>Time- (ZONE-3)= (In Sec)	1.00						
K>FAULT MVA AT 80% OF THE LINE=	613						

LINE PARAMERERS	
400 KV---"R"	FALSE
400 KV---"X"	FALSE
400 KV---"Z"	FALSE
220 KV---"R"	FALSE
220 KV---"X"	FALSE
220 KV---"Z"	FALSE
132 KV---"R"	0.1402
132 KV---"X"	0.3976
132 KV---"Z"	0.42159

DISTANCE RELAY SETTING CALCULATION

SYSTEM DATA

HATIA(N)-NAMKUM

RELAY TYPE			MICOM P442			OTHERS(MHO)	
1> LINE LENGTH =	27		ZONE-1	Z1=	4.59	ZONE-1	4.59
2> SYSTEM VOLTAGE=	132			R1G=	22.50	ZONE-2	6.58
(RESISTANCE)- Per Km	0.1402			R1Ph=	10.00	ZONE-3(For)	15.55
(REACTANCE)- Per Km	0.401			tZ1=	0.00	ZONE-4(Rev)	1.15
(IMPEDANCE)- Per Km	0.42473			KZ1 Res Comp=	0.70	Time-(Z-2)	0.35
LINE ANGLE=	68			KZ1 Angle=	0.00	Time-(Z-3)	1.00
3>FAULT MVA OF THE S/S=	2689		ZONE-2	Z2=	6.58	Time-(Z-4)	0.50
4>C.T.RATIO=	600			R2G=	28.13	IMP UPTO NEXT LEVEL	12.70
5>P.T.RATIO=	1200			R2Ph=	12.50	(80% OF TR IMP)	
6>NEXT SHORTEST SECTION= (IN KM)(NAMKUM-UM)	8			tZ2=	0.35	Compensation	0.70
7>NEXT LONGEST SECTION= (IN KM)(NAMKUM-SIKIDRI)	34			KZ2 Res Comp=	0.70		
8>INFEED RATIO=[I(act)/I(infeed)]	0			KZ2 Angle=	0.00		
9>ARC RESISTANCE=(Pri Value)	20		ZONE-3/4	Z3=	15.55		
10>TOWER- FOOTING RESISTANCE=(Pri Value)	25			Z4(Reverse)=	1.15		
11>TRANSFORMER AT OTHER END S/S=(IN MVA)	150			KZ3/KZ4 Res Comp=	0.70		
12>MAXIMUM LOAD (110% CT)= (IN MVA)	151			KZ3/KZ4Angle=	0.00		
13>X0/X1=R0/R1=	3.1			R3G/R4G=	35.16		
14>SINGLE CKT (S) / DOUBLE CKT (D)=	S			R3Ph/R4Ph=	15.63		
15>ADDITIONAL Dir.O/C,E/F RELAY USED=(YES/NO)	NO			tZ3=	1.00		
16>In	1		Dir.O/C	Char..=	NI		
17> CT SECONDARY=	1			%PLUG SET=	100%		
18>THARMAL CAPACITY[40-75°C](MVA)=	95			TIME SET=	0.18		
19>LOAD IMP..(90% VOLTAGE & [40-75°C]THER.. RATING)	82.53		Dir.E/F	Char..=	NI		
20>MAX LOAD IMP= (Sec)[110% CT RATING with 90% VOLTAGE]	51.96			%PLUG SET=	20%		
				TIME SET=	0.27		
DERIVED VALUES			Non-Dir.O/C	Char..=	DT		
				%PLUG SET=	100%		
A) COMPENSATION (K)=	0.70			TIME SET=	2Sec		
B>MAXIMUM LOADING (IN OHM)= (Sec Value)	51.96305		Non-Dir.E/F	Char..=	DT		
C>IMPEDANCE/REACTANCE UPTO 80% OF OTHER END	6.97			%PLUG SET=	20%		
TRANSFORMER (%Z=12)= (Sec Value)				TIME SET=	2Sec		
D>ARC RESISTANCE=(Sec Value)	10.00						
E>TOWER FOOTING RESISTANCE=(Sec Value)	12.50		LINE	LENGTH=	27		
F>If/In (PHASE FAULT AT 80%OF THE LINE)=	8.11			Z=	5.733855		
G>FIRST STAGE BACK UP O/C & E/F TIME=(In Sec)	0.60			ANGLE=	68		
H>If/In (EARTH FAULT AT 80% OF THE LINE)=	40.53						
I>Time- (ZONE-2)= (In Sec)	0.35						
J>Time- (ZONE-3)= (In Sec)	1.00						
K>FAULT MVA AT 80% OF THE LINE=	1113						

LINE PARAMERERS	
400 KV---"R"	FALSE
400 KV---"X"	FALSE
400 KV---"Z"	FALSE
220 KV---"R"	FALSE
220 KV---"X"	FALSE
220 KV---"Z"	FALSE
132 KV---"R"	0.1402
132 KV---"X"	0.401
132 KV---"Z"	0.42473

DISTANCE RELAY SETTING CALCULATION

SYSTEM DATA

HATIA(O)-HEC-8C

RELAY TYPE					MICOM P442			OTHERS(MHO)	
1> LINE LENGTH =	8								
2> SYSTEM VOLTAGE=	132								
(RESISTANCE)- Per Km	0.1402								
(REACTANCE)- Per Km	0.3976								
(IMPEDANCE)- Per Km	0.42159								
LINE ANGLE=	68								
3>FAULT MVA OF THE S/S=	2689	ZONE-1	Z1=	0.67				ZONE-1	0.67
4>C.T.RATIO=	300		R1G=	11.25				ZONE-2	1.26
5>P.T.RATIO=	1200		R1Ph=	5.00				ZONE-3(For)	2.02
6>NEXT SHORTEST SECTION= (IN KM)(HEC-HATIA)	8		tZ1=	0.00				ZONE-4(Rev)	0.17
7>NEXT LONGEST SECTION= (IN KM)(HEC-HATIA)	8		KZ1 Res Comp=	0.70				Time-(Z-2)	0.35
8>INFEED RATIO=[I(act)/I(infeed)]	0		KZ1 Angle=	0.00				Time-(Z-3)	0.60
9>ARC RESISTANCE=(Pri Value)	20	ZONE-2	Z2=	1.26				Time-(Z-4)	0.50
10>TOWER- FOOTING RESISTANCE=(Pri Value)	25		R2G=	14.06				IMP UPTO NEXT LEVEL	6.37
11>TRANSFORMER AT OTHER END S/S=(IN MVA)	94.5		R2Ph=	6.25				(80% OF TR IMP)	
12>MAXIMUM LOAD (110% CT)= (IN MVA)	75		tZ2=	0.35				Compensation	0.70
13>X0/X1=R0/R1=	3.1		KZ2 Res Comp=	0.70					
14>SINGLE CKT (S) / DOUBLE CKT (D)=	D		KZ2 Angle=	0.00					
15>ADDITIONAL Dir.O/C,E/F RELAY USED=(YES/NO)	NO	ZONE-3/4	Z3=	2.02					
16>In	1		Z4(Reverse)=	0.17					
17> CT SECONDARY=	1		KZ3/KZ4 Res Comp=	0.70					
18>THARMAL CAPACITY[40-75°C](MVA)=	95		KZ3/KZ4Angle=	0.00					
19>LOAD IMP..(90% VOLTAGE & [40-75°C]THER.. RATING)	41.27		R3G/R4G=	17.58					
20>MAX LOAD IMP= (Sec)[110% CT RATING with 90% VOLTAGE]	51.96		R3Ph/R4Ph=	7.81					
			tZ3=	0.60					
DERIVED VALUES		Dir.O/C	Char..=	NI					
			%PLUG SET=	100%					
A) COMPENSATION (K)=	0.70		TIME SET=	0.27					
B>MAXIMUM LOADING (IN OHM)= (Sec Value)	51.96305	Dir.E/F	Char..=	NI					
C>IMPEDANCE/REACTANCE UPTO 80% OF OTHER END	5.53		%PLUG SET=	20%					
TRANSFORMER (%Z=12)= (Sec Value)			TIME SET=	0.27					
D>ARC RESISTANCE=(Sec Value)	5.00	Non-Dir.O/C	Char..=	DT					
E>TOWER FOOTING RESISTANCE=(Sec Value)	6.25		%PLUG SET=	100%					
F>If/In (PHASE FAULT AT 80%OF THE LINE)=	27.65		TIME SET=	2Sec					
G>FIRST STAGE BACK UP O/C & E/F TIME=(In Sec)	0.60	Non-Dir.E/F	Char..=	DT					
H>If/In (EARTH FAULT AT 80% OF THE LINE)=	138.27		%PLUG SET=	20%					
I>Time- (ZONE-2)= (In Sec)	0.35		TIME SET=	2Sec					
J>Time- (ZONE-3)= (In Sec)	0.60								
K>FAULT MVA AT 80% OF THE LINE=	1898	LINE	LENGTH=	8					
			Z=	0.84318					
			ANGLE=	68					

LINE PARAMERERS	
400 KV---"R"	FALSE
400 KV---"X"	FALSE
400 KV---"Z"	FALSE
220 KV---"R"	FALSE
220 KV---"X"	FALSE
220 KV---"Z"	FALSE
132 KV---"R"	0.1402
132 KV---"X"	0.3976
132 KV---"Z"	0.42159

DISTANCE RELAY SETTING CALCULATION

SYSTEM DATA

HATIA(O)-HEC-8C

RELAY TYPE					MICOM P442			OTHERS(MHO)	
1> LINE LENGTH =	8								
2> SYSTEM VOLTAGE=	132								
(RESISTANCE)- Per Km	0.1402								
(REACTANCE)- Per Km	0.3976								
(IMPEDANCE)- Per Km	0.42159								
LINE ANGLE=	68								
3>FAULT MVA OF THE S/S=	2689	ZONE-1	Z1=	0.34				ZONE-1	0.34
4>C.T.RATIO=	150		R1G=	5.63				ZONE-2	0.63
5>P.T.RATIO=	1200		R1Ph=	2.50				ZONE-3(For)	1.01
6>NEXT SHORTEST SECTION= (IN KM)(HEC-HATIA)	8		tZ1=	0.00				ZONE-4(Rev)	0.08
7>NEXT LONGEST SECTION= (IN KM)(HEC-HATIA)	8		KZ1 Res Comp=	0.70				Time-(Z-2)	0.35
8>INFEED RATIO=[I(act)/I(infeed)]	0		KZ1 Angle=	0.00				Time-(Z-3)	0.60
9>ARC RESISTANCE=(Pri Value)	20	ZONE-2	Z2=	0.63				Time-(Z-4)	0.50
10>TOWER- FOOTING RESISTANCE=(Pri Value)	25		R2G=	7.03				IMP UPTO NEXT LEVEL	3.19
11>TRANSFORMER AT OTHER END S/S=(IN MVA)	94.5		R2Ph=	3.13				(80% OF TR IMP)	
12>MAXIMUM LOAD (110% CT)= (IN MVA)	38		tZ2=	0.35				Compensation	0.70
13>X0/X1=R0/R1=	3.1		KZ2 Res Comp=	0.70					
14>SINGLE CKT (S) / DOUBLE CKT (D)=	D		KZ2 Angle=	0.00					
15>ADDITIONAL Dir.O/C,E/F RELAY USED=(YES/NO)	NO	ZONE-3/4	Z3=	1.01					
16>In	1		Z4(Reverse)=	0.08					
17> CT SECONDARY=	1		KZ3/KZ4 Res Comp=	0.70					
18>THARMAL CAPACITY[40-75°C](MVA)=	95		KZ3/KZ4Angle=	0.00					
19>LOAD IMP..(90% VOLTAGE & [40-75°C]THER.. RATING)	20.63		R3G/R4G=	8.79					
20>MAX LOAD IMP= (Sec)[110% CT RATING with 90% VOLTAGE]	51.96		R3Ph/R4Ph=	3.91					
			tZ3=	0.60					
DERIVED VALUES		Dir.O/C	Char..=	NI					
			%PLUG SET=	100%					
A) COMPENSATION (K)=	0.70		TIME SET=	0.27					
B>MAXIMUM LOADING (IN OHM)= (Sec Value)	51.96305	Dir.E/F	Char..=	NI					
C>IMPEDANCE/REACTANCE UPTO 80% OF OTHER END	2.77		%PLUG SET=	20%					
TRANSFORMER (%Z=12)= (Sec Value)			TIME SET=	0.27					
D>ARC RESISTANCE=(Sec Value)	2.50	Non-Dir.O/C	Char..=	DT					
E>TOWER FOOTING RESISTANCE=(Sec Value)	3.13		%PLUG SET=	100%					
F>If/In (PHASE FAULT AT 80%OF THE LINE)=	55.31		TIME SET=	2Sec					
G>FIRST STAGE BACK UP O/C & E/F TIME=(In Sec)	0.60	Non-Dir.E/F	Char..=	DT					
H>If/In (EARTH FAULT AT 80% OF THE LINE)=	276.54		%PLUG SET=	20%					
I>Time- (ZONE-2)= (In Sec)	0.35		TIME SET=	2Sec					
J>Time- (ZONE-3)= (In Sec)	0.60								
K>FAULT MVA AT 80% OF THE LINE=	1898	LINE	LENGTH=	8					
			Z=	0.42159					
			ANGLE=	68					

LINE PARAMERERS	
400 KV---"R"	FALSE
400 KV---"X"	FALSE
400 KV---"Z"	FALSE
220 KV---"R"	FALSE
220 KV---"X"	FALSE
220 KV---"Z"	FALSE
132 KV---"R"	0.1402
132 KV---"X"	0.3976
132 KV---"Z"	0.42159

DISTANCE RELAY SETTING CALCULATION

SYSTEM DATA

HATIA(O)-PTPS

RELAY TYPE						MICOM P442			OTHERS(MHO)	
1> LINE LENGTH =	44			ZONE-1	Z1=	3.71	ZONE-1	3.71
2> SYSTEM VOLTAGE=	132				R1G=	11.25	ZONE-2	5.95
(RESISTANCE)- Per Km	0.1402				R1Ph=	5.00	ZONE-3(For)	8.73
(REACTANCE)- Per Km	0.3976				tZ1=	0.00	ZONE-4(Rev)	0.93
(IMPEDANCE)- Per Km	0.42159				KZ1 Res Comp=	0.70	Time-(Z-2)	0.35
LINE ANGLE=	68				KZ1 Angle=	0.00	Time-(Z-3)	1.00
3>FAULT MVA OF THE S/S=	2689			ZONE-2	Z2=	5.95	Time-(Z-4)	0.50
4>C.T.RATIO=	300				R2G=	14.06	IMP UPTO NEXT LEVEL	6.38
5>P.T.RATIO=	1200				R2Ph=	6.25	(80% OF TR IMP)	
6>NEXT SHORTEST SECTION= (IN KM)(PTPS-KANKE)	25				tZ2=	0.35	Compensation	0.70
7>NEXT LONGEST SECTION= (IN KM)(PTPS-KANKE)	25				KZ2 Res Comp=	0.70		
8>INFEED RATIO=[I(act)/I(infeed)]	0				KZ2 Angle=	0.00		
9>ARC RESISTANCE=(Pri Value)	20			ZONE-3/4	Z3=	8.73		
10>TOWER- FOOTING RESISTANCE=(Pri Value)	25				Z4(Reverse)=	0.93		
11>TRANSFORMER AT OTHER END S/S=(IN MVA)	300				KZ3/KZ4 Res Comp=	0.70		
12>MAXIMUM LOAD (110% CT)= (IN MVA)	75				KZ3/KZ4Angle=	0.00		
13>X0/X1=R0/R1=	3.1				R3G/R4G=	17.58		
14>SINGLE CKT (S) / DOUBLE CKT (D)=	D				R3Ph/R4Ph=	7.81		
15>ADDITIONAL Dir.O/C,E/F RELAY USED=(YES/NO)	NO				tZ3=	1.00		
16>In	1			Dir.O/C	Char..=	NI		
17> CT SECONDARY=	1				%PLUG SET=	100%		
18>THARMAL CAPACITY[40-75°C](MVA)=	95				TIME SET=	0.22		
19>LOAD IMP..(90% VOLTAGE & [40-75°C]THER.. RATING)	41.27			Dir.E/F	Char..=	NI		
20>MAX LOAD IMP= (Sec)[110% CT RATING with 90% VOLTAGE]	51.96				%PLUG SET=	20%		
					TIME SET=	0.27		
DERIVED VALUES				Non-Dir.O/C	Char..=	DT		
					%PLUG SET=	100%		
A) COMPENSATION (K)=	0.70				TIME SET=	2Sec		
B>MAXIMUM LOADING (IN OHM)= (Sec Value)	51.96305			Non-Dir.E/F	Char..=	DT		
C>IMPEDANCE/REACTANCE UPTO 80% OF OTHER END	1.74				%PLUG SET=	20%		
TRANSFORMER (%Z=12)= (Sec Value)					TIME SET=	2Sec		
D>ARC RESISTANCE=(Sec Value)	5.00							
E>TOWER FOOTING RESISTANCE=(Sec Value)	6.25			LINE	LENGTH=	44		
F>If/In (PHASE FAULT AT 80%OF THE LINE)=	11.90				Z=	4.63749		
G>FIRST STAGE BACK UP O/C & E/F TIME=(In Sec)	0.60				ANGLE=	68		
H>If/In (EARTH FAULT AT 80% OF THE LINE)=	59.52							
I>Time- (ZONE-2)= (In Sec)	0.35							
J>Time- (ZONE-3)= (In Sec)	1.00							
K>FAULT MVA AT 80% OF THE LINE=	817							

LINE PARAMERERS	
400 KV---"R"	FALSE
400 KV---"X"	FALSE
400 KV---"Z"	FALSE
220 KV---"R"	FALSE
220 KV---"X"	FALSE
220 KV---"Z"	FALSE
132 KV---"R"	0.1402
132 KV---"X"	0.3976
132 KV---"Z"	0.42159

DISTANCE RELAY SETTING CALCULATION

SYSTEM DATA

HATIA(O)-KANKE

RELAY TYPE			MICOM P442			OTHERS(MHO)	
1> LINE LENGTH =	28		ZONE-1	Z1=	4.72	ZONE-1	4.72
2> SYSTEM VOLTAGE=	132			R1G=	22.50	ZONE-2	8.54
(RESISTANCE)- Per Km	0.1402			R1Ph=	10.00	ZONE-3(For)	13.41
(REACTANCE)- Per Km	0.3976			tZ1=	0.00	ZONE-4(Rev)	1.18
(IMPEDANCE)- Per Km	0.42159			KZ1 Res Comp=	0.70	Time-(Z-2)	0.35
LINE ANGLE=	68			KZ1 Angle=	0.00	Time-(Z-3)	0.60
3>FAULT MVA OF THE S/S=	2689		ZONE-2	Z2=	8.54	Time-(Z-4)	0.50
4>C.T.RATIO=	600			R2G=	28.13	IMP UPTO NEXT LEVEL	16.36
5>P.T.RATIO=	1200			R2Ph=	12.50	(80% OF TR IMP)	
6>NEXT SHORTEST SECTION= (IN KM)(KANKE-PTPS)	25			tZ2=	0.35	Compensation	0.70
7>NEXT LONGEST SECTION= (IN KM)(KANKE-PTPS)	25			KZ2 Res Comp=	0.70		
8>INFEED RATIO=[I(act)/I(infeed)]	0			KZ2 Angle=	0.00		
9>ARC RESISTANCE=(Pri Value)	20		ZONE-3/4	Z3=	13.41		
10>TOWER- FOOTING RESISTANCE=(Pri Value)	25			Z4(Reverse)=	1.18		
11>TRANSFORMER AT OTHER END S/S=(IN MVA)	100			KZ3/KZ4 Res Comp=	0.70		
12>MAXIMUM LOAD (110% CT)= (IN MVA)	151			KZ3/KZ4Angle=	0.00		
13>X0/X1=R0/R1=	3.1			R3G/R4G=	35.16		
14>SINGLE CKT (S) / DOUBLE CKT (D)=	D			R3Ph/R4Ph=	15.63		
15>ADDITIONAL Dir.O/C,E/F RELAY USED=(YES/NO)	NO			tZ3=	0.60		
16>In	1		Dir.O/C	Char..=	NI		
17> CT SECONDARY=	1			%PLUG SET=	100%		
18>THARMAL CAPACITY[40-75°C](MVA)=	95			TIME SET=	0.18		
19>LOAD IMP..(90% VOLTAGE & [40-75°C]THER.. RATING)	82.53		Dir.E/F	Char..=	NI		
20>MAX LOAD IMP= (Sec)[110% CT RATING with 90% VOLTAGE]	51.96			%PLUG SET=	20%		
				TIME SET=	0.27		
DERIVED VALUES			Non-Dir.O/C	Char..=	DT		
				%PLUG SET=	100%		
A) COMPENSATION (K)=	0.70			TIME SET=	2Sec		
B>MAXIMUM LOADING (IN OHM)= (Sec Value)	51.96305		Non-Dir.E/F	Char..=	DT		
C>IMPEDANCE/REACTANCE UPTO 80% OF OTHER END	10.45			%PLUG SET=	20%		
TRANSFORMER (%Z=12)= (Sec Value)				TIME SET=	2Sec		
D>ARC RESISTANCE=(Sec Value)	10.00						
E>TOWER FOOTING RESISTANCE=(Sec Value)	12.50		LINE	LENGTH=	28		
F>If/In (PHASE FAULT AT 80%OF THE LINE)=	7.97			Z=	5.90226		
G>FIRST STAGE BACK UP O/C & E/F TIME=(In Sec)	0.60			ANGLE=	68		
H>If/In (EARTH FAULT AT 80% OF THE LINE)=	39.85						
I>Time- (ZONE-2)= (In Sec)	0.35						
J>Time- (ZONE-3)= (In Sec)	0.60						
K>FAULT MVA AT 80% OF THE LINE=	1094						

LINE PARAMERERS	
400 KV---"R"	FALSE
400 KV---"X"	FALSE
400 KV---"Z"	FALSE
220 KV---"R"	FALSE
220 KV---"X"	FALSE
220 KV---"Z"	FALSE
132 KV---"R"	0.1402
132 KV---"X"	0.3976
132 KV---"Z"	0.42159

DISTANCE RELAY SETTING CALCULATION

SYSTEM DATA

HATIA(O)-KAMDARA

RELAY TYPE			MICOM P442			OTHERS(MHO)	
1> LINE LENGTH =	60.2		ZONE-1	Z1=	5.11	ZONE-1	5.11
2> SYSTEM VOLTAGE=	132			R1G=	11.25	ZONE-2	7.03
(RESISTANCE)- Per Km	0.1402			R1Ph=	5.00	ZONE-3(For)	15.32
(REACTANCE)- Per Km	0.401			tZ1=	0.00	ZONE-4(Rev)	1.28
(IMPEDANCE)- Per Km	0.42473			KZ1 Res Comp=	0.70	Time-(Z-2)	0.35
LINE ANGLE=	68			KZ1 Angle=	0.00	Time-(Z-3)	1.00
3>FAULT MVA OF THE S/S=	2689		ZONE-2	Z2=	7.03	Time-(Z-4)	0.50
4>C.T.RATIO=	300			R2G=	14.06	IMP UPTO NEXT LEVEL	12.20
5>P.T.RATIO=	1200			R2Ph=	6.25	(80% OF TR IMP)	
6>NEXT SHORTEST SECTION= (IN KM)(KAMDARA-RAILWAY+)	12			tZ2=	0.35	Compensation	0.70
7>NEXT LONGEST SECTION= (IN KM)(KAMDARA-GUMLA)	60			KZ2 Res Comp=	0.70		
8>INFEED RATIO=[I(act)/I(infeed)]	0			KZ2 Angle=	0.00		
9>ARC RESISTANCE=(Pri Value)	20		ZONE-3/4	Z3=	15.32		
10>TOWER- FOOTING RESISTANCE=(Pri Value)	25			Z4(Reverse)=	1.28		
11>TRANSFORMER AT OTHER END S/S=(IN MVA)	90			KZ3/KZ4 Res Comp=	0.70		
12>MAXIMUM LOAD (110% CT)= (IN MVA)	75			KZ3/KZ4Angle=	0.00		
13>X0/X1=R0/R1=	3.1			R3G/R4G=	17.58		
14>SINGLE CKT (S) / DOUBLE CKT (D)=	S			R3Ph/R4Ph=	7.81		
15>ADDITIONAL Dir.O/C,E/F RELAY USED=(YES/NO)	NO			tZ3=	1.00		
16>In	1		Dir.O/C	Char..=	NI		
17> CT SECONDARY=	1			%PLUG SET=	100%		
18>THARMAL CAPACITY[40-75°C](MVA)=	95			TIME SET=	0.19		
19>LOAD IMP..(90% VOLTAGE & [40-75°C]THER.. RATING)	41.27		Dir.E/F	Char..=	NI		
20>MAX LOAD IMP= (Sec)[110% CT RATING with 90% VOLTAGE]	51.96			%PLUG SET=	20%		
				TIME SET=	0.27		
DERIVED VALUES			Non-Dir.O/C	Char..=	DT		
				%PLUG SET=	100%		
A) COMPENSATION (K)=	0.70			TIME SET=	2Sec		
B>MAXIMUM LOADING (IN OHM)= (Sec Value)	51.96305		Non-Dir.E/F	Char..=	DT		
C>IMPEDANCE/REACTANCE UPTO 80% OF OTHER END	5.81			%PLUG SET=	20%		
TRANSFORMER (%Z=12)= (Sec Value)				TIME SET=	2Sec		
D>ARC RESISTANCE=(Sec Value)	5.00						
E>TOWER FOOTING RESISTANCE=(Sec Value)	6.25		LINE	LENGTH=	60.2		
F>If/In (PHASE FAULT AT 80%OF THE LINE)=	9.42			Z=	6.392187		
G>FIRST STAGE BACK UP O/C & E/F TIME=(In Sec)	0.60			ANGLE=	68		
H>If/In (EARTH FAULT AT 80% OF THE LINE)=	47.12						
I>Time- (ZONE-2)= (In Sec)	0.35						
J>Time- (ZONE-3)= (In Sec)	1.00						
K>FAULT MVA AT 80% OF THE LINE=	647						

LINE PARAMERERS	
400 KV---"R"	FALSE
400 KV---"X"	FALSE
400 KV---"Z"	FALSE
220 KV---"R"	FALSE
220 KV---"X"	FALSE
220 KV---"Z"	FALSE
132 KV---"R"	0.1402
132 KV---"X"	0.401
132 KV---"Z"	0.42473

DISTANCE RELAY SETTING CALCULATION

SYSTEM DATA

HATIA(O)-SIKIDRI

RELAY TYPE			MICOM P442			OTHERS(MHO)	
1> LINE LENGTH =	58		ZONE-1	Z1=	9.85	ZONE-1	9.85
2> SYSTEM VOLTAGE=	132			R1G=	22.50	ZONE-2	13.38
(RESISTANCE)- Per Km	0.1402			R1Ph=	10.00	ZONE-3(For)	23.45
(REACTANCE)- Per Km	0.401			tZ1=	0.00	ZONE-4(Rev)	2.46
(IMPEDANCE)- Per Km	0.42473			KZ1 Res Comp=	0.70	Time-(Z-2)	0.35
LINE ANGLE=	68			KZ1 Angle=	0.00	Time-(Z-3)	0.60
3>FAULT MVA OF THE S/S=	2689		ZONE-2	Z2=	13.38	Time-(Z-4)	0.50
4>C.T.RATIO=	600			R2G=	28.13	IMP UPTO NEXT LEVEL	44.48
5>P.T.RATIO=	1200			R2Ph=	12.50	(80% OF TR IMP)	
6>NEXT SHORTEST SECTION= (IN KM)(SIKIDRI-IPP+)	10			tZ2=	0.35	Compensation	0.70
7>NEXT LONGEST SECTION= (IN KM)(SIKIDRI-NAMKUM)	34			KZ2 Res Comp=	0.70		
8>INFEED RATIO=[I(act)/I(infeed)]	0			KZ2 Angle=	0.00		
9>ARC RESISTANCE=(Pri Value)	20		ZONE-3/4	Z3=	23.45		
10>TOWER- FOOTING RESISTANCE=(Pri Value)	25			Z4(Reverse)=	2.46		
11>TRANSFORMER AT OTHER END S/S=(IN MVA)	32.5			KZ3/KZ4 Res Comp=	0.70		
12>MAXIMUM LOAD (110% CT)= (IN MVA)	151			KZ3/KZ4Angle=	0.00		
13>X0/X1=R0/R1=	3.1			R3G/R4G=	35.16		
14>SINGLE CKT (S) / DOUBLE CKT (D)=	S			R3Ph/R4Ph=	15.63		
15>ADDITIONAL Dir.O/C,E/F RELAY USED=(YES/NO)	NO			tZ3=	0.60		
16>In	1		Dir.O/C	Char..=	NI		
17> CT SECONDARY=	1			%PLUG SET=	100%		
18>THARMAL CAPACITY[40-75°C](MVA)=	95			TIME SET=	0.14		
19>LOAD IMP..(90% VOLTAGE & [40-75°C]THER.. RATING)	82.53		Dir.E/F	Char..=	NI		
20>MAX LOAD IMP= (Sec)[110% CT RATING with 90% VOLTAGE]	51.96			%PLUG SET=	20%		
				TIME SET=	0.27		
DERIVED VALUES			Non-Dir.O/C	Char..=	DT		
				%PLUG SET=	100%		
A) COMPENSATION (K)=	0.70			TIME SET=	2Sec		
B>MAXIMUM LOADING (IN OHM)= (Sec Value)	51.96305		Non-Dir.E/F	Char..=	DT		
C>IMPEDANCE/REACTANCE UPTO 80% OF OTHER END	32.17			%PLUG SET=	20%		
TRANSFORMER (%Z=12)= (Sec Value)				TIME SET=	2Sec		
D>ARC RESISTANCE=(Sec Value)	10.00						
E>TOWER FOOTING RESISTANCE=(Sec Value)	12.50		LINE	LENGTH=	58		
F>If/In (PHASE FAULT AT 80%OF THE LINE)=	4.85			Z=	12.31717		
G>FIRST STAGE BACK UP O/C & E/F TIME=(In Sec)	0.60			ANGLE=	68		
H>If/In (EARTH FAULT AT 80% OF THE LINE)=	24.23						
I>Time- (ZONE-2)= (In Sec)	0.35						
J>Time- (ZONE-3)= (In Sec)	0.60						
K>FAULT MVA AT 80% OF THE LINE=	665						

LINE PARAMERERS	
400 KV---"R"	FALSE
400 KV---"X"	FALSE
400 KV---"Z"	FALSE
220 KV---"R"	FALSE
220 KV---"X"	FALSE
220 KV---"Z"	FALSE
132 KV---"R"	0.1402
132 KV---"X"	0.401
132 KV---"Z"	0.42473

DISTANCE RELAY SETTING CALCULATION

SYSTEM DATA

RAMCHANDAPUR-CHANDIL

RELAY TYPE		MICOM P442			OTHERS(MHO)	
1> LINE LENGTH =	35	ZONE-1	Z1=	4.67	ZONE-1	4.67
2> SYSTEM VOLTAGE=	220		R1G=	20.00	ZONE-2	11.64
(RESISTANCE)- Per Km	0.0749		R1Ph=	10.00	ZONE-3(For)	31.01
(REACTANCE)- Per Km	0.41		tZ1=	0.00	ZONE-4(Rev)	1.17
(IMPEDANCE)- Per Km	0.41678		KZ1 Res Comp=	0.70	Time-(Z-2)	0.35
LINE ANGLE=	79		KZ1 Angle=	0.00	Time-(Z-3)	1.00
3>FAULT MVA OF THE S/S=	6873	ZONE-2	Z2=	11.64	Time-(Z-4)	0.50
4>C.T.RATIO=	800		R2G=	25.00	IMP UPTO NEXT LEVEL	11.64
5>P.T.RATIO=	2000		R2Ph=	12.50	(80% OF TR IMP)	
6>NEXT SHORTEST SECTION= (IN KM)(CHANDIL-POWERGRID)	93.5		tZ2=	0.35	Compensation	0.70
7>NEXT LONGEST SECTION= (IN KM)(CHANDIL-STPS)	120		KZ2 Res Comp=	0.70		
8>INFEED RATIO=[I(act)/I(infeed)]	0		KZ2 Angle=	0.00		
9>ARC RESISTANCE=(Pri Value)	25	ZONE-3/4	Z3=	31.01		
10>TOWER- FOOTING RESISTANCE=(Pri Value)	25		Z4(Reverse)=	1.17		
11>TRANSFORMER AT OTHER END S/S=(IN MVA)	400		KZ3/KZ4 Res Comp=	0.70		
12>MAXIMUM LOAD (110% CT)= (IN MVA)	335		KZ3/KZ4Angle=	0.00		
13>X0/X1=R0/R1=	3.1		R3G/R4G=	31.25		
14>SINGLE CKT (S) / DOUBLE CKT (D)=	S		R3Ph/R4Ph=	15.63		
15>ADDITIONAL Dir.O/C,E/F RELAY USED=(YES/NO)	NO		tZ3=	1.00		
16>In	1	Dir.O/C	Char..=	NI		
17> CT SECONDARY=	1		%PLUG SET=	100%		
18>THARMAL CAPACITY[40-75°C](MVA)=	245		TIME SET=	0.19		
19>LOAD IMP..(90% VOLTAGE & [40-75°C]THER.. RATING)	71.12	Dir.E/F	Char..=	NI		
20>MAX LOAD IMP= (Sec)[110% CT RATING with 90% VOLTAGE]	51.96		%PLUG SET=	20%		
			TIME SET=	0.27		
DERIVED VALUES		Non-Dir.O/C	Char..=	DT		
			%PLUG SET=	100%		
A) COMPENSATION (K)=	0.70		TIME SET=	2Sec		
B>MAXIMUM LOADING (IN OHM)= (Sec Value)	51.96305	Non-Dir.E/F	Char..=	DT		
C>IMPEDANCE/REACTANCE UPTO 80% OF OTHER END	5.81		%PLUG SET=	20%		
TRANSFORMER (%Z=12)= (Sec Value)			TIME SET=	2Sec		
D>ARC RESISTANCE=(Sec Value)	10.00					
E>TOWER FOOTING RESISTANCE=(Sec Value)	10.00	LINE	LENGTH=	35		
F>If/In (PHASE FAULT AT 80%OF THE LINE)=	8.47		Z=	5.83492		
G>FIRST STAGE BACK UP O/C & E/F TIME=(In Sec)	0.60		ANGLE=	79		
H>If/In (EARTH FAULT AT 80% OF THE LINE)=	42.36					
I>Time- (ZONE-2)= (In Sec)	0.35					
J>Time- (ZONE-3)= (In Sec)	1.00					
K>FAULT MVA AT 80% OF THE LINE=	2587					

LINE PARAMERERS	
400 KV---"R"	FALSE
400 KV---"X"	FALSE
400 KV---"Z"	FALSE
220 KV---"R"	0.0749
220 KV---"X"	0.41
220 KV---"Z"	0.41678
132 KV---"R"	FALSE
132 KV---"X"	FALSE
132 KV---"Z"	FALSE

DISTANCE RELAY SETTING CALCULATION

SYSTEM DATA

RAMCHANDAPUR-JODA

RELAY TYPE			MICOM P442			OTHERS(MHO)	
1> LINE LENGTH =	130		ZONE-1	Z1=	13.00	ZONE-1	13.00
2> SYSTEM VOLTAGE=	220			R1G=	15.00	ZONE-2	17.50
(RESISTANCE)- Per Km	0.0749			R1Ph=	7.50	ZONE-3(For)	41.56
(REACTANCE)- Per Km	0.41			tZ1=	0.00	ZONE-4(Rev)	1.63
(IMPEDANCE)- Per Km	0.41678			KZ1 Res Comp=	0.70	Time-(Z-2)	0.35
LINE ANGLE=	79			KZ1 Angle=	0.00	Time-(Z-3)	1.00
3>FAULT MVA OF THE S/S=	6873		ZONE-2	Z2=	17.50	Time-(Z-4)	0.50
4>C.T.RATIO=	600			R2G=	18.75	IMP UPTO NEXT LEVEL	22.06
5>P.T.RATIO=	2000			R2Ph=	9.38	(80% OF TR IMP)	
6>NEXT SHORTEST SECTION= (IN KM)(JODA-TSIL+)	20			tZ2=	0.35	Compensation	0.70
7>NEXT LONGEST SECTION= (IN KM)(JODA-TTPS)	147			KZ2 Res Comp=	0.70		
8>INFEED RATIO=[I(act)/I(infeed)]	0			KZ2 Angle=	0.00		
9>ARC RESISTANCE=(Pri Value)	25		ZONE-3/4	Z3=	41.56		
10>TOWER- FOOTING RESISTANCE=(Pri Value)	25			Z4(Reverse)=	1.63		
11>TRANSFORMER AT OTHER END S/S=(IN MVA)	300			KZ3/KZ4 Res Comp=	0.70		
12>MAXIMUM LOAD (110% CT)= (IN MVA)	251			KZ3/KZ4Angle=	0.00		
13>X0/X1=R0/R1=	3.1			R3G/R4G=	23.44		
14>SINGLE CKT (S) / DOUBLE CKT (D)=	S			R3Ph/R4Ph=	11.72		
15>ADDITIONAL Dir.O/C,E/F RELAY USED=(YES/NO)	NO			tZ3=	1.00		
16>In	1		Dir.O/C	Char..=	NI		
17> CT SECONDARY=	1			%PLUG SET=	100%		
18>THARMAL CAPACITY[40-75°C](MVA)=	245			TIME SET=	0.12		
19>LOAD IMP..(90% VOLTAGE & [40-75°C]THER.. RATING)	53.34		Dir.E/F	Char..=	NI		
20>MAX LOAD IMP= (Sec)[110% CT RATING with 90% VOLTAGE]	51.96			%PLUG SET=	20%		
				TIME SET=	0.27		
DERIVED VALUES			Non-Dir.O/C	Char..=	DT		
				%PLUG SET=	100%		
A) COMPENSATION (K)=	0.70			TIME SET=	2Sec		
B>MAXIMUM LOADING (IN OHM)= (Sec Value)	51.963048		Non-Dir.E/F	Char..=	DT		
C>IMPEDANCE/REACTANCE UPTO 80% OF OTHER END	5.81			%PLUG SET=	20%		
TRANSFORMER (%Z=12)= (Sec Value)				TIME SET=	2Sec		
D>ARC RESISTANCE=(Sec Value)	7.50						
E>TOWER FOOTING RESISTANCE=(Sec Value)	7.50		LINE	LENGTH=	130		
F>If/In (PHASE FAULT AT 80%OF THE LINE)=	4.19			Z=	16.25442		
G>FIRST STAGE BACK UP O/C & E/F TIME=(In Sec)	0.60			ANGLE=	79		
H>If/In (EARTH FAULT AT 80% OF THE LINE)=	20.97						
I>Time- (ZONE-2)= (In Sec)	0.35						
J>Time- (ZONE-3)= (In Sec)	1.00						
K>FAULT MVA AT 80% OF THE LINE=	961						

LINE PARAMERERS	
400 KV---"R"	FALSE
400 KV---"X"	FALSE
400 KV---"Z"	FALSE
220 KV---"R"	0.0749
220 KV---"X"	0.41
220 KV---"Z"	0.41678
132 KV---"R"	FALSE
132 KV---"X"	FALSE
132 KV---"Z"	FALSE

DISTANCE RELAY SETTING CALCULATION

SYSTEM DATA

RAMCHANDAPUR-ADITYAPUR (TB C-R)

RELAY TYPE					MICOM P442			OTHERS(MHO)	
1> LINE LENGTH =	8.3		ZONE-1	Z1=	1.40	ZONE-1	1.40
2> SYSTEM VOLTAGE=	132			R1G=	22.50	ZONE-2	2.12
(RESISTANCE)- Per Km	0.1402			R1Ph=	10.00	ZONE-3(For)	4.20
(REACTANCE)- Per Km	0.3976			tZ1=	0.00	ZONE-4(Rev)	0.35
(IMPEDANCE)- Per Km	0.42159			KZ1 Res Comp=	0.70	Time-(Z-2)	0.35
LINE ANGLE=	68			KZ1 Angle=	0.00	Time-(Z-3)	0.60
3>FAULT MVA OF THE S/S=	3459		ZONE-2	Z2=	2.12	Time-(Z-4)	0.50
4>C.T.RATIO=	600			R2G=	28.13	IMP UPTO NEXT LEVEL	6.98
5>P.T.RATIO=	1200			R2Ph=	12.50	(80% OF TR IMP)	
6>NEXT SHORTEST SECTION= (IN KM)(ADITYAPUR-UM)	3.5			tZ2=	0.35	Compensation	0.70
7>NEXT LONGEST SECTION= (IN KM)(ADITYAPUR-RAMCHANDAPUR)	8.3			KZ2 Res Comp=	0.70		
8>INFEED RATIO=[I(act)/I(infeed)]	0			KZ2 Angle=	0.00		
9>ARC RESISTANCE=(Pri Value)	20		ZONE-3/4	Z3=	4.20		
10>TOWER- FOOTING RESISTANCE=(Pri Value)	25			Z4(Reverse)=	0.35		
11>TRANSFORMER AT OTHER END S/S=(IN MVA)	200			KZ3/KZ4 Res Comp=	0.70		
12>MAXIMUM LOAD (110% CT)= (IN MVA)	151			KZ3/KZ4Angle=	0.00		
13>X0/X1=R0/R1=	3.1			R3G/R4G=	35.16		
14>SINGLE CKT (S) / DOUBLE CKT (D)=	D			R3Ph/R4Ph=	15.63		
15>ADDITIONAL Dir.O/C,E/F RELAY USED=(YES/NO)	NO			tZ3=	0.60		
16>In	1		Dir.O/C	Char..=	NI		
17> CT SECONDARY=	1			%PLUG SET=	100%		
18>THARMAL CAPACITY[40-75°C](MVA)=	95			TIME SET=	0.24		
19>LOAD IMP..(90% VOLTAGE & [40-75°C]THER.. RATING)	82.53		Dir.E/F	Char..=	NI		
20>MAX LOAD IMP= (Sec)[110% CT RATING with 90% VOLTAGE]	51.96			%PLUG SET=	20%		
				TIME SET=	0.27		
DERIVED VALUES			Non-Dir.O/C	Char..=	DT		
				%PLUG SET=	100%		
A) COMPENSATION (K)=	0.70			TIME SET=	2Sec		
B>MAXIMUM LOADING (IN OHM)= (Sec Value)	51.96305		Non-Dir.E/F	Char..=	DT		
C>IMPEDANCE/REACTANCE UPTO 80% OF OTHER END	5.23			%PLUG SET=	20%		
TRANSFORMER (%Z=12)= (Sec Value)				TIME SET=	2Sec		
D>ARC RESISTANCE=(Sec Value)	10.00						
E>TOWER FOOTING RESISTANCE=(Sec Value)	12.50		LINE	LENGTH=	8.3		
F>If/In (PHASE FAULT AT 80%OF THE LINE)=	16.19			Z=	1.749599		
G>FIRST STAGE BACK UP O/C & E/F TIME=(In Sec)	0.60			ANGLE=	68		
H>If/In (EARTH FAULT AT 80% OF THE LINE)=	80.97						
I>Time- (ZONE-2)= (In Sec)	0.35						
J>Time- (ZONE-3)= (In Sec)	0.60						
K>FAULT MVA AT 80% OF THE LINE=	2223						

LINE PARAMERERS	
400 KV---"R"	FALSE
400 KV---"X"	FALSE
400 KV---"Z"	FALSE
220 KV---"R"	FALSE
220 KV---"X"	FALSE
220 KV---"Z"	FALSE
132 KV---"R"	0.1402
132 KV---"X"	0.3976
132 KV---"Z"	0.42159

DISTANCE RELAY SETTING CALCULATION

SYSTEM DATA

RAMCHANDAPUR-ADITYAPUR

RELAY TYPE					MICOM P442			OTHERS(MHO)	
1> LINE LENGTH =	8.3							ZONE-1	1.40
2> SYSTEM VOLTAGE=	132							ZONE-2	2.12
(RESISTANCE)- Per Km	0.1402							ZONE-3(For)	10.95
(REACTANCE)- Per Km	0.3976							ZONE-4(Rev)	0.35
(IMPEDANCE)- Per Km	0.42159							Time-(Z-2)	0.35
LINE ANGLE=	68							Time-(Z-3)	1.00
3>FAULT MVA OF THE S/S=	3459		ZONE-2	Z2=	2.12			Time-(Z-4)	0.50
4>C.T.RATIO=	600			R2G=	28.13			IMP UPTO NEXT LEVEL	6.98
5>P.T.RATIO=	1200			R2Ph=	12.50			(80% OF TR IMP)	
6>NEXT SHORTEST SECTION= (IN KM)(ADITYAPUR-UM)	3.5			tZ2=	0.35			Compensation	0.70
7>NEXT LONGEST SECTION= (IN KM)(ADITYAPUR-RKSN)	35			KZ2 Res Comp=	0.70				
8>INFEED RATIO=[I(act)/I(infeed)]	0			KZ2 Angle=	0.00				
9>ARC RESISTANCE=(Pri Value)	20		ZONE-3/4	Z3=	10.95				
10>TOWER- FOOTING RESISTANCE=(Pri Value)	25			Z4(Reverse)=	0.35				
11>TRANSFORMER AT OTHER END S/S=(IN MVA)	200			KZ3/KZ4 Res Comp=	0.70				
12>MAXIMUM LOAD (110% CT)= (IN MVA)	151			KZ3/KZ4Angle=	0.00				
13>X0/X1=R0/R1=	3.1			R3G/R4G=	35.16				
14>SINGLE CKT (S) / DOUBLE CKT (D)=	D			R3Ph/R4Ph=	15.63				
15>ADDITIONAL Dir.O/C,E/F RELAY USED=(YES/NO)	NO			tZ3=	1.00				
16>In	1		Dir.O/C	Char..=	NI				
17> CT SECONDARY=	1			%PLUG SET=	100%				
18>THARMAL CAPACITY[40-75°C](MVA)=	95			TIME SET=	0.24				
19>LOAD IMP..(90% VOLTAGE & [40-75°C]THER.. RATING)	82.53		Dir.E/F	Char..=	NI				
20>MAX LOAD IMP= (Sec)[110% CT RATING with 90% VOLTAGE]	51.96			%PLUG SET=	20%				
				TIME SET=	0.27				
DERIVED VALUES			Non-Dir.O/C	Char..=	DT				
				%PLUG SET=	100%				
A) COMPENSATION (K)=	0.70			TIME SET=	2Sec				
B>MAXIMUM LOADING (IN OHM)= (Sec Value)	51.96305		Non-Dir.E/F	Char..=	DT				
C>IMPEDANCE/REACTANCE UPTO 80% OF OTHER END	5.23			%PLUG SET=	20%				
TRANSFORMER (%Z=12)= (Sec Value)				TIME SET=	2Sec				
D>ARC RESISTANCE=(Sec Value)	10.00								
E>TOWER FOOTING RESISTANCE=(Sec Value)	12.50		LINE	LENGTH=	8.3				
F>If/In (PHASE FAULT AT 80%OF THE LINE)=	16.19			Z=	1.749599				
G>FIRST STAGE BACK UP O/C & E/F TIME=(In Sec)	0.60			ANGLE=	68				
H>If/In (EARTH FAULT AT 80% OF THE LINE)=	80.97								
I>Time- (ZONE-2)= (In Sec)	0.35								
J>Time- (ZONE-3)= (In Sec)	1.00								
K>FAULT MVA AT 80% OF THE LINE=	2223								

LINE PARAMERERS	
400 KV---"R"	FALSE
400 KV---"X"	FALSE
400 KV---"Z"	FALSE
220 KV---"R"	FALSE
220 KV---"X"	FALSE
220 KV---"Z"	FALSE
132 KV---"R"	0.1402
132 KV---"X"	0.3976
132 KV---"Z"	0.42159

DISTANCE RELAY SETTING CALCULATION

SYSTEM DATA

RAMCHANDAPUR-AAPL

RELAY TYPE						MICOM P442			OTHERS(MHO)	
1> LINE LENGTH =	4.26			ZONE-1	Z1=	0.36	ZONE-1	0.36
2> SYSTEM VOLTAGE=	132				R1G=	11.25	ZONE-2	0.67
(RESISTANCE)- Per Km	0.1402				R1Ph=	5.00	ZONE-3(For)	1.08
(REACTANCE)- Per Km	0.3976				tZ1=	0.00	ZONE-4(Rev)	0.09
(IMPEDANCE)- Per Km	0.42159				KZ1 Res Comp=	0.70	Time-(Z-2)	0.35
LINE ANGLE=	68				KZ1 Angle=	0.00	Time-(Z-3)	0.60
3>FAULT MVA OF THE S/S=	3459			ZONE-2	Z2=	0.67	Time-(Z-4)	0.50
4>C.T.RATIO=	300				R2G=	14.06	IMP UPTO NEXT LEVEL	6.26
5>P.T.RATIO=	1200				R2Ph=	6.25	(80% OF TR IMP)	
6>NEXT SHORTEST SECTION= (IN KM)(AAPL-RAMCHANDAPUR)	4.26				tZ2=	0.35	Compensation	0.70
7>NEXT LONGEST SECTION= (IN KM)(AAPL-RAMCHANDAPUR)	4.26				KZ2 Res Comp=	0.70		
8>INFEED RATIO=[I(act)/I(infeed)]	0				KZ2 Angle=	0.00		
9>ARC RESISTANCE=(Pri Value)	20			ZONE-3/4	Z3=	1.08		
10>TOWER- FOOTING RESISTANCE=(Pri Value)	25				Z4(Reverse)=	0.09		
11>TRANSFORMER AT OTHER END S/S=(IN MVA)	90				KZ3/KZ4 Res Comp=	0.70		
12>MAXIMUM LOAD (110% CT)= (IN MVA)	75				KZ3/KZ4Angle=	0.00		
13>X0/X1=R0/R1=	3.1				R3G/R4G=	17.58		
14>SINGLE CKT (S) / DOUBLE CKT (D)=	D				R3Ph/R4Ph=	7.81		
15>ADDITIONAL Dir.O/C,E/F RELAY USED=(YES/NO)	NO				tZ3=	0.60		
16>In	1			Dir.O/C	Char..=	NI		
17> CT SECONDARY=	1				%PLUG SET=	100%		
18>THARMAL CAPACITY[40-75°C](MVA)=	95				TIME SET=	0.27		
19>LOAD IMP..(90% VOLTAGE & [40-75°C]THER.. RATING)	41.27			Dir.E/F	Char..=	NI		
20>MAX LOAD IMP= (Sec)[110% CT RATING with 90% VOLTAGE]	51.96				%PLUG SET=	20%		
					TIME SET=	0.27		
DERIVED VALUES				Non-Dir.O/C	Char..=	DT		
					%PLUG SET=	100%		
A) COMPENSATION (K)=	0.70				TIME SET=	2Sec		
B>MAXIMUM LOADING (IN OHM)= (Sec Value)	51.96305			Non-Dir.E/F	Char..=	DT		
C>IMPEDANCE/REACTANCE UPTO 80% OF OTHER END	5.81				%PLUG SET=	20%		
TRANSFORMER (%Z=12)= (Sec Value)					TIME SET=	2Sec		
D>ARC RESISTANCE=(Sec Value)	5.00							
E>TOWER FOOTING RESISTANCE=(Sec Value)	6.25			LINE	LENGTH=	4.26		
F>If/In (PHASE FAULT AT 80%OF THE LINE)=	39.20				Z=	0.448993		
G>FIRST STAGE BACK UP O/C & E/F TIME=(In Sec)	0.60				ANGLE=	68		
H>If/In (EARTH FAULT AT 80% OF THE LINE)=	196.02							
I>Time- (ZONE-2)= (In Sec)	0.35							
J>Time- (ZONE-3)= (In Sec)	0.60							
K>FAULT MVA AT 80% OF THE LINE=	2691							

LINE PARAMERERS	
400 KV---"R"	FALSE
400 KV---"X"	FALSE
400 KV---"Z"	FALSE
220 KV---"R"	FALSE
220 KV---"X"	FALSE
220 KV---"Z"	FALSE
132 KV---"R"	0.1402
132 KV---"X"	0.3976
132 KV---"Z"	0.42159

DISTANCE RELAY SETTING CALCULATION

SYSTEM DATA

ADITYAPUR-RAMCHANDAPUR

RELAY TYPE			MICOM P442			OTHERS(MHO)	
1> LINE LENGTH =	8.3	ZONE-1	Z1=	1.40	ZONE-1	1.40
2> SYSTEM VOLTAGE=	132		R1G=	22.50	ZONE-2	2.20
(RESISTANCE)- Per Km	0.1402		R1Ph=	10.00	ZONE-3(For)	4.20
(REACTANCE)- Per Km	0.3976		tZ1=	0.00	ZONE-4(Rev)	0.35
(IMPEDANCE)- Per Km	0.42159		KZ1 Res Comp=	0.70	Time-(Z-2)	0.35
LINE ANGLE=	68		KZ1 Angle=	0.00	Time-(Z-3)	1.00
3>FAULT MVA OF THE S/S=	3045	ZONE-2	Z2=	2.20	Time-(Z-4)	0.50
4>C.T.RATIO=	600		R2G=	28.13	IMP UPTO NEXT LEVEL	4.07
5>P.T.RATIO=	1200		R2Ph=	12.50	(80% OF TR IMP)	
6>NEXT SHORTEST SECTION= (IN KM)(RAMCHANDAPUR-AAPL)	4.26		tZ2=	0.35	Compensation	0.70
7>NEXT LONGEST SECTION= (IN KM)(RAMCHANDAPUR-ADITYAPUR)	8.3		KZ2 Res Comp=	0.70		
8>INFEED RATIO=[I(act)/I(infeed)]	0		KZ2 Angle=	0.00		
9>ARC RESISTANCE=(Pri Value)	20	ZONE-3/4	Z3=	4.20		
10>TOWER- FOOTING RESISTANCE=(Pri Value)	25		Z4(Reverse)=	0.35		
11>TRANSFORMER AT OTHER END S/S=(IN MVA)	450		KZ3/KZ4 Res Comp=	0.70		
12>MAXIMUM LOAD (110% CT)= (IN MVA)	151		KZ3/KZ4Angle=	0.00		
13>X0/X1=R0/R1=	3.1		R3G/R4G=	35.16		
14>SINGLE CKT (S) / DOUBLE CKT (D)=	D		R3Ph/R4Ph=	15.63		
15>ADDITIONAL Dir.O/C,E/F RELAY USED=(YES/NO)	NO		tZ3=	1.00		
16>In	1	Dir.O/C	Char..=	NI		
17> CT SECONDARY=	1		%PLUG SET=	100%		
18>THARMAL CAPACITY[40-75°C](MVA)=	95		TIME SET=	0.24		
19>LOAD IMP..(90% VOLTAGE & [40-75°C]THER.. RATING)	82.53	Dir.E/F	Char..=	NI		
20>MAX LOAD IMP= (Sec)[110% CT RATING with 90% VOLTAGE]	51.96		%PLUG SET=	20%		
			TIME SET=	0.27		
DERIVED VALUES		Non-Dir.O/C	Char..=	DT		
			%PLUG SET=	100%		
A) COMPENSATION (K)=	0.70		TIME SET=	2Sec		
B>MAXIMUM LOADING (IN OHM)= (Sec Value)	51.96305	Non-Dir.E/F	Char..=	DT		
C>IMPEDANCE/REACTANCE UPTO 80% OF OTHER END	2.32		%PLUG SET=	20%		
TRANSFORMER (%Z=12)= (Sec Value)			TIME SET=	2Sec		
D>ARC RESISTANCE=(Sec Value)	10.00					
E>TOWER FOOTING RESISTANCE=(Sec Value)	12.50	LINE	LENGTH=	8.3		
F>If/In (PHASE FAULT AT 80%OF THE LINE)=	14.89		Z=	1.749599		
G>FIRST STAGE BACK UP O/C & E/F TIME=(In Sec)	0.60		ANGLE=	68		
H>If/In (EARTH FAULT AT 80% OF THE LINE)=	74.46					
I>Time- (ZONE-2)= (In Sec)	0.35					
J>Time- (ZONE-3)= (In Sec)	1.00					
K>FAULT MVA AT 80% OF THE LINE=	2045					

LINE PARAMERERS	
400 KV---"R"	FALSE
400 KV---"X"	FALSE
400 KV---"Z"	FALSE
220 KV---"R"	FALSE
220 KV---"X"	FALSE
220 KV---"Z"	FALSE
132 KV---"R"	0.1402
132 KV---"X"	0.3976
132 KV---"Z"	0.42159

DISTANCE RELAY SETTING CALCULATION

SYSTEM DATA

ADITYAPUR-UM(CPP)

RELAY TYPE		MICOM P442			OTHERS(MHO)	
1> LINE LENGTH =	3.5	ZONE-1	Z1=	0.59	ZONE-1	0.59
2> SYSTEM VOLTAGE=	132		R1G=	22.50	ZONE-2	1.11
(RESISTANCE)- Per Km	0.1402		R1Ph=	10.00	ZONE-3(For)	1.77
(REACTANCE)- Per Km	0.3976		tZ1=	0.00	ZONE-4(Rev)	0.15
(IMPEDANCE)- Per Km	0.42159		KZ1 Res Comp=	0.70	Time-(Z-2)	0.35
LINE ANGLE=	68		KZ1 Angle=	0.00	Time-(Z-3)	0.60
3>FAULT MVA OF THE S/S=	3045	ZONE-2	Z2=	1.11	Time-(Z-4)	0.50
4>C.T.RATIO=	600		R2G=	28.13	IMP UPTO NEXT LEVEL	5.96
5>P.T.RATIO=	1200		R2Ph=	12.50	(80% OF TR IMP)	
6>NEXT SHORTEST SECTION= (IN KM)(UM-ADITYAPUR)	3.5		tZ2=	0.35	Compensation	0.70
7>NEXT LONGEST SECTION= (IN KM)(UM-ADITYAPUR)	3.5		KZ2 Res Comp=	0.70		
8>INFEED RATIO=[I(act)/I(infeed)]	0		KZ2 Angle=	0.00		
9>ARC RESISTANCE=(Pri Value)	20	ZONE-3/4	Z3=	1.77		
10>TOWER- FOOTING RESISTANCE=(Pri Value)	25		Z4(Reverse)=	0.15		
11>TRANSFORMER AT OTHER END S/S=(IN MVA)	200		KZ3/KZ4 Res Comp=	0.70		
12>MAXIMUM LOAD (110% CT)= (IN MVA)	151		KZ3/KZ4Angle=	0.00		
13>X0/X1=R0/R1=	3.1		R3G/R4G=	35.16		
14>SINGLE CKT (S) / DOUBLE CKT (D)=	D		R3Ph/R4Ph=	15.63		
15>ADDITIONAL Dir.O/C,E/F RELAY USED=(YES/NO)	NO		tZ3=	0.60		
16>In	1	Dir.O/C	Char..=	NI		
17> CT SECONDARY=	1		%PLUG SET=	100%		
18>THARMAL CAPACITY[40-75°C](MVA)=	95		TIME SET=	0.25		
19>LOAD IMP..(90% VOLTAGE & [40-75°C]THER.. RATING)	82.53	Dir.E/F	Char..=	NI		
20>MAX LOAD IMP= (Sec)[110% CT RATING with 90% VOLTAGE]	51.96		%PLUG SET=	20%		
			TIME SET=	0.27		
DERIVED VALUES		Non-Dir.O/C	Char..=	DT		
			%PLUG SET=	100%		
A) COMPENSATION (K)=	0.70		TIME SET=	2Sec		
B>MAXIMUM LOADING (IN OHM)= (Sec Value)	51.96305	Non-Dir.E/F	Char..=	DT		
C>IMPEDANCE/REACTANCE UPTO 80% OF OTHER END	5.23		%PLUG SET=	20%		
TRANSFORMER (%Z=12)= (Sec Value)			TIME SET=	2Sec		
D>ARC RESISTANCE=(Sec Value)	10.00					
E>TOWER FOOTING RESISTANCE=(Sec Value)	12.50	LINE	LENGTH=	3.5		
F>If/In (PHASE FAULT AT 80%OF THE LINE)=	18.39		Z=	0.737783		
G>FIRST STAGE BACK UP O/C & E/F TIME=(In Sec)	0.60		ANGLE=	68		
H>If/In (EARTH FAULT AT 80% OF THE LINE)=	91.93					
I>Time- (ZONE-2)= (In Sec)	0.35					
J>Time- (ZONE-3)= (In Sec)	0.60					
K>FAULT MVA AT 80% OF THE LINE=	2524					

LINE PARAMERERS	
400 KV---"R"	FALSE
400 KV---"X"	FALSE
400 KV---"Z"	FALSE
220 KV---"R"	FALSE
220 KV---"X"	FALSE
220 KV---"Z"	FALSE
132 KV---"R"	0.1402
132 KV---"X"	0.3976
132 KV---"Z"	0.42159

DISTANCE RELAY SETTING CALCULATION

SYSTEM DATA

ADITYAPUR-CHANDIL

RELAY TYPE			MICOM P442			OTHERS(MHO)	
1> LINE LENGTH =	19		ZONE-1	Z1=	3.23	ZONE-1	3.23
2> SYSTEM VOLTAGE=	132			R1G=	22.50	ZONE-2	6.65
(RESISTANCE)- Per Km	0.1402			R1Ph=	10.00	ZONE-3(For)	20.13
(REACTANCE)- Per Km	0.401			tZ1=	0.00	ZONE-4(Rev)	0.81
(IMPEDANCE)- Per Km	0.42473			KZ1 Res Comp=	0.70	Time-(Z-2)	0.35
LINE ANGLE=	68			KZ1 Angle=	0.00	Time-(Z-3)	1.00
3>FAULT MVA OF THE S/S=	3045		ZONE-2	Z2=	6.65	Time-(Z-4)	0.50
4>C.T.RATIO=	600			R2G=	28.13	IMP UPTO NEXT LEVEL	6.65
5>P.T.RATIO=	1200			R2Ph=	12.50	(80% OF TR IMP)	
6>NEXT SHORTEST SECTION= (IN KM)(CHANDIL-GOLMURI)	30			tZ2=	0.35	Compensation	0.70
7>NEXT LONGEST SECTION= (IN KM)(CHANDIL-TOMAR)	60			KZ2 Res Comp=	0.70		
8>INFEED RATIO=[I(act)/I(infeed)]	0			KZ2 Angle=	0.00		
9>ARC RESISTANCE=(Pri Value)	20		ZONE-3/4	Z3=	20.13		
10>TOWER- FOOTING RESISTANCE=(Pri Value)	25			Z4(Reverse)=	0.81		
11>TRANSFORMER AT OTHER END S/S=(IN MVA)	400			KZ3/KZ4 Res Comp=	0.70		
12>MAXIMUM LOAD (110% CT)= (IN MVA)	151			KZ3/KZ4Angle=	0.00		
13>X0/X1=R0/R1=	3.1			R3G/R4G=	35.16		
14>SINGLE CKT (S) / DOUBLE CKT (D)=	S			R3Ph/R4Ph=	15.63		
15>ADDITIONAL Dir.O/C,E/F RELAY USED=(YES/NO)	NO			tZ3=	1.00		
16>In	1		Dir.O/C	Char..=	NI		
17> CT SECONDARY=	1			%PLUG SET=	100%		
18>THARMAL CAPACITY[40-75°C](MVA)=	95			TIME SET=	0.20		
19>LOAD IMP..(90% VOLTAGE & [40-75°C]THER.. RATING)	82.53		Dir.E/F	Char..=	NI		
20>MAX LOAD IMP= (Sec)[110% CT RATING with 90% VOLTAGE]	51.96			%PLUG SET=	20%		
				TIME SET=	0.27		
DERIVED VALUES			Non-Dir.O/C	Char..=	DT		
				%PLUG SET=	100%		
A) COMPENSATION (K)=	0.70			TIME SET=	2Sec		
B>MAXIMUM LOADING (IN OHM)= (Sec Value)	51.96305		Non-Dir.E/F	Char..=	DT		
C>IMPEDANCE/REACTANCE UPTO 80% OF OTHER END	2.61			%PLUG SET=	20%		
TRANSFORMER (%Z=12)= (Sec Value)				TIME SET=	2Sec		
D>ARC RESISTANCE=(Sec Value)	10.00						
E>TOWER FOOTING RESISTANCE=(Sec Value)	12.50		LINE	LENGTH=	19		
F>If/In (PHASE FAULT AT 80%OF THE LINE)=	10.42			Z=	4.034935		
G>FIRST STAGE BACK UP O/C & E/F TIME=(In Sec)	0.60			ANGLE=	68		
H>If/In (EARTH FAULT AT 80% OF THE LINE)=	52.10						
I>Time- (ZONE-2)= (In Sec)	0.35						
J>Time- (ZONE-3)= (In Sec)	1.00						
K>FAULT MVA AT 80% OF THE LINE=	1431						

LINE PARAMERERS	
400 KV---"R"	FALSE
400 KV---"X"	FALSE
400 KV---"Z"	FALSE
220 KV---"R"	FALSE
220 KV---"X"	FALSE
220 KV---"Z"	FALSE
132 KV---"R"	0.1402
132 KV---"X"	0.401
132 KV---"Z"	0.42473

DISTANCE RELAY SETTING CALCULATION

SYSTEM DATA

ADITYAPUR-RKSN

RELAY TYPE			MICOM P442			OTHERS(MHO)	
1> LINE LENGTH =	35		ZONE-1	Z1=	3.96	ZONE-1	3.96
2> SYSTEM VOLTAGE=	132			R1G=	15.00	ZONE-2	6.37
(RESISTANCE)- Per Km	0.1402			R1Ph=	6.67	ZONE-3(For)	15.80
(REACTANCE)- Per Km	0.401			tZ1=	0.00	ZONE-4(Rev)	0.99
(IMPEDANCE)- Per Km	0.42473			KZ1 Res Comp=	0.70	Time-(Z-2)	0.35
LINE ANGLE=	68			KZ1 Angle=	0.00	Time-(Z-3)	1.00
3>FAULT MVA OF THE S/S=	3045		ZONE-2	Z2=	6.37	Time-(Z-4)	0.50
4>C.T.RATIO=	400			R2G=	18.75	IMP UPTO NEXT LEVEL	14.91
5>P.T.RATIO=	1200			R2Ph=	8.33	(80% OF TR IMP)	
6>NEXT SHORTEST SECTION= (IN KM)(RKSN-CHAIBASA)	20			tZ2=	0.35	Compensation	0.70
7>NEXT LONGEST SECTION= (IN KM)(RKSN-GOELKERA)	58			KZ2 Res Comp=	0.70		
8>INFEED RATIO=[I(act)/I(infeed)]	0			KZ2 Angle=	0.00		
9>ARC RESISTANCE=(Pri Value)	20		ZONE-3/4	Z3=	15.80		
10>TOWER- FOOTING RESISTANCE=(Pri Value)	25			Z4(Reverse)=	0.99		
11>TRANSFORMER AT OTHER END S/S=(IN MVA)	70			KZ3/KZ4 Res Comp=	0.70		
12>MAXIMUM LOAD (110% CT)= (IN MVA)	101			KZ3/KZ4Angle=	0.00		
13>X0/X1=R0/R1=	3.1			R3G/R4G=	23.44		
14>SINGLE CKT (S) / DOUBLE CKT (D)=	S			R3Ph/R4Ph=	10.42		
15>ADDITIONAL Dir.O/C,E/F RELAY USED=(YES/NO)	NO			tZ3=	1.00		
16>In	1		Dir.O/C	Char..=	NI		
17> CT SECONDARY=	1			%PLUG SET=	100%		
18>THARMAL CAPACITY[40-75°C](MVA)=	95			TIME SET=	0.21		
19>LOAD IMP..(90% VOLTAGE & [40-75°C]THER.. RATING)	55.02		Dir.E/F	Char..=	NI		
20>MAX LOAD IMP= (Sec)[110% CT RATING with 90% VOLTAGE]	51.96			%PLUG SET=	20%		
				TIME SET=	0.27		
DERIVED VALUES			Non-Dir.O/C	Char..=	DT		
				%PLUG SET=	100%		
A) COMPENSATION (K)=	0.70			TIME SET=	2Sec		
B>MAXIMUM LOADING (IN OHM)= (Sec Value)	51.96305		Non-Dir.E/F	Char..=	DT		
C>IMPEDANCE/REACTANCE UPTO 80% OF OTHER END	9.96			%PLUG SET=	20%		
TRANSFORMER (%Z=12)= (Sec Value)				TIME SET=	2Sec		
D>ARC RESISTANCE=(Sec Value)	6.67						
E>TOWER FOOTING RESISTANCE=(Sec Value)	8.33		LINE	LENGTH=	35		
F>If/In (PHASE FAULT AT 80%OF THE LINE)=	10.81			Z=	4.955183		
G>FIRST STAGE BACK UP O/C & E/F TIME=(In Sec)	0.60			ANGLE=	68		
H>If/In (EARTH FAULT AT 80% OF THE LINE)=	54.03						
I>Time- (ZONE-2)= (In Sec)	0.35						
J>Time- (ZONE-3)= (In Sec)	1.00						
K>FAULT MVA AT 80% OF THE LINE=	989						

LINE PARAMERERS	
400 KV---"R"	FALSE
400 KV---"X"	FALSE
400 KV---"Z"	FALSE
220 KV---"R"	FALSE
220 KV---"X"	FALSE
220 KV---"Z"	FALSE
132 KV---"R"	0.1402
132 KV---"X"	0.401
132 KV---"Z"	0.42473

OVER CURRENT TIME 220kV Chandil S/s

RELAY	CHAR...	NAME	CTR	P.S.M	T.S.M	Pry Fault (A)	I--(FAULT)	T--(CAL)
NI	3	LINE#1 (HV)	2000	1	0.15	XXX	#VALUE!	#VALUE!
NI	3	LINE#2 (HV)	2000	0.75	0.25	XXX	#VALUE!	#VALUE!
NI	3	LINE#3 (HV)	2000	1	0.2	XXX	#VALUE!	#VALUE!
NI	3	TR-HV #1	800	0.4	0.175	787	2.46	1.363
NI	3	TR-LV #1	800	0.6	0.175	1311	2.73	1.219
NI	3	TR-HV #2	1000	0.5	0.2	787	1.57	3.106
NI	3	TR-LV #2	1000	0.75	0.2	1311	1.75	2.517
NI	3	TR-HV #3	1000	0.5	0.2	1573	3.15	1.219
NI	3	TR-LV #3	1000	1	0.2	2622	2.62	1.453
NI	3	LINE#1 (LV)	600	1	0.22	5244	8.74	0.702
NI	3	LINE#2 (LV)	800	1	0.15	XXX	#VALUE!	#VALUE!
NI	3	LINE#3 (LV)	800	1	0.15	XXX	#VALUE!	#VALUE!
				100%	110%	800-1	1000-1	
		160	HV	419	461	0.58	0.46	
			LV	699	769	0.96	0.77	
		315	HV	454	499	0.62	0.50	
			LV	825	908	1.13	0.91	
							5	0.661
							10	0.251
							15	0.278
							25	0.342
							35	0.419
							40	0.465
							50	0.575

220kV Chandil S/s

BASE MVA=	100
BASE VOLTAGE=	400
Ω/KM=	0.4
HV LINES=	0
TRANSFORMER=	3
LV LINES=	1

					HV	LV	HV	LV	HV	LV				
		220	220	220	220	132	220	132	220	132	132	132	132	132
	SOURCE	LINE-1	LINE-2	LINE-3	TR#1		TR#2		TR#3		LINE-1	LINE-2	LINE-3	FAULT
(actual fault level)	MVA	(KM)	(KM)	(KM)	MVA	(%) IMP	MVA	(%) IMP	MVA	(%) IMP	(KM)	(KM)	(KM)	(Ω)
5403	5403	1E-28	1E-13	1E-20	100	12	100	12	200	12	15.2	1E+20	1E+41	0
(Ω)		4E-29	4E-14	4E-21		192		192		96	6.08	4E+19	4E+40	0
PU=	0.018508	8.26446E-32	8.26446E-17	8.26E-24		0.12		0.12		0.06	0.034894	2.3E+17	2.3E+38	0
TOTAL PU=	0.083403													
FAULT MVA=	1199.003													
Req=			8.26446E-32					0.03				0.034894		

OVER CURRENT TIME 220kV HATIA S/s

RELAY	CHAR…	NAME	CTR	P.S.M	T.S.M	Pry Fault (A)	I--(FAULT)	T--(CAL)
NI	3	LINE#1 (HV)	2000	1	0.15	XXX	#VALUE!	#VALUE!
NI	3	LINE#2 (HV)	2000	0.75	0.25	XXX	#VALUE!	#VALUE!
NI	3	LINE#3 (HV)	2000	1	0.2	XXX	#VALUE!	#VALUE!
NI	3	TR-HV #1	600	0.75	0.175	880	1.96	1.831
NI	3	TR-LV #1	800	0.9	0.175	1467	2.04	1.725
NI	3	TR-HV #2	600	0.75	0.175	880	1.96	1.831
NI	3	TR-LV #2	800	0.9	0.175	1467	2.04	1.725
NI	3	TR-HV #3	1200	0.375	0.175	880	1.96	1.831
NI	3	TR-LV #3	800	0.9	0.175	1467	2.04	1.725
NI	3	LINE#1 (LV)	600	1	0.18	4402	7.34	0.626
NI	3	LINE#2 (LV)	800	1	0.15	XXX	#VALUE!	#VALUE!
NI	3	LINE#3 (LV)	800	1	0.15	XXX	#VALUE!	#VALUE!
				100%	110%	800-1	1000-1	
		160	HV	419	461	0.58	0.46	
			LV	699	769	0.96	0.77	
		315	HV	454	499	0.62	0.50	
			LV	825	908	1.13	0.91	
							5	1.205
							10	0.251
							15	0.278
							25	0.342
							35	0.419
							40	0.465
							50	0.575

220kV Hatia S/s

BASE MVA=	100
BASE VOLTAGE=	132
Ω/KM=	0.4
HV LINES=	0
TRANSFORMER=	3
LV LINES=	1

					HV	LV	HV	LV	HV	LV				
		220	220	220	220	132	220	132	220	132	132	132	132	132
	SOURCE	LINE-1	LINE-2	LINE-3	TR#1		TR#2		TR#3		LINE-1	LINE-2	LINE-3	FAULT
(actual fault level)	MVA	(KM)	(KM)	(KM)	MVA	(%) IMP	MVA	(%) IMP	MVA	(%) IMP	(KM)	(KM)	(KM)	(Ω)
4329	4329	1E-28	1E-13	1E-20	150	12	150	12	150	12	21.6	1E+20	1E+41	0
(Ω)		4E-29	4E-14	4E-21		13.9392		13.9392		13.9392	8.64	4E+19	4E+40	0
PU=	0.0231	8.26446E-32	8.26446E-17	8.26E-24		0.08		0.08		0.08	0.049587	2.3E+17	2.3E+38	0
TOTAL PU=	0.099353													
FAULT MVA=	1006.507													
Req=			8.26446E-32					0.02667				0.049587		

OVER CURRENT TIME 220kV RCP S/s

RELAY	CHAR…	NAME	CTR	P.S.M	T.S.M	Pry Fault (A)	I--(FAULT)	T--(CAL)
NI	3	LINE#1 (HV)	2000	1	0.15	XXX	#VALUE!	#VALUE!
NI	3	LINE#2 (HV)	2000	0.75	0.25	XXX	#VALUE!	#VALUE!
NI	3	LINE#3 (HV)	2000	1	0.2	XXX	#VALUE!	#VALUE!
NI	3	TR-HV #1	600	0.75	0.2	1736	3.86	1.033
NI	3	TR-LV #1	600	1.1	0.2	2893	4.38	0.943
NI	3	TR-HV #2	600	0.75	0.2	1736	3.86	1.033
NI	3	TR-LV #2	600	1.1	0.2	2893	4.38	0.943
NI	3	TR-HV #3	600	0.75	0.2	1736	3.86	1.033
NI	3	TR-LV #3	600	1.1	0.2	2893	4.38	0.943
NI	3	LINE#1 (LV)	600	1	0.21	8679	14.46	0.541
NI	3	LINE#2 (LV)	800	1	0.15	XXX	#VALUE!	#VALUE!
NI	3	LINE#3 (LV)	800	1	0.15	XXX	#VALUE!	#VALUE!
				100%	110%	800-1	1000-1	
		160	HV	419	461	0.58	0.46	
			LV	699	769	0.96	0.77	
		315	HV	454	499	0.62	0.50	
			LV	825	908	1.13	0.91	
							5	0.492
							10	0.251
							15	0.278
							25	0.342
							35	0.419
							40	0.465
							50	0.575

220kV Ramchandrapur S/s

BASE MVA=	100
BASE VOLTAGE=	132
Ω/KM=	0.4
HV LINES=	0
TRANSFORMER=	3
LV LINES=	1

					HV	LV	HV	LV	HV	LV				
		220	220	220	220	132	220	132	220	132	132	132	132	132
	SOURCE	LINE-1	LINE-2	LINE-3	TR#1		TR#2		TR#3		LINE-1	LINE-2	LINE-3	FAULT
(actual fault level)	MVA	(KM)	(KM)	(KM)	MVA	(%) IMP	MVA	(%) IMP	MVA	(%) IMP	(KM)	(KM)	(KM)	(Ω)
6873	6873	1E-28	1E-13	1E-20	150	12	150	12	150	12	4	1E+20	1E+41	0
(Ω)		4E-29	4E-14	4E-21		13.9392		13.9392		13.9392	1.6	4E+19	4E+40	0
PU=	0.01455	8.26446E-32	8.26446E-17	8.26E-24		0.08		0.08		0.08	0.009183	2.3E+17	2.3E+38	0
TOTAL PU=	0.050399													
FAULT MVA=	1984.163													
Req=			8.26446E-32					0.02667				0.009183		

Annexure-7.2

Over current Settings of 220/132 kV Transformers of JUSNL

1. 220/132 kV Chandil S/s: 4x100 MVA Auto-transformers

Considerations: 220 kV Fault level: 5403 MVA

Recommended settings for all 100 MVA Auto-transformer:			
	HV side (220 kV)	LV side (132 kV)	Remarks
Available CT Ratio	600/1	600/1	
PSM	0.4	0.6	Standard Inverse Characteristics
TSM	0.175	0.175	
High Set	10	8	To be implemented if directional feature is available.

2. 220/132 kV Ramchandrapur S/s: 3x150 MVA Auto-transformers

Considerations: 220 kV Fault level: 6873 MVA

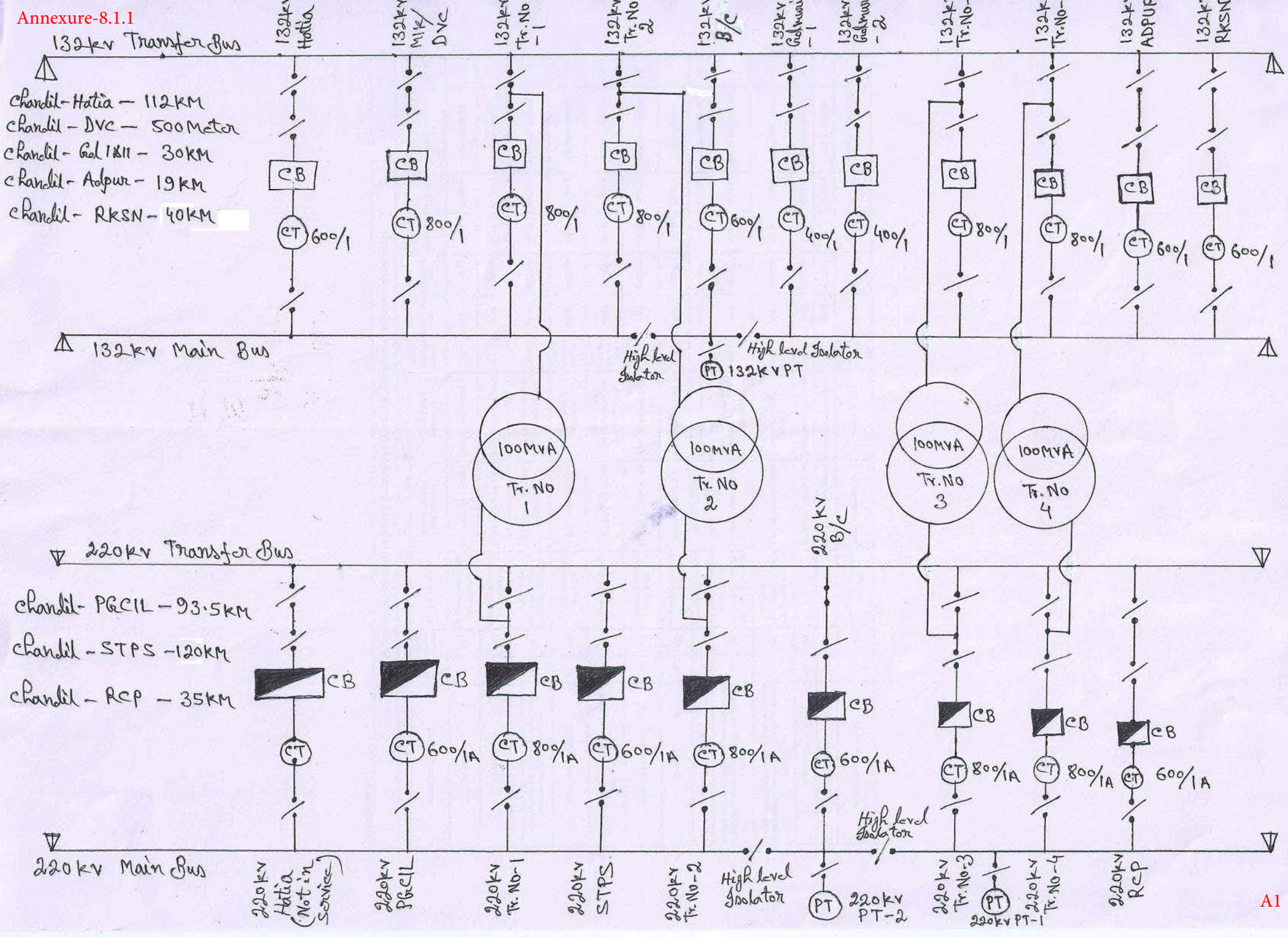
Recommended settings for all 150 MVA Transformer:			
	HV side (220 kV)	LV side (132 kV)	Remarks
Available CT Ratio	600/1	600/1	
PSM	0.75	1.1	Standard Inverse Characteristics
TSM	0.2	0.1	
High Set	10	8	To be implemented if directional feature is available.

3. 220/132 kV Hatia-II S/s: 3x150 MVA Auto-transformers

Considerations: 220 kV Fault level: 4329 MVA

Recommended settings for 150 MVA Transformer I & II:			
	HV side (220 kV)	LV side (132 kV)	Remarks
Available CT Ratio	600/1	800/1	
PSM	0.75	0.9	Standard Inverse Characteristics
TSM	0.175	0.175	
High Set	10	8	To be implemented if directional feature is available.
Recommended settings for 150 MVA Transformer III:			
Available CT Ratio	1200/1	800/1	
PSM	0.375	0.9	Standard Inverse Characteristics
TSM	0.175	0.175	
High Set	10	8	To be implemented if directional feature is available.

Annexure-8.1.1



A1

Annexure- 8.1.2

Sl. No.	Name of Feeders	Name of Equipment	Details of equipment	Year of Manufacturing
1	220Kv PGCIL	CT	R Phase	2009
		CT	Y Phase	2006
		CT	B Phase	2007
2	220Kv RCP	CT	R Phase	1996
		CT	Y Phase	2006
		CT	B Phase	1996
3	220Kv STPS	CT	R Phase	2013
		CT	Y Phase	2013
		CT	B Phase	2013
4	100 MVA Tr-I (220kv SIDE)	CT	R Phase	2005
		CT	Y Phase	1981
		CT	B Phase	1981
5	100 MVA Tr-II (220kv SIDE)	CT	R Phase	1975
		CT	Y Phase	1975
		CT	B Phase	1975
6	100 MVA Tr-III (220kv SIDE)	CT	R Phase	1975
		CT	Y Phase	1975
		CT	B Phase	1975
7	100 MVA Tr-Iv (220kv SIDE)	CT	R Phase	2013
		CT	Y Phase	2013
		CT	B Phase	2013
8	220Kv B/C	CT	R Phase	1981
		CT	Y Phase	1981
		CT	B Phase	2007
9	132KV Hatia (IDEAL BAY)	CT	R Phase	2005
		CT	Y Phase	2005
		CT	B Phase	2005
10	132Kv MIK	CT	R Phase	1981
		CT	Y Phase	1981
		CT	B Phase	1981
11	132Kv Golmuri-I	CT	R Phase	1984
		CT	Y Phase	1984
		CT	B Phase	1984
12	132Kv Golmuri-II	CT	R Phase	1992
		CT	Y Phase	1992
		CT	B Phase	1992
13	100 MVA Tr-I (132kv SIDE)	CT	R Phase	2007
		CT	Y Phase	1981
		CT	B Phase	1981
14	100 MVA Tr-II (132kv SIDE)	CT	R Phase	1975
		CT	Y Phase	1975
		CT	B Phase	1975
15	100 MVA Tr-III (132kv SIDE)	CT	R Phase	1975
		CT	Y Phase	1975
		CT	B Phase	1975
16	100 MVA Tr-Iv (132kv SIDE)	CT	R Phase	2007
		CT	Y Phase	2007
		CT	B Phase	2012
17	132Kv B/C	CT	R Phase	1997
		CT	Y Phase	1997
		CT	B Phase	1986
18	132Kv RKSN	CT	R Phase	2013
		CT	Y Phase	2013
		CT	B Phase	2013
19	132Kv ADPUR	CT	R Phase	1997
		CT	Y Phase	1997
		CT	B Phase	1986
		PT	R Phase	1981

20	132 KV Main Bus PT	PT	Y Phase	1981
		PT	B Phase	1981
21	220 KV Main Bus PT-I	PT	R Phase	1984
		PT	Y Phase	1984
		PT	B Phase	1984
22	220 KV Main Bus PT-II	PT	R Phase	2012
		PT	Y Phase	2012
		PT	B Phase	2012
23	220Kv PGCIL	Breaker		2005
24	220Kv RCP	Breaker		2006
25	220Kv STPS	Breaker		2014
26	100 MVA Tr-I (132kv SIDE)	Breaker		1987
27	100 MVA Tr-II (132kv SIDE)	Breaker		2005
28	100 MVA Tr-III (132kv SIDE)	Breaker		1993
29	100 MVA Tr-Iv (132kv SIDE)	Breaker		2013
30	220Kv B/C	Breaker		1993
31	132KV Hatia (IDEAL BAY)	Breaker		2005
32	132Kv MIK	Breaker		2008
33	132Kv Golmuri-I	Breaker		2008
34	132Kv Golmuri-II	Breaker		2008
35	100 MVA Tr-I (132kv SIDE)	Breaker		2001
36	100 MVA Tr-II (132kv SIDE)	Breaker		2008
37	100 MVA Tr-III (132kv SIDE)	Breaker		2008
38	100 MVA Tr-Iv (132kv SIDE)	Breaker		2008
39	132Kv B/C	Breaker		2008
40	132Kv RKSN	Breaker		2005

41	132Kv ADPUR	Breaker		2008
42	220/132 KV 100 MVA Tr.-I	Transformer		2001
43	220/132 KV 100 MVA Tr.-II	Transformer		2006
44	220/132 KV 100 MVA Tr.-III	Transformer		1966
45	220/132 KV 100 MVA Tr.-IV	Transformer		2013

Annexure-8.1.3

CT details of 220/132 KV Chandil GSS

Sl. No.	Name of Feeders	Comprehensive C.T. details	Make	CT ratio	Connected Ratio	Core No.	Class of accuracy	Protection class use	Knee voltage
1	220Kv PGCIL	R Phase	Areva	1200/600/300/150/1A	600/1Amp	4 core	0.2	PS	
		Y Phase	Areva	1200/600/300/150/1A			0.2	PS	
		B Phase	BHEL	1200/600/300/150/1A			0.2	PS	
2	220Kv RCP	R Phase	Balteau	1200/600/300/150/1A	600/1Amp	4 core	1	PS	
		Y Phase	Areva	1200/600/300/150/1A			0.2	PS	
		B Phase	Balteau	1200/600/300/150/1A			1	PS	
3	220Kv STPS	R Phase	SCT LTD.(UP)	600/300/150/1A	600/1Amp	3 core	0.5	PS	
		Y Phase	SCT LTD.(UP)	600/300/150/1A			0.5	PS	
		B Phase	SCT LTD.(UP)	600/300/150/1A			0.5	PS	
4	100 MVA Tr-I (220kv SIDE)	R Phase	BHEL	800/400/200/1A	800/1 Amp	3 core	0.2	PS	
		Y Phase	Balteau	800/400/200/1A			1	PS	
		B Phase	Balteau	800/400/200/1A			1	PS	
5	100 MVA Tr-II (220kv SIDE)	R Phase	Balteau	800/400/200/1A	800/1 Amp	3 core	1	PS	
		Y Phase	Balteau	800/400/200/1A			1	PS	
		B Phase	Balteau	800/400/200/1A			1	PS	
6	100 MVA Tr-III (220kv SIDE)	R Phase	Balteau	800/400/200/1A	800/1 Amp	3 core	1	PS	
		Y Phase	Balteau	800/400/200/1A			1	PS	
		B Phase	Balteau	800/400/200/1A			1	PS	
7	100 MVA Tr-Iv (220kv SIDE)	R Phase	BHEL	800/400/200/1A	800/1 Amp	3 core	0.5	PS	
		Y Phase	BHEL	800/400/200/1A			0.5	PS	
		B Phase	BHEL	800/400/200/1A			0.5	PS	
8	220Kv B/C	R Phase	Balteau	1200/600/300/150/1A	600/1 Amp	4 core	1	PS	
		Y Phase	Balteau	1200/600/300/150/1A		4 core	1	PS	
		B Phase	SCT LTD.(UP)	1200/600/300/1A		3 core	0.5	PS	
9	132KV Hatia (IDEAL	R Phase	SCT LTD.(UP)	600/300/150/1A	600/1A	3 core	0.5	PS	
		Y Phase	SCT LTD.(UP)	600/300/150/1A			0.5	PS	
		B Phase	SCT LTD.(UP)	600/300/150/1A			0.5	PS	
10	132Kv MIK	R Phase	ASEA	800/400/200/1A	800/1A	3 core	1	PS	
		Y Phase	ASEA	800/400/200/1A			1	PS	
		B Phase	ASEA	800/400/200/1A			1	PS	
	132Kv	R Phase	BHEL	400/200/100/1A			1	PS	

11	132Kv Golmuri-I	Y Phase	BHEL	800/400/200/1A	400/1A	3 core	1	PS	
		B Phase	BHEL	800/400/200/1A			1	PS	
12	132Kv Golmuri-II	R Phase	SCT LTD.(UP)	400/200/100/1A	400/1A	3 core	1	PS	
		Y Phase	SCT LTD.(UP)	400/200/100/1A			1	PS	
		B Phase	SCT LTD.(UP)	400/200/100/1A			1	PS	
13	100 MVA Tr-I	R Phase	SCT LTD.(UP)	800/400/200/1A	800/1A	3 core	0.5	PS	
		Y Phase	ASEA	800/400/200/1A			1	PS	
		B Phase	ASEA	800/400/200/1A			1	PS	
14	100 MVA Tr-II	R Phase	ASEA	800/400/200/1A	800/1A	3 core	1	PS	
		Y Phase	ASEA	800/400/200/1A			1	PS	
		B Phase	ASEA	800/400/200/1A			1	PS	
15	100 MVA Tr-III	R Phase	ASEA	800/400/200/1A	800/1A	3 core	1	PS	
		Y Phase	ASEA	800/400/200/1A			1	PS	
		B Phase	ASEA	800/400/200/1A			1	PS	
16	100 MVA Tr-Iv	R Phase	Victrans eng.	800/400/200/1A	800/1A	3 core	0.5	PS	
		Y Phase	Victrans eng.	800/400/200/1A			0.5	PS	
		B Phase	SCT LTD.(UP)	800/400/200/1A			0.5	PS	
17	132Kv B/C	R Phase	SCT LTD.(UP)	1200/600/1A	600/1A	2 core	1	PS	
		Y Phase	SCT LTD.(UP)	1200/600/1A		2 core	1	PS	
		B Phase	Brown Bowri	600/300/150/1A		3 core	1	PS	
18	132Kv RKSN	R Phase	SCT LTD.(UP)	1200/600/300/1A	600/1A	3 core	0.2	PS	
		Y Phase	SCT LTD.(UP)	1200/600/300/1A			0.2	PS	
		B Phase	SCT LTD.(UP)	1200/600/300/1A			0.2	PS	
19	132Kv ADPUR	R Phase	Brown Bowri	600/300/150/1A	600/1A	3 core	1	PS	
		Y Phase	Brown Bowri	600/300/150/1A			1	PS	
		B Phase	Brown Bowri	600/300/150/1A			1	PS	

Annexure-8.1.4

VT details of 220/132 KV Chandil GSS

Sl. No.	V.T. details	Comprehensive P.T. details	Make	Core No.	Class of accuracy
1	132 KV Main Bus PT	R Phase	ASEA	4 Core	5
		Y Phase	ASEA	4 Core	5
		B Phase	ASEA	4 Core	5
2	220 KV Main Bus PT-I	R Phase	Balteau	2 Core	1/5
		Y Phase	Balteau	2 Core	1/5
		B Phase	Balteau	2 Core	1/5
3	220 KV Main Bus PT-II	R Phase	SCT LTD.(UP)	3 Core	0.2/3P/3P
		Y Phase	SCT LTD.(UP)	3 Core	0.2/3P/3P
		B Phase	SCT LTD.(UP)	3 Core	0.2/3P/3P

Annexure-8.1.5

Fault lelvel at JUSNL Sub-stations

Bus Name	Bus Voltage	3 Ph Fault current	SLG Fault current
CHANDIL 220	220	14514	9735
RAMCHANDRAPUR 220	220	18450	15443
CHANDIL	132	18105	12652
ADITPUR	132	12098	8624
RAMCHANDRAPUR 132	132	13000	11126

Note: Data recieved from ERLDC

TRANSFORMERS DETAILS OF GSS CHANDIL -1

1. 100MVA TR NO.1:- EMCO TRANSFORMER (MAHARASTRA).
   YEAR OF MANUFACTURE-2000-2001
   Voltage: -220/132/33kv
   100/80/50MVA
   Impedance voltage
   HV-LV tap1-7.49%, tap5 (normal)-7.41%,tap17-7.56%
2. 100MVA TR-2:- KANOHAR ELECTRICALS LTD, MERUT (INDIA).
   YEAR OF MANUFACTURE-2006
   Voltage: -220/132/33kv
   100/80/50MVA
   Impedance voltage
   HV-LV tap1-7.03%, tap5 (normal)-6.98%,tap17-7.08%
   HV-TER -25.54%, LV-TER- 15.99%
3. 100MVA TR- 3:- CANADIAN WESTING HOUSE CO.LTD.HAMILTON CANADA.
   YEAR OF MANUFACTURE-2006
   Voltage: -220/132/33k
   100/80/60MVA
   Impedance voltage
   HV-LV-7.4%, HV-TV-25.5%,LV-TV-17.4% (at normal tap)
4. 100MVA TR 4:- TRANSFORMERS & RECTIFIERS (INDIA) LTD, VILL – CHANGODAR , TA – SANAND,DIST –AHMEDABAD (GUJARAT).
   YEAR OF MANUFACTURE-2013
   Voltage: -220/132/33k
   100/80/60MVA
   Impedance voltage
   HV-IV-7.22%, IV-LV-16.19%,HV-LV-25.36% (at normal tap no.5)

   HV-IV-7.35% (at tap no.1)

   HV-IV-7.27% (at tap no.17)

24/11/15

Assistant Excutive Engineer
Transmission Sub-Division
Chandil - I

Annexure-8.1.7

Cable details used for C.T. connection of Chandil S/s

Sl No.	Name of Feeder	No. of Cable use C.T.		Cross section of cable	Length of cable J/B to C/R panel
1	Hatia	10 Core	1 No.	2.5 Sq. mm	115 mtr
2	PGCIL	18	1	2.5 Sq. mm	137 mtr
3	220 KV Tr.-I	4	3	2.5 Sq. mm	148 mtr
4	STPS	20	1	2.5 Sq. mm	159 mtr
5	220 KV Tr.-II	4	3	2.5 Sq. mm	181 mtr
6	220 KV B/C	4	3	2.5 Sq. mm	214 mtr
7	220 KV Tr.-III	4	3	2.5 Sq. mm	226 mtr
8	220 KV Tr.-IV	18,10,4,2	1,1,1,4	2.5 Sq. mm	248 mtr
9	220 KV RCP	4	3	2.5 Sq. mm	270 mtr
10	132 KV Hatia	12	1	2.5 Sq. mm	104 mtr
11	MIK	12	1	2.5 Sq. mm	106 mtr
12	132 KV Tr.-I	4	3	2.5 Sq. mm	119 mtr
13	132 KV Tr.-II	4	3	2.5 Sq. mm	130 mtr
14	132 KV B/C	4	3	2.5 Sq. mm	152 mtr
15	GOL-I	12	1	2.5 Sq. mm	163 mtr
16	GOL-II	12	1	2.5 Sq. mm	176 mtr
17	132 KV Tr.-III	4	3	2.5 Sq. mm	186 mtr
18	132 KV Tr.-IV	12,6,2	1,1,2	2.5 Sq. mm	218 mtr
19	ADPUR	6	2	2.5 Sq. mm	253 mtr
20	RKSN	6	2	2.5 Sq. mm	285 mtr

Annexure-8.1.8

Measurement of Earth Resistance Name of G/S/S = 220/132KV Chandil

132KV Side

SL NO	Name of Earth Pit	Earth Resistance in Ohm	Remarks
1	132KV Hatia	2 Ohm	
2	132KV Maniqui	2 Ohm	
3	132 KV Golmuri-I	1 Ohm	
4	132KV Golmuri-II	0.5 Ohm	
5	132 KV RKSN		

220 KV side

SL NO	Name of Earth Pit	Earth Resistance in Ohm	Remarks
1	220 KV STPS earth pit-1	0.7 ohm	
2	220 KV STPS earth pit-2	0.4 ohm	
3	220KV STPS south side-1	0.6 ohm	
4	220KV STPS south side-2	0.4 ohm	
5	220KV B/C pit 1	0.3 ohm	
6	220KV B/C pit 2	0.4 ohm	

Near Transformer Side

SL NO	Name of Earth Pit	Earth Resistance in Ohm	Remarks
1	Tr.No-1 (132Kv Side)	0.4 ohm	
2	Tr.No-2 (132Kv Side)	0.3 ohm	
3	Tr.No-2 (SST Side)	0.2 ohm	
4	Tr.No-3 (132Kv Side)1	0.3 ohm	
5	Tr.No-3 (132Kv Side)2	0.2 ohm	
6	Tr.No-3 (220Kv Side)	0.2 ohm	
7	Tr.No-4 (132Kv Side)	0.4 ohm	
8	Tr.No-4 (220Kv Side)	0.2 ohm	

Control room Side

SL NO	Name of Earth Pit	Earth Resistance in Ohm	Remarks
1	220 KV Side	0.70 ohm	
2	132 KV Side	0.70 ohm	
3	Near Control Room	0.75 ohm	

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CIRCUIT BREAKER TEST REPORT

Site Name :- Chandil 220/132 kV S/S.
Date of testing :- 10.09.14.
Feeder name :- Transformer-1 (132 kV side).

Name Plate details

Make :- CGL.
Rated Current :- 3150A.
Rated Voltage :- 145 kV.
Serial number :- 137826
Type :- 120-SFM-32A.
Short Time Amps :- 40kA/3sec.

TEST RESULTS :-

A. Operating time (In milli Second) :-

Conditions	R-R'	Y-Y'	B-B'
Closing time	90	89	88
Opening time for trip coil 1	24	24	25
Closing-Opening time for trip coil 1	—	—	—
Opening time for trip coil 2	23	23	24
Closing-Opening time for trip coil 2	—	—	—

Remarks:- ok. for closing & opening. But C-O timing is "0"ms. hence Mechanical Adjustment for closing spring.

	Tested By	Witness By	Witness By
Signature	Akash Agrawal	11/9/14	11/09/14
Name		AEE/TSC	AEE/Chandil-I
Date	10.09.14.		

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CIRCUIT BREAKER TEST REPORT

Site Name :- Chandil 220 KV / 132 KV S/S.
Date of testing :- 10.09.14.
Feeder name :- 220 KV Transformer - 1.

Name Plate details

Make	:- HINDUSTAN BROWN BOVERI	Serial number	:- 1B103398.
Rated Current	:- 3150A.	Type	:- ELF 245 No-2.
Rated Voltage	:- 245 KV	Short Time Amps	:- 40KA/3sec.

TEST RESULTS :-

A. Operating time (In milli Second) :-

Conditions	R-R'	Y-Y'	B-B'
Closing time	117	110	109.
Opening time for trip coil 1	21	21	36
Closing-Opening time for trip coil 1	29	29	31
Opening time for trip coil 2	21	21	36
Closing-Opening time for trip coil 2	29	29	31.

Remarks. OK. No problem found during testing.

	Tested By	Witness By	Witness By
Signature	Avlash Sharma	11/9/14	11/09/14
Name		BEE/TSC	AEE/Chandil-I
Date	11.09.14.		

CIRCUIT BREAKER TEST REPORT

Site Name :- Chandil 220KV / 132KV S/S.
Date of testing :- 11.09.14.
Feeder name :- Transformer-2 (132KV side).

Name Plate details

Make	:-	AREVA.	Serial number	:-	102834.
Rated Current	:-	3150A.	Type	:-	40KA/3sec
Rated Voltage	:-	145KV	Short Time Amps	:-	FK3-1

TEST RESULTS :-

A. Operating time (In milli Second) :-

Conditions	R-R'	Y-Y'	B-B'
Closing time	73	69	69
Opening time for trip coil 1	39	39	39
Closing-Opening time for trip coil 1	69	71	72
Opening time for trip coil 2	40	40	39
Closing-Opening time for trip coil 2	69	71	72.

Remarks: OK. No problem found during testing.

	Tested By	Witness By	Witness By
Signature	Ashok Ghosh	11/09/14	11/09/14.
Name		AEE/TL	AEE/Chandil
Date	11.09.14.		

16.12.15
Electrical Executive E

16/12/15
Assistant

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CIRCUIT BREAKER TEST REPORT

Site Name :- Chandil [220/132 s/s].
Date of testing :- 09.09.14.
Feeder name :- Tranjomer - 3 (132 KV side).

Name Plate details

Make :- CGL.
Rated Current :- 3150A.
Rated Voltage :- 145KV
Serial number :- 26418C
Type :- 120-SFM-32B
Short Time Amps :- 40KA/3sec.

TEST RESULTS :-

A. Operating time (In milli Second) :-

Conditions	R-R'	Y-Y'	B-B'
Closing time	93	94	93
Opening time for trip coil 1	27	26	27
Closing-Opening time for trip coil 1	34	33	34
Opening time for trip coil 2	27	26	27
Closing-Opening time for trip coil 2	34	33	34.

Remarks :- Ok, no problem carried out during testing.

	Tested By	Witness By	Witness By
Signature	[signature]	[signature] 11/9/14	[signature] 11/09/14
Name		AEE/PRC	AEE/Chandil-I
Date	11.09.14.		

CIRCUIT BREAKER TEST REPORT

Site Name :- Chandil 220/132 S/S.
Date of testing :- 09.09.14.
Feeder name :- 132 KV Adityapur Line.

Name Plate details

Make	:- CGL.	Serial number	:- 26417C.
Rated Current	:- 3150A.	Type	:- 120-SFM-32B.
Rated Voltage	:- 145KV.	Short Time Amps	:- 40KA/3sec.

TEST RESULTS :-

A. Operating time (In milli Second) :-

Conditions	R-R'	Y-Y'	B-B'
Closing time	94	97	96
Opening time for trip coil 1	26	24	26
Closing-Opening time for trip coil 1	38	36	38
Opening time for trip coil 2	24	24	26
Closing-Opening time for trip coil 2	38	34	38

Remarks :- ok. No problem carried out during testing.

	Tested By	Witness By	Witness By
Signature	A. Bhattacharya (signature)	(signature) 11/9/14	(signature) 11/09/14
Name		AEE/TRC	AEE/ Khadil-I
Date	11.09.14		

(signature) 16.12.15
Electrical Executive Engineer

(signature) 16/12/15
Assistant Executive Engineer

(20)

CIRCUIT BREAKER TEST REPORT

Site Name :- 220 KV / 132 KV chandil s/s.
Date of testing :- 10.09.14.
Feeder name :- Transformer – 2 [220 KV side].

Name Plate details

Make :- CGL.
Rated Current :- 3150 A.
Rated Voltage :- 245 KV
Serial number :- 201 30 C(R) 201 31 C(Y)
Type :- 201 28 C(B).
Short Time Amps :- 200 – SFM – 40-S 40 KA / 3 sec.

TEST RESULTS :-

A. Operating time (In milli Second) :-

Conditions	R-R'	Y-Y'	B-B'
Closing time	132	125	136
Opening time for trip coil 1	24	22	24.
Closing-Opening time for trip coil 1	31	28	37.
Opening time for trip coil 2	24	22	24
Closing-Opening time for trip coil 2	31	28	37.

Remarks. For closing mechanism adjustment needed.

	Tested By	Witness By	Witness By
Signature	Avinash Sharma.	11/9/14	11/09/14
Name		BCC/TDC	AEE/Chandil-I
Date	11.09.14.		

CIRCUIT BREAKER TEST REPORT

Site Name :- Chandil 220/132 KV S/S.
Date of testing :- 10.09.14.
Feeder name :- 220KV side "Trafo – 3" (Transformer-3).

Name Plate details

Make	:- CGL.	Serial number	:- 6067-C
Rated Current	:- 1600 A.	Type	:- Not visible at site.
Rated Voltage	:- 245 KV	Short Time Amps	:- 40 KA/3 sec.

TEST RESULTS :-

A. Operating time (In milli Second) :-

Conditions	R-R'	Y-Y'	B-B'
Closing time	94	97	84.
Opening time for trip coil 1	24	25	23
Closing-Opening time for trip coil 1	12	14	18
Opening time for trip coil 2	22	25	23.
Closing-Opening time for trip coil 2	12	14	18

Remarks. OK. No Problem found during testing.

	Tested By	Witness By	Witness By
Signature	Amit Ghosh.	[signature] 11/9/14	[signature] 11/09/14
Name		AEE/T&C	AEE/Chandil-1
Date	11.09.14		

[signature] 16-12-15
Electrical Executive Engineer

[signature] 16/12/15
Assistant Excutive Engineer

CIRCUIT BREAKER TEST REPORT

Site Name :- Chandil 220 KV /132 KV S/S.
Date of testing :- 09.09.14.
Feeder name :- Golmuri-1

Name Plate details

Make :- AREVA.
Rated Current :- 3150A.
Rated Voltage :- 145 KV
Serial number :- 102899
Type :- FK3-1
Short Time Amps :- 40 KA /3 Sec.

TEST RESULTS :-

A. Operating time (In milli Second) :-

Conditions	R-R'	Y-Y'	B-B'
Closing time	69	68	71
Opening time for trip coil 1	39	39	40
Closing-Opening time for trip coil 1	62	62	61
Opening time for trip coil 2	39	39	40
Closing-Opening time for trip coil 2	62	62	61

Remark :- Ok. No problem carried out during testing.

	Tested By	Witness By	Witness By
Signature			11/09/14
Name			
Date	11.09.14.	JOE/T&C	AEE/Chandil-I

16.12.15
Electrical Executive Engineer

Assistant Executive Engineer

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CIRCUIT BREAKER TEST REPORT

Site Name :- Dankuni 220/132 kV S/S.
Date of testing :- 09.09.14.
Feeder name :- Kolmuri-2.

Name Plate details

Make :- CGL
Rated Current :- 03150A
Rated Voltage :- 145KV
Serial number :- 264196
Type :- 120SFM-32-B
Short Time Amps :- 40KA/3SR.

TEST RESULTS :-

A. Operating time (In milli Second) :-

Conditions	R-R'	Y-Y'	B-B'
Closing time	91	92	91
Opening time for trip coil 1	29	28	29
Closing-Opening time for trip coil 1	40	41	41
Opening time for trip coil 2	30	29	30
Closing-Opening time for trip coil 2	41	41	41

Remarks :- ok. No problem carried out during testing.

	Tested By	Witness By	Witness By
Signature		11/9/14	11/09/14
Name		SDE/T&C	AEE/Circle-I
Date	11.09.14		

CIRCUIT BREAKER TEST REPORT

Site Name :- Chandil 220 KV / 132 KV S/S.
Date of testing :- 10.09.14.
Feeder name :- Hatia.

Name Plate details

Make	:- CGL.	Serial number	:- 20146C
Rated Current	:- 3150A.	Type	:- 120-SFM-32-B
Rated Voltage	:- 145 KV	Short Time Amps	:- 40 KA / 3Sec.

TEST RESULTS :-

A. Operating time (In milli Second) :-

Conditions	R-R'	Y-Y'	B-B'
Closing time	94	94	93
Opening time for trip coil 1	28	27	28
Closing-Opening time for trip coil 1	45	45	44
Opening time for trip coil 2	28	28	28
Closing-Opening time for trip coil 2	45	45	44

Remarks :- ok. No problem carried out during testing.

	Tested By	Witness By	Witness By
Signature	Ashish Ghosh	11/9/14	11/09/14
Name		AEE/TEC	AEE/Chandil-I
Date	11.09.14.		

16.12.15
Electrical Executive Engineer

16/12/15
Assistant Excutive Engineer

CIRCUIT BREAKER TEST REPORT

Site Name :- Chandil 220 /132 KV S/S.
Date of testing :- 10.09.14.
Feeder name :- Mankui - feeder.

Name Plate details

Make :- AREVA.
Rated Current :- 3150 A.
Rated Voltage :- 145 KV

Serial number :- 102848
Type :- FK3-1
Short Time Amps :- 40KA/3 sec.

TEST RESULTS :-

A. Operating time (In milli Second) :-

Conditions	R-R'	Y-Y'	B-B'
Closing time	70	70	68
Opening time for trip coil 1	37	36	37
Closing-Opening time for trip coil 1	54	54	56
Opening time for trip coil 2	38	37	36
Closing-Opening time for trip coil 2	57	54	56

Remarks:- OK. No problem carried out during testing.

	Tested By	Witness By	Witness By
Signature	Anilesh Ghatak	[signature]	[signature]
Name		11/9/14	11/09/14
Date	11.09.14.	AEE/TRL	AEE/Chandil-I

[signature] 16.12.15 Electrical ...

[signature] 16/12/15 Assistant ...

CIRCUIT BREAKER TEST REPORT

Site Name :- Chandil 220 KV / 132 KV S/S.
Date of testing :- 11.9.14.
Feeder name :- 220 KV (P.G.C.I.L) Line.

Name Plate details

Make	:- CGL.	Serial number	:- 20130C
Rated Current	:- 3150A.	Type	:-
Rated Voltage	:- 245KV	Short Time Amps	:- 40KA/3Sec.

TEST RESULTS :-

A. Operating time (In milli Second) :-

Conditions	R-R'	Y-Y'	B-B'
Closing time	136	133	114.
Opening time for trip coil 1	24	25	25
Closing-Opening time for trip coil 1	37	41	35
Opening time for trip coil 2	24	25	25
Closing-Opening time for trip coil 2	37	41	35

Remarks. Mechanical adjustment needed for closing mechanism.

	Tested By	Witness By	Witness By
Signature			
Name			
Date	11.09.14.	BEE/TSC	AGM/Chandil-I

16/12/15

CIRCUIT BREAKER TEST REPORT

Site Name :- chandi 220/132 KV S/S.
Date of testing :- 11.09.14
Feeder name :- 220 KV Ramchandrapur line.

Name Plate details

Make :- AREVA.		Serial number :-	150420
Rated Current :-	3150A.	Type :-	
Rated Voltage :-	245KV	Short Time Amps :-	40KA/3sec.

TEST RESULTS :-

A. Operating time (In milli Second) :-

Conditions	R-R'	Y-Y'	B-B'
Closing time	70	69	70
Opening time for trip coil 1	42	42	42
Closing-Opening time for trip coil 1	42	42	42
Opening time for trip coil 2	42	42	44
Closing-Opening time for trip coil 2	42	41	44

Remarks: No Problem found during testing.

	Tested By	Witness By	Witness By
Signature			
Name		11/9/14	11/09/14
Date	11.09.14.	AEE/TSC	ADE/Chandil.

16/12/15

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CIRCUIT BREAKER TEST REPORT

Site Name :- Chandil 220/132 S/S.
Date of testing :- 09.09.14.
Feeder name :- 132 KV R.S.S.M

Name Plate details

Make :- CGL
Rated Current :- 3150A.
Rated Voltage :- 145KV.
Serial number :- 20145C
Type :- 120-SFM-32B
Short Time Amps :- 40KA/3sec.

TEST RESULTS :-

A. Operating time (In milli Second) :-

Conditions	R-R'	Y-Y'	B-B'
Closing time	105	105	109.
Opening time for trip coil 1	26	25	23
Closing-Opening time for trip coil 1	42	40	41
Opening time for trip coil 2	26	25	24
Closing-Opening time for trip coil 2	41	44	38

Remarks :- OK. No problem carried out during testing.

	Tested By	Witness By	Witness By
Signature		11/9/14	11/09/14
Name		AEE/TSS	AEE/Chandil-I
Date	11.09.14.		

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CIRCUIT BREAKER TEST REPORT

Site Name :- Chardi 220 KV / 132 S/S.
Date of testing :- 11.09.14.
Feeder name :- 220 KV S.T.P.S Line.

Name Plate details

Make	:- CGL.	Serial number	:- 6070C
Rated Current	:- 1600 A.	Type	:- ~~FK~~
Rated Voltage	:- 245 KV.	Short Time Amps	:- 40 KA / 3 sec

TEST RESULTS :-

A. Operating time (In milli Second) :-

Conditions	R-R'	Y-Y'	B-B'
Closing time	121	114	118
Opening time for trip coil 1	21	22	26
Closing-Opening time for trip coil 1	12	—	19
Opening time for trip coil 2	21	22	26
Closing-Opening time for trip coil 2	12	—	19

Remarks :- "C-O" timing value comes "0"ms every time. for Y-Y' hence its suggest- mechanical adjustment is needed.

	Tested By	Witness By	Witness By
Signature		11/9/14	11/09/14
Name		AEE/Tee	AEE/Chardi-I
Date	11.09.14.		

Annexure-8.1.10

CT/PT earting details

Sl No	Name of GSS	CT earthing details	PT earthing details
1	Chandil	All CT neutral earthing provided in field junction Box.	All PT neutral earthing provided in field junction Box.

Annexure-8.1.11

220 KV PGCIL

Micom P442,
Model- P44291AB6M0550K Serial No-33219527/02/15

Line Length	93.5 ohm
Z1	9.25 ohm
Z2	13.95 ohm
Z3	16.55 ohm
Z4	2.85 ohm
tZ1	0 s
tZ2	300.0 ms
tZ3	600.0 ms
tZ4	1.000 s

Back UP>I

I> 1Directional FWD
I>1 current set= 1.1A
I> Time delay= 1 sec
I> 2Non Directional
I>2 current set= 2A
I>2 Time delay= 100ms

Earth fault O/C

IN> 1Directional FWD
IN>1 current set= 200ma
IN> Time delay= 1 sec
IN> 2Non Directional
IN>2 current set= 300ma
IN>2 Time delay= 2 sec

220 KV STPS

Micom P442,
Model-P44291AB6MO550K,
Serial No-33219526/02/15

Line Length	120 km
Z1	11.85 ohm
Z2	17.70 ohm
Z3	25.05 ohm
Z4	3.7 ohm
tZ1	0 s
tZ2	300.0 ms
tZ3	600.0 ms
tZ4	1.000 s

Back UP>I

I> 1Directional FWD
I>1 current set= 1A
I> Time delay= 400ms
I> 2Non Directional
I>2 current set= 2.5A
I>2 Time delay= 100ms

Earth fault O/C

IN> 1Directional FWD
IN>1 current set= 200ma
IN> Time delay= 300ms
IN> 2Non Directional
IN>2 current set= 300ma
IN>2 Time delay= 100ms

220 KV RCP

Micom P442,
Model- P44291AB6M0550K
Serial No-33219529/02/15

Line Length	35 km
Line Impedance	14.21 ohm
Line Angle	79.3
kz1	1
kz1 Angle	79.3
Z1	4.590 ohm
R1G	8.000 ohm
R1Ph	2.200 ohm
tz1	0s
kz2 Res comp	840.0 m
kz2 Angle	0
Z2	6.820 ohm
R2G	8.000 ohm
R2ph	2.200 ohm
tz2	300.0 ms
kz3/4Res comp	840.0 m
kz3/4 Angle	0
Z3	11.68 ohm
R3G-R4G	8.000 ohm
R3ph-R4ph	2.200 ohm
tZ3	600.00 ms
Z4	1.130 ohm
tZ4	1.000 s

Back UP>I

I> 1Directional FWD
I>1 current set= 1.2A
I> Time delay= 1sec
I> 2Non Directional
I>2 current set= 2.0A
I>2 Time delay= 1sec

Earth fault O/C

IN> 1Directional FWD
IN>1 current set= 200ma
IN> Time delay= 1sec
IN> 2Non Directional
IN>2 current set= 300ma
IN>2 Time delay= 2sec

132 KV RKSN

Micom P442, P442316BMO550K, 31963042/11/11	Model- Serial No-
Line Length	40 km
Line Impedance	8.334
Line Angle	68.2
kz1	820.0m
kz1 Angle-	0
Z1-	6.667 ohm
R1G-	38.11 ohm
R1Ph	19.13 ohm
tz1	0s
kz2 Res comp	820.0m
kz2 Angle	0
Z2	10 ohm
R2G	31.11 ohm
R2ph	19.13 ohm
tz2	300 ms
kz3/4Res comp	820.0 m
kz3/4 Angle	0
Z3	17.9 ohm
R3G-R4G	38.11 ohm
R3ph-R4ph	19.13 ohm
tZ3	1.5 ms
Z4	1.666 ohm
tZ4	1.2 s

Back UP>I

I> 1Directional FWD
I>1 current set= 700ma
I> Time delay= 2 sec
I> 2Non Directional
I>2 current set= 1.5A
I>2 Time delay= 1.4 sec

Earth fault O/C

IN> 1Directional FWD
IN>1 current set= 200ma
IN> Time delay= 2 sec
IN> 2Non Directional
IN>2 current set= 500ma
IN>2 Time delay= 1.4 sec

132 KV ADPUR

Micom P442, Model-
P442316BMO550K, Serial No-
31963040/11/11

Line Length	19 km
Line Impedance	3.959 ohm
Line Angle	68.2
kz1	820.0m
kz1 Angle-	0
Z1-	3.167
R1G-	38.11
R1Ph	19.13
tz1	0s
kz2 Res comp	820
kz2 Angle	0
Z2	4.75
R2G	38.11
R2ph	19.13
tz2	300.0ms
kz3/4Res comp	820.0m
kz3/4 Angle	0
Z3	9.580 ohm
R3G-R4G	38.11 ohm
R3ph-R4ph	19.13 ohm
tZ3	1.00 s
Z4	792.0 m ohm
tZ4	1.200 s

Back UP>I

I> 1Directional FWD
I>1 current set= 700ma
I> Time delay= 2 sec
I> 2Non Directional
I>2 current set= 1.5A
I>2 Time delay= 1.4 sec

Earth fault O/C

IN> 1Directional FWD
IN>1 current set= 200ma
IN> Time delay= 2 sec
IN> 2Non Directional
IN>2 current set= 500ma
IN>2 Time delay= 1.4 sec

132 KV GOL-I

Micom P442,
Model-P44231A2A0300G
Serial No-140311640628002

Line Length	30 km
Line Impedance	4.13 Ohm
Line Angle	70
kz1	819.0m
kz1 Angle-	0
Z1-	3.330 ohm
R1G-	25 ohm
R1Ph	20 ohm
tz1	0s
kz2 Res comp	819.0m
kz2 Angle	0
Z2	5 ohm
R2G	25 ohm
R2ph	20 ohm
tz2	300 ms
kz3/4Res comp	819.0 m
kz3/4 Angle	0
Z3	10.93 ohm
R3G-R4G	25 ohm
R3ph-R4ph	20 ohm
tZ3	1 ms
Z4	0.683 ohm
tZ4	1.2 s

Back UP>I

I> 1Directional FWD
I>1 current set= 850ma
I> Time delay= 1.5 sec

Earth fault O/C

IN> 1Directional FWD
IN>1 current set= 200ma
IN> Time delay= 0.1 TMS

132 KV GOL-II

Micom P442,
Model-P4423111A2A0300G Serial No-140311640628017

Line Length	30 km
Line Impedance	4.13 Ohm
Line Angle	70
kz1	819.0m
kz1 Angle-	0
Z1-	3.330 ohm
R1G-	25 ohm
R1Ph	20 ohm
tz1	0s
kz2 Res comp	819.0m
kz2 Angle	0
Z2	5 ohm
R2G	25 ohm
R2ph	20 ohm
tz2	300 ms
kz3/4Res comp	819.0 m
kz3/4 Angle	0
Z3	10.93 ohm
R3G-R4G	25 ohm
R3ph-R4ph	20 ohm
tZ3	1 ms
Z4	0.683 ohm
tZ4	1.2 s

Back UP>I

I> 1Directional FWD
I>1 current set= 850ma
I> Time delay= 1.5 sec

Earth fault O/C

IN> 1Directional FWD
IN>1 current set= 200ma
IN> Time delay= 0.1 TMS

Name of GSS : - 220/132 KV CHANDIL-1, GSS.
Details:

Name of Feeder – 132 KV B/C			**Remarks**
Line	Length – NA Conductor - ZEBRA		
Panel	Make – ENGLISH ELECTRIC Model – NA	DoM - NA DoC - NA	
Relay	DPR	Make – MICOM Model – P442 Sr. No. - 140311640628003	
	O/C	Make – MICOM Model –P442(P442311A2A0300G Sr. No. - 140311640628003	PSM -1.250A TMS -1.500S
	E/F	Make – MICOM Model –P442(P442311A2A0300G Sr. No. - 140311640628003	PSM -1.250A TMS -1.500S
	LBB	Make – NA Model – NA Sr. No. -NA	PSM -NA TMS -NA
CT	R Ph	Make – SCT LTD Type – O.D.D.T. Current Ratio – 1200/600/1A Rated Voltage – 145KV	Sr. No. – 96/813 DoM - NA DoC - NA
	Y Ph	Make – SCT LTD Type – O.D.D.T. Current Ratio – 1200/600/1A Rated Voltage – 145KV	Sr. No. – 96/803 DoM - NA DoC - NA
	B Ph	Make – BROWN BOVRI Type – TMBRK-145 Current Ratio – 600/300/150/1A Rated Voltage –20KA1SEC	Sr. No. – IB069449 DoM - NA DoC - NA
Breaker	Make – CGL LTD. Type – 120-SFM-32-B Rated Voltage – 145KV Rated Current – 3150A Short Time Amp –40KA/3SEC		Serial No. – 26422C DoM - NA DoC - NA
EM	Make – SECURE METERE LTD Model – C3V021 MTR – 600/1A Class –0.2S		Serial No. –BEBOO387 DoM - NA DoC - NA

Name of GSS : - 220/132 KV CHANDIL-1, GSS.
Details:

Name of Feeder – 132 KV RKSN			**Remarks**
Line	Length – 40 Conductor - PANTHER		
Panel	Make – ENGLISH ELECTRIC Model – NA	DoM - NA DoC - NA	
Relay	DPR	Make –ALSTOM Model – P430 Sr. No. – P4309893020MDB000	
	O/C	Make – ALSTOM(MICOM) Model – P430 Sr. No. –P4309893020MDB000	PSM -0.80IN TMS -0.30SEC
	E/F	Make – ALSTOM(MICOM) Model – P430 Sr. No. –P4309893020MDB000	PSM -1.20IN TMS -0.20SEC
	LBB	Make – NA Model – NA Sr. No. -NA	PSM -NA TMS -NA
CT	R Ph	Make – SCT LTD. Type – O.D.D.T Current Ratio – 1200/600/300/1A Rated Voltage – 145KV	Sr. No. -2010/667 DoM - NA DoC - NA
	Y Ph	Make – NA Type – NA Current Ratio – 1200/600/300/1A Rated Voltage –NA	Sr. No. - NA DoM - NA DoC - NA
	B Ph	Make – SCT LTD. Type – O.D.D.T Current Ratio – 1200/600/300/1A Rated Voltage – 145KV	Sr. No. -2010/665 DoM - NA DoC - NA
Breaker	Make – CGL Type – 120-SFM-32B Rated Voltage – 145KV Rated Current – 3150A Short Time Amp –40KA/3SEC	Serial No. – 20145C DoM - NA DoC - NA	
EM	Make – SECURE METER LTD. Model – C3V021 MTR – 600/1A Class –0.2S	Serial No. – BEB00382 DoM -NA DoC - NA	

Name of GSS : - 220/132 KV CHANDIL-1, GSS.
Details:

Name of Feeder – 132KV GOL-II			**Remarks**
Line	Length – 33KV Conductor - PANTHER		
Panel	Make – ENGLISH ELECTRIC Model – NA	DoM - NA DoC - NA	
Relay	DPR	Make – MICOM Model – P442311A2A0300G Sr. No. - 140311640628017	
	O/C	Make – MICOM Model – P442311A2A0300G Sr. No. - 140311640628017	PSM -1.250A TMS -1.500SEC
	E/F	Make – MICOM Model – P442311A2A0300G Sr. No. - 140311640628017	PSM -200mA TMS -0.100SEC
	LBB	Make – NA Model –NA Sr. No. -NA	PSM -NA TMS -NA
CT	R Ph	Make – SCT LTD. Type – O.D.D.T. Current Ratio – 400/200/100/1A Rated Voltage –145KA	Sr. No. – 2003/191 DoM - NA DoC -NA
	Y Ph	Make – SCT LTD. Type – O.D.D.T. Current Ratio – 400/200/100/1A Rated Voltage –145KA	Sr. No. – 2003/192 DoM - NA DoC -NA
	B Ph	Make – SCT LTD. Type – O.D.D.T. Current Ratio – 400/200/100/1A Rated Voltage –145KA	Sr. No. – 2003/191 DoM - NA DoC -NA
Breaker	Make – CGL LTD. Type – 120-SFM-32-B Rated Voltage – 145KV Rated Current – 3150A Short Time Amp –40KA/3SEC	Serial No. – 26419C DoM - NA DoC - NA	
EM	Make – SECURE METERS LTD Model – E3V021 MTR – 800/1A Class –0.2S	Serial No. – JSE00002 DoM - NA DoC - NA	

Details:

Name of Feeder – 132KV GOL-1			**Remarks**
Line	Length – 33KV Conductor - PANTHER		
Panel	Make – ENGLISH ELECTRIC Model – NA	DoM - NA DoC - NA	
Relay	DPR	Make – MICOM Model – P442 (P44231182A0300G) Sr. No. – 062802C	
	O/C	Make – MICOM Model – P442(P44231182A0) Sr. No. - 0628002	PSM -1.250A TMS -1.500S
	E/F	Make – MICOM Model – P442(P44231182A0) Sr. No. - 0628002	PSM -200.0mA TMS -0.100SEC
	LBB	Make – NA Model – NA Sr. No. - NA	PSM -NA TMS -NA
CT	R Ph	Make – BHEL LTD. Type – NA Current Ratio – 400/200/100/1A Rated Voltage – 145KV	Sr. No. - 6142241 DoM -NA DoC – NA
	Y Ph	Make – BHEL LTD. Type – NA Current Ratio – 800/400/200/1A Rated Voltage – 145KV	Sr. No. - 2208749 DoM -NA DoC – NA
	B Ph	Make – BHEL LTD. Type – NA Current Ratio – 800/400/200/1A Rated Voltage – 145KV	Sr. No. - 2208730 DoM -NA DoC – NA
Breaker	Make – AREVA Type – FK3-1 Rated Voltage – 145KV Rated Current – 3150A Short Time Amp –40KA/3SEC	Serial No. – 102829 DoM - NA DoC - NA	
EM	Make – SECURE METER LTD. Model – E3V021 MTR – 400/1A Class –0.2S	Serial No. – JSE00022 DoM - NA DoC - NA	

Name of GSS : - 220/132 KV CHANDIL-1, GSS.
Details:

Name of Feeder – 132 KV MIK			**Remarks**
Line	Length – NA Conductor - ZEBRA		
Panel	Make – ENGLISH ELECTRIC Model – NA	DoM - NA DoC - NA	
Relay	DPR	Make – NA Model –NA Sr. No. - NA	
	O/C	Make – ENGLISH ELECTRIC Model – CAG(SPECM3BF45B)) Sr. No. – M162955	PSM -2 TMS -2SEC
	E/F	Make – ENGLISH ELECTRIC Model – CAG(SPECM3BF45B)) Sr. No. – M162955	PSM -0.2 TMS -0.2SEC
	LBB	Make – NA Model – NA Sr. No. -NA	PSM -NA TMS -NA
CT	R Ph	Make – ASEA LTD. Type – MBA-145A3 Current Ratio – 200/400/800/1A Rated Voltage –132KV	Sr. No. - 6069/612 DoM - NA DoC - NA
	Y Ph	Make – NA Type – NA Current Ratio –200/400/800/1A Rated Voltage –NA	Sr. No. - NA DoM - NA DoC - NA
	B Ph	Make – ASEA LTD. Type – MBA-145A3 Current Ratio – 200/400/800/1A Rated Voltage –132KV	Sr. No. - 6069/611 DoM - NA DoC - NA
Breaker	Make – AREVA LTD Type – FK3-1 Rated Voltage – 145KV Rated Current – 3150A Short Time Amp –40KA/3SEC	Serial No. – 102848 DoM -NA DoC - NA	
EM	Make – SECURE METERE LTD Model – E3V021 MTR – 800/1A Class –0.2S	Serial No. – JSB44823 DoM - NA DoC - NA	

Name of GSS : - 220/132 KV CHANDIL-1, GSS.
Details:

Name of Feeder – 132 KV HATIA	**Remarks**

Line	Length – 82 Conductor - ZEBRA			
Panel	Make – EASUN REYROLLE LTD Model –NA		DoM - NA DoC - NA	
Relay	DPR	Make – SEL Model – SEL-311C Sr. No. - NA		
	O/C	Make – EASUN REYROLL Model – 2TJMI2 Sr. No. – HR0802036	PSM – 0.75 TMS -0.2 SEC	
	E/F	Make – EASUN REYROLL Model – 2TJMI2 Sr. No. –HR0802036	PSM -0.2 TMS -0.1 SEC	
	LBB	Make – NA Model – NA Sr. No. -NA	PSM -NA TMS -NA	
CT	R Ph	Make – SCT LTD Type –O.D.D.T Current Ratio – 600/300/150/1A Rated Voltage – 145 KV	Sr. No. - 2005/1145 DoM -NA DoC - NA	
	Y Ph	Make – SCT LTD Type –O.D.D.T Current Ratio – 600/300/150/1A Rated Voltage – 145 KV	Sr. No. - 2005/1142 DoM -NA DoC - NA	
	B Ph	Make – SCT LTD Type –O.D.D.T Current Ratio – 600/300/150/1A Rated Voltage – 145 KV	Sr. No. - 2005/1146 DoM -NA DoC - NA	
Breaker	Make – CGL Type – 120-SFM-32B Rated Voltage – 145KV Rated Current – 3150A Short Time Amp –40KA/3SEC		Serial No. – 20146C DoM - NA DoC - NA	
EM	Make – SECURE METER LTD Model – E3MO21 MTR –150/1A Class –0.2S		Serial No. – KAU08740 DoM - NA DoC -NA	

Name of GSS : - 220/132 KV CHANDIL-1, GSS.
Details:

Name of Feeder – 132 KV TR.3			Remarks
Line	Length – NA Conductor - ZEBRA		
Panel	Make – ASEA Model – NA	DoM - NA DoC - NA	
Relay	DPR	Make – NA Model – NA Sr. No. - NA	
	O/C	Make – ASEA Model – NA Sr. No. - NA	PSM -0.30 TMS -0.6SEC
	E/F	Make – ASEA Model – NA Sr. No. -NA	PSM -0.2 TMS -0.4SEC
	LBB	Make – MICOM Model – P127 Sr. No. -140422340815004	PSM -0.50 TMS -0.50SEC
CT	R Ph	Make – ASEA Type – 1MBA-145A3 Current Ratio – 200/400/800/1A Rated Voltage –132KV	Sr. No. – 6069/635 DoM - NA DoC - NA
	Y Ph	Make – ASEA Type – 1MBA-145A3 Current Ratio – 200/400/800/1A Rated Voltage –132KV	Sr. No. – 6069/634 DoM - NA DoC - NA
	B Ph	Make – ASEA Type – 1MBA-145A3 Current Ratio – 200/400/800/1A Rated Voltage –132KV	Sr. No. – 6069/640 DoM - NA DoC - NA
Breaker	Make – CGL Type – 120-SFM-32B Rated Voltage – 145KV Rated Current – 3150A Short Time Amp –40KA/3SEC		Serial No. –26418C DoM - NA DoC - NA
EM	Make – SECURE METER Model – E3V021 MTR – 800/1A Class –0.2S		Serial No. – JSE00009 DoM - NA DoC - NA

Name of GSS : - 220/132 KV CHANDIL-1, GSS.
Details:

Name of Feeder – 132 KV TR2	Remarks

Line	Length – NA Conductor - ZEBRA			
Panel	Make – ASEA Model – NA		DoM - NA DoC - NA	
Relay	DPR	Make – NA Model –NA Sr. No. - NA		
	O/C	Make – ASEA Model – NA Sr. No. -NA	PSM -0.3 TMS -0.6S	
	E/F	Make – ASEA Model – NA Sr. No. -NA	PSM -0.2 TMS -0.4S	
	LBB	Make – MICOM Model –P127 Sr. No. -140422340815001	PSM -0.20 IN TMS – 0.50 SEC	
CT	R Ph	Make – ASEA Type – 1MBA-145A3 Current Ratio – 200/400/800/1A Rated Voltage –132KV	Sr. No. – 6069/609 DoM - NA DoC - NA	
	Y Ph	Make – ASEA Type – 1MBA-145A3 Current Ratio – 200/400/800/1A Rated Voltage –132KV	Sr. No. – 6069/610 DoM - NA DoC - NA	
	B Ph	Make – ASEA Type – 1MBA-145A3 Current Ratio – 200/400/800/1A Rated Voltage –132KV	Sr. No. – 6069/608 DoM - NA DoC - NA	
Breaker	Make – AREVA Type – FK3-1 Rated Voltage – 145KV Rated Current – 3150A Short Time Amp –40KA/3SEC		Serial No. – 102834 DoM -NA DoC -NA	
EM	Make – SECURE METER Model – E3V021 MTR – 800/1A Class –0.2S		Serial No. – JSE00007 DoM - NA DoC -NA	

Name of GSS : - 220/132 KV CHANDIL-1, GSS.
Details:

Name of Feeder – 132 KV Tr-1			**Remarks**
Line	Length – NA Conductor - ZEBRA		
Panel	Make – EASUN REYROLLE Model – NA	DoM - NA DoC - NA	
Relay	DPR	Make – Model – Sr. No. -	
	O/C	Make – Model – Sr. No. -	PSM - TMS -
	E/F	Make – Model – Sr. No. -	PSM - TMS -
	LBB	Make – Model – Sr. No. -	PSM - TMS -
CT	R Ph	Make – Type – Current Ratio – Rated Voltage –	Sr. No. - DoM - DoC -
	Y Ph	Make – Type – Current Ratio – Rated Voltage –	Sr. No. - DoM - DoC -
	B Ph	Make – Type – Current Ratio – Rated Voltage –	Sr. No. - DoM - DoC -
Breaker	Make – Type – Rated Voltage – Rated Current – Short Time Amp –	Serial No. – DoM - DoC -	
EM	Make – Model – MTR – Class –	Serial No. – DoM - DoC -	

Name of GSS : - 220/132 KV CHANDIL-1, GSS.
Details:

Name of Feeder – 220 KV B/C			**Remarks**
Line	Length – NA Conductor - ZEBRA		
Panel	Make – EASUN REYROLLE Model – NA	DoM - NA DoC - NA	
Relay	DPR	Make – ABB Model – REL650 Sr. No. – I1314009	
	O/C	Make – ABB Model – REL650 Sr. No. – I 1314009	PSM -100 % TMS -0.250 SEC
	E/F	Make – ABB Model –REL650 Sr. No. –I 1314009	PSM -30% TMS -0.150 SEC
	LBB	Make – NA Model –NA Sr. No. -NA	PSM -NA TMS -NA
CT	R Ph	Make –BALTEAU Type –NA Current Ratio – 150-300-600-1200/1A Rated Voltage –460 KV	Sr. No. - 53392/6805 DoM - NA DoC - NA
	Y Ph	Make –BALTEAU Type –NA Current Ratio – 150-300-600-1200/1A Rated Voltage –460 KV	Sr. No. - 53392/6809 DoM - NA DoC - NA
	B Ph	Make –SCT LTD Type –O.D.D.T Current Ratio – 1200-600-300/1A Rated Voltage –245 KV	Sr. No. - 2001/2313 DoM - NA DoC - NA
Breaker	Make – CGL Type – 200-SFM-40A Rated Voltage – 245KV Rated Current – 3150A Short Time Amp –40KA 3 SEC		Serial No. – 6070C DoM -NA DoC - NA
EM	Make – SECURE METER LTD Model – E3V021 MTR – 100/1A Class –0.2S		Serial No. – KAB00519 DoM - NA DoC - NA

Name of GSS : - 220/132 KV CHANDIL-1, GSS.
Details:

Name of Feeder – 220 KV TR.3	**Remarks**

Line	Length – NA Conductor - ZEBRA			
Panel	Make – ASEA LTD Model – NA		DoM - NA DoC - NA	
Relay	DPR	Make – NA Model – NA Sr. No. -NA		
	O/C	Make – ASEA. Model – NA Sr. No. - NA	PSM – 0.3 TMS -0.6SEC	
	E/F	Make – ASEA Model – NA Sr. No. -NA	PSM -0.2 TMS -0.4SEC	
	LBB	Make – MICOM Model – P217 Sr. No. -140422340815004	PSM -0.50 TMS -0.50S	
CT	R Ph	Make – BALTEAU Type –NA Current Ratio – 100-200-400-800/1A Rated Voltage – 460KV	Sr. No. - 53393/6912 DoM - NA DoC - NA	
	Y Ph	Make – BALTEAU Type –NA Current Ratio – 100-200-400-800/1A Rated Voltage – 460KV	Sr. No. - 53393/6911 DoM - NA DoC - NA	
	B Ph	Make – BALTEAU Type –NA Current Ratio – 100-200-400-800/1A Rated Voltage – 460KV	Sr. No. - 53393/6910 DoM - NA DoC - NA	
Breaker	Make – CGL Type – 200-SFM-40A Rated Voltage – 245KV Rated Current – 3150A Short Time Amp –40KA3SEC		Serial No. – 6067C DoM - NA DoC - NA	
EM	Make – SECURE METRE LTD Model – E3V021 MTR – 800/1A Class –0.2S		Serial No. – JSE00009 DoM - NA DoC - NA	

Name of GSS : - 220/132 KV CHANDIL-1, GSS.
Details:

Name of Feeder – 220 KV TR.2		**Remarks**
Line	Length – NA Conductor - ZEBRA	

Panel	Make – ASEA Model – NA		DoM - NA DoC - NA	
Relay	DPR	Make – NA Model –NA Sr. No. -NA		
	O/C	Make – ASEA Model –NA Sr. No. - NA	PSM -0.3 TMS -0.6SEC	
	E/F	Make – Model – Sr. No. -	PSM -0.2 TMS -0.4 SEC	
	LBB	Make – MICOM Model – P127 Sr. No. -140422340815001	PSM -0.20 TMS -0.50SEC	
CT	R Ph	Make – BALTEAU Type – NA Current Ratio – 100-200-400-800/1A Rated Voltage – 480KV	Sr. No. - 53393/6908 DoM - NA DoC - NA	
	Y Ph	Make – BALTEAU Type – NA Current Ratio – 100-200-400-800/1A Rated Voltage – 480KV	Sr. No. - 53393/6901 DoM - NA DoC - NA	
	B Ph	Make – BALTEAU Type – NA Current Ratio – 100-200-400-800/1A Rated Voltage – 460KV	Sr. No. - 53393/6903 DoM - NA DoC - NA	
Breaker	Make – CGL Type – 200-SFM-40S Rated Voltage – 245 KV Rated Current – 3150A Short Time Amp –40KA/3SEC		Serial No. – 20130C DoM - NA DoC - NA	
EM	Make – SECURE METER LTD Model – E3V021 MTR – 800/1A Class –0.2S		Serial No. – JSE00007 DoM - NA DoC - NA	

Name of GSS : - 220/132 KV CHANDIL-1, GSS.
Details:

Name of Feeder – 220KV TR NO.01	**Remarks**

Line	Length –NA Conductor - ZEBRA			
Panel	Make – ASEA Model – NA		DoM - NA DoC - NA	
Relay	DPR	Make –NA Model – NA Sr. No. -NA		
	O/C	Make –ASEA Model – NA Sr. No. - NA	PSM -0.25 TMS -0.6SEC	
	E/F	Make – ASEA Model –NA Sr. No. -NA	PSM -0.25 TMS -0.4SEC	
	LBB	Make – MICOM Model – P127 Sr. No. -14042230815002	PSM -0.50 TMS -0.50SEC	
CT	R Ph	Make – BHEL LTD. Type – IS:2705 Current Ratio –200/400/800/1A Rated Voltage –245KV	Sr. No. -2446802 DoM - NA DoC - NA	
	Y Ph	Make – BALTEAU Type – NA Current Ratio – 100/200/400/800/1A Rated Voltage – 460KV	Sr. No. - 53393/6906 DoM - NA DoC - NA	
	B Ph	Make – BALTEAU Type – NA Current Ratio – 100/200/400/800/1A Rated Voltage – 460KV	Sr. No. - 53393/6902 DoM - NA DoC - NA	
Breaker	Make – HINDUSTAN BROWN BOVRI LTD Type – ELF 245 no-2 Rated Voltage – 245KV Rated Current – 3150A Short Time Amp –40KA/3SEC		Serial No. – 1B103398 DoM - DoC -	
EM	Make – SECURE METERS LTD Model – E3V021 MTR –800/1A Class –0.2S		Serial No. – JSE00008 DoM -NA DoC - NA	

Name of GSS : - 220/132 KV CHANDIL-1, GSS.
Details:

Name of Feeder – 220 KV STPS		**Remarks**
Line	Length – 120 KM Conductor - ZEBRA	

Panel	Make – EASUN REYROLLE Model – NA	DoM -NA DoC - NA	
Relay	DPR	Make – SEL Model – 311C-SEL Sr. No. - NA	
	O/C	Make – EASUN RAEYROLLE Model – 2TJM12 Sr. No. –HR0802037	PSM -1.00 TMS -0.2 SEC
	E/F	Make – EASUN RAEYROLLE Model –2TJM12 Sr. No. –HR0802075	PSM -0.20 TMS -0.15 SEC
	LBB	Make – NA Model – NA Sr. No. - NA	PSM - NA TMS - NA
CT	R Ph	Make – SCT LTD Type – O.D.D.T Current Ratio – 600-300-150/1A Rated Voltage – 245 KV	Sr. No. - 2013/664 DoM - NA DoC - NA
	Y Ph	Make – SCT LTD Type – O.D.D.T Current Ratio – 600-300-150/1A Rated Voltage – 245 KV	Sr. No. - 2013/662 DoM - NA DoC - NA
	B Ph	Make – SCT LTD Type – O.D.D.T Current Ratio – 600-300-150/1A Rated Voltage – 245 KV	Sr. No. - 2013/663 DoM - NA DoC - NA
Breaker	Make – CGL Type – 200-SFM-50A Rated Voltage – 245KV Rated Current – 3150A Short Time Amp –50KA/3 SEC	Serial No. – 42525C DoM -NA DoC - NA	
EM	Make – SECURE METER LTD Model – E3M021 MTR –150/1A Class –0.2S	Serial No. – KAU08742 DoM - NA DoC - NA	

Name of GSS: - 220/132 KV CHANDIL-1, GSS.
Details:

Name of Feeder – 220 KV PGCIL			**Remarks**
Line	Length – 78KM Conductor -ZEBRA		
Panel	Make – EASUN REYROLLE LTD Model – ER771	DoM - NA DoC -NA	

Relay	DPR	Make – NA Model – NA Sr. No. - NA	
	O/C	Make – EASUN REYROLLE LTD PSM -1.25 Model – 2TJM12 TMS -0.2SEC Sr. No. – HRO6O2172	
	E/F	Make – EASUN REYROLLE LTD PSM -0.2 Model – 2TJM12 TMS -0.15SEC Sr. No. –HR0601417	
	LBB	Make – NA PSM -NA Model – NA TMS -NA Sr. No. -NA	
CT	R Ph	Make –AREVA Sr. No. – 20061080/2006 Type – IT-245 DoM - NA Current Ratio – 1200-600-300-150/1A DoC - NA Rated Voltage – 245/220KV	
	Y Ph	Make –AREVA Sr. No. -20061082/2006 Type – IT-245 DoM - NA Current Ratio – 1200-600-300-150/1A DoC - NA Rated Voltage – 245/220KV	
	B Ph	Make – NA Sr. No. - NA Type – NA DoM - NA Current Ratio – NA DoC - NA Rated Voltage –NA	
Breaker	Make – CGL Serial No. – 20130C Type – 200-SFM-40S DoM - NA Rated Voltage –245KV DoC - NA Rated Current – 3150A Short Time Amp –40KA/3SEC		
EM	Make – SECURE METER LTD Serial No. – KAU03192 Model – E3V021 DoM - NA MTR –300/1A DoC - NA Class –0.2S		

Name of GSS : - 220/132 KV CHANDIL-1, GSS.
Details:

Name of Feeder – 220 kv Ramchandrapur			**Remarks**
Line	Length – 35km Conductor - Panther		
Panel	Make – English Electric Model – NA	DoM - NA DoC - NA	

Relay	DPR	Make – NA Model – NA Sr. No. -	
	O/C	Make – NA Model – NA Sr. No. - NA	PSM -NA TMS -NA
	E/F	Make – NA Model – NA Sr. No. -NA	PSM -NA TMS -NA
	LBB	Make – MICOM Model –P127 Sr. No. -1403161506310001	PSM -0.50 TMS -0.50SEC
CT	R Ph	Make – Balteau Type – NA Current Ratio – 150/300/600/1200/1a Rated Voltage – 460kv	Sr. No. - 53392/6813 DoM - DoC -
	Y Ph	Make – Areva Type – IT-245 Current Ratio –1200-600-300-150/A Rated Voltage –245/220kv	Sr. No. -20060718/2006 DoM - NA DoC - NA
	B Ph	Make – Balteau Type – NA Current Ratio – 150/300/600/1200/1a Rated Voltage – 460kv	Sr. No. - 53392/6801 DoM - DoC -
Breaker	Make – AREVA Type – NA Rated Voltage – 245KV Rated Current – 3150A Short Time Amp –40KA/3SEC		Serial No. – 150420 DoM - NA DoC -NA
EM	Make – SECURE METER LTD. Model – E3M021 MTR – 600/1A Class –0.2S		Serial No. – JSB44797 DoM - NA DoC - NA

Annexure-8.1.12

D.C. system details with Charger and battery									
Sl. nO.	**Name of G/s/s**	**Details of Battery Charger**	**Single /Double**	**Total voltage**	**Capacity**	**no. of Cells**	**D.C. system Earth fault**	**D.C. positive to earth**	**D.C. Nigative to earth**
1	**Chandil**	Mode- Float Ac- 400+-10% v Amp- 15A DC- 262+-1%V Phase-3 Sl.No- CE480/36 Mode- Boost DC- 205-325 V Amp.- 38A	Single	223V	2V-300AmpH	112	Not tested	191V	20V

Name of the Sub-station:-Chandil		
Name of the line	Line length(KM)	Conductor type
220KV PGCIL	93.5	ZEBRA
220KV STPS	120	ZEBRA
220KV RAMCHANDRAPUR	35	ZEBRA
132KV MANIQUI	0.5	ZEBRA
132KV GOLMURI 1	30	PANTHER
132KV GOLMURI 2	30	PANTHER
132KV RAJKHARSAWAN	40	PANTHER
132KV ADITYAPUR	19	PANTHER

						Connected CT core number & Details					Relay setting										
Name of feeder		Nomenclature	Make & Model	Distance- O/C	Distance - E/F	Location(bus side or line side)	Ratio	Core number	C.T. details	Core details	Zone 1	Zone 2	Zone 3	Zone 4	tZ 1	tZ 2	tZ 3	tZ 4	PSM	TSM	Characteristics for O/C, E/F
220KV PGCIL	Main 1	MICOM	AREVA, P442	PSM-1.1A, TMS-1s	PSM-200mA, TMS-1s	BUS SIDE	600/1	4	1200/600/300/150/1A Class-0.2 , Rated voltage-245KV, Type-IT245	PS	9.25Ω	13.95Ω	16.55Ω	2.85Ω	0	300ms	600ms	1s			
220KV STPS		MICOM	AREVA, P442	PSM-1A, TMS-400ms	PSM-200mA, TMS-300ms	BUS SIDE	600/1	3	600/300/150/1A Class-0.5 , Rated voltage-245KV, Type-IT245		11.85Ω	17.70Ω	25.05Ω	3.7Ω	0	300ms	600ms	1s			
220KV RAMCHANDRAPUR		MICOM	AREVA, P442	PSM-1.2A, TMS-1s	PSM-200mA, TMS-1s	BUS SIDE	600/1	4	[illegible]0/300/150/1A Class-R&B(1),Y		4.59Ω	6.82Ω	11.68Ω	1.13Ω	0	300ms	600ms	1s			
132KV MANIQUI		MICOM	AREVA, P141	PSM-2A, TMS-2s	PSM-0.2A, TMS-0.2s	BUS SIDE	800/1	3	800/400/200/1A Class-1 , Rated voltage-132KV, Type-MBA145A3												

132KV GOLMURI 1		MICOM	AREVA, P442	PSM-1.2A, TMS-1s	PSM-200mA, TMS-1s	BUS SIDE	400/1	3	R-phase 400/200/ 100/1A		3.33Ω	5Ω	10.93Ω	0.683Ω	0	300ms	1s	1.2s			
132KV GOLMURI 2		MICOM	AREVA, P442	PSM-1.25A, TMS-1.5s	PSM-200mA, TMS-1s	BUS SIDE	400/1	3			3.33Ω	5Ω	10.93Ω	0.683Ω	0	300ms	1s	1.2s			
132KV RAJKHARSAWAN		MICOM	AREVA, P442	PSM-700mA, TMS-2s	PSM-200mA, TMS-2s	BUS SIDE	600/1	3			6.667Ω	10.11Ω	17.9Ω	1.666Ω	0	300ms	1s	1.2s			
132KV ADITYAPUR		MICOM	AREVA, P442	PSM-700mA, TMS-2s	PSM-200mA, TMS-2s	BUS SIDE	600/1	3			3.167Ω	4.75Ω	9.580Ω	792.0mΩ	0	300ms	1s	1.2s			
	Make & Model																				
	Main 2																				
	Remarks:																				
	Bus coupler protection																				
	Trip relay																				

Annexure-8.1.14

Name of the Sub-station: Chandil GSS

Transformer Details	EMCO,2000 Vector-YNn0d11	
Transformer Number	1	
MVA Rating	100	
% Impedance	Tap no. 1- 7.49, Tap no. 5(Normal)- 7.41, Tap no. 17- 7.56	
Ratio	220/132KV	

Name of the Protection		**C.T.**	**C.T. Details (Make & Model)**	**Connected CT/PT Ratio**	**Core number**	**Core details**	**Setting**	**High set setting**
		HV	R-phase(BHEL) Y & B-phase(BALTEAU), Rated voltage(BHEL)-245KV Rated voltage(BALTEAU)-460KV Class of Accuracy- 0.2(BHEL),1(BALTEAU)	800/1A	3	PS		
		LV	R-phase(SCT), Y & B phase(ASEA) Rated voltage-132KV Class of Accuracy- 0.5(R), 1(Y&B)	800/1A	3	PS		
Nomenclature		**Make & model**						
Differential Protection	Asea sweden	RIDI					BIAS-40%	
Restricted E/F (HV)	Asea sweden	RIDI					N.A.	
Restricted E/F (LV)	Asea sweden	RIDI					N.A.	
HV O/C	Asea sweden	RIDI					PSM-0.6, TMS-0.3	

LV O/C	Asea sweden	RIDI					PSM-0.6, TMS-0.3	
HV E/F	Asea sweden	RIDI					PSM-0.4, TMS-0.2	
LV E/F	Asea sweden	RIDI					PSM-0.5, TMS-0.2	
Over flux	English Electrical	GTT21AF8001A					2.585	

Trip relay	Master trip relay	86

Name of the Sub-station: Chandil GSS

Transformer Details	Kanohar Electricals LTD,2006 Vector-YNn0d11							
Transformer Number	2							
MVA Rating	100							
% Impedance	Tap no. 1-07.03, Tap no. 5(Normal)-06.98, Tap no. 17-07.08							
Ratio	220/132KV							
Name of the Protection		**C.T.**	**C.T. Details (Make & Model)**	**Connected CT/PT core number & Ratio**	**Core number**	**Core details**	**Setting**	**High set setting**
		HV	(BALTEAU), Rated voltage-460KV Class of Accuracy- 1	800/1A	3	800/400/ 200/1A		
		LV	ASEA Rated Voltage-145KV Class-1	800/1A	3	800/400/ 200/1A		
Nomenclature		**Make & model**						
Differential Protection	ASEA	RIDI					BIAS-32%	
Restricted E/F (HV)								
Restricted E/F (LV)								
HV O/C	Asea sweden	RIDI					PSM-0.6, TMS-0.3	
LV O/C	Asea sweden	RIDI					PSM-0.6, TMS-0.3	
HV E/F	Asea sweden	RIDI					PSM-0.4, TMS-0.2	

LV E/F	Asea sweden	RIDI					PSM-0.4, TMS-0.2	
Over flux								

Trip relay	MASTER TRIP	86

Name of the Sub-station: CHANDIL GSS

Transformer Details	CANADIAN MAKE, 1766 Vector-YNn0d11	
Transformer Number	3	
MVA Rating	100	
% Impedance	HV-LV-7.4, HV-TV-25.5, LV-TV-17.4 (AT NORMAL TAP)	
Ratio	220/132KV	

Name of the Protection		**C.T.**	**C.T. Details (Make & Model)**	**Connected CT/PT core number & Details**			**Setting**	**High set setting**
				Ratio	**Core number**	**Core details**		
		HV	(BALTEAU), Rated voltage-460KV Class of Accuracy- 1	800/1A	3	800/400/200/1A		
		LV	ASEA Rated Voltage-145KV Class-1	800/1A	3	800/400/200/1A		
Nomenclature		**Make & model**						
Differential Protection							BIAS-25	
Restricted E/F (HV)								
Restricted E/F (LV)								
HV O/C	Asea sweden	RIDI					PSM-0.6, TMS-0.3	

LV O/C	Asea sweden	RIDI					PSM-0.6, TMS-0.3	
HV E/F	Asea sweden	RIDI					PSM-0.4, TMS-0.2	
LV E/F	Asea sweden	RIDI					PSM-0.4, TMS-0.2	
Over flux								

Trip relay	Master trip	86

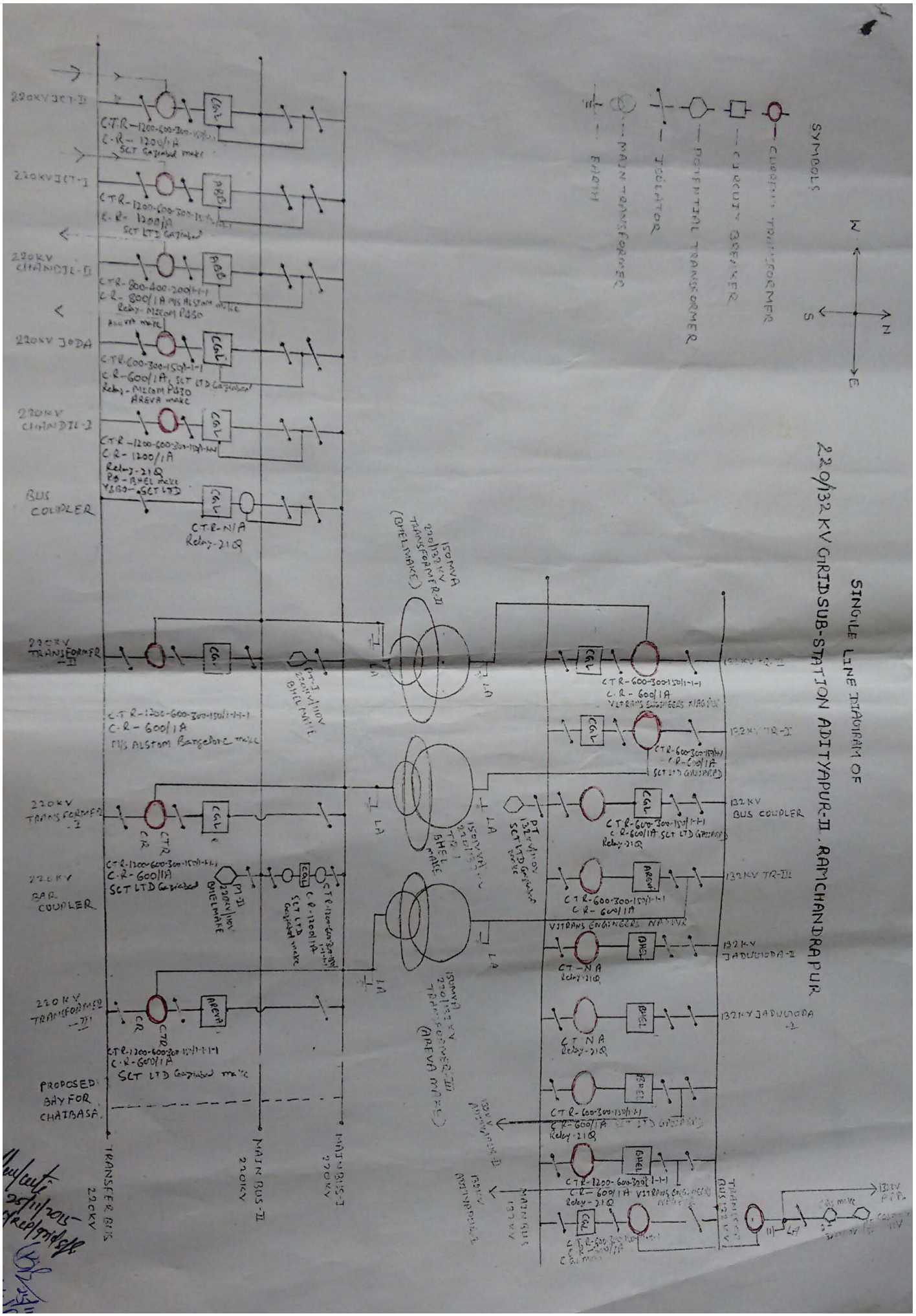
Name of the Sub-station: CHANDIL GSS

Transformer Details	TRANSFORMER RECTIFIERS INDIA LTD.,2013 Vector-YNn0d11	
Transformer Number	4	
MVA Rating	100	
% Impedance	TAP NO 1-7.35 TAP NO.5-7.22 (AT NORMAL TAP) TAP NO. 17- 7.27	
Ratio	220/132KV	

Name of the Protection		**C.T.**	**C.T. Details (Make & Model)**	**Connected CT/PT core number & Ratio**	**Core number**	**Core details**	**Setting**	**High set setting**
		HV	BHEL, Rated voltage-245KV Class of Accuracy- 0.5	800/1A	3	800/400/ 200/1A		
		LV	R&Y -VICTRANS B-SCT Rated Voltage-145 Class-0.5	800/1A	3	800/400/ 200/1A		
Nomenclature		**Make & model**						
Differential Protection							BIAS-30	
Restricted E/F (HV)								
Restricted E/F (LV)	EASUN REYYOLLE	5B380					80	
HV O/C	EASUN REYYOLLE	2TJM11					PSM-0.5, TMS-1	
LV O/C	EASUN REYYOLLE	2TJM11					PSM-0.5, TMS-1	

HV E/F	EASUN REYYOLLE	2TJM11					PSM-0.2, TMS-1	
LV E/F	EASUN REYYOLLE	2TJM11					PSM-0.2, TMS-1	
Over flux								

Trip relay	Master trip	86



Annexure-8.2.1

Annexure-8.2.2

Year of Manufacturing of 220/132kV Ramchandrapur S/s

Sl. No.	Name of Feeders	Name of Equipment	Details of equipment	Year of Manufacturing
1	220 Chandil	CT	R Phase	2012
		CT	Y Phase	2005
		CT	B Phase	2005
2	220KV Joda	CT	R Phase	2012
		CT	Y Phase	2012
		CT	B Phase	2012
3	220 KV Tr.-I	CT	R Phase	1991
		CT	Y Phase	1991
		CT	B Phase	1991
4	220 KV Tr.-II	CT	R Phase	2005
		CT	Y Phase	2005
		CT	B Phase	2005
5	220 KV Tr.-III	CT	R Phase	2007
		CT	Y Phase	2007
		CT	B Phase	2006
6	220 KV Bar Coupler	CT	R Phase	1991
		CT	Y Phase	1991
		CT	B Phase	1991
7	220 KV ICT-I	CT	R Phase	2006
		CT	Y Phase	2006
		CT	B Phase	2006
8	220 KV ICT-II	CT	R Phase	2006
		CT	Y Phase	2006
		CT	B Phase	2006
9	132 KV Tr.-I	CT	R Phase	1997
		CT	Y Phase	1997
		CT	B Phase	1997
10	132 KV Tr.-II	CT	R Phase	2007
		CT	Y Phase	2007
		CT	B Phase	2007
11	132 KV Tr.-III	CT	R Phase	2007
		CT	Y Phase	2007
		CT	B Phase	2007
12	132 KV B/C	CT	R Phase	1997
		CT	Y Phase	1997
		CT	B Phase	1997
13	132 KV Adityapur-I	CT	R Phase	2009
		CT	Y Phase	2009
		CT	B Phase	2009
14	132 KV Adityapur-II	CT	R Phase	2009
		CT	Y Phase	2009
		CT	B Phase	2009
15	132 KV M/S Adhunik Power -I	CT	R Phase	2008
		CT	Y Phase	2008
		CT	B Phase	2008

16	220 KV PT-I	PT	R Phase	1994
		PT	Y Phase	1994
		PT	B Phase	1994
17	220 KV PT-II	PT	R Phase	1992
		PT	Y Phase	1992
		PT	B Phase	1992
18	132 KV PT	PT	R Phase	2001
		PT	Y Phase	2001
		PT	B Phase	2001
19	220 KV Chandil	Breaker		1987
20	220 KV Joda	Breaker		2006
21	220/132 KV 150 MVA Tr.-I	Breaker		1993
22	220/132 KV 150 MVA Tr.-II	Breaker		2005
23	220/132 KV 150 MVA Tr.-III	Breaker		2006
24	220 KV Bar Coupler	Breaker		1993
25	220 KV ICT-I	Breaker		1987
26	220 KV ICT-II	Breaker		1993
27	132 KV Tr.-I	Breaker		1995
28	132 KV Tr.-II	Breaker		2008
29	132 KV Tr.-III	Breaker		2007
30	132 KV B/C	Breaker		2006
31	132 KV Adityapur-I	Breaker		1997
32	132 KV Adityapur-II	Breaker		2008

33	132 KV M/S Adhunik Power -I	Breaker		2008
34	150 MVA Transformer-I	Transformer		1992
35	150 MVA Transformer-II	Transformer		2005
36	150 MVA Transformer-III	Transformer		2006

Annexure-8.2.3

CT details of 220/132 KV Ramchandrapur GSS

Sl. No.	Name of Feeders	Comprehensive C.T. details	Make	CT ratio	Connected Ratio	Core No.	Class of accuracy	Protection class use	Knee voltage
1	220 KV Chandil	R Phase	SCT LTD.(UP)	800/400/200/1A	800/1A	5 Core	0.2	PS	
		Y Phase	Areva	800/400/200/1A		4 Core	0.2	PS	
		B Phase	Areva	800/400/200/1A		4 Core	0.2	PS	
2	220KV Joda	R Phase	SCT LTD.(UP)	1200/600/300/150/1A	600/1A	4 Core	0.5	PS	
		Y Phase	SCT LTD.(UP)	1200/600/300/150/1A			0.5	PS	
		B Phase	SCT LTD.(UP)	1200/600/300/150/1A			0.5	PS	
3	220 KV Tr.-I	R Phase	SCT LTD.(UP)	1200/600/300/150/1A	600/1A	5 Core	1	PS	
		Y Phase	SCT LTD.(UP)	1200/600/300/150/1A			1	PS	
		B Phase	SCT LTD.(UP)	1200/600/300/150/1A			1	PS	
4	220 KV Tr.-II	R Phase	Areva	1200/600/300/1A	600/1A	4 Core	0.2	PS	
		Y Phase	Areva	1200/600/300/1A			0.2	PS	
		B Phase	Areva	1200/600/300/1A			0.2	PS	
5	220 KV Tr.-III	R Phase	SCT LTD.(UP)	1200/600/300/1A	600/1A	4 Core	0.5	PS	
		Y Phase	SCT LTD.(UP)	1200/600/300/1A		4 Core	0.5	PS	
		B Phase	Areva	1200/600/300/150/1A		5 Core	0.2	PS	
6	220 KV Bar Coupler	R Phase						PS	
		Y Phase						PS	
		B Phase						PS	
7	220 KV ICT-I	R Phase	Areva	1200/600/300/150/1A	1200/1A	5 Core	0.2	PS	
		Y Phase	Areva	1200/600/300/150/1A			0.2	PS	
		B Phase	Areva	1200/600/300/150/1A			0.2	PS	
8	220 KV ICT-II	R Phase	Areva	1200/600/300/150/1A	1200/1A	5 Core	0.2	PS	
		Y Phase	Areva	1200/600/300/150/1A			0.2	PS	
		B Phase	Areva	1200/600/300/150/1A			0.2	PS	
9	132 KV Tr.-I	R Phase	SCT LTD.(UP)	1200/600/1A	600/1A	4 Core	1	PS	
		Y Phase	SCT LTD.(UP)	1200/600/1A			1	PS	
		B Phase	SCT LTD.(UP)	1200/600/1A			1	PS	
10	132 KV Tr.-II	R Phase	Victrans eng.	600/300/150/1A	600/1A	4 Core	0.5	PS	
		Y Phase	Victrans eng.	600/300/150/1A			0.5	PS	
		B Phase	Victrans eng.	600/300/150/1A			0.5	PS	
11	132 KV Tr.-III	R Phase	Victrans eng.	600/300/150/1A	600/1A	4 Core	0.5	PS	
		Y Phase	Victrans eng.	600/300/150/1A			0.5	PS	
		B Phase	Victrans eng.	600/300/150/1A			0.5	PS	
12	132 KV B/C	R Phase	SCT LTD.(UP)	1200/600/1A	600/1A	4 Core	1	PS	
		Y Phase	SCT LTD.(UP)	1200/600/1A			1	PS	
		B Phase	SCT LTD.(UP)	1200/600/1A			1	PS	
13	132 KV Adityapur-I	R Phase	Victrans eng.	1200/600/300/1A	600/1A	4 Core	0.2	PS	
		Y Phase	Victrans eng.	1200/600/300/1A			0.2	PS	
		B Phase	Victrans eng.	1200/600/300/1A			0.2	PS	
14	132 KV Adityapur-II	R Phase	Victrans eng.	1200/600/300/1A	600/1A	4 Core	0.2	PS	
		Y Phase	Victrans eng.	1200/600/300/1A			0.2	PS	
		B Phase	Victrans eng.	1200/600/300/1A			0.2	PS	
15	132 KV M/S Adhunik Power - I	R Phase	CGL	600/300/150/1A	300/1A	4 Core	0.2	PS	
		Y Phase	CGL	600/300/150/1A			0.2	PS	
		B Phase	CGL	600/300/150/1A			0.2	PS	

Annexure-8.2.4

VT details of 220/132 KV Ramchandrapur GSS

Sl. No.	V.T. details	Comprehensive P.T. details	Make	Core No.	Class of accuracy
1	220 KV PT-I	R Phase	BHEL	3 Core	0.5/3P/0.5
		Y Phase	BHEL	3 Core	0.5/3P/0.5
		B Phase	BHEL	3 Core	0.5/3P/0.5
2	220 KV PT-II	R Phase	BHEL	3 Core	0.5/3P/0.5
		Y Phase	BHEL	3 Core	0.5/3P/0.5
		B Phase	BHEL	3 Core	0.5/3P/0.5
3	132 KV PT	R Phase	SCT LTD.(UP)	3 Core	0.2/3P/3P
		Y Phase	SCT LTD.(UP)	3 Core	0.2/3P/3P
		B Phase	SCT LTD.(UP)	3 Core	0.2/3P/3P

Annexure-8.1.5

Fault lelvel at JUSNL Sub-stations

Bus Name	Bus Voltage	3 Ph Fault current	SLG Fault current
CHANDIL 220	220	14514	9735
RAMCHANDRAPUR 220	220	18450	15443
CHANDIL	132	18105	12652
ADITPUR	132	12098	8624
RAMCHANDRAPUR 132	132	13000	11126

Note: Data recieved from ERLDC

Annexure: 8.2.6

Transformer Details

(a) 220/132 KV, 150 MVA Transformer No. - I

	HV - IV	HV - LV	IV - LV
Tap No. - 01	12.44	-	-
Tap No. - 05 (Normal Tap)	12.03	40.42	27
Tap No. - 17	12	-	-

(b) 220/132 KV, Transformer No. - II (150 MVA)

	HV - IV	HV - LV	IV - LV
Tap No. - 01	11.87	-	-
Tap No. - 05 (Normal Tap)	11.64	41.55	27.55
Tap No. - 17	11.53	-	-

(c) 220/132 KV, Transformer No. - III (150 MVA)

	HV - IV	HV - LV	IV - LV
Tap No. - 01	11.59	-	-
Tap No. - 05 (Normal Tap)	11.33	42.07	28.27
Tap No. - 17	11.2	-	-

Annexure-8.2.7

Cable details used for C.T. connection of Ramchandrapur S/s

Sl No.	Name of Feeder	No. of Cable use C.T		Cross section of cable	Length of cable J/B to C/R panel
1	220 KV Chandil	12,12		2.5, 6.0 Sq. mm	115 mtr.
2	220KV Joda	12		6 Sq. mm	105 mtr
3	220 KV Tr.-I	12		6 Sq. mm	164 mtr.
4	220 KV Tr.-II	12,12		2.5, 6.0 Sq. mm	150 mtr
5	220 KV Tr.-III	12,12		2.5, 6.0 Sq. mm	205 mtr
6	220 KV Bar Coupler	10,4		6.0, 2.5 Sq. mm	205 mtr
7	220 KV ICT-I	10,12		2.5, 6.0 Sq. mm	129 mtr.
8	220 KV ICT-II	10,12		2.5, 6.0 Sq. mm	129 mtr.
9	132 KV Tr.-I	10		6 Sq. mm	150 mtr
10	132 KV Tr.-II	10		6 Sq. mm	136 mtr.
11	132 KV Tr.-III	10		6 Sq. mm	175 mtr.
12	132 KV B/C	12		6 Sq. mm	162 mtr
13	132 KV Adityapur-I	10		6 Sq. mm	236 mtr
14	132 KV Adityapur-II	10		6 Sq. mm	230 mtr
15	132 KV M/S Adhunik Power -I	4		6 Sq. mm	250 mtr.

Annexure-8.2.8

Measurement of Earth Resistance Name of G/S/S = 220/132KV Ramchandrapur

132KV Side

SL NO	Name of Earth Pit	Earth Resistance in Ohm	Remarks
1	132KV Adityapur ckt I	2 Ohm	
2	132KV Adityapur ckt II	2 Ohm	
3	132 KV AAPL	1 Ohm	
4	132KV Tr.-III bay	0.5 Ohm	

220KV Side

SL NO	Name of Earth Pit	Earth Resistance in Ohm	Remarks
1	220kv Tr-3	2 Ohm	
2	220KV Chandil breaker	1 Ohm	
3	Near main bus-1 of Chandil-II	2 Ohm	

Near Transformer

SL NO	Name of Earth Pit	Earth Resistance in Ohm	Remarks
1	Tr.No-I		
	HV	2 Ohm	
	Lv	1 Ohm	
2	Tr.No-II		
	HV	1 Ohm	
	Lv	0.5 Ohm	
3	Tr.No-III		
	HV	1 Ohm	
	Lv	0.5 Ohm	

Test Report
220/132 Kv Grid Sub-Station, Adityapur-II (RCP)

1. Breaker Specification:

Date 22.12.2015

Name of feeder - 220 Kv Transformer - I
Make - CGL
Type - 200-SPM-40A
Sl. No. - 6071C
Year - 1993

Operating time in Mille Second:

	R Ph	**Y Ph**	**B Ph**
Closing	87	85	84
Tripping Coil 1	45	45	44
C/o Coil 1	16	21	13

2. Breaker Specification:

Date 21.12.2015

Name of feeder - 220 Kv Chandil - II
Make - HBB
Type - ELF-245-nc2
Sl. No. - IB103411
Year - 1987

Operating time in Mille Second:

	R Ph	**Y Ph**	**B Ph**
Closing	146	145	135
Tripping Coil 1	19	18	18
C/o Coil 1	18	42	876

3. Breaker Specification:

Date 21.12.2015

Name of feeder - 220 Kv Transformer - II
Make - CGL
Type - 200-SFM-40S
Sl. No. - 20132C
Year - 2005

Operating time in Mille Second:

	R Ph	**Y Ph**	**B Ph**
Closing	123	140	114
Tripping Coil 1	24	24	22
C/o Coil 1	34	42	31

4. Breaker Specification:

Date 21.12.2015

Name of feeder	-	220 Kv ICT-I
Make	-	HBB
Type	-	ELF-245-nc2
Sl. No.	-	N.A
Year	-	1987

Operating time in Mille Second:

	R Ph	Y Ph	B Ph
Closing	159	131	144
Tripping Coil 1	22	589	589
C/o Coil 1	44	640	628

5. Breaker Specification:

Date 21.12.2015

Name of feeder	-	220 Kv ICT-II
Make	-	CGL
Type	-	200-SFM-40A
Sl. No.	-	6072C
Year	-	1993

Operating time in Mille Second:

	R Ph	Y Ph	B Ph
Closing	93	79	85
Tripping Coil 1	49	40	40
C/o Coil 1	16	16	17

6. Breaker Specification:

Date 21.12.2015

Name of feeder	-	220 Kv Joda
Make	-	AREVA
Type	-	GL314
Sl. No.	-	150418
Year	-	2006

Operating time in Mille Second:

	R Ph	Y Ph	B Ph
Closing	68	68	67
Tripping Coil 1	42	42	42
C/o Coil 1	40	42	40

7. **Breaker Specification:**

Date 22.12.2015

Name of feeder	-	220 Kv Transformer - III
Make	-	AREVA
Type	-	GL314
Sl. No.	-	150419
Year	-	2006

Operating time in Mille Second:

	R Ph	Y Ph	B Ph
Closing	70	68	69
Tripping Coil 1	41	40	40
C/o Coil 1	42	42	42

8. **Breaker Specification:**

Date 22.12.2015

Name of feeder	-	220 Kv Bar-Coupler
Make	-	CGL
Type	-	200-SFM-40A
Sl. No.	-	6068C
Year	-	1993

Operating time in Mille Second:

	R Ph	Y Ph	B Ph
Closing	92	84	81
Tripping Coil 1	39	41	41
C/o Coil 1	0	11	15

9. **Breaker Specification:**

Date 20.12.2015

Name of feeder	-	132 Kv Transformer - I
Make	-	CGL
Type	-	120-SFM-32A
Sl. No.	-	EC7429C
Year	-	1995

Operating time in Mille Second:

	R Ph	Y Ph	B Ph
Closing	87	87	88
Tripping Coil 1	28	28	28
C/o Coil 1	0	0	0
Tripping Coil 2	26	26	26
C/o Coil 2	0	0	0

10. Breaker Specification:

Date 21.12.2015

Name of feeder	-	132 Kv Adityapur -II
Make	-	CGL
Type	-	120-SFM-32B
Sl. No.	-	264220C
Year	-	2008

Operating time in Mille Second:

	R Ph	Y Ph	B Ph
Closing	92	92	92
Tripping Coil 1	25	25	26
C/o Coil 1	37	36	38
Tripping Coil 2	25	25	26
C/o Coil 2	37	37	38

11. Breaker Specification:

Date 21.12.2015

Name of feeder	-	132 Kv Adityapur -I
Make	-	BHEL
Type	-	3ARS 3*DLG-302C
Sl. No.	-	403039
Year	-	1997

Operating time in Mille Second:

	R Ph	Y Ph	B Ph
Closing	108	85	84
Tripping Coil 1	39	38	32
C/o Coil 1	56	60	65

12. Breaker Specification:

Date 21.12.2015

Name of feeder	-	132 Kv Transformer - II
Make	-	AREVA
Type	-	GL312
Sl. No.	-	102832
Year	-	2008

Operating time in Mille Second:

	R Ph	Y Ph	B Ph
Closing	73	72	71
Tripping Coil 1	40	41	38
C/o Coil 1	62	65	60

13. Breaker Specification:

Date 22.12.2015

Name of feeder	-	132 Kv Transformer - III
Make	-	AREVA
Type	-	GL312
Sl. No.	-	101740
Year	-	2007

Operating time in Mille Second:

	R Ph	**Y Ph**	**B Ph**
Closing	71	67	68
Tripping Coil 1	35	35	35
C/o Coil 1	53	56	56
Tripping Coil 2	35	35	35
C/o Coil 2	52	55	55

14. Breaker Specification:

Date 22.12.2015

Name of feeder	-	132 Kv Bus-Coupler
Make	-	CGL
Type	-	120-SFM-32B
Sl. No.	-	22169C
Year	-	2006

Operating time in Mille Second:

	R Ph	**Y Ph**	**B Ph**
Closing	91	91	91
Tripping Coil 1	29	29	29
C/o Coil 1	38	39	39
Tripping Coil 2	28	27	28
C/o Coil 2	39	39	39

Annexure-8.2.10

CT/PT earting details

Sl No	Name of GSS	CT earthing details	PT earthing details
2	**Ramchandrapur**	All CT neutral earthing provided in field junction Box.	All PT neutral earthing provided in field junction Box.

Annexure-8.2.11

220 KV JODA

Micom P442,

Line Length	130KM
Line Impedance	15.84 ohm
Line Angle	79
kz1	0.789
kz1 Angle	0
Z1	12.67 ohm
R1G	25.00 ohm
R1Ph	20.00 ohm
tz1	0s
kz2 Res comp	0.789
kz2 Angle	0
Z2	19.01 ohm
R2G	25.00 ohm
R2ph	20.32 ohm
tz2	300.0 ms
kz3/4Res comp	0.789
kz3/4 Angle	0
Z3	25.00 ohm
R3G-R4G	20.00 ohm
R3ph-R4ph	20.32 ohm
tZ3	1.000 s
Z4	3.168 ohm
tZ4	1.200 s

Back UP>I

I> 1Directional Directional FWD
I>1 VTS Block Non Directional
I> 1 Current Set 750.0 A
I> 1 Time Delay 500.0mA
I> Time VTS 500.0ms

Earth fault O/C

IN> Directional Directional FWD
IN>1 VTS Block Non Directional
IN> 1 Current Set 200.0 m A
IN> 1 Time VTS 100.0 ms
IN> TMS 0.100

Name of GSS:220/132KVRAMCHANDRAPUR G/S/S
Details:

Name of Feeder –B/C (132 KV)			**Remarks**
Line	Length –N.A Conductor - N.A		
Panel	Make – ENGLISH ELECTRIC DoM - N.A Model – N.A DoC - N.A		
Relay	DPR	Make – Alstom DoM - N.A Model – P442 DoC – 25.11.2015 Sr. No. - 33219530/02/15	
	O/C	Make – Alstom PSM -0.90 Model –P442 TMS -0.30s Sr. No. -33219530/02/15	
	E/F	Make – Alstom PSM -0.2 Model –P442 TMS -0.20sec Sr. No. -33219530/02/15	
	LBB	Make – N.A PSM - N.A Model – N.A TMS - N.A Sr. No. - N.A	
CT	R Ph	Make – SCT, Limited Sr. No. -96/810 Type – O.D.D.T DoM - 1997 Current Ratio –1200-600/1A DoC - Rated Voltage –145 kv No. of Core – 4	Length of control cable from JB to Panel -162 Meter Cross Section of C.T. Control Cable Core-12 core*6mm^2
	Y Ph	Make – SCT, Limited Sr. No. -96/808 Type – – O.D.D.T DoM -1997 Current Ratio –1200-600/1A DoC - N.A Rated Voltage –145 kv No. of Core – 4	
	B Ph	Make – SCT, Limited Sr. No. -96/805 Type – – O.D.D.T DoM -1997 Current Ratio –1200-600/1A DoC - N.A Rated Voltage –145 kv No. of Core – 4	
Breaker	Make – CGL Serial No. –22169C Type –120-SFM-32B DoM -2006 Rated Voltage – 145KV DoC - N.A Rated Current –3150 A Short Time Amp –40 KA		
EM	Make – N.A Serial No. – N.A Model – N.A DoM - N.A MTR – N.A DoC - N.A Class – N.A		

Name of GSS :220/132KVRAMCHANDRAPUR G/S/S
Details:

Name of Feeder –132 KV AADHUNIK POWER LTD.			**Remarks**
Line	Length – 4.26 KM Conductor - N.A		
Panel	Make – IMP POWER LTD. DoM - N.A Sr. No. –SCA/183/08-09 DoC - N.A		
Relay	DPR	Make –Micom, AREVA/ALSTOM DoM- N.A Model –P442314B2M0360J DoC - N.A Sr. No. -082701C	
	O/C	Make – Micom, AREVA/ALSTOM PSM -1.5 A Model – P442314B2M0360J TMS -1.0sec Sr. No. –082701C	
	E/F	Make – Micom, AREVA/ALSTOM PSM -200.0mA Model – P442314B2M0360J TMS -1.0 sec Sr. No. –082701C	
	LBB	Make – N.A PSM - N.A Model – N.A TMS - N.A Sr. No. - N.A	
CT	R Ph	Make – CGL Sr. No. –80698 Type – CT: 145/275/650 DoM - 2008 Current Ratio –150-300-600/1A DoC - N.A Rated Voltage –145 kv No. of Core – 4	Length of control cable from JB to Panel -250Met & 162 Meter Cross Section of C.T. Control Cable Core-4 core*6mm^2
	Y Ph	Make – CGL Sr. No. –80697 Type – CT: 145/275/650 DoM -2008 Current Ratio –150-300-600/1A DoC - N.A Rated Voltage –145 kv No. of Core – 4	
	B Ph	Make – CGL Sr. No. –80696 Type – CT: 145/275/650 DoM -2008 Current Ratio –150-300-600/1A DoC - N.A Rated Voltage –145 kv No. of Core – 4	
Breaker	Make – CGL Serial No. –27047C Type –120-SFM-32B DoM -2008 Rated Voltage – 145KV DoC - N.A Rated Current –3150 A Short Time Amp –40 KA		
EM	Make – APEX Meter (Secure Meter Limited), (MAIN)Serial No. –ORBR4829 Model – R3M021-436, 3P- 4W DoM - 2012 MTR – -/1A DoC - N.A Class –0.2 s		
	Make – APEX Meter (Secure Meter Limited), (CHECK) Serial No. –APMA9980 Model – R3M021-436, 3P- 4W DoM –2010 MTR – -/1A DoC - N.A Class – 0.2 s		

Name of GSS :220/132KVRAMCHANDRAPUR G/S/S

Details:

Name of Feeder –132 KV ADITYAPUR-2			**Remarks**
Line	Length – 8 KM Conductor -Panther		
Panel	Make – ENGLISH ELECTRIC DoM - N.A Model – N.A DoC - N.A		
Relay	DPR	Make –Micom, AREVA/ALSTOM DoM-N.A Model –P442318B2A0300G DoC – 28.03.2014 Sr. No. -062713C	
	O/C	Make – Micom, AREVA/ALSTOM PSM -900.0mA Model –P442318B2A0300G TMS -0.5 sec Sr. No. –062713C	
	E/F	Make – Micom, AREVA/ALSTOM PSM -200.0mA Model – P442318B2A0300G TMS -0.1 sec Sr. No. –062713C	
	LBB	Make – N.A PSM - N.A Model – N.A TMS - N.A Sr. No. - N.A	
CT	R Ph	Make – Victrans Engineers Sr. No. –VE/C 19510596 Type – C-114D DoM - 2009 Current Ratio –1200-600-300/1A DoC - N.A Rated Voltage –145 kv No. of Core – 4	Length of control cable from JB to Panel -230 Meter Cross Section of C.T. Control Cable Core-10 core*6mm^2
	Y Ph	Make – Victrans Engineers Sr. No. –VE/C 19510588 Type – C-114D DoM -2009 Current Ratio –1200-600-300/1A DoC - N.A Rated Voltage –145 kv No. of Core – 4	
	B Ph	Make – Victrans Engineers Sr. No. –VE/C 19510603 Type – C-114D DoM -2009 Current Ratio –1200-600-300/1A DoC - N.A Rated Voltage –145 kv No. of Core – 4	
Breaker	Make – CGL Serial No. –26420C Type –120-SFM-32B DoM -2008 Rated Voltage – 145KV DoC - N.A Rated Current –3150 A Short Time Amp –40 KA		
EM	Make – Secure Meter Ltd. Serial No. –JSB44794 Model –E3M021, 3P- 4W DoM - 2013 MTR – 600/1A DoC - 2014 Class –0.2 s		
	Make – APEX Meter (Secure Meter Limited) Serial No. –APM99574 Model – R3M021-334, 3P- 4W DoM –June, 2007 MTR – -/1 DoC - N.A Class – 0.2 s		

Name of GSS :220/132KVRAMCHANDRAPUR G/S/S
Details:

Name of Feeder –132 KV ADITYAPUR-1			Remarks
Line	Length – 8 KM Conductor -		
Panel	Make – ENGLISH ELECTRIC DoM - N.A Model – N.A DoC - N.A		
Relay	DPR	Make –Micom, AREVA/ALSTOM DoM-27/03/2014 Model –P442318B2A0300G DoC - N.A Sr. No. -062706C	
	O/C	Make – Micom, AREVA/ALSTOM PSM -900.0mA Model –P442318B2A0300G TMS -0.5 sec Sr. No. –062706C	
	E/F	Make – Micom, AREVA/ALSTOM PSM -200.0mA Model – P442318B2A0300G TMS -0.1 sec Sr. No. –062706C	
	LBB	Make – N.A PSM - N.A Model – N.A TMS - N.A Sr. No. - N.A	
CT	R Ph	Make – Victrans Engineers Sr. No. –VE/C 19510586 Type – C-114D DoM - 2009 Current Ratio –1200-600-300/1A DoC - N.A Rated Voltage –145 kv No. of Core – 4	Length of control cable from JB to Panel -236 Meter Cross Section of C.T. Control Cable Core-10 core*6mm^2
	Y Ph	Make – Victrans Engineers Sr. No. –VE/C 19510612 Type – C-114D DoM -2009 Current Ratio –1200-600-300/1A DoC - N.A Rated Voltage –145 kv No. of Core – 4	
	B Ph	Make – Victrans Engineers Sr. No. –VE/C 19510591 Type –C-114D DoM -2009 Current Ratio –1200-600-300/1A DoC - N.A Rated Voltage –145 kv No. of Core – 4	
Breaker	Make – BHEL Serial No. –403039 Type –SF6 145KV 3ARS3XBLG-302C DoM -1997 Rated Voltage – 145KV DoC - N.A Rated Current –1600 A Short Time Amp –31.5 KA		
EM	Make – Secure Meter Ltd. Serial No. –JSE00016 Model –E3V021, 3P, 3W DoM - 2001 MTR – 600/1A DoC - N.A Class –0.2 s		
	Make – APEX Meter (Secure Meter Limited) Serial No. –APM99577 Model – R3M021-334, 3P-3W DoM –June, 2007 MTR – -/1 DoC - N.A Class – 0.2 s		

Name of GSS :220/132KVRAMCHANDRAPUR G/S/S
Details:

Name of Feeder –Tr. No.-3 (132 KV)			**Remarks**
Line	Length – N.A Conductor - N.A		
Panel	Make – EASUN REYROLLE DoM - N.A Model – N.A DoC - N.A		
Relay	DIFF. RELAY	Make – N.A DoM - N.A Model – N.A DoC - N.A Sr. No. - N.A	
	O/C	Make – EASUN REYROLLE PSM -1.25 Model –2TJM11 TMS -0.15 sec Sr. No. –HR0601412	
	E/F	Make – EASUN REYROLLE PSM -0.5 Model – 2TJM11 TMS -0.15 sec Sr. No. –HR0601380	
	LBB	Make – N.A PSM - N.A Model – N.A TMS - N.A Sr. No. - N.A	
CT	R Ph	Make – Victrans Engineers Sr. No. –VE/C 1448362 Type – C-114D DoM - 2007 Current Ratio –600-300-150/1A DoC - N.A Rated Voltage –145 kv No. of Core – 4	Length of control cable from JB to Panel -175 Meter Cross Section of C.T. Control Cable Core-10 core*6mm^2
	Y Ph	Make – Victrans Engineers Sr. No. –VE/C 1448371 Type – – C-114D DoM -2007 Current Ratio –600-300-150/1A DoC - N.A Rated Voltage –145 kv No. of Core – 4	
	B Ph	Make – Victrans Engineers Sr. No. –VE/C 1448382 Type – – C-114D DoM -2007 Current Ratio –600-300-150/1A DoC - N.A Rated Voltage –145 kv No. of Core – 4	
Breaker	Make – AREVA Serial No. –101740 Type –GL 312 DoM -2007 Rated Voltage – 145KV DoC - N.A Rated Current –3150 A Short Time Amp –40 KA		
EM	Make – Secure Meter Ltd. Serial No. –JSB44795 Model –E3M021, 3P- 4W DoM - 2013 MTR – 600/1A DoC - 2014 Class –0.2 s		

Name of GSS :220/132KVRAMCHANDRAPUR G/S/S
Details:

Name of Feeder –Tr. No.-2 (132 KV)			**Remarks**
Line	Length – N.A Conductor - N.A		
Panel	Make – ENGLISH ELECTRIC Model – N.A DoC - N.A	DoM - N.A	
Relay	DIFF. RELAY	Make – N.A Model – N.A Sr. No. - N.A	DoM - N.A DoC - N.A
	O/C	Make – ENGLISH ELECTRIC Model –CDG11AF002SA(M) Sr. No. -11192037401008, 16, 15	PSM -1.25 TMS -0.15 sec
	E/F	Make – ENGLISH ELECTRIC Model – CDG11AF005SA(M) Sr. No. - N.A	PSM - N.A TMS - N.A
	LBB	Make – N.A PSM - N.A Model – N.A TMS - N.A Sr. No. - N.A	
CT	R Ph	Make – Victrans Engineers Type – C-114D Current Ratio –600-300-150/1A Rated Voltage –145 kv	Sr. No. –VE/C 1448381 DoM - 2007 DoC - N.A No. of Core – 4
	Y Ph	Make – Victrans Engineers Type – – C-114D Current Ratio –600-300-150/1A Rated Voltage –145 kv	Sr. No. –VE/C 1448364 DoM -2007 DoC - N.A No. of Core – 4
	B Ph	Make – Victrans Engineers Type – – C-114D Current Ratio –600-300-150/1A Rated Voltage –145 kv	Sr. No. –VE/C 1448361 DoM -2007 DoC - N.A No. of Core – 4
Breaker	Make – AREVA Type –GL 312 Rated Voltage – 145KV Rated Current –3150 A Short Time Amp –40 KA	Serial No. –102832 DoM -2008 DoC - N.A	
EM	Make – Secure Meter Ltd. Model –E3M021, 3P- 3W MTR – 600/1A Class –0.2 s	Serial No. –WBB04206 DoM - 2005 DoC - N.A	

Length of control cable from JB to Panel -136 Meter

Cross Section of C.T. Control Cable Core-10 core*6mm^2

Name of GSS :220/132KVRAMCHANDRAPUR G/S/S
Details:

Name of Feeder –Tr. No.-1 (132 KV)			**Remarks**
Line	Length – N.A Conductor - N.A		
Panel	Make – ENGLISH ELECTRIC DoM - N.A Model – N.A DoC - N.A		
Relay	DIFF. RELAY	Make – N.A DoM - N.A Model – N.A DoC - N.A Sr. No. - N.A	
	O/C	Make – ENGLISH ELECTRIC PSM -1.25 Model –CDG11AF002SA(M) TMS -0.15 sec Sr. No. -95088559005	
	E/F	Make – ENGLISH ELECTRIC PSM -0.2 Model – CDG11AF005SA(M) TMS -0.1 sec Sr. No. -95103476002(B)	
	LBB	Make – N.A PSM - N.A Model – N.A TMS - N.A Sr. No. - N.A	
CT	R Ph	Make – SCT, Limited Sr. No. -96/809 Type – O.D.D.T DoM - 1997 Current Ratio –1200-600/1A DoC - N.A Rated Voltage –245 kv No. of Core – 4	Length of control cable from JB to Panel -150 Meter Cross Section of C.T. Control Cable Core-10 core*6mm^2
	Y Ph	Make – SCT, Limited Sr. No. -96/804 Type – – O.D.D.T DoM -1997 Current Ratio –1200-600/1A DoC - N.A Rated Voltage –245 kv No. of Core – 4	
	B Ph	Make – SCT, Limited Sr. No. -96/807 Type – – O.D.D.T DoM -1997 Current Ratio –1200-600/1A DoC - N.A Rated Voltage –245 kv No. of Core – 4	
Breaker	Make – CGL Serial No. –EC 7429C Type –200-SFM-32A DoM -1995 Rated Voltage – 145KV DoC - N.A Rated Current –1600 A Short Time Amp –31.5 KA		
EM	Make – N.A Serial No. – N.A Model – N.A DoM - N.A MTR – N.A DoC - N.A Class – N.A		

Name of GSS :220/132KVRAMCHANDRAPUR G/S/S
Details:-

Name of Feeder –Tr. No-3 (220 KV)			**Remarks**
Line	Length – N.A Conductor - N.A		
Panel	Make – EASUN REYROLLE DoM - N.A Model – N.A DoC - N.A		
Relay	DIFF. RELAY	Make – EASUN REYROLLE Type- N.A Model –DUOBIAS-M Bias-30 % Sr. No. - 100909302/010	
	O/C	Make – EASUN REYROLLE PSM -1.25 Model –2TJM11 TMS -0.15 sec Sr. No. –HR0601402	
	E/F	Make – EASUN REYROLLE PSM -0.2 Model – 2TJM11 TMS -0.15 sec Sr. No. –HR0601382	
	LBB	Make – EASUN REYROLLE PSM -200 ma Model –2DAB TMS -192 ms Sr. No. –BR0531822	
	REF	Make – EASUN REYROLLE PSM - 0.2 Model – 5B3 TMS – N.A Sr. No. –BR0600194 Vs-30	
CT	R Ph	Make – SCT, Limited Sr. No. -2007/2316 Type – O.D.D.T DoM - 2007 Current Ratio –1200-600-300/1A DoC - N.A Rated Voltage –245 kv No. of Core – 4	Length of control cable from JB to Panel -205 Meter Cross Section of C.T. Control Cable Core- 12 core*6mm^2 12 core*2.5mm^2
	Y Ph	Make – SCT, Limited Sr. No. -2007/2317 Type – O.D.D.T DoM -2007 Current Ratio –1200-600-300/1A DoC - N.A Rated Voltage –245 kv No. of Core –4	
	B Ph	Make – AREVA Sr. No. -20060837 Type – IT-245DoM -2006 Current Ratio –1200-600-300-150/1A DoC - N.A Rated Voltage –245 kv No. of Core – 5	
Breaker	Make – AREVA Serial No. –150419 Type –GL 314 DoM -2006 Rated Voltage – 245KV DoC - N.A Rated Current –3150 A Short Time Amp –40 KA		
EM	Make – Secure Meter Ltd. Sr. No. –KAU03195 Model – E3V 021, 3ph- 3w DoM - 2006 MTR – 200/1 DoC - N.A Class –0.2 s		

Name of GSS :220/132KVRAMCHANDRAPUR G/S/S
Details:-

Name of Feeder –Tr. No-2 (220 KV)			**Remarks**
Line	Length – N.A Conductor - N.A		
Panel	Make – ENGLISH ELECTRIC DoM - N.A Model – N.A DoC - N.A		
Relay	DIFF. RELAY	Make – ENGLISH ELECTRIC Type-DTH 32 Model – DTH32HG8014A(M) Bias-30% Sr. No. - 92037498002	
	O/C	Make – ENGLISH ELECTRIC PSM -1.25 Model –CDG21AF0032M(M) TMS -0.15 sec Sr. No. -11192037406001, 08, 05	
	E/F	Make – ENGLISH ELECTRIC PSM -0.2 Model – CDD21PF905SE(M) TMS -0.15 sec Sr. No. -11192037399001	
	LBB	Make – MICOM, Schneider PSM -0.2 Model –P122B00Z112CF0 TMS -200 ms Sr. No. -36234276/07/13	
	REF	Make – AREVA PSM - 0.2 Model – CAG 4AF144 TMS – N.A Sr. No. –140311680627001	
CT	R Ph	Make –ALSTOM Instrument Trans. Pvt. Ltd. Sr. No. -20050631/2005 Type – IT-245 DoM - 2005 Current Ratio –1200-600-300/1A DoC - N.A Rated Voltage –245 kv No. of Core – 4	Length of control cable from JB to Panel -150 Meter Cross Section of C.T. Control Cable Core- 12 core*2.5mm^2 12 core*6.0mm^2
	Y Ph	Make – ALSTOM Instrument Trans. Pvt. Ltd. Sr. No. -20050630 Type – – IT-245 DoM -2005 Current Ratio –1200-600-300/1A DoC - N.A Rated Voltage –245 kv No. of Core –4	
	B Ph	Make – ALSTOM Instrument Trans. Pvt. Ltd. Sr. No. -20050629 Type – – IT-245 DoM -2005 Current Ratio –1200-600-300/1A DoC - N.A Rated Voltage –245 kv No. of Core – 4	
Breaker	Make – CGL Serial No. –20132 C Type –200-SFM-40S DoM -2005 Rated Voltage – 245KV DoC - N.A Rated Current –3150 A Short Time Amp –40 KA		
EM	Make – Secure Meter Ltd. Sr. No. –JSB44798 Model – E3M 021, 3ph- 4w DoM - 2013 MTR – 600/1 DoC - 2014 Class –0.2 s		

Name of GSS :220/132KVRAMCHANDRAPUR G/S/S
Details:-

Name of Feeder –Tr. No-1 (220 KV)			**Remarks**
Line	Length – N.A Conductor - N.A		
Panel	Make – ENGLISH ELECTRIC DoM - N.A Model – N.A DoC - N.A		
Relay	DIFF. RELAY	Make – ENGLISH ELECTRIC Type-DTH 32 Model – DTH32HG8014A(M) Bias-30% Sr. No. - 92037498001	
	O/C	Make – ENGLISH ELECTRIC PSM -1.25 Model –CDG21AF0032M(M) TMS -0.15 sec Sr. No. -11192037406002, 03, 04	
	E/F	Make – ENGLISH ELECTRIC PSM -0.2 Model – CDD21PF905SE(M) TMS -0.15 sec Sr. No. -11192037399002	
	LBB	Make – MICOM, Schneider PSM -0.2 Model –P122B00Z112CF0 TMS -200 ms Sr. No. -36234273/07/13	
	REF	Make – ENGLISH ELECTRIC PSM - 0.2 Model – CAG 14AF14A TMS – N.A Sr. No. – 11192037412001	
CT	R Ph	Make –System Controls & Trans. Pvt. Ltd. Sr. No. -91/828 Type – O.D.D.T DoM - 1991 Current Ratio –1200-600-300-150/1A DoC - N.A Rated Voltage –245 kv No. of Core – 5	Length of control cable from JB to Panel -164 Meter Cross Section of C.T. Control Cable Core-12 core*6mm^2
	Y Ph	Make – System Controls & Trans. Pvt. Ltd. Sr. No. -91/827 Type – – O.D.D.T DoM -1991 Current Ratio –1200-600-300-150/1A DoC - N.A Rated Voltage –245 kv No. of Core – 5	
	B Ph	Make – System Controls & Trans. Pvt. Ltd. Sr. No. -91/826 Type – – O.D.D.T DoM -1991 Current Ratio –1200-600-300-150/1A DoC - N.A Rated Voltage –245 kv No. of Core – 5	
Breaker	Make – CGL Serial No. –6071 C Type –200-SFM-40A DoM -1993 Rated Voltage – 245KV DoC - N.A Rated Current –1600 A Short Time Amp –40 KA		
EM	Make – Secure Meter Ltd. Sr. No. –JSB44798 Model – E3V 021, 3ph- 3w DoM - 2005 MTR – 600/1 DoC - N.A Class –0.2 s		

Name of GSS :220/132KVRAMCHANDRAPUR G/S/S
Details:

Name of Feeder –220 KV CHANDIL LINE			**Remarks**
Line	Length – 35 KM Conductor - Zebra		
Panel	Make – ENGLISH ELECTRIC DoM - N.A Model – DoC - N.A		
Relay	DPR	Make – Micom ,AREVA/ALSTOM DoM - N.A Model – P442 DoC – 25.11.2015 Sr. No. – 332219528/02/15	
	O/C	Make – Micom ,AREVA/ALSTOM PSM -0.75 Model –P430c TMS -1 sec Sr. No. -	
	E/F	Make – Micom ,AREVA/ALSTOM PSM –0.20 Model – P430c TMS –1.0 sec Sr. No. -	
	LBB	Make – MICOM, Schneider PSM -0.2 Model –P122B00Z112CFO TMS -200 ms Sr. No. -36234278/07/13	
CT	R Ph	Make –SCT Gaziyabad Ltd. Sr. No. -2012/1023 Type – N.A DoM - 2012 Current Ratio –800-400-200/1A DoC - N.A Rated Voltage –245 kv No. of Core – 5	Length of control cable from JB to Panel -115 Meter Cross Section of C.T. Control Cable Core- 12 core*2.5mm^2 12 core*6mm^2
	Y Ph	Make – ALSTOM, Limited Sr. No. -20050626 Type – – IT-245 DoM -2005 Current Ratio –800-400-200/1A DoC - N.A Rated Voltage –245 kv No. of Core – 4	
	B Ph	Make – ALSTOM, Limited Sr. No. -20050627 Type – – IT-245 DoM -2005 Current Ratio –800-400-200/1A DoC - N.A Rated Voltage –245 kv No. of Core – 4	
Breaker	Make – Hindustan Brown Boveri Serial No. –IB103411 Type –ELF 245nc2 DoM -1987 Rated Voltage – 245KV DoC - N.A Rated Current –3150 A Short Time Amp –40 KA		
EM	Make – APEX Meter (Secure Meter Limited) Serial No. – APM 99579 Model – R3M021-334, 3 ph- 4 wire DoM - June, 2007 MTR – -/1 A DoC - N.A Class –0.2 s		

Name of GSS :220/132KVRAMCHANDRAPUR G/S/S
Details:

Name of Feeder –220 KV JODA LINE			**Remarks**
Line	Length – 130 KM Conductor - Zebra		
Panel	Make – ENGLISH ELECTRIC DoM - N.A Model – N.A DoC - N.A		
Relay	DPR	Make –Micom,AREVA/ALSTOM DoC -29/03/2014 Model – P442 DoC - N.A Sr. No. -062707C	
	O/C	Make – Micom ,AREVA/ALSTOM PSM -750 ma Model –P442318B2A030G TMS -0.5 sec Sr. No. -062707C	
	E/F	Make – Micom ,AREVA/ALSTOM PSM -200 ma Model – P442318B2A030G TMS -0.1 sec Sr. No. -062707C	
	LBB	Make – MICOM, Schneider PSM -0.2 Model –P122B00Z112CFO TMS -200 ms Sr. No. -36234280/07/13	
CT	R Ph	Make –SCT, Limited Sr. No. -2012/1017 Type – O.D.D.T DoM - 2012 Current Ratio –1200-600-300-150/1A DoC - N.A Rated Voltage –245 kv No. of Core – 4	Length of control cable from JB to Panel -105 Meter Cross Section of C.T. Control Cable Core-12 core*6mm^2
	Y Ph	Make – SCT, Limited Sr. No. -2012/1010 Type – O.D.D.T DoM -2012 Current Ratio –1200-600-300-150/1A DoC - N.A Rated Voltage –245 kv No. of Core – 4	
	B Ph	Make – SCT, Limited Sr. No. -2012/1016 Type – O.D.D.T DoM -2012 Current Ratio –1200-600-300-150/1A DoC - N.A Rated Voltage –245 kv No. of Core – 4	
Breaker	Make –AREVA Serial No. –6072 C Type –GL 314 (SF6) DoM - 2006 Rated Voltage – 245KV DoC -2013 Rated Current –3150 A Short Time Amp –40 KA		
EM	Make – APEX Meter (Secure Meter Limited) Serial No. – APM 99576 Model – R3M021-334, 3 ph- 4 wire DoM - June, 2007 MTR – -/1 A DoC - N.A Class –0.2 s		

Name of GSS :220/132KVRAMCHANDRAPUR G/S/S
Details:

Name of Feeder –ICT-2			**Remarks**
Line	Length – 1.5 km Conductor -Zebra		
Panel	Make – ENGLISH ELECTRIC DoM - N.A Model – N.A DoC - N.A		
Relay	DPR	Make – N.A DoM - N.A Model – N.A DoC - N.A Sr. No. - N.A	
	O/C	Make – ENGLISH ELECTRIC PSM -1 Model –CDD TMS -0.4 sec Sr. No. -2082166002	
	E/F	Make – ENGLISH ELECTRIC PSM -0.2 Model – CDD TMS -0.7 sec Sr. No. - N.A	
	LBB	Make – ENGLISH ELECTRIC PSM -0.2 Model –CTIG39BF8002AG TMS -1 Sr. No. -91083261003	
CT	R Ph	Make –AREVA Sr. No. -20060848 Type – IT-245 DoM - 2006 Current Ratio –1200-600-300-150/1A DoC - N.A Rated Voltage –245 kv No. of Core – 5	Length of control cable from JB to Panel -129 Meter Cross Section of C.T. Control Cable Core- 10 core*2.5mm^2 12 core*6mm^2
	Y Ph	Make – AREVA Sr. No. -20060851 Type – IT-245 DoM -2006 Current Ratio –1200-600-300-150/1A DoC - N.A Rated Voltage –245 kv No. of Core – 5	
	B Ph	Make – AREVA Sr. No. -20060849 Type – IT-245 DoM -2006 Current Ratio –1200-600-300-150/1A DoC - N.A Rated Voltage –245 kv No. of Core – 5	
Breaker	Make –CROMPTON GREAVES Serial No. –6072 C Type –200-SFM-40A DoM - 1993 Rated Voltage – 245KV DoC - N.A Rated Current –1600 A Short Time Amp –40 KA		
EM	Make – APEX Meter (Secure Meter Limited) Serial No. – APM 99578 Model – R3M021-334, 3 ph- 4 wire DoM - June, 2007 MTR – -/1 A DoC - N.A Class –0.2 s		

Details:

Name of Feeder– ICT-1			**Remarks**
Line	Length –1.5 km Conductor -Zebra		
Panel	Make – ENGLISH ELECTRIC DoM - N.A Model – N.A DoC - N.A		
Relay	DPR	Make – N.A DoM - N.A Model – N.A DoC - N.A Sr. No. - N.A	
	O/C	Make – ENGLISH ELECTRIC PSM - 1 Model – CDD TMS - 0.4 sec Sr. No. - N.A	
	E/F	Make – ENGLISH ELECTRIC PSM - 0.2 Model –CDD TMS - 0.7sec Sr. No. - N.A	
	LBB	Make – ENGLISH ELECTRIC PSM - 0.2 Model – CTIG 39BF8002ACMJ TMS - 1 sec Sr. No. -91126328001	
CT	R Ph	Make –AREVA Sr. No. - 20060853 Type –IT-245 DoM - 2006 Current Ratio –1200-600-300-150/1 AMP DoC - N.A Rated Voltage – 245 KV No. of Core – 5	Length of control cable from JB to Panel -129 Meter Cross Section of C.T. Control Cable Core- 10 core*2.5mm^2 12 core*6mm^2
	Y Ph	Make – AREVA Sr. No. - 20060845 Type – IT-245 DoM - 2006 Current Ratio -1200-600-300-150/1 AMP DoC - N.A Rated Voltage –245 KV No. of Core - 5	
	B Ph	Make – AREVA Sr. No. - 20060712 Type – IT-245 DoM - 2006 Current Ratio –1200-600-300-150/1 AMPDoC - N.A Rated Voltage –245 KV No. of Core – 5	
Breaker	Make – Hindustan Brown Boveri Serial No. – N.A Type – N.A DoM - N.A Rated Voltage –245 kvDoC - N.A Rated Current – N.A Short Time Amp – N.A		
EM	Make – APEX Meter (Secure Meter Limited) Serial No. –APM 99578 Model –R3M021-334, 3 ph- 4 wire DoM –June, 2007 MTR –-/1 A DoC - N.A Class –0.2 s		

Annexure-8.2.12

D.C. system details with Charger and battery									
Sl. No.	**Name of G/s/s**	**Details of Battery Charger**	**Single /Double**	**Total voltage**	**Capacity**	**no. of Cells**	**D.C. system Earth fault**	**D.C. positive to earth**	**D.C. Negative to earth**
2	**Ramchandrapur**	**DC charger-1** TYPE- H3V3FMM Input-400V Float charger output- 260V Boost charger output- 330v 3 phase, 50Hz, 3% Ripple Make- Best and Crompton Engineering LTD. **DC charger-II** 300AH HBL make Battery Float cum Boost Charger Model- FCBC340036 AC voltage range- 370v to 460v Frequency-50Hz Output DC voltage-250v Output Current- 36A Make- Signotron India Pvt.LTD	Double	240v	300AH	112	Not tested	227V	7V

Annexure-8.2.13

Name of the Sub-station:-Ramchandrapur		
Name of the line	Line length(KM)	Conductor type
JODA	130	ZEBRA
ADITYAPUR 1	8	PANTHER
ADITYAPUR 2	8	PANTHER
CHANDIL	35	ZEBRA
ADHUNIC	4.26	PANTHER

Name of feeder		Nomenclature	Make & Model	Distance- O/C	Distance - E/F	Connected CT core number & Details					Relay setting										
						Location(bus side or line side)	Ratio	Core number	C.T. details	Core details	Zone 1	Zone 2	Zone 3	Zone 4	tZ 1	tZ 2	tZ 3	tZ 4	PSM	TSM	Characteristics for O/C, E/F
JODA	Main 1	MICOM	AREVA, P442	PSM-750mA, TMS-0.5s	PSM-200mA, TMS-0.1s	BUS SIDE	600/1	4	1200/600/300/150/1A Class-0.5 , Rated voltage-245KV, Type-O.D.D.T.		12.67Ω	19.01Ω	25Ω	3.168Ω	0	300ms	1s	1.2s			
ADITYAPUR 1		MICOM	AREVA, P442	PSM-900mA, TMS-0.5s	PSM-200mA, TMS-0.1s	BUS SIDE	600/1	4	1200/600/300/1A Class-0.2 , Rated voltage-145KV, Type--C-114D		1.299Ω	1.949Ω	11.18Ω	324mΩ	0	300ms	1s	1.2s			
ADITYAPUR 2		MICOM	AREVA, P442	PSM-900mA, TMS-0.5s	PSM-200mA, TMS-0.1s	BUS SIDE	600/1	4	1200/600/300/1A Class-0.2 , Rated voltage-145KV, Type--C-114D		1.299Ω	1.949Ω	11.18Ω	324mΩ	0	300ms	1s	1.2s			
CHANDIL		MICOM	AREVA, P442	PSM-200mA, TMS-200ms	PSM-900mA, TMS-500ms	BUS SIDE	800/1	R phase-5 Y & B phase-4	800/400/200/1A Class-0.2 , Rated voltage-245KV, Type--IT245		4.59Ω	6.82Ω	11.68Ω	1.13Ω	0	300ms	1s	1.2s			
ADHUNIC		MICOM	AREVA, P443	PSM-1.5A, TMS-1s	PSM-200mA, TMS-1s	BUS SIDE	300/1	4	600/300/150/1A Class-0.2 , Rated voltage-145KV, Type--CT145/275/650		320mΩ	480mΩ	800mΩ	80mΩ	0	400ms	1s	2s			
	Make & Model																				
	Main 2																				
	Remarks:																				
	Bus coupler protection																				

Name of the Sub-station: Ramchandrapur GSS

Transformer Details	BHEL,1992 Vector-YNn0d11	
Transformer Number	1	
MVA Rating	150	
% Impedance	Tap no. 1-12.44, Tap no. 5(Normal)-12.03, Tap no. 17-12	
Ratio	220/132KV	

Name of the Protection		**C.T.**	**C.T. Details (Make & Model)**	**Connected CT/PT core**			**Setting**	**High set setting**
				Ratio	**Core number**	**Core details**		
		HV	SCT, Rated voltage-245KV Class of Accuracy- 1	600/1A	5	1200/600/300/150/1A		
		LV	SCT, Rated voltage-245KV Class of Accuracy- 1	600/1A	4	1200/600/1A		
	Nomenclature	**Make & model**						
Differential Protection	English Electrical	DTH32HG8014A(M)					BIAS-30%	
Restricted E/F (HV)	English Electrical	CAG14AF14A					PSM-0.2, TMS-	
Restricted E/F (LV)								
HV O/C	English Electrical	CDG21AF0032M(M)					PSM-1.25, TMS-0.15	
LV O/C	English Electrical	CDG11AF002SA(M)					PSM-1.25, TMS-0.15	
HV E/F	English Electrical	CDD21PF905SE(M)					PSM-0.2, TMS-0.15	
LV E/F	English Electrical	CDG11AF005SA(M)					PSM-0.2, TMS-0.1	
Over flux	AREVA	GTT21AFA001ACH					1.2K, T-12 Sec,	

Trip relay	English Electrical	VAJAMI3SF54D

Name of the Sub-station: Ramchandrapur GSS

Transformer Details	BHEL,1992 Vector-YNn0d11	
Transformer Number	2	
MVA Rating	150	
% Impedance	Tap no. 1-11.87, Tap no. 5(Normal)-11.64, Tap no. 17-11.53	
Ratio	220/132KV	

Name of the Protection		**C.T.**	**C.T. Details (Make & Model)**	**Connected CT/PT core number & Details**			**Setting**	**High set setting**
				Ratio	**Core number**	**Core details**		
		HV	AREVA, Rated voltage-245KV Class of Accuracy- 0.2	600/1A	4	1200/600/300/1A		
		LV	VICTRANS ENG., Rated voltage-145KV Class of Accuracy- 0.5	600/1A	4	600/300/150/1A		
Nomenclature		**Make & model**						
Differential Protection	English Electrical	DTH32HG8014A(M)					BIAS-30%	
Restricted E/F (HV)	AREVA	CAG4AF144					PSM-0.2, TMS-	
Restricted E/F (LV)								
HV O/C	English Electrical	CDG21AF0032M(M)					PSM-1.25, TMS-0.15	
LV O/C	English Electrical	CDG11AF002SA(M)					PSM-1.25, TMS-0.15	
HV E/F	English Electrical	CDD21PF905SE(M)					PSM-0.2, TMS-0.15	
LV E/F	English Electrical	CDG11AF005SA(M)					PSM-0.2, TMS-0.1	
Over flux	AREVA	GTT21AFA001ACH					1.2K, T-12 Sec,	

Trip relay	English Electrical	VAJAMI3SF54D

Annexure-8.2.14.2

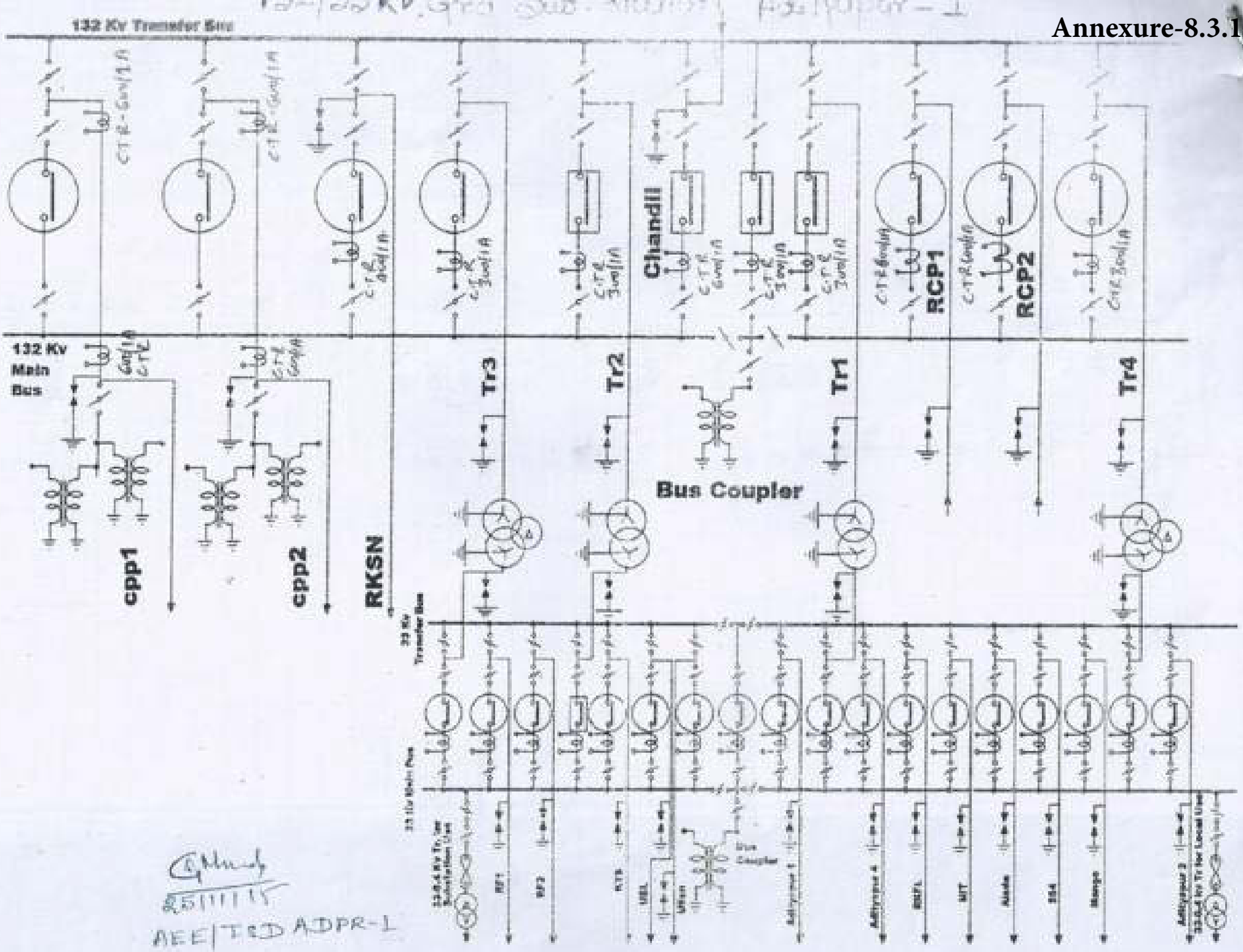
Name of the Sub-station: Ramchandrapur GSS

Transformer Details	AREVA,2006 Vector-YNn0d11	
Transformer Number	1	
MVA Rating	150	
% Impedance	Tap no. 1-11.59, Tap no. 5(Normal)-11.33, Tap no. 17-11.20	
Ratio	220/132KV	

Name of the Protection		**C.T.**	**C.T. Details (Make & Model)**	**Connected CT/PT core number & Details**			**Setting**	**High set setting**
				Ratio	**Core number**	**Core details**		
		HV	R & Y Phase -SCT, B Phase-AREVA, Rated voltage-245KV Class of Accuracy-0.5(R&Y-phase), 0.2(B-phase)	600/1A	R & Y phase -4 B-phase-5	R & Y phase-1200/600/300/1A B phase-1200/600/300/150/1A		
		LV	VICTRANS ENG., Rated voltage-145KV Class of Accuracy-0.5	600/1A	4	600/300/150/1A		
	Nomenclature	**Make & model**						
Differential Protection	EASUN REYROLLE	DUOBIAS-M					BIAS-30%	
Restricted E/F (HV)	EASUN REYROLLE	5B3					PSM-0.2, TMS-	
Restricted E/F (LV)								
HV O/C	EASUN REYROLLE	2TJM11					PSM-1.25, TMS-0.15	
LV O/C	EASUN REYROLLE	2TJM11					PSM-1.25, TMS-0.15	
HV E/F	EASUN REYROLLE	2TJM11					PSM-0.2, TMS-0.15	
LV E/F	EASUN REYROLLE	2TJM11					PSM-0.5, TMS-0.15	
Over flux	AREVA	GTT21AFA001ACH					1.2K, T-12 Sec,	

Trip relay	EASUN REYROLLE	TR221

Annexure-8.3.1



AEE/TRD ADPR-1

Sl. No.	Name of G/S/S	Name of Feeders	e of Equip	ails of equipn	Year of Manufacturing
1	Adityapur	132 KV UML-I	CT	R Phase	2009
			CT	Y Phase	2009
			CT	B Phase	2009
2		132 KV UML-II	CT	R Phase	2010
			CT	Y Phase	2010
			CT	B Phase	2010
3		132 KV RKSN	CT	R Phase	2011
			CT	Y Phase	2011
			CT	B Phase	2011
4		132 KV B/C	CT	R Phase	
			CT	Y Phase	
			CT	B Phase	
5		132 KV 50MVA Tr.-I	CT	R Phase	2009
			CT	Y Phase	2009
			CT	B Phase	2009
6		132 KV 50 MVA Tr.-I	CT	R Phase	
			CT	Y Phase	
			CT	B Phase	
7		132 KV MVA Tr.-IV	CT	R Phase	2007
			CT	Y Phase	2007
			CT	B Phase	2007
8		132 KV Chandil	CT	R Phase	
			CT	Y Phase	
			CT	B Phase	
9		132 KV RCP-I	CT	R Phase	1992
			CT	Y Phase	1992
			CT	B Phase	1992
10		132 KV RCP-II	CT	R Phase	2006
			CT	Y Phase	2006
			CT	B Phase	2006
11		132 KV PT-I connected (UML-I)	PT	R Phase	2011
			PT	Y Phase	2011
			PT	B Phase	2011
12		132 KV PT-I connected (UML-II)	PT	R Phase	2011
			PT	Y Phase	2011
			PT	B Phase	2011
13		132KV Main-Bus	PT	R Phase	20 Years Old
			PT	Y Phase	20 Years Old
			PT	B Phase	20 Years Old
14		132 KV UML-I	Breaker		1998
15		132 KV UML-II	Breaker		2008
16		132 KV RKSN	Breaker		2007
17		132 KV Tr.-I	Breaker		20 Years Old
18		132 KV Tr.-II	Breaker		20 Years Old
19		132 KV Tr.-IV	Breaker		2006
20		132 KV Chandil	Breaker		20 Years Old
21		132 KV RCP-I	Breaker		1999
22		132 KV RCP-II	Breaker		1999
23		2KV Main-Bus Coup	Breaker		20 Years Old
24		50 MVA Transformer-I	Transform er		1994
25		50 MVA Transformer-II	Transform er		1994
26		50 MVA Transformer-IV	Transform er		2006

Annexure-8.3.3

Sl. No.	Name of G/S/S	Name of Feeders	Comprehensive C.T. details	Make	CT ratio	Connected Ratio	Core No.	Class of accuracy	Protection class use	Knee voltage
1	132KV GSS Adityapur	132 KV UML-I	R Phase	CGL	600/300/150/1A	600/1A	5 Core	0.2	PS	
			Y Phase	CGL	600/300/150/1A			0.2	PS	
			B Phase	CGL	600/300/150/1A			0.2	PS	
2		132 KV UML-II	R Phase	CGL	600/300/150/1A	600/1A	5 Core	0.2	PS	
			Y Phase	CGL	600/300/150/1A			0.2	PS	
			B Phase	CGL	600/300/150/1A			0.2	PS	
3		132 KV RKSN	R Phase	SCT LTD.(UP)	800/400/200/1A	400/1A	4 Core	0.5	PS	
			Y Phase	SCT LTD.(UP)	800/400/200/1A			0.5	PS	
			B Phase	SCT LTD.(UP)	800/400/200/1A			0.5	PS	
4		132 KV B/C	R Phase	ASEA	600/300/150/1A	300/1A	3 Core		PS	
			Y Phase	ASEA	600/300/150/1A				PS	
			B Phase	ASEA	600/300/150/1A				PS	
5		132 KV 50MVA Tr.-I	R Phase	Victrans eng.	600/300/150/1A	300/1A	4 Core	0.2	PS	
			Y Phase	Victrans eng.	600/300/150/1A			0.2	PS	
			B Phase	Victrans eng.	600/300/150/1A			0.2	PS	
6		132 KV 50 MVA Tr.-II	R Phase	Bhel	600/300/150/5A	300/1A	4 Core	1	PS	
			Y Phase	Bhel	600/300/150/5A			1	PS	
			B Phase	Alstrom	600/300/150/5A			1	PS	
7		132 KV MVA Tr.-IV	R Phase	SCT LTD.(UP)	600/300/150/1A	300/1A	4 Core	0.5	PS	
			Y Phase	SCT LTD.(UP)	600/300/150/1A			0.5	PS	
			B Phase	SCT LTD.(UP)	600/300/150/1A			0.5	PS	
8		132 KV Chandil	R Phase	ASEA	600/300/150/1A	600/1A	3 Core	0.2	PS	
			Y Phase	Victrans eng.	1200/600/300/1A			0.2	PS	
			B Phase	ASEA	600/300/150/1A			0.2	PS	
9		132 KV RCP-I	R Phase	SCT LTD.(UP)	600/300/150/1A	600/1A	4 Core	1	PS	
			Y Phase	SCT LTD.(UP)	600/300/150/1A			1	PS	
			B Phase	SCT LTD.(UP)	600/300/150/1A			1	PS	
10		132 KV RCP-II	R Phase	SCT LTD.(UP)	600/300/150/1A	600/1A	4 Core	1	PS	
			Y Phase	SCT LTD.(UP)	600/300/150/1A			1	PS	
			B Phase	SCT LTD.(UP)	600/300/150/1A			1	PS	

Annexure-8.3.4

Sl. No.	Name of G/S/S	V.T. details	Comprehensive P.T. details	Make	Core No.
1	Adityapur	132 KV PT-I connected (UML-I)	R Phase	CGL	3 Core
			Y Phase	CGL	3 Core
			B Phase	CGL	3 Core
2		132 KV PT-I connected (UML-II)	R Phase	CGL	3 Core
			Y Phase	CGL	3 Core
			B Phase	CGL	3 Core
3		132KV Main-Bus	R Phase	Seimans	3 Core
			Y Phase	Seimans	3 Core
			B Phase	Seimans	3 Core

Class of accuracy
0.5/3/0.2
0.5/3/0.2
0.5/3/0.2
0.5/3/0.2
0.5/3/0.2
0.5/3/0.2
0.5/3/0.5
0.5/3/0.5
0.5/3/0.5

Annexure-8.3.5

Fault lelvel at JUSNL Sub-stations

Bus Name	Bus Voltage	3 Ph Fault current	SLG Fault current
CHANDIL 220	220	14514	9735
RAMCHANDRAPUR 220	220	18450	15443
CHANDIL	132	18105	12652
ADITPUR	132	12098	8624
RAMCHANDRAPUR 132	132	13000	11126

Note: Data recieved from ERLDC

Cable details used for C.T. connection

Sl No.	Name of G/S/S	Name of Feeder	No. of Cable use C.T.		Cross section of cable	Length of cable J/B to C/R panel
1	**Adityapur**	**132KV UML-I**	**6**		2.5 Sq. mm	65 mtrs
2		**132KV UML-II**	4		2.5 Sq. mm	70 mtrs
3		**132KV RKSN**	4		2.5 Sq. mm	65 mtr
4		**132Kv Tr-II Bay**	12		2.5 Sq. mm	100 mtr
5		**132 Kv Chandil**	4		2.5 Sq. mm	112 mtr
6		**132KV B/C Bay**	10		2.5 Sq. mm	127 mtr
7		**132Kv Tr.-I bay**	10		2.5 Sq. mm	138 mtr
8		**132Kv RCP -I**	10		6 Sq. mm	152 mtr
9		**132Kv RCP- II**	10		6 Sq. mm	165 mtr
10		**132Kv Tr.-IV**	10		2.5 Sq. mm	177mtr

Measurement of Earth Resistance
Name of G/S/S = 132/33KV

33 KV Side Feeder

SL NO	Name of Earth Pit	Earth Resistance in Ohm	Remarks
1	Tr.No-1	0.8 Ohm	
2	Tr.No-2	0.6 Ohm	
3	Tr.No-3	0.6 Ohm	
4	Tr.No-4	0.7 Ohm	
5	Between Nit & Aiada	0.5 Ohm	
6	Between B/C and Kumar Basti	0.7 Ohm	

Near Transformer (New earth Pit)

SL NO	Name of Earth Pit	Earth Resistance in Ohm	Remarks
1	Tr.No-1	1.5 Ohm	
2	Tr.No-2	2.2 Ohm	
3	Tr.No-3	1.8 Ohm	

Near 132Kv Side

SL NO	Name of Earth Pit	Earth Resistance in Ohm	Remarks
1	Tr.No-1	0.4 Ohm	
2	Between RCP I & RCp II	0.6 Ohm	

Near Transformer (Old Earth Pit)

SL NO	Name of Earth Pit	Earth Resistance in Ohm	Remarks
1	Tr.No-1	1 Ohm	
2	Tr.No-2	0.6 Ohm	
3	Tr.No-3	0.9 Ohm	

Control Panel

SL NO	Name of Earth Pit	Earth Resistance in Ohm	Remarks
1	33 Kv Side	0.5 Ohm	
2	132 KV Side	0.4 Ohm	

Test Report
220/132 Kv Grid Sub-Station, Adityapur-II (RCP)

1. Breaker Specification:

Date 22.12.2015

Name of feeder - 220 Kv Transformer - I
Make - CGL
Type - 200-SPM-40A
Sl. No. - 6071C
Year - 1993

Operating time in Mille Second:

	R Ph	Y Ph	B Ph
Closing	87	85	84
Tripping Coil 1	45	45	44
C/o Coil 1	16	21	13

2. Breaker Specification:

Date 21.12.2015

Name of feeder - 220 Kv Chandil - II
Make - HBB
Type - ELF-245-nc2
Sl. No. - IB103411
Year - 1987

Operating time in Mille Second:

	R Ph	Y Ph	B Ph
Closing	146	145	135
Tripping Coil 1	19	18	18
C/o Coil 1	18	42	876

3. Breaker Specification:

Date 21.12.2015

Name of feeder - 220 Kv Transformer - II
Make - CGL
Type - 200-SFM-40S
Sl. No. - 20132C
Year - 2005

Operating time in Mille Second:

	R Ph	Y Ph	B Ph
Closing	123	140	114
Tripping Coil 1	24	24	22
C/o Coil 1	34	42	31

4. Breaker Specification:

Date 21.12.2015

Name of feeder	-	220 Kv ICT-I
Make	-	HBB
Type	-	ELF-245-nc2
Sl. No.	-	N.A
Year	-	1987

Operating time in Mille Second:

	R Ph	Y Ph	B Ph
Closing	159	131	144
Tripping Coil 1	22	589	589
C/o Coil 1	44	640	628

5. Breaker Specification:

Date 21.12.2015

Name of feeder	-	220 Kv ICT-II
Make	-	CGL
Type	-	200-SFM-40A
Sl. No.	-	6072C
Year	-	1993

Operating time in Mille Second:

	R Ph	Y Ph	B Ph
Closing	93	79	85
Tripping Coil 1	49	40	40
C/o Coil 1	16	16	17

6. Breaker Specification:

Date 21.12.2015

Name of feeder	-	220 Kv Joda
Make	-	AREVA
Type	-	GL314
Sl. No.	-	150418
Year	-	2006

Operating time in Mille Second:

	R Ph	Y Ph	B Ph
Closing	68	68	67
Tripping Coil 1	42	42	42
C/o Coil 1	40	42	40

7. **Breaker Specification:**

Date 22.12.2015

Name of feeder	-	220 Kv Transformer - III
Make	-	AREVA
Type	-	GL314
Sl. No.	-	150419
Year	-	2006

Operating time in Mille Second:

	R Ph	Y Ph	B Ph
Closing	70	68	69
Tripping Coil 1	41	40	40
C/o Coil 1	42	42	42

8. **Breaker Specification:**

Date 22.12.2015

Name of feeder	-	220 Kv Bar-Coupler
Make	-	CGL
Type	-	200-SFM-40A
Sl. No.	-	6068C
Year	-	1993

Operating time in Mille Second:

	R Ph	Y Ph	B Ph
Closing	92	84	81
Tripping Coil 1	39	41	41
C/o Coil 1	0	11	15

9. **Breaker Specification:**

Date 20.12.2015

Name of feeder	-	132 Kv Transformer - I
Make	-	CGL
Type	-	120-SFM-32A
Sl. No.	-	EC7429C
Year	-	1995

Operating time in Mille Second:

	R Ph	Y Ph	B Ph
Closing	87	87	88
Tripping Coil 1	28	28	28
C/o Coil 1	0	0	0
Tripping Coil 2	26	26	26
C/o Coil 2	0	0	0

10. Breaker Specification:

Date 21.12.2015

Name of feeder	-	132 Kv Adityapur -II
Make	-	CGL
Type	-	120-SFM-32B
Sl. No.	-	264220C
Year	-	2008

Operating time in Mille Second:

	R Ph	Y Ph	B Ph
Closing	92	92	92
Tripping Coil 1	25	25	26
C/o Coil 1	37	36	38
Tripping Coil 2	25	25	26
C/o Coil 2	37	37	38

11. Breaker Specification:

Date 21.12.2015

Name of feeder	-	132 Kv Adityapur -I
Make	-	BHEL
Type	-	3ARS 3*DLG-302C
Sl. No.	-	403039
Year	-	1997

Operating time in Mille Second:

	R Ph	Y Ph	B Ph
Closing	108	85	84
Tripping Coil 1	39	38	32
C/o Coil 1	56	60	65

12. Breaker Specification:

Date 21.12.2015

Name of feeder	-	132 Kv Transformer - II
Make	-	AREVA
Type	-	GL312
Sl. No.	-	102832
Year	-	2008

Operating time in Mille Second:

	R Ph	Y Ph	B Ph
Closing	73	72	71
Tripping Coil 1	40	41	38
C/o Coil 1	62	65	60

13. Breaker Specification:

Date 22.12.2015

Name of feeder	-	132 Kv Transformer - III
Make	-	AREVA
Type	-	GL312
Sl. No.	-	101740
Year	-	2007

Operating time in Mille Second:

	R Ph	**Y Ph**	**B Ph**
Closing	71	67	68
Tripping Coil 1	35	35	35
C/o Coil 1	53	56	56
Tripping Coil 2	35	35	35
C/o Coil 2	52	55	55

14. Breaker Specification:

Date 22.12.2015

Name of feeder	-	132 Kv Bus-Coupler
Make	-	CGL
Type	-	120-SFM-32B
Sl. No.	-	22169C
Year	-	2006

Operating time in Mille Second:

	R Ph	**Y Ph**	**B Ph**
Closing	91	91	91
Tripping Coil 1	29	29	29
C/o Coil 1	38	39	39
Tripping Coil 2	28	27	28
C/o Coil 2	39	39	39

14. CT/PT earting details

Sl No	Name of GSS	CT earthing details	PT earthing details
3	**Adityapur**	All CT neutral earthing provided in field junction Box.	All PT neutral earthing provided in field junction Box.

Name of GSS: 132/33KV ADITYAPUR-1
Name of Feeder: 132KV B/C

Particular			**Remarks**
Line	Length – N.A. Conductor - Panther		
Panel	Make – ENGLISH ELECTRIC DoM - Model – DoC -		
Relay	DPR	Make – Quadramho DoC- Model – Sr. No. -	
	O/C	Make – UE PSM -1.0 Model – R1117 TMS -0.3 Sr. No. – H827980C	
	E/F	Make – UE PSM -0.2 Model – H1117 TMS -0.20 Sr. No. –H827964B	
	LBB	Make – NA PSM - Model – TMS - Sr. No. -	
CT	R Ph	Make – ASEA LTD, SWEDEN Sr. No. - 5854815 Type – DoM - Current Ratio – 600-300-150/1A DoC - Rated Voltage – 145KV No. of Core-03 Class-	
	Y Ph	Make – ASEA LTD, SWEDEN Sr. No. – 58545813 Type – DoM - Current Ratio – 600-300-150/1A DoC - Rated Voltage –145KV No. of Core-03 Class-	
	B Ph	Make – ASEA LTD, SWEDEN Sr. No. -5854812 Type – DoM - Current Ratio – 600-300-150/1A DoC - Rated Voltage –145KV No. of Core-03 Class-	
Breaker	Make – ASEA LTD, SWEDEN Serial No. – Type – DoM - Rated Voltage –145 KV DoC – Rated Current – Short Time Amp –		
LA			
EM	Make –Secure Meter Ltd. Serial No. – BEB00381 Model – DoM - 2000 MTR – 600/1A DoC - Class –0.2 s		

Name of GSS: 132/33KV ADITYAPUR-1
Name of Feeder: 132KV RKSN

Particular			Remarks
Line	Length – 35 KM Conductor - Panther		
Panel	Make – ENGLISH ELECTRIC DoM - Model – DoC -		
Relay	DPR	Make – Micom, AREVA/ALSTOM DoC-29/03/2014 Model – P441 Sr. No. -	
	O/C	Make – Micom, AREVA/ALSTOM PSM -1 Model – P441 TMS -300 Sr. No. -	
	E/F	Make – Micom, AREVA/ALSTOM PSM -0.2 Model – P441 TMS -0.2 Sr. No. -	
	LBB	Make – PSM - Model – TMS - Sr. No. -	
CT	R Ph	Make – SCT, Limited Sr. No. - 2005/1137 Type – DoM - 2006 Current Ratio – 800-400-200/1A DoC - Rated Voltage – 145KV No. of Core-04 Class-	
	Y Ph	Make – SCT, Limited Sr. No. – 2005/1134 Type – DoM - 2006 Current Ratio – 800-400-200/1A DoC - Rated Voltage –145KV No. of Core-04 Class-	
	B Ph	Make – SCT, Limited Sr. No. -2005/1129 Type – DoM - 2006 Current Ratio – 800-400-200/1A DoC - Rated Voltage –145KV No. of Core-04 Class-	
Breaker	Make – AREVA Serial No. –101739 Type – GL 312 DoM - 2007 Rated Voltage –145 KV DoC – 16/08/2008 Rated Current – 3150 A Short Time Amp –40 KA		
LA			
EM	Make –Secure Meter Ltd. Serial No. – BEB00401 Model – DoM - 2000 MTR – 400/1A DoC - Class –0.2 s		

Name of GSS: 132/33KV ADITYAPUR-1
Name of Feeder: 132KV CHANDIL

Particular			**Remarks**
Line	Length – 16 KM Conductor - Panther		
Panel	Make – ENGLISH ELECTRIC Model –	DoM - DoC -	
Relay	DPR	Make – Micom, AREVA/ALSTOM Model – P441 Sr. No. -	DoC-29/03/2014
	O/C	Make – Micom, AREVA/ALSTOM Model – P441 Sr. No. -	PSM -1 TMS -300ms
	E/F	Make – Micom, AREVA/ALSTOM Model – P441 Sr. No. -	PSM -0.1 TMS -0.05
	LBB	Make – Model – Sr. No. -	PSM - TMS -
CT	R Ph	Make – ASEA LTD, SWEDEN Type – Current Ratio – 600-300-150/1A Rated Voltage – 145KV	Sr. No. - 5854781 DoM - DoC - No. of Core- Class-
	Y Ph	Make – VICTRNS, Nagpur Type – Current Ratio – 1200-600-300/1A Rated Voltage –145KV	Sr. No. - 19510590 DoM - 2009 DoC - No. of Core- Class-
	B Ph	Make – ASEA LTD, SWEDEN Type – Current Ratio – 600-300-150/1A Rated Voltage –145KV	Sr. No. - DoM - DoC - No. of Core- Class-
Breaker	Make – ASEA LTD, SWEDEN Type – Rated Voltage –145kv Rated Current – Short Time Amp –	Serial No. – DoM - DoC -	
LA			
EM	Make –Secure Meter Ltd. Model – MTR – 600/1A Class –0.2 s	Serial No. – BEB00384 DoM - 2000 DoC -	

Name of GSS: 132/33KV ADITYAPUR-1
Name of Feeder: 132KV RCP-2

Particular			Remarks
Line	Length – 8 KM Conductor - Panther		
Panel	Make – ALSTHOM DoM - Model – DoC -		
Relay	DPR	Make – Micom, AREVA/ALSTOM DoC-28/03/2014 Model – P441 Sr. No. -	
	O/C	Make – Micom, AREVA/ALSTOM PSM -0.85 Model – P441 TMS -0.30s Sr. No. -	
	E/F	Make – Micom, AREVA/ALSTOM PSM -0.20 Model – P441 TMS -0.20s Sr. No. -	
	LBB	Make – PSM – Model – TMS – Sr. No. –	
CT	R Ph	Make – SCT Ghaziabad Ltd. Sr. No. - Type – DoM - 1992 Current Ratio – 600/1 DoC – Rated Voltage – No. of Core-04 Class-	
	Y Ph	Make – SCT Ghaziabad Ltd. Sr. No. - Type – DoM - 1992 Current Ratio – 600/1 DoC – Rated Voltage – No. of Core-04 Class-	
	B Ph	Make – SCT Ghaziabad Ltd. Sr. No. - Type – DoM - 1992 Current Ratio – 600/1 DoC – Rated Voltage – No. of Core-04 Class-	
Breaker	Make – CGL Serial No. – Type – DoM - 1999 Rated Voltage – DoC - Rated Current – Short Time Amp –		
LA			
EM	Make –Secure Meter Ltd. Serial No. – BEB00326 Model – DoM - 1995 MTR – 300/1A DoC - Class –0.5 s		

Name of GSS: 132/33KV ADITYAPUR-1
Name of Feeder:132KV RCP-1

Particular			Remarks
Line	Length – 8 KM Conductor -		
Panel	Make – GEC ALSTHOM Model –	DoM - DoC -	
Relay	DPR	Make – Micom, AREVA/ALSTOM DoC-28/03/2014 Model – P441 Sr. No. -	
	O/C	Make – Micom, AREVA/ALSTOM PSM -0.85 Model – P441 TMS -0.30 Sr. No. -	
	E/F	Make – Micom, AREVA/ALSTOM PSM -0.20 Model – P441 TMS -0.20 Sr. No. -	
	LBB	Make – PSM - Model – TMS - Sr. No. -	
CT	R Ph	Make – SCT GhaziabadSr. No. - Type – Current Ratio – Rated Voltage – DoM - 1992 DoC - No. of Core-04 Class-	
	Y Ph	Make – SCT Ghaziabad Sr. No. - Type – DoM - 1992 Current Ratio – DoC - Rated Voltage – No. of Core-04 Class-	
	B Ph	Make – SCT Ghaziabad Sr. No. - Type – DoM - 1992 Current Ratio – 600/1 DoC - Rated Voltage – No. of Core-04 Class-	
Breaker	Make – Type – Rated Voltage – Rated Current – Short Time Amp –	Serial No. – DoM - DoC -	
LA			
EM	Make –Secure Meter Ltd. Model – MTR – 300/1A Class –0.5 s	Serial No. – BEB00332 DoM - 1995 DoC -	

Name of GSS: 132/33KV ADITYAPUR-1
Name of Feeder: 33KV UBL

Particular			Remarks
Line	Length – Conductor -		
Panel	Make – ENGLISH ELECTRIC Model –	DoM - DoC -	
Relay	DPR	Make – N.A. Model – Sr. No. - DoC-	
	O/C	Make – SCHNEIDER Model –MICOM127 Sr. No. – PSM -0.750 TMS -0.100	
	E/F	Make – SCHNEIDER Model – MICOM127 Sr. No. – PSM -0.050 TMS -0.025	
	LBB	Make –N.A. Model – Sr. No. - PSM - TMS -	
CT	R Ph	Make – MAGRINI Type – AMT36S Current Ratio – 600-300-150/5 Rated Voltage – 36KV Sr. No. - 670675 DoM - DoC - No. of Core- Class-	
	Y Ph	Make – VISHAL LTD Type – O/D,D/T Current Ratio – 600-300-150/5 Rated Voltage –36KV Sr. No. – DoM - DoC - No. of Core- Class-	
	B Ph	Make – MAGRINI Type – AMT36S Current Ratio – 600-300-150/5 Rated Voltage –36KV Sr. No. - 670681 DoM - DoC - No. of Core- Class-	
Breaker	Make – AREVA Type – PCOB-36 Rated Voltage –36 KV Rated Current – Short Time Amp – 25KA FOR 3SEC	Serial No. – 29767/P3 DoM –012/07 DoC –	
LA			
EM	Make –Secure Meter Ltd. Model – C3V025 MTR – 300/5A Class –0.2 s	Serial No. –BEB00364 DoM – 2000 DoC -	

Name of GSS: 132/33KV ADITYAPUR-1
Name of Feeder: 33 KV RKFL

Particular			**Remarks**
Line	Length – Conductor -		
Panel	Make – VENSON ELECTRIC Model –	DoM - DoC -	
Relay	DPR	Make – Model – Sr. No. - DoC-	
	O/C	Make – JVS Model – Sr. No. – PSM - TMS -	
	E/F	Make – JVS Model – Sr. No. –C20980 PSM - TMS -	
	LBB	Make – Model – Sr. No. - PSM - TMS -	
CT	R Ph	Make – VISHAL Type – O/D,D/T Current Ratio – 400-200-100/1 Rated Voltage – 36KV Sr. No. - 1162 DoM - DoC - No. of Core- Class-	
	Y Ph	Make – VISHAL Type – O/D,D/T Current Ratio – 400-200-100/1 Rated Voltage –36KV Sr. No. – 1160 DoM - DoC - No. of Core- Class-	
	B Ph	Make – SCT Ghaziabaad Type – ODDT Current Ratio – 400-200-100/1 Rated Voltage –36KV Sr. No. – 2012/1111 DoM - 2012 DoC - No. of Core- Class-	
Breaker	Make – AREVA Type – PCOB-36 Rated Voltage –36KV Rated Current – Short Time Amp – 25KA FOR 3SEC	Serial No. – 24324/P3 DoM –03/06 DoC –	
LA			
EM	Make –Secure Meter Ltd. Model – MTR – 300/1A DoC - Class –0.2 s	Serial No. – KAB01502 DoM – 2003	

Name of GSS: 132/33KV ADITYAPUR-1
Name of Feeder – 33 KV KYS

Particular			**Remarks**
Line	Length – Conductor -		
Panel	Make – ENGLISH ELECTRIC Model –	DoM - DoC -	
Relay	DPR	Make – Model – Sr. No. - DoC-	
	O/C	Make – ENGLISH ELECTRIC Model – SPECM1AF61H Sr. No. – M37738 PSM -3.75 TMS -0.05	
	E/F	Make – ENGLISH ELECTRIC Model – SPECM1AF60H Sr. No. –M37814 PSM -1.0 TMS -0.05	
	LBB	Make – Model – Sr. No. - PSM - TMS -	
CT	R Ph	Make – Type – Current Ratio – Rated Voltage – 145KV Sr. No. - DoM - DoC -	
	Y Ph	Make – Type – Current Ratio – Rated Voltage –145KV Sr. No. – DoM - DoC -	
	B Ph	Make – Type – Current Ratio – Rated Voltage –145KV Sr. No. - DoM - DoC -	
Breaker	Make – Type – Rated Voltage –145 KV Rated Current – Short Time Amp –	Serial No. – DoM - DoC –	
EM	Make –Secure Meter Ltd. Model – MTR – -/1A Class –0.5 s	Serial No. – JSE44431 DoM – 06/10/2005 DoC -	

Name of GSS: 132/33KV ADITYAPUR-1
Details:

Name of Feeder – 33KV RF-2			**Remarks**
Line	Length – Conductor -		
Panel	Make – ENGLISH ELECTRIC Model –	DoM - DoC -	
Relay	DPR	Make – Model – Sr. No. - DoC-	
	O/C	Make – ENGLISH ELECTRIC Model – CDG31EG202A5 Sr. No. – M37678 PSM -3.75 TMS -0.05	
	E/F	Make – ENGLISH ELECTRIC Model – CDG13AF204A5 Sr. No. –M38347 PSM -1.0 TMS -0.05	
	LBB	Make – Model – Sr. No. - PSM - TMS -	
CT	R Ph	Make – Type – Current Ratio – Rated Voltage – 145KV Sr. No. - DoM - DoC -	
	Y Ph	Make – Type – Current Ratio – Rated Voltage –145KV Sr. No. – DoM - DoC -	
	B Ph	Make – Type – Current Ratio – Rated Voltage –145KV Sr. No. - DoM - DoC -	
Breaker	Make – Type – Rated Voltage –145 KV Rated Current – Short Time Amp –	Serial No. – DoM - DoC –	
EM	Make –Secure Meter Ltd. Model – MTR – -/1A Class –0.5 s	Serial No. – JSE45089 DoM – 06/10/2005 DoC -	

Name of GSS: 132/33KV ADITYAPUR-1
Name of Feeder : 33 KV RF-1

Particular			**Remarks**
Line	Length – Conductor -		
Panel	Make – ENGLISH ELECTRIC DoM - Model – DoC -		
Relay	DPR	Make – DoC- Model – Sr. No. -	
	O/C	Make – SCHNEIDER PSM -0.750 Model – MICOM P127 TMS -0.100 Sr. No. –	
	E/F	Make – SCHNEIDER PSM -0.050 Model – MICOM P127 TMS -0.025 Sr. No. –	
	LBB	Make – N.A. PSM - Model – TMS - Sr. No. -	
CT	R Ph	Make – SCT Ghaziabad Sr. No. – 2012/1104 Type – ODDT DoM - 1992 Current Ratio – 600-300-150/1 DoC - Rated Voltage – 36KV No. of Core- Class-	
	Y Ph	Make – SCT Ghaziabad Sr. No. – 2012/1102 Type – ODDT DoM - 1992 Current Ratio – 600-300-150/1 DoC - Rated Voltage – 36KV No. of Core- Class-	
	B Ph	Make – SCT Ghaziabad Sr. No. – 2012/1103 Type – ODDT DoM - 1992 Current Ratio – 600-300-150/1 DoC - Rated Voltage – 36KV No. of Core- Class-	
Breaker	Make –BHELSerial No. – 9081791 Type – PNB-36 DoM - 2008 Rated Voltage –36KV DoC – Rated Current – 1250A Short Time Amp –25KA FOR 3SEC		
LA			
EM	Make –Secure Meter Ltd. Serial No. – JSE45058 Model – DoM –Nov, 2005 MTR – -/1A DoC - Class –0.5 s		

Name of GSS: 132/33KV ADITYAPUR-1
Name of Feeder : 33KV NIT

Particular				Remarks
Line	Length – Conductor -			
Panel	Make – ENGLISH ELECTRIC Model –		DoM - DoC -	
Relay	DPR	Make – Model – Sr. No. -	DoC-	
	O/C	Make – SCHNEIDER Model – MICOM P127 Sr. No. –	PSM -0.750 TMS -0.100	
	E/F	Make – SCHNEIDER Model – MICOM P127 Sr. No. –	PSM -0.050 TMS -0.025	
	LBB	Make – N.A. Model – Sr. No. -	PSM - TMS -	
CT	R Ph	Make – VISHAL LTD Type – ODDT Current Ratio – 1200-600-300/5 Rated Voltage – 36KV	Sr. No. – 10205/1229 DoM - 2006 DoC - No. of Core- Class-	
	Y Ph	Make – VISHAL LTD Type – ODDT Current Ratio – 1200-600-300/5 Rated Voltage – 36KV	Sr. No. – 10806/548 DoM - 2006 DoC - No. of Core- Class-	
	B Ph	Make – VISHAL LTD Type – ODDT Current Ratio – 1200-600-300/5 Rated Voltage – 36KV	Sr. No. – 10806/549 DoM - 2006 DoC - No. of Core- Class-	
Breaker	Make – AREVA Type – PCOB-36 Rated Voltage –36KV Rated Current – 1250A Short Time Amp –25KA FOR 3SEC		Serial No. – 247627P3 DoM –04/06 DoC –	
LA				
EM	Make –Secure Meter Ltd. Model – E3V055 MTR – -/110, -/1A Class –0.5 s		Serial No. – JSE45058 DoM – Nov, 2005 DoC -	

Name of GSS: 132/33KV ADITYAPUR-1
Name of Feeder : 33KV AIADA

Particular			Remarks
Line	Length – Conductor -		
Panel	Make – ENGLISH ELECTRIC Model –	DoM - DoC -	
Relay	DPR	Make – Model – Sr. No. - DoC-	
	O/C	Make – SCHNEIDER Model – MICOM P127 Sr. No. – 36280071	PSM -0.750 TMS -0.100
	E/F	Make – SCHNEIDER Model – MICOM P127 Sr. No. – 36280071	PSM -0.050 TMS -0.025
	LBB	Make – N.A. Model – Sr. No. -	PSM - TMS -
CT	R Ph	Make – VISHAL LTD Type – ODDT Current Ratio – 1200-600-300/5 Rated Voltage – 36KV	Sr. No. – 10806/546 DoM - 2006 DoC - No. of Core- Class-
	Y Ph	Make – VISHAL LTD Type – ODDT Current Ratio – 1200-600-300/5 Rated Voltage – 36KV	Sr. No. – 10806/1221 DoM - 2006 DoC - No. of Core- Class-
	B Ph	Make – VISHAL LTD Type – ODDT Current Ratio – 1200-600-300/5 Rated Voltage – 36KV	Sr. No. – 10806/550 DoM - 2006 DoC - No. of Core- Class-
Breaker	Make – AREVA Type – PCOB-36 DoM – 04/06 Rated Voltage –36KV Rated Current – 1250A Short Time Amp –25KA FOR 3SEC	Serial No. – 247631P3 DoC –	
LA			
EM	Make –Secure Meter Ltd. Model – E3V055 MTR – 150/5A Class –0.5 s	Serial No. – JSE00802 DoM – Nov, 2005 DoC -	

Name of GSS: 132/33KV ADITYAPUR-1
Name of Feeder : 33KV ULIAN/KUWAR BASTI

Particular			**Remarks**
Line	Length – Conductor -		
Panel	Make – ENGLISH ELECTRIC Model –	DoM - DoC -	
Relay	DPR	Make – Model – Sr. No. - DoC-	
	O/C	Make – SCHNEIDER Model – MICOM P127 Sr. No. – 36270571	PSM -0.750 TMS -0.100
	E/F	Make – SCHNEIDER Model – MICOM P127 Sr. No. – 36270571	PSM -0.050 TMS -0.025
	LBB	Make – N.A. Model – Sr. No. -	PSM - TMS -
CT	R Ph	Make – SCT Ghaziabaad Type – ODDT Current Ratio – 400-200-100/5 Rated Voltage –36KV	Sr. No. – 2003/397 DoM - 2012 DoC - No. of Core- Class-
	Y Ph	Make – SCT Ghaziabaad Type – ODDT Current Ratio – 400-200-100/5 Rated Voltage –36KV	Sr. No. – 2003/395 DoM - 2012 DoC - No. of Core- Class-
	B Ph	Make – SCT Ghaziabaad Type – ODDT Current Ratio – 400-200-100/5 Rated Voltage –36KV	Sr. No. – 2003/392 DoM - 2012 DoC - No. of Core- Class-
Breaker	Make – ANDREWYULE Type – 36/26.2 Rated Voltage –36KV Rated Current – 1250A Short Time Amp –25KA FOR 3SEC	Serial No. – 804 DoM – 2012-13 DoC –	
LA			
EM	Make –Secure Meter Ltd. Model – E3V055 MTR – -/110, -/1A Class –0.5 s	Serial No. – JSE44931F DoM – Nov, 2005 DoC -	

Name of GSS: 132/33KV ADITYAPUR-1
Name of Feeder : 33KV SS4

Particular			**Remarks**
Line	Length - Conductor -		
Panel	Make – VENSON ELECTRIC Model –	DoM - DoC -	
Relay	DPR	Make – Model – Sr. No. - DoC-	
	O/C	Make – SCHNEIDER Model – MICOM P127 Sr. No. – 36270570	PSM -0.750 TMS -0.100
	E/F	Make – SCHNEIDER Model – MICOM P127 Sr. No. – 36270570	PSM -0.050 TMS -0.025
	LBB	Make – N.A. Model – Sr. No. -	PSM - TMS -
CT	R Ph	Make – SCT Ghaziabaad Type – ODDT Current Ratio – 600-300-150/1 Rated Voltage –36KV	Sr. No. – 2005/1106 DoM - 2005 DoC - No. of Core- Class-
	Y Ph	Make – SCT Ghaziabaad Type – ODDT Current Ratio – 600-300-150/1 Rated Voltage –36KV	Sr. No. – 2005/1104 DoM - 2005 DoC - No. of Core- Class-
	B Ph	Make – SCT Ghaziabaad Type – ODDT Current Ratio – 600-300-150/1 Rated Voltage –36KV	Sr. No. – 2005/1083 DoM - 2005 DoC - No. of Core- Class-
Breaker	Make – ANDREWYULE Type – 36/26.2 Rated Voltage –36KV Rated Current – 1250A Short Time Amp –25KA FOR 3SEC	Serial No. – 804 DoM – 2012-13 DoC –	
LA			
EM	Make –Secure Meter Ltd. Model – E3V055 MTR – -/110, -/1A Class –0.5 s	Serial No. – JSE44931F DoM – Nov, 2005 DoC -	

132 KV CHANDIL

Micom P441,
Model- P441311B3M0350J
Serial No-140405340749004 , DIAG NO.-10P441 01
CTR- 600/1A

Line Length	19 km
Line Impedance	3.959 ohm
Line Angle	68.2
kz1	820.0m
kz1 Angle	0
Z1	3.167
R1G	38.11
R1Ph	19.13
tz1	0s
kz2 Res comp	820
kz2 Angle	0
Z2	4.75
R2G	38.11
R2ph	19.13
tz2	300.0ms
kz3/4Res comp	820.0m
kz3/4 Angle	0
Z3	9.580 ohm
R3G-R4G	38.11 ohm
R3ph-R4ph	19.13 ohm
tZ3	1.00 s
Z4	792.0 m ohm
tZ4	1.200 s

Back UP>I

I> 1Directional Non Directional
I>1 current set= 630.0mA
I>1 Tms =0. 250

132 KV RCP-I

Micom P441,
Model- P441311B3M0350J
Serial No-140405340749003 , DIAG NO.-10P441 01
CTR - 600/1A

Line Length	8KM
Line Impedance	3.330 ohm
Line Angle	68
kz1	0.819
kz1 Angle	0
Z1	1.330 ohm
R1G	38.10 ohm
R1Ph	38.10 ohm
tz1	0s
kz2 Res comp	0.819
kz2 Angle	0
Z2	2.000 ohm
R2G	38.10 ohm
R2ph	38.10 ohm
tz2	300 ms
kz3/4Res comp	0.819
kz3/4 Angle	0
Z3	2.500 ohm
R3G-R4G	38.10 ohm
R3ph-R4ph	38.10 ohm
tZ3	1.000 s
Z4	333.0m ohm
tZ4	1.200 s

Back UP>I

I> 1Directional Non Directional
I>1 current set= 850.0mA
I>1 Tms = 250

Earth fault O/C

IN> 1Directional Non Directional
IN>1 current set= 200ma
IN> Tms= 0.100

132 KV RCP-II

Micom P441,
Model- P441311B3M0350J
Serial No-140405340749003 , DIAG NO.-10P441 01
CTR-600/1A

Line Length	8KM
Line Impedance	3.330 ohm
Line Angle	68
kz1	0.819
kz1 Angle	0
Z1	1.330 ohm
R1G	38.10 ohm
R1Ph	38.10 ohm
tz1	0s
kz2 Res comp	0.819
kz2 Angle	0
Z2	2.000 ohm
R2G	38.10 ohm
R2ph	38.10 ohm
tz2	300 ms
kz3/4Res comp	0.819
kz3/4 Angle	0
Z3	2.500 ohm
R3G-R4G	38.10 ohm
R3ph-R4ph	38.10 ohm
tZ3	1.000 s
Z4	333.0m ohm
tZ4	1.200 s

Back UP>I

I> 1Directional Non Directional
I>1 current set= 850.0mA
I>1 Tms = 250

Earth fault O/C

IN> 1Directional Non Directional
IN>1 current set= 200ma
IN> Tms= 0.100

132 KV RKSN

Micom P441,
Model- P441311B3M0350J
Serial No-140405340749003 , DIAG NO.-10P441 01
CTR-400/1A

Line Length	35KM
Line Impedance	4.810 ohm
Line Angle	68.2
kz1	0.819
kz1 Angle	0
Z1	3.880 ohm
R1G	25.40 ohm
R1Ph	25.40 ohm
tz1	0s
kz2 Res comp	0.819
kz2 Angle	0
Z2	5.830 ohm
R2G	25.40 ohm
R2ph	25.80 ohm
tz2	300 ms
kz3/4Res comp	0.819
kz3/4 Angle	0
Z3	11.80 ohm
R3G-R4G	25.40 ohm
R3ph-R4ph	25.40 ohm
tZ3	1.000 s
Z4	972.0 m ohm
tZ4	1.200 s

Back UP>I

I> 1Directional Directional FWD
I>1 VTS Block Non Directional
I> 1 Current Set 1.250 A
I> 1 Time VTS 1.500 s
I> TMS 1.000

132 KV UML Ckt II

Micom P441,
Model- P441311B2M0360S
Serial No-31051100
CTR-600/1A

Line Length	3.500KM
Line Impedance	729.0 mA
Line Angle	69.2
kz1	0.12
kz1 Angle	-59.6
Z1	583.0 mΩ
R1G	22.89Ω
R1Ph	20.35Ω
tz1	0s
kz2 Res comp	0.12
kz2 Angle	-59.6
Z2	2.187Ω
R2G	22.89Ω
R2ph	20.35Ω
tz2	300 ms
kz3/4Res comp	0.12
kz3/4 Angle	-59.6
Z3	15.31Ω
R3G-R4G	22.89Ω
R3ph-R4ph	20.35Ω
tZ3	600.0ms
Z4	182.0mΩ
tZ4	1.000 s
Back UP>I	
I> 1Directional Directional FWD	
I>1 VTS Block Block	
I> 1 Current Set 1.500 A	
I> 1 Time delay 500 ms	
I> 2 Function in DT	
I>2 Directional non Directional	
I>2 current set 2.000A	
I>2 Time delay 1.000 s	
Neg. sequence O/C	
I2>1 Function DT	
I2>1 Directional non Directional	
I2>1 current set 200.0mA	
I2>1 Time delay 10.00s	
I2>2 Directional non Directional	
I2>2 Current set 200.0mA	
I2>2 Time delay 10.00s	
I2>Angle -45.00	

D.C. system details with Charger and battery									
Sl. nO.	**Name of G/s/s**	**Details of Battery Charger**	**Single /Double**	**Total voltage**	**Capacity**	**no. of Cells**	**D.C. system Earth fault**	**D.C. positive to earth**	**D.C. Nigative to earth**
3	**Adityapur**	DC charger-1 300AH star make battery capacity-300AH,250V(DC) Input- 400+ - 10% Frequency-50Hz **DC charger-II** 300AH HBL make Battery Float cum Boost Charger Model- FCBC340036 AC voltage range- 370v to 460v Frequency-50Hz Output DC voltage-250v Output Current- 36A Make- Signotron India Pvt.LTD	Double	240V	300AH	110	Not tested	210V	34V

Name of the Sub-station: ADITYAPUR GSS

Transformer Details	NGEF,1994 Vector-YNn0d11	
Transformer Number	1	
MVA Rating	50	
% Impedance	Tap no. 1-14.37, Tap no. 5(Normal)-14, Tap no. 15-13.12	
Ratio	132/33KV	

Name of the Protection		**C.T.**	**C.T. Details (Make & Model)**	**Connected CT/PT core number & Details**			**Setting**	**High set setting**
				Ratio	**Core number**	**Core details**		
		HV	VICTRANS, Rated voltage-145KV Class of Accuracy- 1	300/1A	4	600/300/150/1A		
		LV		1200/1A				
	Nomenclature	**Make & model**						
Differential Protection	ALSTOM	DTH31FF8024ACH					BIAS-30%	
Restricted E/F (HV)								
Restricted E/F (LV)								
HV O/C	English Electrical	CDG21AF0032M(M)					PSM-0.75, TMS-0.35	
LV O/C	English Electrical	CDG11AF002SA(M)					PSM-0.75, TMS-0.1	
HV E/F	English Electrical	CDD21PF905SE(M)					PSM-0.2, TMS-0.2	
LV E/F	English Electrical	CDG11AF005SA(M)					PSM-0.1, TMS-0.025	
Over flux								

Trip relay	MASTER TRIP	86

Name of the Sub-station: ADITYAPUR GSS

Transformer Details	NGEF,1994 Vector-YNn0d11	
Transformer Number	1	
MVA Rating	50	
% Impedance	Tap no. 1-14.37, Tap no. 5(Normal)-14, Tap no. 15-13.12	
Ratio	132/33KV	

Name of the Protection		**C.T.**	**C.T. Details (Make & Model)**	**Connected CT/PT core number & Details**			**Setting**	**High set setting**
				Ratio	**Core number**	**Core details**		
		HV	VICTRANS, Rated voltage-145KV Class of Accuracy- 1	300/1A	4	600/300/150/1A		
		LV		1200/1A				
Nomenclature		**Make & model**						
Differential Protection	ALSTOM	DTH31FF8024ACH					BIAS-30%	
Restricted E/F (HV)								
Restricted E/F (LV)								
HV O/C	English Electrical	CDG21AF0032M(M)					PSM-0.75, TMS-0.35	
LV O/C	English Electrical	CDG11AF002SA(M)					PSM-0.75, TMS-0.1	
HV E/F	English Electrical	CDD21PF905SE(M)					PSM-0.2, TMS-0.2	
LV E/F	English Electrical	CDG11AF005SA(M)					PSM-0.1, TMS-0.025	
Over flux								

Trip relay	MASTER TRIP	86

Name of the Sub-station: ADITYAPUR GSS

Transformer Details	NGEF,1994 Vector-YNn0d11	
Transformer Number	2	
MVA Rating	50	
% Impedance	Tap no. 1-14.8 Tap no. 5(Normal)-14.33, Tap no. 15-13.53	
Ratio	132/33KV	

Name of the Protection		**C.T.**	**C.T. Details (Make & Model)**	**Connected CT/PT core number & Ratio**	**Core number**	**Core details**	**Setting**	**High set setting**
		HV	BHEL	300/1A	4	600/300/150/5A		
		LV		1200/1A				
Nomenclature		**Make & model**						
Differential Protection	ALSTOM	DTH31FF8024ACH					BIAS-30%	
Restricted E/F (HV)								
Restricted E/F (LV)								
HV O/C	English Electrical	CDG21AF0032M(M)					PSM-0.75, TMS-0.325	
LV O/C	English Electrical	CDG11AF002SA(M)					PSM-0.75, TMS-0.1	
HV E/F	English Electrical	CDD21PF905SE(M)					PSM-0.2, TMS-0.2	
LV E/F	English Electrical	CDG11AF005SA(M)					PSM-0.1, TMS-0.025	
Over flux								

Trip relay	MASTER TRP	86

Name of the Sub-station: ADITYAPUR GSS		

Transformer Details	AREVA,2006 Vector-YNn0d11	
Transformer Number	3	
MVA Rating	50	
% Impedance	Tap no. 1-15.24, Tap no. 4(Normal)-15.02, Tap no. 15-11.04	
Ratio	132/33KV	

Name of the Protection		**C.T.**	**C.T. Details (Make & Model)**	**Connected CT/PT core number & Details**			**Setting**	**High set setting**
				Ratio	**Core number**	**Core details**		
		HV	SCT CLASS-1	300/1A	4	600/300/150/1A		
		LV		1200/1A				
	Nomenclature	**Make & model**						
Differential Protection	EASUN REYROLLE						BIAS-30%	
Restricted E/F (HV)								
Restricted E/F (LV)								
HV O/C	EASUN REYROLLE						PSM-1.5, TMS-0.2	
LV O/C	EASUN REYROLLE						PSM-0.75, TMS-0.1	
HV E/F	EASUN REYROLLE						PSM-1, TMS-0.2	
LV E/F	EASUN REYROLLE						PSM-0.1, TMS-0.025	
Over flux								

Trip relay		