EASTERN REGIONAL POWER COMMITTEE
14, GOLF CLUB ROAD, TOLLYGUNGE
KOLKATA-700033

MINUTES OF THE 8th PROTECTION SUB-COMMITTEE MEETING HELD AT ERPC, KOLKATA ON 02.12.2010 (THURSDAY) AT 11:00 HOURS

List of participants is enclosed at Annexure-I.

Member Secretary, ERPC welcomed the esteemed delegates. He thanked Shri S.J.Lahiri, CM (OS), ER-II, Powergrid agreeing to deliver presentation on important protection philosophy adopted in Powergrid substations.

PART – A

ITEM NO. 0 **PRESENTATION ON "LOCAL BREAKER BACK UP (LBB)" AND "BUS BAR DIFFERENTIAL" PROTECTION PHILOSOPHY OF 400KV SUB-STATIONS OF POWERGRID - BY SHRI S.J. LAHIRI ,CHIEF MANAGER (OS), POWERGRID ER-II**

Shri S.J. LAHIRI ,Chief Manger (OS), POWERGRID ER-II gave an exhaustive presentation on LBB and Bus Bar Differential protection philosophy giving details of the features and its application. In Powergrid 400kV sub-stations the features applicable for LBB & Bus Bar protection are as:

- **Standard current setting is 200mA**
- **Standard Time setting is 200mS**
- **If the current through the power circuit-breaker still is above the set value(200mA secondary) of the current measuring detectors after the set time(200mS), the breaker failure relay provides a tripping impulse to adjacent circuit-breakers in the same station.**
- **Powergrid have normally One & Half CB system at 400KV Switchyard wherein Two 400KV Buses are protected by Three(03) Differential relays.**
- **The Bus-I & II have different Main Zone-I & II relays. Third Differential relay for "Check Zone" is provided, covering both the buses.**

The details of the presentation are given in Annexure-II.

Members appreciated and were enlightened through deliberations on the subject.

ITEM NO.:1 **CONFIRMATION OF THE MINUTES OF THE 7th PROTECTION SUB-COMMITTEE MEETING OF ERPC HELD AT ERPC, KOLKATA ON 12.08.2010**

The minutes of the above meeting were circulated vide letter no. ERPC/SE (OPRN)/ PROTECTION/ 2010/ 3384-3416 dated 06.09.2010

No comments have been received from any constituent. If there is no comment, the minutes of the meeting may please be confirmed.

The minutes of the 7th Protection sub-Committee meeting were confirmed, without any modifications.

PART - B **FOLLOW UP OF DECISIONS OF THE PREVIOUS (7th) PROTECTION SUB-COMMITTEE MEETING**

The status on follow up actions is to be furnished by respective constituents.

ITEM NO. 1 **WBSETCL**
(Item No. 2 of MoM of the 7th Protection sub-committee)

Incorporation of Bus-Bar Differential Protection scheme of Bidhannagar 220kV sub-station

Installation of bus differential relay (RADSS) at Bidhannagar 220kV sub-station was to commission by middle of September, 2010.

Replacement of CTs in WBSETCL S/Stns (where tan-delta values were higher than 1.0)

The replacement of the CTs after the assessment of residual life analysis is to be done by CPRI. The status report is to be furnished.

Deliberation in the meeting

It was confirmed that the bus differential relay (RADSS) was commissioned on 12.11.2010 at Bidhannagar 220kV S/Stn and remained in service.

The replacement of CTs in their sub-stations was under process.

ITEM NO. 2 **SIKKIM**
(Item No. 5 of MoM of the 7th Protection sub-committee)

The circuit breaker and proper protection and metering arrangement is to be provided at both Sagbari sub-station (by LILO of 132 kV Rangit-Melli line) and Rohtak sub-station (66 kV Rangit-Melli line) respectively.
132kV Sagbari sub-station would be connected to the grid by LILO of 132 kV Rangit-Melli line in September, 2010 when metering and protection of Sagbari will be ready.

Also, the progress of Rohtak 66kV sub-station may be intimated.

Deliberation in the meeting

The above information would be collected from Sikkim shortly.

ITEM NO. 3 **NOMINATION OF THE OFFICERS TO CONSTITUTE A SUB-GROUP TO DEAL WITH THE 'SYSTEM SECURITY ASPECTS' (PART-5) UNDER CLAUSE 5.2 (K), (N), (O) & (T) OF NEW IEGC IMPLEMENTED FROM 03.05.2010 (REFER ITEM NO.2 OF THE MOM OF PROTECTION SUB-COMMITTEE MEETING)**

Hon'ble CERC has notified new IEGC which had been implemented with effect from 03.05.2010. The new IEGC has assigned some additional responsibility to RPC for its Protection sub-committee, apart from already existing responsibilities. In this connection, one day meeting was arranged at ERPC on 15.07.2010 to address all IEGC related issues and to build up awareness among ERPC constituents. The response from the constituents was encouraging.

In Part-5 of new IEGC under clause 5.2 "System Security Aspects" it was decided in the said meeting that Protection Sub-Committee of ERPC will deal with the items as detailed below:

IEGC Clause No.5.2	Items	Responsibility of Protection sub-Committee
Sub section - **k**	Power System Stabiliser	1. It may finalise plan for PSS tuning which may be vetted by ERPC subsequently. 2. It may constitute a sub-group for checking of PSS and also decide on periodicity of checking / further tuning 3. To create awareness on PSS tuning holding workshop which may be arranged at ERPC. 4. PSS tuning exercise may be funded from capped pool fund.
Sub-section **- n**	Automatic Under Frequency Relay (AUFR) & Df/Dt relay	1. It may decide the quantum of load relief for each constituent at different stages of under frequency settings. The settings and connected load of each constituent will be reviewed on half yearly basis. 2. Monthly report of UFR operation in the respective constituent system to be furnished to ERPC/ERLDC. 3. A small group may be formed to carry out inspection of UFR / periodicity of inspection and method of testing of UFR setting.
Sub-section - **o**	System Protection Schemes(SPS)	1. It will be finalised such scheme in consultation with ERLDC as and when basis. 2. Such scheme will be vetted by ERPC before implementation.
Sub-section- **t**	Voltage Control Measures	1. It will be finalised such scheme for adequate voltage control measures. 2. This will be vetted by ERPC.

Protection sub-committee may decide formation of sub-group to address the above.

In the 7th Protection sub-Committee meeting it was decided that the nomination of the officers from the constituents (preferably located in and around Kolkata) is to be obtained to represent the sub-group for addressing the above issues.

GM (OS), Powergrid ER-II, Kolkata nominated Shri S.J.Lahiri, Chief Manager (OS & IT) as a member of the sub-group, while the nominations are still awaited from ERLDC, DVC, WBSETCL, WBPDCL & CESC Ltd.

The name & designation of the nominated officers may please be intimated to represent the sub-group for further discussion and line of actions needed to deal with the above areas.

Deliberation in the meeting

The nominations from the constituents as received by ERPC are given below:

IEGC Clause No.5.2	Items	Nominations received during the protection committee meeting.
Sub section- **k**	Power System Stabiliser	1. Smt. Arundhati Ghosh, Addl. CE (Testing) WBSETCL 2. Shri Swapan Maity DGM(OS), WBPDCL 3. Shri S.J.Lahiri, CM(OS), Powergrid 4. Shri S.Banerjee CM, ERLDC 5. Shri Sibir Roy, Manager (E & I), CESC
Sub-section**- n**	Automatic Under Frequency Relay (AUFR) & Df/Dt relay	1. Smt. Arundhati Ghosh, Addl. CE (Testing) WBSETCL 2. Shri Swapan Maity DGM(OS), WBPDCL 3. Shri S.J.Lahiri, CM(OS), Powergrid 4. Shri G. Mitra DGM, ERLDC 5. Shri A.Sengupta, Sr. Dy. Manager, CESC
Sub-section- **o**	System Protection Schemes(SPS)	1. Smt. Arundhati Ghosh, Addl. CE (Testing) WBSETCL 2. Shri Swapan Maity DGM(OS), WBPDCL 3. Shri S.J.Lahiri, CM(OS), Powergrid 4. Shri M.K. Thakur Engineer, ERLDC 5. Shri Pankaj Dutt , DVC 6. Shri Francis, NTPC Delhi 7. Shri M.Basu, Sr. Manager, CESC
Sub-section- **t**	Voltage Control Measures	1. Smt. Arundhati Ghosh, Addl. CE (Testing) WBSETCL 2. Shri Swapan Maity DGM(OS), WBPDCL 3. Shri S.J.Lahiri, CM(OS), Powergrid 4. Shri G. Mitra DGM, ERLDC 5. Shri R.Chakravarty, Sr. Manager, CESC

PART - C

ITEM NO. 1 SPECIAL PROTECTION SCHEMES (SPS) FOR ER GRID - PROPOSED BY ERLDC

SPS for:

(i) 400kV Farakka-Kahalgaon line
(ii) 400kV Farakka-Malda line
(iii) 400kV Purnea-Muzaffarpur line
(iv) 400kV Binaguri-Purnea line
(v) 220kV Tenughat –Biharshariff line
(vi) HVDC B t B Gazuwaka
(vii) Talcher-Kolar HVDC
(viii) IPPs Generation

Deliberation in the meeting

The following SPS schemes were discussed:-

i) SPS for Farakka – Kahalgaon D/C
ii) SPS for Farakka – Malda D/C
iii) SPS for Purnea – Muzaffarpur D/C
iv)SPS for Purnea – Binaguri D/C
v) SPS for Tenughat – Biharshariff S/C
vi) SPS for Sterlite Energy Ltd
vii) SPS for Mejia-B & MPL power stations

ERLDC gave detailed presentation and explained the technical aspects and need for implementation of the schemes for Eastern Regional Grid Security purpose.

Further, GM, ERLDC impressed upon the advantages for the ER constituents in respect of relieving the congestion, as any congestion in a corridor would lead to levying of congestion charges @ Rs.5.45/Kwh. In addition, the increase of

load-ability of the flow gates would benefit in exporting of surplus power to other regions and above all increase the security levels through automation rather than manual actions in the corridors where (n-1) compliance is not satisfied during all times of the day.

NTPC expressed reservations about the proposed SPS for outage of one ckt. of 400kV Farakka-Kahalgaon or 400kV Farakka-Malda lines. Since the outage of one ckt. of 400kV D/C line is a normal scenario for any transmission system and requirement of a Special Protection Scheme (SPS) to address such a single contingency was incomprehensible. This reflected inadequacy in Transmission planning and its implementation. This is needed to be addressed before putting forward for SPS implementation.

In response to GM, ERLDC's views that this would result in imposition of additional congestion charges, NTPC opined that congestion management through congestion charges was a commercial mechanism and should be de-linked with SPS application. SPS's were intended purely for grid security & should not be linked up with commercial mechanisms.

ERLDC further explained that the proposed scheme for 400kV Farakka-Kahalgaon / Malda would be required only during the winter season and would become redundant once 400 kV Farakka-Kahalgaon second D/C is commissioned. After discussion, the flow gate limits were increased from 750 MW to 800 MW for Farakka – Kahalgaon 400 kV D/C line and from 750 MW to 850 MW for 400 kV Farakka – Malda D/C line in order to reduce the backing down / run-back requirement of Farakka Power station of NTPC. Since the tripping would be very rare, the SPS schemes would be called upon to operate rarely and would save the grid from propagation of disturbances.

All the constituents except NTPC were in favour of the scheme, while NTPC agreed to revert back after discussion with their corporate office.

After detailed discussion, the following schemes were also approved by the Protection Committee:-

i) SPS for Purnea – Muzaffarpur D/C
ii) SPS for Purnea – Binaguri D/C
iii) SPS for Tenughat – Biharshariff S/C

In respect of the SPS schemes for IPPs, all the constituents unanimously agreed that each IPP should be allowed to connect to the grid with proper Special Protection Scheme (SPS) so that the security of grid is not endangered due to temporary connection /LILOs of the existing corridors. Accordingly, the scheme for Sterlite (600MW units) in Odisha presented by ERLDC was approved by all the constituents. These are to be ratified by the TCC/ERPC. The modified SPS schemes are shown in Annexure-III.

The above issue was referred to TCC/ ERPC for its approval.

ITEM NO. 2 **ANALYSIS ON THE FAILURE OF 315 MVA, 400/ 220KV ICT-II AT BIHARSHARIFF SUB-STATION OF POWERGRID ON 05.10.2010 AT 22:22 HRS (POWERGRID ER-I TO SUBMIT RELEVANT DATA / TEST RESULTS ETC)**

In the 55th OCC meeting held on 19.10.2010, Powergrid intimated that due to

frequent through faults, 315 MVA, 400KV ICT-II failed on 05.10.2010 at 22:22 Hrs at the time of fault in 220kV Biharshariff-Bodhgaya Ckt-II in R-Phase. The matter was referred to Protection sub-committee for further discussion and analysis and Powergrid was requested to submit the relevant data/ test results etc. Moreover, Powergrid and BSEB were requested to coordinate among themselves regarding implementation of the earlier committee's report before the Protection sub-committee meeting.

Powergrid & BSEB are requested to intimate the above.

The details of schemes not implemented at Biharshariff S/stns. of BSEB as indicated by Powergrid are:

- CVT SELECTION SCHEME IN THE 220KV BSEB FEEDERS ARE NOT COMMISSIONED RESULTING INTO CONNECTION OF FEEDERS WITH EITHER 220KV BUS-I, OR 220KV BUS-II.
- 220KV BUS BAR PROTECTION SCHEME IS NOT COMMISSIONED RESULTING INTO CLEARING THE BUS FAULTS BY THE ICTs.
- THE ICTs ARE FEEDING THE LOAD RADIALLY, CAUSING FEEDING THE FAULT CURRENT SOLELY.

Deliberation in the meeting

The Schematic Diagram of Biharshariff is shown in Annexure-IV.

Powergrid stated that joint inspection with M/s. BHEL (manufacturer) got carried out on 20.11.2010 by lifting Bell Tank assembly. M/s BHEL confirmed that the windings of the ICT is in order.

The probable causes of failure was likely to be a high voltage surge experienced by 220kV R-Phase bushing leading to flash over between oil end portion of the bushing with the Tank / Turret. The fault current was about 14KA as per DRs submitted. The existing schemes and other details of Biharshariff S/Stn. were submitted by ER-I, Powergrid.

The OLTC chambers, bushings, Turret, insulations got damage, however, the repairing of the ICT is possible at site on replacement of the above items. All out efforts are being made by POWERGRID to restore the ICT by February,2011

BSEB also submitted the detailed report, regarding implementation of the earlier committees report.

i. ***CVT Selection scheme in 220kV feeders i.e. ICT –I, II & III and 150 MVA auto-transformers are available for its service.***
ii. ***220kV bus coupler is always closed and thus bus -I & II are connected and its protection is on instantaneous operation mode.***
iii. ***220kV bus bar protection scheme in BSEB was not commissioned as one D.C converter was found defective and sent for repair. The repaired D/C converter is now available and one 220kV Biharshariff - Begusarai line bay and one number 150 MVA transformer are to be included in the bus bar protection schemes, Powergrid had placed an order with M/S. AREVA for retrofitting of bus bar relay for this new relays. Since the above job is being undertaken by Powergrid, so Powergrid may request M/s AREVA to commission the entire schemes under one bus bar protection.***

Further, on the insistence of Powergrid, BSEB is under the process of shifting the relay panels located in the old control room to new control room. BSEB desired that the exchange of relay indications, DRs & EL printouts of the two ends of Biharshariff S/stn. would definitely improve the protection coordination between them at Biharshariff.

It was decided that POWERGRID should make all out efforts to restore ICT-II at Biharshariff S/Stn. and implement the bus bar protection schemes with the help of M/s AREVA in order to avoid frequent trippings of ICTs in future.

ITEM NO. 3 ANALYSIS & DISCUSSION ON VARIOUS GRID INCIDENCES WHICH OCCURRED IN CTU / STU SYSTEMS DURING THE PERIOD BETWEEN JULY TO OCTOBER, 2010 (INCLUDING CESC SYSTEM DISTURBANCE ON 21.10.2010) – REPORTS TO BE SUBMITTED BY ERLDC / CTU / STU.

Deliberation in the meeting

The disturbances could not be deliberated in detail due to paucity of time. It was therefore decided to take up in the next protection committee meeting. Further, all constituents may submit updated single line diagrams of important substations with their respective control areas for proper analysis of incidents.

ITEM NO. 4 STATUS OF AUTO-RECLOSER FACILITIES ON IMPORTANT 400KV TRANSMISSION LINES (BOTH CTU & STU).

During the 7th Protection sub-committee meeting, GM, ERLDC cited that during the month of April / May, there were partial grid disturbances occurred in ER system. It was observed that not a single case of operation of single phase re-closer was reported. This clearly reflected that the auto re-closer facility are not functioning or at non-auto mode due to insufficient single phase to ground auto re-close dead time, compressor problem etc. He impressed upon the need of operation of single phase re-closer to prevent undesired tripping of lines during transient faults. He requested the constituents to submit the above requisite information within August 2010 in order to assess / analyse the operation of auto re-closer.

Powergrid ER-II submitted a report of the cases auto re-closers successes during the month of May, 2010. Out of the 8 cases of earth fault registered during the month of May, 2010 occurred in different 220kV & 400kV transmission lines, the auto re-close attempted in 5 cases.

It was intimated that 400 kV Farakka-Jeerat line shall be equipped with new numerical Distance Protection relay with DR within three months.

OPTCL informed that the auto re-close facility is also available at Meramundali and Mendhasal 400kV S/stn. in Orissa which were not functioning, at present would be making this facility operational.

The arrangement of auto recloser on 400KV circuit breakers at Tala end would be made operational after consultation with the supplier.

The status of the above may please be intimated by Powergrid, OPTCL & Tala HEP.

Deliberation in the meeting

Constituents agreed to provide the information regarding status of 'non-operation' of auto-recloser facility available at all major transmission lines (both CTU & STU) in the next protection committee meeting.

ITEM NO. 5 THE STATUS OF CAPACITORS INSTALLED AT DIFFERENT SUB-STATIONS IN THE CONSTITUENT SYSTEMS DURING APRIL,2010 TO OCTOBER,2010 (MONTHWISE)

The constituents are requested to furnish the above details.

Deliberation in the meeting

The constituents agreed to provide the relevant information.

ITEM NO. 6 VOLTAGE COLLAPSE PREDICTION RELAY – PRESENT STATUS

In the 7th Protection Sub-Committee meeting, it was decided to procure about 10 nos. of above relays from M/s A.EBERLE for the entire ER grid which are to be deployed of strategic locations alongwith interfacing of the data to SCADA system. The availability of frequency and rate of change of frequency with high accuracy from different (10 locations) points of the grid would enable better analysis of grid disturbances and tuning of AFLUs.

The proposal was submitted to 15th TCC/ ERPC meeting for its consideration to accord the approval for taking up with task force of CERC for funding from the PSD Fund.

Accordingly, ERPC approved the proposal of ERLDC regarding procurement of 10 nos. voltage collapse prediction relay from M/s A.EBERLE at an estimated cost of Rs. 30 lakhs per relay i.e. 300 Lakh.

ERLDC may please indicate the present status of the above.

Deliberation in the meeting

ERLDC had already submitted the proposal to PSDF Management Committee for approving the scheme as well as for funding the project from PSDF. The scheme would be discussed by PSDF Management Committee after finalization of CBR and finalization of guidelines for approving the schemes under PSDF.

ITEM NO. 7 ANALOG TRIGGERING OF DISTURBANCE RECORDERS

At many Substations DR outputs from Numerical relays as well as disturbance recorders are not available/not functioning and are not time synchronized, causing difficulty in analysing tripping events and disturbances. IEGC clause 4.6.3 mandates keeping all recording instruments time synchronized and in working condition and furnishing of the recorded data. However, as a back up to system wide disturbances and to record phenomenon like low frequency oscillation etc. various DR printouts can be made available by enabling the following analog triggers:

– Under-Frequency & Over-Frequency triggering(e.g. 50.50Hz and 49.00 Hz)

– Under-voltage & over-voltage triggering(e.g. 90% & 110%)

– Under and over current

However, such analog triggering would lead to recording of a more number of events and as such downloading of the information to PC at intervals is essential. The relay suppliers can be asked to provide polling and scheduler software and these could be installed in PCs so that the events are downloaded after every few minutes.

During the 7th Protection sub-committee meeting all the constituents requested ERLDC to write to their highest authority of the respective constituents for kind attention and implementation of the proposal.

Members may kindly discuss the issue for its implementation.

Deliberation in the meeting

The feature is already implemented in ER-I, ER-II & CESC systems. WBSETCL agreed to enable their DRS for analog triggering, OPTCL yet to implement.

ITEM NO. 7 ADDITIONAL AGENDA

Frequent trippings of 132kV Kahalgaon-Lalmatia and Kahalgaon-Sabour lines - Proposed by KhSTPP, NTPC

DGM,KhSTPP, NTPC informed that whenever any fault occurs at Lalmatia or Sabour end, Kahalgaon end CBs tripped on Zone-2 Distance Protection, whereas the CBs at Lalmatia or Sabour ends are unable to clear the fault. In such cases, the ICTs connected to 132kV system at NTPC, Kahalgaon end has to feed the fault for a prolonged duration. This might lead to failure of ICTs and other system disturbances. The incidences are very frequent during September & October, 2010.

After detailed discussion it was decided that following was recommended for early compliance:

i) The healthiness of Protection system at Lalmatia & Sabour S/stn. is to be ensured by the concerned utilities i.e. BSEB & JSEB.
ii) 132kV link between Lalmatia & Sabour may be kept normally open.
iii) Routine line patrolling may be done by the utilities.

ITEM NO. 8 DATE AND VENUE OF THE NEXT (9th) PROTECTION COMMITTE MEETING

The next (9th) meeting will be held tentatively during March, 2011.

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Annexure -I

List of Participants in the 8th Protection sub-committee meeting of Eastern Region held on 02.12.2010 (Thursday) at ERPC, Kolkata

Organisation	Name	Designation	Contact Number
BSEB	Shri S.B PRASAD	EEE (CRTL)	0612-2504229
	Shri R.B.PANDIT	EEE (Biharshariff)	9430957073
	Shri S.K.SENGUPTA	EEE	
JSEB	Shri S.AHMED	ESE (Trans)	9430730503
TVNL	Shri S.R.SINGH	EEE	9431929187
DVC	Shri P.K.DUTTA	Act. CE(CTC)	9431133846
	Shri B.PAN		9903247102
OPGC	Shri S.C.DAS	Manager (E)	9338668192
WBSEDCL	Shri P.P.BISWAS	ADDL. CE/ ALDC	9433394968
WBSETCL	Shri S.NAG	CE /SLDC	9831093513
	Shri A.BISWAS	Addl. CE/SLDC	9239292572
	Smt.A.GHOSH	Addl. CE (Testing)	9433769439
WBPDCL	Shri S.MAITY	DGM(E)	9432021168
CESC	Shri M.BASU	Sr. Manager (Testing)	9831851535
	Shri A. SENGUPTA	Sr. Dy. Manager	9831802682
NTPC	Shri R.KUMAR	DGM(OS)	9431011344
	Shri P.P.FRANCIS	CC (OS)	9650990308
	Shri S.C.DAS	Sr. Supdt. (EMD) /Farakka	9434038940
	Shri C.SARKAR	DGM (EMD) , KhSTPS	9431609665
POWERGRID	Shri S.K.PRAMANIK	DGM(OS), ER-I	9431230239
	Shri S.J.LAHIRI	CM (OS & IT)	9434742016
ERLDC	Shri P.PENTAYYA	GM	9432669226
	Shri D.K.SRIVASTAVA	AGM	9433041802
	Shri P.MUKHOPADHYAY	DGM	9433041810
	Shri G.MITRA	DGM	9433041811
	Shri S.BANERJEE	CM	9433041823
	Shri S.K.SAHAY	Engineer	9432013173
	Shri M.K.THAKUR	Engineer	9432351832
ERPC	Shri A.K.RAMPAL	Member Secretary-in-Chair	9432012412
	Shri A.K.BANDYOPADHYAY	SE (O)	9433068533
	Shri J. BANDYOPADHYAY	SE (C)	9432326351
	Shri B.SARKHEL	SE (PS)	9433065724
	Shri G.GHOSH	EE	
	Shri S.P.DATTA	DGM (NTPC)	9433067022
	Shri S.M.JHA	EE	9748216566
	Shri P.N.SARKAR	AEE	

LOCAL BREAKER BACK-UP(LBB) INTRODUCTION

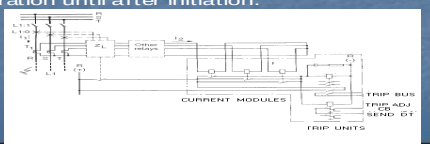
- Primary relays are provided to rapidly initiate fault clearing by power circuit-breakers when, for example, a short-circuit occurs in the power system, consequently isolating the faulty section of the system.
- It is then important that the power circuit-breaker operates correctly, so that the fault clearing is done quickly.
- However, there is always a risk that the breaker will not succeed in interrupting the fault current and that the fault clearing time will be dependent on how fast the back-up protection schemes can initiate clearing.

LBB RELAY TRIP

- Standard current setting is 200mA in Powergrid
- Standard Time setting is 200mS in Powergrid
- If the current through the power circuit-breaker still is above the set value(200mA secondary) of the current measuring detectors after the set time(200mS), the breaker failure relay provides a tripping impulse to adjacent circuit-breakers in the same station.
- Powergrid has multibus-configuration & it is normal practice to arrange for the trip signal to pass the trip to the concerned Bus bar trip relay, in order to trip the particular bus with the faulty breaker

LBB Relay configuration

- The breaker failure relay generally consists of three current relays, one or two time relays, an impulse storing device, and an output relay with auxiliary relay with flag or signal relay.
- LBB relay generally has no power consumption in auxiliary dc circuits during normal service and the current relays can be set below load without operation until after initiation.



START SIGNAL FOR LBB

- The start signal, the trip command to concerned CB by the primary protections to the LBB relay, supplies dc auxiliary voltage to the current modules.
- It is interesting to know that LBB relay of a Particular CB is initiated whenever it is subjected to trip command from any protection. The LBB Relay gets reset once the CB trips successfully.
- Only if current is present above the set levels, with the Current relay picked-up & sealed-in, start the timer
- If the primary breaker fails to trip within 200mS, the timer operates after the above set time to trip the back-up circuit-breakers.
- Before the above, it may provide a 2nd trip signal to the primary breaker (not practised in Powergrid)
- The filter has an RC network to absorb transient energy and prevent false starting of the start verifier (caused, for example, by accidental earth on the initiate output)

BUSBAR PROTECTION

- Busbar protection limits the impact of a busbar fault on the entire power network.
- Busbar protection schemes have to be very dependable to prevent unnecessary tripping and selective to trip only those breakers necessary to clear the busbar fault.
- The clearing time is important to limit the damage caused by the fault current and the selectivity is crucial to maintain the power system integrity
- Powergrid does normally have One & Half CB system at 400KV Switchyard.
- The Two 400KV Buses are protected by Three(03) Differential relays.
- Bus-I & II have different Main Zone-I & II relays. Third Differential relay for "Check Zone" is provided, covering both the buses

BUS TRIP:LOGIC

- Tripping of Bus-I is permitted on operation of Both Main zone-I & Check Zone relay operations.
- Likewise, Tripping of Bus-II is permitted on operation of Both Main zone-II & Check Zone relay operations.
- CT supervision unit is provided to prevent unwanted tripping due to accidental opening of Secondary circuit.
- Bus-Tripping is blocked by operation of the CT supervision unit, CT secondary shorted & an alarm sent to control room.

TYPES OF BUSBAR PROTECTION RELAYS

- Old stations commissioned before 1990 are provided with RADHA/MBCZ type Differential relays.
- RADSS type Percentage restrained bus differential relay is provided mostly to station commissioned within 1990-2000.
- Afterwards, numerical bus-bar protection type REB500 or MICOM P-740 has been provided to the new stations in POWERGRID.
- The numerical busbar protection scheme is designed to protect a wide range of busbar configurations.
- The modular scheme comprises of Two relays: Add one for every feeder.
- • Central Unit
- • Peripheral Units
- These units, interconnected using **optic fibre cables** together with the topology configurator software allow application to all types of busbar configurations.

CENTRAL UNIT

- The **Central Unit** co-ordinates the scheme, receiving signals from all the peripheral units associated with the protected busbars and acting on these signals, initiating a bus-zone protection trip when necessary.

PERIPHERAL UNIT

- One Peripheral Unit is associated with each CT location, usually one per incomer/feeder and one or two for each bus coupler/bus section, depending on number of CT (1 or 2).
- The Peripheral Units acquire the analogue signals from the associated CT and the binary signals from the auxiliary contacts of circuit breakers and isolators.
- The Peripheral Units also incorporate the main circuit breaker failure logic together with backup protection(Optional)

ADDED ADVANTAGE

In addition to the protection and control elements, the Numerical scheme for bus bar protection provides a wide range of measurement, monitoring, post fault analysis and self-diagnostic features along with :

- Circuit breaker control
- Trip circuit supervision (using PSL)
- On-line measurement
- Plant status monitoring
- alternative setting groups =1

Programmable scheme logic (PSL)

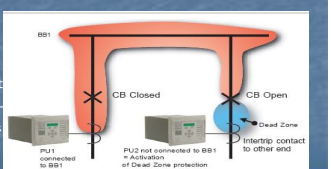
- Sequence of event recording (SOE)
- Comprehensive disturbance recording (waveform capture)
- User configurable LEDs
- Local and remote communication ports
- Time synchronisation
- Multi level password protection
- Test facilities
- Power-up diagnostics and continuous self-monitoring of relay.

CONTINUOUS SUPERVISION OF CURRENT CIRCUITS

- The Relay detects any abnormality in the current circuit by continuously monitoring it.
- Under normal operating conditions the differential current will be negligible.
- An anomaly is detected by a threshold, which can be set to alarm from 1% of the primary basis current

DEAD ZONE OR BLIND SPOT PROTECTION

- The current transformers surrounding the busbars define the limits of the main zones. When the circuit breaker is opened a dead zone or blind spot is created between the CB and the associated CT
- The Relay can detect this condition automatically and provides protection for this zone also.



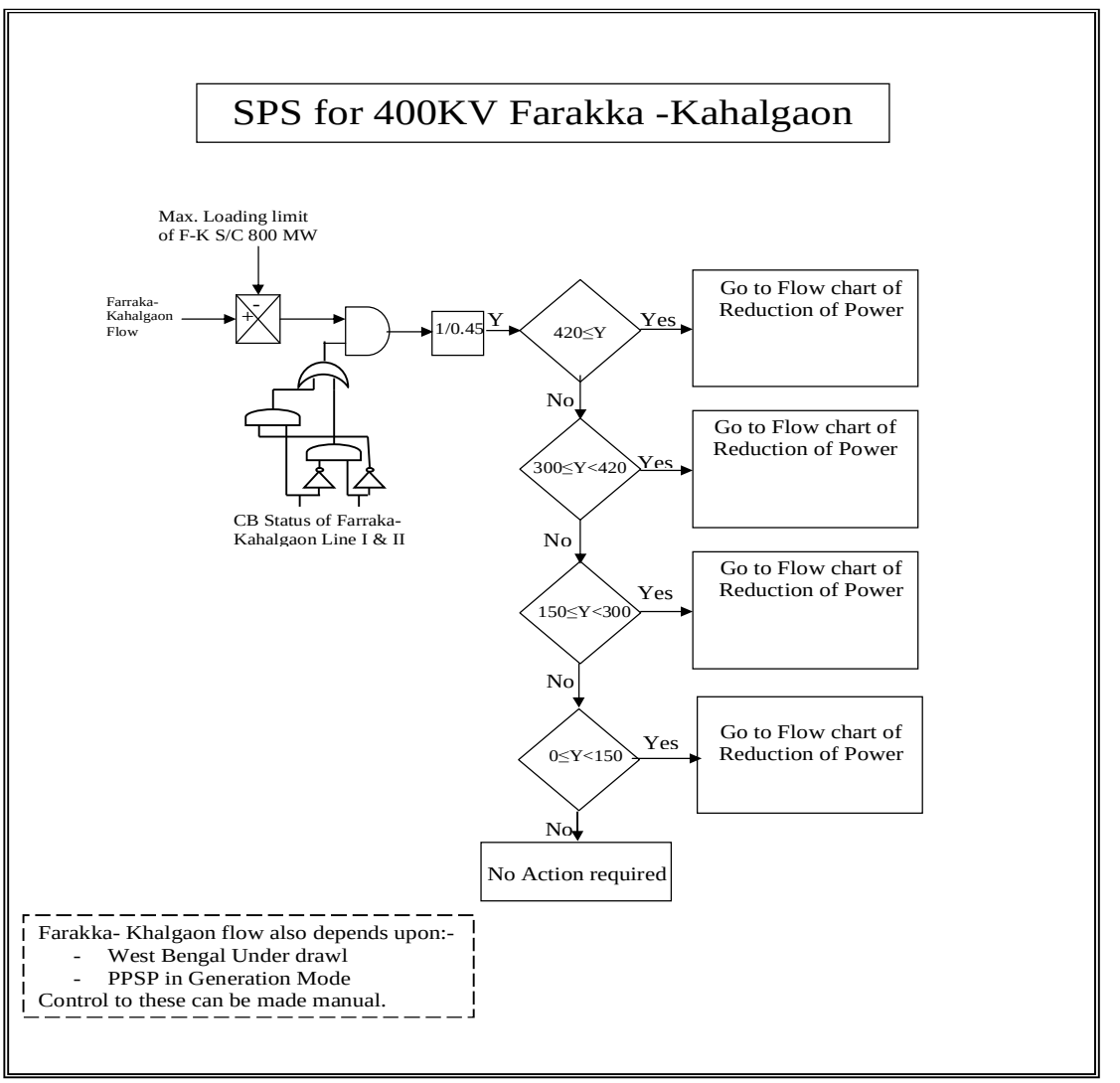
ANNEXURE-III

1. Special Protection Scheme for Eastern Regional Grid

1.1 SPS for Farakka-Kahalgaon

In Low hydro season particularly when KHSTPS generation is low, NR drawl is high and one or more Circuits in FSTPS- Malda- Purnea corridor is under outage, 400 KV Farakka-Kahalgaon gets critically loaded to extent of loading which causes concern, Tripping of one circuit drastically increases the over loading on other circuit. Therefore, a SPS is proposed for the same. From the studies it is found that Farakka-Kahalgaon has a sensitivity of 45 % with FSTPP Generation. The line length of Twin Moose 400 KV Farakka-Kahalgaon D/C is 95 KMs so it can be loaded above its SIL limit, the limiting condition (800 MW each Ckt) based on St Clare's curve.

The proposed SPS continuously monitors the Farakka-Khalgaon flow, Generation of different unit at Farakka along with CB status of 400 KV Farakka-Khalgaon D/C. The SPS remains idle unless and until it receives an actuating signal cause by tripping of any one circuit between Farakka & Kahalgaon.



Working:

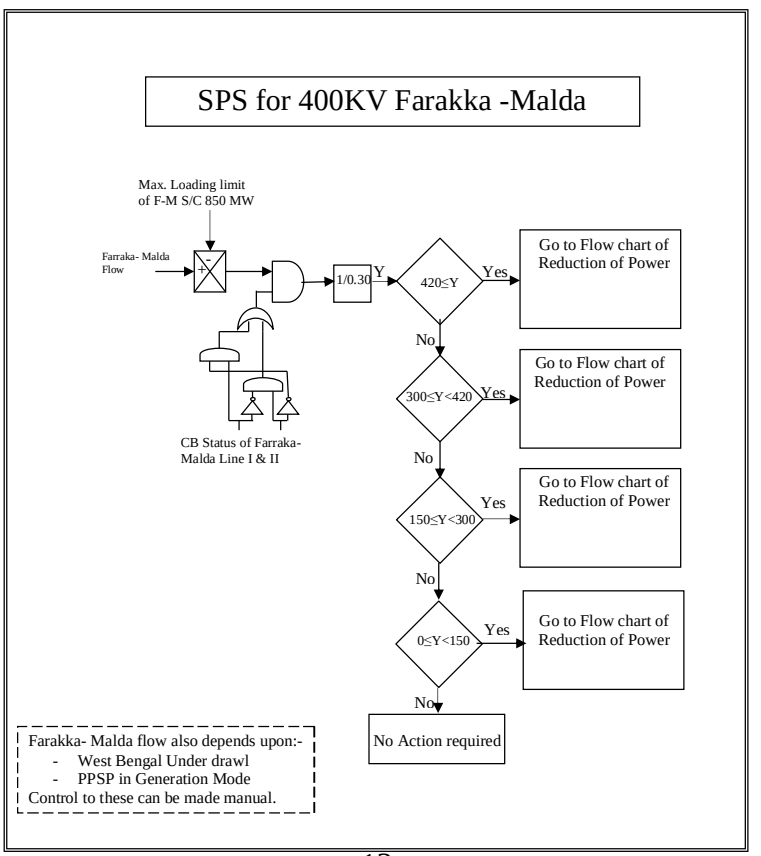
Once any circuit between Farakka & Kahalgaon trips the SPS gets activated. Suppose power flow of Farakka-Kahalgaon is "**A**" MW, allowable flow is 800 MW, so the line is being overloaded by A – 800 = "**B**" MW. Since the Farakka- Kahalgaon line has a sensitivity of 45 % with the generation of Farakka, to reduce the line loading by B MW a reduction of **B/0.45** MW in generation at Farakka is required. Reduction in generation of different units of Farakka is done in such a manner that no unit(s) goes below technical minimum level, unless and until it is extremely required for Grid Security.

Farakka- Kahalgaon flow also depends on whether West Bengal is underdrawing along with mode of operation of PPSP (generation mode) and control of these can be made manual.

1.2 SPS for Farakka-Malda

In winter season, 400 KV Farakka-Malda D/C is critically loaded due to high drawal by NR & NER and low demand in West Bengal and tripping of one circuit drastically increases the over loading on other ckt therefore a SPS is proposed for the same. The easiest way of relieving the line loading will be by way of rapid reduction of generation at FSTPS. From the studies, it is found that Farakka-Malda has a sensitivity of 30 % with Farakka Generation. The line length of Twin Moose 400 KV Farakka-Malda D/C is 40 KMs and therefore it can be loaded above its SIL limit, the limiting condition (950 MW each Ckt) set based on Thermal limit. However SPS is designed initially to limit the single ckt flow to 850MW subsequently, the allowable flow limit would be enhanced in steps of 50MW after gaining experience of SPS operation in subsequent events after commissioning of SPS.

The proposed SPS continuously monitors the Farakka-Malda flow, Generation of different unit at Farakka along with CB status of 400 KV Farakka-Malda D/C. The SPS remains idle unless and until it receives an actuating signal cause by tripping of any one circuit between Farakka & Malda.



Working:

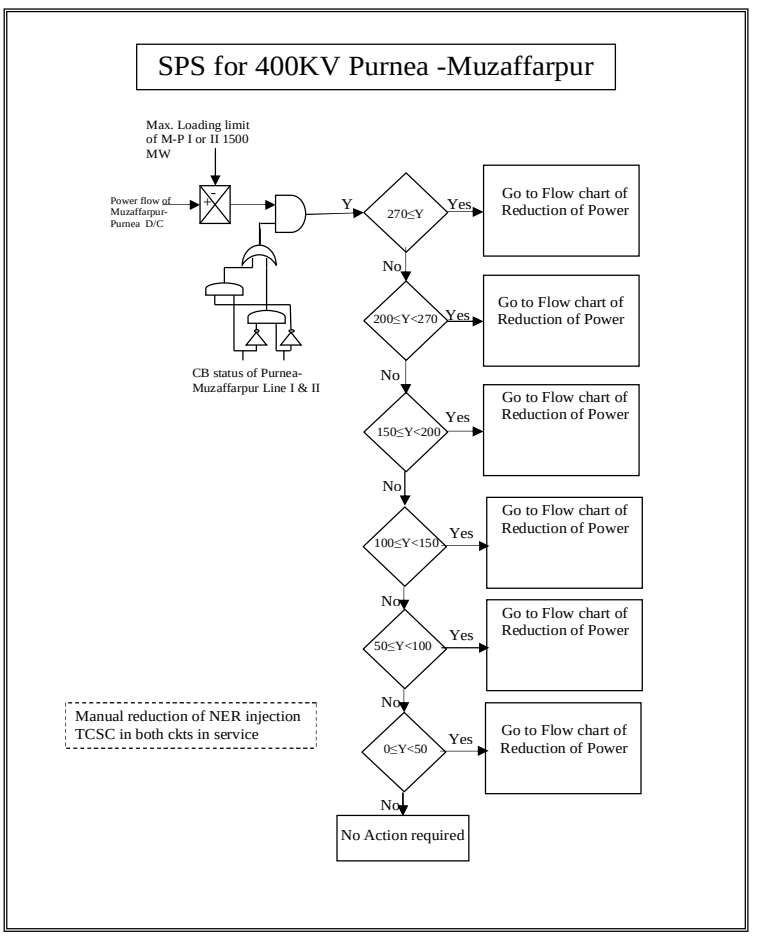
Once any circuit between Farakka & Malda trips the SPS gets activated. Suppose power flow of Farakka-Malda is "**A**" MW, allowable flow is 850 MW, so the line is being overloaded by A – 850 = "**B**" MW. Since the Farakka- Malda line has a sensitivity of 30 % with the generation of Farakka, to reduce the line loading by B MW a reduction of **B/0.30** MW in generation at Farakka is required. Reduction in generation of different units of Farakka is done in such a manner that no unit(s) go below there technical minimum level, unless and until it is required for grid security.

Farakka- Malda flow also depends on whether West Bengal is Under drawing along with mode of operation of PPSP (generation mode) and control of these can be made manual

1.3 SPS for Purnea-Muzaffarpur D/C line

In high hydro season due to high injection from Tala, Teesta & NER hydro stations 400 KV Purnea-Muzaffarpur is critically loaded continuously, tripping of one circuit drastically increases the loading on other line and may even leads to loss of the remaining circuits. Therefore an SPS is proposed for the same in which line loading will be reduced by reducing generation at Teesta HEP. The line length of Quard Moose 400 KV Purnea-Muzaffarpur D/C is 242 KMs and it is also having a series compensation (40 % fixed & 15 % dynamic), so it can be loaded above its SIL limit, the limiting condition (1500 MW each Ckt) arises due to steady state stability limit (St Clare's curve).

The proposed SPS continuously monitors the Purnea -Muzaffarpur flow, Generation of different unit at Teesta along with CB status of 400 KV Purnea-Muzaffarpur D/C. The SPS remains idle unless and until it receives an actuating signal caused by tripping of any one circuit between Purnea & Muzaffarpur.



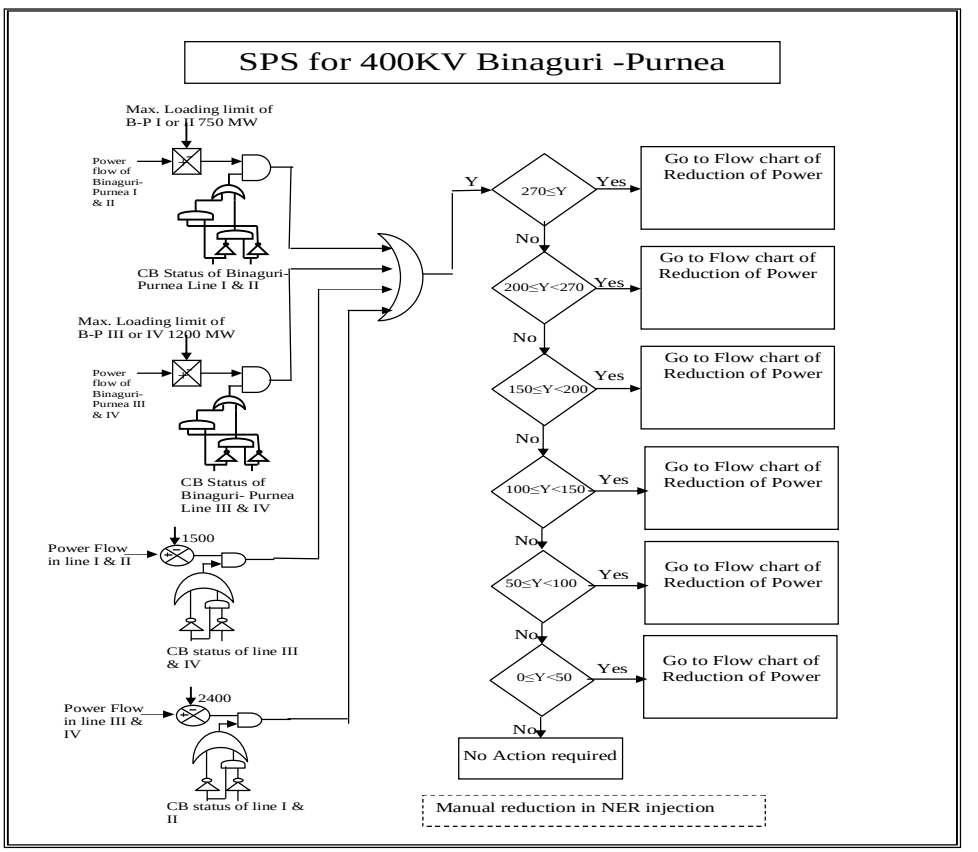
Working:

If any circuit between Purnea & Muzaffarpur trips the SPS gets activated. Suppose power flow of Purnea-Muzaffarpur is "**A**" MW, allowable flow is 1500 MW, thus the line is being overloaded by A – 1500 = "**B**" MW. So it is required to reduce the generation at Teesta by B MW to bring back the flow in line under allowable limits. Since the generation of Teesta directly affects the power flow of Purnea-Muzaffarpur, generation of Teesta needs to be backed down. Purnea – Muzaffarpur flow also depends upon the injection by NER which can be controlled manually.

1.4 SPS for Purnea-Binaguri Q/C

In high hydro season all the four 400 KV circuits between Purnea and Binaguri are heavily loaded continuously due to high injection from Tala, Teesta & NER hydro stations and tripping of one circuit drastically increases the over loading on other lines. The SPS is essentially required to take care of additional injection from NER after the commissioning of Palatana(760 MW) units when all the four ckts are expected to be critically loaded. Therefore, a SPS is proposed for the same. The line length of 400 KV Purnea-Binaguri Line I & II(Twin-Moose) is 168 KMs and that of Line III & IV(Quad-Moose) is 160 KMs, So these lines can be loaded above there SIL limit, the limiting condition of 750 MW (Twin moose) & 1200 MW (Quad Moose) arise due to steady state stability limit (St Clare's curve).

The proposed SPS continuously monitors the Purnea -Binaguri flow, Generation of different units at Teesta along with CB status of all four 400 KV Purnea-Binaguri lines. The SPS remains idle unless and until it receives an actuating signal caused by tripping of any one circuit between Purnea & Binaguri.



Working:

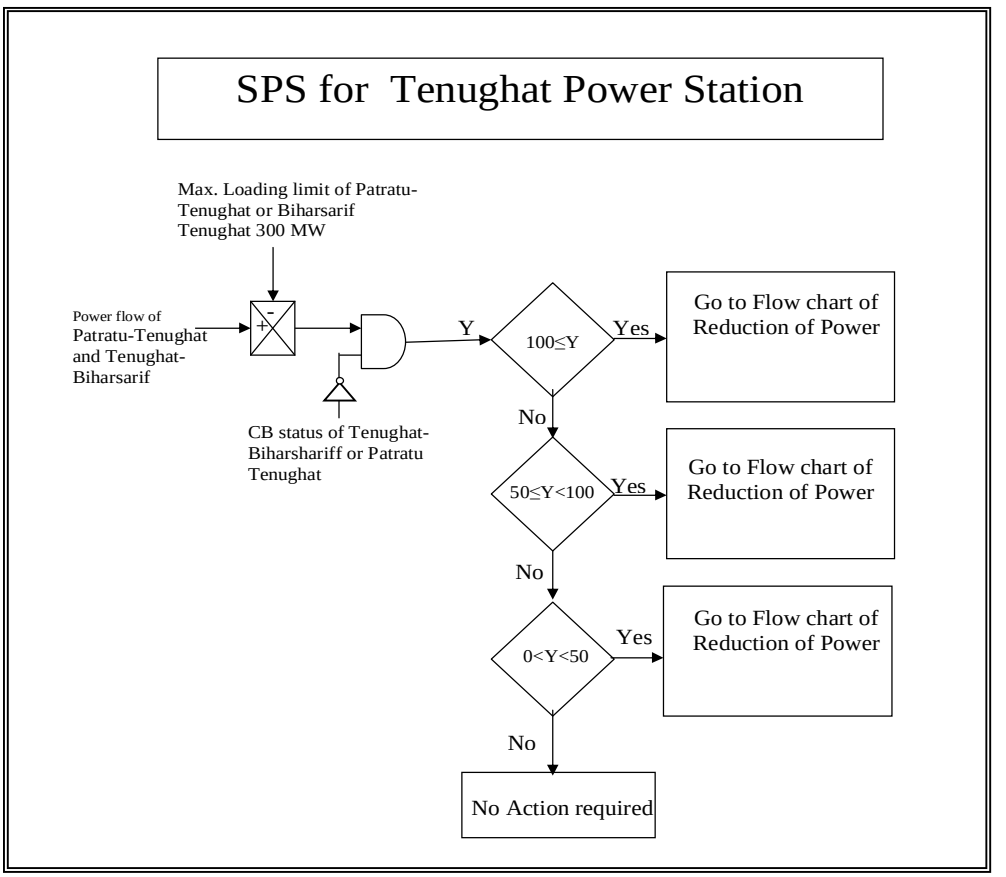
If any circuit between Purnea & Binaguri trips the SPS gets activated. Depending upon which circuit trips the SPS takes different actions (one set of action for tripping of one circuit between I & II and another for tripping either of circuit between III & IV). Suppose one circuit between I & II trips and Power flow in the other circuit is "**A**" MW, allowable flow is 750 MW (1200 MW for circuit III or IV) so the line is being over loaded by A-750 = "**B**" MW (or A-1200 if one of the circuit between III or IV trips) So it is required to reduce the generation at Teesta by B MW to bring back the flow in lines under allowable limits, since the generation of Teesta directly affects the power flow of Purnea-Binaguri

Purnea – Binaguri flow also depends upon the injection by NER which can be made manually controlled.

1.5 SPS for Tenughat

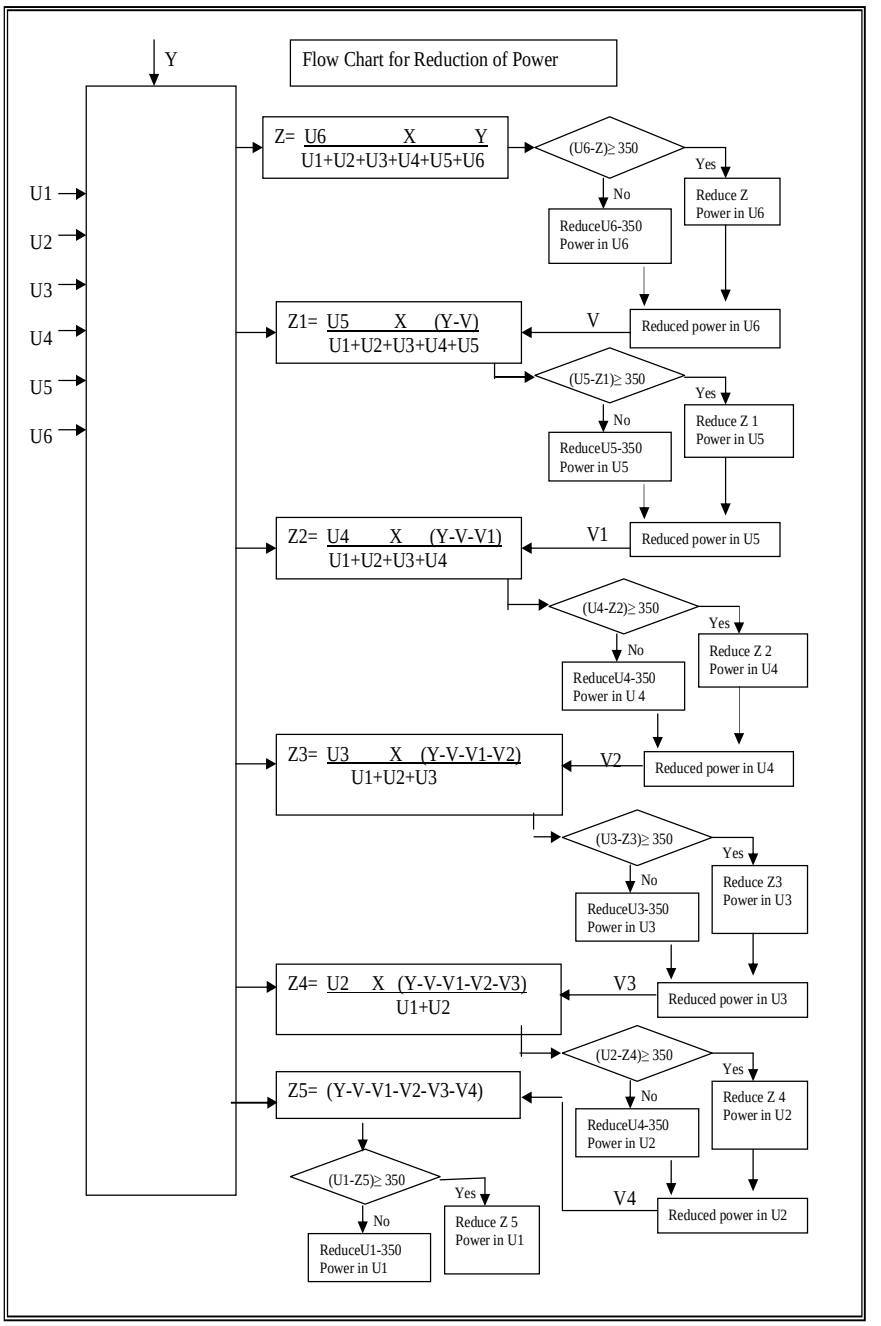
Tenughat thermal power station (2 X 210 MW) is connected to grid via two Twin Moose lines charged at 220 KV. One is Tenughat-Biharshariff and another Tenughat-Patratu, tripping of one line among these drastically increases the loading on the other which may also trip due to overloading leading to a complete black out of Tenughat power station. So a SPS is proposed for the same to prevent complete loss of evacuation paths from the station by rapid reduction of TVNL units. The line length of Tenughat-Biharshariff is 110KMs and that of Tenughat-Patratu is 70 KMs (both are Twin Moose charged at 220 KV). The limiting condition would be 300 MW for each circuit.

The proposed SPS continuously monitors the Tenughat-Biharshariff flow and Tenughat-Patratu flow, Generation of different units at Tenughat along with CB status of both the above lines. The SPS remains idle unless and until it receives an actuating signal caused by tripping of either of the above lines.

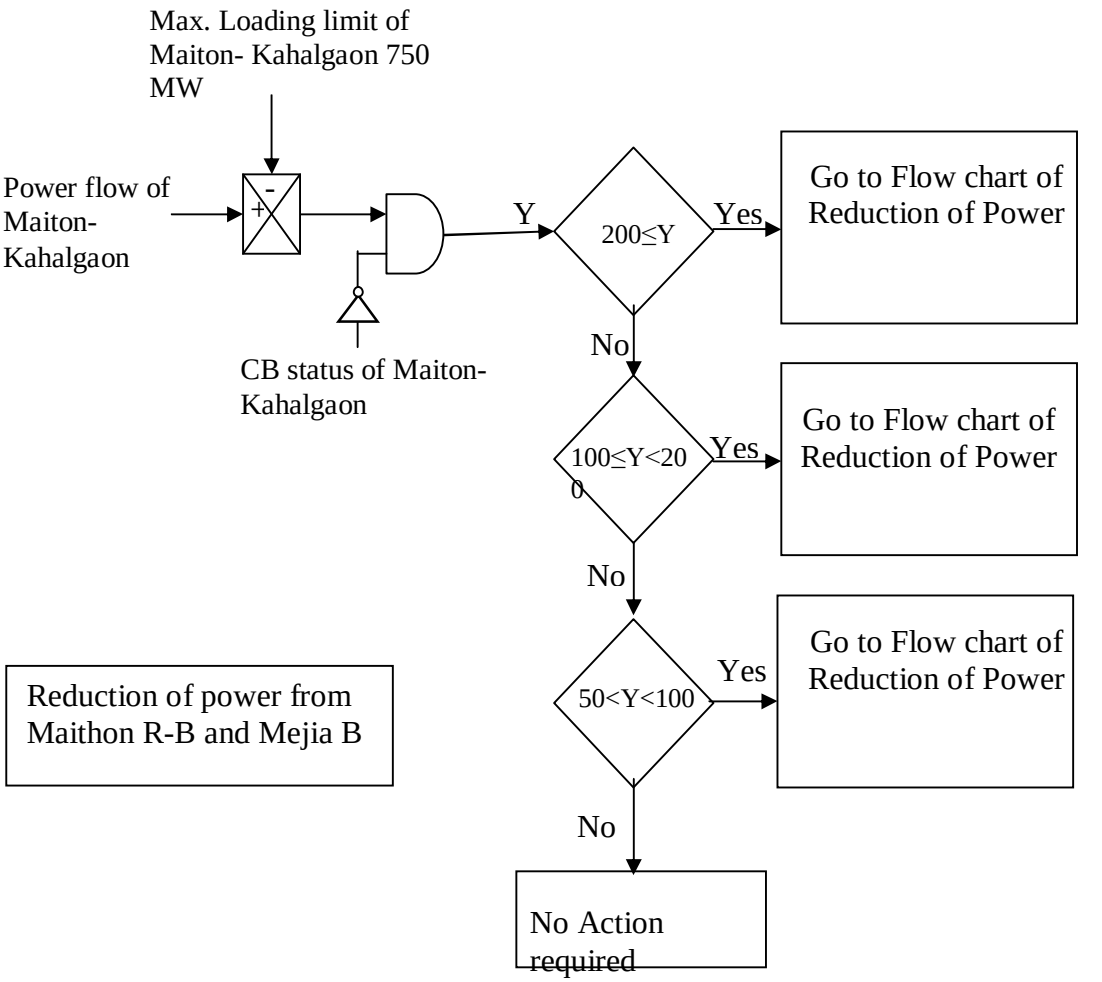


Working:

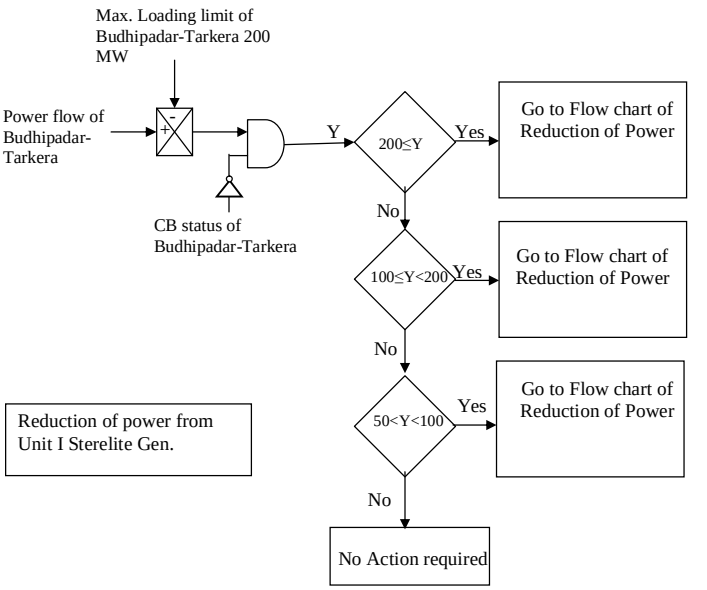
If any circuit either Tenughat-Biharshariff or Tenughat-Patratu trips, the SPS gets activated. Suppose Tenughat-Biharshariff trips and power flow in Tenughat-Patratur is "**A**" MW, allowable flow is 300 MW, thus the line is being overloaded by A – 300 = "**B**" MW. So it is required to reduce the generation at Tenughat by B MW to bring back the flow in line under allowable limits. Reduction in generation of different units of Tenughat is done in such a manner that no unit(s) goes below the technical minimum level, unless and until it is extremely required for Grid Security



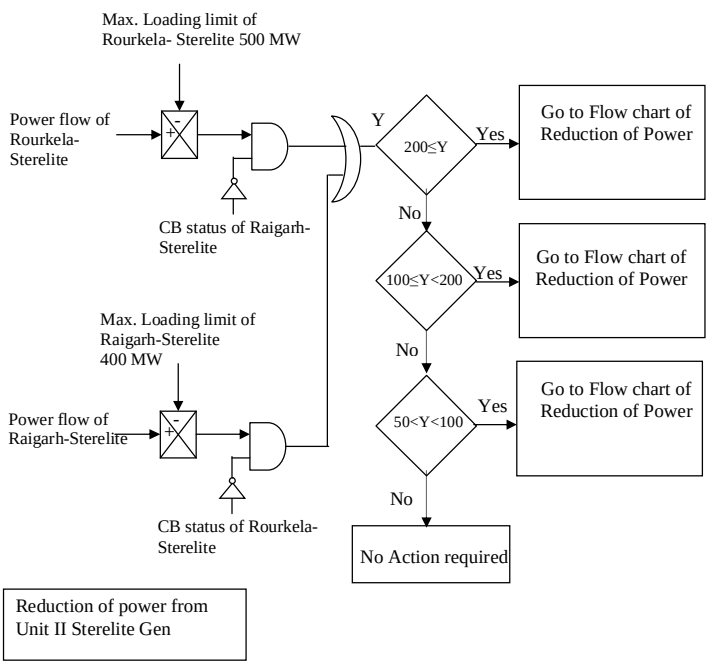
SPS for 400KV Maithon-Kahalgaon D/C

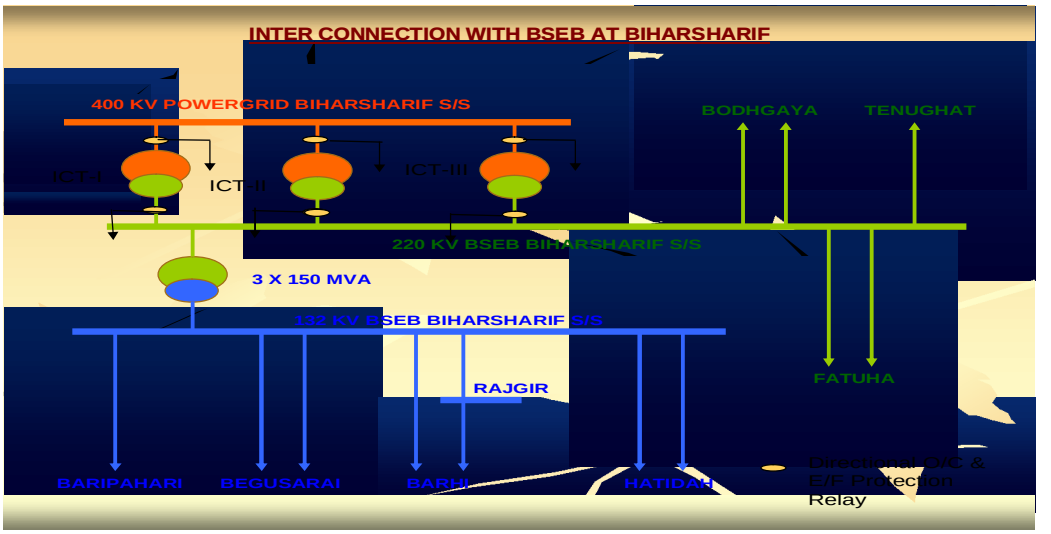


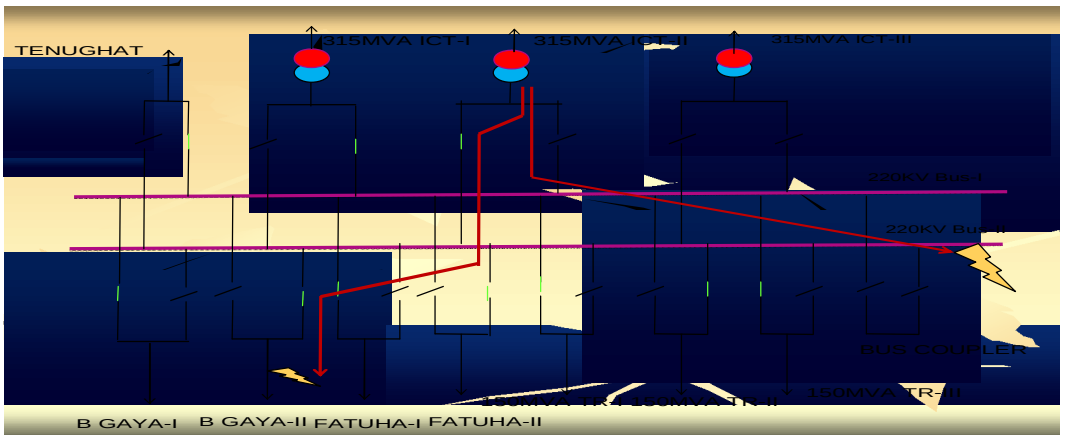
SPS for Unit I of Sterlite

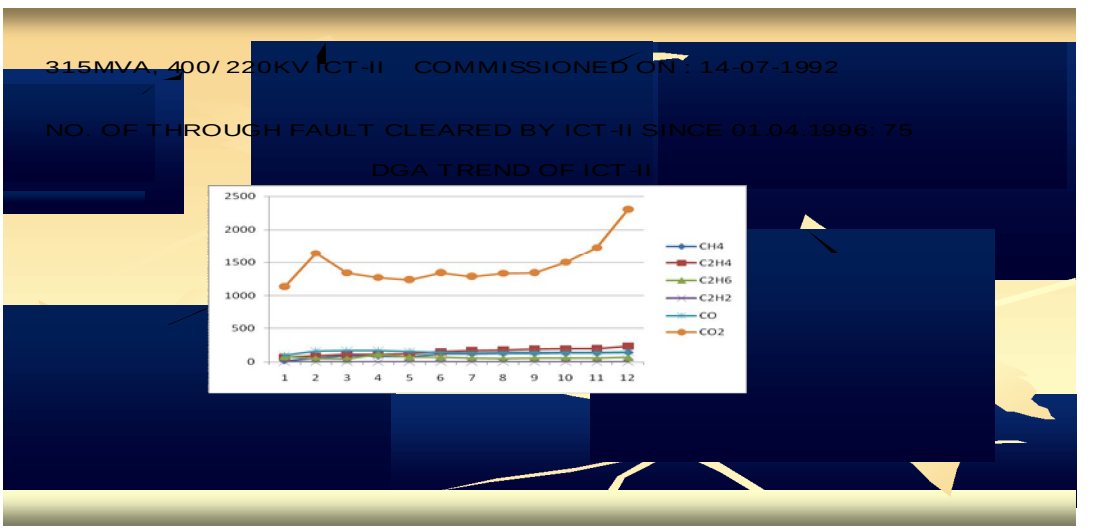


SPS for Unit II of Sterlite




INTER CONNECTION WITH BSEB AT BIHARSHARIF
400 KV POWERGRID BIHARSHARIF S/S
ICT-I
ICT-II
ICT-III
BODHGAYA
TENUGHAT
220 KV BSEB BIHARSHARIF S/S
3 X 150 MVA
132 KV BSEB BIHARSHARIF S/S
RAJGIR
FATUHA
BARIPAHARI
BEGUSARAI
BARH
HATIDAH
Directional O/C & E/F Protection Relay


TENUGHAT
315MVA ICT-I
315MVA ICT-II
315MVA ICT-III
220KV Bus-I
220KV Bus-II
BUS COUPLER
150MVA TR-III
B GAYA-I
B GAYA-II
FATUHA-I
FATUHA-II


315MVA, 400/ 220KV ICT-II COMMISSIONED ON : 14-07-1992
NO. OF THROUGH FAULT CLEARED BY ICT-II SINCE 01.04.1996: 75
DGA TREND OF ICT-II
2500
2000
1500
1000
500
0
1 2 3 4 5 6 7 8 9 10 11 12
CH4
C2H4
C2H6
C2H2
CO
CO2