Eastern Regional Power Committee, Kolkata

Minutes of Special Meeting on Islanding Scheme of IB-TPS held at ERPC, Kolkata on 12th December 2018 at 11:00hrs

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

Member Secretary, ERPC chaired the meeting. He welcomed participants from OPTCL, OPGC, Bakreswar TPS, Bandel TPS, ERLDC and ERPC. He informed that in line with discussion of 73rd PCC Meeting, this special meeting on Islanding Scheme of IB-TPS has been called.

At the start of the meeting, OPTCL and OPGC explained the draft islanding scheme with a detailed presentation. The presentation is enclosed at **Annexure-I**. OPTCL and OPGC had presented two cases for designing the islanding scheme as follows:

- Two units (2 X 210 MW) of IB TPS with 239 MW load
- One unit (210 MW) of IBTPS with the selected loads of 149 MW

Members from Bandel and Bakreswar opined that the difference in generation and load is more in case of islanding Two units (2 X 210 MW) of IB TPS with 239 MW load. The units are to be backing down at a higher rate in order to balance the generation with load. They suggested OPGC to interact with OEM regarding ramping down rate of the units. OPGC agreed to interact with M/s BHEL, OEM to assess the ramping down rate of the units.

OPGC also informed that the unit tripping of IB TPS generators is at 47.5 Hz with 1 sec delay and at 52 Hz with 2 sec delay.

Members discussed both the cases in details and decided to consider the islanding scheme with one unit (210 MW) of IBTPS with the selected loads of 149 MW in view of the following merits:

- Load-Generation balance at the time islanding can be easily achievable
- Traction load at Jharsuguda can be excluded from the islanding scheme
- 149 MW radial loads can be easily segregated at 220/132kV Budhipadar S/s and transferring the trip command to remote substations is not required except 132kV Kalunga S/s to trip 132kV Kalunga-Tarkera line.
- Islanding scheme can survive even with outage of one 220/132kV ATR at 220kV Budhipadar S/s

After detailed discussion the following were decided:

- The alarm for islanding scheme shall be initiated at 49.2 Hz at both Budhipadar and IB TPS to alert the operators
- Islanding of one unit (210 MW) of IBTPS with the selected loads of 149 MW connected through 132 kV level at Budhipadar substation will be initiated at 47.8 Hz of grid frequency with 250msec time delay.
- The islanding relay Micom P341 at Budhipadar will give trip command to all 220KV feeders connected to Bus-I and Bus II along with Bus coupler except Auto transformer- I & II and selected islanding IB TPS ckts either (IB -1 & 3) or (IB-2 & 4).

- Give trip command to circuit breakers of 132kV Budhipadar-Lapanga S/c line, 132kV Budhipadar-Jharsuguda D/C line and 132kV Budhipadar-Rajgangpur S/C lines at Budhipadar end.
- It will send carrier command to both Kalunga and Tarkera end to trip 132kV Kalunga-Tarkera S/c line from both the ends to make radial load at Kalunga.
- It will send carrier signal to IB TPS to start ramping and adjust IB TPS (one unit) generation to match the load.

OPTCL and OPGC were advised to present final islanding scheme in the OCC Meeting of January 2019.

Regarding implementation, OPTCL and OPGC informed the following:

- The islanding relay Micom P341 is already installed at bus coupler panel of 220kV Budhipadar S/s
- OPGW is available for 220 kV lines
- Installation of OPGW is in progress for 132kV lines
- Logic for generation control of islanding after receiving the command from Budhipadar is to be implemented at IB TPS

Meeting ended with vote of thanks to the chair.

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Annexure-A

Participants in Special Meeting on "IB TPS Islanding Scheme"

Venue: ERPC Conference Room, Kolkata Time: 11:00 hrs Date: 12.12.2018 (Wednesday)

Sl No	Name	Designation/ Organization	Contact Number	Email	Signature
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9	PK Mahapatra	AGM, OPGC	9338715401	Pradeep.mahapatra@opgc.co.in	
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11	Shri Mohan Jha	Consultant ERPC	9874738913	erpejha@yahoo.co.in	
12	P. P. Jena	AEE, ERPC	9776198991	ppjena.erpc@gov.in	
13	Sanjib Pal	SM(CRS), WBPDCL	8336903782	spal@wbpdcl.co.in	
14	B. Sarkhel	Consultant	9433065724	buddha_sarkhel@yahoo.co.in	
15	S.K. pradhan	AD-II, ERPC	8249244719	shishir.1505@gmail.com	
16	S. S. Nanda	DGM Electrical Sem Burla OPTCL	9438907803	ssnanda@optcl.co.in	12/12/18
17					
18					
19					
20					

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

ISLANDING SCHEME FOR IB THERMAL – BUDHIPADAR GSS

ISLANDING SCHEME DESCRIPTION

1. Islanding schemes are implemented by generating stations & transmission system to isolate the healthy subsystems following a large-scale disturbance. This is a system requirement under contingency conditions according to which the power network may be split into healthy and self-sustaining zones so that cascade tripping of all generating stations in the entire region is avoided.
2. With a view to protect the generation of IB TPS during sudden and major disturbance in power system network, one special islanding scheme with part loads of Budhipadar GSS of OPTCL has been proposed.
3. Two numbers 210 MW generators of IB TPS connect to 220/132/33kV Grid substation through four numbers dedicated 220kV lines.
4. The islanding scheme envisages segregation of a group of matching 132kV load in closed loop with the IB generators.

ISLANDING SCHEME DESCRIPTION

5. 132kV feeders will be arranged radially in order to form islanding scheme with IB generation.
6. 220kV Budhipadar GSS has system with two main bus and a transfer bus system. The generation & matching loads put into two buses with bus coupler in operation.
7. The two numbers 220kV feeders from IB TPS put into Bus –II and the other two are kept in the other bus as normal arrangement.
8. In normal condition, 220 kV interstate line to Korba-2 & 3 and Raigarh will be distributed to both the buses.
9. The islanding relay Micom P341 is installed at Bus coupler panel of the 220kV system.

ISLANDING SCHEME DESCRIPTION

10. In the event of system disturbance and actuation of islanding relay:

a. Relay will give command to trip all 220KV feeders connected to Bus-I and Bus II along with Bus coupler except selected islanding IB ckts. either (IB -1 & 3) / (IB-2 & 4) and Auto transformer- I & II.
b. It will also trip non- selected islanding IB ckts. incomer breaker either (IB -1 & 3) / (IB-2 & 4).
c. It will send carrier command to Tarkera end and to trip 132kV Tarkera –Rajgangpur feeder I & II and 132kV Tarkera- Kalunga feeder so as to feed Rajgangpur , Kuchinda and Kalunga Grid Load will be in radial arrangement.
d. It will send carrier signal to Lapanga end to trip 132kV Lapanga – Jharsuguda feeder at Lapanga in order to feed Jharsuguda load radially.
e. It will send carrier signal to IB thermal to start ramping and adjust IB generation to match the load.

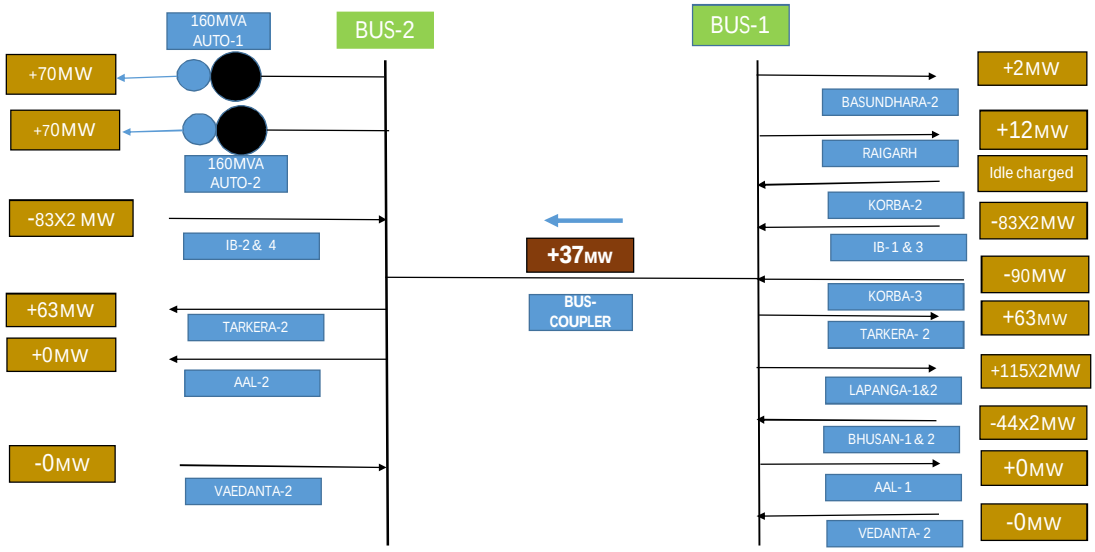
ISLANDING SCHEME DESCRIPTION

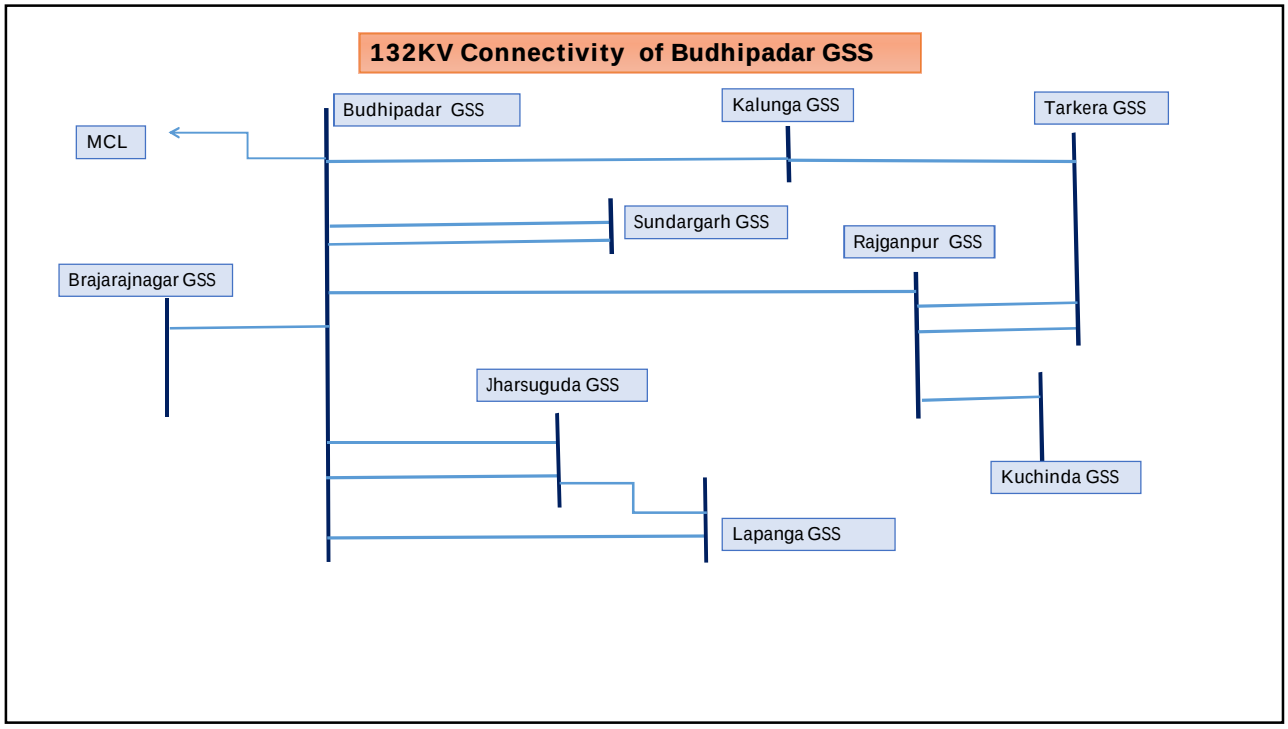
11. The CGP feeders such as Vedanta , Bhusan and Aditya Aluminium have their own islanding schemes to cater their industry load.

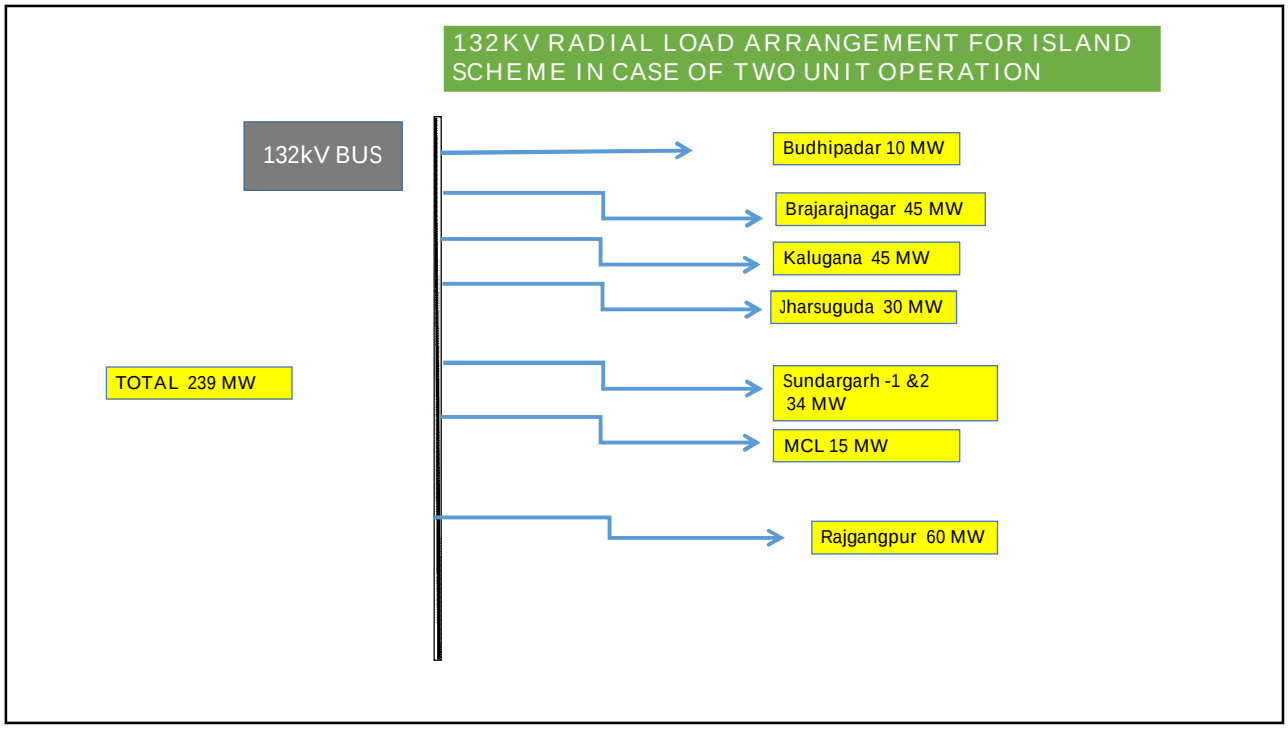
12. The general arrangement of 220kV feeder configuration, 132kV loads for islanding has shown in following slides.

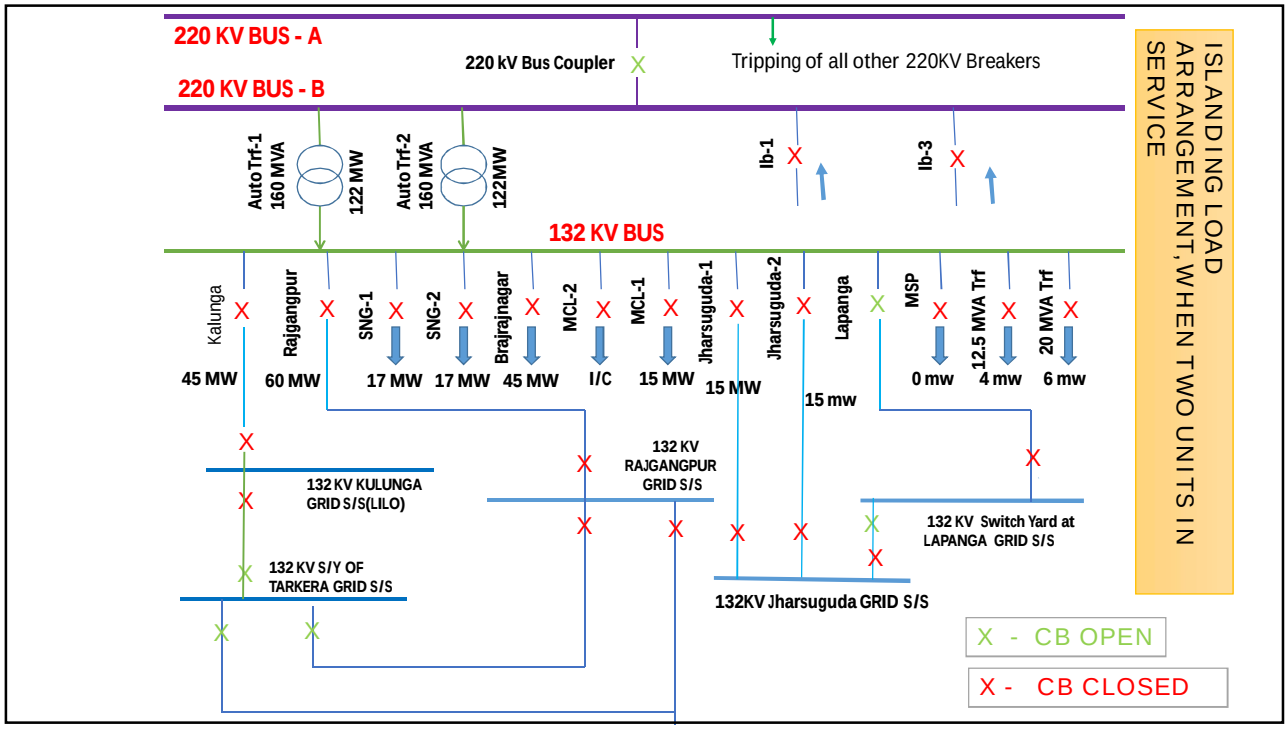
POWER FLOW DETAILS OF 220KV SYSTEM

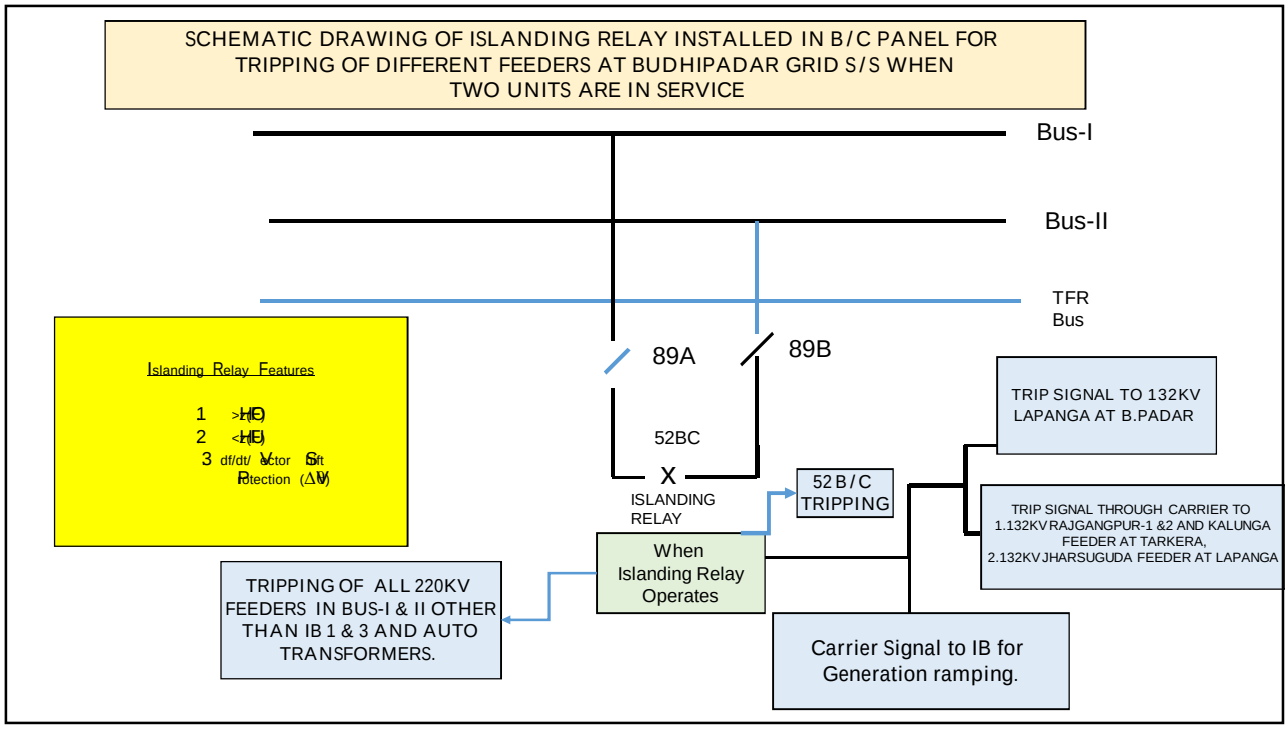
LOAD PATTERN OF DIFFERENT FEEDERS 12.07.2018 AT 12.00 HRS.



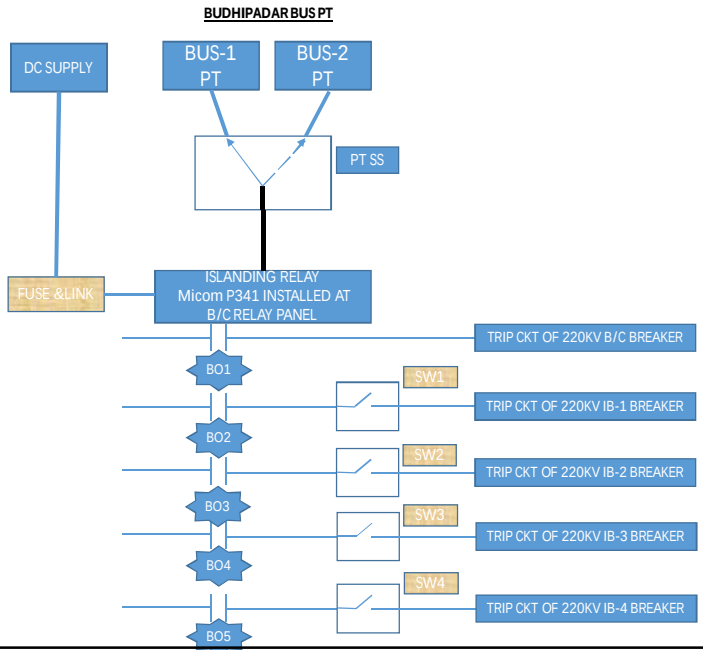

132KV Connectivity of Budhipadar GSS
Budhipadar GSS
Kalunga GSS
Tarkera GSS
MCL
Sundargarh GSS
Rajganpur GSS
Brajarajnagar GSS
Jharsuguda GSS
Kuchinda GSS
Lapanga GSS

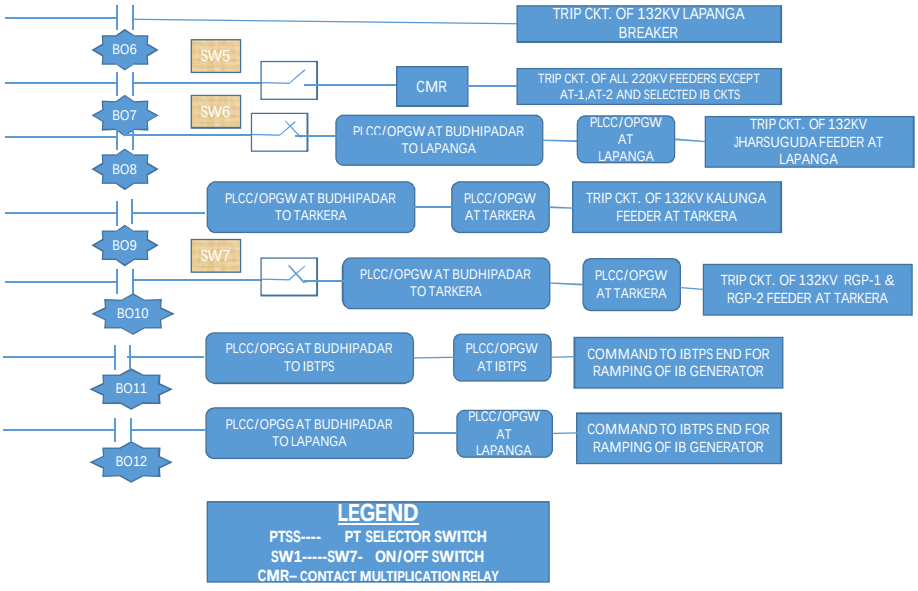

132KV RADIAL LOAD ARRANGEMENT FOR ISLAND SCHEME IN CASE OF TWO UNIT OPERATION
132kV BUS
Budhipadar 10 MW
Brajarajnagar 45 MW
Kalugana 45 MW
Jharsuguda 30 MW
TOTAL 239 MW
Sundargarh -1 &2
34 MW
MCL 15 MW
Rajgangpur 60 MW


220 KV BUS - A
220 KV BUS - B
220 kV Bus Coupler
Tripping of all other 220KV Breakers
Auto Trf-1 160 MVA
122 MW
Auto Trf-2 160 MVA
122MW
Ib-1
Ib-3
132 KV BUS
Kalunga
Rajgangpur
SNG-1
SNG-2
Brajrajnagar
MCL-2
MCL-1
Jharsuguda-1
Jharsuguda-2
Lapanga
MSP
12.5 MVA Trf
20 MVA Trf
45 MW
60 MW
17 MW
17 MW
45 MW
I/C
15 MW
15 MW
15 mw
0 mw
4 mw
6 mw
132 KV KULUNGA GRID S/S(LILO)
132 KV S/Y OF TARKERA GRID S/S
132 KV RAJGANGPUR GRID S/S
132 KV Switch Yard at LAPANGA GRID S/S
132KV Jharsuguda GRID S/S
X - CB OPEN
X - CB CLOSED
ISLANDING LOAD ARRANGEMENT,WHEN TWO UNITS IN SERVICE


SCHEMATIC DRAWING OF ISLANDING RELAY INSTALLED IN B/C PANEL FOR TRIPPING OF DIFFERENT FEEDERS AT BUDHIPADAR GRID S/S WHEN TWO UNITS ARE IN SERVICE
Bus-I
Bus-II
TFR Bus
89A
89B
52BC
X
ISLANDING RELAY
52 B/C TRIPPING
TRIP SIGNAL TO 132KV LAPANGA AT B.PADAR
TRIP SIGNAL THROUGH CARRIER TO 1.132KV RAJGANGPUR-1 &2 AND KALUNGA FEEDER AT TARKERA, 2.132KV JHARSUGUDA FEEDER AT LAPANGA
When Islanding Relay Operates
TRIPPING OF ALL 220KV FEEDERS IN BUS-I & II OTHER THAN IB 1 & 3 AND AUTO TRANSFORMERS.
Carrier Signal to IB for Generation ramping.
Islanding Relay Features
1
2
3 df/dt/ Vector Shift Protection (ΔV)

CONNECTION DIAGRAM OF ISLANDING RELAY (Micom P341) AT BUDHIPADAR SUB-STATION WHEN TWO UNITS ARE IN SERVICE

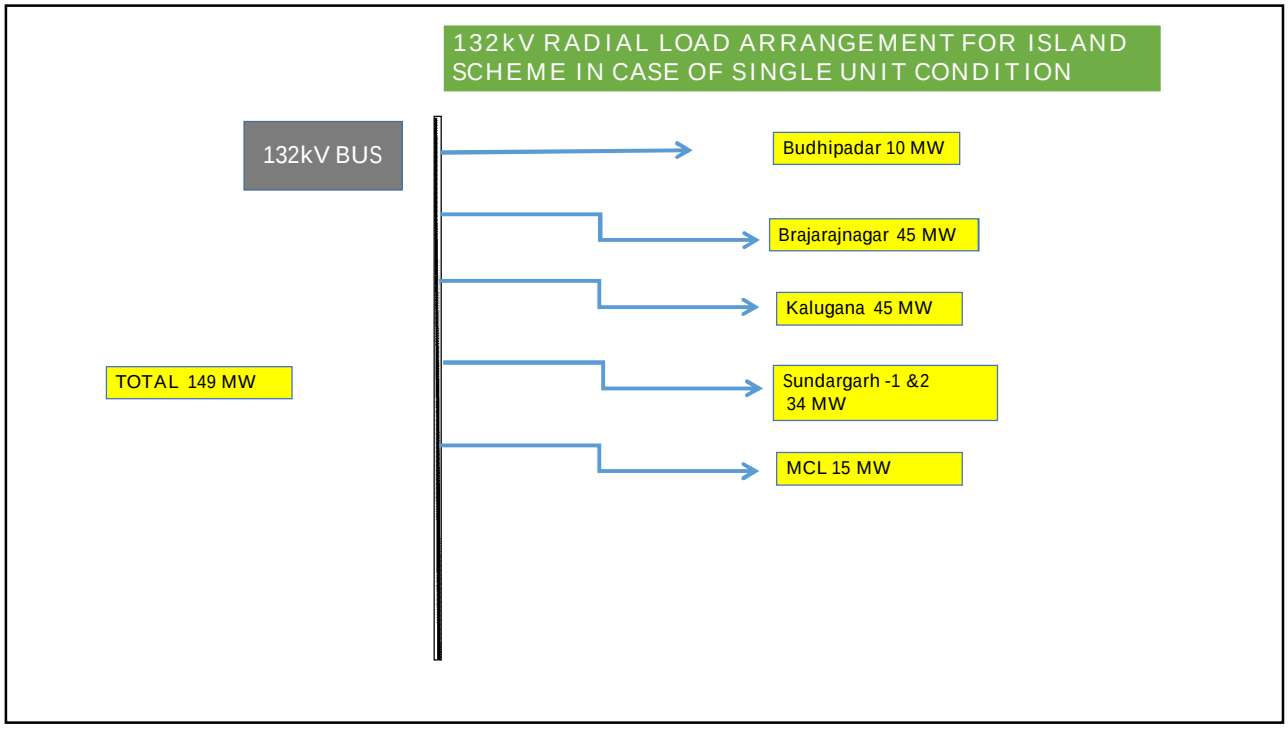


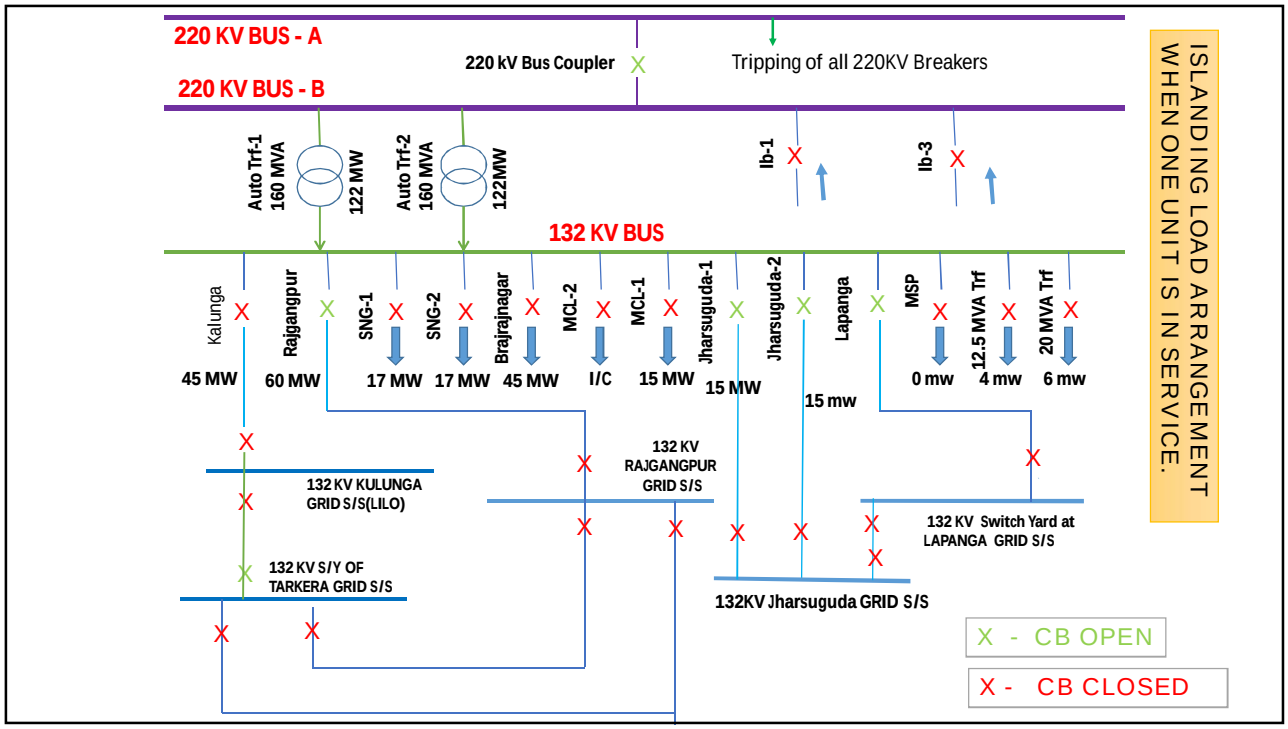


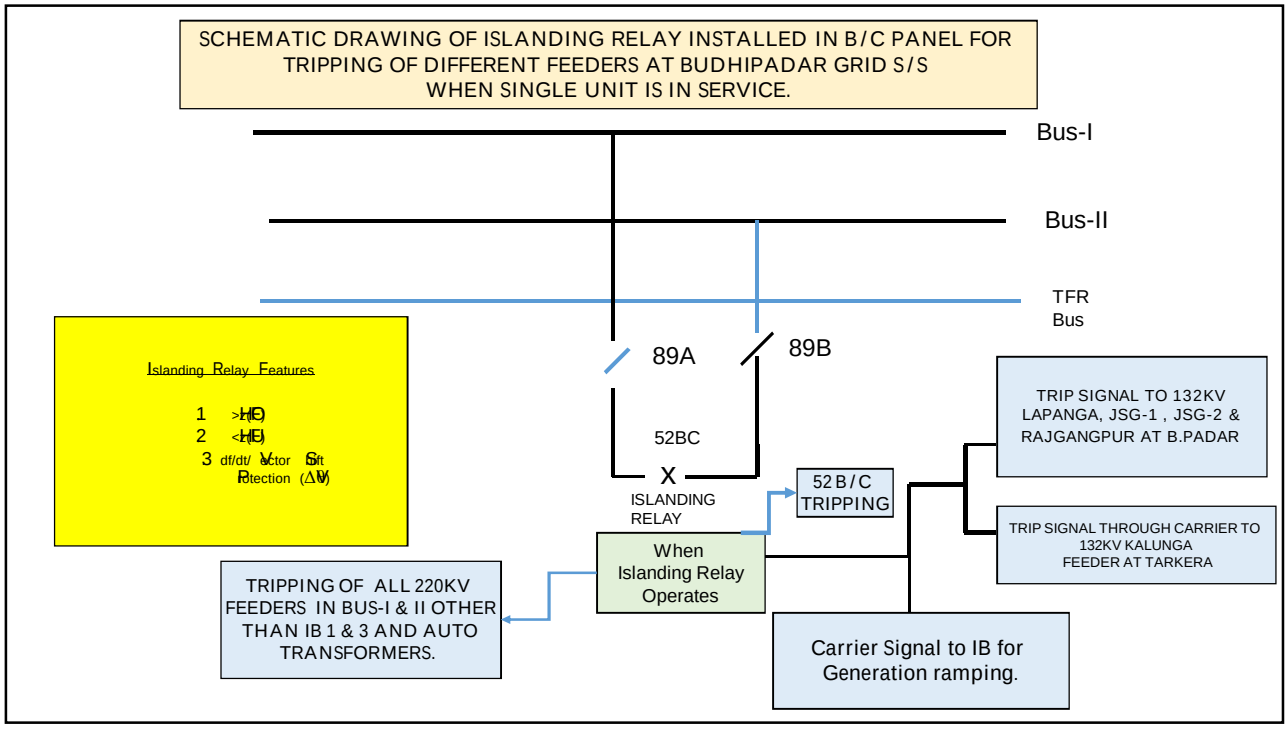
LEGEND

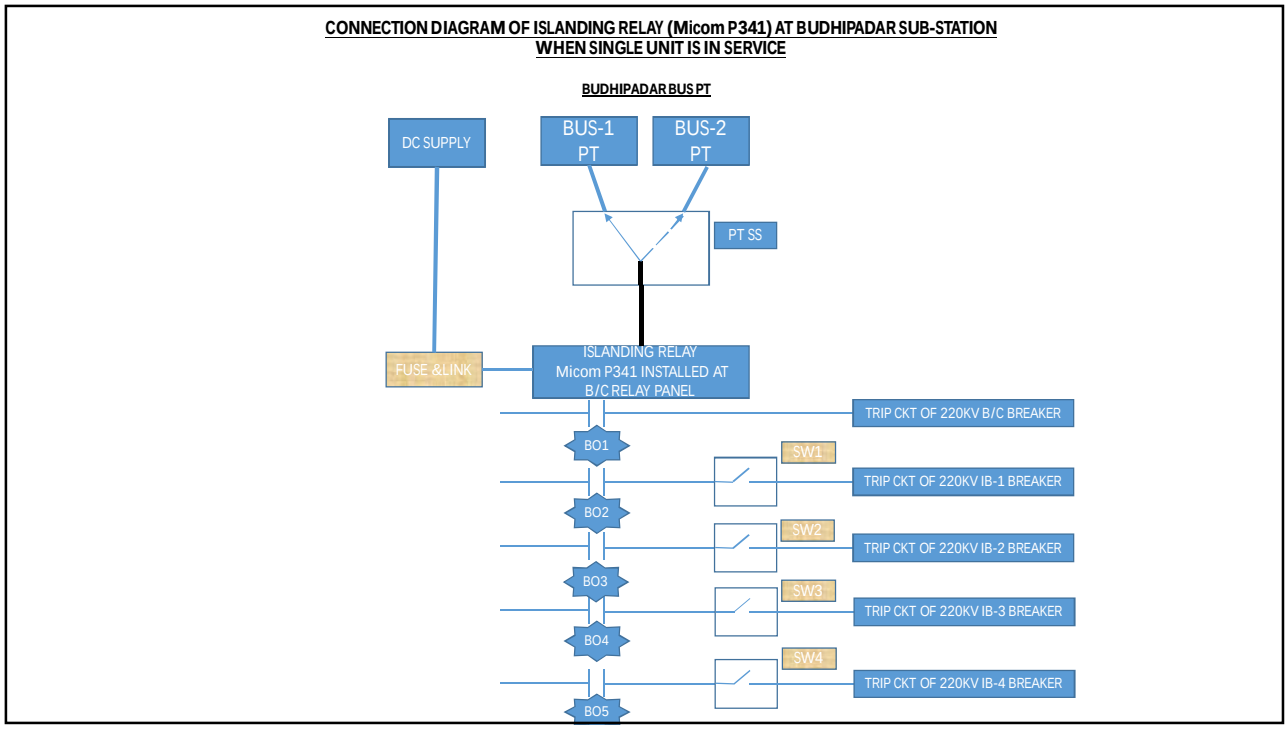
PTSS---- PT SELECTOR SWITCH
SW1-----SW7- ON/OFF SWITCH
CMR– CONTACT MULTIPLICATION RELAY

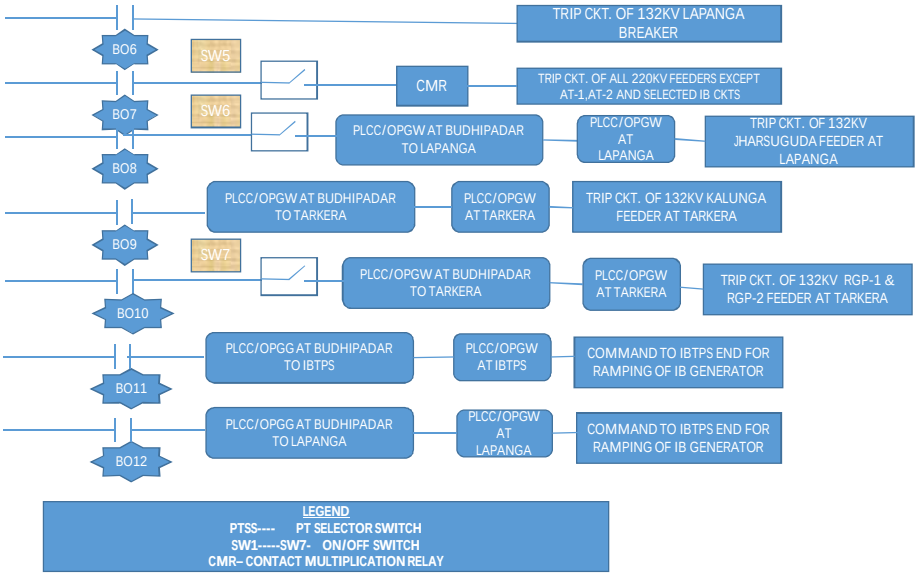
NB:IN CASE OF TWO UNIT OPERATION SW6 AND SW7 IS IN ON CONDITION.


132kV RADIAL LOAD ARRANGEMENT FOR ISLAND SCHEME IN CASE OF SINGLE UNIT CONDITION
132kV BUS
Budhipadar 10 MW
Brajarajnagar 45 MW
Kalugana 45 MW
Sundargarh -1 &2 34 MW
MCL 15 MW
TOTAL 149 MW


220 KV BUS - A
220 KV BUS - B
220 kV Bus Coupler
Tripping of all 220KV Breakers
Auto Trf-1 160 MVA
122 MW
Auto Trf-2 160 MVA
122MW
Ib-1
Ib-3
132 KV BUS
Kalunga
Rajgangpur
SNG-1
SNG-2
Brajrajnagar
MCL-2
MCL-1
Jharsuguda-1
Jharsuguda-2
Lapanga
MSP
12.5 MVA Trf
20 MVA Trf
45 MW
60 MW
17 MW
17 MW
45 MW
I/C
15 MW
15 MW
15 mw
0 mw
4 mw
6 mw
132 KV KULUNGA GRID S/S(LILO)
132 KV S/Y OF TARKERA GRID S/S
132 KV RAJGANGPUR GRID S/S
132 KV Switch Yard at LAPANGA GRID S/S
132KV Jharsuguda GRID S/S
ISLANDING LOAD ARRANGEMENT WHEN ONE UNIT IS IN SERVICE.
X - CB OPEN
X - CB CLOSED


SCHEMATIC DRAWING OF ISLANDING RELAY INSTALLED IN B/C PANEL FOR TRIPPING OF DIFFERENT FEEDERS AT BUDHIPADAR GRID S/S WHEN SINGLE UNIT IS IN SERVICE.
Bus-I
Bus-II
TFR Bus
89A
89B
52BC
X
ISLANDING RELAY
52 B/C TRIPPING
TRIP SIGNAL TO 132KV LAPANGA, JSG-1 , JSG-2 & RAJGANGPUR AT B.PADAR
TRIP SIGNAL THROUGH CARRIER TO 132KV KALUNGA FEEDER AT TARKERA
When Islanding Relay Operates
TRIPPING OF ALL 220KV FEEDERS IN BUS-I & II OTHER THAN IB 1 & 3 AND AUTO TRANSFORMERS.
Carrier Signal to IB for Generation ramping.
Islanding Relay Features
1
2
3 df/dt/ Vector Shift Protection (ΔV)


CONNECTION DIAGRAM OF ISLANDING RELAY (Micom P341) AT BUDHIPADAR SUB-STATION WHEN SINGLE UNIT IS IN SERVICE
BUDHIPADAR BUS PT
DC SUPPLY
BUS-1 PT
BUS-2 PT
PT SS
FUSE &LINK
ISLANDING RELAY Micom P341 INSTALLED AT B/C RELAY PANEL
TRIP CKT OF 220KV B/C BREAKER
BO1
SW1
TRIP CKT OF 220KV IB-1 BREAKER
BO2
SW2
TRIP CKT OF 220KV IB-2 BREAKER
BO3
SW3
TRIP CKT OF 220KV IB-3 BREAKER
BO4
SW4
TRIP CKT OF 220KV IB-4 BREAKER
BO5



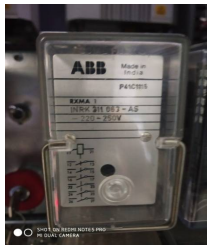
NB:IN CASE OF SINGLE UNIT OPERATION SW6 AND SW7 IS IN OFF CONDITION.

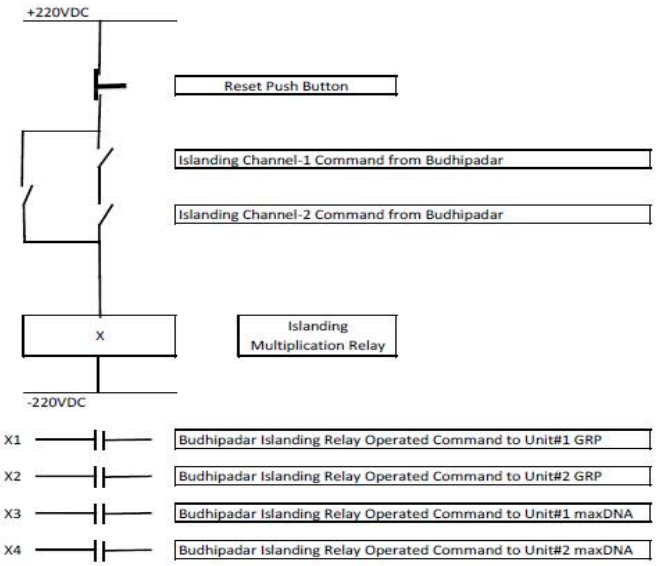
RELAY SETTINGS

Frequency	Budhipadar End	ITPS End	Remarks
Under Frequency	48.7Hz,TD:1Sec	Stage1:47.5Hz,TD:1sec	
		Stage2:47.0Hz,TD:0.5sec	
Df/dt	49.2Hz/-0.6Hz/Sec TD:0.5sec		
Over Frequency	51.2Hz,TD:1sec	52Hz,TD:1Sec	
Df/dt	50.5Hz/+0.6Hz/sec TD:0.5sec		

ISLANDING MULTIPLICATION RELAY CONFIGURED IN IBTPS SWITCHYARD CONTROL ROOM

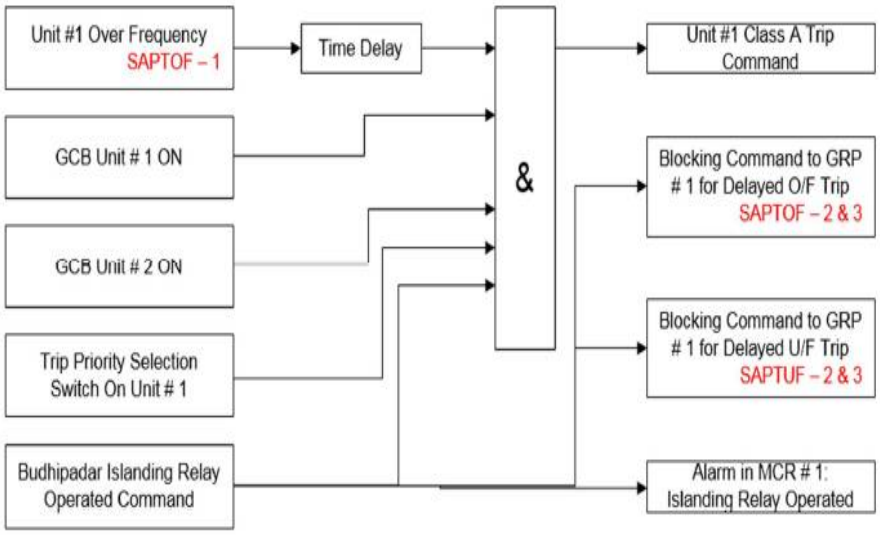
Hold ON Contact of X Relay





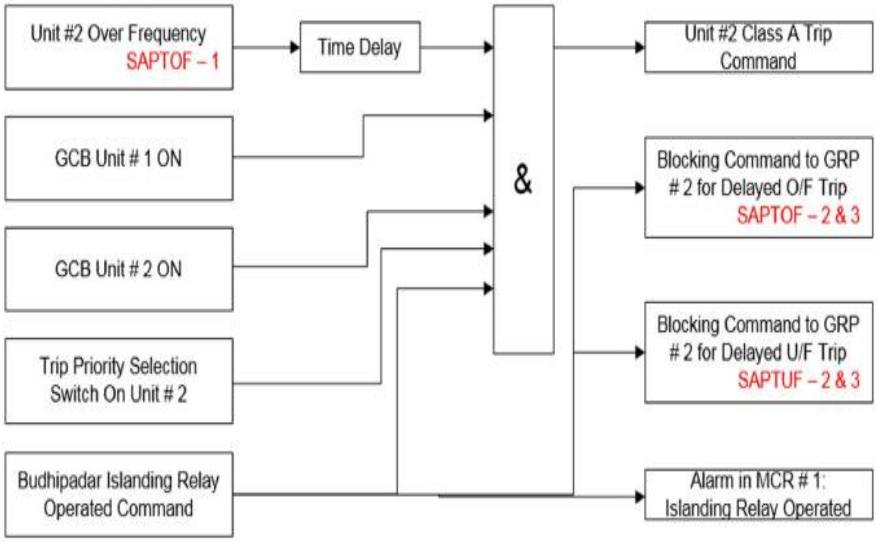
19

Logic configured in REG670 Relay for Islanding of Unit-I Generator



20

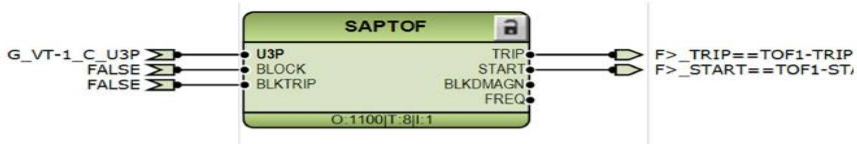
Logic configured in REG670 Relay for Islanding of Unit- 2 Generator



21

- The over – frequency protection is achieved using SAPTOF function block in Generator Protection relay REG670. There are 3 instances of SAPTOF function in REG670 relay, in which the 1st is used to confirm the disturbance in the system frequency (As shown in above figure- red colored), 2nd and 3rd instance is used for delayed operation of the over- frequency function in line with the logic shown above.

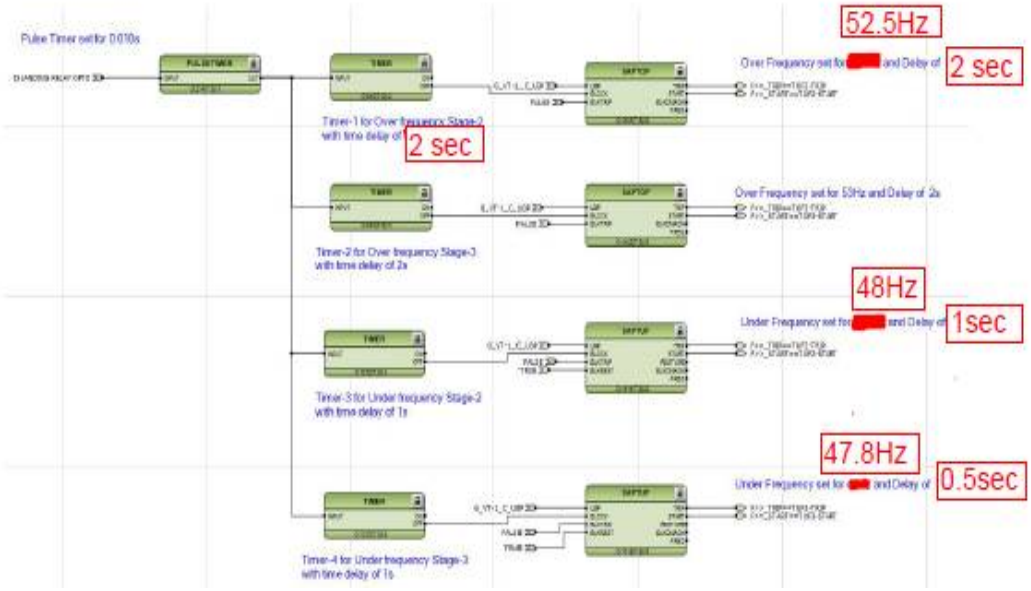
- Function Block and Parameter Settings of Over - Frequency Protection-1st Instance:



SAPTOF: 1				
Setting Group1				
Operation	On			
UBase	15.75	kV	0.05	2000.00
StartFrequency	51.50	Hz	35.00	75.00
IntBlockLevel	50	%UB	0	100
TimeDlyOperate	1.000	s	0.000	60.000
TimeDlyReset	0.050	s	0.000	60.000

22

Configuration of Delayed Over Frequency and Under Frequency Function



- Above timers can be set and adjusted as per requirement. If there is no trip from islanding relay, over and under frequency protections will operate as per the times shown without external timers (timer-1 to 4).
- If there is a trip from Islanding relay, over and under frequency protections are blocked till the time set in corresponding timers as per the above shown configuration. Hence total tripping time delay will be corresponding timer delay + over and under frequency protection function set time delay.

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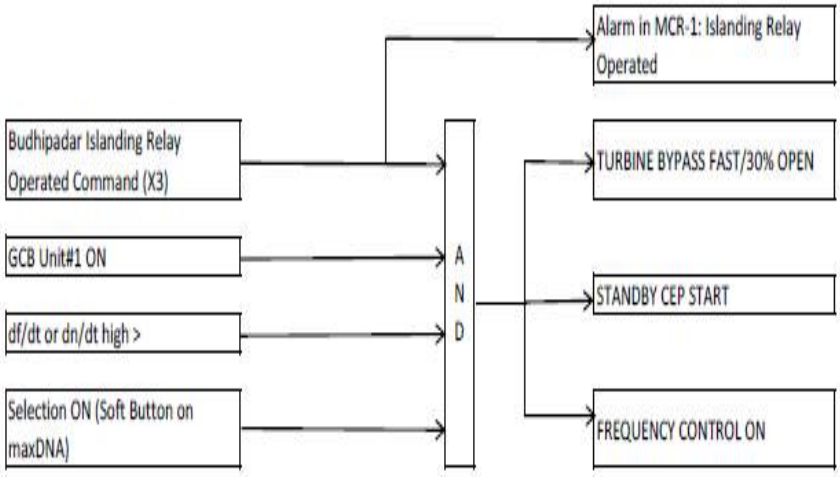
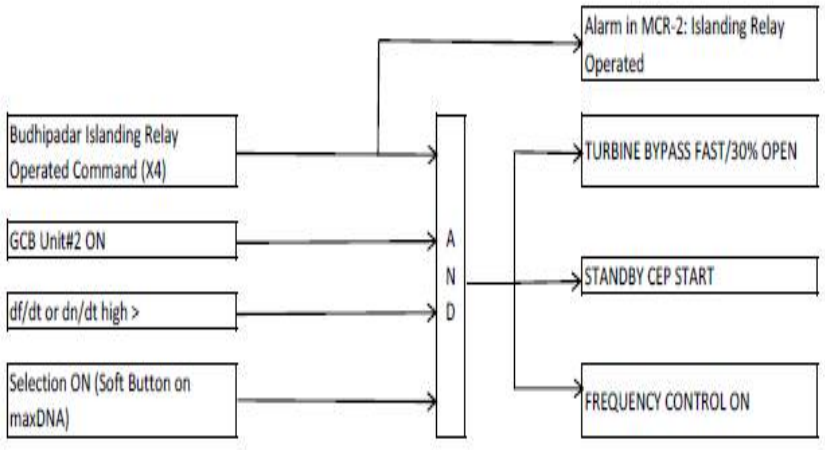
LOAD-GENERATION BALANCE SCHEME CONFIGURATION IN UNIT#1 MAXDNA CONTROL SYSTEM



25

LOAD-GENERATION BALANCE SCHEME CONFIGURATION IN UNIT#2 MAXDNA CONTROL SYSTEM



26

Islanding Operation	After islanding operation, IBTPS Generators shall cater to the demand of connected islanded load and maintain the frequency. In case of further extension of power to other loads if required, it may be done with close coordination of SLDC, IBTPS & Budhipadar S/S so that the islanded system shall not collapse and able to maintain at the desired frequency.
Normalisation / Resynchronisation	After system stabilization, islanded system may be synchronised with main grid at IBTPS end. Ensure that unloaded 220KV IB-Budhipadar lines are disconnected from both (IBTPS & Budhipadar) sides. Charge one of same lines from Budhipadar 220KV Other BUS connected to main system. The same line may be synchronized at IBTPS end after acheiving synchronisation permissive then connecting both systems. After this Budhipadar 220KV Bus Coupler breaker can be closed for normilazation. Alternatively both systems may be synnchronized through 220KV Budhipadar Bus Coupler breaker after acheiving required synnchronisation permissive.

27

NEED INTERCONNECTING REACTOR

Over voltage protection

An over voltage condition could arise when a generator is running but not connected to a power system, or where a generator is providing power to an islanded power system. Such an over voltage could arise in the event of a fault with automatic voltage regulating equipment or if the voltage regulator is set for manual control and an operator error is made. Over voltage protection should be set to prevent possible damage to generator insulation, prolonged over-fluxing of the generating plant, or damage to power system loads.

Under frequency protection

Under frequency operation of a generator will occur when the power system load exceeds the prime mover capability of an islanded generator or group of generators. Power system overloading can arise when a power system becomes split, with load left connected to a set of 'islanded' generators that is in excess of their capacity. Automatic load shedding could compensate for such events. In this case, under frequency operation would be a transient condition. This characteristic makes under frequency protection a simple form of "Loss of Mains" protection on system where it is expected that the islanded load attached to the machine when the grid connection fails exceeds the generator capacity.

Over frequency protection function

Over frequency running of a generator arises when the mechanical power input to the alternator is in excess of the electrical load and mechanical losses. The most common occurrence of over frequency is after substantial loss of load. When a rise in running speed occurs, the governor should quickly respond to reduce the mechanical input power, so that normal running speed is quickly regained.

Rate of Change of Frequency Protection (81R)

The two main applications for df/dt protection are network decoupling (loss of mains/loss of grid) and load shedding. During severe disturbances, the frequency of the system oscillates as various generators try to synchronize on to a common frequency. The frequency decay needs to be monitored over a longer period of time and time delayed df/dt can be used to make the correct decision for load shedding or provide early warning to the operator on a developing frequency problem.

Voltage Vector Shift Protection ($\Delta V\theta$)

The Voltage Vector Shift protection element measures the change in voltage angle over successive power system half-cycles. The element operates by measuring the time between zero crossings on the voltage waveforms. A measurement is taken every half cycle for each phase voltage. Over a power system cycle this produces 6 results, a trip is issued if 5 of the 6 calculations for the last power system cycle are above the set threshold. Checking all three phases makes the element less susceptible to incorrect operation due to harmonic distortion or interference in the measured voltage waveform.

The fast operation of this vector shift function renders it to operate at the instant of a disturbance rather than during a gradual change caused by a gradual change of power flow. Operation can occur at the instant of inception of the fault, at fault clearance or following non-synchronized reclosure, which affords additional protection to the embedded generator.