

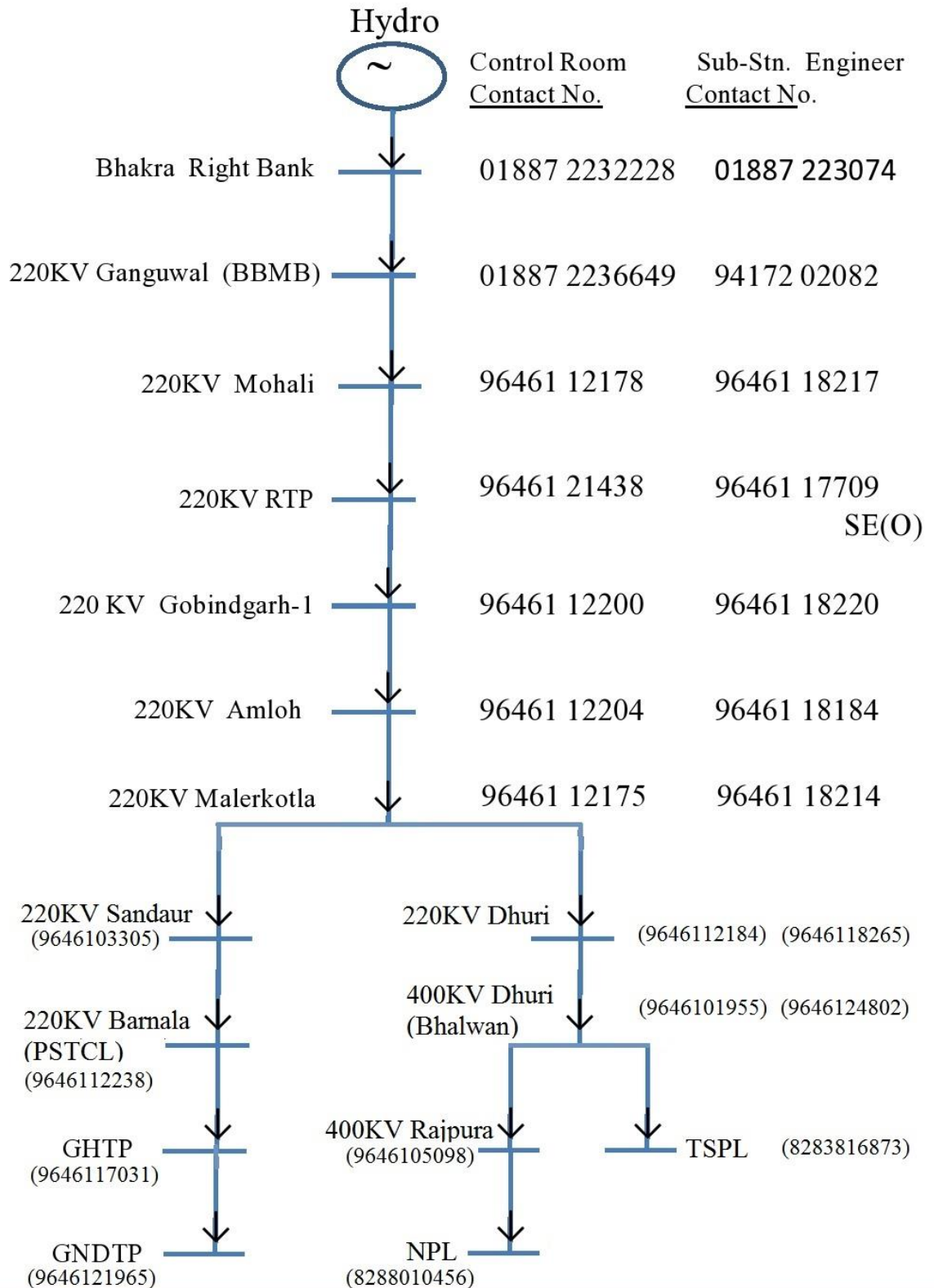


(A State Govt. undertaking)

SYSTEM RESTORATION PROCEDURE FOR PUNJAB

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FLOW CHART – SYSTEM RESTORATION



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STATE LOAD DISPATCH CENTRE

Introduction:

Indian Power system is growing rapidly. It plays an important role in economic growth of the country. Power system network is witnessing phenomenal changes and new power system elements are added to the network at quick intervals. Under these conditions operating and maintaining the grid in a satisfactory manner is a challenge.

Restoration after a blackout is a complex task that requires effective coordination, communication, and decision-making in the face of rarely seen grid configurations and operating conditions. Every disturbance is unique to the conditions of the day and the initiating cause. Exactly how the power system will respond, or the extent of any blackout following a disturbance cannot be predicted.

In order to deal with contingencies like partial or total black out SLDC is regularly updating the document called “System Restoration Procedure for Punjab Control Area” in line with provision in section 5.8 of the Indian Electricity Grid Code (IEGC). However, in view of the fast changing network conditions, it is possible that some of the changes could have not been incorporated as per actual. The up-dated “System Restoration Procedure for Punjab Control Area” is as follows:-

Operational Instructions for Restoration of Grid

PART - 1

General

- PSEB - BBMB System restoration begins from Bhakra Right Bank or Left Bank Power House of BBMB.
- In the initial stage, supply is given from Bhakra to 220KV S/S Ganguwal.

Procedure - 1

- a) From 220KV Ganguwal, energise 220KV Ganguwal - Mohali line.
- b) From Mohali, energise 220KV Mohali - Ropar ckt.

(Alternatively 200KV Ganguwal - Gobindgarh 2 - Gobindgarh 1 – RTP)

Procedure - 2

- a) From 220KV Ganguwal, energise 2x90MVA 220/132KV auto T/F.
- b) From 132KV Ganguwal extend 132KV supply to Kotla to Ropar.
- c) From 132KV Ropar extend 132KV supply to RTP.
- d) RTP to energise 100 MVA 220/132KV T/F from 132KV side and energise 220KV bus.

PART - 2

INSTRUCTIONS FOR 220 KV S/S MOHALI

In the event of Grid failure, following steps be taken:-

- 1 Switch OFF all 220kV Lines & transformers if not already opened except the following :
 - a) 220KV Mohali - Ganguwal ckt.
 - b) 220KV Mohali-RTP Ckt 1
 - c) 100MVA 220/66KV T/F T-1
- 2 Change Tap of T-1 (in de-energised condition due to grid failure) to Tap No.2.
- 3 As soon as 220KV supply is received from Ganguwal following steps are to be taken.
 - a) Inform RTP S/S that 220KV ckt.1 has been energized.
 - b) Put about 50MW load on T-1 T/F keeping in view the system voltage & frequency.
 - c) Energize 220KV Rajpura ckt-1 & instruct 220KV Rajpura S/S to extend 220KV supply to Railways.
 - d) 220KV Rajpura S/S be allowed to energize 1x100MVA 220/66KV T/F & put 10 to 20MW load on it.
 - e) Energize 220KV Lalru/Dera Bassi line.
 - f) Inform 220KV Dera Bassi S/S to give 220KV supply to Railways.
 - g) 220KV Dera Bassi S/S be allowed to energise one 220/66KV T/F & put 10 to 20MW load on it.
 - h) Energize 220KV Sector-80 (Mohali-II) line.

PART - 2(A)

INSTRUCTIONS FOR 220KV RAJPURA S/S

- 1 OPEN 220KV Patiala(PG) Ckt.1 and 220KV Bahadurgarh ckt.
- 2 OPEN 220KV Mohali Ckt. 2.
- 3 OPEN T-1, T-2,100 MVA 220/66KV T/F breakers.
- 4 Keep following breakers ON
 - a) 220KV Mohali Ckt-1
 - b) 220KV Railway's line on confirmation from P.C. Patiala.
- 5 On getting 220KV supply from Mohali S/S, put 10 to 20 MW load on 66KV side.

PART - 2(B)

INSTRUCTIONS FOR DERABASSI

- 1 OPEN 220KV breakers of 220KV T/Fs
- 2 KEEP following breakers ON
 - a) 220KV Lalru line
 - b) Railway's ckt
- 3 On getting 220KV supply from 220KV Lalru S/S, energize 220/66KV T/F & put 10 to 20 MW load.

PART - 3**INSTRUCTIONS FOR 132KV S/S ROPAR**

In the event of grid failure:-

- 1 Open All 132KV breakers except
 - a) 132KV Kotla - Ropar ckts 1,2&3.
 - b) 132KV Ropar – RTP ckt.
 - c) 132KV Ropar – Asron – RTP ckt.
 - d) 132KV Ropar – Nakkian ckt.
 - e) One T/F 132/11 KV (For giving station Aux. Supply).
- 2 Instruct Nakkian to open Nawanshar ckts 1&2.
- 3 Instruct Nakkian S/S to keep following breakers ON
 - a) 132KV Nakkian – Ropar ckt.
 - b) 132KV Nakkian – Ganguwal ckt 1,2.
- 4 Instruct 132KV Asron S/S to keep 132KV Ropar & RTP line breakers ON.
- 5 As soon as 132KV supply is received from Kotla S/S, inform RTP to take supply from 132KV system. Also inform Nakkian & Ganguwal (PSEB) to synchronize their units.

PART-3(A)**INSTRUCTIONS FOR NAKKIAN**

- 1 In case of grid failure:-
 - a) Open 132KV Nawanshahar ckts 1 & 2.
 - b) Keep following breakers ON
 - i) 132KV Ropar ckt.
 - ii) 132KV Ganguwal ckts 1 & 2.
- 2 As soon as 132KV supply is received from Ropar.
 - a) Inform Railways to take traction supply.
 - b) Start & synchronize Nakkian Units.
 - c) Extend 132KV supply to Ganguwal (PSEB) for synchronization of Units.

PART-4**INSTRUCTIONS FOR GGSSTP ROPAR**

In the event of grid failure :

- 1 Open all the 220KV & 132KV breakers except following which are to be kept ON.
 - a) 220KV RTP-Mohali Ckt-1.
 - b) 220/6.6KV Station T/Fs (keep highest voltage tap on 220KV side)
 - c) 132KV line breaker RTP – Ropar ckt.
 - d) 132KV line breaker RTP – Asron ckt.

Sequence of restoration:

Start up supply can come either through 132KV system or through 220KV system.

- a) In case supply is received from 220KV Mohali, the Station T/Fs will get energized & 6.6 KV Aux. supply will be available.
- b) In case supply is received first from 132KV system then
 - i) Open 220KV Mohali-1

- ii) Energise 100 MVA 220/132KV Auto transformer from 132KV side.
 - iii) Energise 220KV bus through 132/220KV Auto T/F.
 - iv) When 220KV supply is received from Mohali ckt-1, the same be paralleled.
 - v) When 220KV supply is received from 220KV Gobindgarh ckt. No.1, the same be paralleled.
 - vi) Extend supply to 220KV S/S Sahnewal through RTP-Ghulal- Sahnewal ckt & instruct Sahnewal S/S to give 220KV supply to Railways S/S.
- c) In case supply is received first from 220KV Gobindgarh Ckt-1 then
- i) OPEN Mohali-1 ckt
 - ii) Close Gobindgarh-1 ckt & extend supply to Sahnewal S/S.
When 220KV supply is received on Mohali-1 S/S, same be paralleled.
 - iii) When supply is received from 132KV system the same be paralleled.
- d) In case supply is received first from 400KV PG S/S Ludhiana through 220KV Sahnewal S/S then:
- i) Open 220KV Mohali-1 and Gobindgarh-1 ckt.
 - ii) Close 220KV Sahnewal ckt.
 - iii) When supply is received from 220KV Mohali-1 ckt, same be paralleled.
 - iv) When supply is received from 132KV system, the same be paralleled.

PART - 5

INSTRUCTIONS FOR 220KV SAHNEWAL

In case of grid failure:

- 1 a) Open Open 220KV Lalton Kalan Ckts 1&2.
b) Open 220KV Kohara ckt.
- 2 a) Keep 220KV Ghulal-RTP ckt ON
b) Keep Railway supply breaker ON
c) Keep PG Ludhinana breaker ON.
- 3 Inform Railways to take supply when 220KV supply is received from RTP.
- 4 Energize 100 MVA 220/66KV T/F & put up to 20MW load.

PART – 6

INSTRUCTIONS FOR GOBINDGARH-2 & GOBINDGARH-1

Gobindgarh-2

In case of grid failure,

- 1 Keep all breakers OFF except the following breakers which are to be kept ON:
 - a) 220KV Ganguwal ckt-1.
 - b) 220KV Gobindgarh-I ckt 1.
- 2 When 220kV supply is received from 220KV Ganguwal S/S, inform and extend supply to 220KV Gobindgarh-1 S/S .

Gobindgarh-1

In case of grid failure,

- 1 Keep all breakers OFF except the following breakers which are to be kept ON:
 - a) 220KV Gobindgarh-2 ckt 1.
 - b) 220KV RTP ckt-1.
 - c) One No. 100 MVA 220/66KV T/F on Tap No. 2.
- 2
 - a) When 220KV supply from 220KV Ganguwal S/S & 220KV Gobindgarh-2 S/S is received, inform RTP to take supply on 220KV Gobindgarh-1 ckt-1.
 - b) Put about 50MW load on 100 MVA T/Fs.
 - c) Close 220KV Amloh line.
 - d) Close 220KV Ekolaha - Malerkotla line.

PART – 6 (A)**INSTRUCTIONS FOR AMLOH**

- 1 In case of grid failure keep following breakers ON:
 - a) 220KV Gobindgarh-1 ckt.
 - b) 220KV Malerkotla ckt.
- 2 All other breakers be kept OFF.

PART- 7**INSTRUCTIONS FOR MALERKOTLA**

In case of grid failure :

- 1 Keep all breakers OFF except the following breakers which are to be kept ON:
 - a) 220KV Amloh ckt.
 - b) 220KV Sandaur ckt.
 - c) 220KV Dhuri ckt No.1.
 - d) 220KV breaker of 100 MVA T-1 (with 66 KV breaker off).
 - e) Bring T-1 to Tap position 2
- 2 When power supply is received from Amloh S/S, put about 20MW load on T-1 & inform Sandaur

PART – 7(A)**INSTRUCTIONS FOR SANDAUR**

In case of grid failure :

- 1 Keep all breakers OFF except the following breakers which are to be kept ON:
 - a) 220KV Malerkotla ckt.
 - b) 220KV Barnala ckt.

PART - 7 (B)**INSTRUCTIONS FOR BARNALA (PSEB)**

On grid failure, following operations be done:

- 1 Open 220KV Inter-connector breaker/isolator with BBMB S/S.
- 2 Open 220KV Lehra Mohabat Ckt.
- 3 Open breaker of 100 MVA 220/66KV T/F T-1
- 4 Keep following breakers ON :
 - a) 220KV Sandaur line
 - b) 1x100MVA T/F T-2, Bring T/F tap to No.2
- 5 As soon as supply is received from 220KV Sandaur S/S, put about 20 MW load on 100 MVA T/F T-2.
- 6 Inform & extend supply to 220KV Lehra Mohabat (GHTP) by closing breaker of 220KV Barnala-Lehra Mohabat (PSEB) line.

PART - 7 (C)**INSTRUCTIONS FOR BARNALA (BBMB)**

- 1 In case of grid failure:
 - a) Keep 220KV Sangrur ckt breaker ON.
 - b) Open inter-connector breaker to 220KV PSEB Barnala S/S.
 - c) Open 220KV Lehra Mohabat ckt.
- 2 On getting supply from 220KV Sangrur
 - a) Energise 220KV Lehra Mohabat ckt.
 - b) Inform PC Patiala & GHTP Lehra Mohabat.
- 3 When PSEB Barnala S/S gets 220KV supply from 220KV Sandaur S/S, close the inter-connector breaker, paralleling the supply of 220KV Sangrur S/S with 220KV Sandaur S/S.

PART-8**LEHRAMOHAHAT**

- 1 Keep following 220KV Breakers ON:
 - a) 220KV Barnala (PSEB) ckt.
 - b) 220KV GNDTP ckt-1
 - c) 220/6.6KV Station T/Fs (Keep on highest voltage tap on 220KV side)
 - d) 100 MVA 220/66KV T/F (keep the T/F on Tap No.2).
- 2 Keep all the other 220KV breakers OFF.
- 3 When supply is received from PSEB Barnala S/S, inform GNDTP that Lehra Mohabat ckt-1 is energized.
- 4 Put about 20 MW load on 220/66 KV T/F.
- 5 In case the BBMB Barnala to Lehra Mohabat ckt is energised first then:
 - a) Open 220KV Lehra Mohabat - Barnala(PSEB) line breaker.
 - b) Close 220KV Lehra Mohabat - Barnala(BBMB) line breaker.

PART - 9**GNDTP, BHATINDA**

In case of grid failure :

- 1 Keep all 220KV & 132KV breakers off, except the following which may be kept ON:
 - a) 220KV Lehra Mohabat ckt-1.
 - b) 220/6.6KV S/Station T/F (to be kept on higher voltage tap).
- 2 On getting supply from 220KV Lehra Mohabat ckt-1, energize 100 MVA Auto T/F & energize 132KV GNDTP bus.
- 3 Put 20 to 30MW load on the 132KV GNDTP bus.

PART - 10**INSTRUCTIONS FOR 220 KV DHURI**

In case of grid failure,

- 1 Keep following breakers ON :
 - a) 220 KV Malerkotla ckt.
 - b) 220 KV Bhalwan (400KV Dhuri) ckt-1.
- 2 All other breakers be kept OFF.

PART – 10(A)**INSTRUCTIONS FOR 400KV DHURI**

In case of grid failure :

- 1 Keep all breakers OFF except the following which are to be kept ON :
 - a) 220KV Dhuri Ckt-1.
 - b) 500 MVA, 400/220 KV ICT No. 1,
Bring ICT tap to higher position to reduce 400KV voltage.
 - c) 400KV Rajpura Ckt No. 1
 - d) 400KV Talwandi Ckt No.1
- 2 As soon as supply is received from 220KV S/S Dhuri, inform 400KV Rajpura S/S & also extend supply to TSPL.

PART– 10(B)**INSTRUCTIONS FOR 400 KV Rajpura**

In case of grid failure :

- 1 Keep all breakers OFF except the following which are to be kept ON :
 - a) 400KV Dhuri Ckt-1
 - b) 500 MVA, 400/220 KV ICT No. 1, (Bring T/F tap to higher position)
 - c) 400KV NPL Ckt No. 1
- 2 As soon as supply is received from 400KV S/S Dhuri, inform NPL.

PART – 11**INSTRUCTIONS FOR NPL**

In case of grid failure :

- 1 Keep all breakers OFF except the following which are to be kept ON :
 - a) 400KV Rajpura Ckt-1
 - b) 400KV Nakodar Ckt.-1
 - c) 400/11KV Station T/Fs (Keep on highest voltage tap on 400KV side)
- 2 In case supply is received from 400KV Rajpura S/S, inform 400KV Nakodar S/S that 400KV NPL-Nakodar Ckt-1 is energized.
- 3 In case the 400KV Rajpura-Nakodar ckt is energized first then inform 400KV Rajpura S/S that 400KV Rajpura-NPL Ckt-1 is energized.

PART – 12**INSTRUCTIONS FOR TALWANDI SABO (TSPL)**

In case of grid failure:

- 1 Keep all breakers OFF except the following which are to be kept ON :
 - a) 400 KV Talwandi Ckt-1
 - b) 400 KV Muktsar Ckt.-1
 - c) 400 KV Moga Ckt.
 - d) 400/11KV Station T/Fs (Keep on highest voltage tap on 400KV side)
- 2 In case supply is received from 400KV Dhuri substation, open 400KV Moga ckt & inform 400KV Muktsar S/S that 400KV Talwandi-Muktsar Ckt 1 is energized .
- 3 In case the 400KV Muktsar-Talwandi ckt is energized first then open 400KV Moga ckt & inform 400KV Dhuri S/S that 400KV Talwandi-Dhuri Ckt 1 is energized .
- 4 In case the 400KV Moga-Talwandi ckt is energized first then open 400KV Muktsar ckt & inform 400KV Dhuri S/S that 400KV Talwandi-Dhuri Ckt 1 is energized

PART – 13**INSTRUCTIONS FOR NAKODAR**

In case of grid failure,

- 1 Keep all breakers OFF except the following which are to be kept ON :
 - a) 400 KV NPL Ckt-1
 - b) 400 KV Makku Ckt.-1
 - c) 400 KV Moga Ckt
 - d) **315 MVA, 400/220 KV** ICT No.-1 (Bring T/F tap to higher position)
- 2 In case supply is received from 400 KV NPL, open 400KV Moga ckt & inform 400KV Makku S/S that 400KV Nakodar-Makku Ckt-1 is energized.
- 3 In case the 400KV Nakodar-Makku ckt is energized first, open 400KV Moga ckt & inform NPL that 400KV NPL-Nakodar Ckt-1 is energized.
- 4 In case supply is received from 400 KV Moga, extend supply to NPL & inform 400KV Makku S/S that 400KV Nakodar-Makku Ckt-1 is energized.
- 5 On receipt of supply, put about 20 MW load as per instructions of PC on 400KV Bus.

PART- 13(A)**INSTRUCTIONS FOR MUKTSAR**

In case of grid failure,

- 1 Keep all breakers OFF except the following which are to be kept ON :
 - a) 400KV Talwandi Ckt-1
 - b) 400KV Makku Ckt.-1
 - c) 315 MVA, 400/220 KV ICT No.-1 (Bring T/F tap to higher position)
- 2 In case supply is received from 400KV TSPL, inform 400KV Makku S/S that 400KV Muktsar-Makku Ckt-1 is energized.
- 3 In case the 400KV Muktsar-Makku ckt is energized first, inform TSPL that 400KV Muktsar-Talwandi Ckt-1 is energized.
- 4 On receipt of supply, put about 20 MW load on 400KV bus as per instructions of PC .

PART - 13(B)**INSTRUCTIONS FOR MAKKU**

In case of grid failure,

- 1 Keep all breakers OFF except the following which are to be kept ON :
 - a) 400 KV Muktsar Ckt-1
 - b) 400 KV Nakodar Ckt.-1
 - c) 400 KV Balachak Ckt.-1
 - d) 315MVA, 400/220 KV ICT No.-1 (Bring tap to higher position)
- 2 On receipt of supply put about 20 MW load on 400KV bus as per instructions of PC.

PART - 14**GENERAL INSTRUCTIONS**

- 1) During grid restoration, initially the supply is extended through one ckt of double ckt line (so as to reduce line charging current and prevent over voltage. However as the grid stabilizes & voltage is reduced, the second ckt of the lines be restored as per instructions of PC.
- 2) During grid restoration capacitor banks be kept OFF.
- 3) Before switching on power T/Fs ensure that the tap position is raised to No. 2 (to prevent over-fluxing).
- 4) Obtain instructions from Power Controller Patiala at each step.
- 5) Ensure that air pressure in compressed air system is preserved so as to maintain the operational availability of breakers.

RESTORATION OF SARNA-RSD SYSTEM & UBDC/ SHANAN/ MHP

- 1 BBMB will give supply from Bhakra(R) to Jamalpur S/S to Jalandhar S/S.
- 2 BBMB will energise 220KV Jalandhar - Dasuya ckts.
- 3 From 220KV Dasuya S/S, energise ckts to 220KV Pong S/S and 220KV Sarna S/S.
- 4 220KV Sarna S/S will extend supply to RSD for starting the unit.

PART-A**INSTRUCTIONS FOR 220KV S/S DASUYA**

In case of grid failure,

- 1 Keep all breakers OFF except the following which are to be kept ON :
 - a) 220KV Jalandhar ckts 1,2
 - b) 220KV Pong ckts 1,2
 - c) 220KV Sarna ckts 1,2
- 2 220KV Dasuya S/S will get supply either from BBMB Jalandhar or Pong side (depending on BBMB). As soon as 220KV supply is received, inform 220KV Sarna S/S.

PART-B**INSTRUCTIONS FOR 220KV SARNA**

In case of grid failure:

- 1 Keep all breakers OFF except following which are to be kept ON :
 - a) 220KV Dasuya-1 & 2 ckts.
 - b) 220KV RSD 1 & 2 ckts.
- 2 Keep 100 MVA 220/132KV T/F on Tap 2.
As soon as power supply is received from Dasuya S/S, inform RSD.
- 3 Energize 100 MVA 220/132KV T/F & give 132KV supply to Sarna S/S for UBDC & extending to 132KV Shanan S/S & giving 66 KV supply to RSD.

PART-C**INSTRUCTIONS FOR RSD**

On grid failure:

- 1 Keep all 220KV breakers off.
- 2 Start DG set & run up Units 1, 2 & 3 on NO load.
- 3 As soon as 220KV supply is received from Sarna S/S, energize 220KV RSD bus.
- 4 Synchronize Unit 1. In case bus voltage is 220KV or above, put Unit 1 on synchronous inductor mode & draw up to 80 MVAR from system, thereby reducing the 220KV bus voltage to less than 200KV.
- 5 Synchronize Unit 2. In case bus voltage is still above 220KV, put Unit 2 on synchronous inductor mode & bring down voltage to less than 200KV.
- 6 Synchronize Unit 3 & put it on generation mode. Load the unit to 100 MW. In case frequency is less than 50Hz, load it up to 150 MW.
- 7 In case frequency is still below 50Hz then start & synchronize Unit 4 & put it on generation mode to bring frequency to 50Hz.

PART-D**Instructions for 220KV SARNA S/S (after RSD units have come on bars)**

- 1 Energise 220KV Sarna - Wadala Granthian ckt No.1 & inform Wadala Granthian S/S.
- 2 Instructions will be issued by NRLDC through PC Patiala to extend the supply to J&K and Kishanpur S/S.

PART-E**INSTRUCTIONS FOR WADALAGRANTHIAN**

On Grid failure :

- 1 Keep all breakers off except 220KV SARNA-1 ckt.
- 2 On receipt of 220KV supply from Sarna S/S, energize 2x100MVA 220/132KV Auto T/Fs.
- 3 Extend 132KV supply to Sri Hargobindpur S/S for MHP units.
- 4 Extend 132KV supply to 132KV Sarna S/S for UBDC units.
- 5 Energize 220KV Verpal ckt-1 & inform Verpal S/S to take 220KV supply.

PART-F**INSTRUCTIONS FOR 132KV SARNA**

- 1 On getting 132KV supply, energise 40/50 MVA 132/66KV T/F & give 66KV supply to Thein Dam on 66KV RSD-1 ckt.
- 2 As soon as 132KV supply is received from 220KV Sarna S/S (through 220/132KV T/F) or from 132KV Wadala Granthian S/S, extend 132KV supply to UBDC PHs 2,1.
- 3 Extend 132KV supply to Shanana S/S through 132KV Pathankot, Kangra ckts.

PART-G**INSTRUCTIONS FOR 132KV SRI HARGOBINDPUR**

On grid failure,

- 1 Open all 132KV breakers, except following breakers which are to be kept ON :
 - a) 132KV Wadala Granthian ckts 1,2
 - b) 132KV MHP ckts 1, 2.

PART-H**INSTRUCTIONS FOR MHP**

On grid failure

- 1 Open 132KV MPH-2, Bhogpur & Tanda ckts.
- 2 Keep 132KV Sri Hargobindpur line breakers ON.
- 3 Keep all 132KV tie lines between MPH 4-3-2-1 ON.
- 4 As soon as supply is received from 132KV Sri Hargobindpur S/S, Energize 132/66 KV T/Fs at MPH-4 for giving Auxiliary start up power to MPH 4 & 3.
- 5 66KV Pong – Talwara ckt be energised from BBMB Pong S/S for giving start up Power to MPH 1 & 2 in advance.