

SECTION – III

	प्लाज़्मा अनुसंधान संस्थान	
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SCOPE OF WORK, TECHNICAL SPECIFICATION, OTHER DETAILS

1) SCOPE OF WORK:

The scope of work indicates the scope of work of each equipment/ system as detailed in this section. The details of the major equipment and their main specification is attached in annexure-I. This scope will begin from the effective date of the contract.

2) DEPLOYMENT OF PERSONS :

a) OPERATION STAFF:

The contractor shall deploy the following persons as detailed in Section III.

Station In Charge: An Engineer with Degree in Electrical Engineering and having at least 8 to 10 years' of experience in operation and maintenance of similar kind of sub stations. He shall be over all In- charge for Sub Station. He shall be posted in **General / Day shift (9AM -5:30PM, 6 days per week)** and responsible for functioning of substation, arranging shut downs, programming for maintenance, co-ordination between Owner and other agencies involved etc. Working knowledge in Hindi English language is essential. Computer literate with knowledge of MS Word, Excel & MS Project

Shifts In Charge: An Engineer with Degree/Diploma of Electrical Engineering and having adequate experience of shift duties of similar kind of substation. He shall be posted in shift of 8 hours. There will be three Engineers per day and one as a Reliever. He shall be responsible for operation of substation. He shall be shift In-charge responsible for reporting to the Station In-charge. Working knowledge in Hindi English language is essential. He should be computer literate with knowledge of MS Word, Excel & MS Project.

Operators: The Operator is having Diploma of Electrical Engineering or ITI and adequate experience of shift duties of similar kind of substation. One operator shall be posted in each shift of 8 hours. There will be nine operators per day and three relievers. He shall be responsible for maintaining log books, operations during his shift. Working knowledge in Hindi English language is essential. The operator staff shall have general literacy of computer with knowledge of MS Word, MS Excel, etc.

3) MAINTENANCE CREW :

The maintenance crew would consist of:

Maintenance Engineer: Engineer having Degree or Diploma of Electrical Engineering and having at least 5 to 10 years' of experience in Maintenance of similar kind of substation. He shall be posted in **General / Day shift (9AM -5:30PM, 6 days per week)** in normal case for

routine/preventive maintenance and is responsible for routine and breakdown maintenance of the substation.

Additional Staff: The additional staff comprising of skilled, unskilled workers headed by Engineer shall be posted for routine, yearly, half yearly maintenance during break downs and shut downs as per requirement and quantum of work. Apart from above the Testing engineers along with skilled staff shall visit substation for annual relay testing and in event of emergency whenever their services required for smooth functioning of substation.

Operation staff shall be exclusive and not utilized for regular, periodic and breakdown maintenance works.

4) TOOLS & TACKLES:

All tools and tackles required for the safe and satisfactory operation and maintenance including preventive and break down maintenance of the substation and related equipment covered under this tender shall be provided by the contractor.

The tools and tackles, apart from other things, must comprise of

- a) Set of Discharge rods (Minimum six nos.)
- b) Complete set of all sizes of Double-ended, Ring, Tubular & box spanners – 2 sets.
- c) Complete set of all sizes of screw drivers -2 sets
- d) Complete Tool Box -2 nos.
- e) 1 No. Blower & Vacuum Cleaner.
- f) One derrick capable of handling highest equipment of the sub station
- g) Guy ropes suitable for hoisting above derrick.
- h) Minimum two sets of Electrical safety heavy duty hand gloves of highest voltage rating available in the market.
- i) 6 nos Safety Helmets, 6 nos. safety belts & Safety shoes.
- j) 2 nos of heavy duty dry cell or rechargeable (without acid) torches.
- k) Rain coats/umbrellas and gum boots as required.
- l) First aid box
- m) 1 No. Insulation tester 5 kV capacity, Motorized /digital Type
- n) 1 No. Insulation tester 1 kV capacity Motorized /digital Type
- o) 1 No. Earth tester Motorized /digital Type
- p) 2 nos. Multi meter - Analog & Digital
- q) Clamp meter for measuring AC/DC current
- r) Temperature sensor adaptor for multi meter
- s) Cable crimping tools of adequate capacity etc.
- t) Metal-clad extension Power supply boards with MCB & surge protection
- u) Phase Sequence meter
- v) Other general purpose test instruments
- w) PC with printer
- x) Analog Thermometer
- y) Series tester
- z) Drill machine (01 no. normal & 01 no. RCC impact)

All the above Equipment shall be produced to the Engineer In-charge for verification every six month basis.

5) CONSUMABLES:

- a) Petroleum jelly as required
- b) Carbon Tetra Chloride (CTC) solution as required
- c) Contact Cleaner Spray (STANVAC chemical or equivalent) as required
- d) M-Seal epoxy compound, sealing compound, emery paper, paint, red oxide, etc. as required.
- e) Insulation tapes, HT tapes & HT sleeves, etc. as required.
- f) Silica gel, gasket (cork sheet type), cotton tape, Teflon tape, etc. as required.
- g) Cotton waste, muslin cloth, waste cloth, cleaning agents, etc. as required.

Other major consumables like transformer oil, SF6 gas with filling kit, indicating lamps, control and power cables/wires, etc. shall be provided by the Institute.

6) SPARES:

- a) All spares recommended by manufacturers of equipment installed in the substation. (To be provided by IPR but a comprehensive list should be prepared by the contractor at the time of starting the contract.)
- b) Nuts, bolts, washers of sizes used in substation and other systems.
- c) Fuse holders and HRC fuses, terminal links, control wires and lugs of rating used in the substation and other systems.
- d) The contractor shall keep ready stock of all items/consumables for day to day maintenance/repairing works.

7) OPERATIONS:

a) Hourly:

- i) Taking readings of all meters installed at control panel. ACDB, DCDB, Battery Charger etc.
- ii) Air and Gas pressures of Gas circuit breakers.
- iii) Oil & Winding temperatures of Transformers.
- iv) Taking the reading of surge arrestor counters of Lightning Arrestors,
- v) Checking any sparking or flash over / hot spots in the substation.

b) Daily :

- i. Visual Checking contacts of Isolators are in proper position or not.
- ii. Checking oil levels of all bushings, Main & OLTC Conservator, CTs and PTs, etc.
- iii. Checking oil leakages if any for Transformers, CTs & PTs & taking appropriate action for its timely repair
- iv. Checking air / gas/ oil leakages if any for Circuit Breakers.
- v. Checking condition of Silica gel.
- vi. Checking DC voltage.
- vii. Cleaning of premises, Control relay panels etc.
- viii. Maintaining log books and daily check list.
- ix. Checking Deposition of dust and dirt on Insulators.
- x. Checking Locks and doors of substation are in good condition.
- xi. Checking no leaks have developed in the roof. Ventilating systems.
- xii. Checking the heating systems are working normally.
- xiii. Checking the prescribed safety aids are in place and in good order.
- xiv. Checking the packing of cables entering and leaving the trenches or tunnels with in the premises is intact.
- xv. Checking the access roads to the oil filled devices is not obstructed.
- xvi. Draining the air / moisture from air conservators of the circuit breakers.
- xvii. Trouble shooting and repair of Electrical circuits components n case of any abnormal conditions.

c) Weekly:

- i) Checking Yard and control room lighting.

d) Monthly:

- i) Checking Auto/ Manual operations of OLTC.
- ii) Checking earthing points and their contact, tighten wherever required.
- iii) Preparation of monthly checklist and events log for the month.

e) Events:

- i) Logging auto / manual operations of OLTC.
- ii) Logging the breakdown events with relay indications etc.
- iii) Logging shut down events, log of operations during shut down period.
- iv) Logging of on /off of feeders in the 22 kV & 11 kV and 415V distribution system.
- v) Maintaining visitors registers along with their comments and details of their visits.

8) MAINTENANCE:

- a) Maintenance scope include both preventive and breakdown maintenance. Preventive maintenance shall be routinely carried as per details provided herein below.
- b) **Breakdown maintenance** shall be provided as and when situation warrants with a failure/fault in the system. The breakdown maintenance shall be attended at the highest priority so as to make the faulted system healthy and putting it into operation. For breakdown maintenance the contractor shall coordinate/liaison with Engineer In-charge and the original equipment manufacturer for replacement parts and services as necessary. Infrastructure, tools and tackles and site support shall be provided by the contractor for such jobs with priority and without unnecessary delays. OEM parts and services, if any, required for the completion of breakdown services shall be approved and cleared for execution by the appropriate authority (IPR Engineer In-charge). **The service charges if any incurred during the completion of breakdown services through OEM shall be borne by the IPR only.**
- c) During the preventive (routine) maintenance the contractor shall carry out the following as listed for various system components:
- d) Though the list contains several individual jobs they could be executed in a combined scope as in servicing or overhauling of the component.
- e) The maintenance jobs which are specifically underlined in the following list shall be carried out by OEM supplier or their authorized service provider only. The contractor shall be required to provide proof for the same before executing the job. These jobs must be carried out during the month mentioned alongside the job. Detailed service reports should be submitted after the completion of the job.
- f) All the maintenance activities shall be carried out by following all the safety measures using required PPE equipment. The contractor will be solely responsible for any mishap due to unsafe act / practice.

LIST OF MAINTENANCE ACTIVITIES IN THE SCOPE INCLUDE THE FOLLOWING:

- 1) **Power Transformers: (for Distribution Transformers the following will be adopted as applicable)**
 - a) **Hourly:**
 - i) Check oil & winding temperatures, check for abnormalities & recording them.
 - ii) Observe and record Load (amperes) and Voltage. Check against rated figure.
 - iii) Visual check for overheating if any at terminal connections (Red hots) and observation for any unusual internal noises. This check must be done in each shift.
 - b) **Daily:**
 - i) Observation of oil levels in (a) main conservator tank (b) OLTC conservator (c) bushings and examining for oil leaks if any from the transformer.
 - ii) Checking the Color of silica gel in the breather and also oil level of the oil seal. If silica gel colour changes from blue to pink by 50% the silica gel is to be reconditioned or replaced.
 - iii) Visual check of explosion vent diaphragm for any cracks.
 - c) **Monthly:**
 - i) Physical examination of diaphragm of vent pipe for any cracks.
 - ii) Cleaning of bushings, inspect for any cracks or chippings of the porcelain and checking of

- tightness of clamps and jumpers.
- iii) Measurement of IR values of transformer with suitable megger according to the rating of the transformer. Recording of the values specifying the temperature which measurements are taken.
- iv) Cleaning of Silica gel breather.
- v) Checking of temperature alarms by shorting contacts by operating the knob.

d) Quarterly:

- i) Testing of Buchholz surge relays & low oil level trips for correct operation.
- ii) Checking of all connections on the transformer for tightness such as bushings, tank earth connection.
- iii) Lubricating / Greasing all moving parts of OLTC mechanism.

e) Half Yearly:

- i) Bushing testing for tan delta.
- ii) Testing of main tank oil for BDV and moisture content.
- iii) Testing OLTC oil for BDV & moisture content.

f) Yearly:

- i) Testing of oil for dissolved gas analysis, acidity, tan delta, interface tension specific resistivity.
- ii) Calibration & testing of oil & winding temperature indicators.
- iii) Measurement of magnetizing current at normal tap and extreme taps.
- iv) Measurement of DC winding resistance.
- v) Turns ratio test at all taps.
- vi) Overhaul of tap changer and mechanism. (Feb)
- vii) Calibration of tap position indicator & DCRM of OLTC.
- viii) Filtration of oil or replacement of oil in main tank as well as OLTC if required.
- ix) Changing the gaskets at all locations as when leakage is found or the gasket is damaged or else yearly.
- x) Replacing of Buchholz relay, OTI, WTI, breather etc. if found malfunctioning (material to be provided by IPR)
- xi) Replacement of bushing when required.
- xii) Sweep Frequency response Analysis test. (As and when required)

2) 145 kV SF6 Circuit Breakers

a) Hourly:

- i) Check SF₆ Gas pressure.

b) Daily:

- i) Check the operation of spring charging motors. Check timing and sound.
- ii) Check gas density in each shift.

c) Monthly:

- i) Air cleaning with blower.
- ii) Cleaning of circuit breaker body and bushings.
- iii) Auxiliary contacts cleaning.
- iv) Tightening of nuts and bolts.
- v) Checking breaker Operation (Local/Remote operation).
- vi) Check anti-condensation protection.
- vii) Check of motor control
- viii) Use of anti-corrosion spray where required

d) Quarterly:

- i) Check for SF6 leaks.(Gas leakage test)
- ii) Oiling and greasing of all moving parts.
- iii) Functional check of trip circuit.
- iv) Checking the settings of air and gas pressure switches.

e) Half yearly:

- i) Checking ON/OFF Timings of Circuit breaker poles.
- ii) Complete servicing, oiling and greasing of all moving parts. Replacement of any defective part.(Dec, Jun)
- iii) Operation and control of Auxiliary circuits. (Dec,Jun)
- iv) Recharge time of operating mechanism after specified sequence.
- v) Checks on specific operations.
- vi) Control Circuit Insulation Checking.
- vii) Measurement of Humidity

f) Yearly:

- i) Touch up painting wherever required. Porcelain insulator.
- ii) Checking contact resistance of Breaker main contact.
- iii) Checking of circuit breaker level with spirit level.
- iv) Mechanism checking and lubrication to all moving parts.(Mar)
- v) IR values of Power and Control Circuits.
- vi) Operating circuits power consumption during operations.
- vii) Verification of correct rated operating sequence. (Mar)
- viii) Checking and adjustment of Track alignment and Interlocking mechanism. (Mar)

Repairs:

Filling the breaker with SF6 – The CB may be filled only by or under the supervision of qualified personnel and in accordance with the SF6 filling curve. SF6 filling kit and SF6 gas cylinder to be provided by IPR.

3) Lightning Arrestors:

a) Hourly:

- i) Checking the readings of surge arrestor counters.

b) Monthly:

- i) Cleaning of porcelains Insulators.

b) Quarterly:

- i) Removing of bird nests, if any.
- ii) Monitor the total leakage current (capacitive and resistive current) and resistive current.
- iii) Records of the number of operations of the Arrestor should be maintained and if more number of operations is seen then the same should be informed to the concerned authority.

c) Yearly:

- i) Testing of counters

Repairs:

Replacement of Lightning Arrestor pole.(LA to be provided by IPR)

4) Isolators**a) Daily:**

- i) Visual Inspection

b) Monthly:

- i) Clean the porcelain insulators and inspect for cracks and chip off.
- ii) Check for tightness of nuts and bolts. Drive tube locknuts. Drive lever and phase coupling pin, bolts etc.

c) Quarterly:

- a. Open the disconnect and earthing switch and inspect the contacts. (Wipe the contact surface with solvent).
- b. Check for contact surface soundness.
- c. After maintenance and inspection, smear contact surface lightly with contact lubricant.
- d. Check for split pins in clevis, if damaged, to replace the same.
- e. Lubricate all clevis pins.
- f. Check contact gap 34-36 mm. if found inadequate replace contact spring.

d) Half Yearly:

- i) _____ **Maintenance of Drive Mechanism: (Sept & Mar)**
- ii) Apply grease on the teeth of the spur gear and GEAR box/ Lead screw and guide nut and in case of lead screw type.
- iii) Oil auxiliary switch linkage and pivot on the guard aperture for manual operation.
- iv) Cleaning of auxiliary switch contact & greasing with silicon grease.
- v) Check that all the electrical components are firmly fixed and let the contactors operate freely.
- vi) Check all electrical connections for tightness.
- vii) Check all mounting bolts for tightness.
- viii) Apply grease to mechanical interlock-cam groove, if the disconnect is with earth switch.
- ix) Check interlocks.
- x) Adjustment of limit switch if it is required.
- xi) Main Contacts
- xii) Cleaning and lubrication of main controls
- xiii) Check Alignment.
- xiv) Main contact resistance measurement
- xv) Tightness of nuts bolts and pins etc.
- xvi) Cleaning of support insulators and checking of insulator cracks, if any.
- xvii) Earth Switch
- xviii) Checking and Alignment of earthing blades
- xix) Cleaning of contacts
- xx) Checking of Contact resistance.
- xxi) Operation of earthing switch.
- xxii) Checking of aluminum Copper flexible conductor.
- xxiii) Checking of earth connections of structures and marshalling box.
- xxiv) Marshalling Box
- xxv) Visual check of auxiliary contacts.

- xxvi) Cleaning and terminal tightness.
- xxvii) Checking of space heaters and illumination.
- xxviii) Checking of healthiness of gaskets else replace the gaskets.

Lubricants recommended:

For Contact Surface - Clean contact surface with plain cloth and apply contact Grease. For External drive linkage - Shell Alvania grease

5) Current Transformers

a) Daily:

- i) Visual Check
- ii) Check for Oil leakage

b) Monthly:

- i) Clean the porcelain insulators and inspect for cracks and chip off.
- ii) Secondary connection of the CT should be intact.

c) Half yearly:

- i) Check the I.R. value of each Current Transformer and keep record.
- ii) Check the Pressure Diaphragm. If pressure diaphragm is defective, replace it with new one as per the procedure explained in the instruction manual.
- iii) If the insulation resistance of the current transformer is low it can be improved by oil filtration under vacuum.
- iv) Attending to oil leakage in the CT. If it due to failure of gaskets, the gaskets need to be replaced. (Gaskets should be provided by the contractor)
- v) Tan-delta and Capacitance measurement

6) Voltage Transformers

a) Daily:

- i) Check Oil level and check for any leakage
- ii) Chattering sounds

b) Monthly:

- i) Cleaning of Bushing
- ii) Checking for Oil level & topping up of oil if, required.

c) Half yearly:

- i) Check the I.R. value of each Voltage Transformer and keep record.
- ii) Check the Pressure Diaphragm. If pressure diaphragm is defective, replace it with new one as per the procedure explained in the instruction manual.
- iii) If the insulation resistance of the Voltage transformer is low it can be improved by oil filtration under vacuum.
- iv) Attending to oil leakage in the VT. If it due to failure of gaskets, the gaskets need to be replaced. (Gaskets should be provided by the contractor)

7) Switch Yard (all equipment including structural that are not covered elsewhere)

- i) Checking the yard at periodic intervals and attend to any unusual observations, defects, sparks, loose contacts, red hot spots and loose bolts and nuts etc., and informing the concerned authority. The records of operational persons shall also be consulted for this purpose.

- ii) Checking the earth resistance of all earthing pits **half-yearly**.
- iii) Checking the Protection and control circuit of each equipment monthly.
- iv) Checking of operation and interlock of all equipment monthly.
- v) The premises should be kept neat and clean.

8) HT/LT/Control & Relay Panels:

a) Daily:

- i) Check for any tripping chattering in the electrical parts, abnormal noise, overheating in the panels.
- ii) Check whether indication lamps, enunciator lights, bell, buzzers and hooter are working.
- iii) Check all terminal cubicles for healthy contacts, minor repairs/services/cleaning etc.
- iv) Observe the annunciation window, and there is any alarm then consults the concerned authority.
- v) Check whether the panel is ingress protected.
- vi) Cleaning of relay cases of dirt etc.
- vii) Cleaning the panels, relay covers, blowing dust from inner side of panels.
- viii) Polarity of DC supply.
- ix) Physical checks of all wiring & connections.

b) Monthly:

- i) Check for the proper working of all ammeters, voltmeters, relays, contactors malfunction etc. and if found faulty/not working replace it with new corresponding spare meters (All spares are to be provided by IPR).
- ii) Clean the panels from inside with the help of the blower/ vacuum cleaners.
- iii) Check all the cables for overheating, tightness of the glands, lugs & crimping.
- iv) Check the fuse-link & fuse holders.
- v) Check the control wiring of the panel along with the controls for the proper functioning and tripping at the preset parameters.
- vi) Tightening of all earthing connections.

c) Yearly:

- i) Check the operation of MCB, relays, TNC.
- ii) Testing and calibration of relays.(Apr)

Repairs:

The following items can be replaced and made functional if they are found not repairable, then need to be replaced MCB, Contactors, Cable termination with glands, relays, TNC, selector switch, indicating lamps, voltmeter, ammeter, fuse holders etc. (All spares to be provided by IPR).

9) 22 kV & 11 kV Switch Boards:

a) Daily:

- i) Visual inspection
- ii) Check whether indication lamps, selector switch, TNC, ammeter, Enercon meters(MFM) are working.
- iii) Check whether all relays, are functioning properly.

b) Quarterly:

- i) Visual inspection of panels.
- ii) Checking of control scheme for healthiness.

- iii) Visual Checking of Panel Meters.
- iv) Checking of heater circuit & rectification if required.
- v) Checking handles and doors & rectification if required.
- vi) Checking and ensuring the closing of all the panels/panel doors etc
- vii) Checking and sealing of cable entry holes.
- viii) Tightening of all earthing connections.

c) Yearly:

- i) Measurement and recording of IR values for Main Bus bar.
- ii) Checking of all terminations for tightness.
- iii) Checking of CT, PT and Relays connections for tightness.
- iv) Testing of all panel Relays and Meters CT & PT. (Apr)
- v) Measurement of insulation resistance value of circuit breaker.
- vi) Measurement of breaker closing and tripping time. (Apr)
- vii) Vacuum test (Apr)
- viii) Measurement of contact resistance. (Apr)
- ix) Checking of control circuit
- x) Visual inspection of earth connections and checking of tightness
- xi) Checking of mechanical and electrical interlocks, interlocks within the switch board to ensure proper functioning of the same. (Apr)
- xii) Checking and sealing of cable entry holes

Repairs:

During the time of operation any of the items mentioned above are found malfunctioning then they must be replaced.(All Spares/materials will be supplied by IPR and tools should be provided by the party)

10) LT Panel:

a) Daily:

- i) Visual inspection
- ii) Check whether indication lamps, selector switch, TNC & all meters are working .
- iii) Check whether all relays, are functioning properly.

b) Quarterly:

- i) Visual inspection of panels.
- ii) Checking and sealing of cable entry holes.
- iii) Checking of D.C. supply & control switchgear.
- iv) Checking of Indication lamps, replacement if required.
- v) Checking of Indication Meter and rectification/replacement if, required.
- vi) Checking/replacement of fuses if required.
- vii) Checking of Bus bar connection, Tightening of nut bolts, cleaning of bus bar if, required.
- viii) Cleaning and Tightening of bus bar in the bus bar chamber.
- ix) Tightening of all earthing connections.
- x) Cleaning of the inside and outside panels using blowers and vacuum cleaner.
- xi) Cleaning and Tightening of cable Incoming and outgoing terminations.

c) Yearly:

- i) Checking of D.C. supply & control switchgear.
- ii) Checking & ensuring the closing of the all panels/panel doors including the supply of necessary material if required
- iii) Cleaning of circuit breakers, lubricating the moving parts as per maintenance procedure

- iv) Checking of alignment in racking mechanism of breakers for free and smooth movement of circuit breakers. (Nov)
- v) Checking of contact erosion of circuit breakers. (Nov)
- vi) Checking of mechanical/ electrical interlocks, interlocks within the switchboard to ensure proper functioning of same. (Nov)
- vii) Functional operations check of limit switches, auxiliary contacts. (Nov)
- viii) Visual inspection of earth connections and checking of tightness
- ix) Measurement of insulation resistance value of circuit breakers
- x) Measurement of contact resistance of circuit breaker poles. (Nov)
- xi) Measurement of circuit breaker closing and tripping time. (Nov)
- xii) Functional operations check of circuit breaker
- xiii) During operation, any of the items found malfunctioning must be replaced. All material will be provided by IPR. (Nov)
- xiv) Measurement and recording of IR values for Main Bus bar.
- xv) Checking of all terminations for tightness.
- xvi) Checking of CT, PT and Relays connections for tightness.
- xvii) Testing of all panel Relays and Meters, CTs & PTs. (Nov)

11) 415V Distribution System (MCCBs, MDBs and DBs):

a) Daily:

- i) Visual inspection
- ii) Check whether indication lamps, selector switch, ammeter, MCBs etc are working.

b) Quarterly:

- i. Check if all the panels are ingress protected.
- ii. Routing of cables for new loads if required.
- iii. At the time of adding new cable proper tags and ferruling must be done.
- iv. Cleaning of the panel.
- v. Tightening of all earthing connections.
- vi. Checking and sealing of cable entry holes.
- vii. Checking of D.C. supply & control switchgear.
- viii. Checking of Indication lamps, replacement if required.
- ix. Checking of Indication Meter and rectification/replacement if, required.
- x. Checking/replacement of fuses if required.
- xi. Checking of Bus bar connection, Tightening of nut bolts, cleaning of bus bar if, required.
- xii. Cleaning and Tightening of bus bar in the bus bar chamber.
- xiii. Cleaning of the inside and outside panels using blowers and vacuum cleaner.
- xiv. Cleaning and Tightening of cable Incoming and outgoing terminations.

Repairs: If any component is found malfunctioning it has to be replaced. Material will be provided by IPR.

12) CABLE NETWORK:

a) Monthly:

- i) Visual inspection of cables.
- ii) Checking all cable terminals & joints for overhauling /loose connections and tightening, terminating, rejoining, if required.
- iii) Checking and recording or IR values of all cables with megger of suitable range if the concerned feeder cable is idle for more than one month.

Fault Diagnosis:

Wherever there is fault in any cable network, the contractor has to diagnose the fault in the pertinent cable and identify the type and location of faults if any.

13) Battery and DC Battery Charger System:

a) Daily:

- i) Visual inspection of both battery and battery charger.
- ii) Check and record of general appearance and cleanliness of battery, charger output current & voltage, electrolyte levels, any crack/leakage in cells, evidence of corrosion at terminals/ connectors and condition of ventilation.

b) Quarterly:

- i) Measurement of specific gravity of each cell, voltage of each cell & total battery terminal voltage.
- ii) Tightness of bolted connections.
- iii) DC distribution board terminal connections

c) Yearly:

- i) Performance test (C10 test) of the batteries.
- ii) Battery charger servicing.
- iii) Boost charging trial of charger.
- iv) Checking earth connection.
- v) Charging discharging test of battery banks.
- vi) Battery impedance Test
- vii) DC leakage test

14) EMERGENCY POWER DISTRIBUTION SYSTEM:

The Emergency Power distribution System caters electrical power demand from systems viz. Cooling Water System, Cryogenic and other important safety and investment protection systems. It comprises of 2 x 1.7 MVA Diesel Generator. This contract does not include the maintenance of both the DG sets. In the event of normal power failure, the operational staff will monitor the operation of DG set and log the required data in the log book.

15) EARTHING SYSTEM:

a) Quarterly:

- i) Checking of all earthing connections, joints and cleaning and tightening thereof.
- ii) Putting adequate quality of water in earth pits.
- iii) Checking and recording of earth resistance of all points, pits and taking corrective action to improve it, if required.

16) METERS:

a) Daily:

- i) Visual inspection.
- ii) Checking of each meter (Analog/Digital) for its correct operation, if found faulty/not working replace it with new spare.

b) Yearly:

- i) Calibration of the meters.

17) PROTECTIVE RELAYS

a) Quarterly:

- i) Visual inspection and cleaning from outside.

c) Yearly:

- i) Checking of each relay for its correct operation by secondary injection. (Apr)
- ii) Cleaning of relay contacts by CRC-2-26. (Apr)
- iii) Calibration of relay. (Apr)
- iv) Checking of current/voltage setting as per recommended setting. (Apr)
- v) Checking of time characteristic as per recommended setting. (Apr)

18) PARTIAL DISCHARGE DETECTION:

a) Yearly:

- i) Partial Discharge Detection Test shall be carried for the entire zone of the 132 kV sub-station with appropriate standard procedures. Comparative assessment of the detection and measurements shall be done with previous year's records.

19) THERMAL IMAGING:

a) Yearly:

- i) Comprehensive thermal imaging for the all the equipment in the entire scope shall be carried out and detailed diagnostic and assessment report shall be provided with suggestive measurements for troubleshooting and preventive measures.

20) AUTOMATIC POWER FACTOR CORRECTION SYSTEM:

- i) This includes 11kV ,1600 KVAR APFC system, which is to be operated depending upon the overall pf condition of the system. It will automatically switched on to maintain the desired pf. The pf reading has to be logged.

Notwithstanding as to what is specifically stated under SUB-STATION MAINTENANCE SCHEDULE, it shall be responsibility of the contractor to attend to all the preventive & routine maintenance and repairs and breakdown services including replacement of necessary parts and components.

ANNEXURE – I

List of Major Equipment and their Main Specifications

Sr. No.	Name of Equipment	Quantity	Make/ Manufacturer	Specifications
1.	Lightening Arrestor	18 Nos.	ELPRO,CGL, W.S Industries	Voltage Rating-120KV Current Rating-10 KA HSV-145 KV
2.	Voltage Transformer	3 Nos.	CGL	Voltage Ratio-132 KV/110V HSV-145 KV
3.	Current Transformer	21 Nos.	CGL	HSV-145 KV CT #1A Ratio-40-80/1 CT#1B Ratio-150-300/1 CT#2 Ratio-150-300/1 CT#3 Ratio-150-300/1 CT#4,5,6 Ratio-150-300/1
4.	Circuit Breaker	6 Nos.	SIEMENS	Current Rating-3150 Amp. Type-Spring Charge Mechanism HSV-145 KV
5.	Isolator/Earth Switches	7 Nos.	S&S	Rating-800 Amp HSV-145 KV (Incoming unit with Earth Switch)
6.	Power Transformers	5 Nos.	TR#1- AYL	Rating-31.5 MVA Percentage Impedence-9.24 Vector Group-DYn11 BIL:-650 KV,Ratio-132 /11.2 KV Cooling-ONAN

			TR#2- NGEF	<p>Insulating Oil volume- 25,290 ltr</p> <p>OLTC present</p> <p>Rating-37.5MVA (Cont.) 75.0MVA(Peak)</p> <p>Percentage Impedence-11.4</p> <p>Vector Group-DYn 11</p> <p>Ratio-132 /11.5 KV</p> <p>Cooling-ONAN</p> <p>Insulating Oil volume- 27,400ltr</p> <p>OLTC present</p>
			TR#3&TR#4-TRIL	<p>Rating-15 MVA</p> <p>Percentage Impedence-7.5</p> <p>Vector Group-DYn 11</p> <p>Ratio-132 /11.5 KV</p> <p>Cooling-ONAN</p> <p>Insulating Oil Volume-17, 350ltr</p> <p>OLTC present</p>
			TR#5-TOSHIBA	<p>Rating-31.5 MVA</p> <p>Percentage Impedence-15.29</p> <p>Vector Group-DYn 11</p> <p>Ratio-132 /22 KV</p> <p>Cooling-ONAN</p> <p>Insulating Oil Volume-25,000ltr</p> <p>OLTC present</p>
7.	Control Relay Panels	6 Nos.	MAKTEL	<p>Each panel consists of Annunciation Window, Multi-function meter, analog meters, Relays, indication lamps, hooter,TNC etc.</p> <p>Relays (numeric & electromagnetic)</p> <p>Mainly consists of</p> <ul style="list-style-type: none"> • Overcurrent relay • Differential protection Relay • REF relays • Master trip relays • Auxiliary relays for WTI, OTI, and bucholz relay

	RTCC Panel	5 Nos.	TRIL,NGEF, TOSHIBA	<ul style="list-style-type: none"> • Trip ckt. Supervision relays <p>Each panel consists of Annunciation, push button, tap position indicator, AVR, hooter etc.</p>
8.	HT Panels 11 kV Switchgear	52 Nos.	SIEMENS	<p>There are 7 HT Panels consists mainly of VCBs, digital meters for current, voltage and frequency, TNC , Selector switch, indicating lamps, analog ammeters & relays</p> <p>VCBs consists of :</p> <p>2500A – 2 set</p> <p>1250A - 11 sets</p> <p>800A – 39 sets</p> <p>Relays (numeric & electromagnetic</p> <p>Mainly consists of :</p> <p>Over current relays(numerical)</p> <p>Under voltage relays(numerical)</p> <p>Mater trip & Auxiliary relays</p> <p>There are 4 nos. 22 kV HT Panels consisting mainly of VCBs, digital meters for current, voltage and frequency, TNC , Selector switch, indicating lamps, analog ammeters & relays</p> <p>22 kV VCBs consists of:</p> <p>1250A – 1 set; 800A – 19 sets</p>
	22 kV Switchgear	10 Nos.	MEGAWIN	
		20 nos.	SIEMENS	
9.	Distribution Transformers	14 Nos.	DANKE ELECT. DT#1 - DT#6 DT#7 DT#8 –DT#11 (TRIL Make) DT#12 Dry Type (AMES IMPEX make) DT#13,14	<p>Ratio-11000/433V</p> <p>Rating-2 MVA</p> <p>Ratio-11000/433V</p> <p>Rating-1 MVA</p> <p>Ratio-11000/418V</p> <p>Rating-2.5 MVA</p>

			(Synergy make)	Ratio-11000/433V Rating-2.5 MVA Ratio-11000/433V Rating-2 MVA
10	Battery and Battery Charger System	2 Sets	Exide	220 V, 400AH, VRLA
	i) Battery System			
	ii) Charger System	2 Sets	Servilink	220V, 50 Amp (FC) & 100Amp (FCBC)
11	LT Panels		GEPC, Schneider, ABB, L&T	Each panel consists of I/C ACB, O/G ACBs/MCCBs, CTs,PTs, analog meters, protection releases and accessories like lamps, space heaters etc.. ACBs are GE make Spectronic breakers with microprocessor based releases- RMS 7 having adjustable current time settings for Overload, Short circuit and Earth Fault with Fault indication module and CT's of standard ratings. Relays mainly consists of: <ul style="list-style-type: none"> • Under voltage relay • Auxiliary relay • Master trip relay • Earth fault relay • RMS 7 relay The ratings of MCCBs are of 63A, 100A, 125A, 200A, 250A 400A
12	415 V ACDBs	21	Misc.	Each MDB panel consists of I/C MCCB, O/G MCBs, CTs, analog meters, protection releases and accessories like lamps etc. Each DB panel consists of I/C TPN MCB, O/G MCBs (SP or DP).
	1) MDB			
	2) Wall DBs	47		
13	DCDB	02	Misc.	Each DCDB panel consists of I/C MCCB and O/G MCCBs.

The details of the LT panels along with their ACB ratings and location are as below:

LT Panel Details					
Sr. No.	Make	LT Panel	Location	Ratings	Quantity
1	GE	LTP#1(3P)	Utility Building	800 A	4
				1250 A	7
				3200 A	3
				Total	14
2	GE	LTP#2(3P)	Utility Building	800 A	2
				2500 A	1
				3200 A	4
				Total	7
3	GE	LTP#3(3P)	Utility Building	800 A	1
				Total	1
4	GE	LTP#4(3P)	Near New Admin Building	3200 A	1
	Schneider			3200 A	1
				630 A	1
				400 A	1
5	GE	LTP#5(4P)	DG Room	800 A	3
				1250 A	1
				2500 A	1
				3200 A	4
				Total	9
6	GE	LTP#6(3P)	SST Hall	800 AMP	2
				2500 A	1
				Total	3
7	GE	LTP#8(3P)	NBI lab(GF)	800 A	1
8	GE	LTP#9(4P)	Utility Building	800 A	1
9	GE	LTP#10(4P)	SST Hall	800 A	2
10	ABB	LTP#11(3P/4P)	Utility Extension	4000 A	8
				3200 A	2
				1600 A	4
				800 A	8

				Total	22
11	ABB	LTP#12(3P)	ITER Building	1600 A	1
12	ABB	LTP#28 (4P)	DG Room	3200 A	2
				2500 A	1
				1250 A	2
				800 A	1
				Total	6
13	ABB	LTP#21(3P/4P)	New auxiliary Building	800 A(3P)	2
				1600 A(3P)	2
				2500 AMP(3P)	2
				3200 A(3P)	2
				4000 A(4P)	4
				Total	12
14	ABB	LTP#26(4P)	New auxiliary Building	800 A(3P)	3
				1600 A(4P)	1
				Total	4
15	ABB	LTP#29(4P)	New auxiliary Building	800 A(4P)	1
				Total	1

R & D Building

1	ABB	LTP#31(4P)	R&D Lab	2500A(4P)	6
				4000A(4P)	2
				Total	8
2	ABB	LTP#32(4P)	R&D Lab	1250A(4P)	3
				2500A(4P)	1
				Total	4
3	ABB	LTP#33(4P)	R&D Lab	800A(4P)	2
				1250A(4P)	2
				2500A(4P)	1
				Total	5
4	ABB	LTP#34(4P)	R&D Lab	800A(4P)	4
				1250A(4P)	2
				2500A(4P)	1
				Total	7
5	ABB	LTP#35(4P)	R&D Lab	800A(4P)	1
				2500A(4P)	1
				Total	2
6	ABB	LTP#36(4P)	R&D Lab	800A(4P)	1
			Total	1	
7	ABB	LTP#37(4P)	R&D Lab	800A(4P)	1
			Total	1	
8	ABB	LTP#38(4P)	R&D Lab	800A(4P)	1
			Total	1	

The details of the MCCBs along with their ratings and location are as below:

MCCB Details					
Sr. No.	Make	Fed From	Location	Ratings	Quantity
1	GE	LTP#1	Utility Building	200A	1
				Total	1
2	L & T	LTP#1 EXT	Utility Building	400A	2
				630A	4
				Total	6
3	GE	LTP#2	Utility Building	100A	1
				200A	1
				250A	4
				400A	2
				630A	1
				Total	9
4	GE	LTP#3	Utility Building	250A	4
				630A	2
				Total	6
5	GE	LTP#6	SST Hall	100A	2
				125A	1
				200A	8
				250A	1
				Total	12
6	GE	LTP#8	NBI Lab(GF)	100A	3
				125A	1
				200A	1
				250A	2
				Total	7
7	GE	LTP#9	Utility Building	100A	6
				400A	1
				Total	7
8	GE	LTP#10	SST Hall	100A	9

				250A	2
				Total	11
9	ABB	LTP#12	ITER Building	63A	8
				125A	5
				250A	3
				400A	2
				Total	18
10	ABB	LTP#13	ITER Building	250A	2
				63A	6
				Total	8
	ABB	LTP#25	New auxiliary Building	250A	1
				400A	1
				630A	1
				Total	3
	11	ABB	LTP#29	R&D Building	125A
200A					1
250A					1
400A					1
Total					7

R & D Building					
1.	ABB	LTP#35	SF	400A	2
				630A	1
				TOTAL	3
2	ABB	LTP#36	PDB#1 CRYO + RFQ	100A	2
				250A	3
				400A	2
				TOTAL	7
3	ABB	LTP#37	PDB#4 HEIS+EHCL+FC	100A	2
				250A	3
				400A	2
				TOTAL	7
4	ABB	LTP#38	PDB#5 RH + LIGO	100A	2
				250A	3
				400A	2
				TOTAL	7

The details of the ACDBs and DCDBs along with their type and location are as below:

ACDB Details				
MDB No.	Fed From	Location	Technical Details	
			I/C	O/G
1	LTP#9	Relay Room	1No-250A, 35kV, TPN, MCCB	2Nos 10A,9kA, TPN, MCB
				5Nos 16A,9kA, TPN, MCB
				7Nos 32A,10kA, TPN, MCB
				2Nos 63A,10kA, TPN, MCB
2	LTP#10	Air Compressor	1No-100A, 25kV, TPN, MCCB	5Nos 32A,10kA, TPN, MCB
				1No 16A,10kA, TPN, MCB
				1No 63A,10kA, TPN, MCB
3	LTP#2	LHCD	1No-200A, 35kV, TPN, MCCB	6Nos 32A,10kA, TPN, MCB
				2Nos 63A,10kA, TPN, MCB
4	LTP#2	ECRH + ICRH	1No-400A, 35kV, TPN, MCCB	5Nos 32A,10kA, TPN, MCB
				3Nos 63A,10kA, TPN, MCB
5	LTP#10	Cryo Hall	1No-100A, 25kV, TPN, MCCB	2Nos 6A,10kA, TPN, MCB
				1No 16A,10kA, TPN, MCB
				1No 32A,10kA, TPN, MCB
				2Nos 63A,10kA, TPN, MCB
6	LTP#6	SST-1 Hall	1No-200A, 35kV, TPN, MCCB	2Nos 32A,10kA, TPN, MCB
				3Nos 40A,10kA, TPN, MCB
				1No 63A,10kA, TPN, MCB
7	LTP#6		1No-200A, 35kV, TPN, MCCB	3Nos 32A,10kA, TPN, MCB
				3Nos 40A,10kA, TPN, MCB
8	LTP#10		1No-200A, 35kV, TPN, MCCB	3Nos 32A,10kA, TPN, MCB
				3No 63A,10kA, TPN, MCB
9	LTP#10		1No-200A, 35kV, TPN, MCCB	3Nos 32A,10kA, TPN, MCB
				2Nos 40A,10kA, TPN, MCB
				1No 16A,10kA, TPN, MCB
10	LTP#6		1No-200A, 35kV, TPN, MCCB	2Nos 32A,10kA, TPN, MCB
		3Nos 40A,10kA, TPN, MCB		
		1No 63A,10kA, TPN, MCB		
11	LTP#6	1No-200A, 35kV, TPN,	3Nos 32A,10kA, TPN, MCB	

			MCCB	3Nos 40A,10kA, TPN, MCB
12	LTP#10		1No-100A, 35kV, TPN, MCCB	5Nos 32A,10kA, TPN, MCB 1No 63A,10kA, TPN, MCB
13	LTP#10		1No-100A, 35kV, TPN, MCCB	5Nos 32A,10kA, TPN, MCB 1No 63A,10kA, TPN, MCB
14	LTP#10		1No-100A, 35kV, TPN, MCCB	5Nos 32A,10kA, TPN, MCB 1No 63A,10kA, TPN, MCB
15	LTP#10		1No-100A, 35kV, TPN, MCCB	5Nos 32A,10kA, TPN, MCB 1No 63A,10kA, TPN, MCB
16	LTP#10		1No-100A, 35kV, TPN, MCCB	5Nos 32A,10kA, TPN, MCB 1No 63A,10kA, TPN, MCB
17	LTP#10		1No-100A, 35kV, TPN, MCCB	5Nos 32A,10kA, TPN, MCB 1No 63A,10kA, TPN, MCB
18	LTP#9	MPH Lab	1 No-250A, 35kV, TPN, MCCB	13Nos 20A,10kA, TPN, MCB 1No 32A,10kA, TPN, MCB 1No 63A,10kA, TPN, MCB
19	LTP#6	Cryo Hall	1No-100A, 35kV, TPN, MCCB	5Nos 32A,10kA, SP, MCB 3Nos 32A,10kA, TPN, MCB
20	LTP#6	Room No.6 (main bldg.)	1 No-250A, 35kV, TPN, MCCB	2Nos 16A,10kA, SP, MCB 4Nos 32A,10kA, SP, MCB 3No 40A,10kA, TPN, MCB 3No 63A,10kA, TPN, MCB
21	LTP#9	Utility Building FF	1No-100A, 35kV, TPN, MCCB	3No 63A,10kA, TPN, MCB

R & D Building				
1	MDB#2	R & D Lab	1No 63A, TPN, MCB	3No 63A, DP, MCB ELCB 3No 16A, SP, MCB
2	LTP#36	R & D Lab	1No-250A, TPN, MCCB	6No 20A, TPN, MCB 6No 40A, TPN, MCB 6No 63A, TPN, MCB
3	MDB#4	R & D Lab	1No 63A, TPN, MCB	3No 63A, DP, MCB ELCB 3No 16A, SP, MCB
4	LTP#36	R & D Lab	1No-250A, TPN, MCCB	6No 20A, TPN, MCB 6No 40A, TPN, MCB 6No 63A, TPN, MCB
5	MDB#6	R & D Lab	1No 63A, TPN, MCB	3No 63A, DP, MCB ELCB 3No 16A, SP, MCB
6	LTP#37	R & D Lab	1No-250A, TPN, MCCB	6No 20A, TPN, MCB 6No 40A, TPN, MCB

				6No 63A, TPN, MCB
7	MDB#8	R & D Lab	1No 63A, TPN, MCB	3No 63A, DP, MCB ELCB
				3No 16A, SP, MCB
8	LTP#38	R & D Lab	1No-250A, TPN, MCCB	6No 20A, TPN, MCB
				6No 40A, TPN, MCB
				6No 63A, TPN, MCB
9	MDB#10	R & D Lab	1No 63A, TPN, MCB	3No 63A, DP, MCB ELCB
				3No 16A, SP, MCB
10	LTP#38	R & D Lab	1No-250A, TPN, MCCB	6No 20A, TPN, MCB
				6No 40A, TPN, MCB
				6No 63A, TPN, MCB
11	MDB#12	R & D Lab	1No 63A, TPN, MCB	3No 63A, DP, MCB ELCB
				3No 16A, SP, MCB
12	LTP#38	R & D Lab	1No-250A, TPN, MCCB	6No 20A, TPN, MCB
				6No 40A, TPN, MCB
				6No 63A, TPN, MCB
13	MDB#14	R & D Lab	1No 63A, TPN, MCB	3No 63A, DP, MCB ELCB
				3No 16A, SP, MCB
14	LTP#38	R & D Lab	1No-250A, TPN, MCCB	6No 20A, TPN, MCB
				6No 40A, TPN, MCB
				6No 63A, TPN, MCB

DCDB Details

DC DB No.	Location	Technical Details		
		I/C	B/C	O/G
DCDB 1	Realy Room	1No 250A,25kA, DP,DC, MCCB	-	30No 6A,10kA, DC, SP, MCB
				15No 20A,10kA, DC, SP, MCB
DCDB 2	Battery Charger Room	2No 160A,15kA, DP,DC, MCCB	1No 160A,15kA, DP,DC, MCCB	6No 40A,10kA, DC, DP, MCCB

The details of the DBs along with their type and location are as below:

DB Details				
DB No.	Fed From	Location	Technical Details	
			I/C	O/G
1	MDB#1	Relay Room	1No 63A,10kA, TPN, MCB	12 Ways DB
2	MDB#1	Behind SCADA Control Room	1No 63A,10kA, TPN, MCB	6 Ways DB
3	MDB#3	NR.MDB#3 (LHCD)	1No 32A,10kA, TPN, MCB	12 Ways DB
4	MDB#3	NR.MDB#3 (LHCD)	1No 63A,10kA, TPN, MCB	12 Ways DB
5	MDB#4	Behind MDB#4 (ECRH)	1No 63A,10kA, TPN, MCB	8 Ways DB
6	MDB#4	Behind MDB#4 (ICRH)	1No 63A,10kA, TPN, MCB	8 Ways DB
7	MDB#4	Behind RF Shield Room	1No 63A,10kA, TPN, MCB	8 Ways DB
8	MDB#6.1	TOKAMAK HALL	1No 40A,10kA, TPN, MCB	4 Ways DB
9	MDB#6.2		1No 40A,10kA, TPN, MCB	4 Ways DB
10	MDB#6.3		1No 40A,10kA, TPN, MCB	4 Ways DB
11	MDB#7.1		1No 40A,10kA, TPN, MCB	4 Ways DB
12	MDB#7.2		1No 40A,10kA, TPN, MCB	4 Ways DB
13	MDB#7.3		1No 40A,10kA, TPN, MCB	4 Ways DB
14	MDB#8		1No 40A,10kA, TPN, MCB	4 Ways DB
15	MDB#8.2		1No 40A,10kA, TPN, MCB	4 Ways DB
16	MDB#8.3		1No 40A,10kA, TPN, MCB	4 Ways DB
17	MDB#9.1		1No 40A,10kA, TPN, MCB	4 Ways DB
18	MDB#9.2		1No 40A,10kA, TPN, MCB	4 Ways DB
19	MDB#9.3		1No 40A,10kA, TPN, MCB	4 Ways DB
20	MDB#10.1		1No 40A,10kA, TPN, MCB	4 Ways DB
21	MDB#10.2		1No 40A,10kA, TPN, MCB	4 Ways DB
22	MDB#10.3		1No 40A,10kA, TPN, MCB	4 Ways DB
23	MDB#11		1No 40A,10kA, TPN, MCB	4 Ways DB
24	MDB#11		1No 40A,10kA, TPN, MCB	4 Ways DB
25	MDB#11		1No 40A,10kA, TPN, MCB	4 Ways DB
26	MDB#12		1No 63A,10kA, TPN, MCB	4 Ways DB
27	MDB#13		1No 63A,10kA, TPN, MCB	4 Ways DB
28	MDB#14		1No 63A,10kA, TPN, MCB	4 Ways DB

29	MDB#15		1No 63A,10kA, TPN, MCB	4 Ways DB
30	MDB#16		1No 63A,10kA, TPN, MCB	4 Ways DB
31	MDB#17		1No 63A,10kA, TPN, MCB	4 Ways DB
32	LTP#2	Nr.TF Power Supply & Nr.PF#2	1No 63A,10kA, TPN, MCB	6Ways DB
33	LTP#2		1No 63A,10kA, TPN, MCB	6 Ways DB
34	MDB#4E	Nr.TF TR Bay	1No 32A,10kA, TPN, MCB	6 Ways DB
35	MDB#1	Nr.LTP#5 Panel	1No 63A,10kA, TPN, MCB	6 Ways DB
36	MDB#18	MPH Control Room	1No 16A,10kA, TPN, MCB	6 Ways DB
			1No 32A,10kA, TPN, MCB	
37	MDB#4E	Battery Charger Room	2No 32A,10kA, TPN, MCB	4 Ways DB
ITER INDIA DBs				
1	LTP # 12	PS HALL + 00 (GF)	1No 63A, TPN, MCB	12 Ways DB
2	LTP # 12	PS HALL + 00 (GF)	1No 63A, TPN, MCB	8 Ways DB
3	LTP # 12	ICRH + 13	1No 63A, TPN, MCB	12 Ways DB
4	LTP # 12	PS HALL + 13	1No 63A, TPN, MCB	8 Ways DB
5	LTP # 12	ECRH + 13	1No 100A, TPN, MCB	12 Ways DB
6	LTP # 12	ECRH + 13	1No 125A, TPN, MCB	8 Ways DB
7	LTP # 12	DIAG HALL + 18	1No 63A, TPN, MCB	12 Ways DB
8	LTP # 13	EDB-1 (PS HALL + 00)	1No 63A, TPN, MCB	12 Ways DB
9	LTP # 13	EDB-2 (PS HALL + 00)	1No 63A, TPN, MCB	12 Ways DB
10	LTP # 13	ICRH-3 (H&CD + 13)	1No 63A, TPN, MCB	12 Ways DB