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Government of India
विद्युत मंत्रालय
Ministry of Power
केन्द्रीय विद्युत प्राधिकरण
Central Electricity Authority
विद्युत प्रणाली अभियांत्रिकी एवं प्रौद्योगिकी विकास प्रभाग
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सं. के.वि.प्रा./पी.एस.ई.टी.डी./310/2020/ 114 दिनांक: 27.02.2020

विषय / Subject: Invitation of comments on Draft Guidelines for the Availability of Spares and inventories for Power Transmission System (Transmission lines & substation) assets -Reg.

Hon'ble MoSP (I/c) for Power, New & Renewable Energy, during the meeting taken on August 2019, had raised the concern about delays in restoration of transmission system during an eventuality like natural disaster due to non-availability of adequate spares. CEA was directed to take up the issue of availability of spares & inventory management with the power utilities, standardize the inventory list, set up a monitoring mechanism for ensuring its compliance and ensure mandatory digitization of spare management by all power utilities.

There is need for standardization of provision of mandatory spares at station level, State level, Regional level and National level, and digitization of spare management. In view of the above, draft guidelines have been formulated by CEA in respect of transmission system (Transmission lines & substation) to lay down provision of mandatory spares required at various levels by power utilities across the Country to meet any eventuality including natural disasters. These guidelines broadly cover Spares for transmission lines, substation/switchyard equipment material, GIS, FSC installation/TCSC installation, HVDC system, STACOM and FCL.

All utilities/stakeholders are requested to provide valuable inputs/comments on these draft guidelines latest by 28th March, 2020 by post or email: (ce-psetd@gov.in).

(भंवर सिंह मीना / Bhanwar Singh Meena)
उप निदेशक / Deputy Director

Copy to: Director (IT), CEA-It is requested to upload document on the CEA website.

Guidelines for Availability of Spares and inventories for Power Transmission System (Transmission lines & substation) assets

A. BACKGROUND

1. The phenomenal growth of Indian Power System includes a vast power transmission system of both HVAC and HVDC with highest transmission system voltage of 765 KV AC and ± 800 KV DC. This transmission network is spread over different geographical areas, difficult terrains, coastal areas which are prone to frequent cyclonic storms/ high speed winds, etc. The transmission system assets include transmission lines & sub stations (both AIS & GIS) and damage to these assets due to natural calamities or unprecedented events such as sabotage or outage during system operation cannot be avoided. Outage free transmission system is practically impossible. However, steps can be taken to maintain highest availability of transmission system and down time can be reduced by adopting suitable mechanism of fast restoration.

2. Spares of equipment/material are essential to meet any exigency and reduce the downtime of the equipment/system. Availability of spares at the time of need plays an important role in bringing back normalcy to the system. Its significance increases manifold in case of natural disasters. Natural Disaster causes devastation to infrastructure including power transmission network. In India, coastal areas, in particular, experience high speed wind, cyclone/tornadoes and frequency of occurrences of such incidences have increased over the years. Power outage due to such incidences have direct impact not only on day to day life of general public but also on the industrial output, thereby impacting economy of the country. Power utilities generally procure mandatory spares along with the supply of equipment/material. However, these spares may not be adequate to restore the power transmission network damaged during natural disasters. Availability of adequate spares of

transmission elements helps in faster restoration of power supply. It avoids delay in tendering process, transportation of new/repaired equipment/ material from manufacturer's works to site, and minimization of financial loss to the affected utility by reducing the down time significantly and alleviate the inconvenience to the consumers, in general.

3. A meeting was held in Ministry of Power on 01.08.2019 to review crisis and disaster management plan for power sector under the Chairmanship of Hon'ble MoSP (I/c) for Power, New & Renewable Energy. Hon'ble Minister raised the concern about delays in restoration of transmission system during an eventuality due to non-availability of adequate spares. CEA was directed to take up the issue of availability of spares & inventory management with the power utilities, standardize the inventory list of the *minimum spares requirement*, specific for similar kind of power establishments, set up a monitoring mechanism for ensuring its compliance and ensure mandatory digitization of spare management by *all* power utilities.

4. Accordingly, a meeting was held in CEA on 16.09.2019 under the Chairmanship of Chief Engineer (PSE&TD). During deliberations on the subject matter, it was brought to notice that there is no uniform practice across the power utilities in the country regarding provision of minimum spares for equipment in substation/switchyard or for transmission line. Minutes of the meeting is enclosed as Annexure-C. The digitization of spares management is yet to be taken up by most of the utilities. Many utilities do not have adequate provision of spares for transmission system assets to meet any eventualities.

5. There is need for standardization of provision of mandatory spares at station level, State level, Regional level and National level, and digitization of spare management. In view of above, the following

guidelines have been formulated to lay down provision of mandatory spares required at various levels by power utilities across the country to meet any eventuality like natural disasters. These guidelines broadly covers the following:

i) Spares for transmission lines-
   - The design of towers vary for different wind zone and voltage class. Moreover, in general, failure of suspension towers is more compared to tension/ angle towers. Accordingly quantities of tower material have to be kept.

ii) Spares for substation/switchyard equipment material
   - The spares, particularly for major equipment / material (CB, ISO, ITs, SA, BPI, T/F, Reactors, Battery and Battery Chargers, CRP, SAS) in substation / switchyard have been covered;

iii) Spares for GIS;
iv) Spares for FSC installation/TCSC installation;
v) Spares for HVDC system;
vi) Spares for STACOM, and
vii) Spares for FCL.

B. GUIDELINES

1. These guidelines shall be applicable to all power utilities in the Country for transmission system of 66 kV and above voltage levels (switchyards/substations and transmission lines) including those located in cyclone/whirlwind/tornado prone areas.

2. The quantity of spares should be based on population of asset (each type and make of substation/switchyard equipment/material or transmission line material), criticality of the equipment/ component/ material, the geographical location of station/ switchyard, terrain through which transmission line traverses, and the length of transmission lines.

3. The list of minimum mandatory spares for substations/switchyards and transmission lines located in cyclone/whirlwind/tornado prone areas is provided at Annexure-A. The list of spares for substations/switchyards and transmission lines located in the other areas have been provided at Annexure-B. Requirement of spares for component/equipment/material for substations/switchyards and transmission lines located in cyclone/whirlwind/tornado prone areas not covered in Annexure-A, shall be as per the quantity provided in Annexure-B.

4. The utility is free to decide additional requirement of spares other than the mandatory provisions specified in Annexure-A & B, based on failure rate, ageing, available inventory, past experience, criticality of component/equipment/material, etc. For remotely located stations/switchyard, the quantity of spares may be suitably increased.

5. The procurement of spares shall be limited by CERC permissible limit for initial spares (presently 1% of Plant and Machinery cost upto cut-off date as per clause No. 13 of CERC Tariff regulation for 2014-19).

6. For private utilities, spares shall be maintained at station/switchyard level; for State utilities, the spares shall be maintained at substation/switchyard level as well as at State level; and for PGCIL/NTPC/NHPC, the spares shall be maintained at station/switchyard level, at State level, at Regional level and at National level.

7. Pooling of spares shall also be done at State level and National level so that these spares may be provided to needy States/utilities for faster restoration of supply.

8. Except circuit breakers and isolators, any equipment/material of one make in a substation/transmission line should be replaceable with same equipment of different make with minor or no modification.

9. There may be cases, where the extent of damage is so much that specified minimum quantum of spares/inventories may be

inadequate in meeting the eventuality. In such cases, support from neighboring State utility or PGCIL shall be requested.

10. All concerned power utilities shall take up digitization of spares and inventory management of transmission system assets (substation equipment / material) and transmission line material using suitable software like SAP at the earliest so that status of availability of the spares at any point of time could be assessed by the utility and necessary action for replenishment can be taken up accordingly. Necessary details of the substation equipment such as rating, serial no., etc. and details of the towers like BOM, drawing number, drawing endorsement, etc. shall also be provided in ERP system to identify the towers. The utilities shall intimate CEA after implementation of digitization of inventory management.

11. Replenishment of the consumed mandatory spares shall be made at the earliest but in any case, not later than six months from the date of its consumption depending on the criticality of equipment component / material.

12. Procurement of imported consumables shall depend on consumption pattern and procurement lead time. Procurement action shall be initiated in advance to keep the item (s) available all the time to meet any eventuality.

13. Goods & Services Tax (GST) is applicable for inter-State transfer of equipment/material. To ease the movement during disaster/crisis, the appropriate Government shall be approached / requested to relax GST for inter-state transfer of spares for emergency restoration, particularly during disaster situation.

14. Proper storage and periodic maintenance of all the spares must be ensured in line with the recommendations of the Original Equipment Manufacturer (OEM) and best Global/International practices.

15. In cyclone prone areas, new substations may be planned as Gas Insulated Substations (GISs)/Mixed Technology Switchgear (MTS) to minimize the need for spares. In case of damage to existing Air

Insulated Substation (AIS) in a cyclone prone area, possibility of converting the same into a GIS/MTS installation may be explored.

16. ERS shall be used for immediate restoration of transmission lines and should not be used on continuous basis for a long time as a substitute to normal tower. The number of Emergency Restoration Systems (ERS) to be maintained by the utilities shall be as communicated to all power utilities, vide Secretary (Power)'s DO letter no. 20/6/2014-OM dated 05.12.2014 (Annexure-D).

17. Quantity of spares/inventories are to be reviewed every three years based on O & M experience and the requirement during natural disaster, etc.

18. The utilities shall furnish half-yearly reports (As on 30th June and on 31st December of each year) of availability of spares in the following format at various levels (separate table for each level) viz. substation/switchyard level, State level, Regional level and National level, as applicable:

Half-yearly reports of availability of spares As on 30th June/31st December						
Sl. No.	Equipment	Rating	Requisite Number of Spares to be maintained as per these Guidelines	Number of spares maintained as finalized by the Utility	Number of Spares available as on date	Shortfall

ANNEXURE-A

MINIMUM MANDATORY SPARES

Substation Equipment/Material

TABLE-I:

Sl. No.	Equipment	Mandatory Minimum Spares to be maintained	
		At Substation	At State Level
i.	Power Transformers	As per Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations	One number single-phase/three-phase unit of each rating, as applicable
ii.	Reactors	As per Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations	One number single-phase/three-phase unit of each rating, as applicable
iii.	Transformer/Reactor Bushings	One number of each voltage class and current rating for each transformer type installed at the	One number of each voltage class and current rating for each transformer type

		substation/switchyard	
iv.	Circuit Breakers (CB) - Complete Pole (Phase) of circuit breaker including closing resistor, grading capacitor, pole column, interrupter, operating mechanism, Marshalling Box and terminal connector but without support structure.	10% poles of each make and model installed at the substation (rounded up to the next integer) subject to a minimum no. of one	Two complete CBs of each voltage class, and highest short-time and normal current rating (along with support structure) available at any of the substations.
v.	Isolators	10% poles of each make and model installed at the substation (rounded off to the next integer) subject to a minimum number of one	Two complete isolators of each voltage class, and highest short-time and normal current rating (along with support structure) available at any of the substations
vi.	Current Transformers (CT)	10% CT of each voltage class installed at the substation (rounded up to the next integer) subject to a	Two complete CTs of each voltage class (along with support structure). CT ratio shall be decided by the

		minimum number of two	utility based on the population of similar ratio CTs available in the State.
vii.	Voltage Transformers/Capacitive Voltage Transformers (VT/CVT)	10% VT/CVT of each voltage class installed at the substation (rounded up to the next integer) subject to a minimum number of two	Two complete VTs/CVTs of each voltage class (along with support structure)
viii.	Surge Arrestors (SA)	10% SA of each voltage class installed at the substation (rounded up to the next integer) subject to a minimum number of two	Four complete SAs of each voltage class (along with support structure)
ix.	Wave Trap	-	Two number of each rating
x.	Bus Post Insulators, (BPI), if provided at the substation/switchyard	10% BPIs of each voltage class installed at the substation (rounded up to the next integer) subject to a minimum number of two	-

xi.	Coupling Capacitors, if provided at the substation/switchyard	One number of each voltage class installed at the substation/switchyard	
xii.	Conductor	5% of the length of each type installed at the substation/switchyard	-
xiii.	Disc Insulators	5% of the total number of discs of each voltage class installed at the substation/switchyard.	-
xiv.	Long Rod Insulator	5% of the total number of insulators of each voltage class installed at the substation/switchyard, subject to a minimum number of three insulators of each voltage class.	-

Note: Storage location at State level shall be decided considering factors like accessibility/connectivity, proximity to cyclone prone areas, etc.

ANNEXURE-A

Transmission Tower Material at State Level for 66 kV and above voltage level Standard Design transmission lines

The quantity for the type of standardized towers/extensions as specified in Table-II below shall be kept by a utility for each of the wind zones separately, provided utility owns installations of such towers/extensions.

TABLE-II:

Sl. No.	Type of Tower	Standard	Extensions for towers				
			+3m	+6m	+9m	+18m	+25m
i.	A	8 Nos.	1 No.	2 No.	1 No.	1 No.	1 No.
ii.	B	1 No.	1 No.	1 No.	1 No.	1 No.	1 No.
iii.	C	1 No.	1 No.	1 No.	1 No.	1 No.	1 No.
iv.	D	1 No.	1 No.	1 No.	1 No.	1 No.	1 No.

Transmission Line Material at State Level

TABLE-III:

Sl. No.	Transmission Line Material	Mandatory Minimum Spares to be maintained at State level	
i.	Conductor (The type used in the transmission line in the State)	Voltage Level	Length (in kms) to be maintained as spares
		66 kV, 132 kV and 220 kV	20
		400 kV	40

		765 kV	100
ii.	Emergency Restoration System	As laid down in Secretary (Power)'s DO letter no. 20/6/2014-OM dated 05.12.2014 (Annexure-D)	

Note 1: If there are five or more substations of a utility in a state, the 'State Level' spares shall be maintained by the utility.
Note 2: The hardware accessories associated with these equipment shall also be maintained by the utility in adequate quantities.
Note 3: The spares for multiple substations and transmission lines of a utility in a State may also be pooled by the utility at a conveniently accessible central location for optimal space utilization. This may be required in cases of inadequacy of space in substation(s) for storage of requisite number of spares.
Note 4: In case of transmission line material if the lines are spread across multiple states, the utility may utilize its discretion, considering all relevant factors e.g. length of line located in a particular wind zone, accessibility, etc., regarding material's distribution across the concerned states.
Note 5: For transmission line material, the number of insulator discs and length of earthwire/OPGW shall be maintained by the utility in adequate quantity commensurate for a total specified conductor length considering worst case scenario.
Note 6: PGCIL shall maintain Regional Level spares equal to the number of spares to be maintained for most cyclone affected State in that particular region. It shall also maintain appropriate number of spares at National Level, if required.

1.0 MANDATORY SPARES FOR SUB STATION EQUIPMENT

Sl. No	Description	Substation	State wise Stores
		Each Make & Type	
1.0	**CIRCUIT BREAKERS**		
1.1	**765/420/ 245/ 145 KV SF6 CIRCUIT BREAKER**		
1.1.1	Complete Pole (Phase) of circuit breaker including closing resistor, grading capacitor, pole column, interrupter ,operating mechanism, Marshalling Box and terminal connector but without support structure	1 pole of each make & type	1 complete CB of each Voltage Class and Highest Current Rating (along with Support structure
1.1.2	Grading Capacitor	3 Nos.	
1.1.3	Rubber gaskets, `O' rings and seals	1 set	
1.1.4	Trip coils with resistor	2 sets	
1.1.5	Closing coils with resistor	2 sets	
1.1.6	Terminal Pads and connectors	2 sets	
1.1.7	Molecular filter	2 Nos.	
1.1.8	Density / pressure monitoring systems (if applicable)	1 No.	
1.1.9	Corona rings	1 No.	
1.1.10	Relays, Power contactors, switch fuse units, limit switches, push buttons, timers & MCB etc.	1 set	
1.1.11	Pressure switches	1 set	
1.1.12	Pressure Gauge and coupling	1 set	
1.1.13	SF6 Gas	50 % as spare with main order Reorder level (ROL) - 15% Reorder quantity (ROQ)– 1 Year's consumption	
1.1.14	Auxiliary switch assembly	1 set	
1.1.15	Operation Counter	1 No.	
1.1.16	Magnetic ventile for ABB make CBs	3 Nos.	
1.1.17	Actuator rings for ABB make CBs	6 Nos.	

Sl. No	Description	Substation	State wise Stores
		Each Make & Type	
1.1.18	Control valves (ABB make)	1 No.	
1.1.19	Fixed, moving and arcing contact assemblies including Insulating Nozzles etc for 1 Interrupter.	2 Nos.	
	****1 Set =For three poles**		
1.1.20	**Pneumatic Operating Mechanism For ICU (INDIVIDUAL COMPRESSOR UNIT)**		
1.1.20.1	Complete compressor assembly along with motor, accessories & coupling along with regenerating unit(wherever applicable)	1 Set	
1.1.20.2	Micro-filters	1 No.	
1.1.20.3	Coupling for compressed air	1 Set	
1.1.20.4	Valves & reducers (Including Safety valve)	1 Set	
1.1.20.5	Pressure switches	1 Set	
1.1.20.6	Pressure gauges	1 Set	
1.1.20.7	Gaskets 'O' rings & seals	1 Set	
1.1.20.8	Dowty Seal	2 Sets	
1.1.20.9	Operating drive	1 Set	
1.1.21	**Hydraulic Operating Mechanism**		
1.1.21.1	Hydraulic operating mechanism with drive motor	1 Set	
1.1.21.2	Ferrules and joints	1 Set	
1.1.21.3	Hydraulic filter	3 Sets	
1.1.21.4	High pressure hose	1 Set	
1.1.21.5	N2 Accumulator	2 No.	
1.1.21.6	Pressure transducer	1 No.	
1.1.21.7	Valves	1 Set	
1.1.21.8	`O' rings, gaskets and seals	1 Set	
1.1.21.9	Pipe length (copper & steel)	1 Set	
1.1.21.10	Pressure switches	1 Set	
1.1.21.11	Pressure gauges	1 Set	
1.1.21.12	Hydraulic oil	50 % spare with main order Reorder Level-15% ROQ – 1 Years consumption	
1.1.22	**Spring Operated Mechanism**		
1.1.22.1	Closing Dashpot	1 set	
1.1.22.2	Opening Dashpot	1 set	
1.1.22.3	Opening Catch gear	1 set	

Sl. No	Description	Substation	State wise Stores
		Each Make & Type	
1.1.22.4	Closing Catch gear	1 set	
1.1.22.5	Complete Spring Operating Mechanism	1 set	
1.1.22.6	Spring Charging Motor	1 nos.	
2.0	**ISOLATORS**		
2.1	**765/420/ 245/ 145/ 72.5 KV HORIZONTAL CENTRE BREAK/ DOUBLE BREAK ISOLATORS**		
2.1.1	One complete pole including support Insulator, motor operating mechanism (MOM) and terminal connector but excluding structure	1 pole	
	Isolator Arms with finger contacts and current carrying assembly	1 set	
2.1.2	Support Insulators	1 set	
2.1.3	Copper contact fingers for male & female contacts	2 sets	
2.1.4	Open / Close contactor assembly, timers, key interlock push button switch & auxiliary switches	1 set	
2.1.5	Limit switch	2 sets	
2.1.6	Motor housing bearing sembly	1 No	
2.1.7	Terminal Pads and connectors	2 sets	
2.1.8	Motor with gear assembly and bevel gear assembly	1 No.	
2.1.9	Corona shield rings	3 Nos	.
2.1.10	Hinge pins	3 Nos.	
2.1.11	Bearings	1 set	
2.1.12	Interlocking coil with resistor	5 Nos.	
2.1.13	Fuses of each rating	5 Nos.	
2.2	**420 KV PENTOGRAPH ISOLATOR**		
2.2.1	Fixed contacts	3	3
2.2.2	Gear Assembly	1	1
2.2.3	Damper assembly	1	1
2.2.4	Scissors assembly	1	1
2.2.5	Scissors contacts	3	3
2.2.6	Drive motor	1	1
2.2.7	Limit switches	1 set	1 set
2.2.8	Bearings	1 set	1 set

Sl. No	Description	Substation	State wise Stores
		Each Make & Type	
2.2.9	Terminal pads and connectors	4	4
2.2.10	Corona shield rings	1 set	1 set
2.2.11	Interlocking coils, timers, key interlocks etc.	1 set	1 set
3.0	**CURRENT TRANSFORMER**		
3.1	**765/420/ 245/ 132/ 72.5/ 33 KV CT**		
3.1.1	Complete CT with Terminal connector & stool structure	2 No. of each rating(not make) for Population up to 20 nos. 3 No. of each rating(not make) for more than 20 nos.	
3.1.2	Primary Terminal bushing	2 sets	
4.0	**VOLTAGE TRANSFORMER**		
4.1	765/420/245/132/ kV		
4.1.1	Complete CVT with terminal connectors & stool structure	2 No. of each rating(not make) for Population up to 20 nos. 3 No. of each rating(not make) for more than 20 nos.	
5.0	**SURGE ARRESTOR**		
5.1	**765/400/245/132 kV SA**		
5.1.1	Complete L.A. with insulating base and Terminal connector & stool structure	2 no. of each rating(not make) for Population upto 10 nos. 3 No. of each rating(not make) for more than 10 nos.	
5.1.2	Surge counter/monitor	10 Nos.	
6.0	**765/400/ 220/ 132/ 66 KV BUS POST INSULATOR**		
6.1	Bus post insulator assembly (Complete)	3 sets for each voltage rating	
7.0	**AUTO TRANSFORMERS & REACTORS**		
7.1	AUTO TRANSFORMERS		1 no. of each rating
	Oil cooler pumps with motor (complete assembly)	1 No.	
7.1.2	Buchholz relay complete (main tank)	1 No.	
7.1.3	Local Winding temperature indicator	1 No.	
7.1.4	Remote winding temperature indicator with sensing device and matching unit	1 No.	

Sl. No	Description	Substation	State wise Stores
		Each Make & Type	
7.1. 5	Oil temperature indicator	1 No.	
7.1. 6	Pressure relief device	1 No.	
7.1.7	Magnetic oil level gauge	1 No.	
7.1.8	Cooler Fan with motor	1 No.	
7.1.9	Set of Valves	1 No. of each size and type	
7.1.10	Set of starters, contactors, relays and switches for electrical control panel	1 set	
7.1.11	Remote tap position indicator	1 No.	
7.1.12	Oil flow indicator with flow switch	1 set	
7.1.13	Breather assembly for main conservator and OLTC Conservator	1 No. each	
7.1.14	Terminal connector	1 set	
7.1.15	Oil surge relay for OLTC	1 No.	
7.1.16	Aux. transformer for control power for cooler control cabinet	1 No.	
7.1.17	Aircell		1 no. each type per State
7.1.18	OLTC		1 no. each type per State
7.2	**765 / 420 KV SHUNT REACTORS :**		1 no. of each rating
7.2.1	Local winding temperature indicator	1 set	
7.2.2	Remote winding temperature indicator with contacts and sensing device	1 set	
7.2.3	OTI with contacts and sensing device	1 No.	
7.2.4	Magnetic Oil level gauge	1 No.	
7.2.5	Pressure relief device	1 No.	
7.2.6	Buchholz relay complete	1 No.	
7.2.7	Terminal connector	2 Nos. of each type/rating	
7.2.8	Neutral L.A. for each Rating - Wherever applicable	1 No.	

Sl. No	Description	Substation	State wise Stores
		Each Make & Type	
7.2.9	Surge monitor for neutral L.A. (Wherever applicable)	1 No.	
7.2.10	Breather assembly	2 Nos.	
7.2.11	Valves	1 set	
7.3	**BUSHINGS**		
7.3.1	Bushings 765/ 400 kV Bushing	2 nos. of each type(dimensional) & rating	
7.3.2	Bushings 245kV/ 145kV / Neutral Bushing (36kV)	1 nos. of each type(dimensional) & rating for upto10 Bushings 2 nos. of each type(dimensional) &(dimensional) & rating for more than10 Bushings	
7.3.3	72.5/52 KV bushings for tertiary	2 nos.	
7.3.4	24 KV grounding bushing of NGR with metal parts gaskets and terminal conductor	1 set	
7.4	**INSULATING OIL**		
7.4.1	Uninhibited Oil or special oil e.g. low pour point	10% of quantity of oil of largest unit	
7.4.2	Inhibited Oil imported (Naphthenic or special e.g. low pour point etc.)	20% of quantity of oil of largest unit	
8.0.	**NEUTRAL GROUNDING REACTOR**		
8.1	NGR for 765kV along with Terminal Clamps & Connectors		1 no. of each Rating for State
8.2	NGR for 400kV along with Terminal Clamps & Connectors		1 no. of each Rating in Powergrid
8.3	145 KV bushing with metal parts and gaskets along with terminal connector(To be covered separately in Bushings)		1 No.
8.4	OTI with contacts	1 No.	
8.5	Oil level gauge	1 No.	

Sl. No	Description	Substation	State wise Stores
		Each Make & Type	
8.6	Pressure relief device	1 No.	
8.7	Buchholz relay	1 No.	
8.8	Online DGA (multi gas)		2 nos in each State
8.9	Online Dry Out		5 nos in each State
8.10	**CSD**		
8.11	Controlled Switching Devices along with transducers, Sensors, Cables, Contactors, Switches etc	1 set of each make	
9.0	**PLCC EQUIPMENT**		
9.1	Set of Prints for Carrier terminal, Speech and Data	2 sets	
9.2	Set of Prints for protection coupler	2 sets	
9.3	Set of Prints for EPAX (24/8)	1 set	
9.4	Coupling device without base plate	2 sets	
9.5	Telephone 2 wire with necessary connecting cable	4 Sets	
9.6	Telephone 4 wire with necessary connecting cable	2 Sets	
9.7	Co-axial connector	10 nos.	
9.8	Straight through joint (wherever applicable)	1 Set	
9.9	Co-axial cable	1 KM	
9.10	PLCC tool kit	1 set	
9.11	Wave Trap LA	1 no.	
9.12	Wave trap with pedestal & terminal connectors		1 no. of each make& rating
9.11	**Digital PLCC/ Digital Communication equipment/ Digital Protection Coupler**		
9.11.1	Card/Module of each type	1 no	
9.11.2	Connector of each type	1 set	
9.11.3	Connecting cables of each type	1 no	
10.0	**BATTERIES AND BATTERY CHARGERS:**		
10.1	**220V/ 110 V/ 50V Batteries**		
10.1.1	Spare battery cell without electrolyte	10 Nos. for population ≥ 100 nos.	

Sl. No	Description	Substation	State wise Stores
		Each Make & Type	
		5 Nos. for population < 100 nos.	
10.1.2	Terminal connectors with Bolts & Nuts	10 Nos. (each type)	
10.1.3	Float level indicators	10 Nos. (each type)	
10.1.4	Vent Plugs	10 Nos. (each type)	
10.2	**220V/ 110 V / 50V Battery Chargers**		
10.2.1	Set of Control Cards	1 Complete set for each type of charger	
10.2.2	Set of relays	1 set	
10.2.3	Rectifier transformer	1 No.	
10.2.4	Control transformer	1 No.	
10.2.5	Series inductor	1 No.	
10.2.6	Set of contactor	1 set	
10.2.7	Micro switches	1 set	
10.2.8	Filter Capacitors	1 set	
10.2.9	Thyristor/ Diode	1 set	
10.2.10	Set of switches	1 set	
10.2.11	Set of wound resistors	1 set	
10.2.12	Potentiometers	1 No.	
10.2.13	Fuses of Thyristor with indicators	6 sets	
10.2.14	Battery Charger	1 no. each of 220V& 48V	
11.0	**Control and Relay Panel**		
11.1	Line Protection Panel Equipment Spare		
11.1.1	Numerical Relay (IED) of each make and type along with software	1 no.	
11.2	Transformer & Reactor Protection Panel		
11.2.2	Numerical Relay (IED) of each make and type along with software	1 no.	

2. MANDATORY SPARES FOR GAS INSULATED SWITCHGEAR (GIS)

Sl.No.	Description	Quantity of Each Type Substation
1.0	**General (For 765 kV, 400KV, 220KV & 132 KV)**	
1.1	Cable Connection Enclosure with the main Circuit (if applicable)	2 nos
1.2	Bus Bar Sections, Bus Bar Interconnection Modules, Bus Ducts Sections, Interconnecting Modules in Bays, Compensators, Bends- along with enclosure , conductor , joints and corona shield etc of each type & rating	3 nos of each type
1.3	SF6 gas Pressure Relief Devices, 3 Nos. of each type	2 sets
1.4	SF6 Pressure gauge cum switch OR Density monitors and pressure switch as applicable	10% of total population of each type
1.5	Coupling device for pressure gauge cum switch for connecting Gas handling plant	3 nos of each type
1.6	Rubber Gaskets, "O" Rings and Seals for SF6 gas of each type	10% of total population
1.7	Molecular filter for SF6 gas with filter bags	10% of total weight
1.8	All types of Control Valves for SF6 gas of each type	3 nos of each type
1.9.	SF6 gas	20% of total gas quantity
1.10	Pipe length (Copper or Steel as applicable) for SF6 Circuit of each type(if applicable)	3 nos
1.11	Locking device to keep the Dis-connectors (Isolators) and Earthing switches in close or open position in case of removal of the driving Mechanism	3 nos
1.12	Spare EHV Cable of longest phase of a feeder as applicable (if applicable)	1 Run (1-phase)
1.13	Bushing for dielectric test on the Cable (if applicable)	1 No.
1.14	Spares for local control cabinet including MCB, Fuses, Timers, Aux. relays, Contactor, Push Buttons, Switches, Lamps, Annunciation Windows etc of each type & rating and terminal of each type	2 set
1.15	HV Cable Termination kit of each type (if applicable)	1 no.
1.16	UHF PD Sensors of each type	10% of the total population or

		maximum 5 nos.
1.17	Support Insulator/Gas Barrier of each type	5% of population
1.18	SF6 to air bushing of each type & rating	3 nos.
2.0	**765 kV, 400KV & 220KV,132 KV SF6 CIRCUIT BREAKER:**	
2.1	Complete Circuit Breaker (3 phase unit) of each type & rating complete with interrupter, main circuit, enclosure and Marshalling Box with operating mechanism (with PIR) to enable replacement of any type/rating of CB by spare (as applicable)	1 set
2.2	Complete Circuit Breaker (3 phase unit) of each type & rating complete with interrupter, main circuit, enclosure and Marshalling Box with operating mechanism (without PIR) to enable replacement of any type/rating of CB by spare (as applicable)	1 set
2.3	Fixed, moving and arcing contacts including insulating nozzles 3 Nos. of each type (for Main Chamber & PIR Chamber as applicable)	1 set
2.4	Trip coil assembly with resistor as applicable, 3 Nos. of each type	2 Set
2.5	Closing coil assembly with resistor as applicable, 3 Nos. of each type	2 Set
2.6	Relays, Power contactors, push buttons, timers & MCBs etc of each type and rating	1 set
2.7	Auxiliary switch assembly, 3 Nos. of each type	1 set
2.8	Operation Counter, 3 Nos. of each type 1 No.	1 set
2.9	Windoscope / Observing window, 3 Nos. of each type	1 set
2.10	Spring operated closing mechanism, 3 Nos. of each type, (if applicable)	1 set
2.11	**For Hydraulic Operated Mechanism, if applicable**	
2.11.1	Hydraulic operating mechanism with drive motor, 3 Nos. of each type	1 set
2. 11.2	Ferrules, joints and couplings, 3 Nos. of each type	1 Set
2. 11.3	Hydraulic filter, 3 Nos. of each type	1 Set
2. 11.4	Hose pipe, 3 Nos. of each type	1 Set
2. 11.5	N2 Accumulator, 3 Nos. of each type	1 Set
2. 11.6	Valves 3 Nos. of each type	1 Set
2. 11.7	Pipe length (copper & steel) 3 Nos. of each size & type	1 Set
2. 11.8	Pressure switches 3 Nos. of each type	1 Set
2. 11.9	Pressure gauge with coupling device, 3 Nos. of each type	1 Set
2.11.10	Hydraulic oil	20% of total qty. used

2.11.11	Pressure Relief Device, 3 Nos. of each type	2 Set
2.12	**For Spring Operated Mechanism, if applicable**	
2.12.1	Complete Spring Operating Mechanism including charging mechanism etc, 3 Nos. of each type	1 set
2.12.2	Spring Charging Motor	2 nos.
3.0	**765 kV, 400KV & 220KV,132 KV ISOLATORS** :	
3.1	Complete set of 3 nos. of single phase / one no. of 3-phase dis-connector of each type, dimension, current & voltage rating including main circuit,enclouser, driving mechanism an dsupport Insulator etc to enable replacement of any type/rating of Isolator by spare	1 Set
3.2	3 no. of single phase / one no of 3-phase Maintenance Earthing switch of each type, dimension, current & voltage including main circuit, enclosure, driving mechanism and support Insulator etc to enable replacement of any type/rating of Earth Switch by spare	1 Set
3.3	3 no. of single phase / one no of 3-phase Fast Earthing switch of each type, dimension, current & voltage rating including main circuit, enclosure, driving mechanism and support Insulator etc to enable replacement of any type/rating of Earth Switch by spare (if applicable)	1 Set
3.4	Copper contact fingers for dis-connector male & female contact – for one complete (3 phase) dis-connector of each type and rating	1 Set
3.5	Copper contact fingers for Maintenance Earthing switch male & female contacts, for one complete (3 phase) earthing switch of each type and rating	1 Set
3.6	Copper contact fingers for Fast Earthing switch male & female contacts, for one complete (3 phase) earthing switch of each type and rating (if applicable)	1 Set
3.7	Open / Close contactor assembly, timers, key interlock, interlocking coils, relays, push buttons, indicating lamps Power contactors, resistors, fuses, MCBs & drive control cards etc for one complete MOM box (3 – phase gang operated or 1 – phase unit) dis-connector and (3 phase) earthing switch of each type and rating	
3.7.1	For isolator	3 Sets
3.7.2	For Maintenance Earth switch	3 Sets
3.7.3	For Fast Earthing Switch (if applicable)	3 Sets
3.8	Limit switch and Aux. Switches for complete 3 phase equipment	
3.8.1	For isolator	3 Sets

3.8.2	For Maintenance Earth switch	1 Set
3.8.3	For Fast Earthing Switch (if applicable)	1 Set
3.9	Drive Mechanism of each type	
3.9.1	For isolator	2 Nos.
3.9.2	For Maintenance Earth switch	2 Nos.
3.9.3	For Fast Earthing Switch (if applicable)	2 Nos.
3.10	Motor for Drive Mechanism of each type	
3.10.1	For isolator	3 Nos.
3.10.2	For Maintenance Earth switch	3 Nos.
3.10.3	For Fast Earthing Switch (if applicable)	3 Nos.
4.0	**765, 400KV & 220,132 KV CURRENT TRANSFORMER**	
4.1	Complete CT of each type and rating with enclosure to enable replacement of any type/rating of CT by spare	2 Nos.
5.0	**765, 400KV & 220,132 KV Voltage Transformer**	
5.1	Complete PT of each type and rating with enclosure to enable replacement of any type/rating of VT by spare (if applicable)	1 No.
6.0	**765, 400KV & 220,132 KV SURGE ARRESTOR**	
6.1	Gas insulated LA for of each type and ratings enclosure & surge monitor counter to enable replacement of any type/rating of Gas Insulated LA by spare (if applicable)	2 Nos.
6.2	Surge counter/ monitor of each rating and type	1 No.
7.0	**(for 765, 400KV & 220,132 KV Voltage Class) Oil/ SF6 bushing for Transformer/Reactor as applicable of each rating**	1 No.
8.0	**(for 765, 400KV & 220,132 KV Voltage Class) Oil/Cable Termination kit for Transformer as applicable of each rating**	1 No.
9.0	**Controlled Switching Device along with Transducers, Sensors, Contactors, Switches etc.**	1 set of each make

3. MANDATORY SPARES FOR FIXED SERIES CAPACITOR (FSC) / THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) INSTALLATION

Sl No	Description	Each Make & Type
1.0	**FSC/TCSC elements**	
1.1	Capacitor units(for FSC & TCSC)	20% of total population
1.2	Fibre optic cable with end termination (1 Piece of longest length)	1 No
1.3	Spark Gap assembly comprising of Trigatron, Ignition coil, Trigger Transformer, Transient suppression card, Voltage divider Capacitor of each rating, Connecting HV leads, Forced Trigger pulse generating card as applicable	2 Set
1.4	Damping Resistor elements	10% of total population subject to minimum 1no. of each type
1.5	Current measuring device complete in all respect including terminal connector, fitment, hardware and accessories as applicable	10% of total population subject to minimum 2 nos. of each type
1.6	Voltage measuring device complete in all respect including terminal connector, fitment, hardware and accessories as applicable	1 set
1.7	Electrical to Optical signal converter of each type as applicable	1 set
1.8	400KV Platform to ground signal transmission system cubicle- relay/ module of each type	1 set
1.9	MOV-FSC	10% of the required MJ rating but minimum 2 nos. as hot spare per phase and 1 Set (for one Phase) as cold spare
1.10	MOV-TCSC	10% of the

Sl No	Description	Each Make & Type
		required MJ rating but minimum 2 nos. as hot spare per phase and 1 Set (for one Phase) as cold spare
1.11	**Thyristor Valve (as applicable)**	
1.11.1	Thyristors of each type and rating	5% of Total Population minimum 10Nos.
1.11.2	Surge arrestor/**MOV** of each type and rating	5% of total population
1.11.3	Valve reactor of each type and rating	2 nos.
1.11.4	Snubber capacitors of each type	5% of Total Population minimum 5Nos.
1.11.5	Snubber resistors of each type	5% of Total Population minimum 5Nos.
1.11.6	Grading capacitors/**Resistor** of each type	2 Nos.
1.11.7	Thyristor electronics (PCBs) of each type	5% of Total Population minimum 10Nos.
1.11.8	Corona shield each type	1 Set
1.11.9	Fiber optics with end termination for each function	1 Set
1.11.10	Insulators of each type	1 Set
1.11.11	Fitment, hardware and accessories for 1 module	1 Set
1.11.12	PEX tubes of each type along with couplings and washers	5% of total population
1.11.13	Clamps and connectors of each type	2 Sets
1.11.14	Gate cards**/TE/TVM**	5% of total population
1.11.15	Spare for Valve base electronics	1 Set
1.11.16	Assembly accessories for surge arrestors of each type and rating along with fitment hardware and accessories	2 Sets
1.11.17	Arrestor counter of each type	1 Set
1.12	**Valve cooling equipment spares**	
1.12.1	Set of Valve cooling control devices and modules	1 Set
1.12.2	Set of valve hall ventilation control devices and modules	1 Set
1.12.3	Fitment hardware and accessories	1 Set
1.12.4	Electrically operated Valve of each type	1 No.

Sl No	Description	Each Make & Type
1.12.5	Filter element assembly of each type	1 Set
1.12.6	Pump shaft seal of each type	1 Set
1.12.7	Rings & Gaskets of each type	1 Set
1.12.8	Contactors, relays and timers of each type	1 Set
1.12.9	PLC with configuration software & manual	1 Set
1.12.10	Flow meter & sensor - each type	1 Set
1.12.11	Pressure gauge of each type	1 Set
1.12.12	Temperature sensors of each type	
1.12.13	Conductivity sensors	1 Set
1.12.14	MCCB & MCB of Each type and rating	10% of total population subject to min. 2 nos. of each type & rating
1.12.15	Indicating instruments – each type	1 Set
1.12.16	Switches – each type	1 Set
1.12.17	UPS of each rating	1 Set
1.12.18	Valve of each type and size	2 Sets
1.12.19	Couplings of each type and size	2 Sets
1.12.20	Clamps and fixing material with hardware and accessories	2 Sets
1.12.21	Heat exchanger fan with motor	1 Set
1.12.22	Complete cooling pump with Motor	1 Set
1.12.23	Rubber compensators	1 Set
1.13	Support insulators of each type and rating	10% of total population
1.14	Fibre Optic signal column	2 Set of longest length
1.15	**Erection Hardware**	
1.15.1	Bus Bar material with connectors of each type	2 Sets
1.15.2	Connecting leads with lugs for Capacitor	20 set
1.16	**Breaker Relay Panel**	
1.16.1	Breaker failure relay of each type (as applicable)	1 No.
1.16.2	Trip/ Close circuit supervision relay of each type (as applicable)	1 No.
1.16.3	Self reset trip relay of each type (as applicable)	1 No.
1.16.4	Hand reset trip relay of each type (as applicable)	1 No.
1.16.5	Timer relay of each type (as applicable)	1 No.
1.16.6	DC supervision relays of each type	1 No.

Sl No	Description	Each Make & Type
	(as applicable)	
1.16.7	Flag relays of each type (as applicable)	1 No
1.16.8	Auxiliary relays used in Controller	10% of total population
1.17	**Control Panel Equipment**	
1.17.1	Digital display unit (as applicable) of each type	1 Set
1.17.2	Red, Green, White indicating lamp with complete assembly (as applicable)	5 Set of each colour
1.17.3	Bulbs (for indication lamps) (as applicable)	50 Nos.
1.17.4	Annunciation windows with necessary annunciation relay (as applicable)	6 Nos.
1.17.5	Red, Yellow, Black, Green Push button (as applicable)	1 Set or each colour
1.17.6	Counters for spark gap operation (as applicable)	2 Sets
1.17.7	Control switch of each type	1 Set
1.17.8	Instrument & meter with transducer of each type	1 No.
1.18	**Relay/ interface Panel**	
1.18.1	Relay/ Module/ Electronic card of each type for each type of function	20% of total population with min 2 set
1.18.2	Filters/ transient suppressor of each type	2 set
1.18.3	Numerical Distance protection with configuration software for setting and Programmable scheme logic and connecting cable for front communication to PC	2 set
1.18.4	Disturbance Recorder for FSC comprising of Evaluation & Acquisition unit with software	2 set
1.18.5	Control card of each type including Programmable CPU	20% of total population with min 2 set
1.18.6	If PC based monitoring of Control & Protection system is provided	
1.18.6.1	Data acquisition card each type	1 Set
1.18.6.2	Hardware for PC with CPU, Motherboard, Memory(RAM	1 Set

Sl No	Description	Each Make & Type
	& Hard disk), CD ROM drive, monitor, key board, mouse	
1.18.6.3	Data switch	1 Set
1.18.6.4	If Rack mounted industrial PC is used, Power supply, Motherboard with Memory (RAM & Hard disk), monitor, CD ROM drive, key board, mouse, fan, PCMCIA card	1 Set
1.18.6.5	Transducer of each type	1 Set
1.19	**Testing & Measuring Equipments**	
1.19.1	Control/ Protection logic programming device with necessary software	1 Set
1.19.2	Special tool for making joints and termination of optical fiber with relevant couplers/ termination hardware –each type	1 Set
1.19.3	Optical loss measuring kit with relevant accessories and visual Fiber Optic cable inspection aid	1 Set
1.19.4	Telescopic earthing device with terminal clamps and earthing wire	4 Set
1.19.5	Capacitance meter with all hardware & accessories	1 Set
1.19.6	Thyristor test unit including power and control unit test handle (for TCSC), Oscilloscope with fitments and accessories	1 Set
1.19.7	Set of tools to change thyristors with fitments and accessories (for TCSC)	1 Set
1.19.8	Equipment & set of tools for replacement of thyristor modules (for TCSC)	1 Set
1.19.9	Capacitor lifting device	1 Set
1.19.10	Maintenance tool kit for optical fibers, Controllers, optical test module for Optical CT/ PTs	1 Set
1.19.11	DM water conductivity measurement kit (for TCSC)	1 Set

Sl No	Description	Each Make & Type
1.19.12	Test kit for testing optical CT/PT and Spark gap triggering	1 Set
1.19.13	Test kit for Spark gap triggering with all hardware & accessories	1 Set
1.20	Optical loss measuring kit with relevant accessories	1 Set
2.0	**Circuit Breaker**	
2.1	By pass breaker of each type Pole of each type complete with control cabinet, operating mechanism, terminal connectors and grading capacitor (one of each type) but without supports structure	1 Set
2.1.1	Rubber gaskets, `O' rings and seals of each type	1 Set
2.1.2	Trip coil assembly with resistor	6 Nos.
2.1.3	Closing coil assembly with resistor	6 Nos.
2.1.4	Terminal Pads and connectors of each type	2 Sets
2.1.5	Molecular filter	2 Sets
2.1.6	SF6 Density / pressure gauge monitoring systems	2 Sets
2.1.7	Corona rings	1 Set
2.1.8	Relays, Power contactors, switch fuse units, limit switches of each type	1 Set
2.1.9	Push buttons, timers & MCB of each type	1 Set
2.1.10	Pressure switches	1 Set
2.1.11	Pressure Gauge and coupling	1 Set
2.1.12	Auxiliary switch assembly	1 Set
2.1.13	Operation Counter	1 Set
2.1.14	Control unit	1Set
2.1.15	SF6 gas	40% of requirement
2.1.16	Copper / steel pipe length for one Pole of each type and size	1 Set
2.2	**Pneumatic Operating Mechanism For Individual Compressor Unit (as applicable)**	
2.2.1	Complete compressor assembly	

Sl No	Description	Each Make & Type
	along with motor, accessories & coupling along with regenerating unit (wherever applicable)	1 Set
2.2.2	Micro-filters	1 Set
2.2.3	Coupling for compressed air	1 Set
2.2.4	Valves & reducers	1 Set
2.2.5	Pressure switches	1 Set
2.2.6	Pressure gauges	1 Set
2.2.7	Gaskets 'O' rings & seals	1 Set
2.2.8	Dowty Seal	2 Sets
2.2.9	Safety valve with hardware & accessories	1 Set
2.2.10	Operating drive	1 Set
2.3	**For Hydraulic Operated Mechanism (as applicable)**	
2.3.1	Hydraulic operating mechanism with drive motor	1 Set
2.3.2	Ferrules and joints	1 Set
2.3.3	Hydraulic filter of each type	1 Set
2.3.4	Hose pipe of each type & size	1 Set
2.3.5	N2 Accumulator	1 Set
2.3.6	Pressure transducer	1 Set
2.3.7	Valves of each type & size	1 Set
2.3.8	Pipe length (copper & steel) of each type & size	1 Set
2.3.9	Pressure switches of each type	1 Set
2.3.10	Pressure gauges	1 Set
2.3.11	Hydraulic oil	40% of requirement
3.0	**420 KV ISOLATOR**	
3.1	One complete pole with Earth switch, motor operating mechanism, support Insulator, terminal connector but excluding structure	1 Set
3.2	Support Insulators	6 Set
3.3	Male & female contacts	3 Sets
3.4	Open / Close contactor assembly, timers, solenoid, key interlock etc.	1 Set
3.5	Push button switch	1 Set
3.6	Aux. Switches and limit switches of each type	1 Set
3.7	Motor housing bearing assembly	1 Set
3.8	Terminal Pads and connectors of each	1 Set

Sl No	Description	Each Make & Type
	type	
3.9	Motor with gear assembly – each type	2 Sets
3.10	Corona shield rings	1 No.
3.11	Hinge pins	1 Set
3.12	Bearings	1 Set
3.13	Current carrying assembly	1 Set
3.14	Interlocking coil assembly with resistor	1 Set
3.15	Operating mechanism with drive motor assembly for earth switch	1 Set
3.16	Earth blade for earth switch of each rating	1 Set
3.17	Fixed contact for earth switch of each rating	1 Set
3.18	Auxiliary contact assembly	1 Set
3.19	Set of contactors, relays, limit switch, control switches, solenoid etc. – each type	1 Set

4. MANDATORY SPARES FOR HVDC STATIONS

Sl No	Description	Each Make & Type
1.0	**Thyristor Valve**	
1.1	Complete Thyristor module	1 set per Bipole/BTB
1.2	Thyristors of each type and rating	2% of total population
1.3	Surge arrestor (VH) of each type and rating	2 Sets per Bipole/BTB
1.4	Valve reactor module of each type and rating	2 nos. per Bipole/BTB
1.5	Snubber capacitors of each type	2% of total population
1.6	Snubber resistors of each type	2% of total population
1.7	Grading capacitors of each type	2% of total population
1.8	Thyristor electronics (PCBs) of each type	2% of total population
1.9	Fiber optics with end termination for each function	1 set (with longest FO length) per Bipole/BTB for single tower
1.10	Insulators of each type with fitments, hardware & accessories	5 Nos per Bipole/BTB
1.11	Corona Shield of each type with fitments, hardware & accessories	1 No
1.12	Fitment hardware & accessories for 1 module	1 set per Bipole/BTB
1.13	Cooling tubes with coupling - each type	5% of Population or 2 sets, whichever is higher
1.14	Clamps and connectors of each type	2 Sets
1.15	Gate cards/ TCU/TE	2% of total population
1.16	Spare parts for Valve based electronics	20% of population or minimum 2 no's
1.17	Assembly accessories for surge arrestors of each type and rating	1 set per Bipole/BTB
1.18	Arrestor counter of each type	1 set per Bipole/BTB
1.19	DC voltage divider	1 set per Bipole/BTB
1.20	Valve Hall ground switch	1 set per Bipole/BTB
1.21	Valve module lifting device including service platform with fitment & accessories	1 set per Bipole/BTB

Sl No	Description	Each Make & Type
1.22	Thyristor test unit with accessories	2 Sets
1.23	Set of tools to change Thyristors with all fitments and accessories	2 Sets
1.24	Mobile work platform with all fitments, hardware and accessories	2 Set
1.25	Equipment for replacement of Thyristor module	2 set
1.26	set of spares for Valve Hall maintenance equipment	2 Set
1.27	Optical loss measuring kit with relevant accessories	1 Set
2.0	**Converter transformer**	
2.1	Converter Transformer-1Ph with fitments, hardware, accessories & oil complete in all respect	1 No. of each make and type for existing stations 2 Nos. of each make and type for new stations In case of any requirement of additional Converter Transformer for existing stations, the procurement action should be taken in consultation with Corporate OS
2.2	Spare Oil	20 % of Qty of oil in largest unit
2.3	Bushing of each type & rating with metal parts & gaskets	1 No per Bipole/BTB
2.4	Terminal clamps & connectors, hardware of each type	2 Sets
2.5	Oil cooler pump with motor	3 Nos
2.6	Pressure relief Device	2 Nos per Bipole/BTB
2.7	Buchholz Relay (Main Tank) complete with contacts	2 Nos per Bipole/BTB
2.8	Oil Surge Relay for OLTC	2 Nos

Sl No	Description	Each Make & Type
2.9	Breather assembly for conservator and OLTC	1complete set for one transformer
2.10	Local winding temperature indicator with contact and Sensor	2 Nos.
2.11	Remote winding temperature indicator with sensing device & matching unit	2 Nos.
2.12	Oil temperature indicator with contacts and Sensor	2 Nos.
2.13	Magnetic oil level gauge with float rod	2 Nos.
2.14	Cooler fan with motor	4 Nos per Bipole/BTB
2.15	Set of valves (each type & Size)	2 Nos. per Bipole/BTB
2.16	Fuses & indicating bulbs (for complete replacement for one transformer)	1 Set per Bipole/BTB
2.17	Starters, contactors, switches, MCBs, Timers & relays of each type for Electrical control cabinets	10% of Population
2.18	Remote Tap Position Indicator	1 No. Per Bipole/BTB
2.19	Oil Flow Indicator with flow Switch	2 Sets per Bipole/BTB
2.20	Motor Operating Mechanism assembly for OLTC with all fitments, hardware and accessories	1 No.per Bipole/BTB
2.21	Diverter switch	1 No.per Bipole/BTB
2.22	Oil filter Unit (as applicable for OLTC)	1 Set for each converter Transformer
2.23	Gaskets	1 No. per Bipole/BTB
2.24	Tap changer serviceable parts	1 No. per Bipole/BTB
2.25	Tap changer set of contacts	1 No. per Bipole/BTB
2.26	Tubes, Fittings for assembly	1 No. per Bipole/BTB
2.27	Cooling System Rack (Radiator)	1 No. per Bipole/BTB
2.28	Turret for bushings of each type & rating	1 No. per Bipole/BTB
2.29	Bushing draw rod with copper block	1 No.
2.30	Set of internal corona rings	1 No. per Bipole
2.31	SF6 gas for bushing	2 bottles of 40 kg.
2.32	SF6 gas connection pipe of each type complete with connection	2 Sets

Sl No	Description	Each Make & Type
	hard-wares couplings	
2.33	Air cell	2 Nos.
2.34	Corona Shield of each type	1 No.
2.35	Terminal block for control cubicle	20 Nos.per Bipole/BTB
2.36	Oil tank with sufficient capacity to drain oil of one complete unit with maximum capacity	1 Set
2.37	Hydraulic lifting jack complete with accessories	1 Set per Bipole/BTB
2.38	Set of handling equipment like 4 sheave pullies, sling etc. complete set as per requirement	1 Set per Bipole/BTB
2.39	Movement trolley	1 Set per Bipole/BTB
2.40	Trolley wheels	10% of population
2.41	Special tools for OLTC	1 Set
3.0	**Smoothing Reactor (**Not applicable to BTB**)**	
3.1	DC smoothing Reactor (air core) complete with fitments, hardware & accessories	1 Set per Bipole
3.2	DC smoothing Reactor (oil filled) complete with fitments, hardware & accessories	1 Set
3.3	Bushings for line & valve side of each type with all fitment hardware and accessories, gaskets etc.	1 Set
3.4	Local and remote WTI with contacts and sensing device	1 No.
3.5	OTI with contacts and sensing device	1 No.
3.6	Magnetic Oil level gauge	1 No.
3.7	Pressure relief device	1 No.
3.8	Buchholz relay complete	1 No.
3.9	Breather assembly	1 No.
3.10	Set of valves of each type & Size	1 No.
3.11	Rubber cell & float for conservator	1 No.
3.12	Insulators of each type	4 Sets
4.0	**DC Filter equipment(**Not applicable to BTB**)**	

Sl No	Description	Each Make & Type
4.1	Filter bank Capacitor units of each type with fitment, hardware & accessories	2% of Population
4.2	Filter Bank Reactor unit of each type with fitment, hardware & accessories	2 Sets
4.3	Filter bank resistor unit of each type with fitment, hardware & accessories	2 Sets
4.4	Insulators of each type with fitments, hardware & accessories	6 Sets
4.5	Clamps, connectors and assembly accessories of each type	2 Set
4.6	DC Filter CTs each type	1 Set per Bipole
4.7	DC Neutral surge capacitor	5 Nos
4.8	Surge arrestor of each type and rating with fitment, hardware & accessories and surge counter etc.	1 Set per Bipole
4.9	Assembly accessories for each type of surge arrestors	1 Set
4.10	Set of special tools for Maintenance & replacement of Capacitor units	1 Set
5.0	**DC Voltage Divider** of each type along with electronic unit with fitment, hardware & accessories	1 Set per Bipole
6.0	**DC SWITCHYARD EQUIPMENT (Not applicable to BTB)**	
6.1	DC Bushings of each type	1 Set per Bipole
6.2	AC wall bushings (Applicable for Balia-Bhiwadi HVDC Link)	2 sets
6.3	Dis-connectors of each type with base unit and accessories*	1 Set per Bipole
6.4	Set of clamps, connectors, hardware and insulators of each type & rating*	2 Sets
6.5	Drive mechanism for Dis-connectors	2 Nos.
6.6	Filter switching contacts for Dis-connectors	1 Set per Bipole
6.7	Fitment, hardware & accessories for each type of Dis-connector	1 Set per Bipole
6.8	Grounding switches of each type*	1 Set per Bipole
6.9	Auxiliary contacts for ground switches	1 Set per Bipole

Sl No	Description	Each Make & Type
6.10	Drive mechanism for Grounding switches of each type	2 Set per Bipole
6.11	Relay, contactors and limit switches of each type for Grounding switches	2 Set per Bipole
6.12	Grounding Switch main contacts of each type	2 Set per Bipole
6.13	Contacts for indoor grounding switches	2 Set per Bipole
6.14	Main contacts of indoor grounding switches	2 Set per Bipole
6.15	DC High Speed Switches of each type*	1 Set per Bipole
6.16	Set of spares for DC High speed switches*	1 Set per Bipole
7.0	**AC Filter equipment**	
7.1	Capacitor unit of each type with fitment, Hardware and accessories, terminal connection leads & connectors	2 % of total population (Min-10 Nos & Max-15 Nos)
7.2	Reactor unit of each type with hardware clamp, connectors & accessories	2 Sets
7.3	Resistor unit of each type with fitment, hardware and accessories	2 Sets
7.4	Insulators of each type with hardware clamp, connectors & accessories	2 Sets
7.5	Filter CT of each type and ratio	2 No for population upto 10 . 3 Nos for population more than 10
7.6	Filter CVT of each type and ratio	1 No for population upto 10 . 2 Nos for population more than 10
7.7	Filter Arrestors of each type with fitments, hardware & accessories	2 sets
7.8	Capacitor fuses with barrel (where ever applicable)	10% of population
7.9	Surge Arrester with base, counter, fitment hardware & accessories	2 Set of each type
8.0	**PLC Filter Equipment**	

Sl No	Description	Each Make & Type
8.1	Capacitor units for each type fitments hardware & accessories	2 Sets of each type of capacitor per Bipole/BTB
8.3	Reactor unit of each type Fitments, hardware & accessories	2 Sets per Bipole/BTB
8.4	Tuning Device- each type	2 Sets per Bipole/BTB
9.0	**Valve cooling Equipment**	
9.1	Raw water pump & Motor	1 set per POLE/BLOCK
9.2	Fine water pump & Motor	1 set per POLE/BLOCK
9.3	De-ionising resin for one complete replacement	1 set per POLE/BLOCK
9.4	Non-return Valve-each type & size	
9.5	Make up pump & motor	1 Set per Bipole/BTB
9.6	Fine filter with fitment, hardware and accessories	5 Set per Bipole/BTB
9.7	Coarse filter with fitment, hardware and accessories	5 Set per Bipole/BTB
9.8	De-oxynising resin for one complete replacement	1 Set
9.9	Cooling fan with drive motor, fittings and accessories	10% of population or 5 Nos, whichever is higher
9.10	Biodides	1 lot
9.11	Modules for each type and function of Valve cooling system	1 Set
9.12	Set of valve hall ventilation control devices and modules	1 Set
9.13	Motor operated Valve of each type	10% of population or 2 Nos per Bipole, whichever is higher *
9.14	Pump shaft seal of each type of pump	2 Sets per Bipole/BTB
9.15	Rings & Gaskets of each type	1 Set per Bipole/BTB
9.16	Contactors/ starters, relays, timers, solenoids, fuses, switches, MCBs of each type & rating	10% of population
9.17	PLC with configuration software & manual	1 Set per Bipole/BTB
9.18	Flow meter/ sensor of each type	2 set
9.19	Pressure gauge of each type	2 set

Sl No	Description	Each Make & Type
9.20	Temperature sensors of each type	2 Set
9.21	Conductivity sensors	2 Set per Bipole/BTB
9.22	Indicating instruments of each type	2 set
9.23	Valve of each type and size	2 Sets
9.24	Couplings of various sizes & types	2 Sets
9.25	Clamps and fixing material	2 Sets
9.26	Heat exchanger fan with motor	1 Set
9.27	Chemical Dosing System pump assembly	1 No.
9.28	Pressure transducer of each type	2 No per Bipole/BTB
9.29	Solenoid valves of each size & type	2 No
9.30	Float valve assembly of each type	2 No
9.31	Spray nozzles & Grommets	10 % of population
9.32	Level Switches & Level transducer of each type	2 Set per Bipole/BTB
9.33	Gas pressure regulators of each type	2 No
9.34	Raw Water Skid Pump	1 No.
9.35	Control Transformer of each type	2 No
9.36	Air Pump of each type	1 No.
9.37	Trip amplifier of each type	1 No.
9.38	Set of spares for Cooling Tower	1 Set
9.39	Power supply module	2 Nos
9.40	Heaters	1 No
10	**HVDC Current Measuring Equipment**	
10.1	HVDC Current Measuring Device Shunt Resistor/Optical CT	1 No per Bipole/BTB
10.2	Associated Insulator for outdoor application with accessories for each type of measuring device	1 No per Bipole/BTB
10.3	ZERO FLUX CT as applicable	1 No per Bipole/BTB
10.4	ZFCT Electronics as applicable	1 No per Bipole/BTB
10.5	Surge arrestor with base unit and counter & accessories of each type for filter bus.	1 No per Bipole/BTB
10.6	Reactor/ Line/ Transformer Surge Arrestor	1 No per Bipole/BTB

Sl No	Description	Each Make & Type
11.0	**Control, Protection and Annunciation Equipment spares**	
11.1	Main & Auxiliary relays of each type used for Protection, Control, Supervision and Contact multiplication	10% of population or minimum 2 Nos
11.2	DC Line Fault Locator spares	1 Set
11.3	Interconnecting cable with connector of each type & function	1 No per Bipole
11.4	Set of Protective Relay/ Set of modules of each type for Converter Protection, Converter Transformer Protection, AC Filter Protection, DC Yard Protection, DC Filter Protection, DC Line Protection and Electrode line Protection.	20% of population or minimum 2 Nos
11.5	Work Station Spare Parts	1 Set
11.6	HMI complete workstation with necessary software	1 Set
11.7	Server Hardware & Software (if applicable)	1 Set
11.8	Hard disk of each type	1 Set
11.9	Cards, Relays and contactors for C&P panels or any other items for HVDC Operation (Including Event Logger/PLC)	20% of population
11.10	Set of Modules of each type and function for Control, Protection, Communication, Annunciation, Alarm, Scada & Monitoring including power supply module (Including modules for Mini simulator/valve test equipment/valv e control test equipment/RCI etc)	20% of population (*In case of ABB system, MACH2 computers (Module) minimum 1no.per pole/block or 20% of population whichever is higher*)
11.11	Cards/module for Transient Fault Recorder/ Disturbance Recorder including software (Wherever applicable)	1 set
11.12	LAN Switch each type	2 No
11.13	GPS Time display unit	1 Set
11.14	GPS receiver card & antenna	1 Set

Sl No	Description	Each Make & Type
11.15	Printer of each type along with cartridges	2 Set
11.16	DAT for Work Station	5 Nos.
11.17	Monitor- each type	1 No
11.18	General control and protection hardware spares	1 lot
11.19	Thermostat	1 No.
11.20	Panel space heater	1 No.
12.0	**Spares for Mimic board/VPS**	
12.1	Titles	1 Set
12.2	Display unit accessories	1 Set
12.3	Panel mounted digital/ analog meters of each type	10% of population or minimum 2 nos.
12.4	Semaphore	5% of Population
12.5	Push buttons & control switches	5% of Population
13.0	**Communication Equipment for each terminal & Repeater station**	
13.1	Set of spare cards for carrier equipment - each type	1 Set
13.2	Set of cards for Protection coupler-each type	1 Set
13.3	Set of cards for Data & speech channel	1 Set
13.4	Co-axial cable of single longest length with termination accessories	1 lot
13.5	Coupling device and other outdoor equipment	1 lot
14	**VESDA**	
14.1	VESDA module	2 Nos
14.2	VESDA PSU	2 Nos
14.3	Filters	1 Complete Set, required for one POLE
15.0	**UPS/UMD each type**	1 No
15.1	Thyristors/IGBT	1 No. Of each type
15.2	Bridge	1 No.
15.3	Control, alarm and interface Cards	1 No. Of each type
15.4	DC/DC converter	1 No.
15.5	Contactor Assembly	1 No. Of each type
15.5	Servo Amplifier with brush set	1 No.

Sl No	Description	Each Make & Type
15.6	Cooling Fan	1 No. Of each type
15.7	MCBs	1 No. Of each type
15.8	Fuses	1 No. Of each type
15.9	Battery for UPS/UMD (with 1 No unit cell charger)	10 Nos for population more than or equal to 100 5 Nos for population less than 100
15.10	Terminal connector with bolt & Nuts	10 Nos (Each type)
16.0	**765/420/ 245/ 145 KV SF6 CIRCUIT BREAKER**	
16.1	Complete Pole for each type of CB including operating mechanism, Control cabinet and all accessories but excluding support structure	2 Sets
16.2	Grading Capacitor	3 Nos.
16.2	A set of SF6 pipe with tube mounting	1 Set
16.3	Rubber gaskets, Ó rings and seals of each type	1 Set
16.4	Trip coil assembly with resistor	10% of population (min 3 nos & max 10 no)
16.5	Closing coil assembly with resistor	10% of population (min 3 nos & max 10 no)
16.6	Terminal Pads and connectors of each type	2 Sets
16.7	Molecular Filter	2 Sets
16.8	SF6 Density/ pressure monitoring systems	2 Sets
16.9	Corona rings	1 Set
16.10	Relays, Power contactor, switch fuse units, limit switches of each type and rating	1 Set
16.11	Push buttons, timers & MCB of each type	1 Set
16.12	Pressure switches	1 Set
16.13	Pressure Gauge and coupling	1 Set
16.14	Auxiliary switch assembly	1 Set
16.15	Operation Counter	1 Set

Sl No	Description	Each Make & Type
16.16	Control unit	1 Set
16.17	SF6 gas	40% of the requirement
16.18	**Hydraulic Operating Mechanism (If applicable)**	
16.18.1	Hydraulic operating mechanism with drive motor	2 Sets
16.18.2	Ferrules and joint	1 Set
16.18.3	Hydraulic filter	3 Sets
16.18.4	High pressure hose with mountings	1 Set
16.18.5	Low pressure Hose with mounting	1 Set
16.18.6	N2 Accumulator	2 No
16.18.7	Pressure transducer	1 No.
16.18.8	Valve of each type	1 Set
16.18.9	Pipe length (Copper & steel)	1 Set
16.18.10	Pressure switches	1 Set
16.18.11	Pressure gauges	1 Set
16.18.12	Hydraulic oil	50% spare with main order, ROL-15%, ROQ – 1 year consumption
16.18.13	`O' rings, gaskets and seals	1 Set
16.19	**Spring operated mechanism**	
16.19.1	Closing dash pot	1 Set
16.19.2	Opening dash pot	1 Set
16.19.3	Opening catch gear	1 Set
16.19.4	Closing catch gear	1 Set
16.19.5	Complete spring operating mechanism	1 Set
16.19.6	Spring charging motor	1 No
17	**420 KV ISOLATORS**	
17.1	Complete one isolator(3 Ph) of each type with support Insulator, motor operating mechanism (MOM) and Terminal connector excluding support structure	1 No
17.2	Support Insulators	6 Nos.
17.3	Copper contact fingers for male and female contacts	3 Set
17.4	Open / Close contactor assembly, timers, key interlock	1 Set
17.5	Push button switch	1 Set

Sl No	Description	Each Make & Type
17.6	Limit switch and aux. Switches of each type	1 Set
17.7	Motor housing bearing assembly	1 No.
17.8	Terminals Pads and connectors of each type	2 Sets
17.9	Motor with gear assembly and bevel gear assembly of each type	2 Nos.
17.10	Corona shield rings	3 Nos
17.11	Hinge pins	3 Nos
17.12	Bearings	1 Set
17.13	Isolator Arms with finger contacts and current Current carrying assembly	1 No.
17.14	Interlocking coil assembly with resistor	5 Nos
17.15	Operating mechanism with drive motor assembly for earth switch	1 Set
17.16	Earth blade for earth switch of each rating	1 Set
17.17	Fixed contact for earth switch of each rating	1 Set
17.18	Auxiliary contact assembly	1 Set
17.19	Set of contactors, relay, limit switch, control switches, solenoid etc.	1 Set
17.20	Single earth switch complete used in Filter earthing	1 Set
18	**CURRENT TRANSFORMER**	
18.1	Complete CT with Terminal connector & stool structure	2 Nos. of each rating (Not make) for Population up to 20 nos. 3 Nos. of each rating (Not make) for Population up to 20 nos.
18.2	Primary Terminal Bushing	2 sets
19	**VOLTAGE TRANSFORMER**	
19.1	Complete CVT with Terminal connectors & stool structure	2 Nos. of each rating (Not make) for Population up to 20 nos. 3 Nos. of each rating (Not make) for Population up to 20 nos.

Sl No	Description	Each Make & Type
20	**SURGE ARRESTOR**	
20.1	Complete LA with insulating base and Terminal connector & stool structure	2 Nos. of each rating (Not make) for Population up to 10 nos. 3 Nos. of each rating (Not make) for Population up to 10 nos.
20.2	Surge counter/monitor	10 Nos.
21	AC Bus Post Insulators of each Voltage rating	3 Sets
22	Cable system	
22.1	Cables used in inter & intra panel wiring in Control & Protection cubicles such as ribon cables-each type & size	2 sets
22.2	Optical fiber Cables used in inter panel wiring in Control room in such as ribon cables-each type & size with termination	2 sets
22.3	Optical Cable termination tool & with loss measurement kit	2 sets
22.4	Cables used in SCADA system- each type of inter connection between server, HMI, LAN, GPS, Data switches, printers	2 sets
22.5	Cable of each type for connecting Laptop to diagnostic ports of various Panels including control & Protection, Valve cooling system etc. etc.	2 sets

5. MANDATORY SPARES FOR STATCOM

Sl No	Description	Each Make & Type
1	**STATCOM Valve based on Semiconductor based Power module**	
1.1	STATCOM Valve based on Semiconductor based Power module of each rating and type	10% of each type subject to minimum 10 No.
1.2	Gate control units of each type & rating	5 set
1.3	Optical fiber signal cable to the power module	1 no. of each length and type
1.4	Insulators of each type and rating	5 no. of each type
1.5	Gaskets	1 lot
1.6	Epoxy bolts/nuts of each type	10% of each type
2	**Spare-Modules of C&P, communication, Annunciation, SCADA, DFR, power supply module**	One Set of each type and function.
3	**STATCOM Protection system relay**	1 no. Protection Relay of each type
4	**400 kV bay Protection system**	
4.1	Protection Relay(IED)of each type	1 No.
4.2	Bay Control Unit(IED) of each type	1 No.
5	**STATCOM other equipments**	
5.1	Arrestor across Valve module	2 nos.
5.2	Arrestor across Valve	2 nos.
5.3	Grounding switch contact kit	1 set
5.4	Support porcelain of each type	**4** nos.
5.5	Wall bushing of each type	1 no.
5.6	Bypass Resistor, if applicable	1 no.
5.7	Series Air core reactor	1 no. of each type & rating
5.8	Control cards, fuses, Semiconductor mudules, etc for UPS	1set
6	**Coupling Transformer**	
6.1	420kV bushing with metal parts and Gaskets	1 no.
6.2	MV bushing with metal parts and gaskets	1 no.
6.3	Winding temp. indicator with contacts	1 no.
6.4	Oil temp. indicator with contacts	1 no.
6.5	Pressure relief device/safety valve	1 no.
6.6	Magnetic oil level gauge	1 no.
6.7	Bucholz relay	1 no.

Sl No	Description	Each Make & Type
6.8	Set of gaskets	Complete replacement for 1 transformer
6.9	Set of valves	1 Set
6.10	Set of pressure gauges	1 Set
6.11	Set of pressure switches	1 Set
6.12	Set of hydraulic jacks suitable for lifting coupling transformer.	1 Set
6.13	Nitrogen sealing equipment	**1** Set
6.14	Set of magnetic contactor, switches, fuses relays for electric control panel	1 set
6.15	Insulating Oil	20 % of total oil quantity of one complete 3 phase bank of Coupling Transformer
7	**Filter Bank, If applicable**	
7.1	Capacitor cans	10% of Each type and rating subject to minimum 5 units
7.2	Resistor Element (if applicable)	10 elements of each type and rating
7.3	Reactors	1 nos. of each type and rating
7.4	Arrestor	1 nos. of each type and rating
7.5	Support Insulator	5 nos. of each type and rating
8	**MSC Bank**	
8.1	Capacitor cans	10% of each type and rating subject to minimum 10 units
8.2	Series Reactor (Air Core)	1 nos. of each type and rating
8.3	Support Insulator	5 nos. of each type and rating
9	**MV AC System :**	
9.1	CT's one phase of each type and rating	1 no. of each type and rating
9.2	Surge arrestor	1 no. of each type and rating
9.3	Voltage transformers (single phase)	1 no. of each type and rating

Sl No	Description	Each Make & Type
9.4	Contact kit for grounding switch	1 no. of each type and rating
9.5	Set of contact fingers for isolators for 3ph	1 no. of each type and rating
9.6	Complete 3 phase isolator with operating mechansim	1 no. of each type and rating
9.7	Set of Insulator for above	Complete replacement for two isolator (3 ph)
9.8	Set of relays, power contactors & switch fuses for electrical Control ckt.	Complete replacement for two isolator (3 ph)
9.9	Rotary bearing for isolator	Complete replacement for two isolator (3 ph)
9.10	MV Bus support insulators	10 nos.of each type and rating
9.11	Surge Capacitor	2 nos.
9.12	One set of Spares consisting of following items for MV Circuit Breaker of each type	
9.13	One complete Pole of CB including Interrupter, pole column, with operating mechanism and MB but without support structure.	1 No.
9.14	Rubber gaskets, 0 rings and seals (complete replacement for one breaker)	1 No.
9.15	Trip coil with resistor	2 no
9.16	Closing coils with resistor	1 Sets
9.17	Molecular filter for SF6 Circuit for 1 Pole of CB(If applicable)	2 no
9.18	Terminal pads and connectors	2 no
9.19	Relays, power contactors, switch-fuse units, limit switches, push buttons, timers and MCBs etc as applicable	1 Sets
9.20	Pressure switches, if applicable	1 Sets
9.21	Auxiliary Switch Assembly	1 Sets
9.22	Controlled switching device	1 no
10	**Valve Cooling System :**	
10.1	Fine Water Pump complete with Motor	1 set of each type
10.2	Resin	For one complete replacement
10.3	Pump with motor except covered under serial no. a above	1 no, of each type and rating

Sl No	Description	Each Make & Type
10.3.1	Flex Pipes for complete replacement	1 Set
10.3.2	Gaskets and "0" Ring of each type	1 Set
10.3.3	Fan - unit of Water to air heat exchanger	2 No.
10.3.4	Set of Contactor, MCB, fuses, PLC/Control Card	1 no. of each type & rating.
11	**Fire Protection System**	
11.1	Quartzoid bulb detectors	10 % of population
11.2	Projectors (Merxles)	10 % of population
11.3	Smoke detectors (if applicable)	10 % of population
11.3.1	Heat detectors	10 % of population
11.3.2	Deluge valve	1 set
11.3.3	Isolation valves (each size each type)	1 set
11.3.3	Electrical control panel - Annunciation printed circuits Boards (For solid state annunciation) in the control panel	1 set
11.3.4	Strainer	1 set
11.3.4	Pressure gauge ,	1 No.
12	**220V Batteries**	
12.1	Spare battery cell (of each type)	5 Nos
12.2	Terminal connectors with Bolts & Nuts	10 Nos. (each type)
13	**220V Battery Chargers**	
13.1	Set of Control Cards	1 set
13.2	Set of relays	1 set
13.3	Rectifier transformer	1 No.
13.4	Control transformer	1 No.
13.5	Series inductor	1 No.
13.6	Set of contactor	1 set
13.7	Micro	1 set
13.8	Filter Capacitors	1 set
13.9	Thyristor/ Diode	1 set
13.10	Set of switches	1 set
13.11	Set of wound resistors	1 set
13.12	Potentiometers	1 No.
13.13	Fuses of Thyristor with indicators	6 sets
14	**DG SETS :**	
14.1	Set of filters (Lube oil/ fuel/ Air ckt)	1 set
14.2	Solenoid coil assembly	1 No.
14.3	Self starter assembly	1 No.
14.4	Lub. oil pressure safety control	1 No.

Sl No	Description	Each Make & Type
14.5	High water temperature safety control	1 No.
14.6	AVR (Auto Voltage Regulator)/ AVR card	1 set
15	**LT Switchgear**	
15.1	Air circuit breaker	1 no. of each type and rating
15.2	Tripping coil for above a)	1 no. of each type and rating
15.3	Closing coil for above a).	1 no. of each type and rating
15.4	Current transformer of each rating and class	1 no.
15.5	Relay & contactors of each type and rating	2 nos.
15.6	Circuit breaker control switches	2 nos.
15.7	Potential transformer of each type and rating	1 no.
15.8	LT switches of each type & rating	1 no.
15.9	MCBs of each type and rating	1 no.
15.10	Switch fuse units of each type and rating	1 no.
15.11	Fuses	100%
15.12	Lamps	100%
15.13	Set of Cards/Module for Voltage Stabilizer.	1 set
16	**AIR CONDITIONING & VENTILATION SYSTEM**	
16.1	AC Unit of each type and rating	1 no. .
16.2	Ventilation system motor	1 nos. of each typt
17	**UPS**	
17.1	Set of Control Cards	1 set
17.2	Set of fuses & Switches	1 set
17.3	Spare Battery cell	2 nos
18	**MSR bank**	
18.1	Air core Reactor Coil	1 no. of each type and rating
18.2	Support insulators	5 nos. of each type
18.3	Clamps and connectors	2 nos. of each type and rating
18.4	400 kV IVT-1 phase with Terminal connector	1 no.
19	**420 kV SF6 Circuit Breaker (Without CR)**	
19.1	One complete Pole of CB (each type) including Grading Capacitor, Interrupter,	1 no.

Sl No	Description	Each Make & Type
	pole column, with operating mechanism and MB but without support structure.	
19.2	Grading capacitors(if applicable)	1 set
19.3	Rubber gaskets, 0 rings and seals for SF6 gas(complete replacement for one breaker)	1 no.
19.4	Trip coils with resistor	2 nos
19.5	Closing coils with resistor	1 set
19.6	Molecular filter for SF6 Circuit-for 1 Pole of CB	2 nos
19.7	Terminal pads and connectors	2 nos
20	**40kV CT** (1 Ph with terminal connector)	1 set
21	**400kV Isolators**	1 set
21.1	Complete one isolator(3 Ph) of each type with support Insulator, motor operating mechanism (MOM) and Terminal connector excluding support structure	1 No
21.2	Support Insulators	6 Nos.
21.3	Copper contact fingers for male and female contacts	3 Set
21.4	Open / Close contactor assembly, timers, key interlock	1 Set
21.5	Push button switch	1 Set
21.6	Limit switch and aux. Switches of each type	1 Set
21.7	Motor housing bearing assembly	1 No.
21.8	Terminals Pads and connectors of each type	1 Set
21.9	Motor with gear assembly and bevel gear assembly of each type	1 Set
21.10	Corona shield rings	1 Set
21.11	Hinge pins	1 Set
21.12	Bearings	1 Set
21.13	Isolator Arms with finger contacts and current Current carrying assembly	1 Set
21.14	Interlocking coil assembly with resistor	1 Set
21.15	Operating mechanism with drive motor assembly for earth switch	1 Set
21.16	Earth blade for earth switch of each rating	1 Set
21.17	Fixed contact for earth switch of each rating	1 Set
21.18	Auxiliary contact assembly	1 Set
21.19	Set of contactors, relay, limit switch, control switches, solenoid etc.	1 Set

Sl No	Description	Each Make & Type
21.20	Single earth switch complete used in Filter earthing	1 Set

6. MANDATORY SPARES FOR FAULT CURRENT LIMITER

Sl No	Description	Quantity (in a State)
1.0	**Fault Current Limiter**	1 complete set for each voltage rating installed in any substation/switchyard in the particular State

7. MANDATORY SPARES FOR SUB-STATION AUTOMATION SYSTEM

S.No	Description	Quantity of Each make and Type	
		Substation	State wise Store
1	SAS server PC, Gateway PC/Standalone Gateway along with software of each type		
2	SMPS used for Master station, HMI, Printer server (each		
3	Fan assembly used for Master station, HMI, Printer server (each type)	1 Set	
4	Bay control unit of each type with configuration software	2 Set	
5	Auxiliary relays used in bay control unit for control applications	10% of population	
6	F O patch card of each type	5 sets	
7	OFC cable	500 meter	
8	Special tool for making joints and termination of optical fiber with relevant couplers of each type	1 Set	
9	Optical loss measuring kit with relevant accessories and visual Fiber Optic cable inspection aid for optical fibre cable	1 Set	
10	Industrial Ethernet switch of each type	1 set	

8. MANDATORY SPARES FOR TRANSMISSION LINES

1.0 Norms of spare tower for 66 kV upto 400 kV voltage level transmission lines

1.1 Mandatory Spares for 66 kV upto 400 kV voltage level Single Circuit Transmission lines which have standard design towers:

Following 66 kV upto 400 kV voltage level *standard design* spare towers of each wind zone, if single circuit transmission lines (of the utility) in that particular wind zone are in operation/under construction, shall be maintained by the Utility:

Table 1

Type of tower	Standard	Extensions for towers				
		+3 M	+6 M	+9 M	+18 M	+25 M
A	5 Nos	1 No.	1 No.	1 No.	1 No.	1 No.
B	1 No.	1 No.	1 No.	1 No.	1 No.	1 No.
C	1 No.	1 No.	1 No.	1 No.	1 No.	1 No.
D	1 No.	1 No.	1 No.	1 No.	1 No.	1 No.

Note – The spare extensions shall be maintained by the utility if the utility has transmission lines with such extensions.

1.2 Mandatory Spares for 66 kV upto 400 kV voltage level Double circuit lines which have standard design towers:

Following 66 kV upto 400 kV voltage level Double Circuit *Standard design* towers for each wind zone, if double circuit transmission lines (of the utility) in that particular wind zone are in operation/under construction, shall be maintained by the Utility:

Table 2

Type of tower	Standard	Extensions for towers						
		+3 M	+6 M	+9 M	+18 M	+25 M	+30 M	Special type (negative, unequal etc.)
DA	5 Nos.	1 No.	1 No.	1 No.	1 No.	1 No.	--	1 No.
DB	1 No.	1 No.	1 No.	1 No.	1 No.	1 No.	--	1 No.

DC	1 No.	1 No.	1 No.	1 No.	1 No.	1 No.	--	1 No.
DD	1 No.	1 No.	1 No.	1 No.	1 No.	1 No.	1 No.	1 No.

Note – The spare extensions shall be maintained by the utility if the utility has transmission lines with such extensions.

2.0 Mandatory Spare towers for lines which have history of failure during last 5 years but are not standard design towers:

To facilitate rapid restoration of collapsed towers of transmission lines which have the history of failure of towers during last 5 years but are not standard design towers, following quantity of spare towers along with their extensions, stubs, cleats and stub setting templates are to be kept:

Table 3

Type of tower to be kept as spare if history of failure during last 5 years	Standard towers	Used Extensions
Suspension towers with stub and cleats	5 Nos.	1 set of each type
Tension towers with stub and cleats	1 No.	1 set of each type
Stub setting Template for each type suspension towers		3 sets
Stub setting Template for each type tension towers		1 set each

3.0 Mandatory Spare towers for high capacity lines like 765 kV, 500 kV HVDC, 800 kV HVDC, 400 kV Quad bundle line, 400 kV lines having conductor other than Moose and of special design having ice loading etc.:

Following *standard design* spare towers will be kept by the utility for each design/wind zone, if such transmission line towers (of the utility) in that particular wind zone are in operation/under construction:

Table 4

Type of tower	Standard	Extensions* for towers					
		+3 M	+6 M	+9 M	+18 M	+25 M	Special type (negative, unequal etc.)
Suspension towers with stub and cleats	5 Nos.	1 No.	1 No.	1 No.	1No.	1 No.	1 No.
Tension towers with	1No.	1No.	1No.	1No.	1No.	1No.	1 No.

stub and cleats							
Stub setting Template for each type suspension towers- 3 sets							
Stub setting Template for each type tension towers- 1 set each							

* - The extensions indicated above need to be assessed by the utility depending upon actual population and revised accordingly.

4.0 Mandatory Spares for multi circuit towers (i.e. more than two circuits):

Following *standard design* multi circuit spare towers will be kept by the utility for each design/wind zone, if such transmission line towers (of the utility) of that particular wind zone are in operation/under construction:

Table 5

Type of tower	**Standard**	Extensions				
		+3 M	**+6 M**	**+9 M**	**+18 M**	**+25 M**
Suspension towers with stub and cleats	5 Nos.	1No.	1No.	1No.	1No.	1No.
Tension towers with stub and cleats	1No.	1No.	1No.	1No.	1No.	1No.
Stub setting Template for each type suspension towers- 3 sets						
Stub setting Template for each type tension towers- 1 set each						

5.0 Transmission line material/Tower accessories/Templates in State Stores:

Following transmission line material, as applicable, will be kept by the utility:

Table 6

Name of Material	**Unit**	**Quantity**
Stubs & cleats for 66 kV upto 400 kV voltage level standard design suspension towers for each wind zones (A & DA)	Set	5 for each type
Stubs & cleats for 66 kV upto 400 kV voltage level standard design tension towers for each wind zones (B & DB, C & DC, D & DD)	Set	1 for each type
Stubs setting templates for 66 kV upto 400 kV voltage level standard design towers for each wind zones (A & DA)	Set	3 for each type
Stubs setting templates for 66 kV upto 400 kV voltage level standard design towers for each wind zones (B & DB, C & DC, D & DD)	Set	1 for each type
ERS suitable for transmission line up to 400 kV twin bundle	Set	As per Annexure-D.
ERS suitable for 765 kV/ 500 kV HVDC/ 800 kV HVDC/ 400 kV Quad Bundle (in States having such system)	Set	
Galvanized steel sections for replacement of missing members	To be decided by the utility	

Anti-theft Galvanized nut bolts & washers of various length	To be decided by the utility	
OPGW	To be decided by the utility	
7 X 3.66 mm GS Earth wire	Km	5
7 X 3.15 mm GS Earth wire (for 132 kV/ 220 kV lines)	Km	2
7 X 4.50 mm GS Earth wire(for 800 kV HVDC lines)	Km	4
Conductor		
ACSR Moose conductor	Km	15
ACSR Zebra conductor (for 220 kV lines)	Km	6
ACSR Zebra conductor (for 765 kV D/C lines)	Km	35
ACSR Panther conductor	Km	6
ACSR Dog conductor	Km	6
ACSR Bersimis conductor	Km	18
ACSR Snowbird conductor	Km	18
ACSR lapwing Conductor	Km	18
Other special type of conductor like AAAC INVAR, HTLS etc.	Km	15

Note - For transmission line material, the number of insulator discs and hardware fittings & accessories shall be maintained by the utility in adequate quantity commensurate for a total specified conductor length considering worst case scenario.

6.0 Mandatory spare for HTLS conductor transmission lines, as applicable :

Name of Material	Unit	For D/C Lines having length less than 20 kms.	For D/C Lines having length more than 20 kms.
HTLS Conductor of each type	kms	5 kms. or 10% of used conductor length whichever is more	40kms. or 10% of used conductor length whichever is less
Suspension clamps	Nos.	12	60
Tension clamps	Nos.	12	48
Pilot suspension clamps	Nos.	6	12
Spacer/ spacer-dampers	Nos.	250	500
Repair sleeves	Nos.	25	50
Mid span joints	Nos.	25	50
Vibration Dampers(if used)	Nos.	40	150
Rigid spacers for jumper	Nos.	40	40

File No.CEA-PS-14-77/3/2018-PSETD Division

Annexure-C

सत्यमेव जयते

भारत सरकार / Government of India

विद्युत मंत्रालय / Ministry of Power

केन्द्रीय विद्युत प्राधिकरण / Central Electricity Authority

विद्युत प्रणाली अभियांत्रिकी एवं प्रौद्योगिकी विकास प्रभाग

Power System Engineering & Technology Development Division

3rd Floor, Sewa Bhawan, R.K.Puram, New Delhi-66

Ph: 011-26732349; Email: faraz@nic.in

To,
As per List.

विषय: Directions of the Hon'ble Minister of State (IC) for Power, New & Renewable Energy regarding availability of spares and inventory management with the power utilities – Minutes of the Meeting held on 16.09.2019 in CEA, Sewa Bhawan, New Delhi to discuss methodology/modalities regarding.

सन्दर्भ: Meeting held on 01.08.2019 under the Chairmanship of the Hon'ble MoSP (I/c) for Power, New & Renewable Energy

Sir/Madam,

Your kind attention is invited to the Reference Meeting taken by Hon'ble MoSP (I/c) for Power, New & Renewable Energy on Crisis and Disaster Management Plan for Power Sector. Point No. 7 of the Minutes of said Meeting states:

> *Hon'ble Minister raised the concern of delays observed in arranging spares/restoration equipment during an eventuality and therefore, there is an urgent need to reduce the overall response time for this. He directed CEA to take up the issue of availability of spares and inventory management with the power utilities. He suggested for preparing standardized inventory lists of the minimum spares requirement specific for similar kind of power establishments and setting up a monitoring mechanism for ensuring its compliance. He also directed for ensuring mandatory digitization of spare management by all the power utilities.*

2. In this regard, a meeting was convened by CEA on 16.09.2019 under the Chairmanship of Chief Engineer, PSE&TD Division, CEA to discuss the methodology/modalities for abiding by the said direction of the Hon'ble MoSP. The Minutes of the said meeting are enclosed herewith for kind information.

3. As per the directions of Hon'ble MoSP, it is requested that spares management may be *mandatorily* digitized by the Utility and information of such digitization may be provided to CEA forthwith for record.

4. In light of the above, it is requested that the following additional information may be furnished to this Office at the earliest:
   a) List of EHV Sub-stations with complete technical details.
   b) Inventory of disaster/crisis emergency spares. List of the following equipment, available as spare, may be furnished:
      i. Power Transformers & Reactors
      ii. Circuit Breakers & Isolators
      iii. Current Transformers & Voltage Transformers/Capacitor Voltage Transformers
      iv. Surge Arrestors, Wave Trap
      v. Bus Post Insulators, Insulators, Conductor, Structure
   c) Complete list of EHV transmission lines with technical details.
   d) Complete list of spares (transmission line wise) of following transmission line material being maintained by the Utility as on date for each transmission line:
      i. Tower material
      ii. Conductors, Insulators
      iii. Earth Wires/OPGW
      iv. Hardware accessories
   e) The current methodology (in detail) employed by the Utility in arriving at the number/quantity of the whole unit spares for the substation/switchyard equipment and transmission line material mentioned at Points 4.b and 4.d above.
   f) Details of Emergency Restoration System (ERS) available with the Utility for employment in case of a transmission line failure.
   g) Status of digitization and details of software used in keeping disaster/crisis emergency spares for utility as a whole.
   h) Any other relevant information.

5. As the issue pertains to the direction of Hon'ble Minister of State (IC) for Power, New & Renewable Energy, you are requested to kindly nominate the concerned senior officer not below the rank of Executive Director, who shall be responsible for implementing the directions of the Hon'ble MoSP and shall also be a Nodal point for communication. Details of nominated officer like address, landline & fax numbers, mobile number and official e-mail ID may kindly be furnished by return mail.

6. The desired information as sought in item 3 & 4 above may please be furnished before 10th October 2019, as it is constantly being monitored by MoP.

फ़राज़
20/09/19

(फ़राज़)

उप निदेशक

Copy for information to:

1. Shri D. Guha, Under Secretary (OM), Ministry of Power, Shram Shakti Bhawan, Rafi Marg, New Delhi-110001
2. Chief Engineer (PSLF Division), CEA

MINUTES OF THE MEETING TO DISCUSS THE METHODOLOGY/MODALITIES FOR IMPLEMENTING AVAILABILITY OF SPARES & INVENTORY MANAGEMENT WITH THE POWER UTILITIES

The list of Participants is enclosed as **Annexure-1.**

Shri Sanjay Srivastava, Chief engineer, PSE&TD Division, CEA welcomed the participants. He gave a brief background of the purpose of the meeting. He informed that a meeting was held on 1.8.2019 under the Chairmanship of the Hon'ble MoSP (I/c) for Power, New & Renewable Energy and read Point No. 7 of the Minutes of said Meeting for information of the participants:

> *Hon'ble Minister raised the concern of delays observed in arranging spares/restoration equipment during an eventuality and therefore, there is an urgent need to reduce the overall response time for this. He directed CEA to take up the issue of availability of spares and inventory management with the power utilities. He suggested for preparing standardized inventory lists of the minimum spares requirement specific for similar kind of power establishments and setting up a monitoring mechanism for ensuring its compliance. He also directed for ensuring mandatory digitization of spare management by all the power utilities.*

He mentioned that in order to discuss the methodology/modalities to proceed with the directions of the Hon'ble MoSP (I/c), it was decided to call this meeting. It was further stated that the purpose is to have a standard inventory of 'Disaster Emergency Spares' for each utility, which could also be pooled in cases of disaster/crisis.

Director (PSE&TD) opined that during disaster complete equipment is most likely to be damaged, the 'Emergency Spares' would be complete unit of the equipment instead of spare parts of the equipment which is required for replacement in a natural disaster or similar eventuality. Thus, quantity of whole unit spares of equipment to be maintained for substations and transmission-lines would be determined by the inventory of 'Emergency Spares' to be standardized by CEA.

The participants gave their view point and the outcome of discussions is summarized hereunder:

PGCIL submitted the following:

1. PGCIL welcomed the suggestion for a standardized inventory of 'Emergency Spares'. It informed that it has standardized inventory of general spares for substations and transmission lines, and submitted a hard copy of the same. The quantity of spares maintained by PGCIL for an equipment depends on the population of total number of units of the equipment available at the substation. Further, PGCIL maintains spares at substation level, regional level and national level. It further submitted that except circuit breakers and isolators, any equipment of one make in a substation/transmission-line is replaceable with the same equipment of a different make with minor/no modifications.
2. It maintains make-wise spares for installed equipment in its substations/transmission-lines. It added that it is not possible to restore the supply through use of Emergency Restoration Systems in case of large number of consecutive tower failures in a single transmission line.

3. PGCIL has already digitized its general spares inventory in SAP software. The quantity of spares is being maintained as per CERC norms.
4. PGCIL suggested that 'Pooling of Emergency Spares' may be done at national-level so that these spares may be provided to needy State/utility for faster restoration of supply but added that the same may not be helpful in replacement of failed towers due to wide variations in tower designs utility-wise and state-wise.

DTL submitted the following:

1. DTL has not suffered much from natural disasters since 2014 affecting its supply as Delhi is not so prone to natural disasters.
2. It maintains general spare parts at substation level and at State level. Further, the quantity of spares for an equipment is decided from its last two years' consumption.
3. DTL has digitized its general spares in SAP software.
4. DTL supported PGCIL's 'Pooling' suggestion but added that inter-state transfers of equipment would be GST applicable (@ 18% as per present rate of GST) and thus, would be quite expensive. PGCIL concurred with the submission.

OPTCL submitted that it has not yet digitized its general spares.

M/s Adani Transmission Ltd. stated that it will provide shortly its written submission to CEA after internal consultation.

M/s Sterlite Power Transmission Ltd. informed that it keeps 1% (one percent) spares (equipment's quantity wise) in TBCB projects under its execution. It agreed to provide CEA list of the maintained spares.

Based on the discussions, Chief Engineer(PSETD) made the following conclusions:

1. *CEA will request the Utilities to provide complete list of i) EHV substation & transmission-lines, ii) criteria being followed by utilities to arrive at quantity for 'disaster/crisis emergency spares', iii) location of spares at sub-station level, regional level and central level.*

2. *To standardize the disaster/crisis emergency spares, the following equipment were identified:*

Sl. No.	***Substation Equipment***	***Transmission-line Equipment***
i.	*Power Transformers*	*Tower material*
ii.	*Reactors*	*Conductors*
iii.	*Circuit Breakers*	*Insulators*
iv.	*Isolators*	*Earth Wires/OPGW*
v.	*Current Transformers*	*Hardware accessories*
vi.	*Voltage Transformers/Capacitive Voltage Transformers*	
vii.	*Surge Arrestors*	
viii.	*Wave Trap*	
ix.	*Bus Post Insulators*	
x.	*Insulators*	
xi.	*Conductor*	
xii.	*Structure*	

Any addition / deletion to the above list could be made consequent to inputs received from utilities.

3. *Pooling of 'Disaster Emergency Spares' could be made at National level as equipment are mostly interchangeable except breakers, isolators & transmission line towers.*

4. *As tower designs are not standardized, there is an issue of replaceability of EHV transmission towers. This issue needs immediate attention and standardization of tower designs needs to be explored.*

5. *To ease the movement during disaster/crisis, the Government shall be requested to relax GST requirement in case of transfer of spares from one place to another for emergency restoration.*

6. *All utilities shall carry out mandatory digitization of the spares (in a specific format as shall be decided by CEA in consultation with utilities) so that availability of the spares at any point of time could be ensured. A designated Central Organization shall compile and monitor the spare position on quarterly/half yearly basis.*

The meeting ended with thanks to the Chair.

Annexure –I

List of Participants:

CEA:

1. Shri Sanjay Srivastava, Chief Engineer **In the Chair**
2. Shri Y. K. Swarnkar, Director
3. Shri Bhanwar Singh Meena, Deputy Director
4. Shri Faraz, Deputy Director
5. Shri Mohit Mudgal, Assistant Director
6. Ms. Bhaavya Pandey, Assistant Director
7. Shri Anand Kumar, Senior Manager
8. Ms. Sippy Srivastava, Engineer

PGCIL:

1. Shri R. K. Tyagi, Chief General Manager
2. Shri Manoj Kumar Singh, General Manager (AM)

M/s Sterlite Power Transmission Ltd.:

1. Shri Tan Reddy, Vice President
2. Shri Rohit Gera, Dy. Manager

DTL:

1. Shri V. Venugopal, General Manager (O&M-II)
2. Shri Om Prakash Meena

OPTCL:

1. Shri S.R. Sarangi, Liaison Officer

M/s Adani Transmission Ltd.

1. Shri Praveen Tamak

Type text here

Annexure-D

प्रदीप कुमार सिन्हा
सचिव
भारत सरकार
PRADEEP K. SINHA
Secretary
Government of India

सत्यमेव जयते

Ministry of Power
Shram Shakti Bhawan
New Delhi - 110001

विद्युत मंत्रालय
श्रम शक्ति भवन
नई दिल्ली–110001
Tele : 23710271/23711316
Fax : 23721487
E-mail : secy-power@nic.in

D.O. No.20/6/2014-OM

05.12.2014

Dear Shri Negi,

As you are aware, India has one of the largest A.C. Synchronous Transmission Grids in the world with more than 3 lakhs circuit kms of 220kV and above lines which form the backbone of the Indian Power System.

2. However, this huge network needs to be operated in a sustained and secure manner, particularly, during the time of natural disasters. Failure to do so leads to severe constraints not only in meeting the power demand but also poses serious problems in maintaining safety and security of the Grid. Difficult situations came to light in the wake of recent natural disasters, such as, floods in J&K and Phailin as well as Hud-Hud cyclone in Odisha and Andhra Pradesh. These disasters caused extensive damage to transmission networks resulting in wide spread disruption of many important transmission links and substations affecting power supply for long periods due to the time taken in restoration.

3. You would appreciate that under such adverse situations, the availability of an effective mechanism for emergent restoration of transmission lines in the shortest possible time is of utmost importance. Immediate and temporary restoration of transmission networks is possible by deploying the "Emergency Restoration Systems (ERS)." Grid Standards notified by the Central Electricity Authority(CEA) stipulate that every Transmission Licensee shall have an arrangement for restoration of transmission lines of at least 220kV and above through the use of ERS. However, presently the States do not possess such ERS infrastructure. Consequently, POWERGRID becomes the last resort whose ERS infrastructure is also limited.

4. Therefore, deployment of adequate ERS infrastructure with the States is necessary. In this connection, CEA had recently convened a meeting of the representatives from State Utilities, CTUs and RPCs to deliberate and review their preparedness to effectively restore transmission networks in times of emergency. Based on the inputs received, an indicative requirement of ERS for States has been assessed which is at Annex-I. Further, CEA has also formulated guidelines for planning, deployment and procurement of such ERS infrastructure (Annex-II).

5. I would, therefore, request you to please issue necessary directives to Transmission Utilities/ Transmission licensees operating in your State to take stock, procure appropriate number of ERS infrastructure and place them at strategic locations. Action taken by the Utilities in this regard may be informed to the CEA and the Ministry of Power, at the earliest.

With regards,

Yours sincerely,

(Pradeep K. Sinha)

Encl : as above

Shri Ramesh Negi
Chief Secretary
Govt of **Arunachal Pradesh**
Itanagar

Dist:- As per list attached.

RIGHT TO INFORMATION

स्वच्छ भारत
एक कदम स्वच्छता की ओर

ANNEX-I

Availability and Proposed Plan for deployment of ERS

Sl. No.	Region	State Utilities / PGCIL	Availability of ERS sets	Additional ERS set to be procured	Remark
I	Northern Region				
	PGCIL	NR1	3	1	
		NR2	1		
	1	Haryana	-	1	
	2	HP	-	1	Hilly terrain
	3	J&K	-	1	-do-
	4	Punjab	-	2	
	5	Rajsthan	-	3	
	6	Uttar Pradesh	-	3	
	7	Uttarakhand	-	1	
	8	Chandigarh	-	-	
	9	Delhi	-	1	DTL is procuring 2 ERS sets
	10	POWERLINKS	2		1 set each is located in NR and ER; each setting is having 14 towers of 400 kV
	Total		6	14	
II	Western Region				
	PGCIL	WR1	2	1	
		WR2	2		
	10	Gujarat	-	3	

	11	MP	1	2	
	12	Chhattisgarh	-		
	13	Maharashtra	2	2	
	14	Goa	-	1	
	15	D&NH	-	-	
	16	Daman& Diu	-	-	
	Total		7	9	
III	Southern Region				
	PGCIL	SR1	1	2	
		SR2	1		
	17	AP	-	3	(To be located at Vishakahapatnam, Vijawada, Nellore)
	18	Telengana	-	1	
	19	Karnataka	-	2	
	20	Kerala	-	1	
	21	Tamil Nadu	-	2	
	22	Lakshadweep	-	-	
	23	Puducherry	-	-	
	Total		2	11	
IV	Eastern Region	PGCIL			
	PGCIL	ER1	1	-	
		ER2	2		
	24	Bihar	2	2	
	25	Jharkhand	-	1	
	26	Orissa	3	2(comprising of 12 nos. of 400kV towers which is in the process of procurement)	Existing ERS located at Bhubaneswar, Chatrapur and Budhipada (each with 14 ERS towers)
	27	West Bengal	-	2	
	28	DVC	-	1	

	29	A&N Island	-	-	
	30	Sikkim	-	-	
	Total		8	8	
V	North Eastern Region		-		
	PGCIL	NER	1		
	31	Assam	4	2	
	32	Manipur	-		
	33	Meghalaya	-		
	34	Nagaland	-		
	35	Tripura	-		
	36	Ar. Pradesh	-		
	37	Mizoram	-		
	Total		5	2	
	Total All India		28	44	

Note: POWERGRID has informed that they are procuring 6 additional sets of ERS for different regions.

Strategy adopted

1. The primary criterion for deciding number of ERS to be arranged by a transmission utility has to be the length of transmission line (ckt-kms) at different voltage levels (e.g 220 kV, 400 kV, 765 kV and +/- 500kV HVDC). Other factors to be taken into account while deciding the number of ERS are

   - Importance of the line considering security of Grid
   - Areas prone to tower failure and failure pattern in different areas
   - Command area of the transmission utility and transportability across the command area

2. For any transmission utility, one set of ERS has been planned to cater to failure of towers for transmission line lengths of up to 5000 Ckt. Kms.. Accordingly, two (2) sets of ERS have been planned for transmission line lengths of about 5000 to 10,000 Ckt. Kms. and three (3) sets for more than 10,000 Ckt. Kms and so on.

3. The transmission Utility with line length less than 500 ckt kms (of 400kV lines) may be given option either to procure ERS or have agreement with other transmission utilities for providing ERS on mutually agreed terms, when need arises.

ANNEX-II

GUIDELINES FOR PLANNING, PROCUREMENT AND DEPLOYMENT OF EMERGENCY RESTORATION SYSTEM (ERS)

1. One set of ERS should include all accessories [structures (Aluminum Alloy), polymer insulators & hardware, anchor assembly, guy wires, foundation plates, guy plate, other equipment & fittings, special Tools & Plants required for erection & stringing of ERS and trailer mounted detachable containers (without engine) for storage & transportation of ERS hardware / material etc.] and associated software.

2. One set of ERS shall be capable of restoring few numbers of suspension towers and tension towers of the transmission line corresponding to the highest transmission voltage in operation in the utility with required type of conductors. The same ERS can be used for lower voltage lines as well. The number of suspension, tension towers, insulators and associated hardware etc., to be included under one set of ERS, may be decided by the utilities at the time of procurement depending on their requirement.

3. Proper management of ERS and training of personnel for erection of towers on ERS and use of associated software is essential. A dedicated and specialized erection & commissioning gang, which is properly trained to execute such work, would be required.

4. ERS should be utilized only for emergency purposes and the line should be restored on normal towers as early as possible. It should not be a practice to run transmission line on ERS for a long time instead of shifting to normal towers. Moreover, ERS should not be used in new lines under construction. Otherwise, the very purpose of ERS will be defeated.

5. The deployment of ERS by any transmission utility / licensee should be reported to concerned RLDC and RPC.

6. The transmission utilities may approach Appropriate Commission for approval and initiate procurement process on urgent basis to comply with Grid Standards. Utilities may also approach State Disaster Management Authorities for funding.

7. The funding for procurement of ERS could be considered from PSDF for North Eastern States and a proposal be submitted by Member Secretary, NERPC.

Annex

List of Chief Secretaries of State and UTs

S. No.	State	Name and Address	Telephone/ Fax/Email
1.	Andhra Pradesh	Shri I.Y.R. Krishna Rao Chief Secretary Government of Andhra Pradesh, Secretariat, Hyderabad-500022	Tel: 040-23453620 040-23455340 Fax: 040-040-23453700, 23451133, 23451144
2.	Arunachal Pradesh	Shri Ramesh Negi Chief Secretary & Principal Secretary (Relief & Rehabilitation & Disaster Management) Arunachal Pradesh Civil Secretariat, Government of Arunachal Pradesh, Itanagar- 791 111	Tel: 0360-2212595 Fax: 0360-2212446, 2215719 M: 9436040035
3.	Assam	Shri Jitesh Khosla Chief Secretary Government of Assam, Assam Sachivalaya, Block C, 3rd Floor, Dispur, Guwahati-781006	Tel: 0361-2261120, 2261403 Fax:-0361-2260900
4.	Bihar	Shri Anjani Kumar Singh Chief Secretary Government of Bihar Old Secretariat, Patna-800015	Tel: 0612-2215804 Fax: 0612-2217085
5.	Chattisgarh	Sh. Vivek Kumar Dhand Chief Secretary Government of Chattisgarh, DKS Bhawan, Mantralaya, Raipur-492001	Tel: 0771-2221207/8 Fax: 0771-2221206
6.	Goa	Shri R.K. Srivastava Chief Secretary Govt. of Goa Secretariat Porvorim	Tel: 0832-2419402 Fax: 0832-2415201
7.	Gujarat	Shri D.J. Pandian Chief Secretary Government of Gujarat New Sachivalaya Gandhingar-382010	Tel: 079-23220372, 079-23250301-3 Fax: 079-23250305
8.	Haryana	Shri. P.K. Gupta Chief Secretary Government of Haryana, Room No.-4, 4th floor, Harayana, Civil Secretariat, Sector-1, Chandigarh-160009	Tel: 0172-2740118 Fax: 0172-2740317
9.	Himachal Pradesh	Shri P. Mitra Chief Secretary Government of Himachal Pradesh Secretariat, Shimla- 171002	Tel: 0177-2621022 Fax: 0177-2621813

10.	Jammu & Kashmir	Sh. Mohammad Iqbal Khandey Chief Secretary Government of J &K Jammu Secretariat, Jammu	Tel: 0191-2546773, 2544338 (Jammu) Fax: 0191-2546188
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12.	Karnataka	Shri Kaushik Mukherjee Chief Secretary Government of Karnataka 3rd Floor, R. No. 320, Vidhan Sauda, Secretariat, Bangalore-560001	Tel: 080-22252442, 22092476 Fax: 080-22258913
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14.	Madhya Pradesh	Shri Anthony J C Desa Chief Secretary Government of Madhya Pradesh Mantralaya, Vallabh Bhawan, Bhopal-462004	Tel: 0755-2441370, 2441848 Fax: 0755-2441521
15.	Maharashtra dscsoffice @gmail.com	Shri Swadheen S Kshatriya Chief Secretary Government of Maharashtra Mantralaya, Mumbai-400032	Tel: 022-22852626 22025042,22028762 22793762 Fax: 022-22028594
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18.	Mizoram	Shri Lalmalsawma Chief Secretary Government of Mizoram, Block C, Civil Secretariat, Aizwal- 796001	Tel: 0389-2322411 Fax: 0389-2322745
19.	Nagaland	Shri M.T. Aier Chief Secretary Government of Nagaland Nagaland Civil Secretariat, Kohima-790001	Tel: 0370-2270082, 2270076 Fax: 0370-2270057
20.	Orissa	Shri Gokul Chandra Pati Chief Secretary Government of Orissa Secretariat, Bhubaneshwar- 751001	Tel: 0674-2534300, 2536700 Fax: 0674-2536660
21.	Punjab	Shri Sarvesh Kaushal Chief Secretary Government of Punjab Punjab Secretariat, Chandigarh-160017	Tel: 0172-2740156, 2740860 Fax: 0172-2742488, 2740936

22.	Rajasthan	Shri C.S. Rajan Chief Secretary Government of Rajasthan Secretariat, Jaipur-302001	Tel: 0141-2227254 Fax: 0141-2227114
23.	Sikkim	Smt. Rinchen Ongmu Chief Secretary Government of Sikkim Secretariat, Gangtok- 737101	Tel: 03592-202315, 204323 (fax) Fax: 03592-222851 03592-204323
24.	Tamil Nadu	Shri. K. Gnanadesikan Chief Secretary Government of Tamil Nadu Secretariat, Chennai-600009	Tel: 044-25671555 Fax: 044-25672304
25.	Tripura	Shri G. Kameswara Rao Chief Secretary Government of Tripura Civil Secretariat, Agaratala-799001	Tel: 0381-2323200, 2324392 Fax: 0381-2324013
26.	Uttar Pradesh	Shri Alok Ranjan Chief Secretary Government of Uttar Pradesh Secretariat, Lucknow-226001	Tel: 0522-2621599 0522-2238212 0522-2238212 Fax: 0522-2239283
27.	Uttarankhand	Shri N. Ravi Shanker Chief Secretary Government of Uttarakhand 4, Subhash Road, Secretariat, Dehradun-248001	Tel: 0135-2712094 0135-2712100, 2712200 Fax: 0135-2712113 0135-2712500
28.	West Bengal	Shri Sanjay Mitra Government of West Bengal Secretariat, Writers Building Kolkata-700001	Tel: 033-22145858 Fax: 033-22144328
29.	Andaman & Nicobar	Sh. Anand Prakash Chief Secretary Secretariat & Administration, Government of Andaman & Nicobar Islands, Port Blair	Tel: 03192-233110, 234087 Fax: 03192-231100, 03192-232656
30.	Chandigarh	Shri K.K. Sharma Advisor to Administrator Union Territory of Chandigarh, Punjab Raj Bhawan, Sector – 6 Chandigarh-160017	Tel: 0172-2740154 Fax: 0172-2740317 0172-2740165
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32.	Daman & Diu	Shri Ashish Kundra Administrator Secretariat Daman, Government of Daman & Diu, Daman & Diu	Tel: 0260-2230770, 2230700 Fax: 0260-2230775

33.	Delhi	Shri D.M. Spolia Chief Secretary Govt of NCT Delhi, Delhi Secretariat, I.P. Estate, New Delhi- 110002	Tel: 011-23392100 Fax: 011-23392102
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35.	Puducherry	Shri Chetan B Sanghi Chief Secretary Puducherry Administration, Chief Secretariat, 1 Beach Road, U.T. of Puducherry, Puducherry- 605001	Tel: 0413-2334145 0413-2335512 Fax: 0413-2337575

36. Telangana Dr. Rajiv Sharma,
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