

POWER GRID CORPORATION OF INDIA LIMITED

TECHNICAL SPECIFICATION

FOR

**BESS Package for
Setting up of Battery Energy Storage System of 100 kW / 100 kWh capacity at
Badarpur Substation of POWERGRID in Assam**

Technical Specification: Section-Project

Setting up of Battery Energy Storage System of 100 kW /100 kWh capacity at Badarpur Substation of POWERGRID in Assam

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SECTION – PROJECT

1.1 GENERAL

1.2 Power Grid Corporation of India Limited (POWERGRID), a Govt. of India Enterprise, is responsible for Bulk Power Transmission of electrical energy from various central Govt. Power Projects to various utilities/ beneficiaries and interconnecting regional grids, operating and maintaining the National Electrical Grid of India. It is established with mission of “We will become a Global Transmission Company with Dominant Leadership in Emerging Power Markets with World Class Capabilities by:

- World Class: Setting superior standards in capital project management and operations for the industry and ourselves
- Global: Leveraging capabilities to consistently generate maximum value for all stakeholders in India and in emerging and growing economies.
- Inspiring, nurturing and empowering the next generation of professionals.
- Achieving continuous improvements through innovation and state-of-the-art technology.
- Committing to highest standards in health, safety, security and environment.

1.3 POWERGRID intends to undertake the project of setting up of Battery Energy Storage System at Badarpur Substation of POWERGRID in Assam.

1.4 It is the intent of this specification to describe primary features, materials and design & performance requirements and to establish minimum standards for the work. The specification is not intended to specify the complete details of various practices of manufactures/ bidders, but to specify the requirements with regard to performance, durability and satisfactory operation under the specified site conditions.

1.5 The work to be done under this specification shall include all labour, plant, equipment, material and performance of all work necessary for the complete installation and commissioning of BESS project. All apparatus, appliances, material and labour etc. not specifically mentioned or included, but are necessary to complete the entire work or any portion of the work in compliance with the requirements implied in this specification is deemed to be included in the scope of contractor.

1.6 Before proceeding with the construction work, the Contractor shall fully familiarize himself with the site conditions and General arrangements & scheme etc. Though the Employer shall endeavor to provide the information, it shall not be binding for the Employer to provide the same. The bidders are advised to visit the substation sites (at their own expense) and acquaint themselves with the topography, infrastructure and also the design philosophy. The bidder shall be fully responsible for providing all equipment, materials, system and services specified or

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otherwise which are required to complete the construction and successful commissioning, operation & maintenance of the substation in all respects. All materials required for the Civil and construction/installation work including cement and steel shall be supplied by the Contractor. Complete design (unless specified otherwise in specification elsewhere) and detailed engineering shall be done by the Contractor.

1.7 The contractor shall, in the execution of all the works required under the specification, provide highly skilled and experienced site supervisory personnel to ensure smooth and satisfactory execution for all aspects of the work. The Contractor shall be responsible, to make a careful examination of access roads/ bridges/ railways/ ports to site in order to confirm the practical permissible maximum weight and dimensions.

2.1 SCOPE OF WORKS

2.2 The scope of works of this specification covers setting up of Battery Energy Storage Systems (BESS) at below mentioned POWERGRID substation. The BESS, including its interconnection with the grid is termed as “**Project**”.

2.3 The scope of work shall include but be not limited to the following, in complete conformity with subsequent sections of the specifications:

- i) Site survey, planning, design, manufacturing, transportation to site, insurance, supply at site, unloading, handling, storage, installation, integration, testing, commissioning & demonstration for acceptance of all equipment / materials and miscellaneous item required to complete the battery energy storage system.
- ii) Delivering a BESS, including bi-directional inverter (PCS), isolation transformer (or PCS Transformer) etc., as required, with minimum footprint area.
- iii) Integration of the BESS system at Point of Common Coupling (PCC) at 415 V ACDB including cables, accessories, additional panels with all the necessary protection devices and CT/PT for energy metering (as applicable) and bus extension (if required) etc.
- iv) Comprehensive Maintenance of the complete BESS for a period of Twelve (12) years from the date of successful commissioning.

2.4 The detailed scope of work is brought out in subsequent clauses of this section.

2.5 Design, engineering, manufacture, testing, supply on FOR destination site basis, including transportation & insurance, storage, erection, commissioning & comprehensive maintenance of the following equipment/items, complete in all respects as mentioned in subsequent paras:

- a) **BESS** of minimum capacity of as mentioned in technical parameters including associated container, Battery Management System (BMS), Power Conditioning System (PCS), PCS Transformer/ Isolation Transformer, Fire protection System, Battery Cooling/Heating System, civil works and other required components complete in all respect, as applicable.

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The energy storage system shall consist of Lithium-ion batteries to meet the application requirement. The voltage level of the battery system, Power Conditioning System (PCS) and other associated equipment shall be finalized by the Contractor ensuring safe and efficient operation of the complete BESS.

The BESS shall be connected with the main Electric Power System (EPS)/ PCC through the PCS Transformer/ Isolation Transformer {as required, depending upon the output voltage level (MV) of PCS} of suitable rating as per the Contractor's design.

Based on the Contractor's design, in case the PCS is capable of direct connection with the EPS/PCC at 415V then PCS can be connected with the 415 Volt. However, if the output voltage level of PCS is different than 415V, then PCS Transformer of suitable rating shall be provided for isolation as well as voltage matching. The Transformer shall be dry type conforming to IS 11171 with minimum efficiency of 97%.

Contractor shall provide the PCS and PCS Transformer (or isolation Transformer, as required) including all associated fittings, interconnection of Transformer with PCS and complete LT bus (415 Volt) work including all necessary equipment, earthing material, support structures, LT/HT/FO/Special cables along with associated accessories, illumination system, Lightning Protection, civil works etc., as applicable, complete in all respect for interconnection of BESS with the electrical grid.

BESS shall meet the following minimum technical parameters:

Sl. No.	Parameter	Value
1.	Project Location	Badarpur Substation, Assam
2.	Output/Input Power Rating of BESS at the delivery point	100 kW
3.	Output/Input Apparent Power Rating of BESS at the delivery point	100 kVA
4.	Initial Design Output Energy Capacity of BESS at the delivery point*	100 kWh
5.	Battery Chemistry	Lithium Ion based
6.	Charge/Discharge (C-Rate)	1.0
7.	Rated Duration of BESS Discharge	1 Hour
8.	Energy content value at the end of the duty cycle	As per design of Contractor
9.	Rated DoD / Min. SOC level	As per design of Contractor
10.	Nominal Energy Capacity	As per design of Contractor
11.	AC to AC Roundtrip efficiency	Minimum 83%
12.	Interconnection Voltage level of BESS	415 V
13.	Delivery Point	Point of common coupling at ACDB/MSB

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14.	Response Time#	Response time of the overall system, preferably, not be more than 300 ms
15.	Positive and Negative Ramp Rate (as defined in IEC 62933-Part 2)	BESS shall be suitable for positive and negative ramp rate to support as emergency backup
16.	The auxiliary power consumption at Rated load	1.8% of rated power capacity of BESS
17.	The auxiliary power consumption at No-load conditions	0.2% of rated power capacity of BESS
18.	Guaranteed Minimum Service Life	At least 6570 cycles at rated DoD at which useful capacity of the battery is designed equivalent to 558.45 MWh energy export from the BESS (measured at PCC) or 12 years after commissioning, whichever is earlier.
19.	The distance between the proposed site for BESS and PCC	60 metres

Response time is the time interval between need for response (e.g. A Loss of Grid Power event) detected by the BESS and the time when output of the BESS has attained the desired power level. This shall include all the intermediate response time of system components.

- b) Energy Management System (EMS) with Control and Communication system for Monitoring and Controlling the BESS operation including Battery-BMS, PCS parameters and data collection & report generation. BESS shall be controlled & monitored remotely from local control center. All the additional items such as enclosures, junction boxes, grounding, instrumentation, wiring etc., as applicable, required for fully functional system as per specification shall be provided / installed by contractor.

A. Functions of BESS

The BESS is aimed towards the back-up support during the power outages. This shall be achieved through a suitably designed Energy Management System (EMS) consisting of necessary hardware and software. EMS shall perform the following applications:

i) Operation in P-Q mode (Simultaneous operation of BESS Charging and Power Factor Improvement)

The BESS shall have capability to get fully charged as per C-rate mentioned in technical parameters. However, it shall be able to charge at a suitable P-Q value to reduce the overall reactive power demand (Battery Charging + existing load of premises) thereby.

In this mode, the BESS shall charge the batteries from the grid based on (State of Charge)

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SoC levels. The charging of BESS will be strictly restricted through the grid. Charging BESS through DG set is not desired.

Additionally, the BESS shall also be able to improve the overall power factor by absorbing/feeding the reactive power. BESS controller shall continuously monitor the power factor of incoming power supply (from utility) and give commands to PCS for compensating the same with reactive power to bring the power factor close to unity to the extent possible. However, in this mode, priority shall be given for charging the batteries and in case of availability in PCS VA ratings, same shall be used to improve the power factor.

Since, same incoming feeder shall be used simultaneously for charging the BESS along with feeding the power requirement of the premises, the EMS shall continuously monitor the power demand and limit the BESS loading (kW & kVA) to limit the power drawl within the prescribed sanctioned load of the premises.

ii) Operation in V-F mode (Back-up Power mode)

In this mode, BESS shall feed the power to the premises. The BESS shall have black start capability and shall be able to supply rated power as per rated discharge duration. In this mode, the PCS shall maintain the supplied voltage and frequency while catering to the active and reactive power demand when the continuous connected load doesn't exceed rated apparent power rating.

iii) Operation in Standby mode

Since, BESS can feed the premises for a limited duration depending on the SoC level of batteries and power demand, the Employer shall use the existing DG sets for secondary back-up. EMS shall continuously monitor the SoC and Power demand. In case, the SoC is reaching the value below the permissible limit (to be finalized during detailed engineering) then the controller shall initiate the command for DG set's operation and shall disconnect (island) the BESS from the bus.

iv) Change of Modes

During the availability of grid, the BESS shall operate in P-Q mode and while during the outage of grid, the BESS shall work in V-F mode. To change the operating modes, EMS shall continuously monitor the incoming feeder supply. During the outage of the grid, the controller shall ensure the opening of the breakers of incoming feeders (grid supply) and then convert the mode of BESS from P-Q to V-F mode and vice-versa on restoration of power supply from grid. This change of modes, including opening/closing of breakers shall be suitably time-consuming. In case of long outages and low SoC conditions where BESS cannot provide power back-up to premises, the EMS shall initiate the operation of existing DG sets and island the BESS from the bus. On restoration of grid supply, BESS shall be connected with the grid and starts operation in P-Q mode. All the changeover among the modes shall be automatic without any manual intervention.

B. Hardware & Software

The Contractor shall provide requisite hardware such as controllers, sensors, breakers, contactors, transducers etc., as required, to monitor the various parameters such as kVA, kW, kVAr, power factor, frequency etc. on the two (2) Nos. of incoming feeder (grid supply). Any other parameter or hardware components required for successful operation of functions of EMS, as specified above, shall be provided by Contractor. The monitoring of parameters of incoming feeder shall be done at interval of Min. 1 second.

The Contractor shall design and supply the requisite software to provide the EMS applications as specified above.

C. Parameters for Integrated System

- a) If the auxiliary system is energized from a source other than the BESS itself, then the energy consumption of the auxiliary system during charging and discharging shall be recorded separately and the Round-Trip efficiency shall be calculated as per the relevant part of IEC 62933.
- b) Auxiliary Power supply arrangement for the BESS along with suitable meters, as applicable. The auxiliary equipment such as lighting, air conditioner, etc. should be energy efficient.
- c) Contractors shall make necessary provision for safe access (like ladder, platform with handrails etc.) for BESS inspection, maintenance etc., as applicable.
- d) Any other equipment/material required to complete the specified scope of setting up BESS and subsequent maintenance.

2.6 Interconnection of BESS with Grid:

- a) BESS system shall be terminated at the PCC at 415 V level along with all necessary measuring and protection equipment. The distance between the proposed site for BESS and PCC is specified elsewhere in the specifications. The contractor shall provide the necessary cables, LT panels, LT breaker, hardware etc. required for connection between the BESS and the existing panel complete in all respects. During survey, the contractor may verify if additional panels and extension of bus of the panel would be required for the termination/connection of BESS. In such case, the same shall be provided by the Contractor without any additional cost implication.
- b) DC cables for Connection between Battery Modules/ Strings to PCS shall be of suitable voltage grade (minimum 1.5 kV DC Grade) & current rating with Fire Retardant capabilities. DC Cables shall conform to relevant Indian/International standard as applicable.
- c) For AC System copper conductor XLPE insulated PVC sheathed armoured FRLS cable

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shall be used. The cables shall conform to IS 7098. The voltage grade and sizing of the cable shall be as per system design requirement.

- d) Installation of cables (both DC and AC) generally conform to IS-1255.
- e) The contractor shall provide the necessary support to the Employer for application to DISCOM/ CEA for integration of BESS into the grid, as required.

2.7 Steel structure works (as applicable):

- a) Design, Engineering, Fabrication, proto-assembly, supply including transportation & insurance, unloading, storage, erection and commissioning of support structures, Lightning Mast etc. including foundation bolts, nuts bolts, fasteners etc. complete in all respect, as applicable.
- b) Factor of safety for design of structures shall be 1.5 under normal condition and 1.2 under short-circuit condition.

2.8 Civil works (as applicable)

- a) The design of foundation shall be based on the soil investigation report, site requirement and other parameters as per relevant IS codes & technical specification.
- b) The scope of civil work shall include but shall not be limited to the following based on design and drawings developed by the contractor:
 - 1. Contouring and Site Leveling, if required.
 - 2. Foundation/platform for Battery containers.
 - 3. Foundations for other associated equipment of BESS including auxiliary systems, lighting poles, structures, panels and control cubicles of equipment, switchgear etc., as applicable.
 - 4. Cable trenches along with covers, road crossings, sump pits etc. as required. The pipes required cable laying works, as applicable, shall deemed to be included under the Contractor's scope.
 - 5. Fencing including gate in the BESS area, as applicable, including dismantling, re-erection, re-routing and storage of the existing fence, if required.
 - 6. Any other items/ designs/ drawings/ components, not explicitly covered in the specification but required for completion of the project, shall deemed to be included in the contractor's scope of works.
 - 7. All materials required for the civil and construction/installation work including cement & steel shall be supplied by the Contractor.
 - 8. Nominal mix 1:1.5:3 concrete shall be used for all RCC work.
 - 9. Excavation in hard rock (requiring blasting), if encountered, shall deemed to be included under Contractor's scope of works.
 - 10. For foundations in filling area, soil improvement shall be carried out by boulder soling.

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11. Factor of safety for design of foundation for structures/ equipment shall be 1.5 in both normal and short circuit condition as per IS 456.
12. Factor of safety for stability of foundations of structures/ equipment, like overturning, shall be 2 (without wind or seismic), 1.5 (with wind or seismic) for normal and short circuit condition as per IS 1904.

2.9 Training to Employer's Personnel

The contractor shall provide training in India to the Employer's personnel, to empower them for the routine operation of the BESS, without any financial implications.

The training shall cover all aspects of battery energy storage system (BESS) needed for its proper operation and maintenance. The contractor shall be responsible for determination of content and duration for the training sessions. All training materials, as applicable, shall be provided by the contractor. A brief requirement of training course is mentioned below:

- a) Orientation course
- b) Operation & Maintenance course
- c) Application software course
- d) Operator training course

2.10 System Engineering and Studies

The Contractor's scope includes overall system studies, engineering and detailed design for all elements, systems, facilities, equipment etc. as per the requirement for successful completion of the scope of works.

2.11 Facilities to be provided by the Employer

- i) The Employer shall make available the auxiliary supplies at a single point in the substation on chargeable basis during construction stage. The prevailing energy rates of the state shall be applicable. All further distribution from the same for construction supply shall be made by the contractor. However, in case of failure of power due to any unavoidable circumstances, the contractor shall make his own necessary arrangements like diesel generator sets etc. at his own cost so that progress of work is not affected and Employer shall in no case be responsible for any delay in work because of non-availability of power.
- ii) The Employer shall make available construction water supply at a single point in the substation without any additional charges during construction stage. All further distribution for the same shall be made by the Contractor. In case of non-availability or inadequate availability of water for construction work, the contractor shall make his own arrangement at his own cost and the Employer shall in no case be responsible for any delay in works because of non-availability or inadequate availability of water.

2.12 The Contractor shall procure the bought-out items from the sub-vendors as per the list in "Compendium of Vendors" available on POWERGRID website www.powergrid.in after ensuring compliance to the requirements/conditions mentioned therein. In case of unavailability / non-response, Contractor may approach the Employer for additional sub-vendor approval as per prevailing norms of Employer.

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3.0 SPECIFIC EXCLUSIONS

The following items of work are specifically excluded from the scope of the specifications:

- a) Procurement of Land/site
- b) Employer's site office
- c) Soil investigation

4.0 SCHEDULE OF QUANTITIES

- a) The requirement of various items/equipment and civil works are indicated in Bid price Schedules.
- b) Wherever the quantities of items/works are indicated in Lot/Set, the bidder is required to estimate the quantity required for entire execution and completion of works and incorporate their price in the Bid price schedules.

5.1 PHYSICAL AND OTHER PARAMETERS

I. Location of the installation:

Name of Substation	132 kV Badarpur substation of POWERGRID
Location of Site	Power Grid Corporation of India Ltd. 132 kV Badarpur Sub-station, National Highway-44 Dist :Hailakandi, Assam. 788803

II. Meteorological data:

S. No	Parameters	Reference/Remarks
1	Snow Fall	No
2	Wind Zone	As per National Building Code (NBC) 2016
3	Seismic Zone	As per IS 1893
4	Design Ambient Temperature	45°C
5	Altitude	< 1000 m (to be check by site)
6	Coastal area consideration	As per site requirement

6.0 BASIC REFERENCE DRAWINGS

The bidder shall maintain the phase to earth clearance, phase to phase clearance and sectional clearances, clearances between buses, bus heights but may alter the locations of equipment to obtain the statutory electrical clearances required for the substation.

It is responsibility of contractor to develop general arrangement drawing, layout drawings, single line drawing, foundation & cable trench layout, erection key diagram & all other layout drawings for present scope of work. Plot plan for land shall be provided to successful bidder during detailed engineering.

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7.0 DIFFERENT SECTIONS OF TECHNICAL SPECIFICATIONS

For the present scope of work, the Technical Specification (Vol. II) shall consist of following parts/sections, and they should be read in conjunction with each other:

1.	Section-Project	Rev 00
3.	Section-BESS	Rev 02

In case of any discrepancy between Section-PROJECT and other technical specifications on scope of works, Section-PROJECT shall prevail over all other sections.

8.0 INSTALLATION & COMMISSIONING

The contractor shall be responsible for installation, testing and commissioning of all materials and equipment under the scope of this specification. The installation, testing and commissioning of all materials, equipment and any other equipment shall be carried out in accordance with the best engineering practice and requirement specified in the specification. The Employer reserves the right to assign Employer's personnel to the contractor's commissioning team to participate in and witness installation, testing and commissioning of the BESS.

9.1 COMPREHENSIVE MAINTENANCE

9.2 General

The scope of work in "Comprehensive Maintenance" shall include maintenance of all the software and hardware provided by the contractor under this project for a period of 12 years.

The first year of the Comprehensive Maintenance period coincides with the defect liability period of the project. The bidder shall quote the charges in BPS accordingly.

Back-to-back warranty arrangements with original equipment manufacturer (OEM), as required, shall be the responsibility of the contractor. In case of end of the life of the BESS before the specified maintenance period, the Employer, at its own discretion, may terminate the Maintenance contract.

The essence of the maintenance services is to carry out all breakdown as well as preventive maintenance to achieve the prescribed availability of the BESS. The maintenance period of BESS shall commence from the date of commissioning.

Maintenance charges, quoted by the Contractor in BPS, shall be paid yearly by the Employer subject to fulfillment of system availability requirements and other applicable provisions of the technical specifications.

All records of maintenance must be maintained by the contractor, which can be accessed by the Employer on demand. The contractor shall be responsible for supply of all spare parts, repairs /

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replacements of any defective equipment at his own cost as required from time to time during the Maintenance period. The contractor shall ensure that the safety practices outlined by the OEMs are strictly followed.

The specified availability shall be maintained on yearly basis. For all bought out major items (hardware as well as software) contractor shall have back-to-back support along with supply of spare with appropriate response time from OEM/OEM authorized representatives. The contractor shall be responsible for coordination with the OEM for all matters related to these items and shall be responsible for meeting the overall response times and availability requirements specified in the Specification.

9.3 Annual Degradation of the BESS Capacity

It is understood that rated capacity of the BESS degrades upon usage as well as passage of time. Hence, during the maintenance period, the degradation in energy and power capacity of the BESS would be allowed as per below table:

Sl. No.	Parameter	Accepted Degradation
1	Energy	2.5% of Rated Capacity per year (when exchanged energy for the year is less than 8.33% of the nominal energy expected from BESS in 12 years of life) or 0.0046% per cycle energy equivalent (when exchanged energy for the year is more than 8.33% of the nominal energy expected from BESS in 12 years of life)

To ascertain the performance of the BESS during the maintenance period, provision of performance guarantee test before the start of new year for maintenance is kept, which is defined in subsequent sections.

9.4 Performance Guarantee Test

Performance Guarantee Test, as per IEC, shall be performed on the overall BESS system at the end of each year of maintenance period to ensure that the degradation of Batteries and other components are not more than the limits specified in this technical specification.

Performance Guarantee Test shall include evaluation of BESS Efficiency as well as capacity.

9.4.1 Efficiency Test of BESS

Roundtrip AC to AC efficiency test of BESS system shall be conducted as per the relevant IEC standard.

9.4.2 Capacity of BESS:

In order to demonstrate the energy (kWh) of the BESS at the point of interconnection to the grid, this test shall be conducted. Detailed procedure shall be finalized during detailed engineering as per the relevant IEC standard.

9.4.3 Non-performance in PG Test

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If the BESS efficiency and capacity drops beyond acceptable limits then suitable corrective actions shall be undertaken by the contractor within 15 days of completion of PG test without any cost to the Employer to maintain the same, which includes replacement/augmentation of cells/battery or other components. However, if corrective actions are not taken by contractor within 15 days and BESS continues to work on reduced efficiency / capacity then charges shall be deducted from contractor as per the methodology defined below:

- i. If AC to AC Roundtrip efficiency is less than the required level, then deduction of charges shall be = $E_{Loss} \times R$ in INR, where

E_{Loss} = (Difference of required efficiency and actual measured efficiency) X Energy input to BESS during the period of non-performance

R = Rs. 82.26/ kWh in the second year of maintenance period with 3.51% increase every subsequent year.

- ii. If the capacity of the BESS is found below required the levels defined for Energy, the contractor shall replace/augment of cells/battery or other components as per the requirement, to meet the specified capacity levels else the deduction of charges for Energy deficiency shall be applied at the rate of total EPC cost/Energy Rating of BESS in KWh from Year to Year (starting from second year of maintenance period).

NOTES:

- i) All applicable deduction of charges shall be first adjusted from the Annual Maintenance Charges (for the period under consideration).
- ii) At no point of time during the maintenance period, the efficiency & capacity of the system shall drop below 70%. In such case, the contractor must immediately undertake rectification, or the Employer shall take necessary action at the risk & cost of contractor for the same.

9.5 Service Response Requirements

Various state of operation / problems of BESS have been categorized under severity levels. The contractor shall submit an appropriate problem / defect reporting procedure to meet the requirement of all severity levels to get the approval of the same from Employer. Severity levels and their resolution time are defined below:

Category	Definition	Resolution Time
Severity 1 (Urgent)	Complete system failure, severe system instability, loss or failure of any major subsystem or system component such as to cause a significant adverse impact to system availability, performance, or operational capability. Failure of application software, cyber security issues shall also come under this category.	24 Hours

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Severity 2 (Serious)	Degradation of services or critical functions such as to negatively impact system operation. Coverage under this severity would not affect complete system but subsequently could result into Severity-1 category problem.	48 Hours
Severity 3 (Minor)	Any other system defect, failure, or unexpected operation not covered in severity 1 & 2.	72 Hours
Severity 4 (General / Technical Help)	Request for information, technical configuration assistance, “how to” guidance, and other requests.	48 Hours

The above problems can be registered by the Employer to the contractor through any media like letter, email, message or telephonic call etc. Support for the same shall be provided within the resolution period described above. The contractor can also provide on-call support. Key objective would be to restore the system to normal operational state as quickly as possible, including by a temporary workaround. After passage of resolution time any delay in attending the problems shall be considered as non-availability period (rounded to hours).

9.6 Release of Payment against Annual Maintenance

During the period of Annual Maintenance, payment towards maintenance shall be released subject to fulfillment of availability conditions.

The contractor shall be liable to pay for the liquidated damages for non-availability of the system and for higher auxiliary losses than the permissible limit specified elsewhere, which shall be deducted from the charges for comprehensive maintenance on pro-rata basis. The maximum deduction shall be limited to the maintenance charges to be paid for that year.

10.1 SPECIFIC REQUIREMENTS

10.2 Testing, including Factory Acceptance Tests and Site Acceptance Tests, of the BESS shall be as per relevant parts of IEC 62933.

10.3 The bidder shall quote the Comprehensive Maintenance charges in BPS, as minimum of 15% of the EPC price (i.e. price for Supply + Installation). In case, the same is not done so by the bidder, Employer shall adjust the quoted prices suitably so that the Comprehensive maintenance charges become 15% of the EPC price (i.e. price for Supply + Installation), in the event of finalization of award.

10.4 Liquidate Damages (LD) for higher auxiliary loss:

The auxiliary loss of the BESS shall be corrected in accordance with provisions of the relevant IEC for the purpose of comparison of maximum permissible losses with the measured losses for levy of liquidated damages.

If the measured loss(es) are found to be more than the specified maximum permissible value(s), the Employer at his discretion may accept or reject the equipment after assessing the liquidated

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damages (LD) against the contract as per the rates given below and such amount plus GST payable thereon shall be deducted from the contract price or otherwise recovered from the Contractor.

No cost benefit shall be considered in case of measured losses are less than the specified maximum permissible losses.

Differential Price Factors for Liquidated Damages:

The factors and the respective Indian Rupees value per unit of differential loss for purpose of calculating differential price shall be as stipulated below:

Sl. No.	Equipment/ System	Parameter	Value of Liquidated damages in Indian Rupees per unit of parameter differential with respect to maximum permissible losses
1.	BESS as per capacity defined in technical parameters	Differential auxiliary loss for charging and discharging	INR 76,858/- per kW
		Differential auxiliary loss for Idle state	INR 4,88,154/- per kW

Note: For a fraction of a kW, the penalty shall be applied on pro-rata basis.

10.5 Work completion period : Entire work as per scope should be completed within 12 months from the date of LOA/NOA.
