**GOVERNMENT OF INDIA**
**CENTRAL ELECTRICITY AUTHORITY**
**Sewa Bhawan (North Wing), Room No. 622, 6th Floor,**
**R. K. Puram, New Delhi-110066**
**Tel. 011-26732632, email: celegal-cea@gov.in**
**Website: www.cea.nic.in**

# PUBLIC NOTICE

In exercise of powers conferred under Section 177 of the Electricity Act, 2003, the Central Electricity Authority (CEA), proposes to notify the following regulations:

1. **Draft Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) ( 2nd Amendment) Regulations, 2025**

2. **Draft Central Electricity Authority (Cyber Security in Power Sector) Regulations, 2025.**

The proposed drafts of both the regulations are available on the CEA Website **www.cea.nic.in** for inviting public comments. All the Stakeholders and the public are requested to send their comments on the draft regulations to Chief Engineer (Legal), Sewa Bhawan (North Wing), Room No. 622, 6th Floor, R. K. Puram, New Delhi-110066 by post or through e-mail (celegal-cea@gov.in) latest by **07.11.2025.**

**(Rakesh Kumar)**
**Secretary, CEA**

[To be published in the Gazette of India, Extraordinary, Part III, Section 4]

CENTRAL ELECTRICITY AUTHORITY
NOTIFICATION
New Delhi, the ....., 2025

F No. .....— In exercise of the powers conferred under clause (e) of sub-section (2) of section 177 of the Electricity Act, 2003 (36 of 2003) read with clause (b) of section 73 of the said Act, the Central Electricity Authority hereby makes the following regulations to amend the Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2022, namely: -

**1. Short Title and Commencement**

(1) These regulations may be called the Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) (Amendment) Regulations, 2025.
(2) They shall come into force on the date of their publication in the Official Gazette.

2. In the Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2022 (hereinafter referred to as the said Regulations), in sub-regulation (1) of regulation (2), after clause (zzh), the following shall be inserted as clause (zzi) *'Definitions for Renewable Energy Stations and Battery Energy Storage Systems'*, namely:

(1) "**Battery Energy Storage System (BESS)**" means a stationary system connected to the electricity system which is used to store electrical energy by means of electrochemical materials, and typically includes batteries, power conversion system and BMS.
(2) "**Battery Management System (BMS)**" means a system which control on batteries in order to obtain safe operation, and also balances the energy of batteries and monitors the status thereof.
(3) "**Battery Container**" means a container in which battery racks are placed.
(4) "**Battery Module**" means a string of series connected cells placed in an encasing.
(5) "**Battery Rack**" means a string of series connected Battery Modules placed in a container.
(6) "**BESS Capacity (in MWh)**" means the rated energy capacity to be delivered to the connected load under specific conditions.
(7) "**C Rate**" means the inverse measure of time duration over which a battery can charge and discharge at its maximum rated power.
(8) "**Cycle**" means the charging of a Battery from its Depth of Discharge (DoD) level to its peak charging level and again discharging to its DoD level.
(9) "**Depth of Discharge (DoD)**" means the level to which a BESS is discharged relative to the maximum possible amount of energy that can be discharged by the system, typically expressed as a percentage.
(10) "**Module**" means the collection of Photovoltaic (PV) cells connected together.
(11) "**Power Conversion System (PCS)**" means an integrated system of inverters, rectifiers, controllers, and associated power electronics that convert Direct Current (DC) power from the battery to Alternating Current (AC) power for the electricity system (discharging), and vice versa (charging).
(12) "**Power Plant Controller**" means the equipment in a renewable energy power plant responsible for maintaining a reference active and reactive power output from the

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renewable energy power plant and also capable of sending & receiving signals from remote end.

(13) "**State of Charge (SoC, %)**" means the present level of charge of a battery expressed in percentage of its maximum capacity

(14) "**State of Health (SoH)**" means the maximum level of charge of a battery expressed in percentage of its initial value at the time of its first use.

3. In the said Regulations, after Clause 108, the following Chapter is added: -

## CHAPTER-VI

## TECHNICAL STANDARDS FOR CONSTRUCTION OF RENEWABLE ENERGY STATIONS AND BATTERY ENERGY STORAGE SYSTEMS

**109. Technical standards for construction of renewable energy stations and Battery energy storage systems shall be covered in the following five parts namely:-**

(1) Part- A: Technical standards for construction of solar power plant;

(2) Part- A1: Technical standards for construction of floating solar plant;

(3) Part- B: Technical standards for construction of wind power plant;

(4) Part- B1: Technical standards for construction of offshore wind power plant; and

(5) Part- C: Technical standards for construction of Battery Energy Storage Systems

**110. General Requirements**

(1) In a renewable energy power plant and BESS plant, all equipment ratings shall be such that the plant is suitable for continuous operation, subject to availability of solar irradiance in the case of a photovoltaic plant, and instantaneous wind energy in case of a wind turbine generator, without any restriction up to the rated MVA capacity of the plant, and State of Charge (SoC) in case of BESS plant, and within the frequency range, voltage range, power factor limits, and combined voltage-frequency variations as specified in the Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulations, as amended from time to time.

(2) The renewable energy power plant and BESS plant owner shall retain the following documents at the site:

(a) As-built drawings including, but not limited to civil and architectural works, mechanical, electrical, control and communication.

(b) Copies of the project design memorandum, technical description, data sheets, operating manuals and manufacturer's warranties for all major items and/ or equipment.

(c) Copies of the results of all tests performed as per contract.

(d) Inputs file containing details of system parameters required for modelling of the renewable energy power plant and output file containing result of modelling of the renewable energy power plant shall be in requisite format.

(e) Type test certificate along with detailed evaluation report at site for examination by statutory bodies as and when required.

(3) Display Board with clear visibility shall be installed at a conspicuous place with the information including plant name, capacity, location, coordinates, type of renewable energy power plant and BESS plant, date of commissioning.

(4) Renewable energy power developer shall install Automatic Weather Station (AWS) in the plant to measure parameters including wind speed, atmospheric temperature, relative

humidity and atmospheric pressure. The Authority shall issue guidelines for installation of AWS at a renewable energy plant within six (6) months of notification of these regulations.

(5) Phasor Measurement Units (PMU) shall be installed at locations specified in CEA 'Guidelines on Unified Philosophy for Placement of Phasor Measurement Unit (PMU) in Indian Grid'.

(6) Harmonic analyzer shall be installed at PoI or pooling station by the owner of substation or the owner of the pooling station, as the case may be.

(7) Power Plant Controllers (PPC) shall be provided for active power and reactive power control of renewable energy power plant with capacity as provided in Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulations, as amended from time to time. The PPC shall have following the features:

(a) Receive set-points in digital and analog form at renewable energy plant or from the SLDC/RLDC remotely.

(b) Receive parameters such as active & reactive power, voltage, current measured at the point of interconnection, as analog values after the same are processed by a power quality (P-Q) meter.

(c) The dynamic performance requirements of PPC shall be as per Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulations.

(8) Every renewable energy power plant and BESS plant shall establish a reliable, redundant, and secure communication system within the plant premises and up to the PoI on the transmission/distribution network and maintain throughout the plant life.

(9) The communication infrastructure provisioned for protection and control functions within the renewable energy power plant and BESS plant such as interlocking, tripping, synchronization, and substation automation shall be physically and logically segregated from channels used for monitoring, SCADA, metering, or general plant data exchange.

(10) The renewable energy power plant shall install power quality (P-Q) meters as per relevant standards.

Provision of space for installation of P-Q meter along with power supply at PoI shall be provided by substation owner.

(11) The renewable energy power plant and BESS plant owner shall provide the equipment for field measurements, on-site tests and grid event data logger.

(12) **Cable and wiring**

(a) All cabling/wiring shall be as per the relevant standards having appropriate size and rating considering the losses, maximum load and fault current, voltage drop within permissible limit and other related factors.

(b) All connections shall be properly made through suitable lug or terminal crimped with use of suitable cable glands. All cables shall be labelled using ferrules for ease of tracing from one end to the other.

(c) In outdoor switchyards, a cable trench system shall be provided and a comprehensive philosophy of segregation and proper spacing between cables shall be maintained.

(d) Power cables and control cables shall be laid on separate tiers.

(e) Laying of different voltage grade cables shall be on different tiers according to the voltage grade of the cables, with the higher voltage grade cables in the topmost tier and the control cables in the bottommost tier.

(f) The cable trench shall be constructed with proper slope to ensure free drainage of any water which may enter the trench and suitable arrangements shall be made to drain out excess water.

(g) The cable shall have a service life that is compatible with the design life of the renewable energy power plant and BESS plant.

(13) **Protection**

(a) Fully graded protection system with requisite speed, sensitivity and selectivity shall be provided for the entire station.

(b) Overvoltage protection shall be coordinated with high voltage ride through requirement of renewable energy power plant and BESS plant at the PoI.

(c) Under voltage protection shall be suitably coordinated with low voltage ride through requirement of a renewable energy power plant and BESS plant at the PoI.

(14) All relevant clauses mentioned in these regulations (1-108) shall be applicable to any substation and supply line installed beyond the Inverter Duty Transformer in a RE generating station and beyond EMS in BESS plant.

(15) Safety requirements for renewable energy power plant and BESS plant shall be in accordance to Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, as amended from time to time.

(16) The renewable energy power plant and BESS plant shall have the capability of voltage ride through as per the Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulations, as amended from time to time.

(17) All civil structure including control room shall be as per National Building Code.

(18) The permissible noise level (dB) during operation shall be limited as per the relevant standard.

(19) The renewable energy power plant and BESS shall provide the capability of mutually exclusive operating modes of reactive power control functions:

(a) Voltage Control Mode

When operating in voltage control mode, plant shall operate in closed-loop automatic voltage control mode to regulate the steady-state voltage at the PoI to the reference value, as adjusted by the droop function, to within 1% of the PoI voltage set point unless to do so requires reactive power exceeding the reactive power capability of the plant. The voltage control system shall be capable of reactive power droop functionality to ensure a stable and coordinated voltage response. The droop setting shall be configurable.

(b) Reactive Power Set Point Control Mode

When operating in Reactive Power Set Point Control mode, the plant shall maintain a specified constant reactive power output at the PoI.

(c) Power Factor Control Mode

When operating in this mode, the plant shall have a reactive power output that is in linear proportion to the active power, equivalent to the power factor setting, for the actual active power output.

(20) The renewable energy power plant and BESS with Grid Forming control shall be capable to comply with the technical requirements as specified in Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulations.

## PART- A

## TECHNICAL STANDARDS FOR CONSTRUCTION OF SOLAR POWER PLANT

**111. Site Selection and Layout Considerations:** The site for a Solar power plant shall be selected based on the following criteria duly considering the data available at the time of selection:

(1) **Type of land:** Site proximity to geological faults, high flood zone, high tide zones, avalanche prone area, and land slide prone area shall be avoided as far as possible.

Provided that solar power plant which are located in extreme weather and site conditions shall be designed to withstand such extreme conditions.

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(2) **Layout Considerations/ Construction**

(a) Minimum clearance of 0.75m shall be provided in the layout of the inverter and DC/AC distribution boxes for adequate ventilation to keep inverter temperature in the operating range.

(b) Minimum clearance of 2.5m space shall be provided between arrays for ease of maintenance of the plant after installation.

(c) PV array shall be oriented in order to maximize annual energy yield of the installation.

(d) All foundations shall be design to withstand all types of load coming on it and made of Reinforced Cement Concrete as per the relevant Standards.

112. **Design Life:** The Solar power plant shall be designed for a life of not less than twenty-five (25) years.

113. **Major Equipment:** A Solar power plant shall mainly consist of:

(1) PV Panel/Module
(2) Module Mounting Structure
(3) PV Junction Box
(4) String Junction Box (SJB)/ Array Junction Boxes (AJB)
(5) Inverter
(6) Inverter Duty Transformer (IDT)
(7) AC Distribution Board (ACDB)
(8) Other Equipment
   (a) Cables, pipes, safety components and other accessories
   (b) Control and Protection Equipment
   (c) Communication system
   (d) Metering Devices (Meters)
   (e) Earthing system
   (f) Lightning Arrestor.
   (g) Fire prevention and Fire Protection system

114. **Salient technical particulars of major equipment**

(1) **PV Panel/Module**

(a) The PV modules used shall comply with the relevant Quality Control Order (QCO) issued by the Government.

(b) PV modules installed in a highly corrosive atmosphere including marine environments or locations near the sea or other large bodies of salt water, shall fulfill the Salt Mist Corrosion Test as per the relevant standards.

(c) Every PV module shall have a bypass diode for optimizing PV output in case of failure of any PV Cell.

(d) All solar panels shall be cleaned without or with minimal water consumption.

(e) Each PV Module shall have Radio-Frequency Identification (RFID) tag on the module lamination and able to withstand all environmental conditions. RFID shall contain the following information:

   (i) Name of the manufacturer of PV Module and Solar cells;
   (ii) Month and year of the manufacture;
   (iii) Country of origin; separately for solar cells and module;
   (iv) I-V curve for the module;

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(v) Peak Wattage, Maximum Voltage(Vm), Maximum Current (Im) and Fill Factor
(vi) Unique Serial No. and Model No. of the module;
(vii) Date and year of obtaining relevant qualification certificate for PV module;
(viii) Name of the test laboratory issuing certificate under relevant standard;
(ix) Other relevant information on traceability of solar cells and module as per ISO 9000.

(f) The following minimum details shall be provided on the PV module:
(i) Name of the manufacturer;
(ii) Month and year of manufacture;
(iii) Country of origin;
(iv) Rated Power at standard test conditions (STC); and
(v) Maximum Voltage (Vm), Maximum Current (Im), Open Circuit Voltage (Voc), Short Circuit Current (Vsc).

(2) **Module Mounting Structure**
(a) Photovoltaic modules shall be mounted on a stable, durable structure having adequate strength, with a minimum factor of safety of 1.5, to bear the load of modules and appropriate design suitable to the locations criteria, which shall support the array and withstand wind, rain, and other adverse conditions.
(b) The modules shall be fixed on structures with proper arrangement so that to support PV modules at a given orientation, absorb and transfer the mechanical loads to the foundation properly.
(c) Structure material shall have provision for earthing.
(d) Structures used shall be protected against rusting either by coating or anodization.
(e) Each structure with fixed tilt shall have a tilt angle as per the site conditions to receive optimum insolation.
(f) Suitable fastening arrangement such as grouting and clamping shall be provided to secure the installation and to withstand against the specific wind speed.

(3) **PV Junction Box**
(a) It shall be UV resistant.
(b) By-pass mechanism to prevent PV cells from hotspot as per relevant standard.
(c) Connectors shall be provided with ingress protection of IP 68.

(4) **String Junction Box (SJB)/Array Junction Box (AJB)**
(a) SJB comprising of an enclosure, copper bus bars, Fuses, Surge Protection Device, disconnector shall designed as per requirement of the Inverter.
(b) The SJB shall be made with full dust, water and vermin proof arrangement.
(c) All wires/cables shall be appropriately terminated through cable lugs.
(d) The SJB shall have minimum IP65 (for outdoor)/ IP54 (indoor) ingress protection.
(e) SJB shall be wired with optical fiber cables for enabling data collection from SJB/AJB of capacity 100 kW onwards.

(5) **Inverters**
(a) Inverters shall at least have the following features:
(i) The AC output power (MVA/MW/MVAR) and current (A) shall be specified at 50°C and in steps of 10 °C within the operating ambient temperature range of -20 °C to 60 °C.
(ii) The inverter shall convert DC input to AC output and the DC component of output shall not be more than 0.5 % of continuous maximum rated inverter output current.
(iii) The power factor of inverter shall be maintained atleast 0.99 and shall have adjustable power factor range from 0.9 leading to 0.9 lagging.

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(iv) Inverter shall have minimum IP20 for indoor and IP55 for outdoor ingress protection.
(v) Efficient cooling shall be provided to achieve minimum efficiency of 98% in the operating temperature range upto 60 °C.
(vi) Inverter shall consume not more than 0.001% of rated power of inverter during non-solar hours.
(vii) The inverter shall be capable to operate at relative humidity range of 20-100%.
(viii) The inverter shall have communication protocol RS485 (Modbus RTU), Modbus TCP, IEC 61850 with reaction time range of 10 ms to 100 ms and rise time range of 40 ms to 900 ms.

(b) Inverter shall have
(i) On the DC side: DC reverse connection protection, DC Leakage current protection, DC switch, Potential Induced Degradation (PID) protection-Anti-PID or PID recovery, DC type-II Overvoltage protection, PV String current monitoring
(ii) On the AC side: AC short circuit protection, AC Leakage current protection, Grid monitoring, Ground fault monitoring, AC switch, Arc fault circuit interrupter (AFCI)

(c) Inverter shall be able to capture all events including all faults and alarm status, Change of operating mode, High and low voltage fault ride through, High and low frequency ride through, Momentary cessation (if applicable), PLL-loss of synchronism, DC current and voltage, AC phase currents and voltage, Pulse width modulation index, Control system command values, reference values, and feedback signals and extend them to SCADA for analysis.
Provided that the inverter shall be capable of retaining data for ninety (90) days and capturing a minimum of twenty-five (25) samples per second.

(d) Inverter shall be placed indoor or under shed/roof/canopy and its ventilation shall be in accordance with the ambient and other environmental conditions.

(e) Inverter shall be capable of complete automatic operation including wake-up, synchronization and shutdown.

(f) Inverter shall have suitable Light Emitting Diode (LED) indications and Liquid Crystal Display (LCD) on the front panel to indicate the system status and monitor important electrical parameters.

(g) There shall be a local provision to download the implemented settings and parameters in all the inverters or if connected to a Local Area Network (LAN), these settings/parameters shall be centrally downloadable in any open source file format.

(h) All the Inverters shall have clear and indelible Marking Labels and Warning Labels as per the standards. The equipment shall be permanently marked with:
(i) The name or trade mark of the manufacturer or supplier.
(ii) A model number, name or other means to identify the equipment.
(iii) A serial number, code or other marking allowing identification of manufacturing location and the manufacturing batch or date.
(iv) Input voltage, maximum continuous current for each input.
(v) For each phase Output voltage, frequency, maximum continuous current and power factor.
(vi) The Ingress Protection rating.

(i) The Inverter shall be type tested at the accredited test centers or labs.

(j) The combined wattage of all inverters shall not be less than the rated capacity of a power plant.

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(k) An Inverter shall have internal protection arrangement against any sustainable fault in the feeder line and against lightning on the feeder.

(l) The Inverter shall have anti-islanding protection in conformity with the relevant standards.

(6) **Inverter Duty Transformer (IDT)**

A 3-phase transformer with LV winding connected to the inverter side and HV winding connected to the grid side shall have the following features:

(a) LV side of IDT shall have 3 phase AC voltage of either 415V or 650V or 1000V.

(b) HV side of IDT shall have 3 phase AC voltage of either11kV or 33kV.

(c) IDT shall be capable to operate within ambient temperature range -20 °C to 60 °C.

(d) IDT shall have minimum IP20 for indoor and IP55 for outdoor ingress protection.

(e) IDT shall be capable to operate at relative humidity range of 20-100 %.

(f) Efficient cooling shall be provided to achieve minimum efficiency of 95% in the operating temperature range upto 60 °C.

(g) IDT shall have Protection / Alarms as per the relevant standards.

(7) **AC Distribution Board (ACDB)**

(a) ACDB panel shall be between the Inverter and the Utility grid and shall be connected with a standard cable/ conductor with suitable termination;

(b) ACDB shall be comprising of necessary surge arrestors or circuit breaker of suitable rating for connection and disconnection of Inverter from the grid;

(c) There shall be a manual disconnection switch to isolate the system from the Grid which shall be situated outside of the ACDB; and

(d) Switches/ circuit breakers/ connectors and other related items shall meet the requirements and safety measurements as per the relevant standards.

(8) **Other equipment**: Requirements for other equipment including Cables, pipes, Control and Protection Equipment, Communication system, Metering Devices, Earthing system, Lightning Arrestor, Fire prevention and Fire Protection system shall be as per relevant CEA regulations.

**115. Control Room**

(1) Control room shall be provided to house the control and relay panels and all other indoor equipment, and measuring, monitoring and recording system required for control and operation of the plant.

(2) Adequate space shall be provided for the operation and maintenance staff.

(3) Provision of space for future requirement shall also be kept.

(4) The following parameters shall be accessible via the operating interface display in real time separately for PV strings, Inverters, transformers and transmission lines in the solar power plant:

(a) DC Input Voltage and Current.

(b) PV Module Temperature

(c) AC Output Voltage and Current

(d) Output Power (Active & Reactive).

(e) Power factor.

(f) Solar irradiation (W/m2)

(g) Relative Humidity.

(h) Ambient Temperature.

(i) AC Over voltage, AC Under voltage, over frequency, under frequency, ground fault, PV starting voltage, PV stopping voltage.

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## PART- A1

## ADDITIONAL REQUIREMENTS FOR CONSTRUCTION OF FLOATING SOLAR PLANT

**116.** The regulations under this part shall be applicable to floating solar plants which shall be in addition to the *relevant* regulations provided under Chapter VI Part-A.

**117. Site Selection and Layout**

(1) Floating Solar Plant (FSP) shall be installed on a body of water having a bund with compact soil, gentle slopes and even surface.

(2) Site parameters such as wind direction, water movement patterns, water-level variations, water current velocity and wave height measurements shall be analyzed for finalizing the site of floating solar project.

(3) Floater coverage area shall not exceed the limits specified by the concerned State authority.

(4) Bathymetry study shall contain floor depth analysis at every 1 meter including soil rock type.

Provided that bathymetry study shall be done using Multi-beam echo-sounder and shall be followed with suitable line spacing with at least 25% overlap.

**118. Panels & Floaters**

(1) The solar panels installed shall be at least 12 inch above water level and 6 inch above floater surface.

(2) The material used for the floaters shall be:
- (a) Resistant to UV radiation, alkalis, and salt water.
- (b) With wall thickness of minimum 2.5 mm and manufactured from virgin and non-toxic.
- (c) Recyclable or reusable at the time of disposal.

(3) Floaters shall be interconnected such that it is possible for replacing damaged floater and solar panels easily.

(4) Sharp or pointed objects such as non-living trees, debris, just beneath the solar panel area shall be removed to avoid damage to associated structure.

(5) The following tests shall be done for floaters as per the relevant standards:
- (a) Wind-tunnel test: Tests platforms in fully assembled condition with winds from various directions at different speeds
- (b) Tensile strength test
- (c) Bending fatigue test: Simulates platform under waves
- (d) Material composition test: Tests material composition of floaters
- (e) Temperature- and UV-accelerated aging test
- (f) Polymeric material properties test for evaluation of
  - (i) flammability,
  - (ii) mechanical stress,
  - (iii) thermal stress,
  - (iv) resistance to weathering,
- (g) Electrical resistance
- (h) Fire resistance tests
- (i) Drinking-water compatibility test
- (j) Corrosion-resistivity tests all structural elements made of metal
- (k) Buoyancy / puncture tests floatability

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(6) Adequate measures shall be taken at all times to prevent floaters and panels from toppling.
(7) PV modules shall not be placed on perimeter floats.
(8) To increase the durability of back sheets and encapsulants of PV panel, moisture-hardened materials with higher Potential Induced Degradation (PID) resistance shall be used.
(9) Junction boxes, wiring, and connectors installed above-water shall have minimum ingress protection of IP67.
(10) The water quality parameters shall be used for selecting the material which are in direct contact with water such as anchoring and mooring system, floating platform, cables.
(11) The water quality parameters shall contain both physical and chemical properties of water including pH, turbidity, salinity, dissolved oxygen, total dissolved solids and temperature

**119. Mooring and Anchoring**

(1) Mooring and Anchoring shall be adaptable to variations in water levels.
(2) Mooring system shall be placed by taking into account the location, bathymetry, soil conditions, and water-level variations.
(3) Rope/cable/elastic mooring or combination of these shall be always at tension or stretched condition.
(4) The junction where the mooring ropes or cables connect to floaters shall be joined with strong material and fastened with water resistant, non-corrosive material screws/ nut bolts.
(5) Anchor points shall be stationed at the perimeter floats.
(6) FSP platforms shall be anchored either to the bottom of the water body or to the bank or bund.
(7) The actual positioning of anchors shall be within 1 meter radius of designed location.
(8) Wind speed study shall be done to decide anchoring positioning.

**120. Cable routing/laying**

(1) Extra length cable in the form of slack shall be provided to accommodate the movement of floating platforms due to wind load and changes in water level.
(2) Cables shall be:
  (a) UV-resistant or protected from direct sunlight.
  (b) Properly tied or clamped.
(3) Wherever the cable is in contact with water, marine-grade cable shall be used.
  Provided that if non-marine-grade cable is used, it shall be fastened at appropriate interval to floaters such that it does not come in contact with water.

**121. Safety from animals/reptiles/rodents/birds**

(1) FSP shall have provisions to protect working personnel from the animals, reptiles, rodents, and birds.
(2) Equipment shall be placed in such a manner that they are not damaged due to presence of animals, reptiles, rodents, and birds.
(3) All unused cable entry holes in the panel shall be plugged in to avoid entry of rodents and reptiles.

**122. Other safety measures**

(1) Appropriate floaters with signage shall be provided for identification of ropes/ cables so as to avoid accidents with ships/ boats.

(2) Floating platform mounted with Inverters/ Transformer/ MV/HV Switchgear shall be adequately illuminated for visibility of working personnel.
(3) Lighting mast at suitable locations shall be provided for general illumination of PV array area.

123. **Earthing:** All non-current carrying metallic structures shall be earthed at bed or shore. Provided that wherever bed-earthing or shore-earthing is not feasible, the earthing plate shall be submerged in the water below floating platforms.

## PART- B

## TECHNICAL STANDARDS FOR CONSTRUCTION OF ONSHORE WIND POWER PLANT

124. **Site Selection and Layout**

The following criteria shall be considered for selection of site for the Wind Power Plant:

(1) **Type of land**: Site proximity to geological faults, high flood zone, high tide zones, avalanche prone area and land slide prone area shall be avoided as far as possible.

Provided that wind power plants which are located in extreme weather and site conditions shall be designed to withstand such extreme conditions.

(2) **Wind Potential:** The project developer shall use the quality data captured at a particular site with correct assessment of the wind resource potential, project viability and sustainability of the project.
(3) **Project logistics:** The project developer shall ensure logistics arrangement for wind turbine and other equipment to the site.
(4) **Layout Considerations:** The wind turbine locations shall be optimized within the land using appropriate wind flow modelling.

125. **Design Life:** The Wind Power Plant shall be designed to give life of not less than twenty-five (25) years.

126. **General Requirements**

(1) The design and installation of a wind turbine shall be in accordance with the relevant standards and the guidelines for Development of Onshore Wind Power Projects issued by the Government time to time.
(2) The developer shall ensure a minimum spacing of five times the Rotor Diameter between the two turbines in the direction perpendicular to the predominant wind direction and minimum spacing of seven times the Rotor Diameter between the two turbines in the predominant wind direction.
(3) Due to disturbed flow of wind caused by the upstream wind turbine, there is a reduction in power generation by downstream turbine i.e. wake loss, which shall not be more than 10%.
(4) The developer shall ensure a clearance of HH+1/2*RD+5 m (Hub Height+ Half Rotor Diameter + 5 meters) from public roads, railway tracks, highways, buildings, public institutions and power and telecom lines.
(5) Wind turbine shall not be installed within 500 meters of any cluster having atleast fifteen inhabited building.
(6) Each Wind Turbine shall have Radio-Frequency Identification (RFID) tag. The RFID shall be able to withstand all environmental conditions and contain the following information;
(a) Name of the manufacturer of wind turbine

(b) Month and year of the manufacture
(c) Country of origin
(d) Rated Power
(e) Unique Serial No. and Model No. of the Turbine
(f) Date and year of obtaining IS/IEC/IECRE /GL or other relevant standard, Wind turbine Type certificate.
(g) Name of the agency issuing Type certification.

(7) The design, testing and certification of a WTG shall be in accordance with the relevant standards.

(8) Adequate lighting shall be provided within the tower and nacelle for operation and maintenance work.

(9) Wind turbines shall be provided with visual markings and lights which are visible during the day and night as per the relevant standards. Aircraft warning lights shall also be provided atop the nacelle.

(10) Wind turbine blades, nacelle and tower shall be provided with lightning protection as per relevant standards.

127. **Major Equipment:** The Wind Power Plant shall mainly consist of the following equipment:

(1) Blades
(2) Nacelle
(3) Tower
(4) Foundation or base
(5) Transformer
(6) Other Equipment
(a) Cables, pipes, safety components and other accessories
(b) Metering devices (Meters)
(c) Earthing System
(d) Lightning Arrestor
(e) Fire prevention and Fire Protection system
(f) Data Communication system
(g) Cyber security devices/tools.

128. **Salient technical particulars of major equipment**

(1) **Blade**
(a) The blades shall be designed as per relevant standards.
(b) The blades shall be provided with day and night visuals as per the relevant Standards.
(c) The blades shall be made protected from cracking, water ingress, ice formation, and lightning damage.

(2) **Nacelle**
(a) Rotor assembly
(i) Rotor assembly shall be constructed and assembled as per the relevant standards.
(ii) Pitch and yaw control shall be provided.
(b) Gear boxes: In case of turbine having gear box proper lubrication arrangement shall be provided.
(c) Generator
(i) The generators shall meet at least the following technical specifications:
a) The AC output power (MVA/MW/MVAR) and current (A) shall be specified at 50°C and in steps of 10 °C within the operating ambient temperature range -20 °C to 60 °C.

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b) Generator shall have minimum IP20 for indoor and IP55 for outdoor ingress protection.
c) Appropriate cooling arrangement shall be made to operate the generator in the ambient temperature upto 60 °C.
d) The generator shall be capable to operate at relative humidity range of 20-100%.

(ii) Generators shall be provided with temperature sensors installed in the stator windings.

(iii) Generators shall be provided with temperature controlled cooling fan having ducts.

(iv) Generator windings shall be provided with corrosion protection to cope with condensation problems caused by the high relative humidity/ temperature gradient at the site.

(v) Generators shall be protected against short circuit, earth fault, over current and over/ under voltage.

(d) Control and Protection Equipment

(e) Ventilation equipment

(3) **Tower:** The tower shall comprises of the following;

(a) Converter

(i) The converter shall meet at least the following technical specifications:
a) The AC output power (MVA/MW/MVAR) and current (A) shall be specified at 50°C and in steps of 10 °C within the operating ambient temperature range -20 °C to 60 °C.
b) The power factor of converter shall be maintained atleast 0.99 and shall have adjustable power factor range from 0.9 leading to 0.9 lagging.
c) Converter shall have minimum IP20 for indoor and IP55 for outdoor ingress protection.
d) Efficient cooling shall be provided to achieve minimum efficiency of 97% in the operating temperature range upto 60 °C.
e) The converter shall be capable to operate at relative humidity range of 20-100%.
f) The converter shall have communication protocol RS485 (Modbus RTU), Modbus TCP, IEC 61850 with reaction time range of 10 ms to 100 ms and rise time range of 40 ms to 900 ms.

(ii) Converter shall have the following protection systems:
a) AC short circuit protection,
b) Leakage current protection,
c) Grid monitoring,
d) Ground fault monitoring,
e) Arc fault circuit interrupter (AFCI),
f) Overvoltage protection

(b) Ladder/lift

(i) Ladder and service lift shall be provided within the tower from tower base to the nacelle.

(ii) Resting space shall be provided at adequate intervals in the tower.

(c) Power/communication cables shall be laid on cable tray with segregation of voltage level.

(4) **Foundation or base:** The foundation shall be as per relevant standards.

(5) **Transformer:** The transformer shall be as per relevant standards.

(6) **Other equipment**: Requirements for other equipment including Cables, pipes, Control and Protection Equipment, Communication system, Metering Devices, Earthing system, Lightning Arrestor, Fire prevention and Fire Protection system shall be as per relevant CEA regulations.

129. **Communication System:** The Communication system of the wind power project shall be in compliance with *CEA (Technical Standards for Communication System in Power System Operation) Regulations, 2020 and any amendments thereafter*. Further, Generators controller shall support Modbus RTU/TCP, IEC 61850, or another relevant standard for communication, ensuring full compatibility with the plant SCADA system and the grid control center.

## PART- B1

## ADDITIONAL REQUIREMENTS FOR CONSTRUCTION OF OFFSHORE WIND POWER PLANT

130. The regulations under this part shall be applicable to offshore wind power plant which shall be in addition to the *relevant* regulations provided under Chapter VI Part-B.

131. **General Requirements**

(1) **Site Selection:** The site for offshore wind plant shall be as per National Offshore Wind Energy Policy.

(2) **Cable route**

(a) Cable route shall be finalized based on all relevant studies and surveys.

(b) Reliability, voltage profile and conductor losses shall be considered to optimize cable length and size.

(c) A series of wind turbines shall be connected to form a string and then connected to the offshore substation.

(d) Cable shall be laid with a bending radius as specified by the cable manufacturer.

(e) Shipping traffic impact on cable route due to prohibited anchoring areas, compass deviations on account of electrical interference shall be taken into account.

(f) All cable crossing shall be as per International Cable Protection Committee (ICPC).

(3) **Wind Turbine layout**

(a) Wind turbines in a wind farm or wind power plant shall be spaced to maximise the generation.

(b) The wind turbine spacing shall not be less than five times the Rotor Diameter in the direction perpendicular to the prevailing wind direction and Seven times the Rotor Diameter in the direction parallel to the wind direction.

(c) All conditions for layout shall be as per the National Offshore Wind Policy and amendments from time to time.

132. **Wind Turbine Foundation**

(1) Design of the wind turbine foundation shall be as per relevant standard.

(2) Scour protection shall be provided at the sea-bed for the fixed-bottom foundation and anchors of floating foundation for preventing seabed erosion due to currents and waves.

(3) Wind-turbine tower and foundation shall be connected by a transition piece.

(4) Transition piece shall be

(a) Of steel pipe and the connection shall be a bolted or grouted type.

(b) Painted yellow to improve visibility.
(c) With platforms, ladders and boat landing systems to enable to access the turbine tower for repair and maintenance work.
(d) With provisions of J-tubes or I-tubes for connecting cables between wind turbine and foundation structure.
(e) Protected from collision due to small boats and vessels by suitable measures
(f) With platform having a crane suitable for pulling electrical cables, lifting supplies from service vessels, and lifting stretchers to service vessels.

(5) Protective coating shall be done on both internal and external areas of foundation, transition piece and tower to protect from corrosion and mechanical forces.

(6) A minimum air gap of 1.5 meter shall be maintained at all times above the highest sea water level and the lowest edge of the supporting structure which is not designed for wave impact forces.

133. **Rotor assembly:** Blade tip shall have a minimum clearance of 22 meter from the Mean High Water Spring (MHWS).

134. **Nacelle**

(1) Wind speed, wind direction sensors shall be installed at the top.
(2) Anti-vibration mount shall be provided for the generator.
(3) Cranes shall be located in the nacelle.
(4) All wind turbines shall be provided with helihoist platforms to enable the turbines to be accessed in all weather conditions;

Provided that the helihoists platform shall be at least of 4 m x 4m size for supporting at least two service engineers.

135. **Transformers**

(1) All oil filled transformers shall have higher flash point so as to minimise fire hazards and avoid frequent repairs and maintenance.
(2) Surge arresters shall be provided for transformers.

136. **Auxiliary System:** The auxiliary transformer shall derive supply from the WTG. Further, there shall be arrangement to derive the auxiliary power from the grid whenever the WTG is not generating power.

Provided that a local Diesel Generator (DG) set shall be provided to supply the critical equipment and devices in the absence of grid supply.

137. **Doors and hatches:** Access doors shall be provided at the tower base and tower-top for entry into the tower and the nacelle.

138. **Off-shore Substation**

(1) **Construction:** The offshore AC substation shall be constructed in two parts namely, the topside and foundation substructure.
(2) **Foundation substructure**
(a) The substation foundation shall be fixed-bottom or floating depending upon the depth of water;
(b) Fixed bottom foundation shall be of monopole, multiple or jacket frame type.
(c) Floating foundation shall be of semi-submersible, barge, or spar type.

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(d) The foundation and transition piece shall accommodate the facilities such as cable entry J-tubes or I-tubes, boat landing facility, access ladders, lifeboats, crane for loading / unloading goods to and from boats, etc.
(e) Collision or impact protection shall be provided to foundation substructure.
(f) The substructure shall be painted in yellow.

(3) The topside shall house the main equipment such as transformers, array cables, and export cables, various auxiliary equipment, LV & HV busbars, switchgear and protection devices.

(4) The rating of HV and LV winding of step-up transformer shall be such that it optimize power flow.

(5) Single bus scheme shall be provided for both LV and HV buses.

(6) There shall be control room for carrying out the various monitoring and control functions.

(7) SCADA/EMS servers and other servers shall be used for monitoring and controlling wind turbine systems.

(8) **Auxiliary systems:** Auxiliary transformers, AC and DC power supply sources shall feed the auxiliary loads of the substation.

(9) **HVAC system:** The electrical and other equipment shall be housed indoor to protect them from all weather conditions.

Provided that there shall be ventilation for effective cooling.

(10) **Lightning protection:** Lightning protection shall be provided for the entire substation structure.

(11) **Communication**

(a) Antenna mast shall be provided at top of the topside for navigational needs.
(b) The primary communication link between the Offshore Substation and the Onshore Substation shall be established through fiber-optic cables embedded within the power export cables.
(c) The information received through communication cables embedded in power cables shall be fed to various monitoring and control systems.
(d) Satellite, preferably indigenous, based time synchronization of various events and the devices shall be done.

(12) All rooms and areas of substation shall be provided with adequate level of illumination for carrying out the specified task.

(13) Backup power supply system shall be with DG set of adequate capacity to meet the requirement for critical system.

(14) There shall be a helipad and a helihoist, to provide access in all weather conditions.

**139. Power cables**

(1) **Array cables**

(a) The voltage rating of the array cable shall be such that it optimize power flow.
Provided that array cable shall contain aluminium or copper 3-core, cross-linked polyethylene (XLPE) or Ethylene Propylene Rubber (EPR) insulated, fibre optic cable embedded, steel armoured, and sheathed.
(b) Array cable entry at the foundations of both wind turbine and offshore substation shall be through J-tube or I-tube.
(c) Incoming array cables carrying power collected from wind turbine generators shall be received through J-tubes or I-tubes and terminated at the LV busbar of the substation.

(2) **Export cables**

(a) The voltage rating of the export cable shall be such that it optimize power flow.

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Provided that export cable shall contain aluminium or copper 3-core, cross-linked polyethylene (XLPE) or Ethylene Propylene Rubber (EPR) insulated, fibre optic cable embedded, steel armoured, and sheathed.

(b) Export cable entry at the foundations of offshore substation shall be through J-tube or I-tube.

(c) Offshore substation or HVDC converter station shall be connected with onshore substation by export cable.

(d) Export cable shall have n-1 reliability criteria.

**140. Transition point**

(1) Export cable shall be buried underground and terminated at the Transition Junction Box (TJB).

(2) TJB shall be located outside Coastal Regulation Zone boundary and fenced to avoid entry of unauthorized person.

**141. Earthing:** Earthing rod connected to the foundation shall be provided to earth all non-current carrying metallic structures.

## PART- C

## TECHNICAL STANDARDS FOR CONSTRUCTION OF BATTERY ENERGY STORAGE SYSTEMS (BESS)

**142. Site Selection and Layout Considerations:** Site proximity to geological faults, high flood zone, high tide zones, avalanche prone and land slide prone area shall be avoided as far as possible.

Provided that BESS which are located in extreme weather and site conditions shall be designed to withstand such extreme conditions.

**143. Civil Structure**

(1) All structures and foundations shall be designed as per the expected service life of BESS.

(2) BESS shall be seismically braced in accordance with the National Building Code.

(3) There shall be proper access or space for the movement of BESS equipment during installation, commissioning, and operation & maintenance as per relevant standard.

**144. Application and Uses Cases**

BESS shall be designed for the following use cases:

(1) Grid Integration of RE sources: To assist in grid integration of RE sources by reducing output volatility & variability, and improving power quality.

(2) Capacity Firming: To provide the firm capacity from RE sources by using energy storage in conjunction to provide a constant energy supply.

(3) Energy Time Shift: To charge with inexpensive electric energy purchased during low price periods and discharge back to the grid during high price periods.

(4) Transmission and Distribution support: To enhance transmission and distribution system performance by offsetting electrical imbalances and interruptions.

(5) Congestion Relief and Deferring System Upgrade & Substitution: To avoid congestion related cost by discharging during peak demand to reduce transmission capacity requirements and postpones or avoids the need to upgrade transmission and/or distribution infrastructure.

(6) Substation on-site Power: To provide power to switching components and, communication & control equipment in the substation.

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(7) Load following and Voltage support: To alter power output in response to variations between electricity supply and demand, and manages the reactive power to maintain the grid voltage within permissible limit.
(8) Time-of-Use Energy Cost and Demand Side Management: To reduce overall electricity cost for end users by allowing customers to charge the BESS during low price periods and discharge during specific peak demand periods.
(9) Black-Start: To provide black-start service avoiding fuel costs and emissions from conventional black-start generators.
(10) Any other application of BESS which is grid-interactive.

**145. Major Equipment:** BESS shall mainly consist of the following equipment:
(1) Cell, Battery Module, Battery Rack, Battery Container
(2) Battery Management System (BMS)
(3) Power Conversion System (PCS)
(4) EMS (Energy Management System)

**146. BESS Components**

(1) **Cell, Battery Module, Battery Rack, Battery Container**
   (a) Each battery module shall be labelled with at least the manufacturer's name, country of origin, cell type, nameplate rating, and date of manufacture.
   (b) Each module shall have RFID tag which shall include the following information:
      (i) Cell type
      (ii) Name of the manufacturer of each cell and module
      (iii) Month and year of the manufacture
      (iv) Country of origin
      (v) Nameplate rating
      (vi) Unique Serial No and Model No. of the module
      (vii) Date of obtaining qualification certificate
      (viii) Name of the lab issuing testing certificate
   (c) Each battery rack shall have provision to disconnect itself, if required, from the rest of the system.
   (d) The Battery Container shall:
      (i) Be able to withstand extreme temperature, pressure, explosion and vibrations etc.
      (ii) Have cooling arrangement so as to maintain operating temperature range of the Batteries.
      (iii) Be weatherproof, dustproof with provisions to prevent moisture condensation, ingress of water, airborne salt and dust.
      (iv) Be corrosion resistant to prevent deterioration of BESS components.

(2) **Battery Management System (BMS)**
   (a) BMS shall be provided at module, rack and container level.
   (b) BMS shall be able to:
      (i) Monitor real-time voltage, current, State of Charge, State of Health, and temperature.
      (ii) Regulate the charging and discharging of the batteries.
      (iii) Protect the battery from deep discharge, over voltage, over current and high temperature.
      (iv) Provide for cell balancing function in order to ensure uniform charging and discharging of different cells.
      (v) Communicate with the PCS.

(3) **Power Conversion System (PCS)**

(a) **General requirements**

(i) PCS shall consist of one or multiple PCUs depending on the application and power configuration.

(ii) In case PCS is installed outdoor, it shall be provided with a canopy.

(b) The PCS shall:

(i) Be able to perform complete automatic unattended operation.

(ii) Be capable of synchronizing and disconnecting with the grid.

(iii) Include self-protective and diagnostic features to protect itself from damage in the event of component failure and abnormal operating parameters.

(iv) Include provisions for disconnecting both its AC and DC terminals for maintenance work.

(v) Not produce electromagnetic interference which can cause mal-operation of instrumentation, communications, or similar electronic equipment within the BESS

(vi) Be able to continuously regulate active power and reactive power.

(vii) Be provided with over-current protection device(s) which shall be able to clear faults due to malfunctions within the PCS, including commutation failures.

(viii) Be designed to include provisions to limit run-on and islanding upon the loss of grid as per the applicable standards.

(ix) Be designed to limit surges on the DC bus to a maximum of twice the normal DC bus voltage.

(x) Be provided with load carrying cables within the PCS subsystem all of which shall have safety factor of two (2).

(4) **EMS (Energy Management System)**

(a) EMS shall:

(i) Comprise of Programmable Logic Controller (PLC), voltage, current and power measurement devices and a software which can interface with BMS, PCS, PLC and measurement devices.

(ii) Control the charge/discharge of the grid-connected storage from a system perspective.

(iii) Allow comprehensive monitoring, reliable information exchange and rapid control of all equipment within BESS.

(iv) Provide for integrated, real-time monitoring, efficient operation and control of active power, reactive power at the interconnection point of BESS.

(v) Be integrated with the SCADA and shall have built-in logic/programming to monitor, control, and optimize the performance of Plant facilities as per specification.

(vi) Be designed for Automatic unattended operation.

(vii) Be designed for local manual and remote operation from a remotely located computer.

(viii) Ensure an orderly startup sequence.

(ix) Ensure an orderly shutdown, even in the absence of grid power.

(x) Provide for safe system reset from any standby or operating condition.

(xi) Allow to enter standby state from any other operating states except connect/disconnect.

(xii) Initiate shutdown under following conditions and shall remain in the shutdown state until a reset signal, either local or remote, is initiated:

a) Emergency trip switch.

b) Loss of utility grid voltage.

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c) An AC circuit breaker trip (either side of transformer).
d) Smoke/fire alarm.
e) A DC ground fault (field-adjustable setting).
f) Remote disable (no reset required).
g) Islanding condition.

(xiii) Provide for reading and reporting of various BESS status information.

(xiv) Be programmable to select optimum-operating mode of whole plant.

(xv) Be able to receive external set points and automatically adapt the Plant Facility behavior to it.

(xvi) Be able to allow following operation modes for the Plant facilities:
a) Reactive Power Control
b) Power Factor Control
c) Voltage Control
d) Voltage Droop
e) Apparent Power Control
f) Active Power Limitation
g) Power Ramp Rate Control
h) Frequency Regulation

(xvii) Provide for synchronization of its real-time clock with standard time source.

(xviii) Provide for self-diagnostic and self-protective features to protect BESS and the battery from damage in the event of BESS component failure or from parameters beyond the BESS's safe operating range.

(xix) Be housed in a controlled environment.

(xx) Have provisions of UPS/ DC Power supply of suitable rating to cater all the load requirements of the EMS system and its auxiliaries.

(b) The EMS shall be capable of receiving target setpoints (e.g., power injection/absorption, SoC limits) from the grid operator or SCADA system using standard communication protocols such as IEC 60870-5-104, Modbus TCP, or IEC 61850, transmitted over Ethernet, fiber-optic, or other approved media. Where required, appropriate protocol converters or gateways may be used to interface with internal systems (e.g., BMS, PCS).

(c) Protocols and media used shall comply with latency and availability norms defined in the CEA (Technical Standards for Communication System in Power System Operation) Regulations, 2020 and any amendments thereafter and the Manual on Communication Planning in Power System Operation.

**147. BESS Technical Specifications**

(1) BESS plant shall be designed to achieve its rated power output for full range of ambient temperature.

(2) Maximum annual degradation of BESS capacity shall not be more than 2% per year.

(3) BESS shall have performance guarantee of at least:
(a) 90% output at the end of 5 years of use;
(b) 80% output at the end of 10 years of use;
(c) 70% output at the end of 15 years of use.

(4) Number of cycles offered by BESS shall correspond to the expected life of the BESS at its rated energy capacity.

(5) BESS shall provide minimum Depth of Discharge (DoD) of 80%.

(6) PCS efficiency with Isolation Transformer shall not be less than 95%.

(7) System availability at PCS level shall not be less than 95%.

(8) Round Trip Efficiency (RTE) (AC-to-AC, including auxiliary consumption) shall not be less than 70%.

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(9) Ramp rate and number of cycles per day shall be designed as per the use case and application of BESS.

Provided for any new technology related to BESS, the technical specification may be issued by the Authority through a separate order.

**148. Safety**

(a) There shall be a DC breaker, fuse, or other current-limiting device on the battery bus.
(b) There shall be over-current protection, either on the AC or the DC side, in cell strings. The over current protection shall be sized and coordinated so that currents from one string do not contribute to a fault in any other cell string.
(c) The cells, wiring, switch gear, and all dc electrical components shall be insulated for the maximum expected voltages plus a suitable factor of safety.
(d) Spacing shall be provided as per Central Electricity Authority (Measures relating to Safety and Electric supply) Regulations, 2023.

**149. Alarm**

(1) There shall be an alarm and display system to notify the occurrence of abnormal conditions including over temperature, over current, over voltage, DC ground fault, smoke, gas or any other parameter specified by OEM.
(2) All the system-generated alarms shall have a provision to be acknowledged by the operator.
(3) The alarm trigger level shall be field adjustable.
(4) The BESS shall alarm when a BESS container door is opened.

**150. Control Room**

(1) Control room shall be provided to house the control and relay panels, EMS and all other indoor equipment, and measuring, monitoring and recording system required for control and operation of the BESS.
(2) Adequate space shall be provided for the operation and maintenance staff.
(3) The following parameters, as applicable, shall be accessible via the operating interface display in real time for BESS, SCADA, transformer, switchyard equipment and transmission line:
    (a) DC Input Voltage and Current.
    (b) Battery Module and Container temperature.
    (c) AC Output Voltage and Current.
    (d) Output Power (Active & Reactive).
    (e) Power factor.
    (f) Relative Humidity.
    (g) Ambient Temperature.
(4) The control panel or console shall also include meters, indicators, and displays.

**151. Sharing of Data**

(1) All requisite Analog and Digital inputs as required by the Control Center (REMC/RLDC/SLDC) shall be made available by BESS.
(2) Active Power/Reactive Power, Event Loggers/DR during tripping/protection operation, LVRT, HVRT triggering data and other data as required shall be stored and made available to Control Center/RPCs.

Provided that the EMS shall be capable of retaining data for ninety (90) days and capturing a minimum of twenty-five (25) samples per second

**152. Auxiliaries**

(1) Auxiliaries shall include HVAC, transformer, wiring, connectors, protective devices, grounding, junction boxes, illumination, CCTV, enclosures and instrumentation.

(2) BESS shall include an auxiliary power system. The auxiliary power system may be derived from any of the following, but not limited to:
   (a) Utility or DISCOM AC bus
   (b) LV side of IDT
   (c) Tertiary winding of IDT

(3) The auxiliary power system shall provide for:
   (a) Necessary emergency power for an orderly system shutdown during abnormal conditions.
   (b) The capability to restart automatically after BESS shutdowns of several days.
   (c) Other auxiliary power requirement of BESS.

(4) BESS shall have HVAC system to maintain battery container temperatures, conducive to maintain battery performance for all seasons/climatic conditions at the site for the entire battery life.

(5) The air handling/distribution system shall be designed to maintain uniform temperature within the container.

**153. Protection and Control**

(1) The BESS shall be capable of interrupting line-to-line fault currents and line-to-ground fault currents available at the PCC or PoI and flowing in the equipment in either direction for faults on either side of the PCC or PoI.

(2) Faults due to malfunctions within the BESS shall be cleared by the BESS protective devices.

(3) Surge-protection devices shall be provided to protect against transient voltage surges from switching, lightning, and similar causes, in accordance with applicable standards.

(4) Control and Instrumentation system provided for the BESS plant shall be consistent with modern power station practices and in compliance with all applicable standards, guidelines, cyber security regulation and safety requirements as per relevant CEA regulation.

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