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CENTRAL ELECTRICITY AUTHORITY
NOTIFICATION
New Delhi, the ……., 2026

F No. CEA-TH-17/1/2021-TETD Division.- Whereas public notice advertising the draft of the Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulation, 2025, was published in six newspaper dailies, as required by sub-section (3) of section 177 of the Electricity Act, 2003, and sub-rule (2) of rule 3 of the Electricity (Procedure for Previous Publication) Rules, 2005, for inviting objections and suggestions from all persons likely to be affected thereby, within the period of forty five days, from the date on which the copies of the said draft regulations were made available to the public;

And whereas copy of the public notice as advertised in the newspapers and the said draft regulations were made available to the public on the website of the Central Electricity Authority on 6th October,2025;

And whereas the objections and suggestions were received from the public on the said draft regulations were considered by the Central Electricity Authority;

Now, therefore, in exercise of the powers conferred by clause (e) of sub-section (2) of section 177, the Central Electricity Authority hereby makes the following amendments in the Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulation, 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) Regulation, 2026.
   (2) They shall come into force on 1st April, 2027.
2. In regulation 2, in sub-regulation (1), after clause (f), the following clauses shall be inserted, namely: -
   "(fa) "battery energy storage system" means a stationary system connected to the electricity system which is used to store electric energy by means of electrochemical materials, typically includes batteries, power conversion system, and battery management system.
   (fb) "battery energy storage system energy capacity" means the product of the rated output power and the output duration time at this rated power, expressed in kWh or MWh, measured at metering point, at the time of commissioning of the battery energy storage system.
   (fc) "battery energy storage system power capacity" means the maximum amount of power, expressed in kW or MW, that a battery energy storage system can deliver at delivery point at any given moment.
   (fd) "battery container" means a container which houses the components such as module, rack, battery management system, thermal management system, safety system and control system.
   (fe) "battery management system" means a system which controls the batteries in order to obtain safe operation, and also balances the energy of batteries and monitors the status thereof.
   (ff) "battery module" means a string of series connected cells placed in a casing.
   (fg) "battery rack" means a string of series connected battery modules placed in a container."
3. In the said regulations, in regulation 2, in sub-regulation (1), after clause (i), the following clause shall be inserted, namely: -
   "(ia) "c rate" means the rate at which a battery charges or discharges relative to its maximum energy capacity.
   (ib) "cycle" means the charging of a battery from its depth of discharge level to its peak charging level and again discharging to its depth of discharge level."
4. In the said regulations, in regulation 2, in sub-regulation (1), after clause (l), the following clause shall be inserted, namely: -
   "(la) "depth of discharge" means the level to which a battery energy storage system is discharged relative to the maximum possible amount of energy that can be discharged by the system, typically expressed as a percentage."
5. In the said regulations, in regulation 2, in sub-regulation (1), after clause (ze), the following clause shall be inserted, namely: -
   "(zea) "module" means the collection of photovoltaic cells connected together."
6. In the said regulations, in regulation 2, in sub-regulation (1), after clause (zk), the following clause shall be inserted, namely: -
   "(zka) "power conversion system" in a battery energy storage system refers to the integrated system of inverters, rectifiers, controllers and associated power electronics system that convert Direct Current power stored in the battery to Alternating Current power for injecting into the electricity system (discharging), and vice versa (charging)
   (zkb) "power plant controller" means the equipment in a renewable energy power plant responsible for maintaining a reference active and reactive power output from the renewable energy power plant and also capable of sending & receiving signals from remote end."
7. In the said regulations, in regulation 2, in sub-regulation (1), after clause (zn), the following clause shall be inserted, namely: -

"(zna) "ramp rate of battery energy storage system" means rate of change of a battery energy storage system output expressed in percentage of MW per minute."

8. In the said regulations, in regulation 2, in sub-regulation (1), after clause (zq), the following clause shall be inserted, namely: -

"(zqa) "state of charge" means the present level of charge of a battery expressed in percentage of its maximum capacity.

(zqb) "state of health" means the maximum level of charge of a battery expressed in percentage of its initial value at the time of its first use."

9. In the said regulation, after regulation 108, the following Chapter shall be inserted, namely: -

"CHAPTER-VI

TECHNICAL STANDARDS FOR CONSTRUCTION OF RENEWABLE ENERGY POWER PLANT AND BATTERY ENERGY STORAGE SYSTEM

109. Technical standards for construction of renewable energy power plant and battery energy storage system 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 onshore 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 system

110. General requirements.-

(1) **Equipment ratings.-**

(a) in a renewable energy power 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, within the frequency range, voltage range, power factor limits, 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.

(b) in battery energy storage system, all equipment ratings shall be such that the plant is suitable for continuous operation, without any restriction up to the rated State of Charge within the frequency range, voltage range, power factor limits, 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 owner of renewable energy power plant or the battery energy storage system, as the case may be, shall retain atleast 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 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 in requisite format.
(e) type test certificate along with detailed evaluation report of equipment within the renewable energy power plant or the battery energy storage system, as the case may be, 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 or the battery energy storage system , as the case may be, and date of commissioning.

(4) The owner of renewable energy power plant having installed capacity of 10 MW and above, shall install world meteorological organization norms compliant Automatic Weather Station in the plant to measure parameters including wind speed, ambient temperature, solar irradiance, relative humidity and atmospheric pressure as per guidelines issued by Authority for installation of Automatic Weather Station at a renewable energy power plant.

(5) Phasor measurement units shall be installed at locations as provided in 'Guidelines on Unified Philosophy for Placement of Phasor Measurement Unit in Indian Grid' issued by Central Electricity Authority.

(6) Harmonic analyzer as per relevant standard shall be made available by the owner of substation or the owner of the pooling station, at all incomer bays at point of interconnection or pooling station, as the case may be.

(7) Power plant controllers shall be provided for active power and reactive power control of renewable energy power plant with the capacity as provided in the Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulations, as amended from time to time and the power plant controllers shall be capable of: -

(a) receiving set-points in digital and analog form at renewable energy plant or from the state load despatch centre or regional load despatch centre remotely, as the case may be.
(b) receiving parameters such as active power, reactive power, voltage, current measured by power quality meter at the point of interconnection.
(c) fulfilling the dynamic performance requirements as per Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulations.

(8) Renewable energy power plant or the battery energy storage system, as the case may be, shall establish a reliable, redundant, and secure communication system within the plant premises and up to the point of interconnection on the transmission or distribution network, as the case may be, and maintain throughout the life of the plant.

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

(10) The owner of the renewable energy power plant shall install power quality meters as per relevant standards at point of interconnection.

Provided that no additional power quality meter is required at point of interconnection if the existing power quality meter at point of interconnection is capable to send required parameter to power plant controllers.

Provided further that the provision of space for installation of power quality meter along with power supply at point of interconnection shall be provided by substation owner.

(11) The owner of the renewable energy power plant or the battery energy storage system, as the case may be, shall provide the equipment which are capable to measure parameters such as frequency, voltage, current, active power, reactive power, apparent power, and sequence components of voltage and current for field measurements as well as on-site tests and also provide grid event data logger.

(12) **Cable and wiring.-**
(a) all cables and wires shall be as per the relevant standards having appropriate size and rating considering the losses, maximum load, 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 and also 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 water.
(g) the cable shall have a service life that is compatible with the design life of the renewable energy power plant or the battery energy storage system, as the case may be.

(13) **Protection.-**
(a) fully graded protection system with requisite speed, sensitivity and selectivity shall be provided.
(b) overvoltage protection of renewable energy power plant or the battery energy storage system, as the case may be, shall be coordinated with their high voltage ride through requirement at the point of interconnection.
(c) under voltage protection of a renewable energy power plant or the battery energy storage system, as the case may be, shall be suitably coordinated with their low voltage ride through requirement at the point of interconnection.

(14) All relevant regulations from regulation 1 to regulation 108 shall be applicable to any substation and electric line installed beyond the inverter duty transformer in a renewable energy power plant or the battery energy storage system, as the case may be.

(15) The safety provisions in the renewable energy power plant or the battery energy storage system, as the case may be, shall be as per Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, as amended from time to time.

(16) The renewable energy power plant or the battery energy storage system, as the case may be, 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 or the battery energy storage system, as the case may be, shall provide the capability of mutually exclusive operating modes of reactive power control functions: -

(a) **Voltage control mode:** When operating in voltage control mode, the plant shall operate in closed-loop automatic voltage control mode to regulate the steady-state voltage at the point of interconnection to the reference value, as adjusted by the droop function, to within 1% of the point of interconnection 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 point of interconnection.

(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 or the battery energy storage system, as the case may be, 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 conditions.

(2) **Considerations for layout and construction.-**

(a) minimum clearance of 0.75m shall be provided in the layout of the inverter and direct current or alternating current 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.

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

(d) all foundations shall be designed to withstand all types of loads coming on it and made as per the relevant standards.

112. Design life.- The solar power plant shall be designed for a life of not less than twenty-five years.

113. Major equipment.- A solar power plant shall mainly consist of:

(1) Photovoltaic panel or module
(2) Module mounting structure
(3) Photovoltaic junction box
(4) String junction box or array junction boxes
(5) Inverter
(6) Inverter duty transformer
(7) Alternating current distribution board
(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 requirements of major equipment

(1) **Photovoltaic panel or module.-**

(a) photovoltaic 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.

(b) photovoltaic module shall have a bypass diode for optimizing photovoltaic output in case of failure of any photovoltaic cell.

(c) all solar panels shall be cleaned without or with minimal water consumption.

(d) photovoltaic module shall have radio-frequency identification tag on the module lamination and be able to withstand all environmental conditions and also radio-frequency identification tag contain the following information: -

(i) name of the manufacturer of photovoltaic module and solar cells
(ii) month and year of the manufacture
(iii) country of origin, separately for solar cells and module
(iv) current-voltage curve for the module
(v) peak wattage, maximum power voltage (V_{mp}), maximum power current (I_{mp}) and fill factor

(vi) unique serial number and model number of the module
(vii) date and year of obtaining relevant qualification certificate for photovoltaic module
(viii) name of the test laboratory issuing certificate under relevant standard
(ix) other relevant information on traceability of solar cells and module.

(e) The following minimum details shall be provided on the photovoltaic module: -
(i) name of the manufacturer
(ii) month and year of manufacture
(iii) country of origin
(iv) rated power at standard test conditions
(v) maximum power voltage (V_{mp}), maximum power current (I_{mp}), open circuit voltage (V_{oc}), short circuit current (I_{sc}).

(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 photovoltaic 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) **Photovoltaic junction box.-**
(a) it shall be ultra violet resistant.
(b) by-pass mechanism to prevent photovoltaic cells from hotspot as per relevant standard.
(c) connectors shall be provided with ingress protection of IP 68.

(4) **String junction box or Array junction box.-**
(a) string junction box comprising of an enclosure, copper bus bars, fuses, surge protection device, disconnector shall be designed as per requirement of the inverter.
(b) the string junction box shall be made with full dust, water and vermin proof arrangement.
(c) all wires and cables shall be appropriately terminated through cable lugs.
(d) the string junction box shall have minimum IP65 for outdoor or IP54 for indoor ingress protection.
(e) string junction box may be wired with optical fiber cables for enabling data collection from string junction box or array junction box of capacity 100 kW onwards.

(5) **Inverters.-**
(a) inverters shall have the following minimum features:-
(i) the output power shall be expressed in MVA, MW and MVAR and output current expressed in Ampere for ambient temperatures, as provided by India Meteorological Department at site, ranging from minimum to maximum in steps of 10 °C.
(ii) the inverter shall convert direct current to alternating current and the direct current component of output shall not be more than 0.5 % of continuous maximum rated inverter output current.
(iii) the power factor of inverter shall have adjustable range from 0.9 leading to 0.9 lagging.
(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%.
(vi) inverter shall consume not more than 0.001% of rated power of inverter during idle condition.
(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 protections: -
(i) on the input side: direct current reverse connection protection, direct current leakage current protection, direct current switch, potential induced degradation protection, anti-potential induced degradation or potential induced degradation recovery, direct current type-II overvoltage protection and inverter input current monitoring.
(ii) on the output side: alternating current short circuit protection, alternating current leakage current protection, ground fault protection, alternating current switch and arc fault circuit interrupter.

(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), phase lock loop-loss of synchronism, input current and voltage, output phase currents and voltage, pulse width modulation index, control system command values, reference values, feedback signals and shall send to supervisory control and data acquisition.

Provided that the supervisory control and data acquisition shall be capable of retaining the captured data for ninety days and capturing a minimum of one thousand samples per second.

(d) inverter shall be placed indoor and its ventilation shall be in accordance with the ambient and other environmental conditions.

Provided that in case the inverter placed outdoor then it shall be under shed or roof or canopy.

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

(f) inverter shall have suitable light emitting diode indications and liquid crystal display 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.

Provided that in case connected to a local area network, these settings and parameters shall be centrally downloadable in any open source file format.

(h) inverter shall have clear and indelible marking labels and warning labels as per the relevant standards and the same shall be permanently marked with: -

(i) name or trade mark of the manufacturer or supplier.

(ii) model number, name or other means to identify the equipment.

(iii) serial number, code or other marking allowing identification of manufacturing location and the manufacturing batch and date.

(iv) input voltage, maximum continuous current for each input.

(v) each phase output voltage, frequency, maximum continuous current and power factor.

(vi) ingress protection rating.

(i) the inverter shall be type tested at the accredited testing labs.

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

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

(6) **Inverter duty transformer.-**

A 3-phase transformer with low voltage winding connected to the inverter side and high voltage winding connected to the grid side shall have the following features: -

(a) low voltage side of inverter duty transformer shall have 3 phase voltage of either 415V or 650V or 1000V.

(b) high voltage side of inverter duty transformer shall have 3 phase voltage of either 11kV or 33kV or 66kV.

(c) inverter duty transformer shall be capable to operate within ambient temperature.

(d) inverter duty transformer shall have minimum IP20 for indoor and IP55 for outdoor ingress protection.

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

(f) efficient cooling shall be provided to achieve minimum efficiency of 95%.

(g) inverter duty transformer shall have protection and alarm system as per the relevant standards.

(7) **Alternating current distribution board.-**

(a) alternating current distribution board panel shall be connected between the inverter and the utility grid.

(b) alternating current distribution board shall be installed with surge arrestor or circuit breaker of suitable rating for connection and disconnection of inverter from the utility grid.

(c) there shall be a manual disconnection switch to isolate the system from the utility grid and shall be placed outside of the alternating current distribution board.

(d) switches, circuit breakers, connectors and other related items shall be rated as per the relevant standards.

(8) **Other equipment.-** Requirements for other equipment such as cables, pipes, control and protection equipment, communication system, metering devices, earthing system, lightning arrestor, alternating current and direct current fire prevention and protection system shall be as per relevant regulations notified by Authority.

115. Control room.-

(1) Control room shall house the control and relay panels and all other indoor equipment, measuring, monitoring and recording system.

(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 photovoltaic strings, inverters, transformers and transmission lines in the solar power plant: -

(a) direct current input voltage and current

(b) photovoltaic module temperature

(c) alternating current output voltage and current

(d) output power (active and reactive)

(e) power factor

(f) solar irradiation expressed in Watt per square meter

(g) relative humidity

(h) ambient temperature
(i) alternating current over voltage, alternating current under voltage, over frequency, under frequency, ground fault, photovoltaic starting and stopping voltage.

Provided that solar power plant having automatic generation control capability shall display the following additional parameters:

(j) maximum available power (maximum power point tracking)
(k) active power and reactive power control mode
(l) voltage set points

PART- A1
ADDITIONAL REQUIREMENTS FOR CONSTRUCTION OF FLOATING SOLAR PLANT

116. The regulations of Chapter VI Part-A shall also be applicable for the construction of floating solar plant.

117. Site selection and layout.-

(1) Floating solar plant 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 plant.
(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 one meter including soil rock type.

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

118. Panels and floaters.-

(1) The solar panels installed shall be at least twelve inch above water level and six inch above floater surface.
(2) The material used for the floaters shall be: -
  (a) resistant to ultra-violet radiation, alkalis and salt water.
  (b) virgin and non-toxic with wall thickness of minimum 2.5 mm.
  (c) recyclable or reusable at the time of disposal.
(3) Floaters shall be interconnected such that the damaged floater can be replaced 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
  (b) tensile strength test
  (c) bending fatigue test
  (d) material composition test
  (e) temperature and ultra violet accelerated aging test
  (f) polymeric material properties test for evaluation of flammability, mechanical stress, thermal stress and resistance to weathering
  (g) electrical resistance test
  (h) fire resistance test
  (i) drinking-water compatibility test
  (j) corrosion-resistivity tests of all structural elements made of metal
  (k) buoyancy and puncture test
(6) Adequate measures shall be taken at all times to prevent floaters and panels from toppling.
(7) Photovoltaic modules shall not be placed on perimeter floats.
(8) To increase the durability of back sheets and encapsulants of photovoltaic panel, moisture-hardened materials with higher potential induced degradation 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 and 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 or cable or 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, fasteners of non-corrosive material.
(5) Anchor points shall be located at the perimeter floats.
(6) Floating solar plant 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 one meter radius of designed location.

(8) Wind speed study shall be done to decide anchoring positioning.

120. Cable routing and 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 properly tied or clamped.

(3) Cables shall be ultra-violet resistant or protected from direct sunlight.

(4) Wherever the cable is in contact with water, the 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 and birds.-

(1) Floating solar plant 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 and cables so as to avoid accidents with ships or boats.

(2) Floating platform mounted with inverters, transformer and switchgear shall be adequately illuminated for visibility of working personnel.

(3) Lighting mast at suitable locations shall be provided for general illumination of photovoltaic 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 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 plant which are located in extreme weather and site conditions shall be designed to withstand such 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 including associated wind turbines shall be designed to give service life of not less than twenty-five years.

126. General requirements.-

(1) The design and installation of a wind turbine shall be in accordance with the relevant standards.

(2) The project developer shall ensure a minimum spacing of five times the rotor diameter in the direction perpendicular to the predominant wind direction and minimum spacing of seven times the rotor diameter in the predominant wind direction from the turbine of other developer.

Provided that in case the adjacent turbines of other project developer having dissimilar rotor diameters, the diameter of larger turbine rotor shall be considered for the calculation of spacing.

(3) 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 transmission lines.

(4) Wind turbine shall not be installed within 500 meters of any cluster of dwellings for the mitigation of noise.
Explanation: For the purpose of this sub-regulation 'cluster of dwellings' shall mean at least 15 inhabited buildings unless any other norm specified by the concerned State Government.

(5) Each wind turbine shall have radio-frequency identification tag which shall be able to withstand all environmental conditions and also radio-frequency identification tag 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 number and model number 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

(6) The design, testing and certification of a wind turbine generator shall be in accordance with the relevant standards.

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

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

128. Salient technical requirements 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 shall be constructed and assembled as per the relevant standards.
  (b) rotor assembly shall be provided with pitch and yaw control.
  (c) turbine having gear box shall be provided with proper lubrication arrangement.
  (d) the generator shall meet at least the following technical specifications: -
    (i) the output power shall be expressed in MVA, MW and MVAR and output current expressed in Ampere shall for ambient temperatures, as provided by India Meteorological Department at site, ranging from minimum to maximum in steps of 10 °C.
    (ii) generator shall have minimum IP20 for indoor and IP55 for outdoor ingress protection.
    (iii) appropriate cooling arrangement shall be made to operate the generator in the ambient temperature.
    (iv) the generator shall be capable to operate at relative humidity range of 20-100%.
  (e) generators shall be provided with temperature sensors installed in the stator windings.
  (f) generators shall be provided with temperature controlled cooling system.
  (g) generator windings shall be provided with corrosion protection to cope with condensation problems caused by the high relative humidity or temperature gradient at the site.
  (h) generators shall be protected against short circuit, earth fault, over current and over voltage or under voltage.
  (i) ventilation, control and protection equipment shall be provided in nacelle.
  (j) converter shall meet the minimum following technical specifications: -
    (i) the output power shall be expressed in MVA, MW and MVAR and output current expressed in Ampere shall for ambient temperatures, as provided by India Meteorological Department at site, ranging from minimum to maximum in steps of 10 °C.
    (ii) the power factor of converter shall have adjustable range from 0.9 leading to 0.9 lagging.
    (iii) converter shall have minimum IP20 for indoor and IP55 for outdoor ingress protection.
    (iv) converter shall have efficient cooling system to achieve minimum efficiency of 97%.
    (v) the converter shall be capable to operate at relative humidity range of 20-100%.
    (vi) converter shall have the protection systems such as alternating current short circuit protection, leakage current protection, ground fault monitoring, arc fault circuit interrupter and overvoltage protection.
(3) **Tower.-**
  (a) ladder and automated climbing system shall be provided within the tower from tower base to the nacelle.
  (b) resting space shall be provided at adequate intervals in the tower.
  (c) provision for laying power and communication cables on cable tray with segregation of voltage level in the tower.
(4) **Foundation or base.-** The foundation of wind turbine shall be as per relevant standards.
(5) **Transformer.-** The transformer installed at wind turbine 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 regulations notified by Authority.
(7) **Control Room.-**

(a) control room shall house the control and relay panels and all other indoor equipment, measuring, monitoring and recording system.
(b) adequate space shall be provided for the operation and maintenance staff.
(c) provision of space for future requirement shall also be kept.
(d) the following parameters shall be accessible via the operating interface display in the wind power plant: -
(i) wind turbine generator temperature
(ii) output voltage and current
(iii) output power (active & reactive)
(iv) power factor
(v) wind speed
(vi) relative humidity
(vii) ambient temperature
(viii) alternating current over voltage, alternating current under voltage, over frequency, under frequency and ground fault

129. Communication System.-

(1) The communication system of the wind power plant shall be in compliance with central electricity authority *(Technical Standards for Communication System in Power System Operation) Regulations, 2020 and any amendments thereafter.*

(2) The generator controller shall support Modbus RTU/TCP, IEC 61850, or another relevant standard for communication, ensuring full compatibility with the plant supervisory control and data acquisition system and the grid control center.

PART- B1

ADDITIONAL REQUIREMENTS FOR CONSTRUCTION OF OFFSHORE WIND POWER PLANT

130. The regulations of Chapter VI Part-B shall also be applicable for the construction of offshore wind power plant.

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 preferably 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.

(3) **Wind turbine layout.-**
(a) wind turbines shall be spaced to maximise the generation.
(b) 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.

134. Nacelle.-

(1) Wind speed, wind direction sensors shall be installed at the top.

(2) Anti-vibration mount shall be provided for the generator.

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.-

(1) The auxiliary transformer shall derive supply from the wind turbine generator.

(2) There shall be arrangement to derive the auxiliary power from the grid whenever the wind turbine generator is not generating power.

Provided that a local diesel generator 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 alternating current 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 or multiple or jacket frame type.

(c) floating foundation shall be of semi-submersible or barge or spar type.

(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 or unloading goods to and from boats.

(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, export cables, various auxiliary equipment, low voltage and high voltage busbars, switchgear and protection devices.

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

(5) Single bus scheme may be provided for both low voltage and high voltage buses.

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

(7) Supervisory control and data acquisition servers and other servers shall be used for monitoring and controlling wind turbine systems.

(8) **Auxiliary systems.-** Auxiliary transformers, alternating current and direct current power supply sources shall feed the auxiliary loads of the substation.

(9) **Heating ventilation and air conditioning system.-** The electrical and other equipment shall be housed indoor to protect them from all weather conditions with effective cooling and ventilation.

(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) preferably indigenous satellite 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 diesel generator 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 3 or 4 core aluminium or copper, cross-linked polyethylene or ethylene propylene rubber 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 low voltage busbar of the substation.

(2) **Export cables.-**

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

Provided that export cable shall contain 3 or 4 core aluminium or copper cross-linked polyethylene or ethylene propylene rubber 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 high voltage direct current 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.
(2) Transition junction box 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 earth all non-current carrying metallic structures.

PART- C
TECHNICAL STANDARDS FOR CONSTRUCTION OF BATTERY ENERGY STORAGE SYSTEM

142. Site selection and layout considerations.- Site proximity to the geological faults, high flood zones, high tide zones, avalanche prone and land slide prone areas shall be avoided, as far as possible.

Provided that battery energy storage system which are located in extreme weather and site conditions shall be designed to withstand such conditions.

143. Civil structure.-
(1) All structures and foundations shall be designed to commensurate with service life of battery energy storage system.
(2) Battery energy storage system shall be seismically braced in accordance with the National Building Code.
(3) There shall be proper access or space for the movement of battery energy storage system equipment during installation, commissioning, and operation & maintenance as per relevant standard.

144. Application and use cases.-
Battery energy storage system shall be designed as per the requirement, for one or any combination of the following use cases: -
(1) To assist grid integration of renewable energy sources by reducing output volatility & variability, and improving power quality.
(2) To provide the firm capacity from renewable energy sources by using energy storage in conjunction to provide a constant energy supply.
(3) To charge with inexpensive electric energy purchased during low price periods and discharge back to the grid during high price periods.
(4) To enhance transmission and distribution system performance by offsetting electrical imbalances and interruptions.
(5) To avoid congestion related cost by discharging during peak demand to reduce transmission capacity requirements and to postpone or avoid the need to upgrade transmission or distribution infrastructure, as the case may be.
(6) To provide power to switching components, communication and control equipment in the substation.
(7) To alter power output in response to variations between electricity supply and demand, and to manage the reactive power to maintain the grid voltage within permissible limit.
(8) To reduce overall electricity cost for end users by allowing customers to charge the battery energy storage system during low price period and discharge during specific peak demand period.
(9) To provide black-start service to avoid fuel cost and reduce emissions from conventional black-start generators.
(10) Any other application of battery energy storage system which is grid-interactive.

Provided that all battery energy storage system shall have the capabilities of Active power control, Reactive Power, Voltage Control, Frequency Response, Fault and Frequency ride through, Communication and control (SCADA/EMS integration), Ramp rate control and Night mode operation

Provided further that battery energy storage system with installed capacity of 50 MW and above shall have additional capabilities of Automatic Generation Control, Grid-forming inverter capability, Black start capability

Provided further that the restrictions such as cooling off period shall not impede the flexible operation of battery energy storage system.

145. Major equipment.- Battery energy storage system shall mainly consist of the following equipment**: -**
(1) Cell, battery module, battery rack, battery container
(2) Battery management system
(3) Power conversion system
(4) Energy management system

146. Battery energy storage system 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 radio frequency identification 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 parameters such as temperature, pressure, explosion and vibrations as per relevant standards.
(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 battery energy storage system components.

(2) **Battery management system.-**

(a) battery management system shall be provided at module level, rack level and container level.

(b) battery management system 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 power conversion system or energy management system or both, as the case may be, as per design requirement.

(3) **Power conversion system.-**

(a) **General requirements.-**

(i) power conversion system shall consist of one or multiple power conditioning unit depending on the application and power configuration.
(ii) In case power conversion system is installed outdoor, ingress protection shall be provided as per the relevant standards.

(b) The power conversion system 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 alternating current and direct current terminals for maintenance work.
(v) not produce electromagnetic interference which can cause maloperation of instrumentation, communications, or similar electronic equipment within the battery energy storage system.
(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 power conversion system, 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 direct current bus to a maximum of twice the normal direct current bus voltage.
(x) be provided with load carrying cables having safety factor of two within the sub-system of power conversion system.

(4) **Energy management system.-**

(a) Energy management system shall: -

(i) comprise of programmable logic controller, voltage, current and power measurement devices and a software which can interface with battery management system, power conversion system, programmable logic controller and measurement devices.
(ii) control the charge or discharge of the grid-connected storage from a system perspective.
(iii) allow comprehensive monitoring, reliable information exchange and rapid control of all equipment within battery energy storage system.
(iv) provide for integrated, real-time monitoring, efficient operation and control of active power, reactive power at the interconnection point of battery energy storage system.
(v) be integrated with the supervisory control and data acquisition and shall have built-in logic or program to monitor, control, and optimize the performance of the 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 or 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 (excluding black start operation).
c) an alternating current circuit breaker trip (either side of transformer).
d) Smoke and fire alarm.
e) a direct current ground fault (field-adjustable setting).
f) remote disable (no reset required).
g) islanding condition.
(xiii) provide for reading and reporting of various battery energy storage system 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 battery energy storage system and the battery from damage in the event of battery energy storage system component failure or from parameters beyond the safe operating range of battery energy storage system.
(xix) be housed in a controlled environment.
(xx) have provisions of uninterrupted power supply or direct current power supply of suitable rating to cater all the load requirements of the energy management system and its auxiliaries.

(b) The energy management system shall be capable of receiving target setpoints (e.g., power injection or absorption, state of charge limits) from the grid operator or supervisory control and data acquisition 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., battery management system, power conversion system).

(c) Protocols and media used shall comply with latency and availability norms defined in the Central Electricity Authority (Technical Standards for Communication System in Power System Operation) Regulations, 2020 as amended time to time and the Manual on Communication Planning in Power System Operation.

147. Battery energy storage system technical specifications.-

(1) Battery energy storage system shall be designed to achieve its rated power output for full range of ambient temperature.
(2) Battery energy storage system 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.
(3) Number of cycles offered by battery energy storage system shall correspond to the expected life of the battery energy storage system at its rated energy capacity.
(4) Battery energy storage system shall provide minimum depth of discharge of 80%.
(5) Power conversion system efficiency with isolation transformer shall not be less than 95%.
(6) Round trip efficiency (alternating current to alternating current including auxiliary consumption) shall not be less than 70%.
(7) Ramp rate and number of cycles per day shall be designed as per the use case and application of battery energy storage system.

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

148. Safety.-

(1) Protections must be layered and redundant.
(2) There should be clear segregation between direct current bus, inverter and alternating current switchgear rooms, with fault isolation capabilities.
(3) There shall be over-current protection, either on the alternating current or the direct current side, in cell strings.

(4) 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.
(5) The cells, wiring, switch gear and all direct current electrical components shall have safety factor of two for the maximum expected voltages.
(6) A minimum space separation shall be provided for adjacent battery energy storage system enclosures as well as nearest building, for various battery chemistries such as Lithium-Ion, Nickel cadmium and Lead Acid batteries as per relevant standard.

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, direct current ground fault, smoke, gas or any other parameter specified by original equipment manufacturer.
(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 battery energy storage system shall alarm when a battery energy storage system container door is opened.

150. Control Room.-

(1) Control room shall be provided to house the control and relay panels, energy management system and all other indoor equipment and measuring, monitoring and recording system required for control and operation of the battery energy storage system.
(2) Adequate space shall be provided for the operation and maintenance staff.
(3) The following minimum parameters, as applicable, shall be accessible in real time via the operating interface display to supervisory control and data acquisition at control room for battery energy storage system, transformer, switchyard equipment and transmission line: -
    (a) direct current input voltage and current.
    (b) battery module and container temperature.
    (c) alternating current 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 such as renewable energy management center or regional load dispatch center or state load dispatch center, as the case may be, shall be made available by battery energy storage system.
(2) The data related to active power, reactive power, frequency, event logger, disturbance recorder and triggering data of low voltage ride through and high voltage ride through, during tripping and protection operation shall be stored and made available to regional power committee and control center such as renewable energy management center or regional load dispatch center or state load dispatch center, as the case may be.

    Provided that the power conversion system and energy management system shall be capable of retaining data for ninety days and capturing a minimum of one thousand samples per second.

152. Auxiliaries.-

(1) The battery energy storage system shall have the auxiliaries such as heating, ventilation and air conditioning, transformer, wiring, connectors, protective devices, grounding, junction boxes, illumination, CCTV, enclosures and instrumentation.
(2) Battery energy storage system shall include an auxiliary power system which may be derived from any of the following: -
    (a) utility or discom alternating current bus.
    (b) low voltage side of inverter duty transformer.
    (c) tertiary winding of inverter duty transformer.
(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 battery energy storage system shutdowns of several days.
    (c) other auxiliary power requirement of battery energy storage system.
(4) Battery energy storage system shall have heating, ventilation and air conditioning or chiller system conducive to maintain battery performance for all climatic conditions at the site for the entire life of battery.
(5) The air handling and distribution system shall be designed to maintain uniform temperature across all the components within the container.

153. Protection and Control.-

(1) The battery energy storage system shall be capable of interrupting any fault current available at the point of common coupling or point of interconnection and fault current flowing in the equipment in either direction.

(2) Faults due to malfunctions within the battery energy storage system shall be cleared by the battery energy storage system protective devices.

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

(4) Control and instrumentation system provided for the battery energy storage system shall be consistent with the modern power station practices and in compliance with all applicable standards, guidelines and the relevant regulations notified by the Authority such as cyber security, safety and communication."

(Rakesh Kumar)
Secretary

Note.- Principle regulations namely Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations. 2022 was notified in the official gazette 27th December, 2022 and was amended on 10th October, 2025