

CENTRAL ELECTRICITY AUHORITY

**(Technical Standards for Connectivity to the Grid), Regulations, 2007,
Dated: 21.02.2007 with amendments Dated: 15.10.2013, 06.02.2019**

Sl. No.	Description	Summary
1.	Control Period	N.A.
2.	Applicability	These regulations shall be applicable to all the users, requesters, Central Transmission Utility and State Transmission Utility.
3.	Standards	The equipment shall meet the requirements in accordance with the provisions of Technical Standards for Connectivity to the Grid as given in the Schedule of these regulations and Central Electricity Authority (Grid Standards) Regulations, 2010 as and when they come into force, and Grid Code and the State Grid Code(s) as specified by the appropriate Commission.
4.	General Connectivity Conditions	<ol style="list-style-type: none"> 1. The requester and user shall furnish data as required by the Appropriate Transmission Utility or by the licensee or generating station with whose system the inner-connection is proposed, for permitting interconnection with the grid. 2. The requester and user shall provide necessary facilities for voice and data communication and transfer of on-line operational data, such as voltage, frequency, line flows, and status of breaker and isolator position and other parameters as prescribed by the Appropriate Load Despatch Centre. 3. The requester and user shall make arrangements for integration of the controls and tele-metering features of his system into the Automatic Generation Control, Automatic Load Shedding, Special Protection System, Energy Management Systems and Supervisory Control and Data Acquisition System of the respective state or region. 4. The requester shall present the mathematical model of the equipment in accordance with the requirements as stipulated by the Appropriate Transmission Utility or distribution licensee, as the case may be. 5. The State Transmission Utility shall inform the Central Transmission Utility and the Authority, within thirty days of acceptance of application for connectivity of a generating station to electricity system operating at 110 kV and above. 6. In order to carry out the study, the requester shall present the mathematical model of the equipment in accordance with the requirements as stipulated by the Appropriate Transmission Utility or distribution licensee, as the case may be.
5.	Site Responsibility Schedule	A Site Responsibility Schedule (SRS) for every connection point shall be prepared by the generating company or licensee operating the electricity system to which connection is taking place.
6.	Access at Connection Site	The requester or user, as the case may be owning the electrical plant shall provide reasonable access and other required facilities to the licensee or Appropriate Transmission Utility or Appropriate Load Despatch Centre, whose equipment is installed or proposed to be installed at the Connection Site for installation, operation and maintenance, etc. of the equipment.

7.	Site Common Drawings	Site Common Drawings shall be prepared for each connection point by the owner of the Sub-station where connection is taking place.
8.	Cyber Security	The requester and the user shall comply with cyber security guidelines issued by the Central Government, from time to time, and the technical standards for communication system in Power Sector laid down by the Authority.
9.	Registration in the Registry maintained by the Authority	The user or the requester, as the case may be, shall get its generating unit or station, of such capacity and with effect from such date as specified by the Authority, registered and get an online generated Unique Registration Number from the Authority.
10.	Compliance of Regulations	<ol style="list-style-type: none"> 1. The licensee shall ensure that before connectivity to the grid, all the provisions with regard to the connectivity specified under these regulations are complied with by the requester. 2. The user may be disconnected from the Grid by the licensee for non-compliance of any provision of these regulations and any non-compliance of the provisions of these regulations shall be reported by the licensee or the State Load Dispatch Centre or the Regional Load Dispatch Centre, as the case may be, to the appropriate Commission.
11.	Standards and Codes of Practice	<ol style="list-style-type: none"> 1. The equipment including overhead lines and cables shall comply with the relevant Indian Standards, British Standard (BS) or International Electrotechnical Commission (IEC) Standard, or American National Standards Institute (ANSI) or any other equivalent International Standard. 2. The effects of wind, storms, floods, lightening, elevation, temperature extremes, icing, contamination, pollution and earthquakes must be considered in the design and operation of the connected facilities.
12.	Safety	The requester shall comply with the Indian Electricity Rules, 1956 till such time Central Electricity Authority (Safety and Electric Supply) Regulations come into force.
13.	Sub-station Grounding	Each transmission sub-station must have a ground mat solidly connected to all metallic structures and other non-energised metallic equipment. Sub-station grounding shall be done in accordance with the norms of the Institute of Electrical and Electronics Engineers (IEEE)-80.
14.	Metering	Meters shall be provided as specified in the Central Electricity Authority (Installation and Operation of Meters) Regulations, 2006.
15.	Insulation Level and Insulation Co-ordination	Insulation co-ordination of equipment and lines on both sides of a connection point belonging to the requester and the grid shall be accomplished and the co-ordination shall be done by the Appropriate Transmission Utility.
16.	Protection System and Co-ordination	<ol style="list-style-type: none"> 1. Every element of the power system shall be protected by a standard protection system having the required reliability, selectivity, speed, discrimination and sensitivity. Where failure of a protective relay in the requester's system has substantial impact on the grid, it shall connect an additional protection as back up protection besides the main protection. 2. Bus Bar Protection and Breaker Fail Protection or Local Breaker Back Up Protection shall be provided wherever stipulated in the regulations.
17.	Disturbance Recording and Event Logging Facilities	Every generating station and sub-station connected to the grid at 220 kV or above shall be provided with disturbance recording and event logging facilities. All such equipment shall be provided with time synchronization facility for global common time reference.

<p>18.</p>	<p>For Generating stations which are connected on or after the date on which Central Electricity Authority (Technical Standards for Connectivity of the Grid) Regulation, 2007 became effective</p>	<ol style="list-style-type: none"> 1. The excitation system for every generating unit:-- <ol style="list-style-type: none"> (a) Shall have state of the art excitation system; (b) Shall; have Automatic Voltage Regulator (AVR). Generators of 100 MW rating and above shall have Automatic Voltage Regulator with digital control and two separate channels having independent inputs and automatic changeover; and (c) The Automatic Voltage Regulator of generator of 100 MW and above shall include Power System Stabilizer (PSS). 2. The Short-Circuit Ratio (SCR) for generators shall be as per IEC-34. 3. The generator transformer windings shall have delta connection on low voltage side and star connection on high voltage side. Star point of high voltage side shall be effectively (solidly) earthed so as to achieve the Earth Fault Factor of 1.4 or less. 4. All generating machines irrespective of capacity shall have electronically controlled governing system with appropriate speed/load characteristics to regulate frequency. The governors of thermal generating units shall have a droop of 3 to 6% and those of hydro generating units 0 to 1.0%. 5. Generating Units located near load centre, shall be capable of operating at rated output for power factor varying between 0.85 lagging (over-excited) to 0.95 leading (under-excited) and Generating Units located far from load centres shall be capable of operating at rated output for power factor varying between 0.9 lagging (over-excited) to 0.95 leading (under-excited). 6. The coal and lignite based thermal generating units shall be capable of generating up to 105% of Maximum Continuous Rating (subject to maximum load capability under Valve Wide Open Condition) for short duration to provide the frequency response. 7. The hydro generating units shall be capable of generating up to 110% of rated capacity (subject to rated head being available) on continuous basis. 8. Hydro generating units having rated capacity of 50 MW and above shall be capable of operation in synchronous condenser mode, wherever feasible.
<p>19.</p>	<p>Generating stations which were already connected to the grid on the date on which CEA (Technical Standards for Connectivity to the Grid) Regulations, 2007 became effective</p>	<ol style="list-style-type: none"> 1. Every generating unit shall have Automatic Voltage Regulator. Generators having rated capacity of 100 MW and above shall have Automatic Voltage Regulator with two separate channels having independent inputs and automatic changeover. 2. Every generating unit of capacity having rated capacity higher than 100 MW shall have Power System Stabilizer. 3. All generating units shall have standard protections to protect the units, not only from faults within the units and within the station but also from faults in transmission lines. The protections shall include but not limited to the Local Breaker Back-up (LBB) protection.
<p>20.</p>	<p>Connectivity standards applicable to the wind generating stations, generating stations using inverters, wind - solar photo voltaic hybrid systems and energy storage</p>	<ol style="list-style-type: none"> 1. Requirements with respect to Harmonics, Direct Current (DC) Injection and Flicker: <ol style="list-style-type: none"> (a) Harmonic current injections from a generating station shall not exceed the limits specified in Institute of Electrical and Electronics Engineers (IEEE) Standard 519. (b) The Generating station shall not inject DC current greater than 0.5 % of the full rated output at the interconnection point. (c) The generating station shall not introduce flicker beyond the limits specified in IEC 61000.

	systems	<p>2. For generating station getting connected on or after completion of 6 months from date of publication of these Regulations in the Official Gazette:</p> <p>(a) The generating station shall be capable of supplying dynamically varying reactive power support so as to maintain power factor within the limits of 0.95 lagging to 0.95 leading.</p> <p>(b) The generating unit shall be capable of operating in the frequency range 47.5 to 52 Hz and be able to deliver rated output in the frequency range of 49.5 Hz to 50.5 Hz:.</p> <p>(c) The generating stations with installed capacity of more than 10 MW connected at voltage level of 33 kV and above shall have governors or frequency controllers of the units at a droop of 3 to 6% and a dead band not exceeding ± 0.03 Hz and shall be equipped with the facility for controlling the rate of change of power output at a rate not more than $\pm 10\%$ per minute.</p> <p>(d) The generating stations of aggregate capacity of 500 MW and above shall have the provision to receive the signal from the State Load Dispatch Centre or Regional Load Dispatch Centre, as the case may be, for varying active and reactive power output.</p> <p>(e) Short Circuit Ratio at the interconnection point where the generating resource is proposed to be connected shall not be less than 5.</p> <p>(f) The generating station connected to the grid, shall remain connected to the grid when voltage at the interconnection point, on any or all phases (symmetrical or asymmetrical overvoltage conditions) rises above the specified values given below for specified time-</p> <table border="1"> <thead> <tr> <th>Over voltage (pu)</th> <th>Minimum time to remain connected (Seconds)</th> </tr> </thead> <tbody> <tr> <td>$1.30 < V$</td> <td>0 Sec (Instantaneous trip)</td> </tr> <tr> <td>$1.30 > V > 1.20$</td> <td>0.2 Sec</td> </tr> <tr> <td>$1.20 > V > 1.10$</td> <td>2 Sec</td> </tr> <tr> <td>$V \leq 1.10$</td> <td>Continuous</td> </tr> </tbody> </table> <p>3. Special provision for certain Generating stations: The generating stations commissioned before the commencement of the Central Electricity Authority (Technical Standards for Connectivity to the Grid) (Amendment) Regulations, 2018 or commissioned within six months of such commencement shall comply with the provisions of these regulations as if they were not amended.</p>	Over voltage (pu)	Minimum time to remain connected (Seconds)	$1.30 < V$	0 Sec (Instantaneous trip)	$1.30 > V > 1.20$	0.2 Sec	$1.20 > V > 1.10$	2 Sec	$V \leq 1.10$	Continuous
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21.	Grid Connectivity Standards applicable to the Transmission Line and Sub-Station	<p>1. Bus bar protection shall be provided on all sub-stations at and above 220 kV levels for all new sub-stations. For existing sub-stations, this shall be implemented in a reasonable time frame.</p> <p>2. Local Breaker Back-up (LBB) protection shall be provided for all sub-stations of 220kV and above.</p> <p>3. Two main numerical Distance Protection Schemes shall be provided on all the transmission lines of 220 kV and above for all new sub-stations. For existing sub-stations, this shall be implemented in a reasonable time frame.</p> <p>4. Power Supply to Sub-Station Auxiliaries, shall for alternating current (AC) supply (Applicable to new sub-stations):</p> <ul style="list-style-type: none"> • <i>220 kV and above:</i> Two high tension (HT) supplies shall be arranged from independent sources. One of the two high tension supplies shall 										

		<p>be standby to the other. In addition, an emergency supply from diesel generating (DG) source of suitable capacity shall also be provided.</p> <ul style="list-style-type: none"> • <i>66 kV and below 220 kV:</i> There shall be one HT supply and one diesel generating source. • <i>33 kV and below 66 kV:</i> There shall be one HT supply. <p>5. for direct current (DC) Supply (Applicable to new sub-stations): Sub-stations of transmission system for 132 kV and above and sub-stations of all generating stations: There shall be two sets of batteries each equipped with its own charger.</p> <ul style="list-style-type: none"> • <i>For substations below 132 kV:</i> there shall be one set of battery and charger. <p>6. Earth Fault Factor for an effectively earthed system shall be not more than 1.4.</p>
22.	Reactive Power	<ul style="list-style-type: none"> • The distribution licensee and bulk consumer shall provide adequate reactive compensation to compensate reactive power requirement in their system so that they do not depend upon the grid for reactive power support. • The power factor for distribution system and bulk consumer shall be within ± 0.95
23.	Voltage and Current Harmonics	<ol style="list-style-type: none"> 1. The limits of voltage harmonics by the distribution licensee in its electricity system, the limits of injection of current harmonics by bulk consumers, point of harmonic measurement, i.e., point of common coupling, method of harmonic measurement and other related matters, shall be in accordance with the IEEE 519-2014 standards, as amended from time to time. 2. Measuring and metering of harmonics shall be a continuous process with meters complying with provisions of IEC 61000-4-30 Class A. 3. The distribution licensee shall install power quality meters in a phased manner within three years from the date of commencement of the Central Electricity Authority (Technical Standards for Connectivity to the Grid) (Amendment) Regulations, 2018 covering at least 33% of the 33 kV substations each year.
24.	Voltage Unbalance	The Voltage Unbalance at 33 kV and above shall not exceed 3.0%.
25.	Voltage Fluctuation	<ol style="list-style-type: none"> 1. The permissible limit of voltage fluctuation for step changes which may occur repetitively is 1.5%. 2. For occasional fluctuations other than step changes the maximum permissible limit is 3%.
26.	Back-Energization	The bulk consumer shall not energize transmission or distribution system by injecting supply from his generators or any other source either by automatic controls or manually unless specifically provided for in the connection agreement with the Transmission or Distribution Licensee.