

PUNJAB STATE ELECTRICITY REGULATORY COMMISSION

Amendment in Supply Code, 2014

Explanatory Memorandum

The Punjab State Electricity Regulatory Commission in exercise of the powers conferred under Section 181 read with Sections 43, 44, 45, 46, 47, 48, 50, 55, 56, 57, 58, 59, 126, 127, 135, 152, 154 & 163 of the Electricity Act, 2003 (Central Act 36 of 2003) read with Electricity (Amendment) Act, 2007 (No. 26 of 2007) and all other powers enabling it in this behalf and in compliance of Electricity (Removal of Difficulties) Order, 2005, issued by the Ministry of Power, Government of India bearing No.S.O.790 (E) dated 8th June 2005, notified the Punjab State Electricity Regulatory Commission (Electricity Supply Code and Related Matters) Regulations, 2014 vide notification dated 5th November, 2014 (hereinafter referred to as Principal Regulations). The first amendment to the Principal Regulations was issued vide notification no. PSERC/Secy./Regu. 114 dated 22.06.2016, second amendment to the Principal Regulations was issued vide notification no. PSERC/Secy./Regu.116 dated 05.10.2016, third amendment to the Principal Regulations was issued vide notification no. PSERC/Secy./Regu.119 dated 21.03.2017, the fourth amendment to the Principal Regulations was issued vide notification no. PSERC/Secy./Regu.125 dated 17.05.2018, the fifth amendment to the Principal Regulations was issued vide notification no. PSERC/Secy./Regu. 137 dated 28.01.2019 and the sixth amendment to the Principal Regulations was issued vide notification no. PSERC/Secy./Regu. PSERC/Secy./Regu.146 dated 09.01.2020.

HARMONICS

In an ideal power system, the voltage supplied to the consumers and the resulting current wave forms are sine waves. However, distortions are caused due to use of non-linear loads such as power electronic converters, arc furnaces, static VAR systems, inverters for distributed generation, etc. Nonlinear loads change the sinusoidal nature of the ac power current thereby resulting in the flow of harmonic currents in the ac power system. Presence of harmonics results in increased losses, overheating, relay malfunctioning and damage to insulation.

1.0 Existing Provisions

Harmonics limits have been specified in Regulation 24 of the Supply Code, 2014 as under:

24. HARMONICS

24.1 *The consumers shall comply with harmonics standards as specified by the CEA for various voltage levels. The distribution licensee shall monitor the harmonic currents and voltages at its HT/EHT sub stations and in respect of those HT/EHT consumers, which it considers prone to generation of harmonics. The Total Harmonic Distortion (THD), which is a measure of distortion of the voltage or current wave form (which shall ideally be sinusoidal) & is square root of the sum of squares of all voltage or current harmonics expressed as %age of the magnitude of the fundamental, shall not exceed the limits as under:*

<i>EHT:-</i>	<i>4%,</i>
<i>HT:-</i>	<i>10%</i>
<i>LT:-</i>	<i>15%</i>

The distribution licensee shall carry out Harmonic measurements at least once in a year at HT/EHT sub stations and at the premises of HT/EHT consumers.

24.2 *The harmonics currents generated by a consumer shall be jointly measured by the distribution licensee and the consumer. The distribution licensee shall maintain the record of all the Harmonic measurements of the consumers and sub-stations and submit the report to the Commission annually.*

24.3 *Consumers contributing harmonic distortion in excess of the specified standards shall be served with a notice by the distribution licensee to rectify the violation within three months failing which such consumers shall be liable to pay penalty, as may be prescribed by the licensee with the approval of the Commission.*

24.4 *In order to suppress harmonics, distribution licensee as well as consumers shall ensure earthing standards of their equipments as per IEEE Guide 80 and balance the load on three phases besides taking such other measures necessary to keep harmonics within limits.*

However, with the notification of CEA (Technical Standards for connectivity to the Grid) (Amendment) Regulations, 2019 and CEA(Technical Standards for Connectivity below 33 kV) Amendment Regulations, 2019, both issued vide notifications dated 06.02.2019, the above provisions of the Supply Code regarding Harmonics needs to be amended.

2.0 Provisions regarding Harmonics under CEA Regulations

Clause(b) of section 73 of the Electricity Act, 2003 (The Act) conferred the powers to Central Electricity Authority (The Authority) to specify the technical standards for construction of electrical plants, electric lines and *connectivity to the grid*. Accordingly, as per the powers conferred under clause(b) of section 73 read with section 177 of the Act, the Authority notified CEA(Technical Standards for connectivity to the Grid) Regulations, 2007. These regulations have been amended vide notification dated 06.02.2019. The paragraph 3 of part-IV of these regulations reads as under;

(3) Voltage and Current Harmonics. –

(i) 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;

(ii) Measuring and metering of harmonics shall be a continuous process with meters complying with provisions of IEC 61000-4-30 Class A.

(iii) The data measured and metered as mentioned in sub-paragraph (ii) with regard to the harmonics, shall be available with distribution licensee and it shall also be shared with the consumer periodically.

(iv) The bulk consumer shall install power quality meter and share the recorded data thereof with the distribution licensee with such periodicity as may be specified by the appropriate Electricity Regulatory Commission:

Provided that the existing bulk consumer shall comply with this provision within twelve months from the date of commencement of the Central Electricity Authority (Technical Standards for Connectivity to the Grid) (Amendment) Regulations, 2018.

(v) In addition to harmonics, periodic measurement of other power quality parameters such as voltage sag, swell, flicker, disruptions shall be done as per relevant International Electrotechnical Commission Standards by the distribution licensee and the reports thereof shall be shared with the consumer.

(vi) 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.

Central Electricity Authority also notified CEA(Technical Standards for Connectivity below 33 kV) Amendment Regulations, 2019 vide notification dated 06.02.2019 and similar provisions have been made in Regulation 11 A of these regulations for system voltages below 33 kV. The relevant clauses of regulation 11 A are as under;

(1) -----

(2) The limits of injection of current harmonics at the point of common coupling by the user, method of harmonic measurement and other such matters, shall be in accordance with the IEEE 519-2014 standards, as amended, from time to time.

(3) The measuring and metering of harmonics shall be a continuous process with power quality meters complying with the provisions of IEC 61000-4-30 Class A.

(6) The data measured and metered as mentioned in sub-regulation (5), shall be available with the distribution licensee and be shared with the consumer periodically.

(7) The applicant seeking connectivity at 11 kV or above shall install power quality meters and share the recorded data thereof with the distribution licensee with such periodicity as may be specified by the appropriate Electricity Regulatory Commission:

Provided that the user connected at 11 kV and above shall comply with the provision of this sub-regulation within twelve months from the date of commencement of the Central Electricity Authority (Technical Standards for Connectivity of the Distributed Generation Resources) Amendment Regulations, 2018.

(8) In addition to harmonics, periodic measurement of other power quality parameters such as voltage sag, swell, flicker, disruptions shall be done by the distribution licensee as per relevant IEC standard and the reports thereof shall be shared with the consumer.

3.0 From the above, it is evident that as per CEA Regulations, which are applicable to all distribution licensees and designated consumers, 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.

IEEE Standards

The Institute of Electrical and Electronics Engineers (IEEE) has specified the “Recommended Practice and Requirements for Harmonic Control in Electric Power Systems” through IEEE 519-2014. Para 1.2 of the IEEE standards defines purpose as under;

1.2 Purpose

This recommended practice is to be used for guidance in the design of power systems with nonlinear loads..-----

This recommended practice should be applied at interface points between system owners or operators and users in the power system. The limits in this recommended practice are intended for application at a point of common coupling (PCC) between the system owner or operator and a user, where the PCC is usually taken as the point in the power system closest to the user where the system owner or operator could offer service to another user. Frequently for service to industrial users (i.e., manufacturing plants) via a dedicated service transformer, the PCC is at the HV side of the transformer. For commercial users (office parks, shopping malls, etc.) supplied through a common service transformer, the PCC is commonly at the LV side of the service transformer.

The limits represent a shared responsibility for harmonic control between system owners or operators and users. Users produce harmonic currents that flow through the system owner’s or operator’s system which lead to voltage harmonics in the voltages supplied to other users. The amount of harmonic voltage distortion supplied to other users is a function of the aggregate effects of the harmonic current producing loads of all users and the impedance characteristics of the supply system. Harmonic voltage distortion limits are provided to reduce the potential negative effects on user and system equipment. Maintaining harmonic voltages below these levels necessitates that

– All users limit their harmonic current emissions to reasonable values determined in an equitable manner based on the inherent ownership stake each user has in the supply system and

–Each system owner or operator takes action to decrease voltage distortion levels by modifying the supply system impedance characteristics as necessary. (Emphasis added)

Thus all users are required to limit injection of current harmonics so that the distribution licensee can supply quality power to other consumers. Accordingly, the harmonic limits have been prescribed for the distribution licensee and the designated consumers.

In the proposed amendments, harmonic limits, point of harmonic measurement, i.e., point of common coupling, method of harmonic measurement and other related matters have been proposed in accordance with the provisions of IEEE 519-2014 except that measurement of daily 99th percentile very short time (3s) harmonic limits has not been provided keeping in view the practical aspects of measurements. However, at a later stage, the measurement of daily very short time harmonic limits may be introduced.

The Power Quality Meter is a device suitable for monitoring and recording of power quality parameters. It shall be capable of accurate measurement, monitoring and recording of harmonics, sags, swells, flickers and other power quality parameters. Power Quality meters shall comply with the IEC 61000-4-30 Class-A for all new installations/connections of identified locations. For existing installations/ connections at identified locations where CTs/PTs are of lower accuracy class than mandated by IEC 61000-4-30 Class-A meters, the meters complying with the IEC 61000-4-30 Class-B may be installed.

Keeping in view the Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulations, 2007, as amended from time to time, CEA(Technical Standards for connectivity below 33 kV) Amendment Regulations, 2019, IEEE standards IEEE 519-2014 standards and the implementation issues including measuring instruments/analysis etc., the amendments in Regulation 2 and 24 of the Supply Code, 2014 have been drafted. The draft notification is placed at Annexure A.