



# Punjab Government Gazette

## EXTRAORDINARY

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PUNJAB STATE ELECTRICITY REGULATORY COMMISSION

### NOTIFICATION

The 21<sup>st</sup> March, 2023

**No. PSERC/Secy/Regu.-172.**—In exercise of powers conferred under section 181 of the Electricity Act, 2003 (36 of 2003) read with section 61, section 57 and section 59 thereof and all other powers enabling it in this behalf, and after previous publication, the Punjab State Electricity Regulatory Commission hereby makes the following regulations, namely:

#### CHAPTER - 1

#### PRELIMINARY

**1. Short Title, Extent and Commencement**

- (1) These regulations may be called the Punjab State Electricity Regulatory Commission (Power Quality) Regulations, 2023.
- (2) These Regulations shall extend to the whole of the State of Punjab.
- (3) These Regulations shall come into force from the date of their publication in the Official Gazette.

Provided that the compensation payable by the distribution licensee for its failure to meet Power Quality standards as per table 15 under chapter 5 of these regulations shall come in to force from the date to be notified separately by the Commission.

**2. Definitions and Interpretations.**—In these regulations, unless the context otherwise requires -

- (1) ‘**Act**’ means the Electricity Act, 2003 (36 of 2003);
- (2) ‘**Appropriate Forum**’ means the Corporate or Zonal or Circle or Divisional Forum constituted by the distribution licensee under sub-section (5) of Section 42 of the Act read with Rule 15 of the Electricity(Rights of Consumers) Rules, 2020, as per the jurisdiction specified in Punjab State Electricity Regulatory Commission (Forum & Ombudsman) Regulations, 2016, as amended from time to time;
- (3) ‘**Authority**’ means the Central Electricity Authority;

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- (4) **‘Consumer’** means any person who is supplied with electricity for his own use by a licensee or the Government or by any other person engaged in the business of supplying electricity to the public under the Act or any other law for the time being in force and includes any person whose premises are for the time being connected for the purpose of receiving electricity with the works of a licensee, the Government or such other person, as the case may be;
  - (5) **‘Central Commission’** means the Central Electricity Regulatory Commission;
  - (6) **‘Commission’** means the Punjab State Electricity Regulatory Commission;
  - (7) **‘Continuous Phenomenon’** means deviations from the nominal value that occur continuously over time;
  - (8) **‘Contract Demand’** means the maximum demand in kVA sanctioned to the consumer and computed in the manner as approved by the Commission;
  - (9) **‘Declared Supply Voltage (Uc)’** means the voltage at the consumers supply terminals declared by the supplier of electrical energy. Declared supply voltage is usually equal to the nominal voltage (Un);
  - (10) **‘Designated Consumers’** means the consumers connected at a supply voltage of 11 kV and above and shall inter alia include the processes/industries such as Arc Furnaces, Induction furnaces, Chloro alkaline units, Billet heaters, Surface hardening Machines, Electrolytic process industries, Electric Bell furnaces for annealing, Electro-slag refining/melting processes, IT/ITES, Malls, Petro-Chemical units, Railway Traction, Pharmaceuticals or as may be specified by the Commission from time to time. The Full Open Access Consumers and deemed licensees covered under above processes/industries using the intra-state transmission and/or distribution system of other licensee to source power through open access shall also be treated as Designated Consumer under these regulations.
  - (11) **‘Flicker’** means the impression of unsteadiness of visual sensation induced by a light stimulus whose luminance or spectral distribution fluctuates with time. It is caused under certain conditions by voltage fluctuation changing the luminance of lamps;
  - (12) **‘Flicker Severity’** means intensity of flicker annoyance evaluated by the following quantities:
    - a) Short term severity ( $P_{st}$ ) measured over a period of 10 min;
    - b) Long term severity ( $P_{lt}$ ) calculated from a sequence of twelve  $P_{st}$ -values over a 2 hour time interval;
  - (13) **‘Frequency’** means the number of alternating cycles per second [expressed in Hertz (Hz)];
  - (14) **‘Grid Code’** means the Grid Code as specified by the Punjab State Electricity Regulatory Commission;
  - (15) **‘Grid Standards’** means the Grid Standards specified by the Authority;

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- (16) **‘Harmonics’** means the sinusoidal component of a periodic wave, either Voltage or Current waveform, having a frequency that is an integral multiple of the fundamental frequency of 50 Hz;
- (17) **‘High Voltage’** means the voltage whose nominal root mean square (r.m.s.) value is more than 33000 volts but less than or equal to 150000 volts;
- (18) **‘Indian Standards (IS)’** means standards specified by Bureau of Indian Standards;
- (19) **‘IEC Standard’** means a standard approved by the International Electrotechnical Commission;
- (20) **‘Interconnection Point (Distribution System)’** means a point on the electricity system, including a sub-station or switchyard, where the interconnection is established between the consumer and the electricity system of the distribution licensee and where electricity injected into or drawn from the electricity system can be measured unambiguously for the consumer;
- (21) **‘licensee’** means the distribution licensee;
- (22) **‘Low Voltage (LV)’** means the voltage whose nominal r.m.s. value is less than or equal to 1000 Volts;
- (23) **‘Medium Voltage (MV)’** means the voltage whose nominal r.m.s. value is more than 1000 volts but less than or equal to 33000 volts;
- (24) **‘Maximum demand load current’** means the current value at the point of common coupling calculated as the sum of the currents corresponding to the maximum 15/30 minute demand during each of the twelve previous months divided by 12;
- (25) **‘Nominal voltage (of the Distribution System) (Un)’** means the value of voltage by which the electrical installation or part of the electrical installation is designated and identified;
- (26) **‘Normal Operating Condition’** means operating condition for an electricity network, where generation and load demands meet, system switching operations are concluded, faults are cleared by automatic protection systems and in the absence of:
- i. temporary supply arrangement;
  - ii. exceptional situations such as:
    - a. exceptional weather conditions and other natural disasters;
    - b. force majeure;
    - c. third party interference;
    - d. acts by public authorities;
    - e. industrial actions (subject to legal requirements);
    - f. power shortages resulting from external events

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- (27) **‘Nominal Frequency’** means the frequency of 50.00 Hz of the supply voltage.
- (28) **‘Point of Common Coupling (PCC)’** means the point of metering, or any other point on supply system of distribution licensee, electrically nearest to the particular load at which other loads are, or could be, connected. For service to industrial users (i.e., manufacturing plants) via a dedicated service transformer, the PCC is usually 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.
- (29) **‘Power Factor’ or ‘Displacement Power Factor’** means the cosine of the electrical angle between the voltage and current vectors in an AC electric circuit;
- (30) **‘Power Quality Meter’** means a device suitable for monitoring and recording of power quality. It shall be capable of accurate measurement, monitoring and recording of harmonics, sags, swells, flickers and other power quality parameters;
- (31) **‘Rural areas’** mean the areas covered by Gram Panchayats, including major and minor Panchayats;
- (32) **‘r.m.s. (root-mean-square) value’** means square root of the arithmetic mean of the squares of the instantaneous values of a quantity taken over a specified time interval and a specified bandwidth;
- (33) **‘Sanctioned Load or Contracted load’** means load in kilowatt (kW) or Horse Power (BHP) for which the Distribution Licensee had agreed to supply from time to time subject to governing terms and conditions;
- (34) **‘Supply Area’** means the area within which a Distribution Licensee is authorised by his License to supply electricity;
- (35) **‘Supply Terminals’** means point in a distribution system designated as such and contractually fixed, at which electrical energy is exchanged between the Customer and distribution licensee. This point can differ from the electricity metering point or the point of common coupling.
- (36) **‘Supply Voltage’** means the r.m.s. value of the voltage at a given time at the supply terminal, measured over a given interval;
- (37) **‘Supply Voltage Interruption’** is a condition in which the voltage at the supply terminals is lower than 5% of the nominal voltage condition. It can be classified as:
- a) **Planned or Pre-arranged Supply Interruptions** means a supply interruption when network users are informed in advance;
  - b) **Forced or Accidental Supply Interruptions**, caused by permanent or transient faults, mostly related to external events, equipment failures or interference.

An Accidental or forced supply interruption is classified as:

- 1) **Sustained or long interruption** means supply interruption is longer than 3 min;
- 2) **Short interruption** means supply interruption is upto & including 3 min.;
- 3) For poly-phase systems, a supply interruption occurs when the voltage falls below 5% of the nominal voltage on all phases (otherwise, it is considered to be a dip).

- (38) **'Supply voltage dip'** means Temporary reduction of the root mean square (r.m.s.) voltage at a point in the electrical supply system below as specified start threshold.

#### NOTES

- 1 Application: For the purpose of standard, the dip start threshold is equal to 90 percent of the reference voltage.
  - 2 Typically, a dip is associated with the occurrence and termination of a short circuit or other extreme current increase on the system or installations connected to it.
  - 3 For the purpose of Standard, a voltage dip is a two dimensional electromagnetic disturbance, the level of which is determined by both voltage and time (duration).
- (39) **'Supply Voltage Dip Duration'** means time between the instant at which the root mean square (r.m.s.) voltage falls below the start threshold and the instant at which it rises to the end threshold.

#### NOTES

- 1 Application : For the purpose of the standard, the duration of a voltage dip is from 10 ms up to and including 1 min.
  - 2 For polyphase events, a dip begins when one voltage falls below the dip start threshold and ends when all voltages are equal to or above the dip end threshold.
- (40) **'Supply Voltage Dip End Threshold'** means Root mean square (r.m.s.) value of the voltage on an electricity supply system specified for the purpose of defining the end of a voltage dip.

- (41) **'Supply Voltage Dip Residual Voltage'** means minimum value of root mean square (r.m.s.) voltage recorded during a voltage dip.

NOTE- For the purpose of this Standard, the residual voltage is expressed as a percentage of the reference voltage.

- (42) **'Supply Voltage Dip Start Threshold'** means Root mean square (r.m.s.) value of the voltage specified for the purpose of defining the start of a voltage dip;

- (43) **'Supply voltage swells (temporary Power Frequency Overvoltage)'** means Temporary increase of the root mean square (r.m.s.), voltage at a point in the electricity supply system above a specified start threshold.



## NOTES

- 1 Application: For the purpose of Standard, the swell start threshold is equal to 110 percent of the reference voltage.
  - 2 For the purpose of Standard, a voltage swell is a two dimensional electromagnetic disturbance, the level of which is determined by both voltage and time (duration).
  - 3 Voltage swells may appear between live conductors or between live conductors and earth. Depending on the neutral arrangement, faults to ground may also give rise to over voltages between healthy phases and neutral;
- (44) **‘Supply voltage swell duration’** means time between the instant at which the root mean square (r.m.s) voltage at a particular point of an electricity supply system exceeds the start threshold and the instant at which it falls below the end threshold.
- NOTE -Application for the purpose of this standard, the duration of a voltage swell is from 10 ms up to and including 1 min.;
- (45) **‘Supply voltage swell end threshold’** means r.m.s. value of the supply voltage specified for the purpose of defining the end of a supply voltage swell;
- (46) **‘Supply voltage swell start threshold’** means r.m.s. value of the supply voltage specified for the purpose of defining the start of a supply voltage swell;
- (47) **‘System Average Interruption Duration Index’ (SAIDI)** means the average duration of sustained interruptions per consumer occurring during the reporting period, determined by dividing the sum of all sustained consumer interruptions durations, in minutes, by the total number of consumers;
- (48) **‘System Average Interruption Frequency Index’ (SAIFI)** means the average frequency of sustained interruptions per consumer occurring during the reporting period, determined by dividing the total number of all sustained consumer interruption by the total number of consumers;
- (49) **‘True Power Factor’** means the ratio between total active power used in a circuit (including harmonics) and the total apparent power (including harmonics) supplied from the source. True power factor is always less than displacement power factor if harmonics are present in the system;
- (50) **‘Transient over voltages’** means short duration oscillatory or non-oscillatory over voltages usually highly damped and with duration of few ms or in microseconds;
- (51) **‘Total Demand Distortion (TDD)’** means the ratio of the root mean square of the harmonic content, considering harmonic components up to the 50<sup>th</sup> order, expressed as a percent of the maximum demand current;
- (52) **‘Total Harmonic Distortion (THD)’** means the ratio of the root mean square of the harmonic content, considering harmonic components up to the 50<sup>th</sup> order, expressed as a percent of the fundamental;

- (53) **‘Voltage Events’** means sudden and significant deviations from normal or desired wave shape. Voltage events typically occur due to unpredictable events (e.g. faults) or due to external causes (e.g. weather conditions);
- (54) **‘Voltage Fluctuation’ or ‘Voltage Variations’** means series of voltage changes or a cyclic variation of the voltage envelope, the magnitude of which does not normally exceed the specified voltage ranges;
- (55) **‘Voltage unbalance’** means a condition in a poly-phase system in which the r.m.s. values of the line-to-line voltages (fundamental component), or the phase angles between consecutive line voltages, are not all equal. The degree of inequality is usually expressed as the ratios of negative and zero sequence components to the positive sequence component;
- (56) **‘Urban Areas’** means the areas covered by all Municipal Corporations and other Municipalities including the areas falling under the various Urban Development Authorities, Cantonment Authorities and Industrial Estate and Townships including those specified by the Punjab Government;

The words and expressions used in these regulations and not defined herein but defined in the Act or any other regulation of the Commission shall have the meaning assigned to them under the Act or any other regulation of the Commission respectively.

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**CHAPTER – 2****GENERAL****3. Objectives**

- (1) The Power Quality of the electrical system refers to both the extent of deviation or distortion in pure supply waveform and the continuity of supply. An ideal power supply is never interrupted, always within voltage and frequency tolerances and has a noise free sinusoidal waveform. Poor power quality causes performance degradation and premature failures of electrical equipment. It also results in increased system losses.
- (2) Different type of disturbances that affects the power quality include Harmonics (waveform distortion), voltage unbalance, voltage variations, flicker, supply interruptions, voltage dips and voltage swell etc. Each of these disturbances has different causes and effects.
- (3) Power quality disturbances can propagate upstream or downstream and could affect other customers connected in the same supply network. Power quality monitors are available to measure all aspects of power quality.
- (4) The objective of standards specified in these Regulations is to ensure the quality and reliability of electricity supplied by the distribution licensee to the end consumers and by the designated consumers.
- (5) Any failure by the Distribution Licensee or Designated Consumer to achieve and maintain the power quality parameters specified in these Regulations shall render the Distribution Licensee or Designated Consumer liable to payment of compensation to an affected entity, as approved by the Commission.

**4. Assessment of Power Quality**

- (1) The assessment of Power Quality shall consist of measuring the various parameters of the power quality and comparing them with the standards specified in these regulations.
- (2) Measurement methods for assessment of Power Quality under these Regulations shall be as per applicable notified IS and in absence of IS, it shall be as per IEC 61000-4-30:2015 namely 'Testing and measurement techniques – Power quality measurement methods' and as amended from time to time.
- (3) For three phase four-wire connections, the line to neutral voltages shall be considered. For three phase three-wire connections the line to line voltages shall be considered. For single phase connections, the supply voltage (line to line or line to neutral, according to the network user connection) shall be considered

**5. Scope and extent of application**

- (1) These Regulations shall apply to Distribution Licensee(s) including Deemed Distribution Licensee(s), distribution franchisees and the Designated Consumers of electricity in the State as decided by the Commission from time to time



including Full open access consumers, deemed licensee(s) using the intra-state transmission and/or distribution system of other licensee to source power through open access.

Provided that the designated consumers (including Full Open Access consumers & deemed licensee sourcing power through open access) using or engaged in any of the following processes/industries, shall be governed by the provisions of these regulations from the date of the publication of these regulations in the Official Gazette:

*Arc Furnaces, Induction furnaces, Chloro-alkaline units, Billet heaters, Surface hardening Machines, Electrolytic process industries, Electric Bell furnaces for annealing, Electro-slag refining/melting processes, Railway traction load connected at 11 kV and above.*

Provided further that the designated consumers using and engaged in other processes/industries, as may be decided by the Commission from time to time, shall be governed by the provisions of these regulations from the date as may be notified by the Commission separately.

Provided also that in case of designated consumer using both PIU and General load (mixed load industry), such consumer shall be covered under these Regulations only if the total installed/connected kVA of the PIU load exceeds 100 kVA. Where rating in kVA is not available, the rated load in kW shall be converted in to kVA by using unity power factor.

- (2) The scope of these Regulations is to specify the main characteristics of power quality of electrical supply at point of common coupling (PCC) or at supply terminals of Consumer in distribution system.
  - (a) The characteristics of power quality of electrical supply considered in these Regulations to be controlled by distribution licensee are:
    - i. Supply voltage variations
    - ii. Supply voltage flicker
    - iii. Supply voltage unbalance
    - iv. Supply voltage dips and swells
    - v. Supply voltage harmonics
    - vi. Supply Interruptions
  - (b) The characteristic of power quality of electrical supply considered in these Regulations to be controlled by designated Consumers is:  
Current harmonics
- (3) The limits specified in these Regulations for power quality parameters shall apply only under normal operating conditions.