

Tamil Nadu Electricity Supply Code on stipulating harmonic limits, Methodology of measurements, meter standards, penalties etc., to ensure quality of supply to consumers [Draft Amendment]

TNERC has issued a draft notification with amendments to electricity supply code on stipulating harmonic limits, methodology of measurements, meter standards, penalties etc., to ensure quality of supply to consumers on 29th June, 2021.

Some of the key points of the proposed amendments are given below:

- ❖ Sinusoidal nature of ac power is changed by non-linear loads, which result in harmonic current being introduced in power system that can cause ill effects, thus these harmonic current needs to be regulated.
- ❖ CEA (Amendment) Regulations 2019 in respect of Current Harmonics:-
 - “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 Std. 519-2014, as amended, from time to time”.
- ❖ Current distortion/ harmonics are measured at point of common coupling (PCC) in:-
 - Bulk consumers at 33KV and above
 - Consumers, prosumers, charging stations below 33KV
- ❖ Power quality meter of IEC Standard 61000-4-30 edition 3.0 class A will be used.
- ❖ Licensee will use power quality meter for 1 week, per consumer installation to measure harmonic distortions.
- ❖ After being compared with values specified in IEEE Standard 519-2014, as amended, from time to time, the highest of The 3 Total Demand Distortion(TDD) values will be considered for penalty:-
 - 99th Percentile (3s) Very Short Time Value
 - 99th Percentile (10min) Short Time Value
 - 95th Percentile (10min) Short Time Value

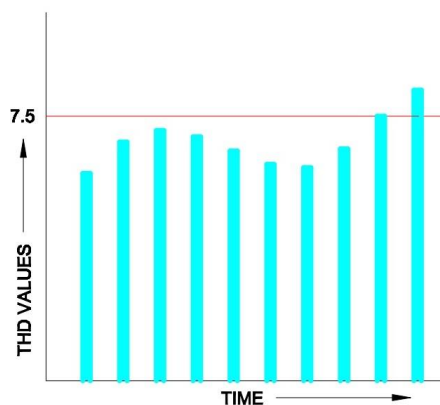


Figure 1. For 99th Percentile: In 24hrs, 28,800 (24hrs x 60min x 60s / 3s) readings are observed, of which 28,512 readings (99%) shall be less than the values specified in IEEE Standard 519-2014, and only 288 readings (1%) can be more than these values, when arranged in a histogram.

- ❖ 6 months of time will be given to install harmonic filters when limits are exceeded. In case of Non Compliance, penalty will be levied for the subsequent 12 months and thereafter service will be disconnected after further Non Compliance.

❖ **Penalty Structure:**

Maximum of 10% in steps of 1% increase will be levied on the monthly current consumption charges as given in the below table,

TDD excess % over and above the limit	Penalty charge % on the monthly current consumption charges
Up to 3%	1%
Above 3% up to 6%	2%
Above 6% up to 9%	3%
Above 9% up to 12%	4%
Above 12% up to 15%	5%
Above 15% up to 18%	6%
Above 18% up to 21%	7%
Above 21% up to 24%	8%
Above 24% up to 27%	9%
Above 27% up to 30%	10%
Above 31 %	10%

- ❖ If Decimal in Excess TDD i.e. over and above the limit, is within 0.1 to 0.4, whole number will be taken (Eg - 3.15, 3.45 => 3); if it is within 0.5 to 0.9 next whole number is taken (Eg - 3.55, 3.95 => 4)
- ❖ Penalty is stopped when filters are installed and Harmonic currents are brought within limits when tested by licensee. Date of stoppage of penalty is when filters are installed and ready for testing, as declared by customer. If limits are exceeded even after testing, the penalty is continued and rectification and retesting must be done within the original 12 months tenure.
- ❖ If after 12 months, adequate filters are not installed or harmonic current levels are not maintained, 30 days disconnection notice shall be served. If customer installs adequate filters within these 30 days and declares the same, re-testing will be done. If harmonic limits are maintained, service is not disconnected, but penalty is levied till the date of declaration. If harmonics exceed limits, disconnection will be done after the expiry of the original 30 days.
- ❖ In case of re-testing/ subsequent testing, if harmonic current level is not maintained, 30 days disconnection notice shall be served, under report to the Commission and thereafter supply will be disconnected.
- ❖ For New connection, applicant has to declare in supply application that filters will be installed. Supply is given initially and after 12 months harmonics testing is done. If limits are exceeded, 30 days disconnection notice shall be served, under report to the Commission and supply is thereafter disconnected. Penalty is levied from date of expiration of 12 months.
- ❖ Licensee can conduct harmonic measurement anytime to check for distortions.

- ❖ The regulation is applicable for:-
 - Bulk consumers at 33KV and above
 - Consumers, prosumers, charging stations below 33KV
 - Not applicable for HT Tariff IV (Lift Irrigation)

The draft amendment can be accessed [here](#)

CER Opinion

1. Scope of Applicability of the Regulation (Regulation 1 (c)): Applicability of the draft regulation seems to be ambiguous as "Measurement of current distortion / harmonic currents shall be made at the point of common coupling (PCC) of the Installation of bulk consumers at 33kV and above and consumers, prosumers, charging stations below 33kV", also refers to consumers connected below 33kV. This may seem to suggest it's applicability to all the consumers of DISCOMs. Also, the point of common coupling (PCC) needs to be defined in the draft regulation.

2. Computation of TDD (Regulation 1 (f)): It may be clarified in the draft regulation that which of the following value(s) should be considered while computing the TDD values at 99th Percentile or 95th percentile at the interval of 3 s/ 10 min:-

- Average Value
- Highest Value
- Value at the beginning/end of the observed time period

3. Violation Limit for Individual and Total Harmonics: The Commission may like to seek appropriate technical advice (say, after 3 year of implementation of these regulations) from a reputed research institution/organisation working on the engineering/technical aspects of power system to identify the scale of problem of harmonic within the system and then consider appropriate adjustment in the multiplier (currently 1.5) for 99th/95th percentile limits.

4. Frequency of Measurement of Harmonic Distortions (Regulation 1 (m)): The frequency of measurement of harmonic disturbances in a year should be included in the draft regulation. A transparent method with a fixed timeline needs to be established for measurement of harmonic disturbances. It is suggested that:

- Consumers below 33kV – Harmonic measurement on a sampling basis, ensuring that all such consumers are covered at least once in 2 years.
- Consumers 33kV and above - Harmonic measurement should be taken at least once in a year
- Consumers with non-linear loads i.e. arc furnace, etc. (irrespective of voltage level) - Harmonic measurement should be taken mandatorily twice a year with about 6 month interval,

It is suggested that the test should be conducted during the normal operating hours of consumer ensuring that harmonic causing load is switched on during such period of measurement. This would help avoid any malpractices to circumvent the process.

5. Standards for Harmonic Filters: The filters to mitigate the harmonics to be deployed by consumers should be in accordance with the applicable IEEE or BIS Standards. The Regulation may identify the same.

6. Basis for Calculation of Penalty (Regulation 1 (h)): Penalty should be linked to the sum of fixed charges (FC) and variable charges (VC) to be paid by the consumer in the current billing cycle. The Regulation refers to consumption charges, which are generally attributed to the variable charges to be paid by the consumer. We suggest that the statement mentioned in the table as "penalty charge % on the monthly current consumption charges" may be rewritten as "penalty charge as a % of the current month's fixed and variable charges". The above suggested provision would ensure that the consumers, who may be paying much lower variable charges to DISCOM on account of its consumption being met through open access or captive generation sources, are not treated leniently by the compliance framework.

7. Calculation of Penalty (Regulation 1 (h)): The statement "TDD excess % over and above the limit" may be re-written as 'TDD in excess of the percentage points over and above the limit' to provide more clarity.

8. Re-structuring of Compliance Timeline (Regulation 1 (g)): After the installation of harmonic filters, the Licensee should conduct a test within 6 months of each such installation. In case of the harmonics going beyond the prescribed limit, adequate filters needs to be installed within the next 6 months, otherwise penalty should be applied. In case of failure of two subsequent tests after each installation of the harmonic filters, the penalty should be applicable for each of the preceding months, since the first installation of the harmonic filter. In the absence of such a provision, the consumer may perpetually extend installation of appropriate harmonic filter and also avoid the payment of penalty.

9. Cost of Harmonic measurement: Cost incidence for the harmonic measurement test should be clarified in the regulation. We suggest that the cost of measurement test would be borne by the licensee if it is found within the prescribed limits. If not, it should be borne by the consumer. It is suggested that the cost of testing should also be specified in the supply code. For small consumers (category (a) identified in comment # 4 above), cost of first test may be borne by the licensee. Cost of any subsequent test (required due to failure of first test and the need for installation of appropriate filters) should be at the cost of the consumer in case the test fails, else it should be borne by the licensee. The above provision would provide incentive to the consumer in ensuring that the measures taken by the consumers are successful in addressing the identified harmonic issue due to its load characteristics.