

**Grid Controller of India Ltd.
National Load Despatch Centre (NLDC)**



Draft
GUIDELINES FOR HARMONICS MEASUREMENTS
AT TRANSMISSION LEVEL



Revision-R0

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GUIDELINES FOR HARMONICS MEASUREMENTS

AT TRANSMISSION LEVEL

1. Introduction

A. Standards for power quality as stipulated in various CEA standards are quoted below:

1. For generating station:

Part II B. of Central Electricity Authority (Technical Standards for Connectivity to the Grid) (Amendment) Regulations, 2013 & 2019 mandates wind generating stations, generating stations using inverters, wind - solar photo voltaic hybrid systems and energy storage systems to restrict harmonic, direct current and flicker injection as per following clauses:

“B1. Requirements with respect to Harmonics, Direct Current (DC) Injection and Flicker

- 1) Harmonic current injections from a generating station shall not exceed the limits specified in Institute of Electrical and Electronics Engineers (IEEE) Standard 519*.
- 2) The Generating station shall not inject DC current greater than 0.5 % of the full rated output at the interconnection point.
- 3) The generating station shall not introduce flicker beyond the limits specified in IEC 61000*. Provided that the standards for flicker will come into effect from 1st April 2014.”

2. For Bulk load and Discom:

Part IV of Central Electricity Authority (Technical Standards for Connectivity to the Grid) (Amendment) Regulations, 2013 & 2019 mandates for Bulk consumer and distribution system:

“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;”

3. For Transmission licensees:

3(2) of CEA (Grid Standards) Regulations, 2010 specified that:

“the transmission licensee shall ensure that the voltage wave-form quality is maintained at all points in the Grid by observing the limits given in Table below-

S.No.	System Voltage (kV rms)	Total Harmonic Distortion (%)	Individual Harmonic of any particular Frequency (%)
1	765	1.5	1.0
2	400	2.0	1.5
3	220	2.5	2.0
4	33 to 132	5.0	3.0

Provided that the standard on Harmonic Distortion shall come into force concurrently with clause 3 of Part IV of the Schedule to the Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulations, 2007.

Explanation: For the purpose of this regulation, Total Harmonic Distortion (VTHD) expressed as percentage, shall be calculated as under-

$$V_{THD} = \sqrt{\sum_{n=2}^{n=40} \frac{V_n^2}{V_1^2}} \times 100$$

‘1’ refers to fundamental frequency (50 Hz)

‘n’ refers to the harmonic of nth order (corresponding frequency is 50 x n Hz).”

4. IEEE 519 current harmonics limits:

Further, it is mentioned in IEEE-519-2022 (IEEE Standard for Harmonic Control in Electric Power Systems) standard that:

“The current distortion limits shall apply to a user’s PCC primarily with harmonic producing loads. For installations with primarily inverter-based resources, users are directed to other applicable standards such as IEEE Std 1547-2018 or IEEE Std 2800-2022. For installations where there is a mix of both loads and inverter based resources, the decision tree in Figure 1 shows when IEEE Std 519 limits shall apply at the installation PCC.”

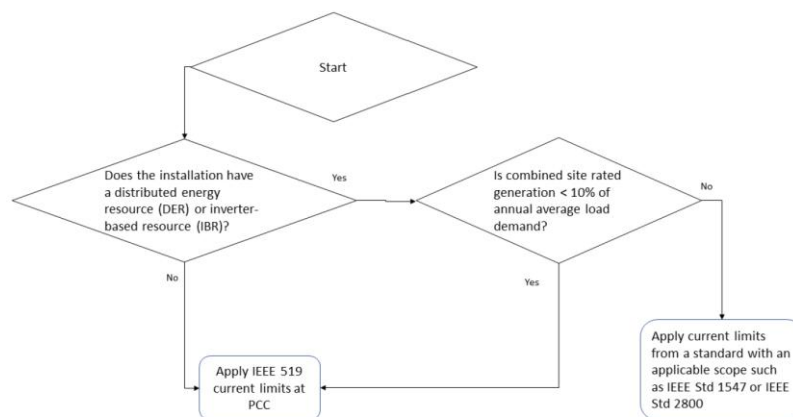


Figure 1 — Decision tree for applying current distortion limits at PCC

For HVDC installation the individual harmonic limits given in IEEE 519 may be increased by a multiplying factor when actions are taken by a user to reduce lower-order harmonics as per the multiplier mentioned in same standard.

B. Mandate for harmonics measurements as stipulated in various CEA standards are quoted below:

1. For generating stations

Part II B. of Central Electricity Authority (Technical Standards for Connectivity to the Grid) (Amendment) Regulations, 2013 & 2019 mandates wind generating stations, generating stations using inverters, wind - solar photo voltaic hybrid systems and energy storage systems to carry out measurement of Harmonics, Direct Current (DC) Injection and Flicker measurement as below:

“4) Measurement of harmonic content, DC injection and flicker shall be done at least once in a year in presence of the parties concerned and the indicative date for the same shall be mentioned in the connection agreement.

Provided that in addition to annual measurement, if distribution licensee or transmission licensee or the generating company, as the case may be, desires to measure harmonic content or DC-injection or flicker, it shall inform the other party in writing, and the measurement shall be carried out within 5 working days.”

2. For Bulk Load and DISCOM

Part IV of Central Electricity Authority (Technical Standards for Connectivity to the Grid) (Amendment) Regulations, 2013 & 2019 mandates for Bulk consumer and distribution system to measure harmonic as per following clauses:

“3 (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.”

3. For transmission licensees

Further as per the Minutes of the Meeting taken by the Chairperson, CEA on 01.07.2024, the following directions were issued regarding harmonic measurement and the installation of harmonic filters by Renewable Energy (RE)

generators:

“The measurement of harmonics shall be done at all ISTS substations, and the data may be shared with RE plants connected at these ISTS substations for better accuracy of simulation studies to assess the requirement of harmonic filters. CTUIL shall include the requirement for installation of PQ meters in the bidding documents for all upcoming ISTS substations. Further, for the existing ISTS substations, PQ meters shall be installed within a period of 6 to 8 months, and the ISTS substations currently under erection and commissioning shall also ensure installation of PQ meters at the time of commissioning.”

C. Mandate for mathematical modelling and studies for power quality

6(6) of Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulations, 2007 mentions that: “For inter-connection studies the requester shall make a request for connection in the planning stage to the Appropriate Transmission Utility. In case a requester is seeking inter-connection to a distribution system such a request will be made to the distribution licensee. The Appropriate Transmission Utility or distribution licensee shall carry out the inter connection study to determine the point of inter-connection, required inter-connection facilities and modifications required on the existing grids, if any, to accommodate the interconnection. The study may also address the transmission system capability, transient stability, voltage stability, losses, voltage regulation, harmonics, voltage flicker, electromagnetic transients, machine dynamics, ferro resonance, metering requirements, protective relaying, sub-station grounding and fault duties, as the case may be. Provided that in order to carry out the said 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”

With a view to ensuring uniform interpretation of the applicable national regulations and their alignment with relevant international standards, the following detailed guidelines have been prepared for reference. In the event of any inconsistency, the provisions of the CEA Regulations shall prevail.

2. Scope & Applicability

These guidelines apply to all Wind generating stations and generating stations using inverters, wind - solar photo voltaic hybrid systems and energy storage systems, transmission licensees i.e owner of ISTS/InSTS transmission substation (220 kV (132 kV for NER) and above) and Bulk consumer.

3. Guidelines:

3.1. Measurement Locations

A. Transmission substation

Owners of following transmission substations at 132 kV and above shall install P-Q meter on the highest voltage level bus of that substation where following are connected directly:

- 50 MW or more (aggregated capacity) Wind generating stations and generating stations using inverters, wind - solar photo voltaic hybrid systems and energy storage systems
- any HVDC or FACTS device
- Bulk consumer

- Traction load

At these transmission substations continuous measurement of voltage harmonic with respect to bus voltage to be done. with standard specification as mentioned in section 4 and measure voltage harmonics on continuous basis.

B. Inverter interfaced Load or generation stations

Developer of wind generating stations and generating stations using inverters, wind - solar photo voltaic hybrid systems and energy storage systems or bulk load shall install PQ meter with standard specification as mentioned in section 4 and measure both voltage and current harmonics on continuous basis. Owner of such asset shall install the P-Q meter at their own substation on the lines which are connecting the plant to the point of inter connection in the grid.

3.2 Timelines for installations of power quality meters

1. Wind generating stations, generating stations using inverters, wind - solar photo voltaic hybrid systems and energy storage systems to carry out measurement of Harmonics, Direct Current (DC) Injection and Flicker measurement on annual basis as mandated in the Central Electricity Authority (Technical Standards for Connectivity to the Grid).
2. Power quality meter shall be installed (before COD) for continuous monitoring of harmonics in new transmission/Inverter interfaced Load or generation stations commissioned post 01st April 2027.
3. For already commissioned transmission substations, a plan for phase-wise installation of power quality meters for continuous monitoring at selected transmission substations to be finalized in respective RPCs. Installation to be completed by 31st Mar 2030. In the interim period, a schedule for periodic measurement (through accredited agency) to be finalized in RPC.

3.3 Parameters to be measured

The following minimum parameters shall be measured and recorded as per IEEE 519 latest amendment:

Quantity	Total Harmonic Distortion	Individual Harmonic Distortion	Flickers
Voltage	1. Daily 99 th percentile very short time (3 s)	1. Daily 99 th percentile very short time (3 s)	1. Weekly Short-term Flicker (10 min) (Pst) 95 th & 99 th percentile.
	2. Weekly 95 th percentile short time (10 min)	2. Weekly 95 th percentile short time (10 min)	2. Weekly Long-term Flicker (2-hour) (Plt) 95 th and 99 th percentile
Current	1. Daily 99 th percentile very short time (3 s)	1. Daily 99 th percentile very short time (3 s)	1. Weekly Short-term Flicker (10 min) (Pst) 95 th and 99 th

			percentile.
	2. Weekly 99 th percentile short time (10 min)	2. Weekly 99 th percentile short time (10 min)	2. Weekly Long-term Flicker(2-hour) (Plt) 95 th and 99 th percentile
	3. Weekly 95 th percentile short time (10 min)	3. Weekly 95 th percentile short time (10 min)	

DC Component in Current at rated current

The format for submission of Power Quality Test Report is attached as Annexure. The recommended limits are as per relevant version of standards IEEE 519 -2022, IEC 61000-3-7: 2008-02, IEEE 1543-2022, IEEE 2800-2022, IEC 614000, CEA Technical standards and amendment thereof.

Base quantities for calculation of harmonic distortion will be determined as per IEEE 519 as amended from time to time. For clarity Base value of current of different feeders for calculation of distortion are listed below:

1. For feeders where RE plants are connected- Rated Current of Installed RE plants on the AC side as per installed capacity (as per IEEE 2800 and amendment thereof)-.
2. For HVDC/FACTS connected feeders- Rated Current of the HVDC/FACTS (as per IEEE 519 and amendment thereof)
3. Feeders where Bulk load are Connected-Rated load current of complete installed load (as per IEEE 519 and amendment thereof).
4. Feeders where Traction loads are connected- maximum demand load current under normal load operating conditions as per last one year data.

3.4 Period and Duration of Measurement

Measurement shall be carried out continuously. In case of breakdown of measurement device, the same shall be reported in annual report.

Till the time continuous measurement equipment are installed, Measurement shall be done once in every financial year. Once during peak RE generation season. Measurement shall be done at least for 7 days. Very short and short time harmonic values should be accumulated over periods of one day and one week respectively in line with IEEE Standard 519-2022 and amendment thereof. Other than this, RPC/RLDC/SLDC may advise for additional measurement as and when required.

3.5 Methodology

Transmission substation owner shall engage a third-party testing agency which NABL/IEC accredited and their report shall be submitted. The measurement methodology shall follow latest amendment of IEC 61000-4-7 Class I and IEC 61000-4-30 Class A and Measurement window width, the statistical methodology for measuring harmonic and inter harmonic values in this requirement shall follow latest amendment of IEEE Std 519 in line with CEA regulations. Data aggregation shall utilize the 'Flagging' concept as per latest amendment of IEC 61000-4-30. Harmonic values recorded during time intervals flagged for voltage dips, swells, or interruptions shall be excluded from the statistical analysis (95th/99th percentile calculations) to prevent fault events from skewing steady-state harmonic compliance results (CIGRE TB 596 Reference: Chapter 2, Section 2.2.1)

3.6 Notice & Necessary parties

Only During the interim period till meters are installed, measurement of harmonic content, DC injection and flicker shall be done at least once in a year in the presence of the parties concerned if desired by the parties.

- a) Measurement of harmonic content, DC injection and flicker shall be done at least once in a year in the presence of the parties concerned if desired by the parties.
- b) Provided that in addition to annual measurement, if distribution licensee or transmission licensee or the generating company, as the case may be, desires to measure harmonic content or DC-injection or flicker, it shall inform the other party in writing, and the measurement shall be carried out within 5 working days

3.7. Retention and Submission of Data & Submission of Reports

As per IEEE 2800 latest amendment:

Provision data type	Recording rate	Retention
Power quality—Very short-term harmonics (COMTRADE or PQDIF* format)	3 s	10 Days
Power quality—short-term harmonics (COMTRADE or PQDIF* format)	10 min	90 Days
Power quality—long-term harmonics (COMTRADE or PQDIF* format)	95 weekly percentile (per IEEE Std 519)	1 Year

*PQDIF-Power Quality Data Interchange Format.

Report Format:

- a) The following graphs to be included in the report:
 - Voltage trend (High voltage side equivalent value based on the point of measurement with appropriate scaling of PT ratio)
 - Current trend (High voltage side equivalent value based on the point of measurement with

appropriate scaling of CT ratio)

- Power trend (High voltage side equivalent value based on the point of measurement as above)
- Voltage THD and individual harmonic order (both 95th and 99th percentile) trend in line with IEEE 519 and amendment thereof
- TDD and individual harmonic order (both 95th and 99th percentile) trend in line with IEEE 519 and amendment thereof
- DC injection trend
- Flicker trend
- Individual harmonic power flow for violating harmonic orders as per 61000-4-7 latest edition.

b) Raw file .csv and raw meter file used for High voltage side measurements.

c) software details to view the raw file.

d) Sample calculation of 99th percentile value and 95th percentile value for voltage and current harmonics in excel.

e) Scale factor to scale the values to rated HV side voltage and current.

f) CT details along with photograph, used for testing

g) Sample calculation of TDD value (As per IEEE Std 519-2022 and amendment thereof).

h) Voltage, current, power (active and apparent) and power factor summary (min, max and avg) in day wise at point of measurement with base of respective HV side as the case may be, requested to use the scale factor value to convert the measured value to actual HV side equivalent value.

i) Analysis of Harmonics distortion during different part of the day, showing current trend and current THD trend

4. Instrumentation Requirements

Instruments used must comply with the specifications of IEC 61000-4-7 and IEC 61000-4-30 (as per latest amendment of these standards at the time of installation or periodic measurement), Class A. For Class A instruments, measurements are required to be made at least up to the 50th order. PQ meters should have auto report generation facility of daily and weekly reports of Harmonics/Flicker and DC currents as per IEEE519/IEC61000(latest amendment), so that it can be quickly submitted to SLDC/RLDC/RPC/CTUIL/STU/RE developer. All Power Quality monitoring devices must be time-synchronized via GPS to ensure a timestamp accuracy of better than 1 ms, enabling correlation of events between different nodes in the grid.

5. Data sharing

In addition to annual measurement, if distribution licensee or transmission licensee or the generating company or appropriate LDC or RPC, as the case may be, desires power quality report from the entities connected to its substation, the entity shall share the report.

Power quality report may be required by entities for filter design during connectivity stage. Transmission licensees of envisaged point of interconnection substations to share the power quality report on request. If RLDC/SLDC/RPC/CTUIL, desires power quality report from the transmission licensees, transmission licensees shall share the report.

6. Review/Update of this document

The above document would be reviewed by NPC/CEA periodically and update them in light of new standards/ technologies / on need basis/ based on experience.

Annexure Power Quality Test Report Format

Power quality measurement report to be submitted in the following format.

Test Report Number:			
1.	Name and address of Transmission substation :		
2.	Reference: - Service request form number: Date of receipt of EUT:		
3.	Location of testing :		
4.	Testing Detail: - Date of issue: Date of testing:		
4.	Duration of testing:		
5.	Description of Measurement: - Measurement Point (PCC):		
6.	Environmental conditions of measurements: Temperature: Relative humidity:		
7.	Witnessed by :		
8.	Description of Power Quality Analyzer used for testing:		
	Power Quality Analyzer	Calibration valid up to	Calibration Details
	Power Quality & Energy Analyzer Make: XXXXX Model: XXXX Sr. No.- XXXXXX EI No.: - XXXX	DD-MM-YYYY	Voltage Harmonic, Current Harmonic, Flicker, DC Current Injection
9.	Measurement Procedure		

In addition to above, Measurement standard followed, measurement instrument connection details may also be included.

10. Electrical: Power Supplies & Stabilizers

10.1 Measurement

A. For Voltage Circuit PQ Parameter Measurement

1. Daily Total Harmonic Distortion in Voltage circuit (THD) for Very short

time (3second) values 99th percentile:

Day	Recommended limit as per Standard IEEE 519-2022 (%)	R Phase (%)	Y Phase (%)	B Phase (%)	Remarks
1					
2					
3					
4					
5					
6					
7					

2. Weekly Total Harmonic Distortion in Voltage circuit (THD) for short time (10minute) values 95th percentile:

Recommended limit as per Standard IEEE 519-2022(%)	R Phase (%)	Y Phase (%)	B Phase (%)	Remarks

**3. Individual Voltage Harmonic distortion measurement for very short time (3second)
values 99th percentile**

Day 1

3.Individual Voltage Harmonic distortion measurement for very short time (3second) values 99th										
Even Harmonics	Recommend ed limit as per Standard IEEE 519-2022 (%)	R Pha se (%)	Y Pha se (%)	B Pha se (%)	Odd Harmon ics	Recommend ed limit as per Standard IEEE 519-2022 (%)	R Pha se (%)	Y Pha se (%)	B Pha se (%)	R e m a r k
2					3					
4					5					
6					7					
8					9					
10					11					
12					13					
14					15					
16					17					
18					19					
20					21					
22					23					
24					25					
26					27					
28					29					
30					31					
32					33					
34					35					
36					37					
38					39					
40					41					
42					43					
44					45					
46					47					
48					49					
50										

**3. Individual Voltage Harmonic distortion measurement for very short time (3second)
values 99th percentile**

Day 2

3.Individual Voltage Harmonic distortion measurement for very short time (3second) values 99th										
Even Harmonics	Recommend ed limit as per Standard IEEE 519-2022(%)	R Pha se (%)	Y Pha se (%)	B Pha se (%)	Odd Harmon ics	Recommend ed limit as per Standard IEEE 519-2022(%)	R Pha se (%)	Y Pha se (%)	B Pha se (%)	R e m a r k
2					3					
4					5					
6					7					
8					9					
10					11					
12					13					
14					15					
16					17					
18					19					
20					21					
22					23					
24					25					
26					27					
28					29					
30					31					
32					33					
34					35					
36					37					
38					39					
40					41					
42					43					
44					45					
46					47					
48					49					
50										

**3. Individual Voltage Harmonic distortion measurement for very short time (3second)
values 99th percentile**

Day 3

3.Individual Voltage Harmonic distortion measurement for very short time (3second) values 99th										
Even Harmonics	Recommend ed limit as per Standard IEEE 519-2022(%)	R Pha se (%)	Y Pha se (%)	B Pha se (%)	Odd Harmon ics	Recommend ed limit as per Standard IEEE 519-2022(%)	R Pha se (%)	Y Pha se (%)	B Pha se (%)	R e m a r k
2					3					
4					5					
6					7					
8					9					
10					11					
12					13					
14					15					
16					17					
18					19					
20					21					
22					23					
24					25					
26					27					
28					29					
30					31					
32					33					
34					35					
36					37					
38					39					
40					41					
42					43					
44					45					
46					47					
48					49					
50										

**3. Individual Voltage Harmonic distortion measurement for very short time (3second)
values 99th percentile**

Day 4

3.Individual Voltage Harmonic distortion measurement for very short time (3second) values 99th										
Even Harmonics	Recommended limit as per Standard IEEE 519-2022(%)	R Phase (%)	Y Phase (%)	B Phase (%)	Odd Harmonics	Recommended limit as per Standard IEEE 519-2022(%)	R Phase (%)	Y Phase (%)	B Phase (%)	Remark
2					3					
4					5					
6					7					
8					9					
10					11					
12					13					
14					15					
16					17					
18					19					
20					21					
22					23					
24					25					
26					27					
28					29					
30					31					
32					33					
34					35					
36					37					
38					39					
40					41					
42					43					
44					45					
46					47					
48					49					
50										

**3. Individual Voltage Harmonic distortion measurement for very short time (3second)
values 99th percentile**

Day 5

3.Individual Voltage Harmonic distortion measurement for very short time (3second) values 99th										
Even Harmonics	Recommended limit as per Standard IEEE 519-2022(%)	R Phase (%)	Y Phase (%)	B Phase (%)	Odd Harmonics	Recommended limit as per Standard IEEE 519-2022(%)	R Phase (%)	Y Phase (%)	B Phase (%)	Remark
2					3					
4					5					
6					7					
8					9					
10					11					
12					13					
14					15					
16					17					
18					19					
20					21					
22					23					
24					25					
26					27					
28					29					
30					31					
32					33					
34					35					
36					37					
38					39					
40					41					
42					43					
44					45					
46					47					
48					49					
50										

**3. Individual Voltage Harmonic distortion measurement for very short time (3second)
values 99th percentile**

Day 6

3.Individual Voltage Harmonic distortion measurement for very short time (3second) values 99th										
Even Harmonics	Recommended limit as per Standard IEEE 519-2022(%)	R Phase (%)	Y Phase (%)	B Phase (%)	Odd Harmonics	Recommended limit as per Standard IEEE 519-2022(%)	R Phase (%)	Y Phase (%)	B Phase (%)	Remark
2					3					
4					5					
6					7					
8					9					
10					11					
12					13					
14					15					
16					17					
18					19					
20					21					
22					23					
24					25					
26					27					
28					29					
30					31					
32					33					
34					35					
36					37					
38					39					
40					41					
42					43					
44					45					
46					47					
48					49					
50										

**3. Individual Voltage Harmonic distortion measurement for very short time (3second)
values 99th percentile**

Day 7

3.Individual Voltage Harmonic distortion measurement for very short time (3second) values 99th										
Even Harmonics	Recommended limit as per Standard IEEE 519-2022(%)	R Phase (%)	Y Phase (%)	B Phase (%)	Odd Harmonics	Recommended limit as per Standard IEEE 519-2022(%)	R Phase (%)	Y Phase (%)	B Phase (%)	Remark
2					3					
4					5					
6					7					
8					9					
10					11					
12					13					
14					15					
16					17					
18					19					
20					21					
22					23					
24					25					
26					27					
28					29					
30					31					
32					33					
34					35					
36					37					
38					39					
40					41					
42					43					
44					45					
46					47					
48					49					
50										

4. Weekly Individual Voltage Harmonic distortion measurement for short time (10 Minutes) values 95th percentile

4.Individual Voltage Harmonic distortion measurement for short time (10 Minutes) values 95th										
Even Harmonics	Recommend ed limit as per Standard IEEE 519-2022 (%)	R Pha se (%)	Y Pha se (%)	B Pha se (%)	Odd Harmon ics	Recommend ed limit as per Standard IEEE 519-2022 (%)	R Pha se (%)	Y Pha se (%)	B Pha se (%)	R e m a r k
2					3					
4					5					
6					7					
8					9					
10					11					
12					13					
14					15					
16					17					
18					19					
20					21					
22					23					
24					25					
26					27					
28					29					
30					31					
32					33					
34					35					
36					37					
38					39					
40					41					
42					43					
44					45					
46					47					
48					49					
50										

Flicker Measurement

1. 1. Weekly value of Short term Flicker (Pst) measurement values 95th percentile:

Recommended limit as per Standard IEEE 1453-2022 & IEC 61000-4-15 IEC 61000-3-7 (%)	R Phase (%)	Y Phase (%)	B Phase (%)	Remarks

2. Long term Flicker (Plt) measurement values 95th percentile:

Recommended limit as per Standard IEEE 1453-2022 & IEC 61000-4-15 IEC 61000-3-7 (%)	R Phase (%)	Y Phase (%)	B Phase (%)	Remarks

3. Short term Flicker (Pst) measurement values 99th percentile:

Recommended limit as per Standard IEEE 1453-2022 & IEC 61000-4-15 (%)	R Phase (%)	Y Phase (%)	B Phase (%)	Remarks

4. Long term Flicker (Plt) measurement values 99th percentile:

Recommended limit as per Standard IEEE 1453-2022 & IEC 61000-4-15 (%)	R Phase (%)	Y Phase (%)	B Phase (%)	Remarks

B. For Current Circuit PQ Parameter Measurement

1. Total Harmonic Distortion in Current circuit (THD)/ Total Demand Distortion in Current circuit (TDD) for Very short time (3second) values 99th percentile:

Day	Recommended limit as per Standard IEEE 519-2022 (%)	R Phase (%)	Y Phase (%)	B Phase (%)	Remarks
1					
2					
3					
4					
5					
6					
7					

2. Weekly Total Harmonic Distortion in Current circuit (THD)/ Total Demand Distortion in Current circuit (TDD) for short time (10Minute) values 99th percentile:

Recommended limit as per Standard IEEE 519-2022(%)	R Phase (%)	Y Phase (%)	B Phase (%)	Remarks

3. Weekly Total Harmonic Distortion in Current circuit (THD)/ Total Demand Distortion in Current circuit (TDD) for short time (10Minute) values 95th percentile:

Recommended limit as per Standard IEEE 519-2022 (%)	R Phase (%)	Y Phase (%)	B Phase (%)	Remarks

4. Individual Current Harmonic distortion measurement for very short time (3second) values 99th percentile:

Day 1

4. Individual Current Harmonic distortion measurement for very short time (3second) values 99th percentile										
Even Harmonics	Recommended limit as per Standard IEEE 519-2022(%)	R Phase (%)	Y Phase (%)	B Phase (%)	Odd Harmonics	Recommended limit as per Standard IEEE 519-2022 (%)	R Phase (%)	Y Phase (%)	B Phase (%)	Remark
2					3					
4					5					
6					7					
8					9					
10					11					
12					13					
14					15					
16					17					
18					19					
20					21					
22					23					
24					25					
26					27					
28					29					
30					31					
32					33					
34					35					
36					37					
38					39					
40					41					
42					43					
44					45					
46					47					
48					49					
50										

**4. Individual Current Harmonic distortion measurement for very short time (3second)
values 99th percentile:**

Day 2

4. Individual Current Harmonic distortion measurement for very short time (3second) values 99th percentile										
Even Harmonics	Recommended limit as per Standard IEEE 519-2022(%)	R Phase (%)	Y Phase (%)	B Phase (%)	Odd Harmonics	Recommended limit as per Standard IEEE 519-2022 (%)	R Phase (%)	Y Phase (%)	B Phase (%)	Remark
2					3					
4					5					
6					7					
8					9					
10					11					
12					13					
14					15					
16					17					
18					19					
20					21					
22					23					
24					25					
26					27					
28					29					
30					31					
32					33					
34					35					
36					37					
38					39					
40					41					
42					43					
44					45					
46					47					
48					49					
50										

4.Individual Current Harmonic distortion measurement for very short time (3second)
values 99th percentile:

Day 3

4. Individual Current Harmonic distortion measurement for very short time (3second) values 99th percentile										
Even Harmonics	Recommend ed limit as per Standard IEEE 519-2022(%)	R Pha se (%)	Y Pha se (%)	B Pha se (%)	Odd Harmon ics	Recommend ed limit as per Standard IEEE 519-2022 (%)	R Pha se (%)	Y Pha se (%)	B Pha se (%)	R e m a r k
2					3					
4					5					
6					7					
8					9					
10					11					
12					13					
14					15					
16					17					
18					19					
20					21					
22					23					
24					25					
26					27					
28					29					
30					31					
32					33					
34					35					
36					37					
38					39					
40					41					
42					43					
44					45					
46					47					
48					49					
50										

4.Individual Current Harmonic distortion measurement for very short time (3second)
values 99th percentile:

Day 4

4. Individual Current Harmonic distortion measurement for very short time (3second) values 99th percentile										
Even Harmonics	Recommend ed limit as per Standard IEEE 519-2022(%)	R Pha se (%)	Y Pha se (%)	B Pha se (%)	Odd Harmon ics	Recommend ed limit as per Standard IEEE 519-2022 (%)	R Pha se (%)	Y Pha se (%)	B Pha se (%)	R e m a r k
2					3					
4					5					
6					7					
8					9					
10					11					
12					13					
14					15					
16					17					
18					19					
20					21					
22					23					
24					25					
26					27					
28					29					
30					31					
32					33					
34					35					
36					37					
38					39					
40					41					
42					43					
44					45					
46					47					
48					49					
50										

4.Individual Current Harmonic distortion measurement for very short time (3second)
values 99th percentile:

Day 5

4. Individual Current Harmonic distortion measurement for very short time (3second) values 99th percentile										
Even Harmonics	Recommend ed limit as per Standard IEEE 519-2022(%)	R Pha se (%)	Y Pha se (%)	B Pha se (%)	Odd Harmon ics	Recommend ed limit as per Standard IEEE 519-2022 (%)	R Pha se (%)	Y Pha se (%)	B Pha se (%)	R e m a r k
2					3					
4					5					
6					7					
8					9					
10					11					
12					13					
14					15					
16					17					
18					19					
20					21					
22					23					
24					25					
26					27					
28					29					
30					31					
32					33					
34					35					
36					37					
38					39					
40					41					
42					43					
44					45					
46					47					
48					49					
50										

4.Individual Current Harmonic distortion measurement for very short time (3second)
values 99th percentile:

Day 6

4. Individual Current Harmonic distortion measurement for very short time (3second) values 99th percentile										
Even Harmonics	Recommend ed limit as per Standard IEEE 519-2022(%)	R Pha se (%)	Y Pha se (%)	B Pha se (%)	Odd Harmon ics	Recommend ed limit as per Standard IEEE 519-2022 (%)	R Pha se (%)	Y Pha se (%)	B Pha se (%)	R e m a r k
2					3					
4					5					
6					7					
8					9					
10					11					
12					13					
14					15					
16					17					
18					19					
20					21					
22					23					
24					25					
26					27					
28					29					
30					31					
32					33					
34					35					
36					37					
38					39					
40					41					
42					43					
44					45					
46					47					
48					49					
50										

4. Individual Current Harmonic distortion measurement for very short time (3second) values 99th percentile:

Day 7

4. Individual Current Harmonic distortion measurement for very short time (3second) values 99th percentile										
Even Harmonics	Recommended limit as per Standard IEEE 519-2022(%)	R Phase (%)	Y Phase (%)	B Phase (%)	Odd Harmonics	Recommended limit as per Standard IEEE 519-2022 (%)	R Phase (%)	Y Phase (%)	B Phase (%)	Remark
2					3					
4					5					
6					7					
8					9					
10					11					
12					13					
14					15					
16					17					
18					19					
20					21					
22					23					
24					25					
26					27					
28					29					
30					31					
32					33					
34					35					
36					37					
38					39					
40					41					
42					43					
44					45					
46					47					
48					49					
50										

5. Individual Current Harmonic distortion measurement for short time (10minute) values 99th percentile:

5. Individual Current Harmonic distortion measurement for short time (10 minute) values 99th percentile										
Even Harmonics	Recommended limit as per Standard IEEE 519-2022 (%)	R Phase (%)	Y Phase (%)	B Phase (%)	Odd Harmonics	Recommended limit as per Standard IEEE 519-2022 (%)	R Phase (%)	Y Phase (%)	B Phase (%)	Remark
2					3					
4					5					
6					7					
8					9					
10					11					
12					13					
14					15					
16					17					
18					19					
20					21					
22					23					
24					25					
26					27					
28					29					
30					31					
32					33					
34					35					
36					37					
38					39					
40					41					
42					43					
44					45					
46					47					
48					49					
50										

**6. Individual Current Harmonic distortion measurement for short time (10Minute) values
95th percentile:**

6. Individual Current Harmonic distortion measurement for short time (10 minute) values 95th percentile										
Even Harmonics	Recommend ed limit as per Standard IEEE 519-2022 (%)	R Pha se (%)	Y Pha se (%)	B Pha se (%)	Odd Harmonics	Recommend ed limit as per Standard IEEE 519-2022 (%)	R Pha se (%)	Y Pha se (%)	B Pha se (%)	R e m a r k
2					3					
4					5					
6					7					
8					9					
10					11					
12					13					
14					15					
16					17					
18					19					
20					21					
22					23					
24					25					
26					27					
28					29					
30					31					
32					33					
34					35					
36					37					
38					39					
40					41					
42					43					
44					45					
46					47					
48					49					
50										

7. DC Current Injection

Percentage of Full load rated current at POI	Recommended limit as per CEA 2013 standard and amendment	R Phase (%)	Y Phase (%)	B Phase (%)	Remarks
Maximum/rated current					