Power
Quality
Solutions

63 Finch Street
East Malvern
Victoria, 3145
Australia

Phone:
Fax: (
A.H.:(
e-mail:
www.pqsolutions.com.au

11 September 2019

Energy Division
Essential Services Commission
Level 37, 2 Lonsdale Street
Melbourne Vic 3000

Dear Sir/Madam,

Victorian Electricity Distribution Code Review 2019

The following comments relate to the Technical Standards section of the review as discussed in the Electricity Distribution Code (EDC) Review Issues Paper of 13 August 2019.

The comments below are directed at improving the measurement and data analysis processes to ensure that outcomes are consistent, repeatable and performed in accordance with global best practices.

1. Measurements
All electrical parameter measurements should be performed using measuring equipment that is compliant with the standard AS/NZS 61000.4.30:2012 Testing and measurement techniques – Power quality measurement methods.

Standard AS/NZ 61000-4-30 defines power quality measurement methods and accuracy levels by parameter. Its objective is to provide 'reliable, repeatable and comparable results regardless of the compliant instrument being used'. It is to be used in conjunction with other standards that set limits for power quality parameters e.g. AS/NZ 61000.3.6, AS/NZ 61000.3.7, AS 61000.3.100 etc.

Measurements taken for compliance assessment with the EDC should preferably be performed using an AS/NZ 61000.4.30 Class A instrument.
AS 61000.3.100 Clause 4.1 has some additional comments.

2. Data Analysis Methodology

Compliance assessment should be based on statistical analysis techniques to allow for the time varying nature of the electrical parameters listed in the EDC.

International power quality standards generally use 95% of the weekly 10-minute aggregated means to assess for compliance against the limits. Some parameters use other percentile values.
The statistical approach is consistent with the requirements of AS 61000.3.100, AS/NZ 61000.3.6 and AS/NZ 61000.3.7 which are mentioned in the Review Issues paper.
The 2014 version of IEEE 519 also uses 95% and 99% percentile values with data measured in accordance with IEC 61000.4.30 requirements.

It is suggested that a table be included in the revised EDC that lists the requirements by parameter. An illustrative example table follows.

Parameter	**Value assessed**	**Aggregation period**	**Minimum duration**	**Assessment against limits**
Power frequency voltage	Mean rms value of aggregation period	10-minute	1-week	95% percentiles
Power factor	Mean value of aggregation period	15 or 30-minute	1-week	5% & 95% percentiles
Voltage harmonic/interharmonic & voltage THD	Mean rms value of aggregation period	10-minute	1-week	95% percentiles
Current harmonic/interharmonic & current THDD	Mean rms value of aggregation period	10-minute	1-week	95% percentiles
Negative sequence voltage	Mean rms value of aggregation period	10-minute	1-week	95% percentiles
Load balance	Mean rms value of aggregation period	10-minute	1-week	95% percentiles
Short term flicker severity	P_{st}	10-minute	1-week	LV – 95% MV – 99%
Long term flicker severity	P_{lt}	120-minute	1-week	LV – 95% MV – 99%

3. Power Frequency Voltage

The EDC voltage limits should be aligned with AS 60038.

Steady state power frequency voltage compliance should be statistically assessed against the limits using data collected with a 10-minute aggregation interval over a minimum duration of 1-week.

AS 61000.3.100 is a statistically based Australian developed voltage assessment methodology using 1% and 99% cumulative probability values for assessment against limits using data collected with a 10-minute aggregation interval over a minimum duration of 1-week.

Internationally a mix of 95%, 99% and 100% values are used for voltage compliance, often with different percentiles for LV and MV.

IEC consumer equipment product standards generally have a design supply voltage tolerance of 230V ±10%.
Steady state voltage excursions over time above the upper value may lead to product degradation and premature failures. These high excursions should be minimised. Excursions below the lower limit may result in malfunctions but rarely failure.

The existing EDC Clause 4.2.2 has voltage requirements for 'less than 1-minute' and 'less than 10-seconds' that are not addressed by AS 61000.3.100.
The 'less than 10-seconds' performance is of significant interest to most industrial customers.

4. Power Factor
Clearly state that the power factor being assessed is total power factor and not fundamental frequency power factor (also called displacement power factor).

Compliance assessment should be statistically based as discussed earlier. It is suggested that 5% and 95% cumulative probability values be used for assessment against limits using data collected with a 15-minute or 30-minute (based on customer energy contract) aggregation interval over a minimum duration of 1-week.

5. Harmonics
The existing EDC approaches for both voltage and current harmonics are relatively easy to apply at a customer evaluation point, however they are probably not as refined as the AS/NZ 61000.3.6 methodology.

If the AS/NZ 61000.3.6 methodology is adopted as a result of the EDC Review, distributors should be requested to allocate harmonic current levels at the customer point of evaluation.

To determine the customer contribution to total harmonic voltage distortion, harmonic impedance at the point of evaluation is required. Harmonic impedance at a connection point is not generally available from distributors. Harmonic impedance determination is not a trivial exercise by either modelling or measurement and could add cost to EDC compliance assessments.

The harmonic range to be included in THD calculations should be clearly stated in the EDC e.g. h=40 or h=50.

Consideration be given to including voltage and current interharmonic requirements. Interharmonics are produced by some power electronic drives.

Harmonic compliance assessment should be statistically based as discussed earlier. It is suggested that 95% cumulative probability values be used for assessment against limits using data collected with a 10-minute aggregation interval over a minimum duration of 1-week.

6. Negative Sequence Voltage
Compliance assessment should be statistically based as discussed earlier. It is suggested that 95% cumulative probability values be used for assessment against limits using data collected with a 10-minute aggregation interval over a minimum duration of 1-week.

7. Load Unbalance
Compliance assessment should be statistically based as discussed earlier. It is suggested that 95% cumulative probability values be used for assessment against limits using data collected with a 10-minute aggregation interval over a minimum duration of 1-week.

8. Voltage Fluctuations
The EDC stated standard AS/NZ 61000.3.7:2001 requires the use of statistical analysis with assessments based on 99% cumulative probability values.

For LV assessment, it is suggested that 95% cumulative probability values be used for assessment against limits using data collected with a 10-minute aggregation interval over a minimum duration of 1-week.

9. Standards Revisions
Harmonisation of relevant standards with the Nation Electricity Rules may be beneficial for all parties.
Standards references should be dated to avoid any assessment ambiguity.

Should you require clarification or additional details on any of the above, please contact the undersigned.

Yours sincerely

Ian McMichael
Director FIEAust, CPEng, RPEQ