Embedded Generator Quality of Supply specification

CITY OF CAPE TOWN		ENERGY DIRECTORATE	
Document Type	**TECHNICAL STANDARD**	Document Number	**EBE27**
Title	**Embedded Generator Quality of Supply Specification**	Reference Numbers	
Responsible Section	Electricity Supply, Network Control, Quality of Supply	Document Status	**Current**
Technical Reference	Peter Jaeger	Revision	*0*
Date	2022-02-17	Review Date	Feb 2024
Compiled by	PPO: Network Control	Peter Jaeger	Digitally signed by Peter Jaeger Date: 2022.11.22 22:54:19 +02'00'
Supported by	Head: Network Control	Gordon Dindi	Digitally signed by Gordon Dindi Date: 2022.12.01 10:55:29 +02'00'
	Head: High Voltage		Digitally signed by Michael de Swardt Date: 2022.12.01 11:10:39 +02'00'
	Head: Protection and Telecommunications	Ryno van der Riet	Digitally signed by Ryno van der Riet Date: 2022.12.01 11:38:51 +02'00'
	Head: Service Connection Planning		
	Head: Transmission System Development		
	Manager: Engineering		
Approved	Director: Electricity Generation and Distribution		

INDEX

Embedded Generator Quality of Supply specification

1 OBJECTIVE

This Specification is to ensure that the NRS048 standards are met.

2 SCOPE

The purpose of this specification is to provide a reference for establishing an appropriate QOS contract with the Embedded Generator greater than 1 MVA specifying the reference parameters, emission limits and the obligations and required actions of the Parties.

3 REFERENCE / RELATED DOCUMENTS

Identifier	Title
NRS048	National Specification for Quality of Supply

The standards and limits set out in this Specification are subject to change necessitated by amendments to either the Act or the CCT licences issued by NERSA or NRS048.

4 DEFINITIONS, ABBREVIATIONS AND TERMS

Please see the Municipality Embedded Generator Distribution System Connection Contract and the Standard for the Interconnection of Embedded Generation (EEB 705) for Definitions, Abbreviations and Terms.
In addition to the above:
Point of Evaluation (POE) : This is where the evaluation will take place and that will be at the POC where possible, but may also take place at the PCC.

5 TECHNICAL DETAIL

Note, blue and green text are action items for CCT for the individual customer and are to be deleted before the final document is sent to the customer.

A. REFERENCE PARAMETERS

1. The reference parameters, used in determining the Parties' obligations with respect to the quality of supply as set out in this Specification, are as follows:

1.1 The description of the Point of Common Coupling (PCC), the Point of Connection (POC) and the Point of Evaluation (POE) are:

1.1.1 Point of Connection (POC) …… *(insert description).*
1.1.2 Point of Common Coupling (PCC) …… *(insert description).*
1.1.3 Point of Evaluation (POE) is at the *……(insert POC or PCC).*

1.2 Reference fault levels used for voltage quality calculations

1.2.1 The three-phase fault level under normal operating conditions at the Point of Evaluation is .....MVA (.....megavolt ampere).

[This should represent the lowest typical generation scenario with a healthy supply network]

1.2.2 The three-phase fault level under weakened operating conditions at the Point of Evaluation is .....MVA (.....megavolt ampere).

[Quality of supply specialist to determine the weakened operation condition – typically, n-1]

1.3 The Maximum Export Capacity is specified in CCT EG Grid Connection Equipment.

1.4 Nominal Connection Voltage

1.4.1 A nominal connection voltage at the Point of Common Coupling of ..... kV ..... (.....kilovolts)

1.4.2 A nominal connection voltage at the Point of Connection of ..... kV ..... (..... kilovolts)

1.4.3 A nominal connection voltage at the Point of Evaluation of ..... kV ..... (..... kilovolts)

B. CITY OF CAPE TOWN's (CCT) OBLIGATIONS

1. CCT will use its reasonable endeavours to furnish the CUSTOMER with a reliable network for the delivery of electricity from the Facility at the Point of Connection. However, it is not practicable for CCT to guarantee that the continuity and voltage quality at the Point of Connection will always be maintained under all contingencies. It is therefore incumbent on the CUSTOMER to take adequate measures to protect its business and the Facility against any losses and/or damage arising from frequency deviations, loss of connection or connection interruptions, voltage variations (including voltage dips), voltage harmonics, voltage flicker, voltage unbalance, voltage swells and transients, under voltages and over voltages at the Point of Connection.

1.1 Planned and Emergency Interruptions

1.1.1 Notwithstanding the provisions of Section B.1.2, CCT shall have the right, for purposes of the efficient operation and extension of the High Voltage (HV) Transmission and Distribution Medium Voltage (MV) Systems and also in emergencies, to temporarily interrupt the Connection.

1.1.2 CCT shall give the CUSTOMER not less than 14 (fourteen) calendar days' written notice of any planned interruptions.

1.2 Forced Interruptions

1.2.1 CCT shall use its reasonable endeavours to minimise the number of forced interruptions that occur on the Transmission and Distribution System.

1.2.2 CCT shall manage forced interruption performance at the Point(s) of Connection in accordance with the provisions of Section D below.

1.3 Voltage Dips

1.3.1 CCT shall use its reasonable endeavours to minimise the number of voltage dips that originate on the Transmission and the Distribution System or from its other customers.

1.3.2 Characteristic levels of dip performance for South African networks are provided in NRS 048-2. It is incumbent on the CUSTOMER to take this into consideration in the design and specification of the Facility. If required, more specific dip performance data may be requested by the CUSTOMER from CCT, and will be provided by the CCT where such performance data is available.

1.4 VOLTAGE QUALITY

1.4.1 Voltage Magnitude

Subject to the provisions of Section E.1, the declared voltage at the Point of Connection is .....kV (..... kilovolts); provided further that the maximum permitted variation in the magnitude of the voltage shall be in accordance with the requirements specified in NRS 048-2.

1.4.2 Frequency

The nominal frequency of the three-phase alternating current at the Point of Connection is 50 Hz (fifty hertz) and the maximum permitted variation in the frequency shall be in compliance with the compatibility levels specified in NRS 048-2.

1.4.3 Voltage Harmonics, Voltage Unbalance and Voltage Flicker

Provided that the CUSTOMER complies with limits specified in Section C, CCT shall Connect the CUSTOMER at the Point of Connection such that the voltage harmonics, voltage unbalance, and voltage flicker at the Point of Common Coupling are in compliance with the levels specified in NRS 048-2.

1.4.4 The levels of quality specified in Sections B.1.4.1, B.1.4.2 and B.1.4.3 above define the range of the voltage quality that may be supplied.

C. THE CUSTOMER'S OBLIGATION

1. The CUSTOMER shall so Connect to the Distribution System as not to interfere with an efficient and economical supply to other customers of CCT, and shall ensure that any voltage distortions caused by the Facility shall not at any time exceed the limits specified in Sections C.1.1, C.1.2 and C.1.3. NRS 048-parts 2 and 4 apply inclusive.

If the customer capacity is less than 5 MVA (customer maximum notified demand or generator maximum export capacity) and is less than 0.2% of the fault level, no detailed apportionment is required in terms of harmonics or voltage unbalance, provided that the planning levels and the generic emission limits as detailed in NRS048-4 are not exceeded at the point of common coupling.

1.1 HARMONIC EMISSION LEVELS

1.1.1 Subject to the provisions of Section E.1 below, the CUSTOMER shall ensure that the harmonic voltage emission levels from the Facility at the Point of Evaluation shall at all times not exceed the limits set out in Table 1.

1.1.2 The CUSTOMER shall ensure that all other harmonic voltage emission levels at all other frequencies not specified in Table 1 caused by the CUSTOMER at the Point of Evaluation shall be less than 30% (thirty per cent) of the individual voltage harmonic planning limits as specified in NRS 048-4.

1.1.3 The CUSTOMER shall ensure that any power factor correction, harmonic filters, shunt capacitor banks or any other reactive compensation do not cause resonance at any of the Points of Common Coupling or the Point of Connection or the Point of Evaluation higher than the harmonic limits in Table 1.

1.1.4 The CUSTOMER shall ensure that the harmonic current emission levels from the Facility at the Point of Evaluation for the range of reference fault levels specified in Section A shall at all times not exceed the limits set out in Table 1 and Sections C.1.1.2 and C.1.1.3.

[CCT to copy Table 1 from apportioning spreadsheet here]

Table 1 – Harmonic Voltage and Current Emission Limits for weakened operating condition (n-1) and the normal operating conditions

Harmonic Order	2	3	4	5	6	7	8	9	10	11
Voltage (%)										
Current (Ampere)										
Harmonic Order	12	13	14	15	16	17	18	19	20	21
Voltage (%)										
Current (Ampere)										
Harmonic Order	22	23	24	25	26	27	28	29	30	31
Voltage (%)										
Current (Ampere)										
Harmonic Order	32	33	34	35	36	37	38	39	40	41
Voltage (%)										
Current (Ampere)										
Harmonic Order	42	43	44	45	46	47	48	49	50	
Voltage (%)										
Current (Ampere)										

1.2 VOLTAGE FLICKER

1.2.1 The CUSTOMER shall ensure that the contribution to voltage flicker by the Facility at the Point of Evaluation shall at all times be less than the limits set out in Table 2:

[CCT to copy Table 2 from apportioning spreadsheet here]

Table 2 – Voltage Flicker Emission Limits

Short-term voltage flicker	Pst	.....
Long-term voltage flicker	Plt	.....

1.3 VOLTAGE UNBALANCE

1.3.1 The CUSTOMER shall ensure that the contribution to voltage unbalance by the Facility at the Point of Evaluation shall at all times be less than the limits set out in Table 3.

[CCT to Copy Table 3 from apportioning spreadsheet here]

Table 3 – Voltage Unbalance Emission Limits

Negative sequence voltage unbalance	..... %	..... per cent

1.4 RAPID VOLTAGE CHANGE

1.4.1 The CUSTOMER shall ensure that the number of rapid voltage changes originating from the Facility, as recorded by CCT at the Point of Evaluation, shall not exceed the limits set out in the following Table 4.

[CCT to Copy Table 4 from apportioning spreadsheet here]

Table 4 – Rapid Voltage Changes Limits

Number of changes per hour	**Percentage Change in the Voltage**
r	nominal voltage at POE
	.....
r<1	.....
1<*r*<=10	.....
10<*r*<=100	.....
100<*r*<1000	.....

1.4.2 The limits in Table 4 may be temporarily waived in the event of a contingency operation.

1.5 It is incumbent on the CUSTOMER to design, construct, operate and maintain the Facility in such a way that it will operate normally under the range of the voltage quality as defined in Section B.1.4.

1.6 Notwithstanding the provisions of Section B.1 that define the voltage quality pertaining to the Standard Connection;

1.6.1 it is incumbent on the CUSTOMER to take reasonable measures to protect the Facility due to voltage quality variations outside the specifications of Section B.1; and

1.6.2 the CUSTOMER shall comply with the provisions of the Code(s) in respect of abnormal frequency or voltage conditions.

1.7 The customer shall install power quality instrument (s) in the CCT substation supplying the POC for any EG above 1 MVA.

D. Management of Voltage Dips and Interruptions

1. CCT shall manage any complaints related to voltage disturbances and interruptions in terms of its complaints management procedures, which are in compliance with the regulatory requirements pursuant to CCT's licences issued by NERSA. In terms of these requirements:

1.1 it is incumbent on the CUSTOMER to provide CCT with relevant information in writing related to the complaint. This information shall include for each incident relating to the complaint, at least: the date, the time, and the effect on the Facility. CCT shall keep record of such complaints;

1.2 CCT shall investigate the complaint and provide the CUSTOMER with information on the cause of such problems (if such cause is known or can be identified) and where appropriate, what remedial action, if any, it intends taking;

1.3 should the CUSTOMER be dissatisfied with the manner in which the complaint is dealt with by CCT, it is incumbent on the CUSTOMER to send CCT a non-conformance report, in writing, detailing the reason for the non-conformance. It is an obligation on CCT in terms of the above regulatory requirements to report such non-conformance reports to NERSA on an annual basis;

1.4 should the CUSTOMER not be satisfied with CCT's response to the non-conformance report, the CUSTOMER may choose to lodge a formal complaint with NERSA and, in connection with such complaint, the provisions of the Confidentiality Agreement clause shall not apply to any information provided to NERSA in connection with such complaint or in connection with any regulatory or other legal proceedings that arise in connection with such complaint; and

1.5 when lodging a complaint with NERSA, it should be noted that it is incumbent on the CUSTOMER to demonstrate to NERSA that reasonable measures were taken

to protect its business and the Facility against losses and/or damage caused by voltage disturbances or interruptions.

2. The CUSTOMER shall keep record of all voltage dips originating from the Facility and the cause of the fault(s). If requested by CCT, the CUSTOMER shall be obliged to provide CCT with information pertaining to the cause of such voltage dips and faults and where appropriate, what remedial action, it intends taking.

E. MEASUREMENT OF QUALITY OF SUPPLY

1. The voltage magnitude, frequency, voltage harmonics, voltage unbalance, voltage flicker and the variation thereof at the Point of Connection shall be measured, assessed and otherwise determined in accordance with the relevant provisions and the specific criteria for determining compliance with compatibility levels of NRS 048-2.

2. CCT may from time to time monitor any of the quality of supply emissions (including the harmonic voltage emission, the flicker, voltage unbalance and rapid voltage changes) caused by the Facility.

F. REMEDIAL ACTION

1. The quality of the voltage at the Point of Connection is affected by events on the Transmission System or Distribution System and by CCT's other customers connected to the Transmission System or Distribution System. Should circumstances arise where the quality of the voltage is negatively impacted by such events or customers such that the voltage is no longer within the range referred to in Section B.1.4:

1.1 the CUSTOMER will use its reasonable endeavours to notify CCT of such non-compliance as soon as practicable after it becomes aware of such non-compliance; and

1.2 CCT (whether or not it has received a notice from the CUSTOMER pursuant to Section F.1.1) shall take appropriate action to remedy such non-compliance as soon as is practicable after it becomes aware of such non-compliance. It is incumbent on the CUSTOMER to take reasonable measures to protect its business and the Facility against losses and/or damage under these circumstances.

2. Should the CUSTOMER not comply with any of its obligations under this Specification, including exceedance of any one of the voltage and/or current quality limits specified in Section C.1:

2.1 CCT will use its reasonable endeavours to notify the CUSTOMER of such non-compliance as soon as practicable after it becomes aware of such non-compliance; and

2.2 the CUSTOMER (whether or not it has received a notice from CCT pursuant to Section F.2.1) shall take appropriate action to remedy such non-compliance (including, where so requested by CCT (acting reasonably) reducing its energy output and/or installing at the CUSTOMER's expense corrective equipment) as soon as is practicable after it becomes aware of such non-compliance.

G. NOTICE OF EXTENSIONS/ NETWORK CHANGES

1. The CUSTOMER shall give at least 3 (three) months' notice in writing to CCT of intended extensions or upgrading of the Facility including (without limitation) any changes which may impact the power quality or impedance at the Point of Common Coupling to enable CCT to implement in a timely manner any countermeasures. If the CUSTOMER fails to give CCT such notice and other customers of CCT are negatively impacted as a result, then the CUSTOMER shall take remedial action as specified in Section F.2 above.
2. The limits specified in Sections C.1 may be revised if any of the fixed values in Section A change.

H. FUTURE AMENDMENTS OF LEGISLATION OR CCT's LICENCE

1. The standards and limits set out in this Specification are subject to change necessitated by amendments to either the Act or the CCT licences issued by NERSA or NRS048.

6 RESPONSIBILITIES

The CCT Network Control, QOS team will arrange the completion of the tables in this Specification.