Standard

00503

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CUSTOMER PERFORMANCE STANDARDS AND TECHNICAL REQUIREMENTS FOR MAJOR CUSTOMERS

Foreword

This Standard sets out the customer performance standards and technical requirements for the connection to the ***network*** of large customers who have not entered into a negotiated connection contract with ENERGEX.

A large customer has either:

1) a demand above 1 MVA,
2) an energy consumption which exceeds 4 GWh per annum or
3) is connected at High Voltage (11 kV and above) and does not have a generating system operating in parallel with the *network*.

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CUSTOMER PERFORMANCE STANDARDS AND TECHNICAL REQUIREMENTS FOR MAJOR CUSTOMERS

1. General

1.1. Scope

This Standard sets out the customer performance and technical requirements for large customers who have not entered into a negotiated connection contract with Energex and does not have a generating system which operates in parallel with the Energex ***network***.

A large customer has either

1) a demand above 1 MVA,
2) an energy consumption which exceeds 4 GWh per annum or
3) is connected at High Voltage (11 kV and above) and does not have a generating system operating in parallel with the ***network***.

A separate agreement covers customer performance and technical requirements for small customers.

1.2. Application

Appendix 1 outlines the performance standards and technical requirements in this Standard and include:

1. Protection systems and settings
2. Power factor requirements
3. Balancing of load currents
4. Voltage levels and fluctuations
5. Harmonics and voltage notching,
6. Load shedding facilities
7. Design standards
8. Settings of protection and control systems
9. Design requirements for Network Users' substations

1.3. Referenced Documents

- National Electricity Rules
- Queensland Electricity Connection and Metering Manual
- AS/NZS 61000.3.6 Electromagnetic capability (EMC) – Limits – Assessment of emission limits for distorting loads in MV and HV power systems
- AS/NZS61000.3.7 Electromagnetic compatibility (EMC) - Limits - Assessment of emission limits for fluctuating loads in MV and HV power systems
- AS2279.4 Disturbances in mains supply networks - Limitation of voltage fluctuations caused by industrial equipment
- Queensland Code of Practice-Works
- ENA EG-0 Power System Earthing Guide
- AS/NZS3000 Electrical Installations (Wiring Rules)

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1.4. Definitions For This Document

Nil

1.5. Enquiries Regarding This Document

Principal Engineer Asset Management

2. Changes From Previous Version

Revision 3 –

- Table 3 - The flicker limits for short term has been increased from 0.25 to 0.3 and long term from 0.2 to is 0.25.

Revision 2 –

- Changes to references to Code of Practice – Electrical Works, change to Table 5 – Current Distortion Limits.

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Appendix 1 - Schedule 7
Customer Performance Standards and Technical Requirements

Definitions and Interpretation

In this Schedule:

(a) words and expressions used in this Schedule which are defined in the ***National Electricity Rules (NER)*** shall have the same meanings as are respectively assigned to them in the ***NER***;
(b) references to sections, Chapters and provisions are references to the respective sections, chapters and provisions of the ***NER***, unless otherwise indicated

This Schedule applies to customer installations with either
(1) demand above 1 MVA,
(2) energy consumption above -4 GWh per annum or
(3) connected at HV (above 11 kV) and with no generating systems operating in parallel with the Energex network.

1 Requirement to provide information

1.1 Before the Customer connects any new or additional electrical equipment to the Energex ***network*****,** the Customer must submit the following information to Energex:

(i) a single line diagram of the electrical installation with the protection details including protection settings;
(ii) ***metering system*** design details for any metering equipment being provided by the Customer;
(iii) a general arrangement drawing locating all the equipment on the site;
(iv) a general arrangement drawing for each new or altered ***substation*** showing all exits and the position of all electrical equipment;
(v) type test certificates for all new switchgear and ***transformers***, including measurement ***transformers*** to be used for ***metering*** purposes
(vi) earthing details including, but not limited to;
  (a) the proposed methods of earthing cables and other equipment to comply with the regulations of Queensland;
  (b) ***plant*** and earth grid test certificates from approved test authorities;
(vii) a secondary injection and trip test certificate on all circuit breakers and their associated protection devices;
(viii) certification that all new equipment has been inspected before being ***connected*** to the ***supply***;
(ix) operational arrangements;
(x) estimated maximum demand; and
(xi) any additional information deemed relevant by Energex

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2 Customer Performance Standards

2.1 Protection systems and settings

2.1.1 The Customer must ensure that all connections to the Energex network are protected by protection devices which effectively and safely ***disconnect*** any faulty circuit or plant item automatically within a time period specified by Energex in accordance with the relevant performance standard outlined in Clause 2.1.2.

2.1.2 The performance standard relevant to this Clause 2.1 is as follows:

(i) The ***fault clearance time*** of a primary ***protection system*** for a ***short circuit fault*** of any ***fault type*** anywhere within the Customers installation shall not exceed 200 msec or an agreed clearance time specified by Energex.

(ii) This clearance time includes ***Breaker fail protection systems*** or other ***protection system*** which are provided to clear faults that are not cleared by the circuit breakers controlled by the ***primary protection system***,

Each primary ***protection system*** must have sufficient redundancy to ensure that a faulted element within its protection zone is ***disconnected*** from the ***power system*** within the applicable ***fault clearance time*** with any single protection element (including any communications facility upon which that ***protection system*** depends) out of service.

2.2 Power factor requirements

2.2.1 If the ***power factor*** falls outside the relevant performance standard (as outlined in Clause 2.2.3 below) over any critical ***loading*** period nominated by Energex, the Customer must, where required by Energex in order to maintain satisfactory ***voltage*** levels at the ***connection point*** take action to ensure that the ***power factor*** falls within range as soon as reasonably practicable. This may be achieved by installing additional ***reactive plant*** or reaching a commercial agreement with Energex to install, operate and maintain equivalent ***reactive plant*** as part of the ***connection assets*** or by alternative commercial arrangements with another party.

2.2.2 If a Customer installs ***shunt capacitor*** or other reactive compensation equipment to comply with power factor requirements it must comply with Energex's reasonable requirements to ensure that the design does not severely attenuate audio frequency signals used for load control or operations, or adversely impact on harmonic voltage levels at the ***connection point***.

2.2.3 The performance standard relevant to this Clause 2.2 is:

(i) For ***loads*** equal or greater than 30 percent of the ***maximum demand*** at the ***connection point*** the ***power factors*** for the Customer and for ***distribution networks connected*** to another ***transmission network*** or ***distribution network*** are given in Table 1.

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Table 1 - Permissible Power Factor Range

Permissible Range	
Supply Voltage (nominal)	**Power Factor Range**
≤1kV	At least 0.8 lagging
1 kV <	At least 0.9 lagging

(ii) For ***load*** less than 30 percent of the ***maximum demand*** at the ***connection point,*** Energex may accept a ***power factor*** outside the range stipulated above provided this does not cause the s***ystem standards*** to be violated.

2.2.4 Energex will provide details of the maximum allowable limits of reactive compensation (in kVar or MVar) as required.

2.3 Balancing of load currents

2.3.1 Energex requires a ***connected*** Customer's ***load*** to be balanced across all phases in order to maintain the negative sequence ***voltage*** at each ***connection point*** at less than or equal to the limits of the ***system standards*** for the applicable nominal ***supply voltage*** level, being as set out in Table 2:

Table 2 - Maximum Negative Sequence Voltage Limits

Nominal supply voltage (kV)	**Maximum negative sequence voltage (% of nominal voltage)**			
Column 1	**Column 2**	**Column 3**	**Column 4**	**Column 5**
	no contingency event	**credible contingency event**	**General**	**once per hour**
	30 minute average	**30 minute average**	**10 minute average**	**1 minute average**
10 or less	2.0	2.0	2.5	3.0

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2.3.2 The Customer must ensure that the current in any phase is not greater than 105 percent or less than 95 percent of the average of the currents in the three phases;

2.3.3 The limit to ***load*** current unbalance is subject to verification of compliance by Energex.

2.4 Voltage fluctuations

2.4.1. The Customer must ensure that variations in current at each of its connection points including those arising from the energisation, de-energisation or operation of any plant within or supplied from the Customer's substation are such that the contribution to the magnitude and rate of occurrence of the resulting voltage disturbance does not exceed 80% of the threshold of perceptibility set out in Figure 1 of Australian Standard AS2279, Part 4.

2.4.2. The Customer must ensure that the voltage fluctuations caused by variations in loading level at the connection point, including those arising from energisation, de-energisation or other operation of the plant must not exceed the emission limits at the Customer's connection point and given in Table 3.

Table 3 - Short and long term flicker emission limits

Individual Short Term Emission Limit E_{Psti}	Individual Long Term Emission Limit E_{Plti}
0.30	0.25

Rapid Voltage Changes Emission Limits (Starting Condition) are given in Table 4, where the maximum voltage change $\Delta U/U_N$ for normal operating conditions is expressed in percent of the actual voltage. A Customer may cause voltage changes, depending on the repetition frequency of these changes, where ΔU is the steady state voltage change and U_N is the steady state voltage.

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Table 4 - Emission Limits for voltage changes as a function of the number of changes per hour, r

Repetition frequency r (hour^{-1})	$\Delta U_{dyn} / U_N$ (%)
	LV
r ≤ 1	5
1 < r ≤ 10	4
10 < r ≤ 100	2.5
100 < r ≤ 1000	1.5

2.5 Voltage Harmonics and voltage notching

2.5.1 The Customer must ensure that the harmonic ***voltage*** distortion caused by non-linearity, commutation of power electronic equipment, harmonic resonance and other effects within the ***plant***, must not exceed the limits set out in Table 5.

Customer emission limits

(i) The Customer emission limits given in Table 5 are derived based on IEEE Std 519: IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems. Site specific limits will be available on request.

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Table 5 - Current Distortion Limits for distribution system

Maximum Harmonic Current Distortion in Percent of I_L						
Individual Harmonic Order (Odd Harmonics)						
I_{SC}/I_L	**<11**	**11≤ *h* <17**	**17≤ *h* < 23**	**23 ≤ *h* < 35**	**35 ≤ *h***	**TDD**
<20	**4.0**	**2.0**	**1.5**	**0.6**	**0.3**	**5.0**
20<50	**7.0**	**3.5**	**2.5**	**1.0**	**0.5**	**8.0**
50<100	**10.0**	**4.5**	**4.0**	**1.5**	**0.7**	**12.0**
100<1000	**12.0**	**5.5**	**5.0**	**2.0**	**1.0**	**15.0**
>1000	**15.0**	**7.0**	**6.0**	**2.5**	**1.4**	**20.0**
Even harmonics are limited to 25% of the odd harmonic limits above.						
Current distortions that result in a dc offset, e.g. , half- wave converters,						

Where

h **= order of harmonic**

I_{SC} = Maximum short-circuit current at PCC.

I_L = Maximum demand load current (fundamental frequency component) at PCC

TDD = Total Demand Distortion

2.5.2 The harmonic ***voltage*** distortion emission limits are subject to verification of compliance by Energex.

2.6 Operational and Maintenance Standards – High Voltage Installations

For high voltage installations, the Customer must ensure its Testing and Commissioning and Operating Procedures comply with relevant legislation and codes of practice.

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2.6.1 Testing and Commissioning

The Electrical Safety Act and Electrical Safety Code of Practice 2010 – Electrical Work require that an inspection of new and altered high voltage equipment must be performed in accordance with the regulations prior to connection of supply. Routine test certificates of all high voltage equipment up to and including the main switch must be submitted to Energex for approval prior to supply being made available. Energex will not connect the whole or any part of the installation which in the opinion of Energex is unsatisfactory for connection to the network.

2.6.2 Operating Procedures

The Electrical Safety Act and Electrical Safety Code of Practice 2010 – Electrical Work require HV customers to have, maintain and use up-to-date Operation Procedures and a trained Operator.

2.6.3 Trained Operators

The Customer must ensure that high voltage switches, other than control switches designated for use of plant operators, are operated only by persons selected and authorised to perform the work in accordance with Section B4 - Electrical Safety Code of Practice 2010 – Electrical Work.

2.6.4 Maintenance

A high voltage customer must ensure that the electrical installation is maintained in good order to ensure that any malfunction will not cause a hazard or cause interference to the Energex supply system.

3 Customer Technical Conditions

3.1 Design Standards

The Customer must ensure that:

3.1.1 the electrical ***plant*** complies with the relevant ***Australian Standards*** as applicable at the time of first installation of that electrical ***plant*** in the ***facility***;

3.1.2 circuit breakers provided to isolate the Customer's ***facilities*** from Energex's ***facilities*** are capable of breaking, without damage or restrike, fault currents nominated by Energex;

3.1.3 new equipment including circuit-breakers provided to isolate the Customer's ***facilities*** from Energex's ***facilities*** is capable of withstanding, without damage, power ***frequency voltages*** and impulse levels nominated by Energex to apply at the ***connection point*** in accordance with the relevant provisions of the ***system standards*** and recorded in this Schedule;

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3.1.4 metering equipment is designed and installed in accordance with the Queensland Electricity Connections and Metering Manual – Service and Installation Rules (in particular Chapters 5,6 and 7) and the NER requirements.

3.2 Settings of protection and control systems

3.2.1 The Customer must only apply settings to a ***control system*** or a ***protection system*** that are necessary to comply with performance requirements of this Schedule or if the settings have been approved in writing by Energex. The Customer must not allow its ***plant*** to take ***supply*** of electricity from the ***power system*** without such prior approval.

3.2.2 If the Customer seeks approval from Energex to apply or change a setting, approval must not be unreasonably withheld by Energex.

3.2.3 Energex will consult with the Customer, and may request in writing that a setting be applied in accordance with the determination. Energex may also request a test to verify the performance of the relevant ***plant*** with the new setting.

3.2.4 The Customer who receives such a request from Energex must arrange for the notified setting to be applied as requested and for a test to be conducted as requested. After the test, the Customer must, on request, provide Energex with a report of a requested test, including evidence of its success or failure. Such a report of a test is ***confidential information***.

3.2.5 The Customer must not change a setting requested by Energex without its prior written agreement, which will not be unreasonably withheld. If Energex requires the Customer to change a setting within 18 months of a previous request, Energex will pay the Customer its reasonable costs of changing the setting and conducting the tests as requested.

3.3 Design requirements for Network Users' substations

The Customer must comply with the following requirements applicable to the design, substation layout and choice of equipment for the ***substation:***

3.3.1 safety provisions must comply with requirements applicable to Queensland as notified by Energex;

3.3.2 where required by Energex, appropriate interfaces and accommodation must be incorporated for communication ***facilities***, remote monitoring and control and protection of ***plant*** which is to be installed in the ***substation***;

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3.3.3 ***substation*** must be capable of continuous uninterrupted operation with the levels of ***voltage***, harmonics, unbalance and ***voltage*** fluctuation specified in the ***system standards***

3.3.4 earthing of primary ***plant*** in the ***substation*** must be in accordance with the Electrical Safety Code of Practice 2010 – Electrical Works, ENA EG-O Power System Earthing Guide, and other relevant Australian Standards (e.g AS/NZS 3000 Electrical Installations);

3.3.5 a secure and adequate capacity of electricity supply must be provided for ***plant*** performing communication, monitoring, control and protection functions;

3.3.6 ***plant*** must be tested to ensure that the ***substation*** complies with the approved design and specifications as included in this contract;

3.3.7 the protection equipment required would normally include protection schemes for individual items of ***plant***, back-up arrangements, auxiliary DC supplies and instrumentation ***transformers***;

3.3.8 insulation levels of ***plant*** in the ***substation*** must co-ordinate with the insulation levels of the Energex ***network*** to which the ***substation*** is ***connected;***

3.3.9 assess the maximum fault current rating of the substation, taking into account when electrical equipment (such as transformers) and embedded generators are operating in parallel;

3.3.10 ensure electrical plant has the fault rating capability to match the maximum fault current levels on the substation

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