



NK8010

Technical Requirements for Connecting Distributed Generation over 500kW Standard

Issue Version Number: 2.0

Data Classification: Public

Published Date: 25/07/2017

Next Review Due: 14/07/2022

©2017 Unison Networks Limited

This is an approved controlled document and is subject to change.

Please ensure you have the most up-to-date copy at all times.

Contact the Business Assurance Group for the latest version.

NK8010 Technical Requirements for Connecting Distributed Generation Over 500kW Standard

Overview

Document status

Draft ☐**In Service** ☒Under Review ☐Archived ☐

Document purpose

The purpose of this document is to set out the technical issues and requirements to be met before distributed generation ('DG') of 500kW and above is connected to any part of Unison's distribution networks.

This standard:

- applies to any import of generated electrical energy, apart from Transpower GXPs, into Unison's distribution network, and
- sets out the technical requirements for embedded generating facilities. It should be used as a guide for processing applications for generation connections to the network.

Existing generation

Existing generation (e.g. Ravensdown, Rotokawa, etc) shall be subject to existing agreements, but in the event of any review being necessary the provisions of this document apply.

Technical challenges and modification to conditions

DG connection onto distribution networks presents many technical challenges. These challenges have not yet been fully resolved or standardised at national or international levels. Therefore, no one document can cover all eventualities. Unison reserves the right to modify the conditions in this standard to meet the particular issues that might arise from any specific installation.

Intended audience

This document applies to all:

- Commercial and Control Room employees, and
- owners or operators of the connected distributed generation.

Document contributors

Contributors	Name and Position Title	Approval Date
Creator	Energy Solutions Manager	13/07/2017
Authoriser	Energy Solutions Manager	14/07/2017
Approver	General Manager Networks and Operations	14/07/2017

Continued on next page

Overview, Continued

Key dates	Published Date	25/07/2017
	Next Review Date	14/07/2022

Related references	Legislation
	- Electricity Governance (Connection of Distributed Generation) Regulations 2007 - Electricity Regulations 1997 and Amendments

Unison Policies

- NK0003 Service Main Ownership Policy
- OS2001 Distributed Generation Congestion Policy
- OS0001 Operational Control Policy

International Standards

- NZEC 35:1993 New Zealand Electrical Code of Practice for Power System Earthing
- NZEC 36:1993 New Zealand Electrical Code of Practice for Harmonic Levels
- AS/NZS 61000.3.6:2001 Electromagnetic compatibility (EMC) - Limits - Assessment of emission limits for distorting loads in MV and HV power systems (IEC 61000-3-6:1996)
- AS/NZS 61000.3.7:2001 Electromagnetic compatibility (EMC) - Limits - Assessment of emission limits for fluctuating loads in MV and HV power systems (IEC 61000-3-7:1996, MOD)
- AS/NZS 3000:2007 Electrical installations (known as the Australian/New Zealand Wiring Rules)
- AS4777.1-2005 Grid connection of energy systems via inverters

Unison Standards

- CM2001 Network Connection Standard
- CM2002 System Loss Allocation Standard
- CM2002-SS1 System Loss Spreadsheet
- NK2001 Quality of Supply Standard
- NK3030 Design Requirements for Public Safety
- NK3031 Surge Arrestor Applications
- NK3040 Earthing – Unison Engineering Principles
- NK5022 Protection Relay Maintenance and Testing
- OS1004 Switching Plan – Application and Approval
- OS1014 Commissioning and Livening Equipment

Continued on next page

Overview, Continued

Related references (cont)

- CM0003 Connection of Distributed Generation – Small Generators <10kW
- NK8011 Technical Requirements for Connecting Distributed Generation under 500kW

Unison Forms

- DG2 – Initial Application to Connect to Distributed Generation >10kW
- DG3 – Final Application to Connect to Distributed Generation >10kW
- Technical Requirements for Connecting Distributed Generation

Other References

- EEA Guide – Connection of Generating Plant 2007
- EEA SM-EI Safety Rules

Content

This document contains the following topics:

Topic	See Page
1. Definitions/Abbreviations.....	5
2. Background.....	6
3. Application	6
4. Regulatory Requirements	9
5. Point of Connection Circuit Breaker	9
6. Unison's Limits of Load Transfer and Operating Limits	10
7. Protection.....	10
8. Islanding, Synchronising and Earthing	15
9. Metering and Indication.....	16
10. Operating Requirements	16
11. Power Quality and Losses.....	17
12. Testing, Commissioning and Maintenance	17
13. Right to Access	18
14. Curtailment and Disconnection	18
15. Penalties	19
Appendix A – Application to Connect Forms	21
Appendix B – Technical Requirements for Connecting Distributed Generation	23
Appendix C – Summary of Document Changes	28

1. Definitions/Abbreviations

Distributed Generation (DG)	Generators of electrical energy at 50Hz that connect to Unison's distribution network for the purpose of using the network to transport that energy:
------------------------------------	--

- to consumers on its network, or
 - through the network to other networks.
-

Generator	In this context, the plant providing the electricity to be exported into Unison's network.
------------------	--

Islanding	A situation where a generator, or small collection of generators, are the sole source of power to a group of customers. There is no interconnection or frequency reference to the national grid.
------------------	--

Large plant	Generating plant >500kW output.
--------------------	---------------------------------

Medium plant	Generating plant >10kW but <500kW output.
---------------------	---

Network operator	Unison Networks Limited except where otherwise specified.
-------------------------	---

PCC (Point of Common Coupling)	The transfer point for electricity between the electrical conductors owned by Unison and the electrical conductors of the producer.
---------------------------------------	---

Producer	The owner and/or operator of distributed generation connected to Unison's distribution network.
-----------------	---

Small plant	Generating plant <10kW maximum output.
--------------------	--

System Operator	The Transpower System Operator responsible for managing the national grid.
------------------------	--

TCC	Time-Current-Characteristic – the relationship between the magnitude and duration of a short circuit current.
------------	---

Unison	Unison Networks Limited
---------------	-------------------------

2. Background

2.1 Distributed generation

The installation of distributed generation is being encouraged at a national level, and lines companies are obliged to facilitate their connection.

Unison has a document to cover small plant, <10kW, but the issue of catering for larger plant is also required. Larger plant will or may impact the operation of the distribution network to which it is connected.

Unison's networks have previously been designed for supplying load from a few input sources, such as GXPs, and then distributing energy to widespread passive loads. The use of distributed generation alters the dynamics of load flow. This document aims to provide guidance for ensuring the technical implications of DG installations are considered and dealt with.

Along with this document the following standards also relate to this issue:

- CM0003 Connection of Distributed Generation – Small Generators <10kW, and
- NK8011 Technical Requirements for Connecting Distributed Generation under 500kW.

These documents have different levels of technical requirements that relate to the degree which the network dynamics are likely to be affected.

3. Application

3.1 Initial application

The initial application for technical approval for connection shall be given on the DG2 form shown in *Appendix A*. In addition, the information requested in Technical Requirements for Connecting Distributed Generation form (*Appendix B*) shall be supplied with the application or as soon as possible thereafter.

Other supporting documentation may be given with the application. Unison reserves the right to seek further details on any matter affecting any aspect of the operation of its network.

If any conflict exists:

- between any national standard or regulatory requirement and this document, the provisions of the national code shall prevail, and
 - between any other Unison standard or code and this document, the provisions of this document shall prevail.
-

Continued on next page

Application, Continued

3.2 Small plant <10kW	The rules for generators of less than 10kW are covered in CM0003 Connection of Distributed Generation – Small Generators <10kW . These rules shall be the rules governing such installations. However, Unison reserves the right to impose the conditions of this document. These conditions will be imposed for installations on any such installation that for technical reasons has or may have an adverse effect on its network or on other users of the network.
---------------------------------	---

3.3 Medium plant <500kW	The rules for generators of less than 500kW are provided in NK8011 Technical Requirements for Connecting Distributed Generation under 500kW .
-----------------------------------	--

3.4 Part of Commercial Agreement	This document to be referenced in any commercial standard or contract entered into by Unison. It shall be deemed part of that standard or contract unless it is specifically excluded.
---	--

Any such specific exclusion shall be made only with the consent of the Energy Solutions Manager.

Default penalties for breaches of the provisions of this standard are given in this document. These shall apply unless specifically altered by the provisions of the Commercial Agreement.

3.5 Application process	The process described in CM0003 Connection of Distributed Generation – Small Generators <10kW is to be used for all applications for plant below 10kW rated output.
--------------------------------	---

All other applications to connect distributed generation to Unison's network shall use the Application to Connect forms (DG2 and DG3) and the Technical Requirements for Connecting Distributed Generation form (refer to the appendices A and B). These forms are available on Unison's website. Forms should be posted, emailed or faxed to Unison's Network Planning Department for the attention of:

Planning Engineer
Unison Networks Ltd
1101 Omaha Road
PO Box 555
HASTINGS
Fax: 06-873-9311
dis.gem@unison.co.nz

Before approval is given for the connection of any distributed generation Unison will study the technical implications for its network and the effects on other customers. This may require the applicant to provide provision of additional information to that requested on the application form.

Continued on next page

Application, Continued

3.5 Application process (cont)

Because each case is likely to be unique in its effect, Unison may require limits and restrictions on the operation of the connected plant. Sometimes Unison may not be able to connect the generation to its system for practical technical reasons.

Unison will however seek to accommodate the application and find ways to overcome any technical issues that may arise. Costs for any changes required on the network will be charged to the applicant, unless Unison itself will benefit, in which case costs may be shared on an agreed basis.

No distributed generation is to be connected to Unison's electricity distribution network until:

- the retailer or plant operator has received 'Permission to Live' from Unison, and
- the installation has been properly inspected by an electrical inspector or suitably qualified electrical engineer.

3.6 Size of plant

In general terms the degree of effect that distributed generation will have on Unison's network will depend on the size of the generator and the following:

- capacity of the lines and cables at the point of connection and beyond
- distance from load centres
- magnitude of voltage regulation
- degree of variation of generated output and input into the network
- ability to absorb or generate VARs
- voltage of connection
- earthing arrangements
- fault levels, and
- ride-through capabilities.

Applicants shall endeavour to provide Unison with as much information as possible to enable these factors to be analysed.

4. Regulatory Requirements

4.1 Electrical qualification

Applications are to be made by, or under the advice and direction of, suitably qualified electricians or electrical engineering specialists.

4.2 General compliance

The generation scheme is to comply with the technical and safety requirements set out in the following standards:

- AS4777.1-2005 Grid connection of energy systems via inverters, and
 - AS/NZS3000-2007 Electrical Installations (known as the Australian/New Zealand Wiring Rules).
-

4.3 Compliance certificate

The vendor of the equipment is to provide a certificate showing that the equipment has been tested by an independent test organisation in New Zealand (or Australia), and meets the above standards. Although the above standards refer to inverters, the requirements are the same for non-inverter based small to medium generation equipment.

Medium and large plant shall also have evidence provided of the plant's compliance with an internationally recognised standards organisation such as IEC, ISO, BSI, DINJIS, SAA and SNZ.

4.4 Compliance with rules

For connection of medium and large plant the applicant and the operator are to give evidence of knowledge of:

- the current Electricity Governance Rules and Electricity Governance Regulations for the operation of the plant, and
- the means by which they will comply with those rules insofar as it may affect the operation of Unison's network.

Aspects that do not directly affect the technical operation of Unison's network shall come under the appropriate Unison commercial standards and agreements.

Compliance with the EEA Guide - Connection of Generating Plant is also expected.

5. Point of Connection Circuit Breaker

5.1 Circuit breaker requirements

Unison will generally require the producer to provide a circuit breaker or other automated switch at the point of connection.

The circuit breaker is to be controlled by the producer's own protection schemes and from any agreed signal sent from Unison's Control Room.

6. Unison's Limits of Load Transfer and Operating Limits

6.1 Settings at connection point

In conjunction with each application, agreement shall be reached with Unison on:

- maximum and minimum kW export into Unison's network
- maximum and minimum kVA export into Unison's network
- limits on the export and import of VArS and power angle variations
- permitted fluctuation of voltage at the point of connection
- harmonics – with assurance that they will be maintained within the prescribed limits of legislation, and
- any other technical issue that may be part of the proposed installation.

In addition, the operator shall provide:

- a list of the expected shutdown times the plant will require, and
- an expected profile of exported power from the generator. (This is important if the generator is also supplying an on-site load to the operator's own plant, or has a prime energy source, such as wind or solar power, that can vary widely with time.)

6.2 Maximum demand from network to producer

Where or if electricity is conveyed from the network to the generator facility at the point of connection, then the maximum demand entitlement shall be restricted to an amount negotiated between Unison and the producer. This quantity is to be stated in the application.

7. Protection

7.1 Protection scheme

The applicant is required to submit the proposed protection arrangements and settings for the generator installation to Unison's Protection Engineer for their approval. Unison will provide the producer with the appropriate site-specific limits and gradings.

Continued on next page

Protection, Continued

7.2 Protection settings The Network Operator shall maintain the following protection settings at the point of connection.

Factor	33kV Values	11kV Values	400/230V Values
Over-voltage Alarm	34.7kV (1.05 p.u.)	11.6kV (1.05 p.u.)	
Over-voltage Trip	36.3kV (Inst.) 35.3kV (1.07 p.u.) if >10 seconds	12.1kV (Inst.) 11.8kV (1.07 p.u.) if >10 seconds	1.07 p.u.
Under-voltage Trip	29.7kV (0.9 p.u.) if >30 seconds	9.9kV (0.9 p.u.) if >30 seconds	0.9 p.u.
Directional Overcurrent Alarm (export)	To be negotiated	To be negotiated	To be negotiated
Directional Overcurrent Trip (export)	To be negotiated	To be negotiated	To be negotiated

Table 1 - Settings at the Point of Connection

7.3 Protection configuration The producer shall provide Unison with a diagram and details of the protection systems, including proposed relay settings. Unison will then check these against its own system requirements.

7.4 Visual disconnection required Unless specifically waived, Unison will require any operation that disconnects the generator from its network to remain disconnected or locked out until permission is given from Unison's Control Room to permit reconnection.

Reconnection shall be done following Unison's operation procedures. There shall be no automatic reclosing of the circuit breaker at the point of connection.

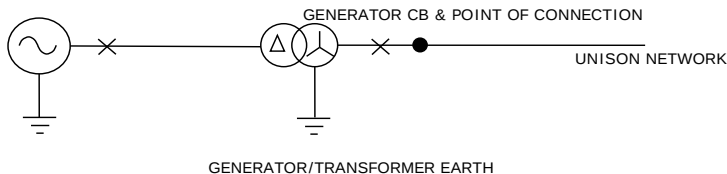
7.5 Protection function requirements The table below lists the protection requirements to be provided for the scheme.

Protection Function	What is Required
Overcurrent	Overcurrent protection settings will be subject to negotiation as they provide protection for the generator plant and for Unison's lines, cables and equipment. Overcurrent protection: - may also have to be set to accommodate any ride-through capabilities of the plant, and - will be independently set for both import and export situations.

Continued on next page

Protection, Continued

7.5 Protection function requirements (cont)

Protection Function	What is Required
Overvoltage	Overvoltage protection shall be provided and shall have the settings given in Table 1 above.
Synchronisation	The circuit breaker at the point of connection is to have a synchronising relay. This prevents the connection of the generator output onto Unison's network, unless the frequency and phase angles of the two systems are synchronous.
Under and Over Frequency	Under and over frequency protection is to be negotiated for each situation as the requirements may vary according to: • ride-through requirements, and • the effects it may have on the generator and/or Unison's obligations to the System Operator. The generator is expected to operate synchronously within the limits of 50Hz $\pm$0.75Hz of the Grid Operator. Refer to the <i>point</i> 7.6 for the ride-through requirements for under and over frequency tripping limits.
Neutral Voltage Displacement	Unison will normally require a solidly earthed neutral for: • the transformer through which generated power is connected to its network, or • the generator itself, if connected directly. This will generally mean that the arrangement will be as shown below.  Figure 1 - Earthing of Supply Connection However, in some instances it may be of advantage to have resistive earthed neutrals or resonant frequency earthing (Petersen coil). These arrangements shall be discussed with Unison's Protection Engineer and an appropriate final design agreed. The protection relay system shall provide for earth faults to be detected and the disconnection of the generator from Unison's network. The time-current relationships are to be mutually agreed upon with Unison's Protection Engineer. They shall also be responsible for determining the 'ride-through' capabilities of the generator.
Reverse Power	Reverse power protection considerations are to be negotiated with Unison's Protection Engineer for each situation as requirements for this may vary.

Continued on next page

Protection, Continued

7.5 Protection function requirements (cont)

Protection Function	What is Required
Flagging and Indication	The generator owner or operator is responsible for all aspects of operation and protection of their own plant.
Reactive Power	Reactive power flows can significantly affect the behaviour of Unison's network. Therefore, Unison will undertake load flow studies to determine the limits that can be tolerated. These limits shall be observed by the producer.
Voltage Regulation	Unison's network engineers, in conjunction with Unison's Operations Manager shall determine the voltage limits to be observed at the point of connection. Normally these will be $\pm 5\%$ of nominal voltage, but there may need to be some other limit depending on the circumstances of the site. The limits shall be observed by the installation operator who shall provide appropriate controls to ensure those limits are observed. Unison shall be given the details of the controls and is required to give its approval of the scheme.

7.6 Ride-through capabilities

7.6.1 Under and Over Voltage Ride-through

International practice varies and is mainly concerned with grid voltages $>110\text{kV}$, but distributed generation at distribution level will have a cumulative effect. Therefore, Unison will endeavour to contribute toward grid stability.

Generally, Unison will not require any ride-through capabilities for generating units less than 1MVA at any point of connection. Above this Unison will endeavour to maintain ride-through capabilities in order to assist the Grid Operator.

Therefore, depending on location, Unison may require that when any under-voltage, over-voltage or under-frequency events occur then the following ride-through capabilities be provided.

Note

Any short-circuit occurrence will take protection precedence over any ride-through requirements.

The requirement shown in the graph below is intended to be a general requirement. It may be varied by negotiation to suit the actual generation plant concerned.

Continued on next page

Protection, Continued

7.6 Ride-through capabilities (cont)

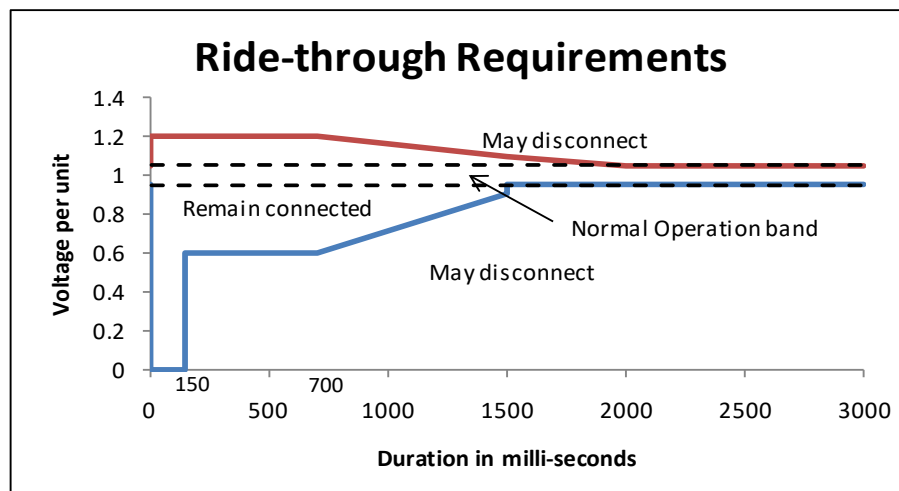


Figure 2 - Ride-through Requirements

7.6.2 Frequency Variation

The generator shall be capable of remaining synchronised to the national grid frequency, with frequency variations of 50Hz $\pm$ 0.75Hz as part of normal operations.

In the event of a system disturbance it is required that any generator >1MVA be capable of riding through frequencies:

- as low as 47.5Hz, or
- as high as 52.5Hz for a period of 30 seconds.

The generator may disconnect if events are outside these criteria.

Unison will be prepared to negotiate on individual applications according to the circumstances of each case.

8. Islanding, Synchronising and Earthing

8.1 Black starting

The applicant shall advise Unison whether or not the plant will be capable of black starting or will require power input from Unison's network.

If power input is required then the applicant is to advise Unison on the maximum demand and reactive power requirements that will be needed. The applicant and Unison's Planning Engineer are to negotiate any factors, such as voltage dip and current requirements that may affect the operation of Unison's network.

8.2 Anti-islanding

Should the generating plant become 'islanded' through disconnection to a GXP via the distribution network, then Unison reserves the right to disconnect the plant at the point of connection. As a rule, Unison will either manually or automatically disconnect the generator from its system in the event of islanding.

Depending on the plant capacity, location and other relevant factors Unison may allow for a generator to connect to an islanded load. This will only be permitted by mutual agreement and with prior arrangement between the parties.

8.3 Earthing

The generator or generator-transformer that connects to the point of connection shall be star connected with the neutral solidly earthed.

For large plant (>10MVA) Unison may consider restricting earth fault currents by the use of Petersen coil or resistance earthing.

9. Metering and Indication

9.1 Metering information

The producer is to make available to Unison the following metering information. This data is to be given in electronic form for each half hour and as agreed between the parties:

- exported or imported active power, kW
- exported or imported reactive power, kVAr
- export or import current, Amps, and
- voltage at the point of connection, V or kV.

This data is to be communicated to Unison's Control Room.

In addition, the status of the circuit breaker (or other switch at the point of connection) is to be communicated to Unison's Control Room.

Depending on the specific situation, Unison reserves the right to impose other metering or signalling data deemed necessary for the proper operation of its network.

Meters are to be MARIA compliant.

kWh and kVArh meters are to record the half hour (30 minute) values as well as the cumulative values.

10. Operating Requirements

10.1 General obligations

All operational interaction between Unison and the operator shall be according to the following Unison documents:

- OS0001 Operational Control Policy
- OS1004 Switching Instructions - Preparations and Approval, and
- OS1014 Commissioning and Livening of Equipment.

In addition, Unison may agree to protocols specific to the applicant's site, but these shall be formally negotiated and agreed to by both parties.

10.2 Shutdowns

The plant operator shall:

- inform Unison's Control Room of any planned outages or reduced output, and
- endeavour to cooperate with Unison in arranging such shutdowns.

This obligation will not be necessary if it is specifically excluded from any formal agreement made between the parties.

11. Power Quality and Losses

11.1 Power quality

The producer shall ensure the power quality at either the point of connection or the point of common coupling (PCC) meets:

- all the New Zealand legal requirements, and
- Unison's **NK2001 Quality of Supply Standard**.

The aspects covered shall include, but not be limited to:

- harmonic distortion
 - radio interference
 - voltage surge and sag criteria, and
 - electro-magnetic compatibility.
-

11.2 Losses

The addition of distributed generation will affect the quantity of electrical energy losses incurred on Unison's distribution network. The effect can vary, in some cases losses will be reduced, in other cases increased by the addition of any particular generating plant.

The calculation of losses shall be as given in **CM2001 Network Connection Standard** and **CM2002 System Loss Allocation**.

Any cost recovery from the producer for additional losses or cost benefit to the producer will be subject to separate negotiation.

12. Testing, Commissioning and Maintenance

12.1 Testing and commissioning

The producer is to submit the testing and commissioning plans relating to the connection of the plant to Unison's network. They must obtain approval for those plans from both Unison's Control Room and the Energy Solutions Manager.

In particular, the procedures of **OS1014 Commissioning and Livening of Equipment** are to be followed but agreed variations may be allowed to suit the situation.

12.2 Maintenance

The producer is responsible for the maintenance of all equipment and plant up to the point of connection.

The producer also has an obligation to maintain all equipment and plant to sound international best practice. Unison reserves the right to disconnect any plant that, in its opinion is unsafe, or is a risk to its network or the public.

13. Right to Access

13.1 Access Unison shall have the right of unrestricted access to any of its plant, including meters and/or communication equipment, except that agreed protocols for such access shall be observed by both parties.

The use of locks or other restrictions intended for safety and security purposes is accepted by Unison provided that agreed arrangements are made for those situations.

14. Curtailment and Disconnection

14.1 General This standard is only concerned with the technical obligations of the parties. Any restrictions or disconnections required under the commercial obligations of the parties shall be directed to Unison's Operations Manager.

Notwithstanding any commercial agreement, the Operations Manager shall have the right to disconnect the generating plant from Unison's network if:

- there are sound safety reasons to do so
 - there is an immediate threat or danger to the public, persons or property
 - there are clear breaches of the technical obligations of this document that have not been dealt with after notification, and/or
 - any other technical reasons that may arise and which in the opinion of Unison's Operations Manager could pose a threat to the stability of Unison's own network.
-

14.2 Force majeure Any disconnection of the generator directly or indirectly attributed to, or caused by force majeure, shall not be a breach of any obligations that the parties have made to each other. If there is disagreement as to whether a particular event is to be treated as a force majeure event, then that dispute shall be referred to a mutually agreed referee whose decision shall be binding.

14.3 Non-emergency disconnection by producer In some cases, disconnections made by the producer could affect the stability of Unison's network or the quality of its supply to other customers. Except for emergency disconnections the producer must notify Unison's Control Room of any disconnection to be made and seek a mutually agreed time for this. As much advance notice as possible shall be given.

Continued on next page

Curtailment and Disconnection, Continued

14.4 Non-emergency disconnection by Unison

From time-to-time Unison may need to disconnect the generator from the network for routine maintenance or network construction purposes. Unison will:

- advise the producer of the requirement for such disconnection, and
- aim to reach a mutual agreement for the time and duration of the disconnection.

The producer is obligated to cooperate with Unison's requirements for such disconnection.

14.5 Records to be kept

Records are to be kept by both parties of all times and durations of each disconnection.

15. Penalties

15.1 General

The purpose of this document is to protect the stability of supply to other customers on Unison's network. Unison reserves the right to disconnect the generator from its network should at any time:

- network stability or contractual obligations to customers be threatened, or
- the producer be in breach of any of the provisions of this document.

Notwithstanding Unison's right to make immediate disconnection, Unison will endeavour to give the producer as much notice as possible before making such disconnection if this is technically feasible without prejudice or obligation.

Some breaches may not pose an immediate threat to Unison's system or customers. In such cases, Unison will communicate to the producer the nature of the breach and provide a timeframe for remedy. If remedy is not made within that timeframe Unison may either disconnect the generator or impose a penalty regime.

Unless otherwise negotiated the penalty regime is to be a multiplier of five (5) times the contracted charge made for the connection to Unison's network.

Continued on next page

Penalties, Continued

15.2 Contractual provisions

The penalties given above are subordinate to any provisions expressly negotiated in the formal contract and/or commercial agreement made between the parties.

15.3 Liability

Unison accepts no liability for:

- any loss incurred by the producer for any technical failure on Unison's network, or
 - any failure caused by any Unison operational or control error unless Unison is proved to be grossly negligent.
-

Appendix A – Application to Connect Forms

DG2 FORM unison The Powerlines People		YOU CAN RETURN YOUR COMPLETED CONNECTION FORM/S ONLINE BY SCANNING AND ATTACHING TO THE FORM UPLOAD AT: www.unison.co.nz/DGupload ALTERNATIVELY YOU CAN POST TO THE ADDRESS BELOW, OR SUBMIT VIA EMAIL: Unison Networks Limited, 1101 Omaha Road, PO Box 555, Hastings 4156 Fax (06) 873 9394 Email: dist.gen@unison.co.nz DISTRIBUTED GENERATION 0800 286 476 www.unison.co.nz
INITIAL APPLICATION TO CONNECT DISTRIBUTED GENERATION > 10KW		
This form complies with the Electricity Industry Participation Code Part 6 Connection of Distributed Generation Regulations and constitutes an initial application for connection in accordance with Clause 11, Part 2, Schedule 6.1.		Any approved connection shall be connected and operated in accordance with the Unison connection and operation policies available at www.unison.co.nz and the terms will be negotiated with Unison prior to connection.
APPLICANT DETAILS		TECHNICAL DETAILS
Full Name: Company: Address: City: Postcode: Telephone: Mobile: Fax: Email:		*For Generators 1MV or larger, or generating a 11kV or higher, Unison may request further information in accordance with System Operator requirements. Manufacturer: Model: Output Voltage: Output Current: Output kW: Output kVA: Power factor: Reactive Power (kVar) requirements: Fault Level Contribution (kA): Method of Voltage Control: Means of Synchronisation and connection and disconnection (provide circuit breaker details): Means of compliance with frequency and voltage: Proposed injection: ☐ Intermittent ☐ Peak ☐ Continuous Single Line Diagram (attached): ☐ Yes ☐ No Type: ☐ Solar PV ☐ Gas Turbine ☐ Battery Storage ☐ Wind Turbine ☐ Steam Turbine ☐ Micro Hydro ☐ Other (specify): Existing connected DG: ☐ Yes ☐ No No of Phases: ☐ Single ☐ Three ☐ DC Inverter Connected ☐ AC Synchronous ☐ AC Asynchronous If inverter connected - does system comply with AS4777? ☐ Yes ☐ No Details of any battery storage: Details of Isolation/Disconnection: Details of Protection Scheme: Proposed date of connection to the Unison network:/...../.....
ELECTRICIAN DETAILS		
Full Name: Company: Address: City: Postcode: Telephone: Mobile: Mobile: Fax: Email:		
INSTALLATION DETAILS		
Expected installation time frame: ICP Number: Energy Retailer: ☐ New OR ☐ Existing ☐ Residential OR ☐ Commercial Address: City: Postcode: Phone: Fax:		
I hereby apply to connect a Distributed Generator to the Unison network and confirm that the above information is correct and that the Generator shall at all times be operated in accordance with all Unison connection and operational standards I confirm that I will not connect any generation until I have received written approval from Unison. Name: Date:/...../..... Signature:		
WWW.UNISON.CO.NZ 0800 286 476		

Continued on next page

Appendix A – Application to Connect Forms, Continued

		YOU CAN RETURN YOUR COMPLETED CONNECTION FORM/S ONLINE BY SCANNING AND ATTACHING TO THE FORM UPLOAD AT: www.unison.co.nz/DGupload ALTERNATIVELY YOU CAN POST TO THE ADDRESS BELOW, OR SUBMIT VIA EMAIL: Unison Networks Limited, 1101 Omaha Road, PO Box 555, Hastings 4156 Fax (06) 873 9394 Email: dist.gen@unison.co.nz DISTRIBUTED GENERATION 0800 286 476 www.unison.co.nz				
FINAL APPLICATION TO CONNECT DISTRIBUTED GENERATION > 10KW						
This form complies with the Electricity Industry Participation Code Part 6 Connection of Distributed Generation Regulations and constitutes an initial application for connection in accordance with Clause 11, Part 2, Schedule 6.1. Any approved connection shall be connected and operated in accordance with the Unison connection and operation policies available at www.unison.co.nz and the terms will be negotiated with Unison prior to connection.						
<table border="1" style="width: 100%; border-collapse: collapse;"><thead><tr><th style="width: 50%; text-align: left; padding: 5px;">APPLICANT DETAILS</th><th style="width: 50%; text-align: left; padding: 5px;">TECHNICAL DETAILS</th></tr></thead><tbody><tr><td style="vertical-align: top; padding: 5px;"> Full Name: Company: Address: City: Postcode: Telephone: Mobile: Fax: Email: </td><td style="vertical-align: top; padding: 5px;"> *For Generators 1MW or larger, or generating a 11KV or higher, Unison may request further information in accordance with System Operator requirements. Manufacturer: Model: Output Voltage: Output Current: Output kW: Output kVA: Power factor: Reactive Power (kVAr) requirements: Fault Level Contribution (kA): Method of Voltage Control: Means of Synchronisation and connection and disconnection (provide circuit breaker details): Means of compliance with frequency and voltage: Proposed injection: ☐ Intermittent ☐ Peak ☐ Continuous Single Line Diagram (attached): ☐ Yes ☐ No Type: ☐ Solar PV ☐ Gas Turbine ☐ Battery Storage ☐ Wind Turbine ☐ Steam Turbine ☐ Micro Hydro ☐ Other (specify): Existing connected DG: ☐ Yes ☐ No No of Phases: ☐ Single ☐ Three ☐ DC Inverter Connected ☐ AC Synchronous ☐ AC Asynchronous If inverter connected - does system comply with AS4777? ☐ Yes ☐ No Details of any battery storage: Details of Isolation/Disconnection: Details of Protection Scheme: Proposed date of connection to the Unison network: </td></tr></tbody></table>			APPLICANT DETAILS	TECHNICAL DETAILS	Full Name: Company: Address: City: Postcode: Telephone: Mobile: Fax: Email:	*For Generators 1MW or larger, or generating a 11KV or higher, Unison may request further information in accordance with System Operator requirements. Manufacturer: Model: Output Voltage: Output Current: Output kW: Output kVA: Power factor: Reactive Power (kVAr) requirements: Fault Level Contribution (kA): Method of Voltage Control: Means of Synchronisation and connection and disconnection (provide circuit breaker details): Means of compliance with frequency and voltage: Proposed injection: ☐ Intermittent ☐ Peak ☐ Continuous Single Line Diagram (attached): ☐ Yes ☐ No Type: ☐ Solar PV ☐ Gas Turbine ☐ Battery Storage ☐ Wind Turbine ☐ Steam Turbine ☐ Micro Hydro ☐ Other (specify): Existing connected DG: ☐ Yes ☐ No No of Phases: ☐ Single ☐ Three ☐ DC Inverter Connected ☐ AC Synchronous ☐ AC Asynchronous If inverter connected - does system comply with AS4777? ☐ Yes ☐ No Details of any battery storage: Details of Isolation/Disconnection: Details of Protection Scheme: Proposed date of connection to the Unison network:
APPLICANT DETAILS	TECHNICAL DETAILS					
Full Name: Company: Address: City: Postcode: Telephone: Mobile: Fax: Email:	*For Generators 1MW or larger, or generating a 11KV or higher, Unison may request further information in accordance with System Operator requirements. Manufacturer: Model: Output Voltage: Output Current: Output kW: Output kVA: Power factor: Reactive Power (kVAr) requirements: Fault Level Contribution (kA): Method of Voltage Control: Means of Synchronisation and connection and disconnection (provide circuit breaker details): Means of compliance with frequency and voltage: Proposed injection: ☐ Intermittent ☐ Peak ☐ Continuous Single Line Diagram (attached): ☐ Yes ☐ No Type: ☐ Solar PV ☐ Gas Turbine ☐ Battery Storage ☐ Wind Turbine ☐ Steam Turbine ☐ Micro Hydro ☐ Other (specify): Existing connected DG: ☐ Yes ☐ No No of Phases: ☐ Single ☐ Three ☐ DC Inverter Connected ☐ AC Synchronous ☐ AC Asynchronous If inverter connected - does system comply with AS4777? ☐ Yes ☐ No Details of any battery storage: Details of Isolation/Disconnection: Details of Protection Scheme: Proposed date of connection to the Unison network:					
<table border="1" style="width: 100%; border-collapse: collapse;"><thead><tr><th style="width: 50%; text-align: left; padding: 5px;">ELECTRICIAN DETAILS</th><th style="width: 50%; text-align: left; padding: 5px;">INSTALLATION DETAILS</th></tr></thead><tbody><tr><td style="vertical-align: top; padding: 5px;"> Full Name: Company: Address: City: Postcode: Telephone: Mobile: Mobile: Fax: Email: </td><td style="vertical-align: top; padding: 5px;"> Expected installation time frame: ICP Number: Energy Retailer: ☐ New OR ☐ Existing ☐ Residential OR ☐ Commercial Address: City: Postcode: Phone: Fax: </td></tr></tbody></table>			ELECTRICIAN DETAILS	INSTALLATION DETAILS	Full Name: Company: Address: City: Postcode: Telephone: Mobile: Mobile: Fax: Email:	Expected installation time frame: ICP Number: Energy Retailer: ☐ New OR ☐ Existing ☐ Residential OR ☐ Commercial Address: City: Postcode: Phone: Fax:
ELECTRICIAN DETAILS	INSTALLATION DETAILS					
Full Name: Company: Address: City: Postcode: Telephone: Mobile: Mobile: Fax: Email:	Expected installation time frame: ICP Number: Energy Retailer: ☐ New OR ☐ Existing ☐ Residential OR ☐ Commercial Address: City: Postcode: Phone: Fax:					
I hereby apply to connect a Distributed Generator to the Unison network and confirm that the above information is correct and that the Generator shall at all times be operated in accordance with all Unison connection and operational standards I confirm that I will not connect any generation until I have received written approval from Unison. Name: Date:/...../..... Signature:						
WWW.UNISON.CO.NZ 0800 286 476						

Appendix B – Technical Requirements for Connecting Distributed Generation

Technical Requirements for Connecting Distributed Generation							
1.0 Global Station Data							
1.1 General		Enter Parameter	Unit of Measure	Required as Preliminary Planning Data	General System Studies		
					Identification	Fault Studies	Load Flow Studies
1.1.1	Applicant Details		Text	*	*		
1.1.2	Consultant or Electrician Details		Text	*	*		
1.1.3	Location of DG		Text	*	*		*
1.1.4	Plant Fuel Source ¹		Text	*	*		
1.1.5	Nominal voltage at Point of Connection		kV	*	*		*
1.1.6	Total installed capacity at Point of Connection		MVA	*	*		*
1.1.7	Total Maximum Continuous Rating (MCR) ²		MW		*		*
1.1.8	Maximum Import Demand		MVA		*		*
1.1.9	Reactive Power Range (inductive and/or capacitive)		MVAr		*		*
1.1.10	Single Line diagram Attached?		Yes/No		*	*	
1.1.11	Does generator have any special islanding, protection or synchronising requirements? (Specify full details of these requirements)		Yes/No		*	*	

Form Issued under NK8010 Technical Requirements for Connecting Distributed Generation over 500kW
Uncontrolled When Printed

Page 1 of 5
Classification – External

Continued on next page

Appendix B – Technical Requirements for Connecting Distributed Generation, Continued

Technical Requirements for Connecting Distributed Generation  unison The Powerlines People							
2.0 Generator ³							
2.1 General		Enter Parameter	Unit of Measure	Required as Preliminary Planning Data	General System Studies		
					Identification	Fault Studies	Load Flow Studies
2.1.1	Machine Type (Synchronous/Asynchronous)		Text	*	*		
2.1.2	No of Phases			*	*	*	*
2.1.3	Output through transformer		Yes/No	*	*		
2.1.4	Inverter to be connected		Yes/No	*	*		
2.1.5	Rated MVA		MVA	*		*	*
2.1.6	Rated MW (MVA * Power Factor)		MW	*		*	*
2.1.7	Maximum continuous power output per machine if different from rated value		MW			*	*
2.1.8	Reason if different		Text			*	*
2.1.9	Rated Terminal Voltage		kV	*		*	*
2.1.10	Terminal Voltage Adjustment Range		+/- kV	*			*
2.1.11	Turbine Generator Inertia constant		s	*		*	
2.1.12	Active Auxiliary Load at Rated Generator Power		MW				*
2.1.13	Reactive Auxiliary Load at Rated Generator Power		MVAr				*
2.1.14	Short circuit Ratio (Synchronous Machines only)			*		*	
2.1.15	Synchronous Rotor Type (Salient Pole/Round)		Text	*		*	
2.1.16	Asynchronous Rotor Type (Wound Rotor/Squirrel Cage)		Text	*		*	

Form Issued under NK8010 Technical Requirements for Connecting Distributed Generation over 500kW
Uncontrolled When Printed

Page 2 of 5
Classification – External

Continued on next page

Appendix B – Technical Requirements for Connecting Distributed Generation, Continued

Technical Requirements for Connecting Distributed Generation					 unison The Powerlines People		
2.0 Generator ³							
2.2 Synchronous Machine Characteristic Curves		Enter Parameter	Unit of Measure	Required as Preliminary Planning Data	General System Studies		
					Identification	Fault Studies	Load Flow Studies
2.2.1	Generator Capability Curves Attached? ⁴		Yes/No	*			*
2.2.2	Open Circuit Characteristic Attached?		Yes/No	*			*
2.2.3	Short Circuit Characteristic Attached?		Yes/No	*			*
2.2.4	Generator V-Curve Attached?		Yes/No	*			*

2.3 Synchronous Machine Impedances (unsaturated) in p.u. on generator MVA base		Enter Parameter	Unit of Measure	Required as Preliminary Planning Data	General System Studies		
					Identification	Fault Studies	Load Flow Studies
2.3.1	Amature/Stator Resistance Ra		p.u.	*		*	
2.3.2	Direct Axis synchronous reactance Xd		p.u.	*			
2.3.3	Direct Axis transient reactance X'd		p.u.	*		*	
2.3.4	Direct axis sub-transient reactance X''d		p.u.	*		*	
2.3.5	Negative sequence reactance X ₂		p.u.	*		*	
2.3.6	Zero sequence reactance X ₀		p.u.	*		*	
2.3.7	Earthing resistance ⁵ R _e		Ohms	*		*	
2.3.8	Earthing reactance ⁵ X _e		Ohms	*		*	

Form Issued under NK8010 Technical Requirements for Connecting Distributed Generation over 500kW
Uncontrolled When Printed

Page 3 of 5
Classification – External

Continued on next page

Appendix B – Technical Requirements for Connecting Distributed Generation, Continued

Technical Requirements for Connecting Distributed Generation					 unison The Powerlines People		
2.0 Generator ³							
2.4 Asynchronous Machine Impedances in p.u. on generator MVA base		Enter Parameter	Unit of Measure	Required as Preliminary Planning Data	General System Studies		
					Identification	Fault Studies	Load Flow Studies
2.4.1	Stator resistance R_1		p.u.	*		*	
2.4.2	Magnetizing reactance X_m		p.u.	*		*	
3.0 Grid Interface Circuit Breakers ²⁰							
3.0 General		Enter Parameter	Unit of Measure	Required as Preliminary Planning Data	General System Studies		
					Identification	Fault Studies	Load Flow Studies
3.0.1	Equipment Manufacturer		Text		3.0.1		
3.0.2	Rated Voltage		kV	*	3.0.2		
3.0.3	Nominal Rating		A	*	3.0.3		
3.0.4	Short Circuit Rating (3 sec)		kA	*	3.0.4		
Form Issued under NK8010 Technical Requirements for Connecting Distributed Generation over 500kW Uncontrolled When Printed							
Page 4 of 5 Classification – External							

Continued on next page

Appendix B – Technical Requirements for Connecting Distributed Generation, Continued

Technical Requirements for Connecting Distributed Generation					 The Powerlines People		
4.0 Indications and Measurement							
4.0 General		Enter Parameter	Unit of Measure	Required as Preliminary Planning Data	General System Studies		
					Identification	Fault Studies	Load Flow Studies
4.0.1	Is a 'Station Net MW Export' indicator provided?		Yes/No				
4.0.2	Is a 'Station Net MW Import' indicator provided?		Yes/No				
4.0.3	Is a 'Station Net MVar Export' indicator provided?		Yes/No				
4.0.4	Is a 'Station Net MVar Import' indicator provided?		Yes/No				
4.0.5	Is a 'Generator Circuit Breaker Status' indicator provided?		Yes/No				
4.0.6	Is a 'Generating Unit Operating Mode' indicator provided?		Yes/No				

Form Issued under NK8010 Technical Requirements for Connecting Distributed Generation over 500kW
Uncontrolled When Printed

Page 5 of 5
Classification – External

Appendix C – Summary of Document Changes

Date	Version No.	Changes to Document	Creator	Authoriser	Approver
01/10/2009	1.0	New Standard.	Contracted Engineer	Development Manager	General Manager Networks & Operations
14/07/2017	2.0	Restructured for installations 500kW and over. Full review and update to new template.	Energy Solutions Manager	Energy Solutions Manager	General Manager Networks & Operations
