Vector Limited

Distribution code – electricity network

Effective: 1 January 2009

IMPORTANT

This distribution code is a working document. It will be subject to amendment from time to time to reflect industry changes and changes to comply with legislation and good industry practice.

As a user of the vector network it is your responsibility to ensure that you possess the most up to date copy. Each separate page has the issue date on it.

Copies of the distribution code can be downloaded from the following vector websites:

www.vectorelectricity.co.nz
www.unitednetworks.co.nz

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1. GENERAL

1.1 INTRODUCTION

To protect the integrity of the Vector Network and ensure that it operates in a safe and efficient manner, all Users and any other person who has equipment connected, or to be connected, to the Vector Network (excluding Transpower) must comply with the requirements set out in this Distribution Code.

Vector may disconnect, or refuse to connect, any User, or other person that does not comply with this Distribution Code.

This Distribution Code is referred to:

- in Vector's agreements with Users as the "Distribution Code";
- in UnitedNetworks (a division of Vector) agreements with Users as the "Network Connection Requirements".

This Distribution Code covers four broad areas:

- standard and technical requirements for connection to the Vector Network
- requirements for operational communications
- requirements for long-term planning
- health and safety management of the Vector Network

It is also a statement to Users of how they can expect the Vector Network to be planned, operated and managed.

In addition to complying with the Distribution Code, both Vector and Users of the Vector Network must comply with their obligations under the Electricity Act 1992, the Regulations, the Electricity Governance Rules, the Resource Management Act 1991 and other relevant legislation.

1.2 SCOPE

The Distribution Code comprises:

(i) General (Section 1);
(ii) Distribution Planning Code (Section 2);
(iii) Distribution Operating Code (Section 3);
(iv) Safety Co-ordination (Section 4);
(v) Contingency Planning (Section 5);
(vi) Appendices

1.3 DEFINITIONS

In this Distribution Code:

(a) A reference to a "person" includes an individual, firm, company, corporation or unincorporated body of persons, or any state or national governmental body, or any agency thereof (in each case, whether or not having a separate legal personality) and a reference to a "company" includes a person.

(b) A reference to a statute, or regulation is a reference to that statute or regulation as amended or re-enacted from time to time.

(c) A reference to a published standard or code of practice is a reference to that standard or code of practice as amended or substituted from time to time.

(d) A reference to Vector's "approval", or a reference that Vector "may" do any act is deemed to include a reference that Vector may approve or act in its absolute discretion.

(e) A reference to "including" or similar words does not imply any limitation.

(f) The following terms have the following meanings unless the context otherwise requires:

Act	Electricity Act 1992.
Active Power	The product of voltage and the in-phase component of alternating current (measured in kilo-watts (kW) or mega-watts (MW)).
Appliance	Any appliance inside or on an End-Consumer's Premises that uses, or is designed or intended to use, electricity, whether or not it also uses, or is designed or intended to use, any other form of energy.
Apparent Power	The product of voltage and alternating current (measured in kilo-volt-amperes (kVA) or mega-volt-amperes (MVA)).
Back-up Protection System	The system designed to open a fault-current interrupting device in the absence of the correct operation of the Protection System.
Black Start	The procedure by which a Generating Plant commences generating electricity without requiring an external power supply.
Connection Agreement	Any contractual agreement or arrangement between Vector and a User setting out the terms and conditions for

	connection of the User's Equipment to the Vector Network (but excludes any arrangement with Transpower for connection to Transpower's Network).
Control Person	A person who has been nominated by Vector, Transpower or a User (as appropriate) to be responsible for controlling and co-ordinating network operations and all health and safety requirements, and network emergencies.
Demand	The electricity demand of apparent power, Active Power and Reactive Power expressed in kVA/MVA, kW/MW or kVAr/MVAr respectively.
Design Rating	The maximum current or voltage, or combination of both, which an item of equipment is intended to have applied to it, taking into account cyclic variations of that voltage and current, together with other parameters as appropriate to specific items of equipment.
Distributed Generator	Distributed Generator has the same meaning as Embedded Generator.
Electrical Code of Practice	An Electrical Code of Practice issued pursuant to the Act.
Electricity Commission	A Crown entity established under the Act to regulate the operation of the electricity industry and markets to ensure electricity is produced and delivered to consumers in an efficient, fair, reliable, and environmentally sustainable manner.
Electricity Governance Rules	The Electricity Governance Rules 2003 as amended from time to time.
Electricity Retailer	A person who supplies, or proposes to supply, electricity to another person for consumption by that other person via the Vector Network.
Embedded Generator	A person who owns or operates Generating Plant and/or injects or is able to inject electricity into the Vector Network.
Embedded Network	Any electricity network (including all Fittings) connecting, or to be connected, to the Vector Network which conveys electricity to a third party, or injects, or is able to inject, electricity directly into the Vector Network.
End-Consumer	Any person who consumes, or may consume, electricity distributed through the Vector Network at one or more

	Points of Connection.
End-Consumer Installation	Any Fittings owned or used by an End-Consumer that form part of a network for conveying electricity from the Point of Connection to where the electricity may be consumed.
End-Consumer Premises	Any premises all or part of which are occupied by an End-Consumer or on which an End-Consumer Installation is situated.
Event	An unscheduled or unplanned occurrence on or relating to an Embedded Network or the Vector Network, including faults, outages, incidents and breakdowns.
Fittings	Everything used or designed or intended for use, in or in connection with the conversion, transformation, conveyance, measurement or use of electricity.
Generating Plant	One or more electricity generating units and all associated Fittings used to generate and convey the electricity generated to the Vector Network.
Good Industry Practice	The exercise of that degree of skill, diligence, prudence and foresight which would reasonably and ordinarily be expected from a skilled and experienced operator engaged in New Zealand in the same type of undertaking under the same or similar circumstances having regard to common industry practice in New Zealand at the time.
High Voltage	6600 volts ac between phases or greater.
kVA	Kilo-volt-ampere (1000 volt-amperes).
kVAr	Kilo-volt-ampere reactive (1000 volt-amperes reactive).
kW	Kilo-watt (1000 watts).
Low Voltage	230 volts ac single phase or 400 volts ac, 3 phase.
MVA	Mega-volt-ampere (1,000,000 volt-ampere).
MVAr	Mega-var (1,000,000 vars).
MW	Mega-watt (1,000,000 watts).
Metering Equipment	Equipment used to measure the quantity of Active Power and Reactive Power entering and/or exiting a Point of Connection.

Planned Outage A pre-planned outage of a Generating Plant, Embedded Network, part of Transpower's Network, or part of the Vector Network.

Point of Connection A point at which a User's Fittings interconnect with Vector's Network.

Power Factor The ratio of Active Power to apparent power calculated in accordance with the following formula:

$$\text{Power Factor} = \frac{A}{\sqrt{A^2 + R^2}}$$

where: A = Active Power being the measured value of the product of current and the component of voltage in phase with the current; and

R = Reactive Power being the measured value of the product of current and the component of voltage in quadrature with the current.

Both A and R being the instantaneous values integrated over one and the same minimum time period used for billing purposes.

Protection System The primary arrangements designed to detect abnormal conditions in the Vector Network, any Generating Plant, Embedded Network and/or End-Consumer Installation and initiate fault clearance, or actuate signals or indications.

Reactive Power The product of voltage and current and the sine of the phase angle between them, which is normally measured in Kilo-vars (kVAr) or Mega-vars (MVAr).

Regulations Regulations made pursuant to the Act and any other relevant regulations in force from time to time.

System Operator The service provider responsible for scheduling and dispatching electricity on Transpower's Network in a manner that avoids fluctuations in frequency or disruption of supply (currently carried out by Transpower).

Top-Up The supply of electricity to a User on a continuing or regular basis to make good any shortfall between the User's total supply requirements and that met from other sources.

Transpower	Transpower New Zealand Limited and its successors and assigns in its capacity as owner/operator of Transpower's Network (and not in its capacity as an End-Consumer).
Transpower's Network	The electricity transmission system currently owned by Transpower.
Use of System Agreement	An agreement between Vector and an Electricity Retailer relating to the use of the Vector Network by the Electricity Retailer to supply electricity to its customers.
User	An End-Consumer, Embedded Generator, Embedded Network operator, Electricity Retailer or any other person who for the time being has Fittings connected or to be connected to the Vector Network, but does not include Transpower.
User Equipment	Appliances, Fittings, Generating Plant and any other equipment owned or operated by a User.
Vector	Vector Limited (including its division UnitedNetworks) and its successors and assigns.
Vector's Design and Construction Standards	The design and construction standards for the Vector Network published by Vector from time to time and available on request.
Vector Network	The electricity networks (including all Fittings) for the conveyance and distribution of electricity owned or operated by Vector from time to time.
Vector's Website	www.vector.co.nz.

1.4 COST OF COMPLIANCE

Where a person is required to supply information to another person under this Distribution Code, the person supplying the information will bear the reasonable costs of supplying that information. If a person requests information in addition to that required under this Distribution Code, the person requesting the information may be required to bear the reasonable costs of supplying the information incurred by the person supplying the information.

2. DISTRIBUTION PLANNING CODE

2.1 INTRODUCTION

This section specifies Vector's technical, design and connection criteria and procedures for planning and developing the Vector Network.

The objectives of this section are:

(a) to enable the Vector Network to be planned, designed and constructed to operate safely, securely and economically;

(b) to facilitate the use of the Vector Network by Users;

(c) to establish technical conditions to facilitate the interface between Embedded Networks and the Vector Network;

(d) to formalise the exchange of planning information; and

(e) to provide sufficient information for a User to assess opportunities for connection and, where appropriate, to plan and develop its Embedded Network so as to be compatible with the Vector Network.

The cost responsibility for any alteration or addition to the Vector Network required for compliance with the Distribution Code is part of the commercial arrangement between Vector and the relevant User and is not included in this Distribution Code.

Information exchanged between Vector and a User for planning purposes is confidential to the parties holding the information. In many cases this will comprise sensitive commercial information and must be kept confidential and not be directly or indirectly disclosed to any other person without the prior written consent of the party providing the information unless the disclosing party's legal advisor's reasonably believe disclosure is required by law or the relevant stock exchange.

2.2 STANDARDS AND DESIGN PRINCIPLES

This section sets out the principles and standards for the design of the Vector Network and any Embedded Network or End-Consumer Installation. This Distribution Code is not intended to inhibit design innovation or restrict the introduction of new technologies or electricity networks which are consistent with the overall requirements of this Distribution Code.

Vector recognises that some Users may not presently comply with all requirements in this section, and has made or in the process of making arrangements with those Users to rectify the situation. Subject to those arrangements, nothing limits the obligation of the User to comply with this Distribution Code within a time frame acceptable to Vector.

2.2.1 Standard of supply

2.2.1.1 Security

The Vector Network, any Embedded Network and any Fittings which are to be transferred to Vector (including Fittings for subdivisions and other development), must be designed to meet:

- the Electricity Network Security Criteria (refer Vector's Design and Construction Standards document ENS-ND01 Network Security Standard Rev 1); and
- all relevant legislation, Regulations, the Electricity Governance Rules and Electrical Codes of Practice.

2.2.1.2 Frequency and voltage

The Vector Network, any Embedded Network and any Fittings which are to be transferred to Vector (including Fittings for subdivisions and other development), must be designed to:

- enable the Vector Network to operate at 50 Hertz or such other number of alternating current cycles at which the Vector Network normally operates;
- enable a range of voltages to be supplied to Users; and
- comply with all relevant legislation, Regulations, the Electricity Governance Rules and Electrical Codes of Practice.

2.2.1.3 Network disturbances and waveform distortion

To limit the potential effects of voltage waveform distortion and other disturbances on the Vector Network caused by certain types of User Equipment, a User's load must comply with the following:

(a) voltage and current waveform distortion must comply with the limits set out in all relevant Regulations, Rules, Electrical Codes of Practice and 61000 series joint Australian / New Zealand EMC standards;

(b) the voltage and current waveform distortion by any load or End-Consumer Installation must comply with:

i) AS/NZS 61000.3.2:2007 Electromagnetic compatibility (EMC) Part 3.2 Limits – Limits for harmonic current emissions (equipment input current less than or equal to 16 A per phase);

ii) AS/NZS 61000.3.4 Electromagnetic compatibility (EMC) Part 3.4 Limits – Limitation of emission of harmonic currents in low voltage power supply systems for equipment with rated current greater than 16 A; and

iii) AS/NZS 61000.3.6 Electromagnetic compatibility (EMC) Part 3.6 Limits – Assessment of emission limits for distorting loads in MV and HV power systems (IEC 61000-3-6:1996, MOD).

(c) Voltage fluctuations and flicker due to any load or equipment (eg, motor starting, motor operation, sudden switching of large loads or equipment, operation of electrical arcing equipment such as welding machines or arc furnaces, etc) must comply with:

i) AS/NZS 61000.3.3 Electromagnetic compatibility (EMC) Part 3.3 Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current less than or equal to 16 A per phase and not subject to conditional connection.

ii) AS/NZS 61000.3.5 Electromagnetic compatibility (EMC) Part 3.5 Limits – Limitation of voltage fluctuations and flicker in low-voltage supply systems, for equipment with rated current greater than 16 A.

iii) AS/NZS 61000.3.7 Electromagnetic compatibility (EMC) Part 3.7 Limits – Assessment of emission limits for fluctuating loads in MV and HV power systems (IEC 61000-3-7:1996, MOD).

Vector may require a User to implement corrective measures to limit the level of distortion, at its own expense, if the User's Equipment does not comply with the requirements above. Under special circumstances Vector may consider other limits or levels.

Under fault and circuit switching conditions the rated frequency or voltage may fall or rise transiently. The fall or rise in voltage will be affected by the method of earthing of the neutral point of the Vector Network, and this variation in voltage will be taken into account by Users in selecting User Equipment. Vector's earthing design and construction practice is contained in the Earthing Standard (Vector's Design and Construction Standards document ENS-0007).

2.2.1.4 Signalling systems

Vector operates signalling systems for load control and other control purposes at the frequencies detailed in Appendix 1. To ensure the correct operation of the signalling systems, User Equipment must be designed and operated to not interfere with the operation of the signalling systems or the Vector Network. Vector may require a User to provide any necessary corrective measures or removal of the User's Equipment at the User's expense if the User's Equipment interferes with Vector's signalling systems or the Vector Network.

2.2.1.5 Power Factor

The Power Factor of a User's load measured at the metering point must not be less than 0.95 lagging at all times. Vector may require a User to provide any necessary corrective measures at the User's expense if the User's power factor falls below 0.95 at any time. Any corrective measures must not cause disturbance or distortion in excess of those specified in sections 2.2.1.3 or 2.2.1.4. If the User fails to implement corrective measures, Vector may implement corrective measures, and the User will pay Vector's reasonable costs of doing so.

2.2.1.6 Voltage imbalance

Under normal operating conditions, during each period of one week, 95% of the 10 minute mean rms values of the negative phase sequence component of the supply voltage must comply with the requirements of BS EN 50160:1995 "voltage characteristics of electricity supplied by public distribution systems" and be within the range 0 to 2% of the positive phase sequence component.

2.2.2 Design Principles

2.2.2.1 Materials and construction standard

The materials used in the construction of the Vector Network, any Embedded Network and any Fittings which are to be transferred to Vector (including Fittings for subdivisions and other development), must comply with Vector's Design and Construction Standards.

Vector may not accept ownership of and/or refuse to connect any User Equipment that does not conform to Vector's Design and Construction Standards or any other technical standards which Vector may reasonably set.

2.2.2.2 Earthing

The method of earthing the Vector Network is contained in the Earthing Standard (Vector's Design and Construction Standards documents ENS-0007) and is designed to comply with the Regulations and relevant Electrical Codes of Practice. All Fittings must meet the voltages and fault levels which will be imposed on the Fittings as a result of the method of earthing.

Multiple earth neutral networks must be designed by Users to comply with Good Industry Practice.

Where there is more than one source of energy, Users must take precautions to limit the occurrence and effects of circulating currents in respect of the neutral points connected with earth.

2.2.2.3 Protection

The Vector Network and each Embedded Network must incorporate Protection Systems in accordance with any relevant Regulations and Electrical Codes of Practice.

To ensure satisfactory operation of the Vector Network, Users must obtain Vector's approval to operating times, discrimination and sensitivity of Protection Systems at the Point of Connection before commissioning, or making any change to, the Point of Connection.

Unless otherwise agreed by Vector in writing Users must not limit the fault current infeed to the Vector Network by the use of Protection Systems as the failure of that Protection System to operate as intended, in the event of a fault, could cause the fault rating of Fittings owned by Vector to be exceeded.

2.2.2.4 Superimposed signals

Any User Equipment including mains borne signalling equipment installed by a User for the purpose of information transfer, load management, or any other purpose must:

- comply with the appropriate industry standards; and
- not be used to superimpose, inject or convey signals on the Vector Network without Vector's prior written approval (usually in conjunction with a commercial agreement setting out other terms and conditions).

Vector may disconnect a User's mains borne signalling equipment which has been installed without Vector's approval.

If a User's signals leak into the Vector Network, the User will indemnify Vector from any loss or damage whatsoever caused by the User using the Vector Network for conveyance of signals.

2.2.2.5 Mains signalling channels

Vector will from time to time designate which channels Electricity Retailers may use for signalling at Points of Connection. Each Electricity Retailer must ensure that the load management equipment at Points of Connection supplied by it, will reliably respond to the designated channel signal.

Vector may reserve or allocate certain channels for use by a certain Electricity Retailer or for Vector's own use. Other Electricity Retailers must not use a reserved channel without providing Vector with evidence satisfactory to Vector that the designated Electricity Retailer has given written approval to the use of that channel by the other Electricity

Retailer. Any Electricity Retailer who wishes to carry out load management on a reserved channel must enter into a separate agreement with Vector.

2.2.2.6 Capacitors

Any capacitors installed by a User must:

- be designed so that they do not adversely affect the Vector Network and any signals conveyed by Vector over the Vector Network (refer to section 2.2.1.4 above);
- not generate or cause to generate waveform (or harmonic) distortions or transient overvoltages and transient overcurrents in excess of the limits given in clause 2.2.1.3.

Before installing capacitors, the User should discuss the technical details with Vector and Vector will provide technical information to assist the User to design the capacitors. Vector may require the User to implement appropriate corrective measures if the User's capacitors interfere with Vector's signals or other Embedded Networks, End-Consumer Installations or their use of the Vector Network.

2.2.2.7 Interconnection

A User may not interconnect between Points of Connection without Vector's prior written approval.

2.3 CONNECTIONS TO THE VECTOR NETWORK

This section specifies the information required by Vector from a User (including Embedded Generators) in order to ensure that adequate technical provision is made for new supplies, increases in existing load, or changes in load characteristics.

2.3.1 Load Characteristics

2.3.1.1 Low Voltage supplies

For Low Voltage supplies the User must provide the following data to Vector when a connection is requested:

(a) maximum Apparent Power requirements (kVA);
(b) type and electrical loading of equipment to be connected eg, number and size of motors, including maximum starting currents and electrical heating arrangements;
(c) capacity of generating units installed (if any) and their mode of operation (standby or base load); and
(d) the date when the connection is required.

If Vector requires more detailed information, the User will provide the information to Vector on request at the User's cost.

2.3.1.2 High Voltage supplies

For High Voltage supplies the User must provide the following information in addition to the information required under 2.3.1.1:

(a) all types of demand:

(i) maximum Active Power requirements;
(ii) maximum and minimum Reactive Power requirements;
(iii) type of load and control arrangements eg, controlled rectifier or larger motor drives with maximum starting currents;
(iv) maximum load on each phase at the time of maximum demand; and
(v) the maximum levels of harmonic voltage and current to be imposed on the Vector Network.

(b) fluctuating Loads:

details of the cyclic variation, and where applicable the duty cycle, of Active Power (and Reactive Power, if appropriate), in particular:

(i) the rates of change of Active Power and Reactive Power, both increasing and decreasing;
(ii) the shortest repetitive time interval between fluctuations in Active Power and Reactive Power; and
(iii) the magnitude of the largest step changes in Active Power and Reactive Power, both increasing and decreasing.

(c) generation (if applicable):

details of generation schedule:

(i) rates of change of Active Power and Reactive Power;
(ii) the schedule of intended generation; and
(iii) whether the generation is running in parallel with Vector's Network and if so, the fault current contribution to Vector's Network.

Where required by Vector, the User will also provide more detailed information such as an indication of the pattern of build up of load and a proposed commissioning programme.

2.3.2 Connection arrangements

The design of connections between the Vector Network and an Embedded Network or End-Consumer Installation must be in accordance with the principles set out in 2.2, subject to any modification approved by Vector.

When an application for connection is made, Vector will agree with the relevant User the voltage and capacity at which the User will be connected in accordance with Vector's

normal practice for the type of load to be supplied. Vector may specify a different connection voltage to avoid potential disturbance caused by the User's Equipment, or for other technical reasons, or may agree alternative methods for minimising the effects of disturbing loads. The User must use reasonable endeavours to keep its Demand within the agreed supply capacity. Should the User anticipate its Demand will exceed the agreed supply capacity, it must notify Vector to agree on necessary (if any) remedial actions.

Before entering into a Connection Agreement the relevant User must reasonably satisfy Vector in writing that the Embedded Network or End-Consumer Installation will comply with all appropriate requirements of the Distribution Code.

2.3.2.1 Standard LV connections

Connections to residential and small business End-Consumers are normally made at 60A single phase. Where appropriate and possible, Vector can provide the following standard connections:

(i) residential connections: 230V single phase 60A, 400V three phase 60A
(ii) commercial / industrial connections: 230V single phase 60A, 400V three phase 60A, 100A or 160A

2.3.2.2 Subdivisions

For subdivision reticulation where ownership may be transferred to Vector, provision must be made for future development in accordance with the relevant District Plan to ensure cabling has adequate capacity to supply on-going development stages without the need for upgrade. Full details and requirements are included in Technical Requirements for Subdivisions (Vector’s Design and Construction Standards ENG-0001).

2.3.2.3 Enhanced Low Voltage connections

For larger loads at Low Voltage, Vector may need to reinforce the Vector Network, and will advise the User of such requirements. If the supply or supply increase is greater than 200A, the User must apply in writing.

Where a new transformer is required for a proposed connection, the User must first enter into an agreement with Vector in relation to the location and provision of accommodation for the transformer. In general, a new transformer will be necessary when the User’s anticipated or actual demand is in excess of 100 kVA in the case of business supply, and in excess of 50 kVA in the case of residential supply.

Full details and requirements for substations on Customer’s Premises are included in Technical Requirements for Substations on Customers Premises (Vector’s Design and Construction Standards ENS-0070).

Unless otherwise agreed, Vector will provide all Fittings to a suitable Low Voltage frame or termination, which will be the Point of Connection.

2.3.2.4 Supply at High Voltage

If a User requires supply at High Voltage, the User must contact Vector to agree on the voltage. Once agreed, Vector will supply High Voltage cables and switchgear up to the End-Consumer's Point of Connection. The User will be responsible for all Fittings beyond the Point of Connection.

Full details and requirements for High Voltage supplies are included in Technical Requirements for Customers supplied at High Voltage (Vector's Design and Construction Standards document ENS-0070).

2.3.2.5 Supply to Embedded Networks at High Voltage

In addition to the requirements specified in 2.3.2.4, Embedded Networks must comply with the Electricity Governance Rules requirements for Metering Equipment.

2.3.3 Communications

Routine and emergency communication between Vector and the User will be provided and maintained as agreed in writing between Vector and the relevant User in each particular case.

2.3.4 Demand management

Where Vector or a User needs to coordinate demand management, the parties will agree a procedure for implementing demand management.

Vector is required by the Electricity Governance Rules to interrupt supply to Users under emergency situations or to avoid a grid emergency. Users will, on request, provide Vector with information on available emergency load shedding. Vector will at its discretion arrange sufficient load to be disconnected to meet its obligation under the Electricity Governance Rules.

2.4 TECHNICAL REQUIREMENTS FOR CONNECTION

This section specifies the technical arrangements for the Point of Connection between the Vector Network and an Embedded Network, Generating Plant or End-Consumer Installation and applies to all voltage levels.

2.4.1 Fittings at Point of Connection

All Fittings at the Point of Connection must meet the design principles contained in this Code and Vector's Design & Construction Standards. Any connection to the Vector Network will include a means of disconnection of the Embedded Network or End-Consumer Installation readily accessible by Vector.

2.4.2 Protection requirements

The User's Protection System must be compatible and co-ordinated with standard practices on the Vector Network, as specified by Vector. In particular:

(a) maximum clearance times must be within the limits established by Vector;

(b) equipment short circuit ratings must not be exceeded;

(c) Protection Systems for Generating Plant and capacitors must prevent unintended back-feeding of electricity into the Vector Network;

(d) in connecting to the Vector Network, the User should be aware that auto-reclosing or sequential switching features may be in use by Vector on the Vector Network. Vector will, on request, provide details of auto-reclosing or sequential switching features in order that the User may take this into account in the design of the Protection System;

(e) the User should be aware that the Protection Systems on the Vector Network may cause disconnection of one phase only of a three phase supply for certain types of fault and take the necessary steps to safeguard their User Equipment from the effect of the Event.

Vector's Design and Construction standards give some details of commonly used Fittings. Protection Systems discrimination between a User's Fittings and Vector's Fittings must be maintained at all times and evidence of satisfactory discrimination may be requested by Vector.

2.4.3 Earthing

Embedded Networks must be earthed in accordance with all relevant Regulations and Electrical Codes of Practice. Vector's earthing requirements are contained in the Earthing Standard (Vector's Design and Construction Standards documents ENS-0007).

2.4.4 Fault level consideration

The short circuit rating of a User's Fittings at the Point of Connection must not be less than the design fault level of the Vector Network (available from Vector on request).

2.4.5 Motor starting

Except where Vector agrees otherwise in writing, voltage fluctuation due to motor starting must comply with clause 2.2.1.3 of this Distribution Code.

2.4.6 Capacitive and inductive effects

Users must provide design details of capacitor banks, reactors and reactive loads connected at any voltage which could adversely affect the Vector Network to:

- verify that controlling equipment of the Vector Network is suitably rated; and
- show that the supply quality of the Vector Network will not be impaired.

2.4.7 Intermittent load

Unless otherwise agreed by Vector in writing, any voltage fluctuation, flickers and harmonic contents due to intermittent load or installations, such as arc furnaces, welders and cranes etc., must comply with the limits set out in clause 2.2.1.3 of this Distribution Code.

2.4.8 Telemetry and measurement equipment

Vector will specify any telemetry and measurement equipment required for monitoring an Embedded Network.

Embedded Generators must provide signals to Vector's and Transpower's Control Centres for the efficient management of Transpower's Network including response to grid emergencies in accordance with the Electricity Governance Rules.

2.5 REQUIREMENTS FOR EMBEDDED GENERATION

This section applies to all existing or prospective Embedded Generators. Vector recognises that some existing Embedded Generators may not presently comply with all requirements in this section, where appropriate Vector has made or will make arrangements with those Embedded Generators Subject to those arrangements, nothing limits the obligation of the Embedded Generator to comply with this Distribution Code within a time frame acceptable to Vector.

2.5.1 General requirements

Embedded Generators with Generating Plant connected to the Vector Network must comply with all relevant Regulations and Electrical Codes of Practice, the requirements specified in the Electricity Governance Rules and any Vector requirements as specified in Vector's Technical requirements for Connection of Distributed Generation (available from Vector's Website.

The presence of Embedded Generators shall not restrict Vector's switching operations on the Vector Network.

Metering Equipment installed at Embedded Networks and Generating Plants must comply with the requirements of the Electricity Governance Rules.

2.5.2 Information required

Before entering into an agreement to connect Generating Plant to the Vector Network (directly or via an Embedded Network), Embedded Generators must provide sufficient information to ensure successful interfacing with the Vector Network without affecting

other Users. The information requirements are listed in the procedure for "Distributed Generation (>10kW) Connecting to Vector's electricity network" as published on the Vector's Website.

Vector will, where applicable, use the information provided to model the Vector Network to decide the method and voltage level of the connection. Vector may require the Embedded Generator to meet the reasonable costs in doing so. The procedure for agreeing on the connection requirements and the cost for doing so are published on Vector' Website

The information will remain confidential between the parties until agreed otherwise. Vector reserves the right to release sufficient information relating to existing Embedded Generators and those for which a Connection Agreement has been approved for the purpose of meeting its obligations under the Electricity Governance Rules.

The System Operator may also require Embedded Generators to provide information in accordance with the Electricity Governance Rules.

2.5.3 Technical and performance requirements

Protection and control equipment for all Generating Plant connected to the Vector Network must:

- comply with Vector's Technical Requirements for Connection of Distributed Generation; and
- not interfere with the quality of supply to other Users of the Vector Network.

Generating Plant with a Design Rating 30 MW or more are subject to asset owner performance obligations and technical standards contained in Part C of the Electricity Governance Rules.

2.5.3.1 Metering Equipment

Any Metering Equipment must comply with the reconciliation requirements under the Electricity Governance Rules.

2.5.3.2 Contribution to frequency support

Generating Plant, when connected to the Vector Network (directly or via an Embedded Network), must remain connected and synchronised under the frequency range and for the duration prescribed in the asset owner performance obligations of the Electricity Governance Rules.

2.5.3.3 Voltage support

Generating Plant, when connected to the Vector Network (directly or via an Embedded Network), must remain connected and synchronised, and continue to operate in a manner that supports voltage and voltage stability on the grid in accordance with the asset owner performance obligations of the Electricity Governance Rules.

2.5.3.4 Protection

Each Embedded Generator must ensure the protection system on their Generating Plant is designed and constructed to the requirements as specified in the "Technical Requirements for Connection of Distributed Generators".

2.5.3.5 Islanding

An Embedded Generator with Generating Plant operating in islanded mode must not supply any part of the Vector Network beyond the Point of Connection, except when directed by Vector to do so under Transpower Network emergency recovery procedures (refer to section 5.2). If there are no facilities to resynchronise the islanded Generating Plant with the rest of the Vector Network at the Point of Connection, the Embedded Generator will, under Vector's instruction, ensure that the Generating Plant is disconnected for resynchronisation. An Embedded Generator must not, under any circumstances, re-energise parts of the Vector Network that have been disconnected from the rest of the Vector Network.

2.5.3.6 Synchronisation

Each Embedded Generator must install automatic synchronising facilities as specified in the "Technical Requirements for Connection of Distributed Generators."

2.5.3.7 Black Start capability

Each Embedded Generator must:

- notify Vector in writing if its Generating Plant is capable of Black Starts and provide Vector with the details of such facilities; and
- install synchronising facilities to allow the Generating Plant to be resynchronised and reconnected to the Vector Network after a Black Start.

2.5.4 Commissioning tests

Each Embedded Generator must provide Vector with copies of the test records for the Generating Plant, including protection and control equipment, prior to connection of the Generating Plant to the Vector Network. Vector may not connect Generating Plant to the Vector Network unless it is satisfied the relevant equipment meets the specified technical requirements.

2.6 PLANNING INFORMATION

This section sets out the planning information to be exchanged between Vector and each relevant User.

2.6.1 Requirements for Vector

Vector will on request provide all relevant Vector Network parameters reasonably required for planning to a User.

2.6.2 Requirements for Electricity Retailers and other Users

Users must provide to Vector sufficient planning data/information and safety management requirements as requested by Vector from time to time, to enable Vector to comply with technical and legislative requirements.

A User must give adequate notice of any significant changes to its User Equipment or operating regime to enable Vector to design and implement any required modifications to the Vector Network.

2.6.3 Reactive compensation plant

Each User must provide Vector with information on any reactive compensation plant connected to the Vector Network, other than at Low Voltage, including:

(a) the MVAr capacitive or inductive rating of the equipment and operating range if variable;
(b) details of any automatic control logic;
(c) impedance of the compensation plant with respect to harmonic frequencies from fundamental to 50^{th} harmonic and any other frequencies as requested by Vector; and
(d) the Point of Connection.

Where attenuation of load control or any other superimposed signals has occurred, or may occur, as a result of reactive compensation plant connected at Low Voltage, Vector may request, and the User will provide, the information in clauses (a) to (d) above.

2.6.4 Lumped Network Susceptance

Each User must, on request, provide Vector with details of the equivalent lumped network susceptance of its User Equipment provided the details are reasonably accessible.

2.6.5 Fault infeeds

Vector and each User will exchange information on potential fault infeed levels at the Point of Connection in the form of:

(a) the maximum and minimum 3 phase symmetrical and phase-earth short circuit infeed; and
(b) in the case of interconnected networks, adequate equivalent network information.

2.6.6 Demand transfer capability

Vector and each User will exchange information on demand transfer capability where the same demand may be supplied from alternative Points of Connection, including the proportion of demand normally fed from each Point of Connection and the arrangements for transfer under outage conditions.

3. DISTRIBUTION OPERATING CODE

This section 3 specifies:

- the requirements, criteria and procedures used by Vector in operating the Vector Network;
- operational matters affecting Users, including the provision of forecasts of likely demand, the planning of outages testing/monitoring, demand control, and the reporting of operational changes and Events.

Unless otherwise stated, this section 3 applies to all Users of the Vector Network.

3.1 DEMAND FORECASTS

3.1.1 Introduction

To operate the Vector Network efficiently, and to ensure maximum security and network stability, Vector needs to forecast:

- loadings on the Vector Network with sufficient accuracy and for a sufficiently long forward period to enable it to plan the development of the Vector Network; and
- demand for each busbar from which it takes supply, or proposes to take supply, from Transpower.

This section 3.1 applies to:

(a) Embedded Generators with Generating Plant over 1MW; and
(b) any User with demand over 1.5 MVA.

3.1.2 Information required

Users described in 3.1.1 must, on request, provide the following information to Vector:

- winter maximum demand
- summer maximum demand
- power factor at maximum demand
- total annual energy
- projected demand / energy usage over any period specified by Vector
- forecasts of additional load that will require additional transformer or cable capacity.

In addition, Embedded Generators must furnish such information as Vector may reasonably consider would affect its demand forecasts.

3.2 OUTAGE PLANNING

3.2.1 Introduction

To plan and coordinate its construction, maintenance and operational activities, Vector needs information from certain major Users on their planned outages of significant User Equipment which may affect the operation of the Vector Network, or require the commitment of resources. This section applies to the following Users:

(a) Embedded Generators with Generating Plant with a maximum Design Rating of greater than 1 MW; and

(b) High Voltage Users.

3.2.2 Outage planning procedures

3.2.2.1 Generating Plant

Embedded Generators must on request provide information relating to their Generating Plant to Vector (including scheduling information on the intended usage of the Generating Plant).

3.2.2.2 Planned outages

Users described in 3.2.1 must on request provide to Vector details and schedules of planned outages of their User Equipment which may materially affect the operation of the Vector Network.

3.3 TESTING AND MONITORING

3.3.1 Introduction

Vector reserves the right to test and/or monitor the Vector Network and to request certification from Users to ensure that Users are not operating outside the technical parameters required by this Distribution Code or the performance requirements of the Electricity Governance Rules.

3.3.2 Costs of tests

Vector may levy a charge on Users for carrying out tests on the Vector Network.

3.3.3 Testing & monitoring procedures

The testing and monitoring procedures relate to the quality of supply and the Power Factor parameters on the Vector Network.

3.3.3.1 Quality of supply

Vector may from time-to-time test and/or monitor the quality of supply, particularly harmonics level, at various points on the Vector Network (which may follow receipt of a complaint).

Where the test shows that a User is operating outside the technical parameters specified in Section 2 of this Distribution Code, or any relevant Regulations, the Electricity Governance Rules, Transpower's Connection Code or Electrical Codes of Practice, Vector will advise the User and the User will immediately, or within such time as may be agreed with Vector, remedy the situation or disconnect the User Equipment causing the problem. If the User does not remedy the situation, Vector may disconnect the User from the Vector Network.

3.3.3.2 Power factor

Vector may from time-to-time monitor the effect of the User's load on the Vector Network, particularly the amount of Active Power and Reactive Power transferred across the Point of Connection. Where the User is exporting or importing Active Power and Reactive Power in excess of the level specified in the Connection Agreement, Vector will advise the User of, and where appropriate demonstrate, the results of the monitoring.

Users must:

- apply to Vector in writing to increase the Active Power and/or Reactive Power at the Point of Connection above the connection capacity used to calculate the connection charge, or that technically allowed by the capacity of the Fittings;
- restrict power transfers to the connection capacity used to calculate the connection charge until Vector has agreed to amend the Connection Agreement and any physical changes have been completed.

3.4 DEMAND CONTROL

3.4.1 Introduction

This section sets out procedures to enable Vector to achieve a reduction in demand following a request from the System Operator, or when Vector otherwise is aware that a Transpower Network or Vector Network emergency is occurring or likely to occur, to avoid a collapse, breakdown or overload of any part of the Transpower Network or the Vector Network. The following methods of reducing demand are dealt with:

(a) voltage reduction;
(b) user demand management;
(c) user disconnection;
(d) automatic under-frequency disconnection;
(e) automatic under-voltage disconnection; and
(f) emergency manual disconnection.

3.4.2 Demand control procedures

Vector's implementation of demand control, which may result in disconnection of load may affect End-Consumers, and where applicable, contractual arrangements between Electricity Retailers and End-Consumers should reflect this.

3.4.2.1 Operational network load reduction (voltage reduction, User demand management, User disconnection)

Vector has developed procedures (which may be amended or replaced from time to time) to reduce load within the Vector Network in a controlled manner by reducing voltage and/or disconnecting End-Consumers or portions of End-Consumer loads.

The load reduction procedures may include a system to give notice to a User's Control Person (where practicable) that load reduction measures will be implemented beyond normal operational or economically based demand control measures.

3.4.2.2 Automatic Under Frequency or under voltage disconnection

The Electricity Governance Rules require Vector to allocate parts of the Vector Network to be disconnected from Transpower's Network during emergencies and contingencies. Vector will not be liable for any voltage related or low frequency disconnection operations initiated or required by the System Operator, even if such operations were made in consultation with Vector.

3.4.2.3 Emergency manual disconnections

Vector may (at the request of the System Operator or otherwise) arrange to have an emergency manual disconnection procedure available, based on Transpower points of supply or any other groupings Vector considers reasonable. The procedure will be designed to operate irrespective of network frequency or voltage contingencies. Vector will not be liable for any emergency manual disconnection operations initiated or required by the System Operator, even if such operations were made in consultation with Vector.

3.5 OPERATIONAL LIAISON

This section sets out the requirements for the exchange of information in relation to operations on the Vector Network, or any Embedded Network or Generating Plant connected directly to the Vector Network. It does not seek to deal with any actions arising from the exchange of information, but merely with that exchange.

3.5.1 Nomination of personnel

Vector and any User to whom this section of the Distribution Code applies will nominate personnel having the knowledge and experience required to operate the Vector Network and the Embedded Network/Generating Plant respectively and will agree communication channels to ensure the effectiveness of the exchange of information specified herein.

3.5.2 Notification of operations and Events

3.5.2.1 Requirement to notify

In the case of an operation or Event on the Embedded Network/Generating Plant which has an operational effect on the Vector Network, the User will notify Vector in writing in accordance with this Distribution Code.

3.5.2.2 Form of notification

Any notification under this section of the Distribution Code must be of sufficient detail to describe the operation or Event and must include the name of the individual reporting the operation or Event.

3.5.2.3 Timing of notification

Notification of a planned or anticipated operation will be given as far in advance as possible, and in any case must be given in sufficient time to reasonably allow the recipient to consider and assess the implications and risks arising. In all other cases, notification must be given as soon as practical following the operation or Event occurring.

3.6 FITTINGS NUMBERING AND NOMENCLATURE

3.6.1 New Fittings

When Vector or a User intends installing Fittings at a Point of Connection, the proposed numbering and/or nomenclature to be adopted for the Fittings must be notified to the other party. The notification will be made in writing to the relevant party and will consist of an operation diagram incorporating the proposed new Fittings to be installed, and its proposed numbering and/or nomenclature.

The notification will be made to the relevant party prior to the proposed installation of the Fittings with a view to obtaining such parties agreement to the proposed numbering and nomenclature. If the parties cannot agree, Vector, will have the right (acting reasonably) to determine the numbering and nomenclature to be applied at that site.

3.6.2 Existing Fittings

Vector and the User at each Point of Connection must:

- provide and erect clear unambiguous labels showing the numbering and nomenclature of their respective Fittings;
- supply each other, on request, with details of the numbering and nomenclature of their respective Fittings.

3.6.3 Changes to existing Fittings

Where Vector or a User needs or wishes to change the existing numbering or nomenclature of any of its Fittings at the Point of Connection, clause 3.6.1 applies but amended to reflect that only a change is being made.

Vector and the User must provide and erect clear unambiguous labels showing the numbering and nomenclature of its changed Fittings.

3.7 ACCESS TO EQUIPMENT

The User will allow Vector access to its site to operate, inspect, maintain, repair, install, replace or test Vector Fittings. Failure to provide access may result in disconnection of supply.

3.8 MAINTENANCE OF SUBSTATION ACCOMMODATIONS

Vector is responsible for maintaining the substation accommodation on public road reserve and End-Consumer Premises if such accommodation forms an integral part of the Fittings.

Each User is responsible for maintaining any substation accommodation on its premises if the substation accommodation is a standalone structure or a structure that forms an integral part of the User's buildings in a reasonable condition and carrying out any necessary repairs.

3.9 VEGETATION CONTROL

Subject to the Electricity (Hazards from Trees) Regulations 2003, Users must maintain any trees on their sites clear of Vector's Fittings.

3.10 ASSET MANAGEMENT PLAN

Each year Vector will prepare an Asset Management Plan setting out how Vector will manage and maintain the Vector Network to provide a safe and reliable supply to Users. The Asset Management Plan will be available on Vector's Website.

4. SAFETY COORDINATION

This section specifies the safety management criteria Vector will apply to meet the Safety Rules & General Safety Handbooks for the Electricity Industry, and other relevant Regulations and codes imposed on owners and operators of other distribution networks.

Users must provide similar criteria and standards of safety management when carrying out work or tests at the Point of Connection with the Vector Network.

4.1 OBJECTIVE

The objective is to specify the requirements with a view to ensuring safety of persons working on the Vector Network and/or any Embedded Network or End-Consumer Installation.

4.2 PROCEDURE

Vector and all Users must comply with this section of the Distribution Code.

4.2.1 Safety management systems

Vector will prepare an approved health and safety management system in accordance with the Health and Safety in Employment Act 1991, specifying the principles and procedures and documentation to ensure the health and safety of all persons working or testing on the Vector Network, or on User Equipment connected to it.

4.2.2 Principles

Vector and the relevant User will:

- adopt health and safety management procedures including provision for Control Persons who have the knowledge and experience to operate to the health and safety management procedures in use by field personnel where appropriate;
- maintain a system of documentation which records the agreed inter-system safety precautions taken when:
  - work or testing is to be carried out on high voltage plant and/or apparatus across the Point of Connection; and
  - isolation and/or earthing of the other's network is needed.
- where relevant exchange copies of the health and safety management procedures and related documentation, and if appropriate, for each working occasion.

4.2.3 Authorised personnel

The health and safety management procedures must include a procedure for written authorisation confirming the training, knowledge and experience of personnel concerned with the control, operation, work, or testing of User Equipment forming part of, or connected to, the Vector Network.

Each individual authorisation must indicate the class of operation and/or work permitted, and the section of the Vector Network to which the authorisation applies.

4.2.4 Environmental safety

Arrangements must be made by Vector and the relevant User to ensure site environmental safety and security, as required by statute. Where risks include contamination or similar, suitable decontamination facilities and procedures must be provided and used.

4.2.5 Operations Control

4.2.5.1 Control responsibilities

Vector and each User must:

- jointly agree and set down in writing schedules specifying the responsibilities for operations control of equipment at the Point of Connection to ensure that only one party is responsible for any item of Fittings at any one time; and
- at all times have a nominated Control Person.

4.2.5.2 Control documentation

Vector and each User must maintain a suitable set of documentation which records all relevant operations or Events that have taken place on the Vector Network or any Embedded Network or End-Consumer Installation, and the coordination of relevant safety precautions for work.

4.2.5.3 Network diagrams

Vector and each User will exchange and update diagrams (together with written documentation) illustrating sufficient and up to date information for Control Persons to carry out their duties

4.2.5.4 Communications

Vector and each User will establish:

- suitable communication links to ensure the control function is carried out in a safe and secure manner; and
- 24-hour availability of Control Persons where required by the User.

4.2.6 Responsibility

4.2.6.1 Ownership, operation and maintenance schedules

Vector's contract with each User will specify the responsibilities for ownership, operation and maintenance of Fittings.

4.2.6.2 Maintenance of schedules and diagrams

All schedules and diagrams shall be maintained by Vector and Users and exchanged as necessary to ensure they reflect the current agreements and network configuration.

5. CONTINGENCY PLANNING

This section of the Distribution Code specifies the requirements:

- for assisting the re-start or operation of the Transpower Network in abnormal situations which require co-ordination between the System Operator, Vector and Users, with a common approach to give uniformity of priorities;
- to be met during periods of declared civil emergencies.

5.1 EMERGENCY LOAD SHEDDING

Vector is required to make provision for automated emergency load shedding on under frequency or low voltage events, under the Electricity Governance Rules for connection to Transpower's Network. Emergency load shedding is undertaken from major substations and it is not possible to isolate individual Users from automatic or manual load shedding blocks. Therefore any User who has a critical load should make provision for its own standby generation.

5.2 NETWORK RECOVERY PROCEDURES

Where the Transpower Network experiences complete or partial shutdown (eg when a major fault has a cascading effect, when there has been a significant loss of generation, or when part of the Transpower Network experiences excessive Reactive Power deficit) Vector is required to:

- follow procedures agreed with or instructed by the System Operator;
- liaise with the System Operator when taking any action which may have an impact on Transpower's Network.

Where supply of electricity to the Vector Network has been completely lost, Vector will co-ordinate the start-up of any Embedded Generators with Generating Plant capable of Black Starts and notify the System Operator. Vector may establish stable "islands of supply" around particular Generating Plant where sufficient generating capacity will be available by configuring the Vector Network appropriately.

Vector will document the strategy it applies in the above circumstances.

5.3 CIVIL EMERGENCIES

Vector is required to carry out certain duties in a civil emergency in accordance with the Civil Defence Emergency Management Act 2002.

APPENDIX 1
MAIN SIGNALLING FREQUENCIES

The following signal frequencies are used on the Vector Network:

475 Hz
1050Hz
Other means of control also exist:
Pilot wires
Cyclo