

NETWORK CODE

Technical requirements for connections to Orion's
electricity distribution network

The logo for Orion, featuring the word "Orion" in a stylized, italicized, green font.

About Orion

Orion New Zealand Limited owns and operates the electricity distribution network in central Canterbury between the Waimakariri and Rakaia rivers, and from the Canterbury coast to Arthur's Pass. Our network covers 8,000 square kilometres of diverse geography, including Christchurch city, Banks Peninsula, farming communities and high country.

We transport electricity from Transpower grid exit points to more than 200,000 homes and businesses. Orion charges electricity retailers for this delivery service, and electricity retailers then on-charge homes and businesses. Retailers also charge customers for the cost of generating electricity plus a retail charge.

Orion's charges typically amount to about one third of a household's electricity bill.

Our shareholders are:

- Christchurch City Council 89.3%
- Selwyn District Council 10.7%.

Further information about Orion is available from our website – oriongroup.co.nz

Contents

1	General	5
1.1	Introduction	5
1.2	Scope	5
1.3	Status of this code	6
2	Getting connected	7
2.1	Introduction	7
2.2	Network connection point	7
2.3	Arranging a temporary connection	7
2.4	Arranging a permanent connection	7
2.5	Arranging for electrical reticulation in a new subdivision	8
2.6	Existing connections	8
2.7	Upgrading existing connections	8
2.8	Connection of distributed generation	8
3	Network design and construction	10
3.1	Introduction	10
3.2	Network extensions built for Orion	10
3.3	Connecting subdivisions to Orion's network	10
3.4	Design standards and technical specifications	10
3.5	Ownership of poles	10
4	Installations	11
4.1	Introduction	11
4.2	Access and easements	11
4.3	Electrical protection	11
4.4	Protecting sensitive equipment	12
4.5	Load management	12
4.6	Metering equipment	12
4.7	Interference to operation of Orion's network or other installations	13
4.8	Maintenance	14
4.9	Trees	14
4.10	Hazards	14
4.11	Changes in installation requirements	14
4.12	Capacitors and power factor of load	15
4.13	Orion owned substations on customer premises	15
4.14	Moving Orion's plant or equipment	15
4.15	High voltage installation owners	15
4.16	Final meter reading of existing premises	15

Contents

4.17	Reconnection of existing premises	15
4.18	Demolition of existing premises	15
4.19	Isolations / make safe	15
5	Service levels	16
5.1	Introduction	16
5.2	Security of supply	16
5.3	Reliability of supply	16
5.4	Supply quality	16
6	Network operation	20
6.1	Introduction	20
6.2	Customer service	
6.3	Liaison - customer, electricity retailer and Orion	20
6.4	Provision of information	20
6.5	Permits	21
6.6	Planned interruptions	21
6.7	Unplanned interruptions	21
6.8	Signalling via Orion's network	22
6.9	Emergency load shedding	22
6.10	Civil emergencies	22
7	Appendices	23
7.1	Definition of terms	23
7.2	Illustration of a network connection point	24
7.3	Safe distances from buildings to power lines	28
7.4	Electrical disturbance types	30
7.5	Ownership of poles	31

General

1

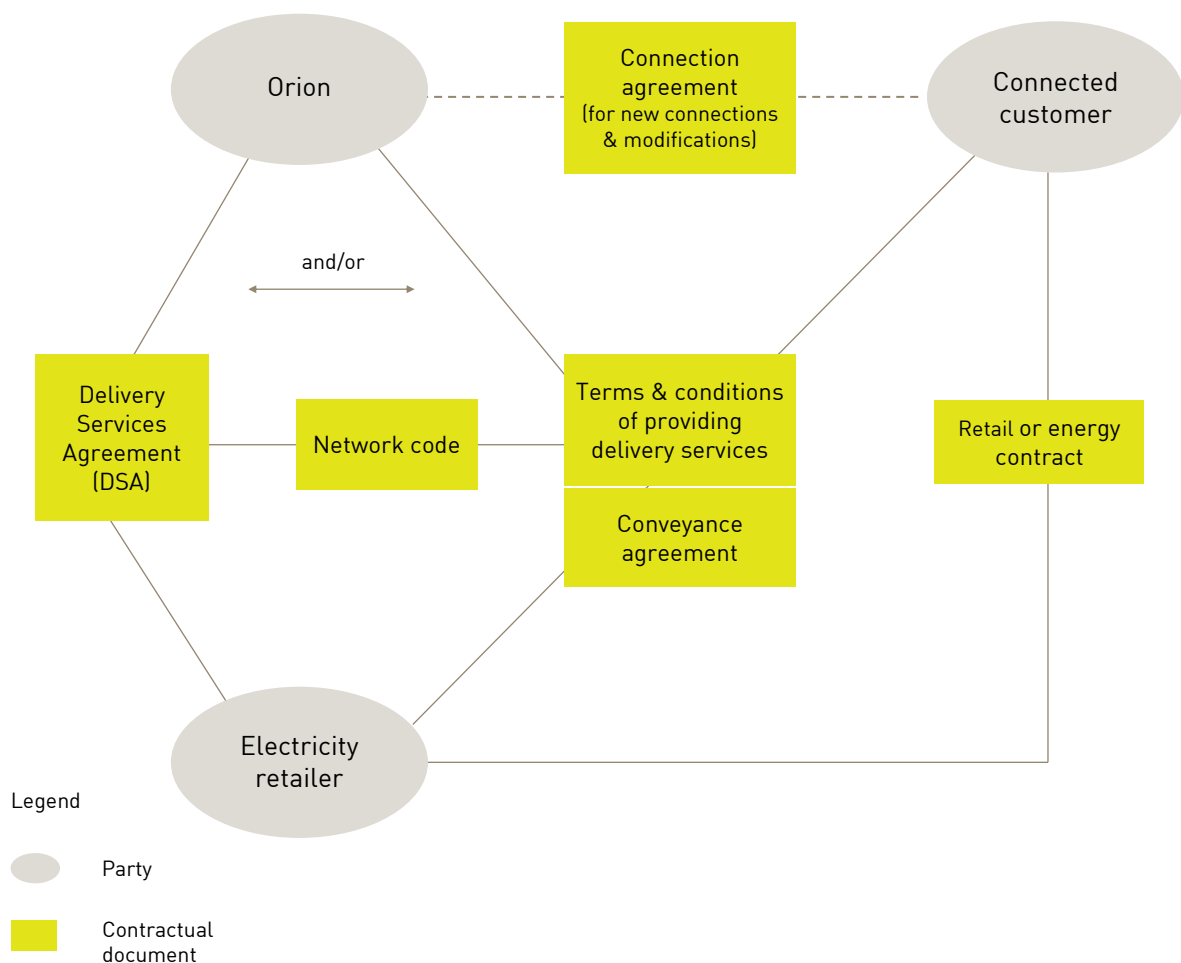
1.1 Introduction

This network code outlines technical requirements for connections to Orion's electricity distribution network. It is relevant to all stakeholders in Orion's business including electricity retailers, contractors, developers, connected customers, consultants and advisers.

Overall, this code outlines how we accommodate and manage electrical loads on our network. It starts by explaining the connection process, then covers the design and construction of our network and the customer's installation followed by service levels and network operation.

1.2 Scope

This diagram shows the context of this code in relation to parties and agreements:



This code is specifically referred to in the delivery services agreement (DSA) and the terms and conditions of providing delivery services.

While this code contains some specific details on technical matters including some helpful advice, it mostly serves as a guide to other documentation on standard practices, procedures and policy.

1.3 Status of this code

This code does not introduce any new commercial terms of our services. Such terms are detailed in the various agreements, particularly the delivery service agreement (DSA) and conveyance agreement (CA), in place between Orion and the relevant party.

This code substantially sets out our current standard procedures and practices, which may be modified or amended at our discretion, subject to Orion at all times meeting all necessary legislative and regulatory obligations. When this code is modified or updated, unless stated otherwise, any new requirements are effective from the date of issue, and apply to any new connections or other modifications from this date onwards.

Anyone intending to rely on the terms of this code and incur expenditure or otherwise materially alter their position should first check with us that it is appropriate to do so, in that person's individual circumstance.

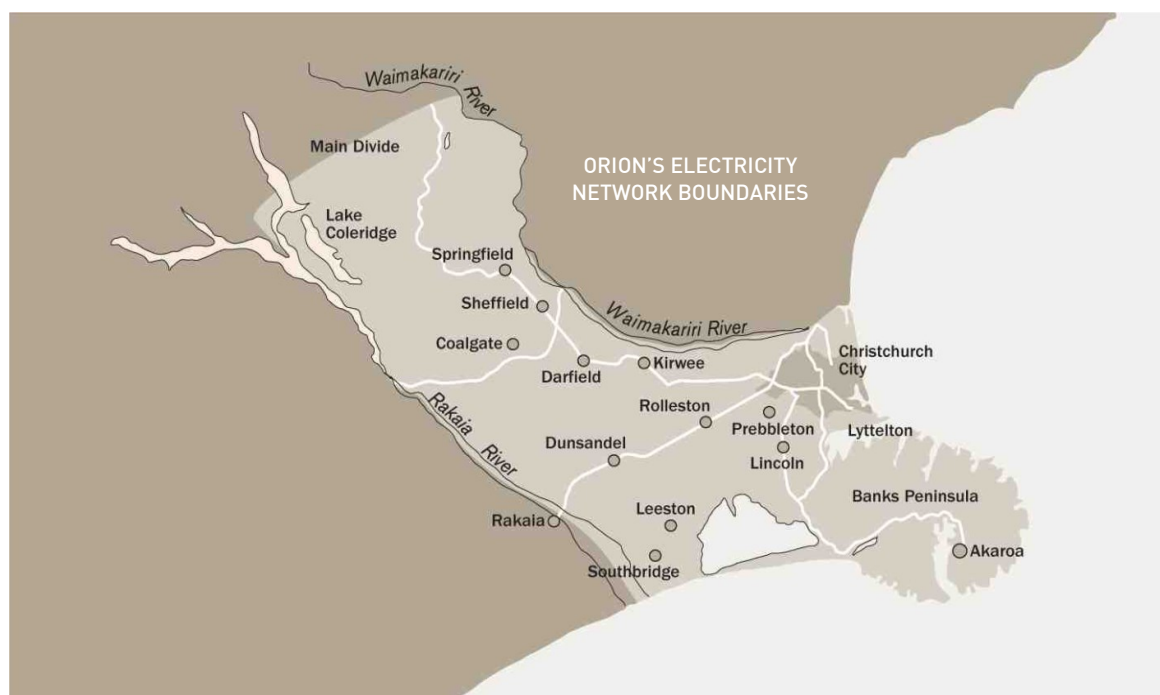
This code does not of itself create any legal obligations between Orion and any other party except to the extent that any other agreement such as a DSA or CA or agreement with a major customer in a particular context requires compliance by Orion, the electricity retailer or the major customer (as appropriate) with this code. Customers in their contracts with electricity retailers are also required to comply with certain provisions of this code. This is necessary for safety reasons and for the efficient operation of our network.

In the event of any conflict between this code and either the DSA, CA or agreement with a major customer in the context of the responsibilities of Orion, the electricity retailer or the major customer (as appropriate), the terms of the DSA, CA or agreement with a major customer shall prevail.

If you have any questions or suggestions in relation to this code you should contact:

Shane Watson
Network Asset Manager
Orion NZ Limited
PO Box 13896
Christchurch 8141

Phone +64 3 363 9624
Fax +64 3 363 9707



Getting connected

2

2.1 Introduction

Before connecting any new home or business to the electricity network, Orion must be satisfied that the connection can be made safely, without adversely affecting the delivery of electricity to other connected customers.

All new connections, increases in load beyond an existing agreement or increases to existing mains fuse/protection device are made at our discretion. There must be sufficient capacity and a suitable configuration available.

The steps in the connection process are set out in this document, covering the process for both temporary connections for construction purposes, and permanent connections.

Connection contractors, authorised by Orion, build and live the connections.

2.2 Network connection point

The network connection point (NCP) is the point where ownership of the electricity reticulation changes from Orion to the property owner. The NCP is usually near a property boundary (refer to Appendix 7.2 for typical arrangements). The property owner is responsible for providing the installation on the premises side of the NCP and Orion owns all equipment on the street side (i.e. upstream) of that point. The property owner may be required to contribute to the provision of equipment upstream of the NCP (refer to Orion's Connection and extension policy).

We record information relating to the NCP, but do not record details of the customer's installation.

2.3 Arranging a temporary connection

Orion can provide a temporary connection (TC) to supply power for builders who are building a new home or business premises. Application for a TC may be made through either Orion or your electricity retailer. We will arrange and live the TC, and invoice the applicant for all associated costs. A TC is available for a maximum period of six months after which a permanent connection is to be established.

For small capacity connections, such as a house, the TC is an un-metered, single phase supply with a maximum capacity of 60 Amps. A larger capacity TC will be metered and capacity restraints may apply.

The person requesting the TC must advise us when it is no longer required. The granting of a TC does not imply that the capacity required for the finished premises is available, or that a permanent connection has been approved.

2.4 Arranging a permanent connection

Before work to establish a new connection to our network can begin, we need to be satisfied that the network configuration at the location is suitable and sufficient capacity of electricity to supply the new connection is available.

If there is insufficient network capacity, then the quality of electricity supplied to the premises, and to others nearby, will be below the standard required by regulation. Our network will need to be upgraded to meet the standards, and the party seeking the new connection may be required to contribute either some or all of the cost of this work. Please note, a substation site may be required.

Before a permanent connection is constructed and lived we require the following information:

- an accurately completed and signed electricity connection application
- a separate signed connection contract (generally only required for non-residential applications)
- evidence of compliance with statutory electrical regulations and codes of practice (a certificate of compliance)
- evidence of an energy supply contract with an electricity retailer who has an agreement with Orion for delivery services
- for residential connections, a meter box as per the specification for domestic electric meter boxes - NZS 6206:1980.

Note: Wherever possible customers should design their installation to take advantage of ripple control (e.g. night rate water heating). This can result in significant savings in ongoing delivery charges. Utilisation of our network is improved by shifting load into the lighter load periods of a 24 hour day. Refer also to Orion's requirements for emergency load management in section 4.5.

Connection application forms are available from our Distribution Services staff or can be downloaded from our website. When filling in the application form the following information must be supplied:

- the name and contact details of the applicant
- the address of the connection
- the capacity required (e.g. 60, 100 Amps, irrigation pump size)
- the number of phases required (e.g. one, two or three)
- the land title description (e.g. fee simple or cross-leased)
- a description of what the connection will be used for e.g. residential, factory, irrigation
- an accurate sketch of the location helps us verify the connection in relation to our network and may reduce the time taken to process the application
- preferred location of the connection and distance from the connection to any landmarks
- any generation that may be connected.
- Once our requirements have been met and the application form processed, approval of the connection capacity will be confirmed in writing and Orion will assign an ICP number.

For larger or more complex new connections to the network, we will discuss any specific requirements with the applicant and an agreement, called a connection contract, will be established to formally record the required connection capacity and any other relevant legal requirements.

2.5 Arranging for electrical reticulation in a new subdivision

The initial application can be made using the standard connection application form. We will arrange for the appropriate person to discuss the proposal with the applicant.

2.6 Existing connections

If a new home or business premise is being built at a site where a connection is already established, the existing connection will have been subject to a specified maximum capacity. If the new activity at the site requires either an increase or significant decrease in specified capacity, a new connection agreement will be required.

2.7 Upgrading existing connections

If the load at an existing connection is to be significantly increased, an application must be made for the additional capacity needed. This ensures the extra load does not exceed the capacity available at the NCP. We also need to determine if our network has sufficient capacity to supply this additional load within the voltage levels required by regulation. This application may be made directly by the customer or through their electricity retailer.

2.8 Connection of distributed generation

If you intend to install distributed generation that is capable of exporting any excess energy from the generator into our network (even if this seems unlikely), you will need to involve us in the process as early as possible. Installing distributed generation is complex; each situation is different and needs to be discussed with us.

If your generation is to be used for localised purposes only and you have no requirements to export any excess energy into Orion's network, there should be limited issues and no commercial arrangements required.

The connection of distributed generation to an electricity network has a wide range of implications including safety, network performance, service quality, investment in the network, potential transmission benefits and commercial agreements. Safety equipment and procedures will need to be put in place to ensure safe interaction between any private network and Orion's network. For everyone's safety your generating system must meet all statutory and regulatory requirements and comply with all applicable safety standards.

Any agreement to connect distributed generation to our network may include costs associated with design and reinforcement of the existing network. If network reinforcement is required, the design and schedule for this project work will need to be factored into your installation planning. Projects may be constrained by network resources and restrictions.

Once you have finalised your installation design, we may require a design review before approving the connection of your system to our network. As with any new or altered connection, a copy of the Certification of compliance will be required before the installation is connected to Orion's network.

Large generators above 1000kW may be subject to Electricity Governance Rules. If this is the case we will facilitate responses to Transpower's requests. The generation owner will be responsible for providing any requested information to assist us in the process.

For further information about operating distributed generation and connecting it to our network, please refer to our distributed generation information pack. A copy of this pack can be obtained from the Orion office, or downloaded from our website: oriongroup.co.nz

Please also refer to the following further information about distributed generation on our website:

Your Network/Connecting to the network:

/Distributed generation

/Installation and connection of distributed generation

Publications & Disclosures/Pricing:

/Export and generation credits

/Application of export and generation credits

Other sources of information include:

Electrical codes of practice and AS/NZS 3000 – Electrical Installations (known as the Australian/New Zealand Wiring Rules)

Australian standard AS 4777 is a standard for connecting inverter-based systems, but is also a useful guideline to installing other forms of generation

Generators that export may wish to make arrangements with an electricity retailer for purchase of the energy. Information can be found at website m-co.com, the Electricity Commission's website (electricitycommission.govt.nz) or from your electricity retailer.

Network design and construction

3

3.1 Introduction

We use independent contractors to design and build extensions to our network and to connect new installations. All Orion-owned network extensions must comply with our design standards. Where the network extension is to be owned and operated by a party other than Orion, we require sufficient details to ensure the new network is electrically safe to be connected and will not impinge on existing customers.

3.2 Network extensions built for Orion

Where we require an extension to our network, we will first scope the work. It will then be tendered to design and/or design-build contractors. Before construction begins we will ensure the proposal meets the standard specified in our design standards. Once accepted, the proposed work is constructed to the standard specified within our technical specifications. Construction work is always audited to ensure it complies with our requirements.

Consistent work quality is ensured by the use of selective tendering from a predetermined list of competent contractors. We generally choose the "lowest price conforming" tender.

3.3 Connecting subdivisions to Orion's network

Whether new subdivision reticulation is to become part of Orion's network, or just be connected to it, close liaison is required with us during design and construction. This liaison ensures that adequate reinforcement occurs, if needed in that area of our network. In addition, if it is to become part of our network it must be constructed to meet our design standards.

3.4 Design standards and technical specifications

A general overview of connection requirements is included in our Design standard NW70.10.03 "Extensions and connections to the network".

Approved contractors also have access to our detailed network design standards and technical specifications. This includes contractors who have consultancy agreements or construction and maintenance contracts with us or those authorised to connect to our network.

The documents are all available on a restricted area of our website accessible to contractors with PIN access.

3.5 Ownership of poles

Orion and Chorus NZ Limited both own poles in public roadways and right-of-ways. These arrangements are described in Appendix 7.5.

Installations

4

4.1 Introduction

An “installation” is the electrical equipment on the customer premises, excluding appliances. The customer (landlord, or property owner, as appropriate) owns the installation and is responsible for providing and maintaining it. Electrically, there is free interaction and interdependence between events that occur within the customer's installation and our network. Consideration of the key aspects of design, construction, maintenance and operation of installations is required to ensure that both ours and the customer's needs are met.

4.2 Access and easements

Some parts of our network are located on private property.

Orion's right to have equipment located on private property may be covered in either an easement or lease agreement. If neither exists, legal rights are governed by sections 22 and 23 of the Electricity Act 1992 for network equipment installed on or prior to 1 January 1993.

The current practice for the installation of new Orion-owned network equipment on private property is for an easement to be established to protect the right to be installed, and agree in writing the ownership of any equipment and ongoing access for Orion to operate and maintain the equipment.

In general, we require access to private property on a limited basis for the future maintenance and operation of equipment. Where possible, contact will be made with the customer prior to entry on to the premises. However, in an emergency, access may be required at any time without prior customer contact. Arrangements are to be made to ensure 24 hour unobstructed access is maintained.

4.3 Electrical protection

Electrical protection is required to protect staff and equipment on both the customer's installation and premises, and Orion's network and equipment. Some parameters of protection operation are stipulated in the Electricity Regulations. To ensure correct operation of the equipment, our protection and the customer's protection must be compatible and correctly co-ordinated.

To facilitate compatibility and co-ordination with Orion's equipment, the customer's designer must take into account the effects any changes will have on the existing protection system and provide the necessary modifications to ensure that the integrity of the overall protection is maintained.

4.3.1 Safeguarding of Orion's network

Maximum clearance times must be within the limits established by Orion in accordance with protection settings and equipment short circuit ratings.

4.3.2 Safeguarding a customer's installation

The electricity supply to a customer's installation may be subject to multiple short interruptions caused by switching facilities that may be in use on our network. We will, on request, provide details of auto re-closing or automatic switching facilities, including protection arrangements, so the customer can take this into account during the design of their installation or our network.

4.3.3 Protection against damage

With certain types of fault protection arrangements on our network one phase of a three phase supply may disconnect. The customer should therefore ensure equipment such as three phase electric motors are adequately protected, as required by AS/NZS3000, from phase failure, earth faults, surges, overload and over/under voltage.

4.3.4 Discrimination in operating times

Adequate discrimination must be maintained between the operating times of any customer protection equipment and Orion equipment. We may request evidence of satisfactory discrimination.

4.3.5 Short circuit rating of customer fittings

The short circuit rating of customer fittings at the NCP should be not less than the design fault level of our network. Design fault levels are specified in our design standards and are available on request. This is now the responsibility of a qualified person such as an electrician to determine as required by AS/NZS3000.

4.3.6 Protection of distributed generators

For protection of distributed generators refer to section 2.8.

4.4 Protecting sensitive equipment

Modern electronically controlled appliances are much less tolerant of electrical spikes and surges than older appliances. Spikes and surges (also known as fluctuations) can be caused by home appliances switching on and off, a vehicle hitting a power pole or opossums/birds/trees touching power lines.

To reduce the impact of fluctuations on sensitive equipment we recommend that customers install appropriate surge protection devices as recommended by the equipment supplier.

Protection requirements for electrical installations are covered by AS/NZS3000.

4.5 Load management

Orion injects ripple signals for load control and other purposes. To enable loads to be switched, customers need to have controllers such as ripple receiver-relays installed. The relays need to respond to ripple signals with carrier frequencies of 175Hz or 317Hz, depending on the location in Orion's network area. Note that the requirements in this section 4.5 do not apply where Orion does not provide ripple signals such as in Orion's remote GXP areas of Arthurs Pass, Castle Hill and Coleridge. Specific detailed information is in our Technical specification NW70.26.01 "Technical details of Orion's ripple control system". This document is available on our website.

To take advantage of ripple control (e.g. night rate water-heating), customers with suitable controllable load should always design their installation to accommodate a controller, such as a ripple receiver-relay, allowing for 7 hours supply per day under fixed time control. This can result in significant savings in ongoing electricity charges from electricity retailers. Utilisation of our network is improved by shifting load into the lighter load periods of a 24 hour day.

All new connections from 1 April 2007, and all existing connections that already have ripple controlled water heating as at that date, must have or continue to have a controller or control system (satisfactory to Orion), such as a ripple receiver-relay, whenever a customer has "suitable controllable load". This requirement applies to both business and residential connections. Suitable controllable load means an electric water-heater of 100 to 500 litres storage capacity with a heating element of more than 1.2kW. The output from this controller must be connected to the controllable load to enable Orion to switch it off during emergencies that occur on its distribution network or on Transpower's grid. Three compliant arrangements are as follows:

1. The controller is installed as required by the retailer's "economy" or "controlled" pricing plan and is switched by Orion for both regular dynamic load control and for emergencies.
2. The controller is installed for fixed-time control of a night-only or an off-peak load usually associated with a day/night pricing plan. With this arrangement, Orion may switch the load off during an emergency, if it is otherwise switched on.
3. The controller is installed to enable Orion to switch off the controllable load only during emergencies. We provide a special ripple command for this purpose only. This arrangement applies in situations where customers require near-continuous water heating and control is not required for the retailer's pricing plan.

4.6 Metering equipment

Unless otherwise contracted, the quantity of electricity delivered through the NCP to the customer's premises will be measured by metering equipment installed according to the Electricity governance rules (EGRs).

In most cases, meters are owned, installed, operated and maintained by the electricity retailer, the customer or an agreed third party. Orion does not own the meters at a customers' premise.

Where we own high voltage switchgear dedicated to supply a specific customer, an agreement may be required for us to provide measuring transformers (voltage and current transformers) for metering purposes. This equipment must be designed and tested to comply with the connection capacity and the requirements of the EGRs.

For residential customer connections, a meter box as specified for domestic electric meter boxes – NZS 6206:1980, is required before connection can proceed.

4.7 Interference to operation of Orion's network or other installations

We endeavour to meet our obligation to provide a supply to customers at disclosed performance standards (refer to section 5.4). To enable us to meet these obligations, customers must not take any action or use any equipment that adversely affects the supply of electricity to another customer. Any changes required to the network to mitigate interference caused by a customer will be at their cost.

The starting and operation of certain electrical equipment (existing or proposed) may interfere with the quality of the electrical supply. This equipment can include, but is not limited to any of the following; electrical rotating equipment e.g. pumps, lathes etc. and all types of electrical control equipment e.g. starters, drives and inverters. Customers have two options available:

1. To accept a possible degradation in the electrical power quality as a result of the above; or
2. To arrange and pay to have a totally independent power supply installed for their own requirements.

Once individual requirements have been identified, the details will be recorded in the connection agreement.

Some common sources of power quality issues arising from customer operations include:

(a) MOTOR STARTING

Direct on line (DOL) motor starting causes many supply quality issues. Traditionally this has been an issue with industrial customers, but is becoming more prevalent in residential areas with the installation of spa pools and air conditioning/heat pumps.

The following should be used as a guide:

For three phase installations, any motor greater than 4kW (5hp) must NOT have DOL starting (unless approved by Orion).

For single phase installations, any motor greater than 1.5kW (2hp) must NOT have DOL starting (unless approved by Orion).

(b) WELDERS

Welding can interfere with the voltage to other customers, particularly where supply is from an overhead line. To minimise this effect welders exceeding 5kVA will be required to mitigate their impact on other customers. As a minimum, welders exceeding 5kVA input and up to 10kVA should have a power factor of not less than 0.8pf with a secondary voltage of 30V while operating at full load. Welders exceeding 10kVA input should have a power factor of not less than 0.8pf with a secondary voltage of 30V while operating at half full load.

If these basic requirements prove to be insufficient and still cause power quality issues, users may be requested to take further measures, e.g. have Orion provide a separate supply.

(c) UNBALANCED LOADS

Customers with two or three phase supplies are required to take all reasonable efforts to design and maintain their Installations to balance loads over the phases.

(d) SPECIFIC RULES FOR CONNECTION OF LARGE DISTORTING (NON LINEAR) LOADS (>20kW)

To minimise the effects of harmonic currents on our network and interference to customers' installations, Orion requires that customers notify us of the connection of all individual non-linear loads larger than 20kW.

Examples of large distorting loads are variable-speed-drives (VSD) used to control irrigation pumps and industrial plant and rectified loads.

Connection of these types of devices may contribute to increased network voltage distortion, causing damage to electrical equipment and other adverse affects for other customers.

Harmonic limits for connections up to 400 Amps (275kW)

Orion requires that all such connected loads or the sum of the individual loads (excluding any other linear loads within the installation) are fitted with suitable equipment e.g. low harmonic VSDs, passive or active filters which reduce the total harmonic distortion current (THDi) to <16% for Christchurch urban areas and <10% for rural areas at full load. This assumes the supply is from a 50Hz power supply with no more than 2% total harmonic distortion voltage (THDv) and <1.5% voltage out-of-balance before the harmonic load is applied.

Full load represents the maximum operational load level, and includes both duty and assist loads, but does not include standby loads where the standby load operates in place of a duty or assist load.

A general classification of Christchurch urban areas is high density developments designed for residential, commercial and industrial activities.

Harmonic Limits for Connections >275kW

For connections above 400 Amps Orion's procedures and limits require an individual assessment of harmonics and are specified in section 5.4.5 - Electrical disturbance quality of supply standards.

Orion requires that all such connected loads or the sum of these individual loads (excluding any other linear loads within the installation) are fitted with suitable correction equipment, for example passive or active filters, which reduces the THDi to less than the levels previously stated.

Equipment suppliers and customers should be aware that typical network operating conditions will include some existing voltage distortion and voltage imbalance between phases, and these will modify the effectiveness of harmonic filtering. Manufacturers generally specify harmonic filter performance under ideal network supply conditions, so in most cases a filter specified for a THDi less than the limit is required to be installed to obtain the required 10% THDi at the THDv and voltage out of balance values specified above. It is strongly recommended that the installation be modelled using software provided by the drive and/or filter supplier, to confirm that it will comply with these requirements.

Suppliers and customers should also be aware that Orion uses audio ripple injection at 175Hz and 317Hz for load control and customer signalling and that harmonic filter equipment must be designed not to absorb or interfere with these signals.

4.8 Maintenance

We will carry out all repairs and replacements of equipment such as lines, poles and cables necessary for the supply of electricity between the NCP and the point of entry into the customer's premise. This service covers fair wear and tear, including storm damage, but does not cover damage caused by the customer or any third party. It does not cover maintenance of trees or shrubs (refer section 4.9).

This maintenance service does not include any upgrade or enhancement to the customer's supply. Any work requiring an upgrade or enhancement is subject to agreement between Orion and the customer who may have to meet any additional costs. Customers should notify us as soon as possible regarding any lines, poles or cables on their property which appear to be in an unsafe condition.

4.9 Trees

We require customers to ensure that trees and vegetation on their premises are trimmed or in accordance with the Electricity (Hazards from trees) Regulations 2003 to prevent interference with the electricity supply. The customer is liable to Orion for all network damage caused by trees and vegetation that are on the customer's property.

If we reasonably form the opinion that vegetation on a property is either interfering or likely to interfere with our network, we will request (by issuing a cut notice) that the customer remove the threat or potential threat. If the work is not completed within the specified time on the notice, Orion may undertake the required work at the customer's cost.

For information about trees near power lines and your responsibilities see our website.

4.10 Hazards

Members of the public or customers who discover any hazards or dangerous situations on or around our network, should ring their electricity retailer or Orion immediately. Working and playing around electricity is dangerous. There are a number of basic safety rules that should be applied:

- keep at least four metres away from any lines, as people or equipment do not actually need to touch power lines to suffer damage as high voltage electricity can "arc" over
- treat every electric wire as a "hot" or live wire
- always check for buried power cables before digging.

There are numerous underground cables, both in the street and on private property. Orion has free maps available to help people locate Orion's cables. Refer Orion Appendix 7.3 "Build safely and avoid the risk of electrocution"

4.11 Changes in installation requirements

Where a connected customer has a significant change requiring additional capacity, they must contact us and provide adequate information to enable an assessment of the loading increase to be carried out on the network (refer section 2.7).

Customers should have an assessment carried out (usually by an electrical contractor) on the adequacy of their own installation and service mains before adding significant extra load.

Where a customer requires specific enhanced supply arrangements, these must be identified and negotiated within a specific connection agreement with Orion.

4.12 Capacitors and power factor of load

The average power factor of a connected customer's load, measured at the NCP as the ratio of kWh to kVAh consumed during any 30 minute period, shall not be less than 0.95 lagging at any time.

In the case of irrigation pump motors, power factor correction is only required where the nameplate rating of the pump motor exceeds 20kW. Power factor correction shall be installed to achieve power factors of at least 0.98 for submersible pumps and at least 0.96 for surface pumps. This requirement is to ensure additional loading on our network resulting from reactive energy load flows during times of peak loading is minimal.

Power factor correction capacitors may interfere with ripple control signals and/or cause harmonic resonance problems. Customers must operate such equipment connected to their installations so that it does not interfere with the electricity network or the operation of our ripple control system.

4.13 Orion owned substations on customer premises

We shall repair and maintain self-contained buildings that we own.

Where the substation building is the property of the customer, they are required to maintain it in a condition acceptable to Orion to ensure the protection and safety of personnel and equipment. The customer must co-ordinate with us for access to carry out any maintenance.

For more details refer to our Design Standard NW70.53.02 "Substations on customer premises".

4.14 Moving Orion's plant or equipment

Customers wishing to move any Orion plant from its existing position must contact us at the planning stage. Most plant can be moved, provided sufficient advance notice is given and all our requirements are met. Customers will be responsible for all costs associated with moving Orion plant.

4.15 High voltage installation owners

High voltage installation owners are required to co-ordinate with us in the connection, operation and modification of their installation. Significant disruption to our network may be caused if operation of the installation and any installation changes are not properly co-ordinated. Owners of HV electrical installations are also required to comply with the provisions of AS/NZS3000. Orion's operating standard NW20.10.01 details the requirements and is available on request.

4.16 Final meter reading of existing premises

Customers must contact their electricity retailer to arrange a final meter reading at their premises.

4.17 Reconnection of existing premises

Customers must contact an electricity retailer to arrange for reconnection of their premises.

4.18 Demolition of existing premises

Orion disconnects and isolates installations that are to be demolished or relocated. Retailers must also be involved to ensure that meters are removed and accounts are finalised. Either the customer or their retailer must contact Orion to arrange for a permanent disconnection. Practices for this process vary between retailers and customers may contact Orion in the first instance. Information about this is available from Orion's website or contact centre.

Where Orion is requested by the Fire Service to attend a fire where the building or the point of entry for electrical supply is well ablaze, Orion will disconnect and physically isolate the installation from its network.

4.19 Isolations/make safe

Orion has arranged to provide services to allow customers and/or contractors to work safely near its low voltage lines to carry out work of the following nature:

- replace or paint the barge board on a house where the wires from the street are attached
- replace or paint the spouting on a house where the wires from the street are close
- trim trees near power lines.

A list of contractors able to carry out these services is available by contacting our call centre.

Service levels

5

5.1 Introduction

Our targeted delivery service levels are formally described in our following documents:

- Statement of Intent
- DSAs and conveyance agreements
- Asset management plan (AMP)

The resulting delivery service performance is published in our following documents:

- Orion's Annual report
- Orion's asset management plan (AMP)
- Orion's network quality report
- Orion's disclosures, pursuant to the Electricity (Information Disclosure) Requirements 2004.

Copies of all of the above documents are available on request and on our website (www.oriongroup.co.nz).

The service level topics covered in these documents include:

- security of supply
- reliability of supply
- voltage level
- harmonic content
- number of voltage complaints
- response to enquiries
- unplanned interruptions to delivery (i.e. faults)
- response to fault calls
- restoration of electricity delivery
- notice of planned interruptions to delivery (i.e. shutdowns)
- new connections to our network
- load factor
- loss ratio
- capacity utilisation.

5.2 Security of supply

We design our network to meet the security standards as described in our AMP.

5.3 Reliability of supply

5.3.1 Continuous delivery

We will use reasonable endeavours to provide continuous delivery, but do not guarantee the network will deliver free from defects or interruption.

5.3.2 Period of interruption

We will use reasonable endeavours to minimise the duration of any interruption.

5.4 Supply quality

We operate our network in compliance with the Electricity Regulations Compilation 2003, which sets the following quality standards:

5.4.1 Voltage standards

These are governed by Electricity Regulations Compilation 2003, Clause 53, which states:

1. The supply of electricity to electrical installations operating at a voltage of 200 volts AC or more, but not exceeding 250 volts AC (calculated at the point of supply):
 - (a) must be at standard low voltage – refer section 2 Interpretation and,
 - (b) except for momentary fluctuations, must be kept within 6% of that voltage (216.2 volts to 243.8 volts)."

Note: For Orion's network, standard Low Voltage is 230 volts AC between phase and neutral.
2. The supply of electricity to electrical installations operating at other than standard low voltage (calculated at the point of supply):
 - (a) must be at a voltage agreed between the electricity retailer and the customer, and,
 - (b) unless otherwise agreed between the electricity retailer and the customer, and except for momentary fluctuations, must be maintained within 5% of the agreed supply voltage."

5.4.2 Frequency standards

These are governed by Electricity Regulations Compilation 2003, Clause 55, which states:

1. The frequency of electricity supplied by any person must be maintained within 1.5% of 50Hz, except for momentary fluctuations.
2. The requirement in subclause (1) may be varied for electrical installations operating at other than standard low voltage, if the electricity supplier and the person receiving the supply agree."

5.4.3 Electrical interference standards

These are governed by Electricity Regulations Compilation 2003, Clause 56, which states:

1. No person may use or continue to use any fittings or electrical appliance that unduly interferes with the satisfactory supply of electricity to any other person, or that impairs the safety of, or unduly interferes with the operation of, any fittings or electrical appliance.
2. Compliance with ECP36 is deemed to be compliance with subclause (1) in respect of harmonics interference.

5.4.4 Change in supply characteristic standards

These are governed by Electricity Regulations Compilation 2003, Clause 57, which states:

1. No person supplying electricity or line function services may alter the electrical characteristics of the supply system in a way that may cause danger to people or property.
2. Every person supplying electricity or line function services must take reasonable steps to ensure that the maximum prospective fault currents on the supply system are limited to reasonable levels."

5.4.5 Electrical disturbance quality of supply standards

Orion will use reasonable endeavours to ensure that flicker, voltage sags, voltage surges, spikes and electrical noise, harmonics, inter-harmonics and other disturbances are controlled within the network to avoid disturbance to customers' equipment.

5.4.5.1 Ability of customers' equipment to accept network disturbances

Some level of disturbance is expected as part of the normal operation of the electricity network. IEC/AS/NZS Standard 61000-2-2, 'Compatibility Levels for Low Frequency Conducted Disturbances and Signalling in Public Low Voltage Power Supply Systems', specifies acceptable levels of disturbance which should not unduly affect customers' equipment. Orion expects that customers will use equipment that complies with the compatibility levels specified in the above standard.

Although this standard discusses voltage dips and short interruptions, and transient overvoltage, it does not specify compatibility levels.

5.4.5.1.1 Voltage dips/sags and short interruptions

Voltage dips and short interruptions are discussed in detail in IEC61000-2-8, 'Environment – Voltage dips and short interruptions on public electric power supply systems with statistical measurement results'. This standard details the expected type and frequency of these network events and discusses the basic incompatibility between the characteristics of voltage sags and short interruptions caused by power system faults, (defined by the requirements of power system protection clearance times) and the corresponding standard equipment immunity levels.

Customers should be aware that faults can occur across Orion's entire network, causing voltage dips/sags or short interruptions that may damage customers' equipment. Faults occur more frequently in rural areas where the network is mostly overhead.

If customers need their equipment to continue to operate during and after these network events, one of the following actions is required:

- the installation of a commercially available device such as uninterruptible power supply (UPS)
- equipment will need to be specified as able to continue to operate during such events.

5.4.5.1.2 Transient over-voltages

Transient over-voltages or surges are short duration increases in the supply voltage caused by events such as lightning, network faults or switching.

Orion designs and operates its distribution network to minimise transient overvoltages but there may still be occasions when the voltage increase during an event is large enough to cause customers' equipment to malfunction or even sustain damage. The most common event which may result in damage to customers' equipment is a lightning strike nearby. Equipment could also be damaged due to other events such as third party interference on the network where, for instance, high voltage lines are dropped into low voltage lines supplying customers' premises.

Equipment manufacturers attempt to design their equipment as a trade-off between high immunity and thus higher cost, versus lower immunity at a lower cost. IEC Standard 60664, 'Insulation coordination for equipment within low-voltage systems' provides guidance to manufacturers on acceptable levels of insulation and thus immunity to transient over-voltages. Orion expects that customers will use equipment that complies with the insulation levels specified in the above standard.

5.4.5.2 Emission limits for customers' connected equipment

Orion has some control over disturbances which are caused by the normal operation of the electricity network, however many disturbances are caused by customers' own equipment and thus part of the responsibility for controlling the quality of supply on the electrical network rests with customers themselves. We require that customers' equipment comply, where appropriate, with the following standards:

AS/NZS61000.3.2 - Limits for Harmonic Current Emissions (Equipment Input \leq 16A per Phase)

AS/NZS61000.3.3 - Limitation of Voltage Changes, Voltage Fluctuations and Flicker in Public Low Voltage Supply Systems (Equipment Input \leq 16A phase and not Subject To Conditional Connection)

The preceding two standards generally specify the required performance of standard customer electrical devices in terms of the potential for the equipment to produce disturbances on the electrical network, which could affect other customers. Both standards assume a standard short circuit ratio at the point of common coupling.

AS/NZS61000.3.4 - Limitation of Emission of Harmonic Currents in Low Voltage Power Supply Systems for Re-equipment with Rated Current Greater than 16A.

AS/NZS61000.3.5 - Limitation of Voltage Changes and Flicker in Low Voltage Supply Systems (Equipment Input $>$ 16A per phase).

The preceding two standards specify the required performance of larger electrical devices, which because of their size have a very much increased probability of causing significant disturbances on the electrical network. Both standards specify allowable emission values dependant on the actual short circuit ratio at the point of common coupling.

AS/NZS61000.3.6 - Assessment of Emission Limits for Distorting Loads in MV and HV Power Systems - Basic EMC Publications.

AS/NZS61000.3.7 - Assessment of Emission Limits for Fluctuating Loads in MV and HV Power Systems - Basic EMC Publications.

The preceding two standards specify the required performance of much larger loads connected to the high voltage network.

AS/NZS61000.3.11 - Limitation of Voltage Changes, Voltage Fluctuations and Flicker in Public Low Voltage Supply Systems (Equipment Input \leq 75A per phase and Subject to Conditional Connection).

This standard is applicable to equipment which does not comply with the requirements of AS/NZS61000.3.3 because it would require a source impedance lower than the standard reference impedance and thus is subject to conditional connection.

In addition customers are required to meet the standards set out in the Electricity (Safety) Regulations 2010 - Part 3 Clause 31 (r32) which states:

1. In order to preserve the quality of electricity supplied, the use of fittings and appliances must not unduly interfere with the satisfactory supply of electricity to any other person, or impair the safety, or interfere with the operation, of any other fittings or appliances.
2. In relation to interference from harmonics, compliance with whichever of the following standards is applicable is deemed to be compliance with subclause (1):
 - a) ECP 36: New Zealand Electrical Code of Practice for Harmonic Levels
 - b) IEC 61000-3-2: Limits - Limits for harmonic current emissions (equipment input current less than or equal to 16A per phase)
 - c) IEC/TS 61000-3-4: Limits - Limitation of emission of harmonic currents in low voltage power supply systems for equipment with rated current greater than 75A
 - d) IEC 61000-3-12: Limits - Limits for harmonic currents produced by equipment connected to public low voltage systems with input current >16a and <75A per phase.

Orion also believes that the following standard will be included in the future: AS/NZS 61000-3-6: Limits - Assessments of emission limits for distorting loads in MV and HV power systems.

Network operation

6

6.1 Introduction

We operate our network in a professional and prudent manner, within our agreements for delivery services, the Electricity Regulations and good industry practice.

6.2 Customer service

Information for dealing with the following situations can be found on our website (oriongroup.co.nz) or by contacting our contact centre:

- demolition of premises reticulated at low voltage (refer to Part 4.18)
- cat up an Orion pole
- relocation, isolation or disconnection of overhead mains to allow building maintenance or tree trimming (refer to Part 4.19).

6.3 Liaison between connected customer, electricity retailer and Orion

The block diagram in section 1.2 illustrates the contractual arrangements between parties. An interposed contractual arrangement applies where we provide our delivery service to the electricity retailer who then on-sells it to the connected customer. The exception to this is where we contract to provide a delivery service directly to a few major customers. This does not mean, however, that we have no interaction with the connected customer.

On many day-to-day matters, we will accept requests from either connected customers or electricity retailers. Orion has a 24 hour contact centre which receives telephone calls and keeps all parties informed via our website, fax or email with respect to power cuts and planned shutdowns. In particular, the contact centre welcomes enquiries regarding:

- faults (e.g. no power, flickering lights)
- individual requests for isolation (e.g. for painting near overhead mains)
- any issues of safety, such as items caught in lines, exposed terminals, or a substation door open.

Orion is directly involved in arranging new or temporary connections. Refer to section 2.

In most cases electricity retailers manage the liaison with us on behalf of connected customers. Electricity retailers are responsible for reconnections/disconnections, as required. We will undertake these only in certain exceptional circumstances, such as where there is danger to life or equipment, or as otherwise authorised pursuant to Section 62 of the Electricity Act (e.g., failure of electricity retailer to pay line charges).

6.4 Provision of information

6.4.1 Records

We retain engineering information about our network that is made available to authorised contractors on request.

6.4.2 Plant Location

Contractors or anyone else wanting to work where underground services are likely to be located, must apply to our Mapping Centre to obtain record maps.

Where 66kV and/or 33kV sub-transmission cable are involved, we will mark out the cables and oversee the work to ensure safety.

6.4.3 As-built records

Contractors installing a new network are required to provide as-built records to our standards through our contract manager.

6.5 Permits

6.5.1 Approval for high load

Persons who wish to transport "high loads" (high loads come within the scope of LTNZ rules) through our network area, are required to apply for approval via our website oriongroup.co.nz.

6.5.2 Application to work near conductors

Persons who operate mobile equipment within four metres of our overhead network are required to apply to Orion for a 'close approach permit' via our website oriongroup.co.nz.

6.5.3 Excavations

Persons who construct or excavate:

- where there is a likelihood of underground services being encountered, must comply with the "OSH Guide for safety with underground services".
- near overhead electric line supports, need to comply with ECP34.
- within an Orion easement, must obtain our prior permission.

6.6 Planned interruptions

Orion may interrupt or reduce the delivery to any NCP either totally or partially for any period as necessary, to test, add to, alter, repair, replace or maintain electrical lines, cables, machinery, equipment or any other apparatus including structures and supports.

Supply may also be interrupted or reduced for any other purpose, as listed in the DSA clause 6.1. Subject to clause 6.5.1 in the event of an interruption to or reduction of delivery,

Orion shall:

- (a) If reasonably practical seek agreement with the customer on the timing of the interruption to or reduction of delivery, with a view to minimising the disturbance to the customer.
- (b) Use all reasonable endeavours to notify the customer in advance of its intentions to interrupt or reduce the delivery. Notice may be by advertising in local newspapers, radio announcements, letterbox drop, phone, fax, or email.
- (c) Use all reasonable endeavours to minimise the period of interruption or reduction to delivery.
- (d) Under certain circumstances Orion may at its discretion provide a stand-by generator, ref. NW.20.01.01.

6.6.1 Immediate danger

Notwithstanding the above, if Orion believes there is immediate danger to any people, electrical lines, cables, machinery, equipment or other plant or property, we may, without notice to the customer, immediately interrupt or reduce delivery either totally or partially for any period we deem is necessary to remove the danger.

6.7 Unplanned interruptions

From time to time, events outside our control cause a loss of electricity supply. Orion recognises that electricity is an important service and will use all reasonable endeavours to restore the supply to customers. However, when conditions are dangerous for workers (e.g. storms, high winds, lightning, floods and earthquakes) restoration may take longer than usual.

To ensure supply is restored in the most efficient and beneficial manner, we observe the following restoration priorities:

1. Removal of any life threatening situations.
2. Restoration of supply to essential services, specifically:
 - regional communication infrastructure
 - hospitals
 - emergency services (ambulance, fire, police)
 - sewerage
 - water supplies.
3. Restoration of supply to major customers, farms, residential customers.

Note: To ensure we can achieve the above, restoration would normally occur in this order with emphasis on faults affecting customers on the:

- 66kV network
- 33kV network
- 11kV network
- 400V network

6.8 Signalling via Orion's network

6.8.1 Existing ripple injection

We operate ripple injection plants for load control and other purposes. The ripple carrier frequencies are 175Hz and 317Hz. To ensure the correct operation of the mains signalling equipment, customers must design and operate equipment connected to their installations so that they do not interfere with the operation of the ripple control system. Appliances, apparatus and systems that interfere with the operation of any of our signalling systems may not be used.

6.7.2 Additional superimposed signals

Connected customers must not superimpose signals on Orion's network without our prior written agreement, which may be withheld at our discretion. Any equipment that uses the mains for communication must comply with IEC61000-3-8.

6.8.3 No representation

We do not provide a representation for the performance of our network if customers use installations to convey signals. In addition, Orion does not provide any representation regarding the signalling properties of our network or the networks suitability if customers use installations to convey signals.

6.9 Emergency load shedding

For the safe operation of our network, we must make provision for emergency load shedding during an abrupt reduction in frequency. This is undertaken from our major substations and it is not possible to isolate individual connected customers from any load shedding block. In circumstances where connected customers have critical loads, they should make provision for their own stand-by generation.

6.10 Civil emergencies

We have an obligation to carry out certain civil emergency duties in relation to our network. In such emergency situations the actions of Orion and all parties connected either directly or indirectly to our network will be governed by the procedures laid down in the relevant portions of the Civil Defence Emergency Management Act - 2002.

In such circumstances Orion may be directed as to the priority for restoration of supply to customers or groups of customers.

Appendices

7

7.1 Definitions of terms

In this Network Code:

- (a) Any 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) Any reference to a statute, statutory instrument, regulation or order will be construed as a reference to such statute, statutory instrument, regulation or order as amended or re-enacted from time to time.
- (c) A reference to a published standard or code of practice will be construed as a reference to such standard or code of practice as amended or substituted from time to time.
- (d) Any reference to the electricity retailer, distributor or connected customer includes, where context permits, the agents or employees of the same.

The following terms shall have the following meanings unless the context otherwise requires:

Act: the Electricity Act 1992.

AMP: Asset management plan, a 10 year management plan for Orion's network.

Connected customer: a purchaser of electricity (from an electricity retailer) that is delivered over Orion's network.

Connection agreement: an agreement between the distributor and another party for establishing a connection or modification of an existing connection.

Connection or connected customer's network connection point (NCP): means each point of connection at which a supply of electricity may flow between our network and the connected customer's installation, as defined by Orion.

Delivery: the transportation of electrical energy at 50Hz to the connected customer via Orion's network and the transmission network.

Delivery services: the provision of line function services.

DSA: a Delivery Services Agreement for delivery between Orion and an electricity retailer.

Design Standard: a document issued by Orion that specifies our standard design for an aspect of our network.

Distribution network : or network, Orion's system for the conveyance of electricity including all fittings comprising that system and which terminates at the connected customer's NCP.

ECP: an Electrical code of practice issued pursuant to the Act.

EGRs: Electricity governance rules, administered by the Electricity Commission for the purpose of assigning electricity purchased by electricity retailers.

Electricity retailer: is the person selling or intending to sell electricity to the connected customer.

Emergency: in general, an emergency is a situation where there is an unforeseen severe shortage of capacity including:

Emergency maintenance: which is work of an urgent nature that must be performed immediately because of the interruption to the supply of power that has occurred or the impending loss of supply, significant damage to assets or risk to the safety of the public.

Grid emergency: as notified by the System Operator and as defined in the EGRs. This can relate to a problem with transmission or generation.

Fittings: are everything used or designed or intended for use, in or in connection with the conversion, transformation, conveyance or use of electricity.

HV: high voltage, means a voltage above 1,000 volts, generally 11,000 volts, for supply to connected customers.

ICP: an Installation Control Point is the nominated point at which the retailer will be deemed to have supplied electricity to a customer, and having the attributes defined in Schedule E2 of the EGRs.

Installation or connected customer's installation: means any fittings owned or used by a connected customer (except Orion's equipment) and that form part of a system for conveying electricity from the connected customer's NCP to where the electricity may be consumed.

Line function services: is as defined in the Act and means the provision and maintenance of fittings for the conveyance of electricity and the operation of such fittings, including the control of voltage and responsibility for losses.

kV: kilovolt, means one thousand volts.

LV: low voltage, means a voltage of value up to 1,000 volts, generally 230 or 400 volts for supply to connected customers.

Major customer: the person purchasing the delivery service from Orion at a major customer connection.

Major customer connection: means a connection to Orion's network where this classification is agreed to by Orion that generally does not require or share the use of the low voltage network for delivery of electricity.

NCP: a network connection point is the ownership boundary between Orion's network and the connected customer's installation.

Operating standard: is a document issued by Orion that specifies our standard procedure for operating a part of our network.

Premises or connected customer's premises: means the land and buildings owned or occupied by a connected customer, and any land over which the connected customer has an easement or right to pass electricity.

Temporary connection: is an interim connection for use by a builder or property developer until a permanent connection is established.

Terms and conditions of providing delivery services to major customers: means the agreement for delivery between Orion and a major customer.

Technical specification: is an Orion document that specifies technical requirements for plant that is to be connected to our network.

7.2 Illustration of a network connection point (NCP)

Common examples of an NCP are shown in the following:

Connection practices have changed over the years and these have to be accommodated in order to establish a NCP for all premises. Hence the illustrations are grouped under "present practice" and "historical practice".

The key features of an NCP are:

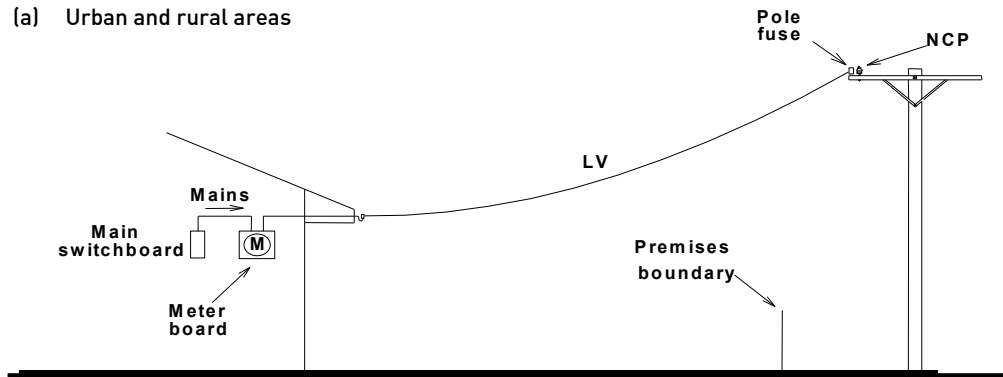
- generally it is the point where ownership of equipment changes between the customer and Orion
- an accessible device is available, provided by Orion, to disconnect the premises from our network
- all equipment "upstream" of the NCP, is integral to the operation of our network
- an NCP is located such that no private cable is located in the street. The only exception is when a customer's installation cables or lines cross their premise's boundary onto a public road without a physical disconnection facility. The local road control authority requires that Orion take ownership responsibility for the portion of line or cable in the public road.

7.2.1 Present practice

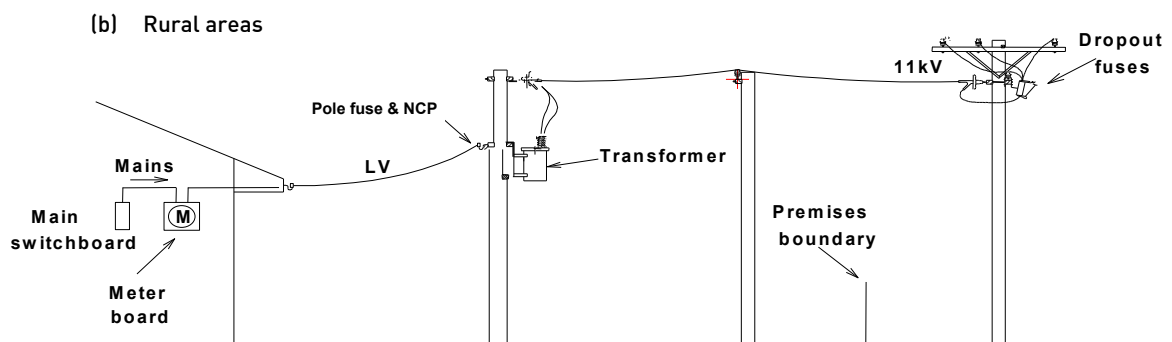
The following connection arrangements are standard practice by Orion, and have applied since 1990.

7.2.1.1 Overhead connections

(a) Urban and rural areas



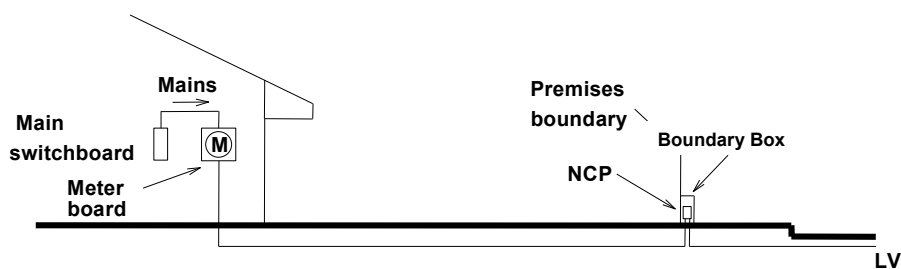
(b) Rural areas



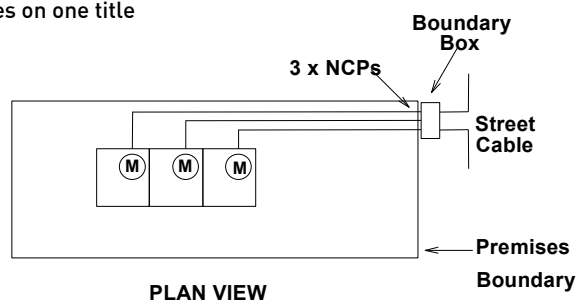
7.2.1.2 Underground connections

(a) Low and medium capacity

Applies principally to residential and commercial premises

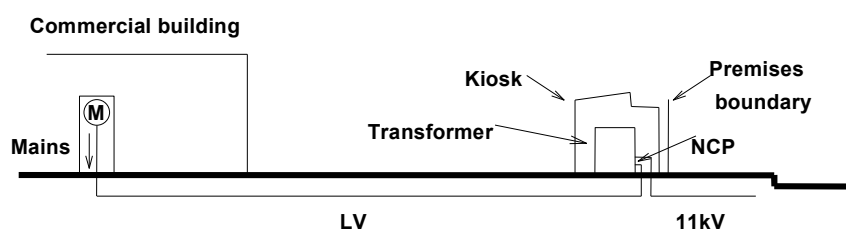


(b) Multiple premises on one title



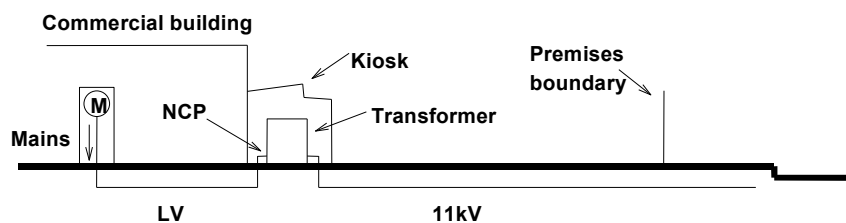
(c) Large capacity, 400V supply, transformer at boundary

Applies to large (typically above 150kVA) capacity premises supplied at LV



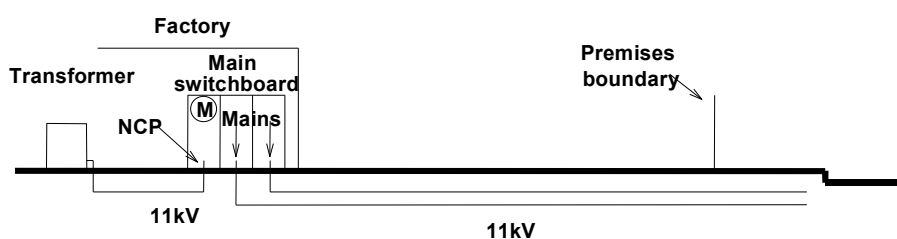
(d) Large capacity, 400V supply, transformer within premises

Applies to large (typically above 150kVA) capacity premises supplied at LV



(e) Very large capacity, 11kV supply

Applies to very large (typically above 1000kVA) capacity premises supplied at 11kV



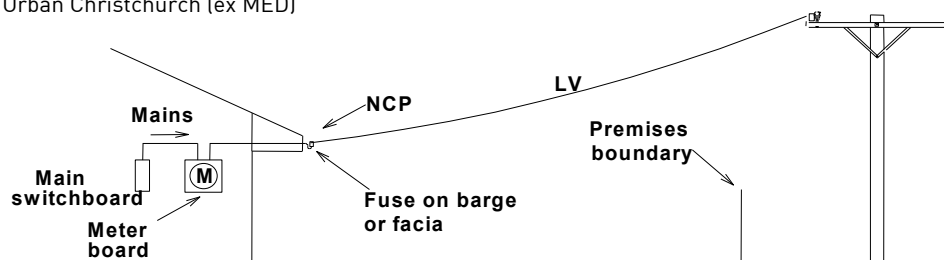
7.2.2 Historical practice

The following connection arrangements also apply within Orion's network as a result of previous practices.

7.2.2.1 Overhead connections

Most premises with an overhead connection in the ex Central Canterbury Electric Power Board, Port Hills Energy, Riccarton Borough Council and Municipal Electricity Department urban areas and rural towns have the same arrangement as shown in 7.2.1.1a. Those in rural areas have arrangements as shown in 7.2.1.1b.

(a) Urban Christchurch (ex MED)

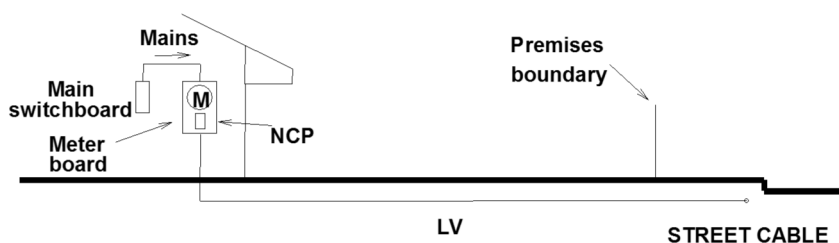


7.2.2.2 Underground connections

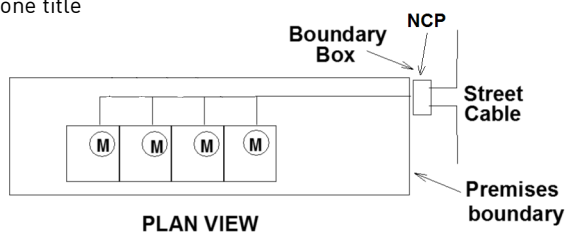
Most premises with underground connections in the ex Central Canterbury Electric Power Board, Port Hills Energy and Riccarton Borough Council areas with underground reticulation have the same arrangement as shown in 7.2.1.2a.

(a) Urban Christchurch

Applies to all low and medium capacity premises (principally residential and commercial) with an underground supply in the ex MED area connected between 1960 & 1990.

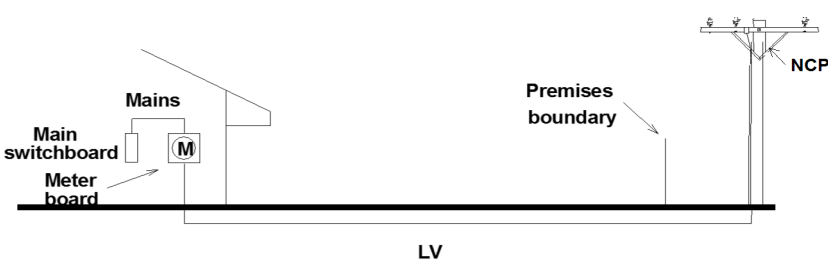


(b) Multiple premises on one title



(c) Overhead reticulation area

Applies to all low and medium capacity premises (principally residential and commercial) with an underground supply in an overhead reticulated area connected before 1990.



7.3 Safe distances from buildings to power lines

The New Zealand Electrical Code of Practice for Electrical Safety Distances - NZECP34 - stipulates minimum distances between buildings and power lines. Buildings must not be constructed in proximity to power lines without written permission of the line owner. These distances depend upon the type of power line, as indicated in the table.

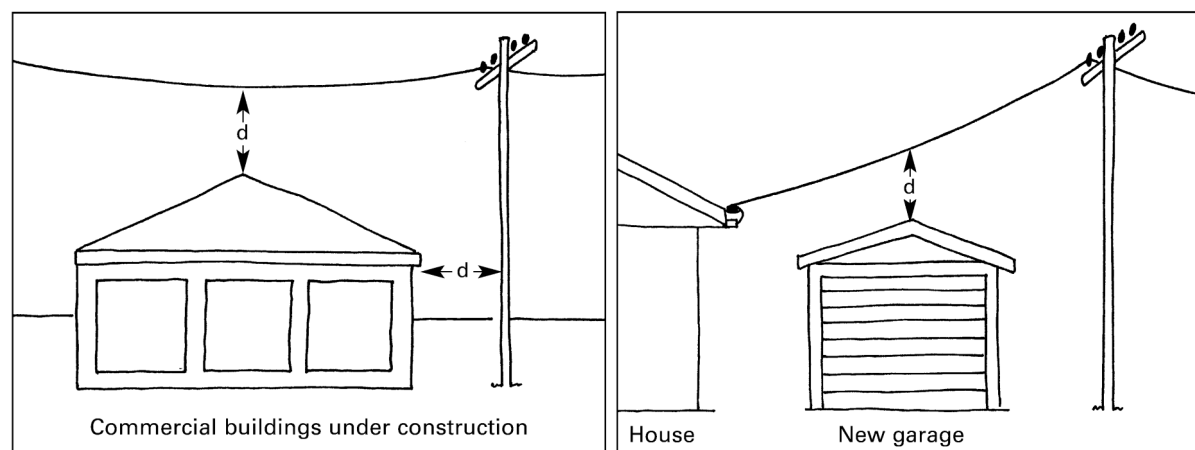
For "d" distance, refer to the table.

Building work

If you are planning building bear in mind the position of the power lines. They must remain clear of any extensions.

Minimum safety distances apply whether the power lines to a building consist of one large wire or two or more separate wires.

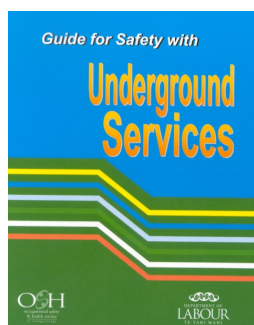
Voltage	Minimum distance beneath conductors	Minimum distance to side of conductors
	d (metres)	d (metres)
Not exceeding 1kV	4	3.5
Exceeding 1kV but not exceeding 11kV	5.5	5
Exceeding 11kV but not exceeding 33kV	7	8.5
Exceeding 33kV but not exceeding 110kV	7.5	9.5
Exceeding 110kV	Refer Table 2 ECP 34	



Consider placing cables underground as an alternative to overhead power lines.

If in doubt, contact Orion for free advice.

The OSH "Guide for Safety with Underground Services" contains useful information on safe work near buried cables and is available from the Department of Labour.



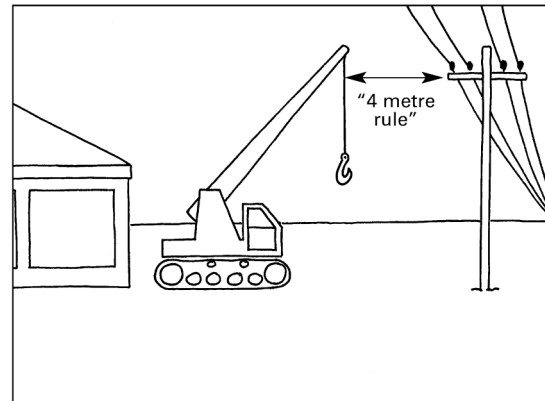
Working safely near power lines

When working on building sites it is important to keep a safe distance from electric lines.

Observe the four metre rule: All work activity should be kept at least four metres from power lines. Orion may issue a permit for a lesser working distance during construction providing that agreed safety controls are applied. Covering or relocating of power lines must be done by specialist contractors.

If the power lines are part of Orion's network you must use an approved contractor (see list over). If they are not part of Orion's network, consult your electrical contractor.

If you damage a power line, treat it as live, and keep all people and animals well away from the area. Never cover up a damaged power line. Contact Orion immediately if you suspect any damage has occurred – do not try to correct the situation yourself.



Demolishing buildings

Sometimes other work may be necessary before power can be removed and the warning notice (right) will be attached.

To arrange a demolition call Orion 0800 363 9898

For reasons of safety, the cables and lines are completely disconnected from our network.

If it is intended to re-use the existing cables or lines, prior approval must be obtained, otherwise they will be disconnected. Contact our network connection team.

We will arrange to disconnect the LV power from a residential building, at no cost, provided at least five working days notice is given. Other situations may need a greater timeline and costs may be applicable.

When power has been removed, the notice (right) will be attached.

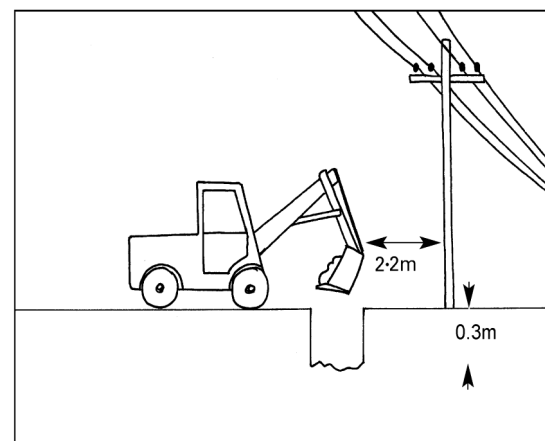
For further information about the process refer NW72.15.03 "Guide to permanent disconnection of customer premises".



Excavations and buried cables

If you plan to excavate, check for underground services before you start to dig. We have extensive records of the location of our cables and will provide maps free of charge.

If you plan to excavate within 2.2 metres of a power pole or pylon and at a depth greater than 300mm, additional pole supports are required to prevent the lines collapsing.



7.4 Electrical disturbance types

Sags - short-term, low voltage, brown-outs

The opposite of surges, these are triggered by the start-up of large loads, switching on our network, network equipment failure, lightning, and Installations that have mains too small for the building demand.



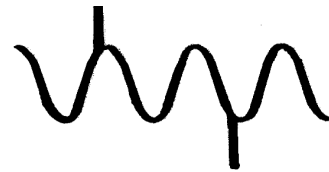
Surges/swells - short-term high voltage

With voltages above 110% of normal, surges can be triggered by rapid reduction in power loads (heavy equipment being turned off) or by switching on our network.



Spikes/transients - instantaneous, very high voltage

Spikes are a brief, intense surge, often lasting no more than a cycle or two, but with voltages 100% or more above normal.



Interruptions

Typically described as a “zero-volt condition lasting longer than a half-cycle”, interruptions can be caused by distribution network equipment failure, accidents, lightning, weather events, fuses and circuit breakers...the list is long.



Waveform - distortion

Waveform distortions that occur at a natural multiple of the standard power wave is called a harmonic. While harmonics can be triggered by equipment inside our network, power may contain harmonics generated hundreds of kilometres away. Caused by motor speed controllers – even computers themselves.



Frequency variations - usually from generators

Rare in a distribution network, frequency variations are most common with back-up power systems such as standby generators.



Noise

Often generated by normal computer operation, noise triggers the exasperating type of problems: program crashes, data corruption, even damage to computer power supplies.



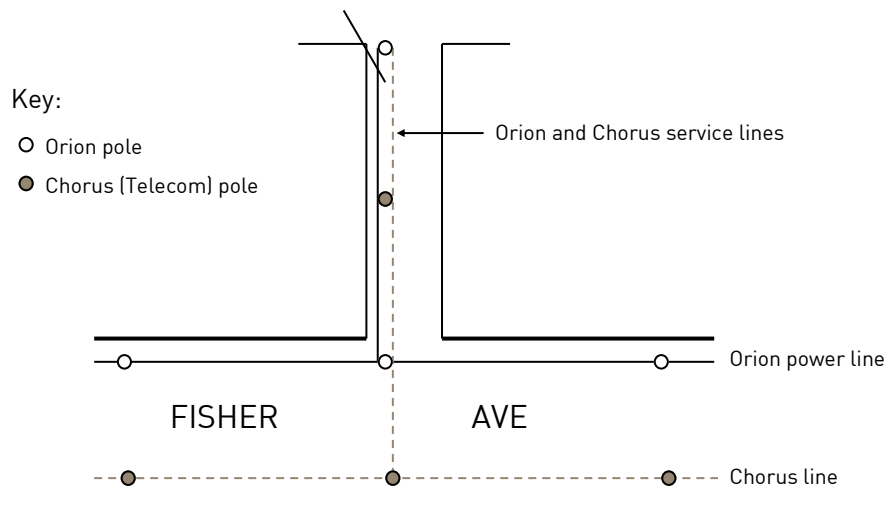
7.5 Ownership of poles on public roads and private land

Orion is the owner, and generally has safety responsibility for all poles on the side of the road that our overhead lines run down. Chorus is the owner, and generally has safety responsibility for all poles located on the opposite side of the road to Orion's poles.

Chorus is the owner and generally has safety responsibility for the first pole on private land. We are the owner and generally have safety responsibility for the balance of the poles located on private land (up to the NCP).

Orion is the owner of all poles with High Voltage conductors (lines and cables) attached to the pole. Variations to this will be recorded and an Orion label attached to any pole on the "Chorus" side of the street.

Example:



Orion New Zealand Limited
565 Wairakei Rd
PO Box 13 896
Christchurch 8011

Website: oriongroup.co.nz
Email: info@oriongroup.co.nz
Telephone: 03 363 9898

Copyright

This document is entitled to the full protection given by the Copyright Act 1994 to the holders of the copyright. Reproduction of any substantial passage from this document is a breach of the copyright. This copyright extends to all forms of photocopying and any storing of material in any kind of information retrieval system. All applications for reproduction in any form should be made to Orion new Zealand Limited.