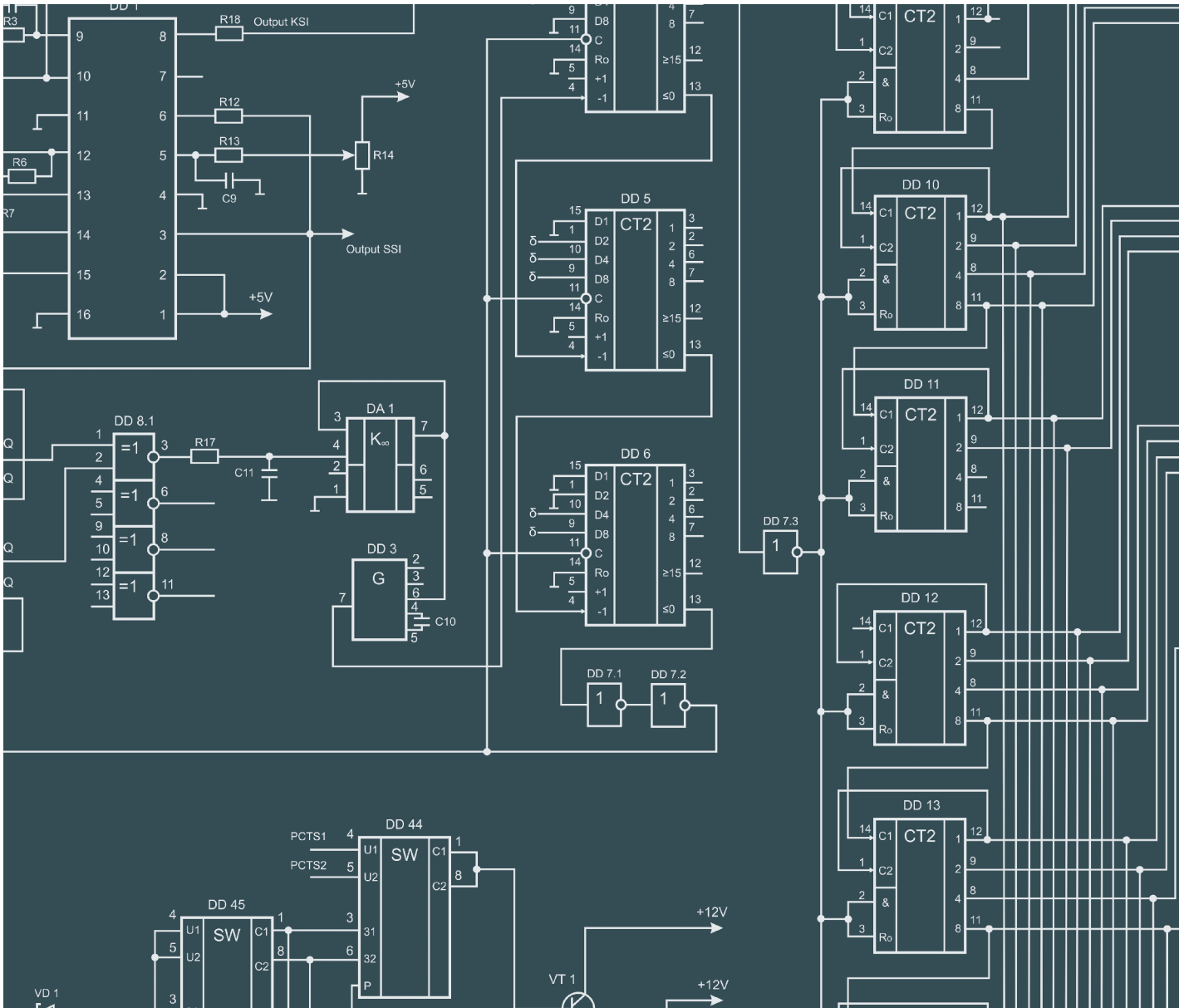
6.0
Electrical, Security and Communications



Electrical, Security and Communications Design Guidelines

The design guidelines have been developed to provide a greater level of certainty for all stakeholders when CIAL embark on developing a new commercial asset – the focus is to deliver on the three core pillars of our mission: enhancing people's lives, fuelling economic prosperity and being great Kaitiaki of our planet.

This document outlines CIAL's Electrical design requirements for commercial projects with the aim of providing safe, compliant, sustainable, simple and cost effective outcomes for the electrical elements of a building asset.

PURPOSE

CHAMPIONING TE WAIPOUNAMU THE SOUTH ISLAND AND AOTEAROA NEW ZEALAND FOR TODAY AND TOMORROW

MISSION

CHRISTCHURCH AIRPORT IS RECOGNISED FOR

ENHANCING PEOPLE'S LIVES
Our team, customers, partners, communities

+

FUELLING ECONOMIC PROSPERITY
of the South Island and New Zealand

+

GREAT KAITIAKI OF OUR PLANET
Safety, security and sustainability

CHRISTCHURCH AIRPORT

CONTENTS

6.1 INTRODUCTION

Electrical, communications and security services to be provided to CIAL developments shall be designed and installed to balance energy efficiency and design flexibility with capital and operating costs. All electrical, communications and security systems shall be specifically designed and installed to spaces requiring them.

The guidelines are intended to ensure that the electrical, communications and security equipment and installation are consistently maintained at a high standard, with a consistent level of quality and service throughout the lifetime of each development.

Selected electrical, communications and security systems must be rationalised against the alternative options described in these guidelines to ensure that all options have been considered and the final solution is the most fit for purpose. All projects are to complete the attached compliance checklist for each major design phase.

The guidelines are not intended to restrict designers from making recommendations in the interest of the project but rather to encourage the incorporation of features and systems that will provide flexibility for change of use, new technologies or expansion in the future.

6.2 ENVIRONMENTALLY SUSTAINABLE DESIGN PRACTICES

Environmentally sustainable design (ESD) practices and features should be considered for the electrical, communications and security systems installed in CIAL developments in accordance with section 1.1.7 of the General Design Guidelines.

Some specific ESD practices to be considered for electrical, communications and security systems are listed below:

- Lighting controls such as daylight harvesting (automatic dimming) and occupancy sensing.
- Power factor correction and harmonic filtering.
- Consideration of the full life cycle cost of installed products.
- The use of products and materials that can be reused, refurbished or recycled at end of life.
- The use of locally manufactured materials and equipment.
- The use of energy monitoring (data capture) and management solutions and systems.
- Where possible, consider sustainable and lower environmental impact materials (i.e. reduce PVC).

6.3 CODES AND STANDARDS

Below are the key codes and standards governing the design, specification and installation of electrical services systems.

Note that, while the design will generally comply with the codes and standards below, some aspects of these codes and standards are not applicable to New Zealand. There are also variations between some of the codes and standards where they overlap. The design and installation shall comply in all respects with the latest/currently ratified versions of the following:

- CIAL Landfill Gas Electrical Equipment Mitigation Bentonite Procedure
- Building Act
- Christchurch District Plan
- Civil Aviation Authority regulations and advisories
- New Zealand Building Code Handbook
- Electrical (Safety) Regulations
- New Zealand Electrical Codes of Practice
- Health and Safety at Work (Hazardous Substances) Regulations
- New Zealand Security Association Codes of Practice
- Radiocommunications Regulations
- Electric Vehicle Charging Safety Guidelines (WorkSafe)
- AS/NZS 3000 *Electrical installations – Known as the Australian/New Zealand wiring rules*
- AS/NZS 61439 *Low-voltage switchgear and control-gear assemblies* suite of standards
- AS/NZS 60079 *Explosive atmospheres* suite of standards
- NZS 4219 *Seismic performance of engineering systems in buildings*
- AS/NZS 1020 *The control of undesirable static electricity*
- AS/NZS 1158 *Lighting for roads and public spaces* suite of standards
- AS/NZS 1680 *Interior and workplace lighting* suite of standards
- AS/NZS 1768 *Lightning protection*
- AS/NZS 3013 *Electrical installations – Classification of the fire and mechanical performance of wiring system elements*
- AS/NZS 11801.1 *Information technology – Generic cabling for customer premises – Part 1: General requirements*
- AS/NZS IEC 61935.1 *Specification for the testing of balanced and coaxial information technology cabling – Part 1: Installed balanced cabling as specified in ISO/IEC 11801 and related standards*
- AS/NZS 3084 *Telecommunications installations – Telecommunications pathways and spaces for commercial buildings*
- AS/NZS 3085.1 *Telecommunications installations – Basic requirements*
- ANSI/TIA 568 C.2 *Balanced twisted-pair telecommunications cabling and components standard*
- AS/NZS 2201.1 *Intruder alarm systems – Client's premises – Design, installation, commissioning and maintenance*
- AS/NZS 2201.5 *Intruder alarm systems – Alarm transmission systems*
- IEC 60839-11-2 *Alarm and electronic security systems – Part 11-2: Electronic access control systems – Application guidelines*
- Relevant New Zealand standard specifications and codes of practice whether specifically mentioned herein or not
- All other standards and documents produced by each and any authority having jurisdiction over the works

6.4 HEALTH AND SAFETY BY DESIGN

All items of installed plant shall be designed to ensure safe and easy access for installation and future maintenance and replacement. Consideration shall be given to the size, weight and type of the plant and any ancillary equipment required for installation and maintenance.

Maintenance access shall form a part of the safety by design review for the development and **mitigation measures put in place to minimise the risks as a result of that review.**

Designers shall avoid locating plant and services in inaccessible or difficult to access locations. This may include areas such as:

- above stairwells or similar
- above roadways
- within or directly above hazardous areas
- above operating machinery
- at height within areas of a building inaccessible to elevated access platforms.

6.5 EARTHQUAKE PROTECTION AND SEISMIC RESTRAINT

Consultation is required with CIAL and the tenant to determine the importance level of the new building, and suitable seismic restraint shall be allowed for in full compliance with all applicable standards.

The electrical contractor shall subcontract a chartered professional structural engineer or specialist seismic restraint supplier to design the services supports, flexible connections at seismic joints and any other measures required for the entire electrical system (including all subtrade works to electrical).

The design must be compliant with NZS 4219, include specific design of aspects that are not covered by standard NZS 4219 solutions and incorporate the requirements of any other standards applicable to the support of the electrical services systems such as AS/NZS 1170.2 for wind loading for exterior-mounted plant.

The seismic designer shall provide design and as-built drawings along with a PS1 and PS4.

6.6 APPROVED CONTRACTORS

Electrical contractors shall hold current membership of Master Electricians.

Communications contractors shall hold current membership of the Building Industry Consulting Service International (BICSI).

Security contractors shall hold current membership of the New Zealand Security Association (NZSA).

Consider and discuss with CIAL prior to tendering of electrical, communications and security works in CIAL developments whether there is a preference for any nominated contractors or subcontractors.

6.7 DESIGN CONDITIONS AND REQUIREMENTS

6.7.1 DOCUMENTATION LEVEL

The level of detailing (LOD) appropriate for the electrical, communications and security services shall be considered and discussed with CIAL. However, the minimum level of detailing expected for these services is LOD 300.

6.7.2 COORDINATION WITH DESIGN TEAM

The electrical, communications and security design and associated drawings/models shall be coordinated with the architectural and other design consultants including but not limited to the following:

- Civil
- Hydraulic
- Mechanical
- Structural
- Fire (including fire protection services).

Where these consultants are not engaged on a project, the electrical consultant shall identify any areas of concern or issues with compliance in these areas to the CIAL project manager for discussion.

6.7.3 FUTURE FLEXIBILITY

Consideration shall be given by the designer to future flexibility of the installation to allow for potential expansion or integration of new technology and appropriate allowances made. In particular, consideration shall be given to the spatial requirements and cable pathways required to allow for potential future expansion.

Additional consultation with the tenant shall be carried out and allowances made for any specific requirements, including potential diverse pathways.

6.7.3.1 Spare capacity

As a minimum, the designer shall consider the following:

- Capacity of main switches and busbars within switchboards.
- Space for additional equipment (e.g. moulded case circuit breakers (MCCBs), miniature circuit breakers (MCBs), patching facilities), or the installation of spares within switchboards and equipment cabinets.
- Space around switchboards and equipment cabinets for future expansion.
- Space within cable access pathways for additional future cabling.
- Installation of spare ducts.

6.7.3.2 Electric vehicle (EV) charging

The Electric Vehicle Charging Safety Guidelines (WorkSafe) and AS/NZS 3000 provide specific requirements for the installation of and electrical supply to EV charging stations.

As a minimum, the designer shall provide the following:

- Installation of a spare duct from the boundary box to the switchboard for future upgrade of the switchboard mains cable.
- Installation of a dedicated spare duct or other cable access from the switchboard to outside the building slab envelope for subcircuit supply to EV charge points. The exact location of any spare duct allowance shall be surveyed and marked on the as-built drawings.
- Spare capacity within switchboards for future EV charging facilities.
- Allowance for installation of dedicated RCD protected subcircuits for each EV charging station.
- Allowance for additional control componentry within the switchboard or installation of a controls cabinet near the switchboard.
- ALL EV infrastructure deisgn should be reviewed with CIAL in the context of their Building Insurance requirements and comply with key risk mitigation measures to protperty.

6.7.3.3
Renewable energy generation systems

As a minimum, the designer shall allow the following:

- Installation of spare ducts or other cable access from the main switchboard to the ceiling space to allow for submain cable access to a roof-mounted renewable energy system.
- Installation or allowance for installation of a spare incoming switch within the main switchboard.
- Additional space near the main switchboard for installation of a power inverter (if required).
- Allowance for additional control componentry within the switchboard or installation of a controls cabinet near the switchboard.
- Allowance for a connected battery storage system as outlined in section 6.7.3.4.

6.7.3.4
Battery storage

As a minimum, the designer shall consider the following:

- Space within the building for the possible location of battery storage facilities including any ancillary equipment (e.g. inverter).
- Cable access facilities necessary between the switchboard and the proposed/future battery storage facilities.
- Switchgear and controls requirements within the switchboard to facilitate the connection of the battery storage facilities.

6.7.4
UTILITY SUPPLY POINTS

6.7.4.1
Orion

The designer shall liaise with Orion to determine appropriate supply arrangements and to lodge a connection application for the development.

Orion supply points (e.g. transformer kiosk, boundary box) shall be located on property boundaries wherever possible and locations selected so as to minimise impact on visual amenity.

6.7.4.2
Generation

The designer shall liaise with CIAL and the tenant to determine the extent (if any) of UPS and standby generation required for the development.

6.7.4.3
Enable

For all developments, the designer shall liaise with Enable to determine the appropriate network connection point and shall arrange for the provision of suitable ducted cable access into the building.

6.7.5
Mustang Park Landfill Gas

In addition to the requirements of this design guideline, underground installations within the Mustang Park subdivision shall conform to the CIAL Landfill Gas Electrical Equipment Mitigation Bentonite Procedure, which can be obtained from CIAL.

6.7.6
REDUNDANT SERVICES

Existing services made redundant as a part of construction and redundant services discovered during construction shall be removed. Redundant services that are unable to be removed shall be identified, GPS located and included in the as-built documentation.

6.7.7
LABELLING

A system of labelling shall be provided throughout the development for all items of installed plant and cabling such that anyone can easily identify the plant, source of supply, isolation point, origin and destination.

Labelling shall comply in all respects with the CIAL procedure for asset numbering and labelling. Refer to the CIAL procedure manuals.

6.7.8
ELECTRICAL SYSTEMS

6.7.8.1
Product Selection

During the selection of fittings and fixtures consider CIAL's existing suite of fittings thorughought the portfolio and specify products that are easily avaliable in New Zealand or transferable. Discuss all specified products with CIAL during the design review process.

6.7.8.2
Metering

The designer shall liaise with the tenant to determine their preferred electricity retailer, and tariff metering shall be provided in accordance with their requirements.

The designer shall liaise with CIAL to determine the extent (if any) of power monitoring required within the development.

6.7.8.3
Lighting

The Civil Aviation Authority of New Zealand requires that "A non-aeronautical ground light which, by reason of its intensity, configuration or colour, might cause confusion or prevent the clear interpretation of aeronautical ground lights should be extinguished, screened or otherwise modified so as to eliminate such a possibility."

As such, lighting performance, in particular, the control of upward light, glare and spill light, is a key design criterion for all developments.

6.7.8.3.1
Performance

Lighting design shall be carried out in accordance with all applicable standards including:

- CIAL procedure manuals
- Christchurch District Plan
- Civil Aviation Authority regulations and advisories
- NZBC acceptable solutions H1/AS1 and G8/AS1
- AS/NZS 1158 *Lighting for roads and public spaces* suite of standards
- AS/NZS 1680 *Interior and workplace lighting* suite of standards.

CIAL has a desire to maintain a consistent appearance to the external lighting throughout their campus. The designer shall familiarise themselves with the external lighting solutions within surrounding developments and design solutions accordingly. Consideration shall be given to:

- pole height
- pole outreach
- pole colour
- luminaire colour
- luminaire style
- colour temperature.

Where the proposed lighting design differs from surrounding developments for any reason, the design shall be presented to CIAL for discussion and approval.

6.7.8.3.2
Internal lighting

Internal lighting design shall be carried out in accordance with all applicable standards including:

- NZBC acceptable solutions H1/AS1 and G8/AS1
- AS/NZS 1680 *Interior and workplace lighting* suite of standards.

Design criteria (including but not limited to illumination levels, maintenance factors and glare indices) shall be determined in compliance with AS/NZS 1680 and in consultation with the tenant.

Consideration shall be given by the designer to the use of environmentally sustainable design practices (see section 6.2) and appropriate allowances made.

6.7.8.3.3

Lighting controls

The designer shall consider the following lighting control solutions and shall liaise with CIAL regarding the extent of use:

- Limitation of rapid on/off cycles in order to limit the possibility of confusion with an aeronautical ground light.
- Automated controls such as occupancy sensing, daylight harvesting and photocell control where appropriate.
- Automated time scheduling.
- Master on/off.
- Integrated systems such as KNX, DALI, BMS.

6.7.8.3.4

Emergency lighting and exit signage

Emergency lighting and illuminated exit signage design shall be carried out in accordance with all applicable standards including NZBC clauses F6 *Visibility in escape routes* and F8 *Signs*.

Design shall be carried out in consultation with the fire engineer.

The designer shall provide all documentation necessary for building consent application and code compliance.

6.7.9 COMMUNICATIONS

The designer shall assess the scope of the communications cabling installation in consultation with the tenant and CIAL.

The scope of the communications cabling works may include:

- HVAC BMS, plant and controllers
- CCTV cameras and monitors
- lighting controllers
- emergency lighting systems
- wireless access points (WAPs) – note that no WAPs shall be installed without the prior approval of CIAL
- uninterruptible power supplies (UPSs)
- security system alarm panels
- fire alarms
- lifts
- generators
- ancillary switchboard equipment (meters, circuit breakers, gateways)
- audio visual (AV) equipment
- any other plant and equipment requiring an ethernet connection.

The designer shall engage with the supplier of each relevant service to ensure that their requirements for remote access/ monitoring are met, in particular, lifts and fire services.

6.7.9.1
Performance

The entire communications cabling system shall be designed to a minimum of Category 6A.

6.7.10
SECURITY AND CCTV

The designer shall assess the scope of the security system installation in consultation with the tenant and CIAL.

The scope of the security system works may include:

- access control
- alarm monitoring
- intercoms
- CCTV
- duress
- fire alarm interface
- remote monitoring.

Where the development adjoins the airfield's airside/landside boundary, the designer shall liaise with CIAL and AVSEC to determine the extent (if any) of security system requirements for the site.

Any designed security system shall comply with all legislative requirements and codes of practice.

6.8
SYSTEMS AND COMPONENTS

6.8.1
BURIED SERVICES

All existing underground services shall be identified located and shown on the design drawings and new trench routes planned accordingly.

Under no circumstances shall existing underground services be relocated or modified without the prior permission of the asset owner and in full compliance with that asset owner's procedures. In particular, existing HV services shall only be worked on (including potholing to locate) by Orion approved HV contractors.

All buried services shall comply with all applicable standards including AS/NZS 3000 and meet the requirements in the following table.

Table 6.1: Buried service requirements

	Buried direct	Ducted
Minimum depth of cover	750mm	600mm
Crusher dust	75mm all around	
Magslab	Required	
Signal warning tape	Required	
Backfill	AP40 or similar (not excavated material)	
Cable ID markers	At building cable entry points	

Where multiple services (e.g. HV, LV and communications cabling) are to be run within a single combined trench, the cabled services are to be separated from one another in conformance with regulatory requirements including AS/NZS 3000.

Ducts shall typically be installed in straight runs with large radius bends at changes in direction and riser positions. They shall have sealed sectional joints, anchored draw wires and end caps for empty ducts.

Ducts shall be of the uPVC solid wall electrical cable duct as per the Marley range or equivalent in the following colours:

- Power – orange.
- Comms – green.

6.8.1.1
Manholes

All manholes shall be complete with lockable lids of a type and class appropriate for the expected and potential traffic and sit flush with the finished ground level.

In addition, manholes shall conform to the following criteria:

- Ducts shall enter the manhole a minimum of 300mm above the bottom of the pit.
- Manhole walls shall be sealed around the ducts (i.e. not left as a large cut-out around the ducts).
- A drainage hole shall be provided in the bottom of the manhole.
- Debris shall be sucked out of the completed manhole.

6.8.2
SEGREGATION OF SERVICES

A system of segregation shall be employed between power cabling and the cabling associated with data, signal and communications level cabling within all buildings. Generally, a minimum separation distance of 300mm shall be provided between parallel runs of such cabling, and crossovers shall be oriented at 90°.

6.8.3
LABELLING

Identification labelling shall be provided to all major equipment items such as switchboards, communications cabinets, panel-mounted controls, protection devices and so on. Labels shall be permanently fixed, machine engraved laminated Formica in the following colours:

- Identification – black on white.
- Warning – white on red.

Similar labels shall identify and indicate the function of ancillary items such as switches, indicating lights, push-buttons, relays, contactors, fuses (including rating), MCBs and other devices that provide a manual or automatic control function, an indicating function or otherwise require periodic inspection.

Submain cables shall be labelled with a proprietary cable labelling system. The label shall state the service, physical location, origin and destination and shall be installed in the following positions:

- At a distance of not more than 1m on both sides of any obstruction (wall, ceiling, floor, enclosure etc.) that the cable penetrates.
- At intervals of not more than 20m on uninterrupted runs.
- At each end of the cable.

All other cabling including subcircuit, control, communications backbone and horizontal cabling shall be securely labelled at each end (and at all junctions and terminations).

For catenary wire runs within concealed ceiling spaces, tags shall be securely fixed to the catenary at 10m intervals.

The identification references shall relate to either a circuit number or wire numbers on the relevant as-built wiring diagram, as applicable.

All distributed items such as switch plates, socket outlets, flush boxes, isolators, control panels etc. shall be labelled using Dymo 3000 or equivalent in the same colours as stipulated above where a proprietary labelling system is not provided by the manufacturer. Labels shall be fixed inside the cover plate where possible.

Where required, all wiring shall be identified adjacent to all terminals by appropriately sized cable markers.

All equipment supplied from distribution boards outside designated DB zones shall be clearly and specifically labelled as such.

Typed circuit legend charts shall be provided within the front door of all switchboards.

6.8.4 CABLING

6.8.4.1 Mains and submain cabling

Mains and submain cables shall be supported by and fixed to a cable ladder or contained in conduit.

Terminations shall be carried out using compression lugs and bolted connections.

6.8.4.2 Subcircuit cabling

Subcircuit cables shall be supported on a tray, contained in conduit or trunking, suspended on catenary wires or clipped to timber battens (see section 6.8.4.5).

Subcircuit cabling shall generally be concealed within the building fabric except within services spaces and cavities.

Concealed subcircuits within areas of exposed concrete shall be contained within cast-in conduits.

Exposed subcircuit wiring in unlined concrete surfaced areas shall be run within grey rigid PVC conduits. The conduits shall be located in unobtrusive positions (e.g. corners, recesses, returns) and oriented straight and horizontal or perpendicular.

On high-density subcircuit routes, cables shall be installed on common cable tray provisions.

Cable trays shall be utilised adjacent to and rising from all distribution boards.

Catenary wires shall be run parallel with the axes of the building and shall be installed in a regular grid pattern. Not more than 10 No. 2E x 1.5mm^2 TPS cables or 6 No. 2E x 2.5mm^2 TPS cables shall be supported on any one catenary wire.

The minimum size of cable for lighting circuits shall be 1.5mm^2, and the minimum size subcircuit cable for plug socket outlets shall be 2.5mm^2.

The use of subcircuit cables with large cross-sectional areas (i.e. greater than 2.5mm^2) for long lighting subcircuits shall require that a junction box be located adjacent to the first fixture in the circuit. The junction box shall be mounted within the ceiling void in an accessible location and shall be complete with din rail mounted terminals. Subcircuit cables with smaller cross-sectional areas (typically 1.5mm^2 or 2.5mm^2) shall then loop from the junction box to the remaining fixtures within the circuit.

All subcircuit protection MCBs shall be suitably rated for the particular circuit. Under no circumstances shall the MCB current rating exceed the current rating of the smallest size cable within a circuit.

Where cables are run within expanded polystyrene insulation, they shall be either:

- sheathed in non-migratory PVC
- wrapped in non-migratory PVC tape
- run within PVC conduit.

Where cabling is proposed to be run to equipment within freezers and chillers, due regard shall be given to the prevention of moisture ingress through penetrations. All penetrations through a sandwich panel shall be sealed to the sandwich panel installation contractor's specifications.

6.8.4.3 Cable types and colour coding

Colour coding for conductors is shown in the following table.

Table 6.2: Cable types and colour coding

Type	Description	Colour
400V 3Ph systems	Phase 1	Red
	Phase 2	White
	Phase 3	Blue
	Neutral	Black
	Earth	Green/yellow
24V AC systems	Phase conductor	Yellow
	Neutral (common)	Blue
230V AC control	Phase conductor	Brown or red
	Neutral (common)	Blue or black
24V DC systems	Positive conductor	Orange
	Negative conductor	White

6.8.4.4
Jointing and terminations

All new cable runs shall be continuous.

Terminals of the rail-mounted pressure type shall be provided within junction boxes required for lighting subcircuit cabling with large cross-sectional areas greater than 2.5mm^2.

All submain and mains cables shall be terminated using approved cable glands and bolted compression lugs.

6.8.4.5
Cable supports

6.8.4.5.1
General

Support facilities shall be provided for all mains, submain, subcircuit, communications and security cabling in accordance with the requirements of these guidelines including:

- cable ladders
- cable trays
- conduits
- trunking
- catenary wires.

Support facilities and routes shall be coordinated with all other services, including mechanical and fire services, to ensure compatibility of routes.

Spatial allowance shall be made on each ladder/tray for maintenance purposes and 30% spare space shall be allocated for future use.

Where structured cable support systems pass across seismic joints, the supports shall be interrupted 50mm either side of the joint (i.e. for a 200mm seismic joint, the cable support system will require a 300mm gap). All cables mounted on the support system shall be clamped on both sides of the gap, and a loop or generous bend shall be introduced into the cable at the location of the seismic joint.

Under no circumstances are catenary wires to cross seismic joints. Where required, catenary wires shall stop immediately either side of the joint and subcircuit cabling shall extend from one catenary to the other unsupported, bunched and tied together in a neat and cohesive manner.

6.8.4.5.2
System support

Structured cable support systems shall be either anchored directly to the building structure via proprietary brackets and clamps or provided with suitable support components of the cantilever or trapeze type. Such componentry shall be of the hot-dip galvanised steel strut section type complete with proprietary couplings and fixings. Supports shall be located in accordance with the system supplier's recommendations for the applicable load.

6.8.4.5.3
Cable ladders

Cable ladders shall be of the aluminium type, constructed to NEMA standard 12B, with welded perforated rungs spaced at a maximum distance of 300mm apart.

6.8.4.5.4
Cable tray

Cable trays shall be of the galvanised sheet steel type. All cable tray systems shall be supported in such a manner to restrict sag between supports to 11mm or less along the entire length of the installation.

6.8.4.5.5
Trunking

Generally, wall and skirting trunking shall be of the two compartment extruded aluminium rectangular cross-section type with nominal overall dimensions of 150 x 50mm. Finish shall be of epoxy powder coat.

Compartments shall be of unequal size and be provided with snap fitted covers. The upper compartment shall be utilised for electrical distribution and the lower compartment for communications. Outlet plates shall be anchored by concealed brackets retained in position by the flush plate fixing screws.

Consecutive sections shall be located by pins, and all bends shall be proprietary items provided by the manufacturer. Site-cut mitre bends are not acceptable.

6.8.4.5.6
Catenary wires

Catenary wires may be used for secondary cable support in concealed ceiling spaces only. They shall consist of metal wires (HD copper or LC steel) of at least 8.5mm^2 cross-section, secured by wire rope couplings and firmly tensioned so there is not more than 50mm sag between supports. Intermediate supports shall be provided to prevent excessive sag. The whole of the installation shall be designed to support the initial cable load and include capacity for 50% spare.

Cord type catenary supports are not acceptable.

6.8.4.5.7
Conduits

Conduits shall be provided for cable access to locations without lining cavities. These conduits shall generally be cast into the concrete structure and completely concealed from view. Fixed conduits shall be of the rigid PVC type, incorporating bends and junction boxes where necessary and excluding elbows and tees.

Draw wires shall be provided.

All conduits shall be of at least 25mm OD.

6.8.4.5.8
Ducts

Underfloor cable ducts shall consist of proprietary PVC items. They shall be continuous and incorporate substantial draw wires and proprietary jointing methods.

6.8.4.6
Clamping and tying of cables

Cables shall be fixed to support facilities in such a manner so as to eliminate any possibility of strain on the cable itself or on cable terminations.

Cable attachment to catenary wires shall be via nylon ties at 300mm intervals. Taped attachment is not acceptable.

Fire-rated cables supported by catenary wires shall be attached via fire-resistant stainless steel cable ties with a 2 hour fire rating in conformance with AS/NZS 3013.

Cables supported by ladder or tray shall be neatly run and held in position using the methods shown in the following table.

Table 6.3: Clamping and tying of cables

Cable	Method
Large thermoplastic cables (>95mm^2)	Proprietary zinc-plated clamps
Small thermoplastic cables (≤95mm^2)	Nylon cable ties
Fire-rated cables	Fire-resistant stainless steel straps with 2-hour fire rating in conformance with AS/NZS 3013

The maximum distance between fixings for cables supported on a ladder or tray shall be:

- horizontal – 1200mm
- vertical – 600mm.

6.8.4.7
Penetrations, access and sealing

All fire-rated or acoustic-rated walls, floors, ceilings and compartments that are penetrated by access ducts, conduits or holes associated with the cabling installation shall be sealed.

The designer shall consider the engagement of a specialist subcontractor for the provision and installation of fire-resisting treatment to services penetrations and cavities as shown in the following table.

Table 6.4: Sealing of penetrations

ITEM	TREATMENT
Electrical services	Install bulkheads and coating systems for cable tray penetrations, such as the Promat Promaseal system. Otherwise, use suitable fire-rated mastic sealant around singular penetrations or appropriate fire stop mortar around multiple penetrations. Where ladders or trays pass through fire-rated elements, terminate the ladders or trays at both sides of the openings and provide holes for the cables only. All holes are to be fire stopped with a proprietary product that is equal to or greater than the fire resistance of the materials being filled and is installed to the manufacturer's specifications.
Recessed fittings	Usually not applicable for lights. Ensure full grout or fire mortar seal around recessed features.
Lights and cabinets	Form a fire-rated recess constructed from the same thickness wall lining (i.e. GIB) as per the ceiling or wall except with an extra layer for the top section of the recess.
Flush boxes	Install proprietary intumescent blocks into flush boxes. Apply fire-rated mastic sealant around outer edges/gaps.

The following listed items shall be adhered to during construction for achieving the appropriate fire rating integrity of services penetrations:

- Test certificates shall be required for all services penetration fire rating products used. Non-certified products shall be deemed non-compliant.
- Fire rating products shall be installed in strict compliance with the manufacturer's requirements for the application and for the specified tested/assessed system.
- Services penetrations shall be made available for inspection to competent qualified persons (i.e. council inspector, consultant engineer or licensed building practitioner) to sample selections of penetrations.
- Components of fire-stopping systems from different manufacturers shall not be mixed and matched.
- Proposals for all fire-stopping systems shall be provided to the fire engineer for approval prior to commencement of installation.
- Fire-stopping systems shall be installed by competent trained persons.

6.8.5
ELECTRICAL SYSTEMS

6.8.5.1
Switchboards

6.8.5.1.1
Electrical system parameters

The assembly shall be designed for connection to an electrical supply with the parameters shown in the following table.

Table 6.5: Electrical system parameters

ITEM	DETAIL
Nominal voltage	400V
System frequency	50Hz
Phases	3
System 3-phase symmetrical RMS PSCC	By assessment
Neutral earthing	MEN (TN-C-S)

6.8.5.1.2
Construction

The assembly shall be constructed in accordance with requirements shown in the following table.

Table 6.6: Construction requirements

Consideration	Requirement
Installation	Floor or wall mounted
Access	Front or front and rear
Cable entry	Top and bottom
Dimensions	Maximum height 2200mm AFFL
Materials	Modular metal cubicle
Doors and access panels	Dish construction complete with lift-off hinges allowing doors to swing left or right Lockable handles to all access doors and panels Neoprene dust protection seals
Access openings and holes	Punched or machine-cut openings Neoprene gasketed or similar
Form of construction	IPX4 ingress protection, where installed near an automatic fire sprinkler system
Seismic restraint	Compliant with NZS 4219
Other	Vermin proof

6.8.5.1.3
Location

All switchboards shall be located in full compliance with AS/NZS 3000 Part 2.

Switchboards shall not be located within or directly adjacent to areas frequented by vehicle traffic. This includes adjacent vehicle doors, access points, roadways and intersections.

All switchboards and primary distribution boards shall be located indoors. External link boxes are acceptable.

6.8.5.1.4
Cable terminations

Cable entries shall be glanded.

Cable terminations shall be carried out within the cubicle in which their connections are made (i.e. not glanded in one cubicle and terminations carried out in the adjacent cubicle).

Terminals shall be:

- of the rail-mounted pressure type for all outgoing control and auxiliary circuits – screw pinch type terminals are not acceptable
- grouped for conductors associated with each outgoing power circuit – in particular, AC and DC terminals shall be grouped
- located adjacent to the point of entry of external cables or wiring
- shrouded – for low and medium voltage terminals.

Busbars from functional devices to cable and busbar terminations shall be sized to accommodate the maximum rated temperature of the connected conductors.

6.8.5.1.5
Busbars

All busbars shall:

- be manufactured from hard drawn high-conductivity copper
- have phase identification and colour coding over their entire length
- have connections secured using high-tensile bolts inserted into pressure plates
- be supported by proprietary busbar supports
- be rated for the maximum loading of the assembly/cubicle plus 50%
- be indoor, enclosed and air insulated.

Phase and neutral busbars shall be provided and fully rated.

6.8.5.1.6
Components

All components selected shall be compliant with CIAL guidelines, be readily available and have a proven history within the Christchurch, New Zealand marketplace, including local support and spare parts availability.

6.8.5.1.7
Metering

Metering (and all associated CTs) shall be provided within the assembly as required for the tariff applicable.

6.8.5.1.8
Power monitoring

Where power monitoring is to be installed, it shall be capable of providing real-time indication of:

- voltage (L-L, L-N) per phase
- current per phase
- power (kW, kVAr and kVA)
- frequency
- power factor
- THD%
- kWh
- waveform capture
- disturbance direction detection.

6.8.5.1.9
Surge protection

Where provided, surge protective devices (SPDs) shall be installed within the assembly in accordance with AS/NZS 1768 and the following requirements:

- Nominal system voltage – 240/415V, 50Hz.
- Visual indication and volt-free contacts.

Primary protection – main switchboard
Primary shunt-type surge protection devices shall meet the parameters shown in the following table.

Table 8: Primary surge protection parameters

Item	Protection
Maximum discharge current (Imax)	≥ 100kA, 8/20µs per phase
Nominal discharge current (In)	> 40kA, 8/20µs per phase
Voltage protection level (Up)	< 1000V @ 3kA, 8/20µs < 1800V @ 20kA
Maximum continuous operating voltage (Uc)	310V

General secondary protection – distribution board
General secondary surge protection devices shall meet the parameters shown in the following table.

Table 9: Secondary surge protection parameters

Item	Protection
Maximum discharge current (Imax)	≥ 50kA, 8/20µs per phase
Nominal discharge current (In)	> 20kA, 8/20µs per phase
Voltage protection level (Up)	< 800V @ 3kA, 8/20µs < 1600V @ 20kA
Maximum continuous operating voltage (Uc)	320V

6.8.5.1.10
Power factor correction

A power factor study shall be carried out and power factor correction (PFC) provided within the assembly to meet an initial target of 0.98 lagging.

Consideration shall be given to the type of PFC componentry to be utilised and static VAr generation (SVG) utilised in preference to capacitive where appropriate.

The PFC cabinet assembly shall incorporate all associated switchgear, capacitors/SVGs, protective devices and related control componentry.

Where capacitors are utilised, they shall be of the low-loss metallised polypropylene type, epoxy coated with a plastic case and terminal covers. Each capacitor shall also be provided with inrush current restrictor coils.

The assembly PFC section (tier) shall be provided with a main switch.

Withdrawable systems shall be utilised.

Automatic control of the PFC shall be provided by a suitable power factor controller.

6.8.5.1.11
Harmonic filtering

A harmonic assessment shall be carried out and filtering equipment provided within the assembly as necessary to meet Orion's connection requirements for total harmonic distortion.

6.8.5.1.12
Labelling

All items of switchgear and instrumentation shall be provided with labelling in accordance with all applicable standards and regulations. This shall include the labelling of all protective devices (MCCBs, MCBs, RCDs, RCBOs etc.), outgoing submain cables and outgoing subcircuit cables, identifying their destination.

Circuit legend charts shall be fixed to the inside of cabinet doors.

6.8.5.1.13
Testing

All factory and on-site testing shall be undertaken as is necessary to ensure a complete and functional assembly in full compliance with all relevant regulations, standards and policies.

After energisation and loading, the complete assembly shall be photographed using an infrared thermovision camera.

6.8.5.1.14
Fire Protection

Consider the need to implement fire surpression within the space. Discuss with CIAL any requirement for this.

6.8.5.2
Fittings

All fittings (e.g. socket outlets, light switches etc.) and associated accessories shall be of the same type and colour.

Adjacent items (e.g. power sockets and data outlets) shall be of the same type and colour, mounted at the same height, aligned with one another, true and square.

Light switches shall be of the vertical pattern and mounted at door handle height.

Where two or more lighting switches are adjacent to one another, multiple gang units shall be utilised as appropriate.

Where switches complete with associated indicating light are specified, these units shall comprise of standard flush plates with separate switch and indicating light modules.

Where key-operated switches are specified, these units shall comprise of standard flush plates incorporating key switch mechanisms. All key switches are to be keyed alike and provided with engraved labels identifying the function of the switch.

Socket outlets shall be of the horizontal style, flush box mounted with a mounting height of 500mm AFL to the centre unless stated otherwise.

All general-purpose socket outlets installed outdoors or within publicly accessible spaces shall be fed from 30mA RCD-protected circuits.

Consideration shall be given to the type of equipment to be supplied by each socket outlet and an integral surge protection provided where appropriate (e.g. for outlets supplying electronic equipment). All socket outlets requiring integral surge protection shall be double switched socket outlets with replaceable MOV modules.

All external fittings shall be suitably IP rated.

6.8.5.2.1
Fixed wired connections

Where flexible connections to items of fixed plant are utilised, the wiring termination shall be located adjacent to the point of entry to minimise the length.

Flexible cables of up to 2.5mm^2 conductor size shall be coloured white, and those connecting heating equipment shall be of the high temperature type.

All flexible conduits shall be of the smooth outer surface waterproof type. Sections of such conduit on or immediately adjacent to equipment items shall be neatly supported to avoid sagging and exposure to mechanical damage.

6.8.5.2.2
Flush boxes

New Zealand standard pattern flush boxes shall be utilised for the fixing of all switches and outlets. Flush boxes shall generally be of the all metal type or polycarbonate construction with metal flush plate fixing threads.

Flush-mounted components located in fire-rated walls shall be mounted on New Zealand standard pattern metal flush boxes incorporating intumescent blocks to provide the appropriate (FFR) fire rating.

Flush boxes shall be fixed to timber framing via screws. Where metal-framed construction of walls is employed, timber dwangs shall be provided between the metal studs for the screw fixing of flush boxes.

GIB-mounted style boxes are not acceptable.

6.8.5.3
Lighting

6.8.5.3.1
Performance

All lighting shall conform to the following performance criteria:

- LED
- Colour rendering index (CRI) >80
- Minimum life expectancy L70/B10 @ 50,000 hours
- ≤3 SDCM (MacAdam Ellipse)
- Local supply and support availability

6.8.5.3.2
Internal lighting

All internal lighting shall additionally conform to the following criteria:

Colour temperature 3000/4000K

6.8.5.3.3
External lighting

External lighting shall additionally conform to the following criteria:

- ≥IP66
- Flat glass
- 0° tilt
- Colour temperature 3000/4000K

Backlight shielding shall be utilised where necessary to comply with the Christchurch District Plan spill light requirements.

Consideration shall be given to the planned location of the luminaire and the likelihood of damage from impact. Fittings of a suitable IK rating shall be selected where appropriate.

Light poles shall generally be of the same colour as the luminaire.

The designer shall generally avoid the use of external uplighting (e.g. for lit façades or signage). Where specifically required, uplighting shall be designed to limit the effects of glare and light pollution, and all such installations shall be discussed with CIAL.

6.8.5.3.4
Street lighting

The designer shall identify the appropriate roadway category in consultation with CIAL and other design team members and design compliant lighting accordingly.

6.8.5.3.5

Lighting controls

Where manual on/off controls are proposed, switches shall be appropriately rated for the load and associated inrush current.

Where two-way (intermediate) switching is proposed, such controls shall indirectly control the lighting circuits via contactors.

Where a single light switch is to control multiple lighting circuits, the lighting circuits shall be contactor controlled.

Consideration shall be given to the use of occupancy sensors to control lighting circuits within spaces that are intermittently occupied. The occupancy sensors installations shall be designed in accordance with the manufacturer and supplier recommendations and the following requirements:

- Avoidance of sensor bias from obstruction or artificial sources affecting reliable and representative sensor function.
- Full coverage of the applicable area as defined on the layout drawings.
- Reliable function without spurious activation.
- Neat aesthetically coordinated installation with concealed wiring.
- Include all related power supply facilities.

Consideration shall be given to the use of daylighting harvesting sensors to control lighting levels within spaces that have significant natural light. Sensor installation shall be designed in accordance with the manufacturer and supplier recommendations.

Where dimming of internal lighting is proposed, this shall be achieved via either DALI or Casambi controls.

All external lighting shall be automatically controlled via an integrated system (e.g. KNX, DALI, BMS) or a basic control system consisting of a time switch, photocell and auto/off/manual switch. Separate controls shall be provided for each category of external lighting (e.g. security lighting, signage, carpark lighting).

Where an integrated system is proposed, preference should be given to the following (in no particular order):

- BMS
- Casambi
- DALI
- KNX

The designer shall have overall responsibility for the concept design of the integrated system but shall specify for a specialist integrator to carry out detailed design, supply, installation and commissioning of the integrated controls in consultation with CIAL and the tenant.

6.8.5.3.6

Emergency lighting and exit signage

The designer shall assess the appropriate system for the development in consultation with CIAL and shall advise the:

- manufacturer
- system type (central battery or single point)
- testing solution (manual or automatic)
- battery type.

Lithium iron phosphate or lithium nanophosphate batteries shall be utilised in all cases unless impractical based on project specific conditions (e.g. within a freezer).

All emergency lighting fittings and illuminated exit signs shall be connected to dedicated emergency lighting circuits.

Phase failure relays shall be provided to automatically initiate emergency lighting fittings in the event of failure of general lighting circuits to meet the requirements of the NZBC and associated emergency lighting standards.

6.8.5.4
Earthing

6.8.5.4.1
General earthing

An electrical earthing system shall be provided throughout the development in full compliance with the requirements of the Electrical (Safety) Regulations and all related amendments and codes of practice.

The earthing system shall be tested at the MSB and all DBs prior to livening and the results of these tests included in the as-built documentation.

All submain and subcircuit cables shall be provided with protective earthing conductors.

A driven earth electrode shall be provided adjacent to the mains cable entry as the main building earth. A green/yellow PVC-covered main earthing conductor shall be connected to the earth electrode using compression lugs and bolted connections. The earth shall be continued and terminated at the main earth busbar.

A separate Wricon type bond-welded connection shall be made to a structural steel column located as close as possible to the main switchboard.

6.8.5.4.2
Equipotential bonding

Equipotential bonding shall be provided in accordance with all regulatory requirements.

6.8.5.4.3
Silent earthing

A copper earth bar shall be provided within any server room adjacent to the communications cabinets and connected to an adjacent switchboard via green/yellow PVC-covered earthing conductor. This earth bar shall be used for the silent earthing of data, telephone, PA system and CCTV system equipment, cabinets and cable trays etc.

6.8.6
COMMUNICATIONS

6.8.6.1
Distribution frames

All distribution frames shall be:

- a floor or wall-mounted cabinet
- securely fastened to the building structure and seismically restrained
- of the 19" rack mount type
- ventilated
- key lockable door access
- complete with cable management
- IP rated to suit the environment in which it is installed
- sufficiently sized to accommodate the tenant's supplied equipment (e.g. switches, routers, modems, servers, UPSs)
- sized to meet the immediate needs with space for future expansion.

6.8.6.2
Horizontal cabling

Horizontal distribution cabling shall be undertaken using 4 pair Category 6A (minimum) UTP cables.

Horizontal distribution cabling shall be carried out using a star topology and home run cabling from the distribution frames to the outlets. No cable run shall be longer than 85m in length.

The cabling installation shall meet the requirements outlined in section 6.8.4.

6.8.6.3
Outlets

Consideration shall be given to the intended use of the development and communications outlets provided as appropriate.

All outlets shall be based on WE8W (RJ45) polarisation utilising EIA 568 A termination sequence. Termination shall be via IDC style contacts. The minimum performance specification shall be as outlined in section 6.7.9.1.

Where multiple jacks are located on the one flush plate, each outlet jack shall be individually wired via home run cabling to the associated distribution frame.

The location and mounting of all outlets and accessories shall be coordinated with the electrical services to ensure that adjacent outlets are of the same type and colour, mounted at the same height, aligned with one another, true and square.

6.8.6.4
Labelling

Labels shall be provided for all outlets, cabinets, distribution frames, patch panels and patching ports/outlets in accordance with section 6.8.3.

These labels shall consist of black lettering (4mm) on a white background, directly adhered to flush plates and permanently fixed to patch panels/frames.

Labels for outlet plates and destination patching ports shall have a sequential alpha-numeric reference that follows an orderly pattern throughout the building.

6.8.7
SECURITY AND CCTV

The designer shall have a certificate of approval to act as a security consultant.

The scope of the security system works may include:

- access control
- alarm monitoring
- intercoms
- CCTV
- duress
- fire alarm interface
- remote monitoring.

The designer shall engage with the supplier of each relevant service to ensure that their requirements for remote access/monitoring are met, in particular, lifts and fire services.

6.8.7.1
Alarm panels

All alarm panels shall be:

- wall-mounted cabinets
- securely fastened to the building structure and seismically restrained
- key lockable door access
- complete with cable management
- IP rated to suit the environment in which it is installed
- complete with battery back-up for a minimum of 8 hours normal operation
- sized to meet the immediate needs with space for future expansion
- located within a secure environment.

6.8.7.2
Cabling

Cabling shall be undertaken using proprietary security cabling.

Ethernet cabling required for security system equipment (e.g. CCTV cameras) shall be provided by the communications cabling contractor.

The security cabling shall be carried out using a star topology and home run cabling from the alarm panels to the security equipment.

The cabling installation shall meet the requirements outlined in section 6.8.4.

6.8.7.3
Equipment

6.8.7.3.1
Access control

Generally, each access-controlled door shall be provided with the following:

- Electromagnetic locks – mag clamps or mortice locks, whichever is most appropriate.
- Proximity card readers wall mounted 1200mm above FFL.
- Request to exit push button wall mounted 1200mm above FFL on the protected side of the door.
- Emergency breakglass switch wall mounted 1400mm above FFL on the protected side of the door unless fire egress requirements dictate that it should be located on the unprotected side of the door.
- Door monitoring reed switches.

The designer shall liaise with the fire engineer to identify the requirement (if any) for access-controlled fire egress doors to be automatically unlocked on fire alarm.

Electromagnetic locks
Generally, electronic door locks shall be of the electromagnetic (maglock) type except where door swing and/or construction prohibits the use or mounting of maglocks. In such cases, mortice locks shall be utilised.

All electromagnetic door locks shall be provided with bond sensing and be of the fail-safe type with a minimum electromagnetic holding force of 500kg.

Locks shall always be mounted on the secure/interior side of the door. L or Z brackets shall be provided and installed as necessary to facilitate this requirement.

Proximity card readers
All card readers shall be of weatherproof and vandal-resistant construction suitable for use both indoors and outdoors.

Readers shall generally be of the prox only type unless prox + pin is specifically required.

Proximity cards
Proximity cards shall be of the 4K smart card proximity type universally available from multiple vendors with a site facility code unique to CIAL complete with a hole at one end suitable for the attaching of pocket clips or pendants.

Emergency breakglass switches
Emergency breakglass switches shall be flush mounted where possible and shall be white in colour with a green label engraved "EMERGENCY DOOR RELEASE". They shall be of a true breakglass type.

Switches shall be three pole with one pole of the switch breaking the lock power circuit, the second pole will be wired to a monitored circuit indicating an emergency egress switch has been triggered and the door is not secure and the third pole shall initiate a local buzzer.

Request to exit push buttons
Request to exit push buttons shall be provided on white flush plates. Push buttons shall be green in colour. Flush plates are to be engraved "PRESS TO EXIT".

Reed switches
Door monitoring shall be provided by door reed switches at all access-controlled doors.

Door monitoring reed switches shall be individually connected into the access control system and monitored 24 hours per day.

Where reed switches are to be fitted to roller grilles/doors, they shall be heavy-duty floor-mounted switches in aluminium die-cast enclosures with armoured stainless steel protected tails. Two reed switches shall be fitted to the secure side of each door, one at each side of the door. The switches shall be connected in series, with terminations carried out in steel junction boxes mounted at a minimum of 300mm above floor level.

6.8.7.3.2

Alarm monitoring

Passive infrared sensors
Sensors shall be suitable for the installed application in each area and shall be fitted with a site-adjustable lens.

Each sensor shall have site-adjustable sensitivity and selective beam crossing choices for alarm activation.

Sensors shall similarly be located and selected to compensate for normal ambient temperature gain from machinery operation.

Each sensor shall be assignable as an individual zone and shall be cabled to facilitate the following functions:

- LED to be enabled/disabled via the security system. LED to be enabled during system set-up and subsequent walk tests. LED to be disabled under normal conditions.
- Tamper and anti-masking alarms to be monitored 24 hours per day by the security system.

Pin-pads
The pin-pads shall each allow partial and/or full setting of the system.

The pin-pads shall be capable of handling multiple access group codes.

The pin-pads shall incorporate an alpha-numeric display that identifies what is happening when used.

Internal and external alarms
The designer shall assess the need for internal piezoelectric sounders and external satellite sounder/strobes.

Both sounders and sounder strobes are to be activated in the event of an after-hours alarm activation.

Plant alarms
The design shall assess the need for plant alarms requiring remote monitoring and allow to provide a connection to the plant as necessary.

The plant alarms are to be monitored 24 hours per day.

Safe alarm
The designer shall liaise with the tenant, and where a safe is to be installed within the tenancy, consideration shall be given to the following:

- Seismic detector within the safe door.
- Reed switch to monitor the safe door.

The equipment shall be connected to the alarm panel as individual zone inputs and assigned to a safe area.

Duress alarms
Where duress alarms are required, they shall generally comprise of:

- duress alarm switches located throughout the premises and generally mounted out of public view in such a position as to be readily accessible to staff
- CCTV system NVR interface.

The duress alarms shall be monitored 24 hours per day and shall be silent (i.e. they shall not activate the local audible alarms).

Duress code
Consideration shall be given to programming the security system so that entering of a four-digit duress code at any of the pin pads:

- unsets the system
- sends an alarm signal to the Police via the remote monitoring company
- sends a signal to the CCTV system NVR to record the images from all cameras live.

Remote monitoring
Connection shall be provided from the security system to a remote monitoring company (e.g. Code 9 Ltd). This shall be set up with primary and secondary back-up connections, one of which shall be via GSM engine.

The alarms that shall be reported as a minimum are:

- intruder detection
- plant alarms
- safe alarms
- mains fail
- forced entry
- battery fail
- tamper alarm on pin-pads, card readers and PIRs
- duress alarms.

Selected alarms shall be programmed to provide text messages on nominated cell phones as directed by the tenant.

6.8.7.3.3
Intercoms

The designer shall assess the requirement for any intercom system within the development.

The intercom system shall generally include:

- power supply unit
- interface to access-controlled doors
- master station(s)
- chime located with the master station
- door station(s)
- all cabling necessary to interconnect the above.

6.8.7.3.4
CCTV

The designer shall assess the requirement for a CCTV system within the development.

The CCTV system shall generally include:

- network video recorder (NVR)
- IP cameras
- monitors and NUCs
- network switches supplied by the client
- software to view images from PCs
- interfaces with other systems (e.g. access control and alarm system).

The NVR shall be set up to provide a minimum of 30 days' archive of camera images.

6.8.7.4
Labelling

Labels shall be provided for all equipment, panels and cabling in accordance with section 6.8.3.

These labels shall consist of black lettering (4mm) on a white background, directly adhered to equipment and permanently fixed to panels.

6.9 DOCUMENTATION

Compliance and as-built documentation shall be provided to CIAL as outlined below:

- As-built drawings of electrical, communications and security services in .dwg and .pdf format, including a schematic drawing of the 400/240V electrical system.
- As-built drawings of electrical, communications and security services seismic restraint.
- Electrical contractor's PS3.
- Security contractor's PS3.
- Seismic restraint designer's PS1 and PS4.
- Electrical consultant's PS1 and PS4.
- Electrical certificate of compliance.
- Electrical safety certificate.
- Operation and maintenance manual (hard cover, A4 ringbound, typed and sectionalised, plus pdf) containing as a minimum:
  - contents page
  - introduction, including a list of contact details of consultants and contractors used (with identification of the applicable responsibility areas) and a description of the building and its use
  - detailed description of installed systems and controls and the operation of the systems
  - schedules of all plant and equipment installed
  - manufacturers' data for all plant and equipment installed
  - commissioning data for all plant and equipment
  - planned preventative maintenance instructions for each system
  - fault-finding procedures
  - final review shop drawings
  - schedule of luminaires, distribution boards etc.
  - test records (including switchboards)
  - copies of all guarantees properly executed
  - system performance guarantee
  - copy of the certificate of compliance
  - hazardous area electrical certificates.
- CIAL asset register to be updated.
- CIAL maintenance register to be updated.

6.10
APPROVED EQUIPMENT AND MATERIALS LIST

Required: As specified. Any alternative products will only be accepted if authorised by the engineer in writing. If an alternative product is intended to be offered, the cost difference (compared to the required product) along with full specifications for the alternative product shall be provided in the request for acceptance of the alternative.

Preferred: This product is preferred unless there is an unreasonable premium to pay. If an alternative product is offered, the cost difference for the preferred product shall be provided in the request for acceptance of the alternative. The preferred product indicates an acceptable standard of equipment.

Flexible: Indicates the standard of the device to be supplied but not necessarily the exact type.

Table 6.8: Approved equipment and materials list

EQUIPMENT	MANUFACTURER/ SUPPLIER	MODEL	COMMENTS
ACBs	Westinghouse	POW-R (SPB-65 minimum)	Flexible
	Schneider	Masterpact (H1 minimum)	Flexible
MCCBs	Schneider	Compact (NSX series up to 630A) – current limiting	Flexible
MCBs	Schneider	5 -63 Amp Multi 9 C32/63L (10kA rating) "C" Curve	Flexible
RCDs	Schneider	Multi 9 (10kA, 30mA)	Flexible
Electrical fittings	HPM	Excel	Flexible
	Clipsal	C2000	Flexible
	PDL	600 Series	Flexible
	Vynco	Logix	Flexible
Flush boxes		Screw fix type	Required
Fuse switches	Siemens	3KL/3KM	Flexible
Cable markers	Grafoplast		Flexible
ACBs	Westinghouse	POW-R (SPB-65 minimum)	Flexible
	Schneider	Masterpact (H1 minimum)	Flexible
MCCBs	Schneider	Compact (NSX series up to 630A) – current limiting	Flexible
MCBs	Schneider	5 -63 Amp Multi 9 C32/63L (10kA rating) "C" Curve	Flexible
RCDs	Schneider	Multi 9 (10kA, 30mA)	Flexible

EQUIPMENT	MANUFACTURER/ SUPPLIER	MODEL	COMMENTS
Electrical fittings	HPM	Excel	Flexible
	Clipsal	C2000	Flexible
	PDL	600 Series	Flexible
	Vynco	Logix	Flexible
Flush boxes		Screw fix type	Required
Fuse switches	Siemens	3KL/3KM	Flexible
Cable markers	Grafoplast		Flexible
Weatherproof fittings	Schneider	PDL 56 Series	Flexible
	Clipsal	Xtreme	Flexible
	HPM	Quantum	Flexible
Conduit		High-impact PVC	Required
Control cables	Carol	Min 22AWG	Flexible
	Beleden	Min 22AWG	Flexible
Flexible conduit	Betaflex	Grey	Flexible
Slotted trunking	Betaduct		Flexible
Trunking	Unistrut	Colour selected powder coat	Flexible
	Vynco	150/50	Flexible
Light poles	Spunlite Poles		Preferred
Power factor correction	Schneider	Static VAr	Preferred
	Power Electronics	Static VAr	Preferred
	NHP	Static VAr	Preferred
Emergency lighting		Lithium nanophosphate battery	Preferred
		Lithium iron phosphate battery	Flexible
Cable ladder	Unistrut	NEMA 12B	Preferred
	Multistrut	NEMA 12B	Preferred
Cable tray	Unistrut	LT series	Preferred
	Multistrut	MT series	Preferred

6.11
ELECTRICAL, COMMUNICATIONS AND SECURITY COMPLIANCE CHECKLIST

PROJECT NAME: **DATE:**

SUBMITTED BY: **STAGE:**

SECTION 6.0 ELECTRICAL, COMMUNICATIONS AND SECURITY DESIGN GUIDELINES

1.0	**GENERAL DESIGN GUIDELINE**	Compliant	Non-Compliant	Not Applicable	Comments
	All Clauses	☐	☐	☐	
6.0	**ELECTRICAL, COMMUNICATIONS AND SECURITY DESIGN GUIDELINES**				
6.1	Introduction	☐	☐	☐	
6.2	Environmentally sustainable design practices	☐	☐	☐	
6.3	Codes and standards	☐	☐	☐	
6.4	Health and safety by design	☐	☐	☐	
6.5	Earthquake protection and seismic restraint	☐	☐	☐	
6.6	Approved contractors	☐	☐	☐	
6.7	Design conditions and requirements	☐	☐	☐	
6.7.1	Documentation level	☐	☐	☐	
6.7.2	Coordination with design team	☐	☐	☐	
6.7.3	Future flexibility	☐	☐	☐	
6.7.3.1	Spare capacity	☐	☐	☐	
6.7.3.2	Electric vehicle (EV) charging	☐	☐	☐	
6.7.3.3	Renewable energy generation systems	☐	☐	☐	
6.7.3.4	Battery storage	☐	☐	☐	
6.7.4	Utility supply points	☐	☐	☐	
6.7.4.1	Orion	☐	☐	☐	
6.7.4.2	Generation	☐	☐	☐	
6.7.4.3	Enable	☐	☐	☐	
6.7.5	Mustang Park Landfill Gas	☐	☐	☐	
6.7.6	Redundant services	☐	☐	☐	

		Compliant	Non-Compliant	Not Applicable	Comments
6.7.7	Labelling	☐	☐	☐	
6.7.8	Electrical systems	☐	☐	☐	
6.7.8.1	Product selection	☐	☐	☐	
6.7.8.2	Metering	☐	☐	☐	
6.7.8.3	Lighting	☐	☐	☐	
6.7.8.3.1	Performance	☐	☐	☐	
6.7.8.3.2	Internal lighting	☐	☐	☐	
6.7.8.3.3	Lighting controls	☐	☐	☐	
6.7.8.3.4	Emergency lighting and exit signage	☐	☐	☐	
6.7.9	Communications	☐	☐	☐	
6.7.9.1	Performance	☐	☐	☐	
6.7.10	Security and CCTV	☐	☐	☐	
6.8	Systems and components	☐	☐	☐	
6.8.1	Buried services	☐	☐	☐	
6.8.1.1	Manholes	☐	☐	☐	
6.8.2	Segregation of services	☐	☐	☐	
6.8.3	Labelling	☐	☐	☐	
6.8.4	Cabling	☐	☐	☐	
6.8.4.1	Mains and submain cabling	☐	☐	☐	
6.8.4.2	Subcircuit cabling	☐	☐	☐	
6.8.4.3	Cable types and colour coding	☐	☐	☐	
6.8.4.4	Jointing and terminations	☐	☐	☐	
6.8.4.5	Cable supports	☐	☐	☐	
6.8.4.5.1	General	☐	☐	☐	
6.8.4.5.2	System support	☐	☐	☐	
6.8.4.5.3	Cable ladders	☐	☐	☐	
6.8.4.5.4	Cable tray	☐	☐	☐	
6.8.4.5.5	Trunking	☐	☐	☐	
6.8.4.5.6	Catenary wires	☐	☐	☐	
6.8.4.5.7	Conduits	☐	☐	☐	
6.8.4.5.8	Ducts	☐	☐	☐	
6.8.4.6	Clamping and tying of cables	☐	☐	☐	
6.8.4.7	Penetrations, access and sealing	☐	☐	☐	
6.8.5	Electrical systems	☐	☐	☐	
6.8.5.1	Switchboards	☐	☐	☐	
6.8.5.1.1	Electrical system parameters	☐	☐	☐	
6.8.5.1.2	Construction	☐	☐	☐	
6.8.5.1.3	Location	☐	☐	☐	
6.8.5.1.4	Cable terminations	☐	☐	☐	

		Compliant	Non-Compliant	Not Applicable	Comments
6.8.5.1.5	Busbars	☐	☐	☐	
6.8.5.1.6	Components	☐	☐	☐	
6.8.5.1.7	Metering	☐	☐	☐	
6.8.5.1.8	Power monitoring	☐	☐	☐	
6.8.5.1.9	Surge protection	☐	☐	☐	
6.8.5.1.10	Power factor correction	☐	☐	☐	
6.8.5.1.11	Harmonic filtering	☐	☐	☐	
6.8.5.1.12	Labelling	☐	☐	☐	
6.8.5.1.13	Testing	☐	☐	☐	
6.8.5.1.14	Fire Protection	☐	☐	☐	
6.8.5.2	Fittings	☐	☐	☐	
6.8.5.2.1	Fixed wired connections	☐	☐	☐	
6.8.5.2.2	Flush boxes	☐	☐	☐	
6.8.5.3	Lighting	☐	☐	☐	
6.8.5.3.1	Performance	☐	☐	☐	
6.8.5.3.2	Internal lighting	☐	☐	☐	
6.8.5.3.3	External lighting	☐	☐	☐	
6.8.5.3.4	Street lighting	☐	☐	☐	
6.8.5.3.5	Lighting controls	☐	☐	☐	
6.8.5.3.6	Emergency lighting and exit signage	☐	☐	☐	
6.8.5.4	Earthing	☐	☐	☐	
6.8.5.4.1	General earthing	☐	☐	☐	
6.8.5.4.2	Equipotential bonding	☐	☐	☐	
6.8.5.4.3	Silent earthing	☐	☐	☐	
6.8.6	Communications	☐	☐	☐	
6.8.6.1	Distribution frames	☐	☐	☐	
6.8.6.2	Horizontal cabling	☐	☐	☐	
6.8.6.3	Outlets	☐	☐	☐	
6.8.6.4	Labelling	☐	☐	☐	
6.8.7	Security and CCTV	☐	☐	☐	
6.8.7.1	Alarm panels	☐	☐	☐	
6.8.7.2	Cabling	☐	☐	☐	
6.8.7.3	Equipment	☐	☐	☐	
6.8.7.3.1	Access control	☐	☐	☐	
6.8.7.3.2	Alarm monitoring	☐	☐	☐	
6.8.7.3.3	Intercoms	☐	☐	☐	
6.8.7.3.4	CCTV	☐	☐	☐	
6.8.7.4	Labelling	☐	☐	☐	
6.9	Documentation	☐	☐	☐	
6.10	Approved equipment and materials list	☐	☐	☐	