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Invercargill Central
Zone 1 – DS Anchor & Childcare Centre
33 Esk Street
Invercargill
Electrical Services Installation

Consent Issue
October 2019
Reference: CS18007-1

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SECTION 1

CONTRACTUAL REQUIREMENTS

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SECTION 1

CONTRACTUAL REQUIREMENTS

This Section, section one, details the Preliminary and General requirements associated with the Electrical Services Installation.

1.1 SCOPE OF WORK

The scope of work, required by this specification, is the trade general requirements for the supply, delivery, assembly, installation, and commissioning of the materials required, and the work necessary for a complete working installation, as set out in the drawings and this specification, of the electrical systems that form part of this contract.

1.2 PRELIMINARY

The successful tenderer is required to enter into a sub-contract agreement with the Main Contractor and will be expected to comply with all standard conditions related to the performance and co-operation of all Electrical Contractors.

The specification shall be read in conjunction with all other relevant contract documents. These shall include, but not necessarily be limited to, the following:

- P & G Clauses
- Special Conditions of Contract
- General Conditions of Contract
- Construction Programme
- Architectural Drawings
- Structural Drawings
- Mechanical Drawings

Examination of the Architectural, Structural and Mechanical drawings is necessary to ensure full allowance is made for all required coordination works, penetrations, conduiting, cable access, in slab services, etc

Tender price shall include all allowances to ensure that the staging and completion dates, as detailed within the Construction Programme, are met.

All tenderers must hold current membership of the Electrical Contractors Association of New Zealand (ECANZ).

The Electrical Contractor shall observe and comply with such provisions of the Main Contract as are relevant to the sub-contract works, including the Preliminary, General and special Conditions of Contract.

1.3 STANDARD DOCUMENTS

The work carried out by the Electrical Contractor must comply with the following:

- The Building Consent and NZ Building Code requirements

- Current issue of relevant NZ and overseas standards.
- Health and Safety in Employment Act.
- The Main Contractors and Principles site specific Health and Safety Policy/Plan.
- The relevant Acts governing installation of the sub-contract works in this class of building.
- Territorial Authority requirements.
- The requirements of the Chief Inspectors of the relevant Statutory Authorities.
- New Zealand Electricity Safety Regulations 2010 and 2012 Amendments.
- New Zealand Electrical Wiring Rules (AS/NZS 3000) and associated Codes of Practice.
- Any other regulations / code of practices that apply directly or indirectly to installations of this type.

All standards and regulations related to this installation shall be the latest issue including all amendments.

Nothing within this specification or on the drawings is to be interpreted to permit sub-standard materials or allow workmanship of a standard inferior to that required by the regulations and standards.

As a minimum the works shall be constructed to comply with the requirements of the New Zealand Building Code and/or the stated Acceptable Solutions. In the event that the Contract Documents exceed the requirements of the New Zealand Building Code and/or the stated Acceptable Solutions, the requirements of the Contract Documents shall apply.

1.4 INSURANCES

Provide all statutory insurances and all insurances detailed in the Contract Documents, as applicable and appropriate to the work.

1.5 ROYALTIES PATENT RIGHTS AND FEES

All payments for royalties, patent rights and fees due or payable for or in connection with any matter or thing used or required to be used in performance of the Sub-Contract or to be supplied under the Sub-Contract whether payable in one sum or by instalments or otherwise, whether payable in New Zealand or elsewhere, shall be included in the Sub-Contract Amount and shall be paid by the Electrical Contractor to those to whom such payments may be due or payable.

The Electrical Contractor shall indemnify the Main Contractor against any action, claim or demand, cost or expense arising from or incurred by reason of any infringement or alleged infringement of letters, patent, design, trade marks or name, copyright or other protected rights in respect of any machine, equipment, work, materials, system or method of using, fixing, working or arrangement used or fixed or supplied by the Electrical Contractor.

The indemnity shall not cover any use of the Sub-Contract Works or any part thereof otherwise than in accordance with the Sub-Contract.

In the event of any claim being made or action brought against the Main Contractor in respect of any matters covered by the indemnity, the Electrical Contractor shall be immediately notified thereof and they shall, with the assistance they may require of the Main Contractor, but at the sole expense of the Electrical Contractor, conduct all negotiations or litigation without making any admission which might be prejudicial thereto.

Should any requirements of the Specification result in the infringement of letters, patent, design, trade mark or name, copyright or other protected rights in respect of any item, the Electrical Contractor shall refer the matter in writing to the Main Contractor who shall inform the Project Manager. If after having been so advised the Main Contractor insists upon the item the Electrical Contractor shall not be held to indemnify the Contractor. In the event of the Electrical Contractor failing to obtain such instructions from the Main Contractor, the requirements of this clause will remain valid and the Electrical Contractor shall bear full responsibility.

1.6 HEALTH AND SAFETY

Allow to carry out the responsibility required within the terms of the Health and Safety in Employment Act. Allow to obtain a copy of the Main Contractor's and the Principal's Health and Safety Policies upon notice of commencement of works. Take all reasonable steps on the site to ensure the safety of all concerned and to exclude all unauthorised personnel.

1.7 SITE INSPECTION

Tenderers shall inspect the site before submission of the tender. No claims will be considered through lack of knowledge of the site or documents.

Submission of tender will be taken as confirmation that a site inspection was completed and all existing conditions have been allowed for.

1.8 PROGRAMME

Within seven days after the signing of a Sub-Contract Agreement or within seven days of notification of award of Sub-Contract, whichever is the shorter period, and prior to commencement of any manufacture, the Electrical Contractor shall submit for approval two copies of a programme of the Sub-Contract works. This programme shall show the sequence of operation intended for ordering of equipment, manufacturing and installation and shall show the dates for commencement and completion of each major activity in both sections of operation as further specified in the following sections. This schedule shall be prepared in collaboration with the Main Contractor to suit the Main Contractor's programme.

The works programme shall allow for providing attendance on site to support the Main Contractor's programme. The Electrical Contractor shall determine what restrictions if any are placed on the time of work by local authorities or others and shall comply with these conditions.

The Electrical Contractor shall be responsible for informing the Main Contractor when any cause arises that may affect the Works programme and to liaise with the Main Contractor accordingly.

The Electrical Contractor shall work within the Works Programme and shall carry all tasks necessary or desirable to complete the Sub-Contract Works or section of the Sub-Contract Works so as to maintain the Works Programme subject to approved extensions of time.

Once a Works Programme has been established for the Sub-Contract Works and provided that the Main Contractor does not prevent the Electrical Contractor from maintaining the schedule then the Electrical Contractor shall work as necessary to complete the Sub-Contract Works in accordance with the Works Programme. All dates and periods shall be subject to adjustment to meet the Works Programme without increase in the Sub-Contract amount.

The Electrical Contractor shall update the Works Programme when requested in writing by the Main Contractor and present the revised Programme acceptable to the Main Contractor within two days of such request.

The Electrical Contractor shall ensure that sufficient experienced trades people are on site to enable completion in accordance with the Works Programme.

1.9 DRAWINGS AND SPECIFICATIONS

Drawings and Specification shall be read together as they mutually explain the intent of the required works. Clarify any doubtful items with the Engineer prior to submitting tender.

Any items included on the drawings but not within the specification, or vice versa, shall be deemed to be included.

Unless specifically stated otherwise the drawings shall be deemed to be diagrammatic and approximate only. Items partially shown on such or briefly described in this specification and which are clearly intended to be included or are obviously necessary or intended/required by trade practice for the satisfactory completion of the Sub-Contract Works shall be provided and installed unless specifically excluded.

The Electrical Contractor shall provide all minor parts, which are necessary for the completion of the work, or to meet the requirements of any statutory authority having jurisdiction over the Sub-Contract Works.

The Plans and Specifications shall remain the property of the consultant and shall not be used for any purpose other than for this project.

When a revised edition of any document is issued it is the Electrical Contractor's responsibility to ensure that all previous issues are recalled and destroyed or unmistakably marked CANCELLED. Errors arising from use of out of date information shall be the responsibility of the Electrical Contractor.

It shall be the Electrical Contractor's responsibility to ensure that all materials and work are carried out in accordance with the latest issue of each specification and drawings.

The Electrical Contractor shall check all dimensions and verify on site before commencing construction drawings or ordering any labour or materials or fabricated work. Before any work is commenced all shop drawings shall be submitted to the Main Contractor for approval. The Electrical Contractor shall advise the Main Contractor in writing of any conflicting dimensions and proceed on their direction.

The Electrical Contractor shall check dimensions levels and templates as necessary and take responsibility for their accuracy.

1.10 ROLES, OBJECTIVES AND EXPECTATIONS

1.10.1 Consulting Engineer

During the construction phase the Consulting Engineer's role is:-

- Analysis of schedule of technical data and alternatives offered.
- Review of construction and shop drawings.
- Review of samples for the purpose of establishing compliance with the design intent.
- Periodic review of the progress of the works, noting any observations with respect to quality of the installation or materials used.
- Issue of any clarification instruction required to interpret the specification or drawings
- Issue of any variation instructions (to the Project Manager) requiring a change to the specification or drawings
- Inspect the works at Practical Completion and schedule any defective or incomplete items.
- Review "As Installed", and operating and maintenance documents.

1.10.2 Specification Objectives

The intent of this specification and the associated documents is: -

- To provide a basis for competitive tendering
- To allow competent contractors to price the works
- To provide a clear statement of contractual requirements against which compliance can be assessed.
- To provide documentation required by Authorities to demonstrate design compliance with statutory requirements.
- To provide documentation to demonstrate to the Client the scope and quality of the project
- To define the expectations upon the Electrical Contractor.
- To define the requirements of the Electrical Contractor with respect to Quality Assurance

1.10.3 Obligations of the Contractor

The Consulting Engineer expects and relies upon the tenderers' possessing specialist trade expertise necessary to complete the works.
In addition, the tenderer has the following obligations: -

- To raise in good time, issues requiring design input or clarification particularly in respect to: -
  - Interpretation of the specification or drawings
  - Problems in complying with the specification
  - Omissions from the tender documents
  - Suggested alternatives/substitutions
- To allow the design verification costs by the Consulting Engineer when suggesting alternatives and departures from the specification.

- To certify compliance with contract documents, including all variation instructions, at Practical Completion.
- To certify compliance with Authority requirements
- To pay all fees
- To obtain all Authority permits and certificates in a timely manner to allow the progress of the work.
- To implement procedures to ensure only competent trades people are used for the works.
- To contribute, in the spirit of partnering, towards the successful execution of the contract
- To fully understand the role of all relevant parties during the construction phase of the project and to assist them in the conduct of their duties wherever possible.
- To provide manufacturer's and construction drawings
- To provide samples and prototypes

1.10.4 Contractors Design Responsibilities

The Contractor shall be responsible for the detailed design activities listed below, in addition to those activities normally undertaken through the custom and practice of the industry.

The Contractor shall be responsible for ensuring that the detailed design, which is undertaken, is fully co-ordinated and compatible with the remainder of the project design. The Contractor's design obligation shall include:

- Interface details with other trades.
- Size and location of penetrations in walls, floors and ceilings.
- Physical coordination of installation with other trades.
- Obtain electrical loads from other trades and compare with design load cables sizes and circuit protection devices, seeking design direction where discrepancies occur.
- Coordination of the construction of the installation.
- Bracket and supports - detailed design and locations.
- Details of Electrical wiring diagrams of all equipment supplied by the Contractor showing all interconnections between equipment to enable the necessary wiring to be undertaken.
- Capacity, location and design of electrical conduit system, similarly trunking where used in lieu of multi-conduit installation.
- Capacity, location and design of cable support systems, cable tray, catenary cables, etc.
- Accommodate thermal expansion, seismic and construction joint movement in all services taking into account final installation details and consistency with specified requirements.
- Sub-circuit cable sizing and installation details, taking into account derating factors and site conditions/routing.

- Settings for protection equipment, time delays, time switches, etc.
- Detailed design of earthing and bonding requirements for electrical engineering services, hydraulic and mechanical engineering services, architectural and structural elements requiring earthing and bonding.
- Detailed design of ceiling and infloor heating systems, including determining exact number and size of heating elements required (if applicable)
- Detailed design of Telecommunications Cabling System (if applicable)
- Detailed design of Call Assistance System (if applicable)
- Detailed design of MATV System (if applicable)
- Detailed design of Intercom System (if applicable)
- Detailed design of Security System (if applicable)
- Detailed design of the Background Music / PA / AV Systems (if applicable)

1.11 RESPONSIBILITY OF ELECTRICAL CONTRACTORS

It will be deemed that the Electrical Contractor before signing the Sub-Contract has investigated and satisfied themselves of everything and every condition affecting the Sub-Contract Works, the labour and materials to be provided and all contract details. The execution of this Sub-Contract by the Electrical Contractor is founded upon their own examination, knowledge, information and judgement. The Electrical Contractor as full compensation shall accept the Sub-Contract Amount for everything furnished and finished complete and for all loss or damage arising out of the difficulties in the execution of the work.

The Electrical Contractor shall be wholly responsible for all work and materials included in the Sub-Contract Works including items of a particular proprietary brand not manufactured by the Electrical Contractor but supplied by them at the Main Contractor's request or nominated in Sub-Contract documents.

The Electrical Contractor shall be wholly responsible to the Main Contractor for the Sub-Contract Works from the time of signing the Sub-Contract Agreement until the completion of the works and shall include workmanship, materials, discipline and any damages or omissions caused by acts of his employees, servants and agents.

Where the Main Contractor has instructed the Electrical Contractor to use such particular materials or equipment the Electrical Contractor may advise the Main Contractor in writing at the time of receipt of such instructions that they are not prepared to include such materials or equipment within the responsibility referred to herein and the reasons for non-inclusion. If the Main Contractor instructs that non-preferred items are to be included they shall only be entitled in respect to the supply of such materials or equipment, to the benefit of any guarantees given to the Electrical Contractor, in respect thereof, by the manufacturer or supplier.

The Electrical Contractor shall be responsible for making good at their expense any damage to services, fencing, piping, paths, roadways, kerbs and guttering or any adjoining property which may be disturbed and/or damaged due to the execution of the Sub-Contract Works. Any necessary repairs shall be carried out promptly to approval.

1.12 DAMAGE TO WORKS AND PROPERTY

The Electrical Contractor shall be liable for any damage caused by their equipment or material while under their control or that of their servants or by any act or omission arising from his negligence.

Such liability shall extend to the completion of the Maintenance and/or Defects Liability Period and any extensions thereof.

1.13 BUILDER'S WORK

Identify the need for builders work associated with this trade and include for the execution of this work. This includes excavation, structural penetrations, floor or wall chases, access conduits in pre cast panels, recessed boxes, cast bases for machinery, framing (luminaires etc), drawings and timber work necessary for the support or enclosure of all equipment and cabling.

Confirm in conjunction with all relevant trades, the suitability and compatibility of all items being supplied or installed, such as excavation, structural penetrations, ducting, plant and equipment location and mounting.

All penetrations required for the installation of the electrical services, including penetrations through floor slabs, concrete walls, block work, GIB lining, etc., are the responsibility of the Electrical Contractor. This includes the formation of all penetrations for recessed luminaries.

Approval must be gained prior to formation of all penetrations. Boring and notching, which may weaken framing members, will not be permitted.

Ensure all penetrations are correctly sized and that the penetrations are formed at the correct stage of the contract works.

Ensure that all building work is carried out in accordance with the relevant sections of the specification.

Fire, noise rating and waterproofing must be maintained after making good. The Electrical Contractor is responsible for filling and sealing around cables and ducts.

1.14 PROJECT STAFF

Experienced registered trades persons shall carry out the installation to the highest standard. A competent person (supervisor) shall be in charge of the electrical works who shall be familiar with the progress and all aspects of the work and through whom all instructions, explanations etc can pass.

A competent foreman responsible for the day-to-day activities and approved by the Main Contractor shall be employed continuously on the Sub-Contract Works. The Supervisor and foreman shall be empowered to receive instructions from the Main Contractor. The Electrical Contractor shall ensure as far as possible that the same staff stay on the job from the day of possession to the day of completion of the Sub-Contract Works.

The foreman shall on reasonable request of the Main Contractor dismiss from the Sub-Contract Works any person employed therein by the Electrical Contractor who may be incompetent and/or misconduct themselves on the Site and such person shall not again be employed on the Sub-Contract Works without the permission of the Main Contractor.

1.15 QUALITY ASSURANCE

Provide a Quality Assurance plan in order to propose, establish, maintain, monitor and document a quality assurance system covering all aspects of the design, purchase, fabrication, installation and completion of the works. The plan shall be in accordance with ISO 9001 (as appropriate).

Designate a Project Quality Inspector to discharge the quality plan, which must include the following minimum:-

- Check all shop drawings for conformance to requirements prior to submission.
- Check equipment compliance schedule against the particular specification requirements and equipment schedules prior to submission.
- Check all samples for conformance to requirements prior to submission.
- Check all tests required for proper manufacturing of the equipment.
- Check all manufactured items for compliance prior to dispatch to site.
- Check installation of all items fixed under this specification.
- Check all materials, welding, joining, terminations, fixing and finishes.
- Check all on-site tests required to commission the works.
- Check operating and maintenance manuals to ensure they contain adequate information to permit systems to be operated by the Client at the end of defects liability period. (Including adequate training and tuition of the client's representative).

Submit the following documentation:-

- Quality System third party certification, if any, to the Standards specified by the Joint Accreditation System of Australia and New Zealand.
- Quality manual detailing, corporate Q.A. policy statement, system element description, register of procedures and project specific ITPs.

1.16 PROVISIONAL PRIME COST AND SIMILAR SUMS

Provisional, Prime Cost and Similar Sums shall be included in the Sub-Contract Amount; refer to the appendices for the sums/monetary allowances to be included.

Unless otherwise specified, such Sums shall be deemed to include supply, delivery, storage and installation of items of material together with any on or off site work covered by Provisional, Prime Cost and Similar Sums.

The Electrical Contractor will be notified of selected items of work and the price that will be paid for such and it shall be the Electrical Contractor's responsibility to place an order for the items of work, the order shall stipulate that the items of work shall be supplied or installed in accordance with the conditions that apply to this Sub-Contract. Failure to place an order in accordance with the conditions of the Sub-Contract shall not relieve the Electrical Contractor of any responsibility in this matter.

The Electrical Contractor shall not be entitled to any trade or other discount or rebate in respect of amounts due upon same except a discount for prompt payment.

Upon receipt of notification the Electrical Contractor shall order, take delivery and pay for such items of work selected and shall take full responsibility for such items of work from the time of taking possession until the Sub-Contract Works are taken over by the Principal.

Items of work provided under this clause shall be subject to the guarantees required for the whole Sub-Contract.

It shall be the Electrical Contractor's responsibility to advise the Main Contractor in sufficient time of the date when items covered by such Sums shall be required to be placed on site so that design, documentation, tendering, order, manufacture and delivery will comply with the Main Contract time requirements.

1.17 APPROVALS

Approval of drawings, samples, workmanship, methods or other matters pursuant to the Sub-Contract or in respect of the Sub-Contract Works shall not be deemed to waive or prejudicially affect any right of the Main Contractor or diminish the responsibility of the Electrical Contractor in respect of the Sub-Contract Works or to derogate from or affect any other requirements. No expression of approval or reasonable satisfaction shall be deemed acceptance of materials or workmanship not complying with this Sub-Contract nor shall it constitute an authority for any variation except when such variation is authorised as provided in the Contract.

1.18 INSPECTIONS

The Main Contractor and Engineer shall have access during normal working hours to factories, assembly shops, and storage areas of the Electrical Contractor for the purpose of inspection of any component intended for the Sub-Contract Works provided prior notice is given to the Electrical Contractor who shall retain the right to be present at such inspections.

This requirement shall also mean reasonable access to factories and assembly shops of suppliers and Electrical Contractors to the Electrical Contractor.

The Main Contractor and Engineer shall have access to the Sub-Contract Works at all times without notice and the Electrical Contractor shall co-operate by attending pre-arranged site inspections.

If the Specification, ordinances or authorities require any work to be specially tested, inspected or approved, then timely notice shall be given to the Main Contractor of its readiness for inspection. If any such work shall be covered without approval or consent, it must if required and at the Electrical Contractor's expense be uncovered for examination and recovered after approval.

The Engineer reserves the right to carry out inspections of the installation on completion of the first fix/pre-wire, it is the responsibility of the Electrical Contractor to notify the Engineer seven days prior to completion of the first fix/pre-wire and prior to the installation of wall linings and ceiling tiles or ceiling linings.

The Electrical Contractor shall advise the Engineer on completion of the installation of all cable support systems (conduit systems, cable tray systems, cable ladder systems and cable trunking systems) this notification shall be given prior to the installation of any cables within conduit or trunking systems or on the associated cable tray or ladder systems.

The Engineer must be given the opportunity carry out inspections of all sub-floor ducting and external cable trenching, it is the responsibility of the Electrical Contractor to notify the

Engineer seven days prior to the laying of floor slabs or the back filling of trenches this notification shall be given prior to the installation of any cables within the ducting or trenching.

The Electrical Contractor shall provide sufficient safe and proper facilities at all times for inspection of work. No inspection will be carried out on weekends or public holidays unless by arrangements with the Electrical Contractor who shall pay the additional cost of these inspections if they have been made necessary by the Electrical Contractor.

1.19 CO-ORDINATION AND LIAISON

Allow to co-ordinate and liaise with other Trades to determine the most practical method of installation and connection to equipment supplied by them.

The Main Contractor shall be responsible for co-ordination of the installation of the ceiling and the installation and commissioning of the services located above, below and within the ceilings and floors.

The co-ordination shall be such as to ensure that all services within false ceilings and walls are completely installed so that it will not be necessary to remove any ceiling tiles sections or panels to finish any other work, or to test, commission or adjust the installed systems.

Allow to liaise with specialist equipment suppliers to determine suitable connection methods and confirm actual ratings and connection requirements before delivery to site.

The Main Contractor will be solely responsible for supervising the coordination of all trades and Sub-contracts and for settling disputes between trades.

The Electrical Contractor shall cooperate and coordinate with other trades in all areas to conform to the building construction programme as directed by the Main Contractor, each shall wait upon and assist the others.

The Electrical Contractor shall accept the authority of the Main Contractor in all matters in connection with site performance and shall work in areas and in the sequence, as directed.

1.20 SUBMITTAL REQUIREMENTS

Within the period given below, the Electrical Contractor shall prepare submittals for review by the Architect and / or Engineer for the information as indicated.

This review relates to general principle of design only. If errors, omission and interference's are noticed, bring same to the Engineer's attention. Review of drawings will not in any way relieve the Electrical Contractor from responsibility of such errors or omissions and interference or from the necessity of furnishing such workmanship or materials as may be required for the completion of these Works in accordance with the Specification.

In no way is this review by the Architect and / or Engineer to be construed as a check that the submissions are detailed correctly, contain the necessary co-ordination with other work, are necessarily complete in all aspects, or that they allow ease of installation.

If any comments are made on the above items they are without prejudice and are provided for the Electrical Contractors assistance.

<u>Submissions Required at Tender</u>

- A signed Statement of Compliance with the provisions of the Specification indicating details all areas of non-compliance.

- Full details of any alternative materials or construction techniques proposed. Details to include construction, capacities and performance characteristics.

Submissions Required for Review

- Construction Drawings: Refer `Construction Drawings and Equipment Data Submissions' clause.
- Shop Drawings of all Switchboards and control panels including layout and terminal numbering. Also include details of all proposed circuit breakers, fuse switches, isolators, starters, contactors, relays, etc.
- Any other items requested by the Architect and / or Engineer during the course of the Contract.

Manufacturer's original trade literature is acceptable for the above provided that the information particular to this project is clearly marked and provided that the information is complete. Photocopied trade literature is not acceptable.

- Details of any changes to the work as shown on the Drawings arising from the acceptance of an offered alternative as set out in the relevant clause of this Specification. Details to be drawn at the same scale as the Drawings and in accordance with the CONSTRUCTION DRAWING Clause of this Section.
- Schematic system diagrams where designs are part of the contract complete with terminal numbering to correspond with control panel/switchboard terminals.
- Completed Commissioning Check Lists and Commissioning Programme:
- Testing and Commissioning Results:

Complete copies of all commissioning test results shall be supplied to the Engineer correctly filled out and any other information as called for under the TESTING AND COMMISSIONING Section.

- Draft and Final Installation Manuals:
- "As-Built" Drawings:

Samples and Prototypes:

Samples of materials and items of equipment described as 'to be approved' or; which are intended for fixing in public areas or; are visible to the building occupants, shall be submitted to the Architect for approval at least eight weeks prior to being required on site for installation. Two samples shall be supplied of each item required, each one to be properly identified and marked with the suppliers name.

The Architect and / or Engineer will be at liberty at any time to test or analyse samples of any materials brought on to the site and intended for these Works.

Identification and Label Schedules:
Prior to any identification or labels being carried out, a complete schedule of all labels, depicting size, wording and materials shall be submitted to the Architect for approval.

Timing of Submissions

- Equipment Items: At least one week prior to ordering of equipment.
- Fabrication/Installation Details: One week prior to fabrication

- System Design Information: One week prior to the use of the design information.
- Commissioning Check Lists: Two weeks prior to commissioning
- Commissioning Programme: Two weeks prior to commissioning.
- Equipment installation and commissioning instructions shall be ordered with the equipment to be delivered with the equipment.
- Installation "As-Built" Drawings and Draft and Final Installation Manuals Refer appropriate specification section. Equipment operating and maintenance instructions shall be ordered with the equipment to be delivered with the equipment. Installation Manuals shall then be prepared and submitted, in draft, for approval no later than two weeks prior to the programmed start of commissioning. Manuals shall be approved in final form prior to Practical Completion and prior to Instruction of the Principals staff.

Submission and Approval Procedure

In addition to whatever copies are needed on-site for use by the Contractor, two copies of the Equipment Items, Fabrication/Installation Details, System Design Information, Blank Commissioning Check Lists and Draft Installation Manuals shall be submitted to the Architect for approval.

Where submissions are returned for amendment, such submissions shall be amended and a further two copies shall be resubmitted within sufficient time to prevent delay to the completion of the Works. Necessary re-submissions shall be made until such time as they are marked as satisfactory.

Neither failure to make these submissions on time nor any requirement by the Architect and / or Engineer calling for amendment to or resubmission, shall relieve the Contractor of his obligations under the terms of the Contract.

1.21 FINAL OR PRACTICAL COMPLETION

The Electrical Contractor shall, subject to the provisions hereof, finally complete each section of the Sub-Contract Works on or before the date of Final Completion for each section of the Sub-Contract Works set out in the Works Programme.

When in the opinion of the Electrical Contractor the Sub-Contract Works are finally completed the Electrical Contractor shall give written notice thereof to the Main Contractor.

Unless otherwise stated, the date of Final Completion shall coincide with that for the Main Contract.

Pursuant to the conditions of the provisions of Sub-Contract a Certificate of Final Completion will not be issued until:

- All parts of the Sub-Contract Works are ready for handing over to the Contractor.
- All services are tested and operating satisfactorily and approved by the Engineer and appropriate authorities. All test results must be submitted in the form of a written report.
- All painting and other finishes are completed to approval. All work included in the Contract is performed including such rectification as may be required to bring the Sub-Contract Works to approved standards.

- The completion of a 'producer statement' for the Main Contractor at the completion of the Works (Building Services) stating that it has been carried out in full accordance with the contract documents and the Building Consent and Building Code requirements.
- "As-Installed" drawings and operating manuals, brochures and instruction data as specified are supplied and approved.

If it is found that items that have been notified as being complete prove to be defective or otherwise unsatisfactory, to the extent of requiring an addition inspection, the Electrical Contractor shall pay for the costs of the re-inspection. This may include airfares, travel, accommodation, meals and incidental expenses.

1.22 PRODUCER STATEMENT

A "Producer Statement - Construction" shall be provided by the Contractor at the completion of the works stating that it has been carried out in full accordance with the contract documents and the Building Consent and Building Code requirements.

Electrical Contractor shall provide for the Main Contractor Producer Statements for their sections of the completed Works.

The Contractors PS3 Producer Statement shall include and cover the building code clauses indicated in the Electrical Engineers PS1 Producer Statement.

The Contractor shall note the requirement for the Electrical Engineer to review their PS3 prior to issuing of their PS4 Producer Statement.

In addition the Contractor shall also note that a site inspection of all works is required & that these works shall be satisfactorily completed prior to the issue of the Electrical Engineers PS4.

It is the Electrical Contractors responsibility to ensure that all works & producer statements are completed/issued prior to this inspection, ensuring sufficient time is provided for the Engineers inspections & review and in line with the Main Contractors program.

The Electrical Engineer **shall not** be held accountable where they are unable to issue their Producer Statement due to incomplete or late completion of Contractors works, for failure by the Contractor to provide sufficient time for the required inspections by the Electrical Engineer & therefore any subsequent contract penalties for failure by the Contractor to complete the project in line with the Main Contractors program.

The Contractor shall provide the following producer statements & information as a prerequisite for contract completion & code compliance:

- PS3 Construction (as above)
- PS1 & PS4 from a Structural Engineer for seismic restraints installed e.g. cable trays & support systems etc.
- A written statement confirming that all plant & equipment (not requiring a Structural Engineers design) has been seismically restrained as required for code compliance and in line with the electrical specification, e.g. luminaires, equipment cabinets, switchboards etc.
- PS1 & PS4 (if required) from a Structural Engineer for all external poles installed

At the completion of the works a Code Compliance Certificate is to be issued by the Territorial Authority. The furnishing of a Producer Statement prior to the application (by the owner or authorised agent) is necessary for the Territorial Authority to issue the Code Compliance Certificate.

Until the Code Compliance Certificate has been issued, no Final Completion Certificate will be issued, unless the non-issue of the Code Compliance Certificate is due to factors entirely removed from the Contractor's responsibility.

1.23 SAFETY DEVICES

All safety devices required by statutes, regulations or local authority bylaws, or those which are consistent with good trade practice, shall be fitted. These shall include, but not be limited to, such items as guards, cover plates, electrical-mechanical interlocks, isolators and warning notices etc.

All parts of the system shall "fail-to-safety" wherever practicable.

1.24 NOISE LEVELS

Excessive noise or vibration emanating from electrical items of equipment will be deemed to be a defect in that equipment and as such these defects shall be made good to the full satisfaction of the Engineer.

1.25 GUARANTEES AND WARRANTIES

The completed installation work defined within the scope of the contract shall be guaranteed for a period of twelve months against faulty components and workmanship from the date of Practical Completion, fair wear and tear accepted.

All faulty parts, including lamps, shall be replaced and the labour required shall be free of charge. The only items exempt from the twelve-month period are incandescent lamps, incandescent lamps shall be guaranteed for sixty days only.

Written guarantees and/or warranties shall be supplied with respect to all items of plant or equipment or the performance thereof or the performance of entire systems as required by the Sub-Contract.

Guarantees and/or warranties shall be in a form acceptable to the Main Contractor and shall be delivered to the Main Contractor on completion of the Sub-Contract Works. No guarantee and/or warranty shall be drafted in a form that shall relieve the Electrical Contractor of their responsibility in respect of the matters specified and covered by the guarantee and/or warranty.

Final payment will not be issued until this requirement has been fulfilled.

Guarantees and/or warranties shall state that workmanship, materials and installations are guaranteed for a period specified above, from the date of Certificate of Final Completion and that any defects that may arise during the Defects Liability Period shall be made good and any work in other trades resulting from such making good shall be done at the expense of the Electrical Contractor upon written notice from the Main Contractor to do so.

1.26 DEFECTS LIABILITY PERIOD

The Electrical Contractor shall warrant the whole of the Sub-Contract Works against defective workmanship and materials and against non-compliance of equipment of complete system with specified performance and operation for the Defects Liability Period.

The Defects Liability Period for Electrical Services Installations shall be twelve months. After the date of Final Completion, the Electrical Contractor shall be responsible for making good with all possible speed any defects arising from defective design materials or workmanship or from any act of the Electrical Contractor or his servants or agents that may develop in the work under the conditions provided for in the Sub-Contract and under proper use.

If during the currency of the Defects Liability Period any defects are not remedied within a reasonable time the Main Contractor may proceed to do the work or have it carried out at the Electrical Contractor's risk and expense but without prejudice to any other rights which the Main Contractor may have against the Electrical Contractor in respect of the failure of the Electrical Contractor to remedy such defects.

If the Electrical Contractor replaces or renews any portion of the Sub-Contract Works the provisions of this clause shall apply to the portion of the Sub-Contract Works so replaced until the expiration of the specified period from the date of such replacement or renewal.

If during the currency of the Defects Liability it becomes necessary to repair or replace a defective part and the repaired or replaced part causes damage to other portions of the Sub-Contract Works the Electrical Contractor's liability shall be the same as if the losses, damage or injury incurred thereby had occurred before any part of the Sub-Contract Works had been taken over.

If the replacement or renewals during the Defects Liability Period are of such a character as may affect the efficiency of the work or any portion thereof the Main Contractor may within one month of such replacement or renewal give to the Electrical Contractor notice in writing requiring that tests on completion be made in which case such tests shall be carried out as directed by the Main Contractor.

During the Defects Liability Period the Electrical Contractor shall be given the right of access at all reasonable working hours at their own risk and expense by him or his duly authorised representative whose names shall have been previously communicated in writing to the Contractor/Principle to all parts of the Sub-Contract Works for the purpose of inspecting the working thereof and to the records of the operation taking notes there from. Subject to approval which shall not be unreasonably withheld, the Electrical Contractor may at their own risk and expense make any tests which are considered desirable.

1.27 MAINTENANCE PERIOD

Routine maintenance and servicing shall be carried out for a period of twelve months from date of Completion to the end of the Maintenance and Defects Liability Period.

Routine maintenance shall be carried out by a monthly basis and emergency service shall be carried out on a twenty four hour call out basis.

The Maintenance Programmes shall fully comply with the following:-

- Shall fully comply with the requirements of the Maintenance Compliance Schedules issued under the Building Act, and clarified by the New Zealand Building Code.
  As part of the maintenance program the subcontractor should prepare detailed Maintenance Schedules to full compliance with the New Zealand Building Code.

- The maintenance carried out in accordance with the Compliance Schedules prepared as outlined above shall be certified by an Independent Qualified Person (IQP) as defined in the New Zealand Building Code. The Project Manager shall be advised of the proposed date and service programme for the last major visit not less than seven days prior to the date of the proposed visit so that a representative may be present to inspect the equipment records.
- Provide an emergency call out of service that shall:
- Be available and be able to be contacted by telephone twenty four hours per day, and seven days per week.
- Within twenty-four (24) hours of being notified of an incident/occurrence attend site and investigate the occurrence/systems failure, blockages, alarms, or fault of the installation.

Notify the Project Manager in writing about the circumstances surrounding each call out. Notification shall be forwarded on the first working day following the call out.

Replace and/or repair any malfunctioning equipment. Negotiate replacement costs associated with equipment malfunctioning due to blockages and/or vandalism with the Project Manager.

Cost call outs as a result of vandalism at current period contract rates - labour and material.

Provide a log sheet, detailing the labour and material costs used on each call out.

Pay out the total costs incurred at the end of the defects liability period.

Routine maintenance shall be deemed to be the regular maintenance of equipment and shall include not less than:

- Checking and replacement of faulty lamps, and accessories - every two months.
- Checking the operation of all electrical switchgear bi-annually.
- Checking the operation, setting and calibration of all controls, bi-annually.
- Checking of all submain cabling excessive temperature quarterly.
- Checking terminations throughout the building. At Completion and at Final Completion.
- Checking emergency and exit lighting system – as required by AS/NZS 2293.

Maintaining a dated record of servicing performed on each system in a servicing record book to be retained under the Proprietors control on site.

The last maintenance visit prior to the end of the Maintenance and Defects Liability Period shall be a major visit for complete service and shall include the following in addition to the above:

- Checking of all light fittings and replacement of all failed components.
- Cleaning of all light fittings.
- Checking the operation of all electrical switchgear including the testing of the operation of over-current relays and motor overloads.
- Checking of contact surfaces of all contactors, combined fused switches and circuit breakers (where possible).

- Checking of all main and submain cables for excessive temperature.
- Checking of all system safety controls.

At the conclusion of each maintenance visit, a check list of items serviced shall be completed, the service book shall be signed and checklist shall be submitted to a responsible person on site. Within seven days of the date of the service visit a report shall be forwarded together with a copy of the checklist to the approving authority.

The cost of maintenance during the Maintenance Period shall be included in the Sub-Contract Amount.

1.28 OPERATOR INSTRUCTION

Prior to handing over the completed installation, instruct the Operating Staff in the correct use of all equipment and systems

To assist with the instruction, supply a copy of the Operating Instructions as part of the Operations and Maintenance Manual.

Prior to the end of the Maintenance Period, Instruct the Maintenance Staff in the correct maintenance procedures of all equipment and systems.

1.29 HANDING OVER

The following procedure shall be adopted prior to handing over the installation:

- All preliminary testing, checking, adjusting and balancing of the installation shall be carried out before forwarding notification that the installation is considered to have reached Completion.
- After inspection, and when the Engineer are satisfied and agree that the installation is ready for handing over to the Client, the installation shall be finally commissioned and Installation Manuals together with Installation Drawings shall be provided as specified.

Completion will be certified only after the plant has been inspected and approved and the above requirements fulfilled.

Also prior to Handing Over ensure all rubbish, packing, tools and other items used in carrying out the installation, but no longer required, are removed. All items of electrical equipment forming part of the installation shall be left clean and immaculate.

1.30 CONSTRUCTION DRAWINGS AND EQUIPMENT DATA SUBMISSIONS

Construction Drawings

Two copies of all Construction Drawings from which the subject works shall be built shall be prepared and submitted for review before commencing manufacture or installation. The standard of drawing production shall be to NZS 5902.

Construction Drawings shall be prepared which are generally in accordance with the Drawings supplied with the Specification. All Construction Drawings shall be fully co-ordinated with other trades.

Construction Drawings shall cover but not be limited to, the following parts of the work.

- All structural penetrations, including full dimensions to enable block-out and sleeve placement.
- Details of erection of major plant items indicating supports, anchoring, expansion fixings etc.
- Cable tray and duct runs and details of proposed installation.
- Fabrication drawings of all non-standard equipment including lighting fittings
- Plant layouts including full manufacturing details of built up or site constructed items of plant. (Detailed drawings of proprietary items of plant are not required).
- Automatic control schematics
- Electrical schematics and switchboard layouts, including switchboard-labelling details.
- Electrical and Communication services reticulation systems.

Construction Drawings shall contain reference to all Builders work and work required by other trades, such as plinth dimensions, drain positions, penetrations, electrical termination's and the like, to enable the Contractor to co-ordinate these requirements with the trades concerned.

Construction Drawings and Equipment Data submitted to and retained by the Contractor and the Architect will not be used for purposes other than those covered by these Works.

All construction drawings shall be produced using a CAD system. Where the design drawings have been prepared in AutoCAD, the files shall be AutoCAD release 2013 or later. Where the design drawings have been prepared in Revit, the files shall be of the same Revit release version that the project has been completed in.

Equipment Data

Equipment Data submissions shall be prepared and submitted for review before ordering, details of construction, weights, physical dimensions and performance characteristics of all equipment and components.

Manufacturers standard trade literature is acceptable provided that the information applicable to the specific items is clearly identified and complete.

Review Procedures

When requested, two copies of the up-dated schedule of drawings shall be submitted to the Architect / Project Manager detailing the following information:

- Reviewed drawings marked as satisfactory.
- Current drawings and Equipment Data submitted for review.
- Dates for resubmission for unsatisfactory drawings and Equipment Data
- Dates for submission of balance of drawings and Equipment Data

Alterations shall not be made to any drawing and Equipment Data marked as satisfactory unless resubmitting such drawings and Equipment Data for further review.

1.31 TESTING AND COMMISSIONING

1.31.1 GENERAL

The installation shall be tested to the satisfaction of the Engineer and the Statutory Authorities, prior to the acceptance of the installation and the commencement of the Defects Liability Period.

The necessary skilled and competent personnel together with all equipment, fuel and electric power required to test and commission the works shall be provided.

All testing and commissioning shall be carefully pre-planned and scheduled in order that it is fully co-ordinated with other relevant trades and shall be carried out in a safe and efficient manner with a minimum of inconvenience to all concerned. Where work is being carried out in an occupied building, the management of the building shall be kept fully informed regarding the nature of the testing and commissioning. Steps shall be taken that any possible hazards or inconvenience that may arise due to the testing and commissioning shall be minimised.

The installation shall be tested progressively as the work is carried out then finally tested once it is completed to ensure compliance with the specification, is mechanically and electrically safe and that it will operate correctly under normal, emergency and fault conditions. Control, protection and operative devices shall be checked for correct adjustment and rating.

All equipment or materials found to be faulty during testing shall either be replaced or repaired free of charge.

The completed installation or stages therefore shall be ready for connection to the Supply Authority mains at the programme target dates and where applicable copies of related correspondence with the Supply Authority shall be submitted to the Engineer.

Should a trial or test be deemed unsatisfactory by the Engineer it shall be repeated at no further charge after necessary rectification, until such time as a satisfactory result is obtained.

1.31.2 TESTING

Where tests are required by relevant New Zealand and/or British Standards, the tests shall be carried out and certified manufacturer's test certificates shall be submitted in duplicate within two weeks of the equipment leaving the manufacturer's works.

The Engineer shall be given five working days notice of any proposed tests and shall be given the opportunity to attend all such tests.

Arrange for a qualified inspector to test the entire installation.

1.31.3 COMMISSIONING

Carry out all commissioning tests necessary to put the systems into commercial use and to approval before Completion is granted. Individual items of equipment and each complete system as a whole shall be checked and adjusted to achieve satisfactory performance.

One month before the commencement of commissioning, the Electrical Contractor shall submit for the Engineer’s approval, a commissioning checklist.

The list shall comprise a comprehensive sequence of events for the entire commissioning of the installation and shall have provision for signatures of both the Electrical Contractor and the Engineer carrying out the checks.

1.31.4 TESTS AND INSTALLATION INSTRUMENTS

All instruments, appliances and test loads shall be provided for the duration of the tests as necessary to complete the test procedures specified.

Gauges and instruments provided as permanent parts of the installation may be used during performance testing providing evidence as submitted of their calibration accuracy.

All instruments shall be checked and calibrated during commissioning and again after 6 months of normal operation. Any instrument, which will not hold calibration, shall be replaced.

1.31.5 TEST RESULTS

All test procedures used and results obtained for both works and site tests shall be submitted in the form of a written "Test Report".

Records shall be kept of test results and two copies shall be submitted to the Supervisor at the completion of the work. Approval of the format required for the test results shall be obtained prior to the submission.

1.31.6 EARTHING

The earthing system shall be tested to the requirements of the NZ Electricity Act.

1.31.7 MAIN SWITCHBOARDS, DISTRIBUTION SWITCHBOARDS AND AUXILIARY PANELS

All Main Switchboards and all Distribution Boards shall be constructed in accordance with AS/NZS 3439.

All "Routine" tests listed in Section 8.0 of AS 3439.1 shall be carried out on the Main Switchboard and all Distribution Boards.

The Electrical Contractor shall complete “Routine Tests” on-site. Refer AS 3439.1, Section 8.3.

In addition to the "Routine Tests" the following tests shall also be carried out on site:

- All cable clamps and terminations shall be checked for mechanical tightness.
- All electrical joints of 100 Amp rating and over shall be physically checked for signs of overheating.

1.31.8 RETICULATION AND DISTRIBUTION SYSTEMS

General

All circuits shall be tested; the Electrical Contractor shall test **all** circuits for:

- Polarity, including phase rotation
- Continuity
- Resistance
- Insulation resistance (All medium voltage cables shall have a minimum insulation resistance of 10.0 meg – ohm)
- Earth loop impedance

All test results shall be recorded and submitted to the Engineer with seven days of the test date.

On completion of testing and prior to hand over balance the load evenly across the three phases at each Distribution Board.

Mineral Insulated Metal Sheathed (MIMS)

MIMS cables shall be tested immediately before and after each termination is made off and again fourteen days later with a Megger. "Infinity" reading shall be obtained in all cases. Cables not having "infinity" resistance between each conductor and between each conductor to earth shall be dried out in accordance with the manufacturer's recommendations and retested until a satisfactory figure is obtained otherwise the cable shall be replaced at no cost.

The insulation resistance of all MIMS cables shall be tested prior to installation, immediately after installation, and just prior to energising the submains. All test results shall be recorded and submitted to the Engineer with seven days of the test date.

1.31.9 ACCESSORIES OUTLETS AND APPLIANCES

All accessories and outlets shall be tested for correct operation. All GPO's shall also be tested to ensure that the active neutral and earth are correctly connected and that the switch controls the active supply.

All appliances supplied and installed under this contract shall be thoroughly tested in all modes of operation.

1.31.10 LIGHTING FITTINGS

Photometric data on specified lighting fittings shall be submitted where required. Data shall be certified by an independent registered laboratory.

All faulty lamps and tubes and noisy auxiliary control gear shall be replaced.

1.31.11 EMERGENCY LIGHTING SYSTEMS

Provide all prescribed tests detailed in AS/NZS 2293.

1.32 AS-BUILT DRAWINGS

As-built drawings shall be provided and shall be defined as a set of the drawings that have been updated to record every instance where the work, as built, varies from that shown on the original documents and shall incorporate any additional information required by the contract.

As-built drawings shall be based on and compatible with the contract drawings. They shall not rely on colour for differentiation.

Submit one set of drawings for approval. Make any modifications requested and resubmit the drawings. Repeat the procedure until agreement is reached that the drawings are a true representation of the final installation.

As-built drawings shall be prepared in accordance with the latest edition and amendments of NZS 5902 (all parts) but using the notations indicated on the contract drawings. Drawings not complying with the standard will not be accepted.

As-built drawings shall: -

- Be the same size and scale as the Contract drawings.
- Have the Electrical Contractors/Contractor's name clearly indicated on each drawing.
- Have the "As-built" date.
- Be certified by the Electrical Contractor/Contractor as “As-built”.

When the drawings have been prepared to an acceptable and approved standard of accuracy and presentation the following copies shall be provided:

- Three complete sets of prints (full size) bound as sets between rigid and durable covers to approval.
- One set of prints reduced to A3 size to be included in each copy of the Maintenance Manual.
- One set of drawings on USB flash drive memory stick in .pdf format in addition to AutoCAD .dwg format (Release 2013 or later) or Revit (of the same Revit release version that the project has been completed in) as applicable to the project.

The Engineer can provide CAD files of the contract drawings within one week of receiving a written request.

The As Built drawings shall include the following, as a minimum:

- Complete layouts showing main and sub-main cable routes and sizes, locations of cable ducts and cast in conduits, junction boxes, switchboards (including switchboard designations), electrical outlets and light fittings, which form part of this sub-contract. Also include positions of all heaters, and telecommunications, call assistance MATV, security outlets, etc., as appropriate. Provide circuit designations for each sub-circuit and ensure these are clearly shown on the drawings.
- Complete electrical schematics and line diagrams including fault ratings, sizes, settings and types of protection apparatus and cables sizes. Also provide terminal numbers for each terminal. Include all control drawings such as lighting control, heating control, etc.
- Physical layouts of switchboards showing locations of switch units and control and instrumentation equipment.
- Unique identifier for each individual emergency luminaire.
- Schematics for call assistance, MATV, telecommunications, background music systems, etc., as applicable to this sub-contract.

1.33 MAINTENANCE AND OPERATIONAL MANUAL

Prior to the issue of the Certificate of Practical Completion, submit one draft copy of Maintenance and Operational Manuals

The Maintenance and Operational Manuals and drawings incorporating comments will be returned within two weeks of the receipt of the draft copies.

Supply two copies of the approved draft Maintenance and Operational Manual within three weeks of their provisional acceptance and prior to the issue of the Certificate of Final Completion.

If there is failure to meet the above requirements, then the cost of producing the Maintenance and Operational Manuals, by other parties, shall be deducted from the Contract Sum.

Maintenance and Operational Manuals shall be bound in hard backed plastic ring binders A4 size with embossed titles on the front and spine. The manuals shall be produced on a word processor utilising a laser jet printer for reproduction. Paper shall be white bond 80 g/m^2. The project identification, and names of the Services

Consultant, Electrical Contractor/ Contractor and Principal shall be shown on the cover. A table of contents that schedules the contents of the manual shall be at the front of the manual. Include in the table, section headings, sub-sections and the page number for each entry. Also provide an introduction that identifies:

- The Construction Managers.
- The Electrical Contractors for the various systems that form part of this contract.
- The approving authorities.
- Name of the Inspector. (if relevant).
- A schedule of other relevant documents that have not been included as part of the manual.

The Maintenance and Operational Manual shall cover the following major aspects and be arranged in the indicated sequence:

- General description of electrical services
- Operating instructions for all equipment.
- Routine maintenance requirements including detailed schedules of all periodic routine maintenance (schedules to be approved).
- Manufacturer's detailed instructions for disassembly, overhaul, assembly and fault correction.
- A full copy of all final test results.
- Copies of Circuit Charts.
- Spare parts lists.
- A copy of the compliance certificate.
- Schedule submains, their size, type and destination.
- Provide details of switches, socket outlets and accessories, including manufacture and catalogue numbers.
- Detail lamp type, nominal life, colour reference
- Schedule of luminaries and a description of their control, provide technical literature relating to the luminaires. Provide details of any special provision for servicing the luminaires.
- Details of the seismic restraints systems installed for all luminaires installed on or within suspended ceiling systems.
- Schedule of heaters and a description of their controls, provide technical literature relating to the heaters and associated control systems.
- Schedule of telecommunications, MATV, call assistance, security systems, etc., as applicable.

The Contractor shall provide copies of the following producer statements & information within each manual:

- PS3 Construction

- PS1 & PS4 from a Structural Engineer for seismic restraints installed e.g. cable trays & support systems etc.
- A written statement confirming that all plant & equipment (not requiring a Structural Engineers design) has been seismically restrained as required for code compliance and in line with the standards & electrical specification, e.g. luminaires, equipment cabinets, switchboards etc.
- PS1 & PS4 (if required) for all external poles installed from a Structural Engineer

List routine maintenance tasks to be carried out at specified times. Maintenance tasks to be documented include, but are not limited to, the following:

- RCD testing and record keeping.
- Emergency lighting, testing and record keeping.
- Lamp replacement recommendations.
- Terminal checks for switchboards etc

SECTION 2

WORKMANSHIP & GENERAL MATERIALS

CONTENTS

SECTION 2

WORKMANSHIP & MATERIALS

This Section, Section II, details the general requirements for workmanship and materials and the installation methodologies to be utilised on this project.

2.1 POSITIONING OF OUTLETS AND EQUIPMENT

The layout of equipment shown on the drawings is diagrammatic only, and exact positions shall be confirmed by the Electrical Contractor on site in conjunction with the Architect. Where prepared by the Architect, the set-out positions of all lights, outlets, etc. shall be as per the Architectural Elevations and the Architectural Reflected Ceiling Plans.

The position of outlets and switches shown on the drawings is assumed to be correct, however, variations of positions of GPOs, lighting switches, permanent connection units, telecommunications outlets and wall brackets of up to 2m shall be effected without cost variation if the change is advised before the outlet or switch is installed.

Positions of all General Power Outlets (G.P.O), wall switches and wall fittings shall be chalked on walls in areas where the outlets are adjacent to tiles, dados or other architectural features and approval of the Architect shall be obtained before placing any final boxes, conduits or wiring for these outlets.

Outlets shall be spaced accurately and symmetrically within rooms, refer to associated standard drawing detail, it is not acceptable to relocate outlets to the nearest stud. It is the Electrical Contractors responsibility to liaise with all other specialist system installers i.e. Telecommunication, Security Systems, etc. and to ensure that the location of all outlet plates is coordinated.

Where outlets are in close proximity, they shall be equally spaced, aligned horizontally and/or vertically, refer to associated data sheet.

Equipment shall be symmetrically located in relation to other equipment and devices, the building module and general aesthetic treatment.

Allow for adequate cable length to enable an outlet to be moved by up to 500 mm from the installed position, unless otherwise indicated.

2.2 MATERIALS AND EQUIPMENT

All materials, equipment, components and devices shall be new and unused, of current manufacture and of the highest quality.

The Electrical Contractor shall provide all items specified. If it is deemed necessary to substitute any materials in lieu of the specified materials, written consent must be obtained prior to any deviation from the specification. No materials or equipment shall be of a lower quality than those specified. The manufacturer shall be approved where this has not been specified.

Where any item is referred to in the Sub-Contract by specific brand type, style, model, finish or manufacturer or approved equivalent the Electrical Contractor shall comply with the following:

The specified brand, type, style, model, finish or manufacturer is intended as a minimum standard and in no way diminishes the responsibility of the Electrical Contractor to ensure the satisfactory installation and operation of all the Sub-Contract Works.

The Electrical Contractor shall install equipment not specifically referred to but substantially similar only after approval.

Unless specified otherwise, the manufacturers recommendations shall be followed with regard to both workmanship and associated materials, equipment, components and devices, whether or not the particular manufacturer has been specified.

All materials, equipment, components and devices shall be rated for the maximum average temperature over any 8 hour period within its immediate enclosure. This temperature will be commonly above the room ambient temperature, with a minimum of 40^0C.

All materials, equipment, component and devices shall be rated for use on the voltage and frequency specified.

Where vibration is present, all materials, equipment, component and devices which could be affected by vibration shall be selected and installed to ensure satisfactory operation.

Where a particular manufacturer has been specified for fittings or equipment, all such fittings and their components shall be uniform throughout the project.

The Electrical Contractor shall be responsible for proper storage and protection of apparatus, materials and equipment on any site adjacent to, associated with or the subject of the Works.

Upon delivery to site all materials and equipment shall immediately be secured properly stacked and protected from the weather, dampness and dust with particular attention to preventing ingress to working parts and pipes.

The Electrical Contractor shall confer with the Main Contractor and accept their instructions with regard to storage of materials particularly heavy loads. All equipment and materials shall be stored clear of floor slabs on timber packers.

When any room in the building is used as a site office or storeroom in connection with these works, all resulting making good and repairs, patching or cleaning of the room arising from such use shall be carried out prior to completion of the Works.

Materials and/or goods shall not be delivered prematurely to site unless they apply to the Main Contractor in writing for permission to make such deliveries stating reasons why such materials and/or goods should be delivered earlier than would be normal or is required for the Sub-Contract Works and such permission is given.

Where materials and/or goods are delivered earlier than is required for the Sub-Contract Works they shall be stored on or adjacent to the Site and shall be protected against weather and accident or theft.

The Sub-Contract shall be based upon a guarantee that all materials and equipment required for the work shall be obtained at such time as to enable the work to be completed in accordance with the Main Contractor's programme. If any doubt exists regarding dates of supplies full information shall be included in the tender.

The Electrical Contractor shall be responsible for ordering all materials in ample time. Lack of such materials due to delay in ordering shall not constitute grounds for extension of time for completion.

2.3 ALTERNATIVE EQUIPMENT

Nomination of a particular manufacture, model, reference or source of supply for materials or equipment shall be used as the basis for tendering. Alternatives from that specified shall be formally requested and will only be allowed upon meeting all of the criteria in terms of the type and quality for the original item. Failure to obtain formal approval shall result in the item being replaced at the Electrical Contractors expense.

Where alternatives are specifically allowed to be offered, provide evidence that the proposed alternatives are 'equivalent' and to submit prices for these alternatives for evaluation without additional cost.

With regard to alternative luminaires, the Electrical Contractor is required to provide lighting calculations for each area where an alternative luminaire is proposed, these lighting calculations shall be based on the same design criteria utilised by the Engineer and shall be provided by the Electrical Contractor without additional cost.

2.4 WORKMANSHIP

The whole of the work shall be carried out by skilled trades people using adequate and proper equipment and methods in accordance with best trade practice. The standard of workmanship throughout shall be of consistently high quality and entirely to the Engineers satisfaction, nothing less will be acceptable. Any work not acceptable to the Architect or Engineer shall be rectified without question, and without charge, to a standard approved by the Architect or Engineer.

The whole of the Sub-Contract Works and all operations related to them shall be carried out in such a manner as to minimise inconvenience or nuisance to occupants, adjacent buildings or tenancies and to the public. The Electrical Contractor shall be solely liable for and shall indemnify the Main Contractor against any claims which shall arise from such nuisance.

The Electrical Contractor shall remove from site all rubbish, debris, material cuttings and other redundant materials which result from the works of this Sub-Contract, progressively and whenever directed by the Main Contractor.

On completion of the work, promptly remove all materials and equipment from site, except such materials and equipment which the Proprietor has agreed to store for use during the Maintenance Period or as are required for testing.

2.5 SHUTDOWNS & CHANGOVERS

Any shut downs, supply changeovers and disconnection works must in every instance be coordinated through the Architect/Project Manager and the Main Contractor and shall take place either out of normal working hours or by prior arrangement. All shut downs, supply changeovers and disconnection works must be carried so as not to disrupt the day to day operation of the clients business. The Electrical Contractor should note that fourteen days notice of all shut downs will be required and the Electrical Contractor must obtain written approval from the Architect/Project Manager for all shut downs and changeover works.

Any necessary changeovers and shutdowns shall in every instance be coordinated by the Electrical Contractor and shall take place out of normal working hours or during shut down periods. Any necessary changeovers and shutdowns shall be completed without disruption to the client's normal routine or working practices and without disruption to other Trades.

In the event that any electrical supply requires isolation in order for changeovers or diversionary works to be completed the Electrical Contractor shall carry out all temporary connections and provide all generating plant necessary for the client to continue their day to day business. Provision of temporary connections and generating plant shall be deemed to include all labour costs, materials, fuel and the like necessary.

The Electrical Contractor should note that no extra to contract payments will be made for premium time working.

2.6 FIXINGS, PLUGS AND SUPPORTS

The Electrical Contractor is responsible for providing all brackets, fixings and supports.

Detail drawings of all brackets and fixings shall be submitted for approval by the Engineer and Architect, all brackets shall be either purpose made galvanised steel construction or constructed/assembled from proprietary Unistrut products.

Holes shall be drilled by electric or compressed air drill wherever possible. Explosive charge fixing devices shall not be used.

Where devices are required for attaching materials or equipment to the building, approved method expansion devices shall be used when and where approved by the Main contractor. Wooden plugs will not be permitted. Approval of the Main Contractor shall also be obtained prior to drilling to ensure that any post tensioning cables in the slab are not damaged. The Main Contractor will mark the location of all such cables.

Zinc plated expanding metallic type masonry anchors shall be used for fixings in concrete, clay or concrete brickwork. Except in fire isolated stairways and tunnels, conduits shall be saddled to walls and ceilings using "Tappits" or similar fixing devices.

Fixed or suspended light fittings shall be supported from the concrete slab using "Dynabolts" or "Ramset" fixings.

Bolts or machine screws with nuts, washers and anti-vibration devices shall be used where necessary for fixings into metal.

Plugs shall be used for screw fixing to masonry construction including plastered expanded metal. Such plugs shall be used only for minor shear loadings. Holes and inserts and PVC screw anchor plugs, "Expandet" brand or equivalent shall be correctly sized.

Zinc plated and passivated bolts, screws and washers shall be used.

2.7 SEISMIC REQUIREMENTS

All equipment installed as a part of the project (switchboards, distribution boards, cabinets, luminaires, emergency luminaires, illuminated exit signs, etc.) shall be seismically restrained.

All supports & restraints shall be designed in accordance with NZS 4219.

The Contractor shall note that the seismic requirements for buildings will differ based on their importance level (IL) rating.

Details of the restraints proposed shall be submitted to the Engineer and written approval obtained before construction is commenced. A Producer Statement Design, PS1, will be required by the Electrical Contractor to cover the design of the type of supports provided, their locations and the quantity.

The Contractor is required to engage a Building Services Seismic Specialist experienced in seismic fixings of plant to complete the design and observation of all equipment installations.

The design of the seismic restraints for the electrical services must be coordinated with and take into account the proximity of the electrical services equipment installed as a part of this project to other services both new and existing, restrained and unrestrained.

The contractor is to make allowance for Building Services Seismic Specialist to provide a Producer Statement PS1 (Design) and PS4 (Construction Review) prior to Practical Completion.

The Contractor shall note the spacing requirements required between restrained and unrestrained equipment located in ceiling voids.

Excerpt from NZS 4219:2009

5.2 INTERACTION BETWEEN COMPONENTS

5.2.1 Clearances

Unless otherwise specified, clearances shall be provided in accordance with table 15.

Table 15 – Clearances

Condition being considered	Minimum clearance (mm)	
	Horizontal	Vertical
Unrestrained component to unrestrained component	250	50
Unrestrained component to restrained component	150	50
Restrained component to restrained component	50	50
Penetration through structure (such as walls and floor)	50	50
NOTE – Ceiling hangers and braces are considered to be restrained components for the purposes of this table.		

C5.2.1
Flexible connections within the service may allow penetration clearances to be reduced.

For cable support systems, the normal operating loads shall be the weight of the support and all associated cabling plus 25% (spare capacity for future cables).

Ensure all anchors and fixings used (including anchors subjected to gravity only loads) are seismically rated to ACI-355.2 in accordance with NZS 4219.

Ensure all anchors and fixings are seismically rated in both Tension (Pull) and Shear (Sideways) actions

Concrete Anchors are to be certified bolts used in “Cracked Concrete”

Irrespective of the buildings IL rating all mains operated luminaires shall be provided with the following restraints.

Where luminaires are suspended from the ceiling system they must be securely fixed in accordance with manufacturers recommendation and NZS 4219.

All remote gear trays/boxes shall be provided with seismic restraints and supported independent of the suspended ceiling system. Restraints shall take the form of galvanised steel chain suspensions fixed to the top side of the fitting and to the underside of the roofing purlins, provide a minimum of two chain suspensions per gear tray/box. Chain suspensions shall be fixed to the gear trays/boxes via closed snap links to ensure the unit can easily be removed from the restraints if required.

At seismic breaks cable trays shall be physically separated for 200mm, all cables shall have expansion loops where they cross the seismic breaks.

Catenary wires shall not cross seismic breaks all cables installed on catenary wires shall have expansion loops where they cross the seismic breaks.

Do not install luminaires across seismic gaps.

2.8 LOAD BALANCING

Checks shall be undertaken under full load conditions; the results of these tests shall be recorded and issued to the Engineer. On completion of the tests the Electrical Contractor shall make all necessary adjustments in order that the installation is evenly balanced across the three phases, all to the satisfaction of the Engineer.

2.9 SEALANT OF PENETRATIONS AND FIRE / SMOKE / ACOUSTIC RATINGS

All penetrations created by the Electrical Contractor or provided for the Electrical Contractor shall be sealed water or air tight, acoustically and fire/smoke rated as appropriate. The fire/smoke and acoustic ratings of the structure must be maintained after the installation of the electrical services.

Where services pass through fire separations or are installed in fire separations, the continuity and effectiveness of the fire separation shall be maintained as required by NZBC C/AS1 to C/AS7 (this will include services through walls and floors as applicable).

All penetrations through fire separations (created by wires, cables, pipes, flush boxes, etc.) or any gaps, or control joints, are required to be fire stopped with systems (collars, wraps, sleeves, mastics, etc.) that are approved for the proposed use (e.g. rating, orientation, penetration type, construction type) in accordance with AS 1530.4 2005 and AS 4072.1:2005. Where fire stopping systems to AS 4072.1 :2005 are not able to be provided, it is acceptable to incorporate systems tested to BS EN 1366.3:2009, or UL 1479. Fire stopping systems are required to be installed strictly in accordance with the manufacturer's instructions.

All penetrations through chambers subject to suction or pressurisation shall be sealed with an approved sealant and flanges.

Flush outlet boxes in fire rated or acoustically rated walls shall be of a type suitable to maintain the integrity of the wall. Fit intumescent blocks in all recessed boxes. Back to back boxes will not be allowed in these areas. Where after installation there are gaps between the flush outlet box and the GIB lined wall (i.e. gap into wall cavity), these shall be sealed with an appropriate intumescent sealant in full compliance to a tested system, to the satisfaction of the Fire Engineer.

Where luminaires are recessed into fire rated or acoustically rated walls the apertures shall be suitably lined to maintain the acoustic and fire integrity.

Where luminaires are recessed into in fire rated ceilings the luminaires shall be provided with fire rated canopies (Firepro or equal) to maintain integrity of the ceiling.

Where luminaires are recessed into in acoustically rated ceilings the luminaire apertures shall be suitably lined to maintain the acoustic integrity.

NB: Confirm the extent of fire/smoke rated and acoustically rated walls and ceilings prior to submitting tender.

Where cable tray, cable ladder, cable trunking, cables, etc pass through fire rated walls ensure all penetrations are sealed complete with a proprietary product correct for the particular application and approved & installed to the satisfaction of the Fire Engineer, thus ensuring the fire/smoke rating of the wall is maintained.

The Electrical Contractor shall note the following:

Test certificates are required for all service penetration fire rating products used. Non-certified products will 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.

Service 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.

It is recommended that components of fire-stopping systems not be 'mixed and matched' from different manufacturers.

Proposal of all fire stopping systems should be provided for the fire engineer's approval prior to commencement of installation.

The Electrical Contractor shall ensure that all penetrations through fire walls for their works including their associated Sub-contractors works are sealed in an appropriate way & approved by the Fire Engineer. Sealing of all fire penetrations for the Electrical Contractor & their associated Sub-contractors shall be carried out by a specialist fire stopping contractor.

Fire stopping systems are required to be installed by competent trained persons.

2.10 PAINTING AND FINISHES

2.10.1 GENERAL

This Section of the Specification covers the painting and finishes requirements pertaining to the installations covered by the Specification.

All paints and their intended use shall meet the requirements of AS 1580, BS 4800, AS/NZS 2311 and NZS 7702.

Exact colours will be determined on site. Paint shall be applied to equipment in accordance with the specific recommendations of the paint manufacturer using correctly prepared surfaces. Brushes, paint containers and other painting accessories used for hand painting shall be kept clean and in good condition.

Where necessary, finished paint work shall be protected during the progress of site works, using suitable dust covers.

Unless already galvanised, factory assembled steel components and pre-fabricated metal parts shall be painted before dispatch with one coat of self etch primer to provide adequate protection against the action of dampness and weather during the transport to site and subsequent erection.

2.10.2 PAINTING

Surfaces shall be cleaned and prepared in an approved manner prior to painting to remove dust, scale, dirt, oil, including spatter and concrete or mortar droppings. Surfaces that cannot be suitably cleaned, particularly due to excessive rusting, shall be replaced.

Paints, fillers, temporary surface dressings and other painting materials are to be products of an approved manufacturer and of the best quality in their respective types. All painting materials shall be delivered to site in the original manufacturer's sealed and labelled containers where painting on site is required.

All painting shall be carried out in strict accordance with the specific instructions of the manufacturer to obtain and retain a finish of true colour, which does not fade, tarnish, peel or otherwise deteriorate except by fair wear and tear, for a minimum of 3 years.

All switchboards, auxiliary panels, proprietary cabinets and lighting fittings shall be factory painted prior to delivery on site.

All surface edges shall be ground smooth and filled prior to painting as follows allowing ample time for thorough drying between coats.

Surfaces shall be finish coated as follows:

- One coat of zinc chromate or similar self-etching primer
- One coat of lacquer primer surface
- Three coats of lacquer finished to a high gloss equivalent to 50 micro-metres

All coats shall be of different colours. Alternatively powder coated painting to an equivalent standard and colour shall be proposed. Full details of this alternative shall be provided for the consideration with the tender.

Unless the complete paint finish is applied off site, all equipment brackets, support frames, metalwork and un-galvanised steel shall be painted with one coat of self-etch primer, one coat of undercoat and one coat of finishing full gloss enamel of selected colour. Unless specified otherwise, galvanised conduits need not be painted. All sealers, primers, undercoats and finishing paints shall be of a type specified by the paint manufacturer as appropriate for the particular application.

2.10.3 REPAIRS TO EQUIPMENT DAMAGED ON SITE

Where factory painted or enamelled surfaces to equipment have been chipped or damaged on site, the repair work shall be carried out by filling, painting and restoring the equipment to the exact finish and colour of the surrounding paintwork.

Where possible damaged parts shall be returned to the original Supplier for the above work to be carried out.

Any damage caused to the finished building resulting from work found to be defective shall be made good. The Main Contractor's approval for all such rectification work carried out shall be obtained.

2.10.4 COLOUR SCHEME

Where any parts of the installation are required to be painted the final colours will be subject to the Architect's approval.

All LED light fittings shall be painted internally and externally with white paint, unless indicated otherwise.

The interiors of switchboard cabinets, meter panels, and tee off boxes shall be white.

The manufacturer's standard colours shall be acceptable however, details shall be submitted with the tender, confirmed in the shop drawings and approved by the Architect.

2.11 SWITCHBOARDS

2.11.1 GENERAL

Supply and install the main switchboard, distribution boards and control panels in the locations indicated on the drawings.

Construction: The switchboards shall be of sheet steel construction forming a rigid frame cubicle enclosure IP Rated as required.

Switchboards, distribution boards and control panels shall be wall mounted or floor mounted as specified or as dictated by their physical size and weight and of totally enclosed metal clad construction with escutcheon plates and hinged doors.

For all wall mounted switchboards, distribution boards and control panels, provide a substantial iron frame for wall mounting in order that all switchboards, distribution boards and control panels are seismically restrained in accordance with the standards and best trade practise.

For all floor mounted switchboards, distribution boards and control panels provide a substantial iron plinth, holding down bolts (tru-bolts or rawl bolts) and seismic restraints at the top of the switchboard, distribution board or control panel. Where switchboards, distribution boards and control panels are sat over open trenches allow to install box section steel supports on which the switchboards, distribution boards and control panels can sit and steel plates over any open area of trench and seismic restraints at the top of the switchboard, distribution board or control panel.

The exact extent of equipment required on all switchboards shall be taken from the drawings, all circuit and switchboard schedules (if provided), circuiting indicated on the layout plans and from the specification. Switchboard elevations if shown on the drawings are indicative only for pricing purposes.

The detailed design of each switchboard shall be by the Electrical Contractor, provide shop drawings of each switchboard for approval prior to commencement of manufacture or ordering of parts.

Provide a fully discriminating protection system. Provide circuit breakers for cable protection. Downstream circuit breakers shall isolate circuits in Overcurrent fault conditions without upstream circuit breakers including HV protection, under voltage or other protection devices affected by the voltage and Overcurrent disturbances, operating. Such discrimination shall occur for Overcurrent fault conditions from overload through to maximum three phase bolted fault current at the circuit breakers line side terminals.

Install isolators, contactors and switches with upstream protection to prevent damage to such devices for downstream fault currents up to the maximum three phase bolted fault current at the line side of the device.

All switchboards shall be constructed as design verified assemblies (i.e. all components shall be tested / compared / evaluated to work to together).

All Switchboards shall comply with requirements of the AS/NZS 61439.1:2016 to AS/NZS61439.6:2016 Standard series and the additional requirements of this specification.

The form of segregation for each switchboard shall be as noted in the schedules and/or on the drawings.

The following applies as a minimum requirement.

- Less than 250 amps capacity — Form 1
- Greater than 250 amps & less than 500 amps — Form 2
- 500 amps & less than 800 amps — Form 3b

2.11.2 PERFORMANCE & FAULT CAPACITY

Specialist manufacturers, who are solely and continuously engaged in the supply of switchboards to the trade, shall build all switchboards and control panels.

The design and construction of switchboards and control panels, associated components and connections shall give satisfactory performance under all variations of load conditions as shall be met within the service, including short time overloads and short circuits. Design verification of every switchboard assembly shall be achieved via alternative and equivalent methods as

applicable across the 13 characteristics defined in AS/NZS 61439.1:2016 Annex D table D.1. Switchboard manufacturers shall adhere to the AS/NZS 61439 restricted conditions under which switchgear devices from a verified assembly can be substituted with alternate make or model devices.

Provide temperature-rise verifications by testing and derivations in accordance with the AS/NZS 61439 series for switchboards with an incoming current greater than 1600 amperes. For switchboard assemblies with an incoming current up to 1600 amperes temperature-rise assessments can be completed by calculation in accordance with the AS/NZS 61439 series.

The rated short time withstand current shall be greater than the fault level of the incoming supply and not less than specified elsewhere. Note verification of each switchboard assembly short circuit withstand strength shall be provided by the switchboard manufacturer for assemblies with rated short-time conditional short circuit current greater than 10kA r.m.s., and where the switchboard assembly is protected by current limiting devices having a cut-off current exceeding 17kA, at the maximum permitted prospective short-circuit current at the terminals of the incoming circuit of the assembly. Short-circuit withstand strength can be certified by derivation for parts of an assembly where the worst variant has been tested before and verified.

The switchboard component manufacturer shall provide all assembly design verifications and shall take responsibility for the appropriate functionality of all their tested switchboard assemblies.

The switchboard assembly manufacturer shall, with respect to the relative switchboard design parameters provided in section 3 of this specification, complete the internal configuration design for each switchboard assembly and shall be responsible for the performance of each assembly. The switchboard manufacturer shall also be responsible for incorporating the various components within the switchboard, ensuring the final design meets the specification, and the switchboard assembly is fully verified and fit for purpose.

Provide equipment which provides protection of semi-conductor components against potential damage caused by switching and other external transients.

2.11.3 DISTRIBUTION SWITCHBOARDS

Distribution switchboards shall be top or bottom entry as appropriate, front connected of totally enclosed metal clad construction with hinged escutcheon plates and doors.

Distribution switchboards shall be sized to ensure that there is 25% spare ways for future expansion.

Distribution switchboards shall comply with the following criteria unless otherwise detailed:

Construction: The switchboards and auxiliary panels unless otherwise detailed, shall be of the sheet steel construction forming a rigid frame cubicle enclosure.

All switchboards shall be surface mounted, unless detailed otherwise.

Sheet and structural members shall be of commercial quality drawn SPC1 bright zinc coated, mild steel, machine bent and folded, flat, smooth and free from warps, twists or other distortions.

The minimum thickness of sheet steel shall be as follows:

- Panels 600mm maximum dimension 1.6mm
- Panels 900mm maximum dimension 2.0mm (where framing is used - 1.6mm)
- Panels over 900mm 2.0mm

Where angle iron framing is used it shall not be visible from the outside of the switchboards or auxiliary panels.

Welded corners shall be neatly mitred ground and fitted prior to painting.

All panels/compartments shall be provided with:

- 13mm lips all around
- Dust proof rubber or neoprene gaskets
- Hinged doors (hinges shall be of the lift-off type with hardened steel hinge pins)
- Escutcheon panels

Hinged doors shall open a minimum of 110 deg.

Distribution and metering cabinets shall be provided with hinged latched doors complete with catch.

Equipment cabinets, control cabinets and the like shall be provided with hinged lockable doors. Confirm lock type with client, if no preference, Type 144 type locks shall be used.

Duct boxes, cable ways and CT chambers shall be hinged and screw fixed.

All hinged doors shall be earthed.

Lift-off panels shall be located with guide pins top and bottom mounted on the frame of the assembly.

Equipment shall be mounted on the switchboards and auxiliary panels in readily accessible compartments. Cable zones shall have cable trays, ducts and supports arranged for access to and removal of any cable without disturbing adjacent cables.

The assembled switchboard shall be constructed to prevent the entry of vermin. Ventilation openings shall be louvered and fitted with brass fly-wire mesh behind the louver.

Escutcheon panels and plates shall expose operable controls, switches, switch and Circuit Breaker handles and toggles, and fuse carriers. Where HRC fuses are used as fault current limiters these shall be located behind the escutcheons to prevent tampering. Appropriate labels shall be mounted on the escutcheon to indicate their location.

Cable entry provisions shall be via removable gland plates or pre-punched conduit knockouts.

Bolts and machine screws shall be zinc plated complete with hexagon nuts and washers with excess threaded sections cut and filed. Nuts, bolts and machine screws exposed to view shall be chrome plated.

Independently braced termination studs shall be provided for all cables with a conductor size of 70mm^2 and over.

Provide vertical cable ways between segregated sections for the routing of services to the various compartments of the board. Cable ways shall be of the same depth, finish and construction and the switchboard cabinetry.

Provide cable ducts for the concealment of all incoming and outgoing cabling between the top of the board and ceiling level and, between the bottom of the board and the floor. Cable ducts shall be of the same depth, finish and construction and the switchboard cabinetry.

Floor mounted switchboards shall be provided with a substantial metal plinth.

All switchboards shall be designed and constructed to fit within the designated room, cupboard or designated area.

The Electrical Contractor shall ensure that switchboards fit within the designated space prior to submitting switchboard shop drawings.

Switch boards shall be complete with the following degree of protection: IP44 for all internal boards in sprinkler protected areas, IP40 for other internal areas and IP65 for external boards.

Busbars: Provide rectangular section radius edge copper busbar circuits within the switchboard, extending from the termination of the incoming unit to the line side of the protective equipment for outgoing circuits. Use four pole busbar systems with the neutral bars equal to phase bars. Busbars shall be of high conductivity hard drawn copper with continuous current ratings as detailed. Ratings shall be considered to be nett values after applicable deratings have been applied relative to the mounting of assembly. Busbars shall be rated to match the frame of the switchgear connected thereto. All main interconnections and tee-offs in excess of 100 amp rating shall be busbar.

The busbar configurations shall match the incoming conductors and phase rotation shall be uniform.

All busbars shall be machine bent and formed. Matching faces shall be smoothed by draw filing or belt sanding before jointing. High tensile steel bolts with washers, torque tensioned to the manufacturers recommendations, shall be used for all busbar joins. Pencils, crayons or dye shall be used when marking out busbars. Scribing of busbars will not be permitted. When scribing marks are found busbars will be condemned and shall be replaced.

Busbars shall be coloured by means of two coats of enamel on etched and primed surface. The colouring shall be applied in 50mm bands on each busbar section in each compartment.

Busbars for distribution boards shall be rectangular sections stamped in one piece. Busbars shall be insulated with phase coloured thermoplastic insulation.

Busbar connections for MCCB's and MCB's shall be installed so that either a triple pole or 3 single pole circuit breakers can be mounted size by side.

Drilled busbars and supports shall be fitted for incoming and outgoing supplies, future switchgear and CT's where detailed. Busbars sections for Ct mounting shall be readily removable.

Provide support sufficient to withstand without damage the maximum prospective fault currents using non-hygroscopic insulation capable of withstanding 105°C. Run phase and neutral bars in the same busbar chamber penetrating metal barriers in the same hole in order to minimise eddy currents in the switchboard metalwork. Busbar supports shall be rigid and made of an approved insulated material, with secondary insulation through each support for un-insulated busbars to prevent tracking paths between phase and earth.

Make busbar joints high tensile bolts and nuts, locked in position with lock nuts or locking tabs. Tighten bolts to the manufacturer's recommendation with a tension wrench. Do not use tapped holes and studs or the like for jointing current carrying sections.

Insulate busbars as follows:

Active and neutral busbars:- A fully insulated system using heat shrinkable polyolefin or double dipped polyethylene as busbar insulation. Use Raychem Type RNF-100 or approved equal for heat shrink insulation.

Insulate joints by either tape or plastic coating coloured to match the specified phase colour. Minimum thickness equal to busbar insulation.

Insulate terminations by tape or solid barriers providing IP2X protection. Insulating tape shall be 3M Type 23 moulding tape or similar.

Insulation and busbars shall be coloured coded as Red, White and Blue for active busbars, Black for neutral busbars and Green or Green and Yellow for earth busbars.

Neutral busbars shall be extended into each switchboard compartment containing outgoing circuits with neutral connections. Provide terminals or drill the busbar for neutral connections. Neutral bars for each supply shall extend for the full length of each supply section of the switchboard. Switchboards in excess of 900mm in length shall have neutral and earth bars extending for their full length.

All terminal connections shall be clearly marked and numbered.

Neutral & Earth Bars: Each supply section of switchboards shall be fitted with readily accessible and removable neutral and earth bars permanently and legibly labelled. Earth and neutral bars shall be adjacent to each other in the cabling zones. Locate neutral and earth bars within 600mm of each cable entry.

Provide M12 stud connections for each outgoing submain circuit and incoming supply, including future circuits. Provide washers and lock washers for each stud.

Clearly label all outgoing earth and neutral cables to correspond with the associated live conductor terminal reference.

General light and power distribution switchboards shall be fitted with screw type neutral and earth bars. Connecting devices shall consist of tunnel connectors of 4.8mm diameter with provision for lug or stud connectors for all cables greater than 10mm sq.

Cable Terminations: Provide adequate cabinet space for the termination, spreading and routing of the incoming mains and outgoing sub-main cables.

Terminate each end of all incoming and outgoing cables as follows:

- Fix the cable by an approved gland
- Fix an approved lug to each core
- Fit an approved phase or polarity identification to each power cable core and identification marker to each control and monitoring cable core.
- Connect to equipment terminals (or terminal blocks).
- Provide machine engraved laminated labels fastened to cables with a minimum of two cable ties at each end to indicate the cable size, destination and origin of submain and mains cables.

Neatly bend each conductor to enter directly into the terminal tunnel or terminal stud section, allowing sufficient slack for easy disconnection and reconnection. Joining or teeing between terminals is not permitted. Use crimp type lugs, fastened with the correct crimping tools, for connection of PVC insulated cables to studs, equipment terminals and terminal blocks.

Insulate terminals to a minimum of IP2X. Provide standard manufacture insulating shrouds on the line and load side terminals of MCCB's.

Terminals shall be sized to continuously carry the load. For connections up to 50 amps, provide Sprecher and Schuh type V4 rail mounted through terminals, or equal. For connections to circuits above 50 amps, provide stud type terminals with washers and lock washer fitted to each stud and barriers between adjacent studs. For through type terminals, connect one conductor only to each end of the tunnel and interconnect terminal groups, where necessary, by standard cross connectors. Terminate internal wiring to the one side of the terminal block, leaving the other side for outgoing circuits.

Segregate terminal groups. Group together terminals for outgoing cables of the same destination and provide separate groups for power circuits and control circuits. Provide separate groups for DC Control Circuits and 240 volt AC control circuits. Arrange and position terminals to provide ready access for maintenance and testing without the necessity to remove

wiring or equipment. Position terminals to enable ready identification under normal access conditions.

Provide spare control terminals on mounting rails for 20% increase in control cables. This requirement is in addition to any terminals provided for terminating spare cable cores. Install wire identification for each group of control terminals. Allocate a number or letter to each group and indicate same on the drawings.

Provide Critchley type Z, Graphoplast or equal identification markers, complete with black characters, for all mains, earth, neutral & control cables. Co-ordinate cable identification with existing systems and do not duplicate within the one switchboard.

Control cables shall be left with sufficient length and neatly looped to allow a fresh termination to be made should the original break off or be damaged. Terminate and identify any spare core into spare terminals.

Cables with screens shall be earthed at one end only, unless recommended otherwise by the equipment manufacturer earth at end where signal operates. Earth copper screens by wrapping three or more turns of 1.0mm sq. stranded copper earthing conductor over exposed screen and making an effective soldered joint with the screen. Insulate the earthing conductor with PVC sleeving or tape. Fit earthing conductors and earth screens with a lug and connect to terminals.

Cables: Provide 0.6kV V-75 PVC insulated cables for general wiring and heat resisting insulated cables for connections to equipment capable of raising the insulation temperature above 75 degrees Celsius.

Provide cables sized to suit a current carrying capacity of not less than the maximum continuous rating of the equipment mounted within the switchboard, or sized to withstand the 'let-through' energy of the circuit protective device, whichever is greater. Apply appropriate de-rating factors to AS/NZS 3008.1: 2010 when determining conductor size if the conductors are to be bunched or installed within wiring ducts.

Cables and wiring shall be run horizontally or vertically neatly loomed and continuously clipped or enclosed in PVC wiring ducts.

All cable ducts shall be attached to switchboard and control panel carcasses.

Control wiring shall be of minimum size 1.5mm^2 stranded copper PVC insulated cable and each cable shall be identified by means of "Critchley Z type" slip-on ferrules fitted to both ends and terminated onto "Sprecher and Schuh" or approved equivalent terminal strips for external connection.

Cables entering the switchboards and control panels shall be enclosed in cable ducts and shall be clamped in approved cable glands. All cables shall be installed so that no stresses are placed on any terminations.

Stranded cables larger than 4 sq. mm. shall be fitted with compression lugs.

Marking & Labelling: Provide labels including control and circuit equipment ratings, functional units, notices for operational and maintenance personnel, incoming and outgoing circuit ratings, sizes and origin of supply and kW rating of motor starters.

Provide labels fixed to access panels, doors, covers and escutcheon panels and internal equipment, indicating the relevant section and component.

Minimum lettering heights shall be as follows:

- Main assembly designation: 25 mm

- Distribution assembly designation: 15 mm
- Small proprietary distribution boards: 10 mm
- Main Switches: 10 mm
- Outgoing functional units: 8 mm
- Danger, warning and caution notices: 10mm for main heading, 5 mm for remainder
- Other labels including equipment labels within cabinets: 3 mm

Label colours shall be as follows:

- Black lettering on White background except as detailed below
- Main switch and Caution labels: Red lettering on White background
- Danger and warning labels: White lettering on Red background

Labels shall be fixed with either screws and double sided adhesive, or riveted to panels. Do not use self-tapping or thread cutting screws.

Align all labels horizontally and vertically with adjacent labels.

Labels on Assembly exteriors shall be as follows:

- Manufacturers name: Required
- Assemblies: Label with essential markings
- Designation labels: For other than main assemblies, provide designation label stating source of electrical supply. Identify separate sections of enclosures.
- Assembly controls: Label controls and fault current limiters, including the following:
  - Circuit designation for main switches, main controls and submain controls
  - Details of consumer mains and submains
  - Fuse link size or circuit breaker rating.

Labels on Assembly Interiors:

- General: Provide labels for equipment within assemblies located so that it is clear which equipment is referred to, and lettering is not obscured by equipment or wiring.
- MCCB's: If circuit breaker manufacturer's markings are obscured by operating handle mechanisms or motor operators, provide additional markings open to view on or next to the circuit breaker.

Danger, Warning and Caution Notices:

- Busbars: If polymer membrane coating is used without further insulation, provide warning notices on the front cover near the main switch or local main switch, and on rear covers, indicating that the busbars are not insulated.
- Fault current limiters: In assembly sections containing fault current limiter fuses provide caution notices fixed next to the fault current limiters, stating that replacement fuse links are to match as installed fuse link ratings, make and characteristics. Provide separate label stating fault current limiting fuse ratings.
- Custom built assemblies: For insulation or shrouding requiring removal during normal assembly maintenance, provide danger notices with appropriate wording for replacement of insulation shrouding before re-energising assemblies.
- Positioning: Locate notices so that they can be readily seen, next to or, in impracticable, on busbar chamber covers of functional units, and behind the front cover of functional units. Provide circuit identification labels in the cabling chamber of each functional unit, located next to external terminations.

Circuit Charts & Schedules: For lighting and power distribution boards, provide schedule cards of minimum size 200 x 150mm, with typewritten text showing the following as installed information:

- Sub-main designation, rating and short circuit protective device.
- Light and power circuit numbers and current ratings, cable sizes and type and areas supplied.

Mount schedule cards in a holder fixed to the inside of the assembly or cupboard door, next to the distribution circuit switches. Protect with hard plastic transparent covers.

2.11.4 SWITCHGEAR, PROTECTION, CONTROLS

General: Supply and install all switchgear, controls, protection and instrumentation for the complete systems including all power systems. The power sources shall be capable of continuous operation at the rated values detailed which are net values after any applicable deratings have been applied relative to the mounting or enclosure of equipment.

Moulded Case & Miniature Overcurrent Circuit Breakers: Circuit breakers shall be mounted on a purpose made chassis. Removal of any breakers shall not disturb connections to other circuit breakers. Circuit breakers shall be screw fixed by fixings independent of terminal studs.

Miniature Overcurrent Circuit Breakers (and Moulded Case Circuit Breakers 400A and smaller)

Circuit breakers shall have instantaneous short circuit and inverse-time Overvoltage tripping characteristics and shall also have positive identification of breaker status "ON", "OFF" and "CENTRE TRIP" (MCCBs only), positions.

Moulded Case Circuit Breakers 400A and smaller shall have symmetrical RMS fault interrupting capacities sized to match the switchboard fault rating at the operating voltage.

All moulded case circuit breakers shall be provided with adjustable trip mechanisms. The trip setting specified shall be the minimum setting. The Electrical Contractor is responsible for setting and adjusting all trip settings during the commissioning stage of the project.

Miniature Overcurrent circuit breakers shall have a minimum fault interrupting capacity of 6 kA. Where the fault level exceeds 10 kA on an installation, HRC fuse "fault current limiters" shall be used to back up the circuit breakers or suitable miniature circuit breakers of higher fault level rating shall be selected and installed. Evidence that a particular make of circuit breaker complies with the above requirements shall be submitted prior to installation.

Single pole circuit breakers shall be interchangeable with multi pole circuit breakers. Duplex MCB's shall not be used.

If not specified elsewhere, MCB sizes shall be as follows:

- Lighting: 16 Amp
- Power: 20 Amp
- Water Heating 20 Amp
- Hot Water Boilers 20 Amp

Double Pole Residual Current Circuit Breaker's With Overload Protection (RCBO's): Where RCD protection is specified and / or required by the Electrical Wiring Rules, double pole RCBO's shall be utilised.

Residual Current Devices shall be 30 milliamp rated devices integrated into the associated MCB (RCBO's). Ensure the circuit breaker component has the same fault rating as all other MCB devices within the distribution board and is correct for the application.

RCBO's shall be double pole type, switching both live conductors (active and neutral) and fit within a single MCB module width.

Short circuit, cascading and discrimination performance of the circuit breaker shall not be affected by the earth leakage device.

Maximum tripping current shall be 30 milliamp and the maximum tripping time shall be 20 milliseconds

Switches / Isolators: rated thermal current of all switches / isolators shall be as applicable to the unit when installed in the specified enclosure. The rated duty shall be uninterrupted. The rated short circuit making capacity shall be not less than the switchboard fault level. Utilisation category shall be not less than AC-23 for circuits comprising essentially motor or other highly inductive loads or not less than AC-22 for other circuits. All / isolators shall be complete with independent manual operation with a positive manually operated ON-OFF indicator. Provide a facility to lock all units in the OFF position.

Control switches: Control switches shall comply with IEC 947, EN 60947.

Switches shall be type tested to be mechanically capable of a minimum of one (1) million operations and shall be derated where applicable to provide an electrical life expectancy of one (1) million operations.

Selector switches shall be cam operated rotary type switches, with displacement of 60 degrees and the 'off' position located at the 12 o'clock position. Provide rectangular escutcheon plates securely fixed to the assembly panel that identify switch position and function.

Rated operational current shall be 10 amps minimum.

Voltmeter selector switches shall have phase to phase and phase to neutral selection and an off position.

Extra Low Voltage Transformers: Extra low voltage transformers shall be complete with centre tap on secondary winding. Primary and secondary windings shall be wired out on opposite sides of transformer case and shall be separated using an earth screen wired out to an insulated terminal. Output loading shall be less than 80% of transformer continuous rating, taking account of degree of ventilation and ambient temperature within assembly, and supplied load.

Instruments & Meters: All energy meters shall be MARIA compliant. All transducers shall be to AS 1384.

Digital Analysers

Provide Type 1 and 2 true RMS metering with 0.5% accuracy digital analysers monitoring three phase 4 wire currents and voltages with LCD display and programmable to display circuit parameters for voltage, current, power factor, energy, frequency, maximum demand and harmonic distortion for each phase.

- I/O's: 4DI/2DO
- 8x multi-tariff energy metering capability
- Two optically isolated RS-485 ports, on IP address

- Schneider PM3560 or equal

Metering & Protection Transformers: The Electrical Contractor is fully responsible for the supply, installation and connection of the Energy Trader metering devices, including ripple relays, etc., as required. Energy Trader will be nominated by the Client during the construction phase.

The Electrical Contractor is required to arrange, supply & install all metering indicated on the drawings, this also includes energy trader meters for any empty tenancies.

All metering devices shall comply with MARIA Codes of Practice, all transducers shall comply with AS 60044.1.

Provide test links for the connection of calibration instruments and meters, and for the shorting of current transformer secondaries. Energy meters, maximum demand meters and ammeters, shall be provided with a set of links comprising screw-clamped slide links and an earth link.

Minimum accuracy classification and class for current transformers shall be as follows:

- Energy measurements: - 0.5M
- Indicating & recording instruments - 2M
- Protection Relays - 10P 60

Rated short-time current shall be not less that the short-time current equivalent of the potential fault capacity of the circuit in which the current transformer is installed.

Surge Diverters: On the Main Switchboards supply and install combined lightning current and surge arrestor Class 1 and 2 surge protection devices between each phase and earth.

Operation:

The Surge Diverter shall operate at a Nominal system Voltage of (Vrms) 240/415V, 50 Hz.

Protection:

- The Maximum Discharge Current, Imax, as defined in IEC 61643-1 shall be 100kA per line, 8/20µs per phase.
- The Nominal Discharge Current, In, as defined in IEC 61643-1 shall be greater than 40kA per line, 8/20µs per phase.
- The Voltage Protection Level Up as defined in IEC 61643-1 shall be less than 800V at 3kA 8/20us .
- The Voltage Protection Level Up as defined in IEC 61643-1 shall be less than 1200V at In.
- The Maximum Continuous Operating Voltage, Uc shall be 415 Volts.
- The products shall be UL recognised under UL1449-3 standard.
- The product shall be equivalent to DEHN DV M TT 255 FM, CRITEC TDX 100M or 2 x CRITEC TDS350 (for three phase applications) or 6 x CRITEC TDS150 with 2 x CRITEC SGD1100-2S-NE or another 2 x CRITEC TDS150.

Alarms and Indicators:

The surge diverter shall have visual indication and voltage free contacts (provide monitoring relay and 22mm diameter red panel lamp with integral test facility). The surge protection device shall have a 100kVA or 2 x 50kA replaceable modules per line for change-over after surge protection depletion has occurred.

Warranty:

There shall be a minimum of 5 years warranty provided for the surge diverter.

Test Standards:

- UL1449 Edition 2
- IEC 61643-12 Class I and II
- AS/NZS 1768:2007

Protect each set of surge diverters with a multi-pole circuit breaker sized in accordance with the manufacturers' requirements. Back-up fuse protection is required for the DEHN surge diverter only when the incoming power supply capacity is rated equal to, or greater than, 315 amps per phase.

Surge Diverters: Where indicated on the drawings provide surge diverters between each phase and earth on the MDB's, and DB's.

Operation:

The Surge Diverter shall operate at a Nominal system Voltage of (Vrms) 240/415V, 50 Hz.

Protection:

- The Maximum Discharge Current, Imax, as defined in IEC 61643-1 shall be at least 25kA and up to 50kA, 8/20µs per phase.
- The Nominal Discharge Current, In, as defined in IEC 61643-1 shall be greater than 12.5kA / 20kA, 8/20µs per phase as applicable to the unit.
- The Voltage Protection Level Up as defined in IEC 61643-1 shall be less than 850V at 3kA 8/20us and 6kV 1.2/50us.
- The Voltage Protection Level Up as defined in IEC 61643-1 shall be less than 1200V at 20kA 8/20us and 6kV 1.2/50us.
- The Maximum Continuous Operating Voltage, Uc shall be 320 Volts.
- Neutral to Earth protection shall be by means of a GDT or MOV with Iimp of 40kA minimum.
- The product shall be equivalent to DEHN DG M TT CI 275FM, CRITEC TDS350 (for three phase applications) or CRITEC TDS150 with CRITEC SGD1100-2S-NE or another CRITEC TDS150 (for single phase applications).

Alarms and Indicators:

The surge diverter shall have visual indication and voltage free contacts (provide monitoring relay and 22mm diameter red panel lamp with integral test facility). The surge protection device shall have a 25kA or 50kA replaceable modules per line as applicable to the unit rating for change-over after surge protection depletion has occurred.

Warranty:

There shall be a minimum of 5 years warranty provided for the surge diverter.

Test Standards:

- L1449 Edition 2
- IEC 61643-12 Class I and II
- AS/NZS 1768:2007

An integral fuse is provided with the DEHN unit. Protect each CRITEC surge diverter or set of diverters with a single or multi-pole circuit breaker (as applicable) sized in accordance with the manufacturers' requirements. Back-up fuse protection required and for the CRITEC surge

diverters only when the incoming power supply capacity is rated equal to or greater than 100 amps per phase.

2.12 RETICULATION AND DISTRIBUTION SYSTEMS

Cables General: Cables shall be of approved manufacture.

All cables shall have high conductivity plain annealed copper conductors (unless indicated otherwise) and all cables shall be of the multi-stranded type.

All cables shall include earth continuity conductors (except low voltage control cables) and shall be insulated for their required duty.

PVC or PVC/PVC cables entering light fittings with H.I.D. lamps or heaters shall be 105°C grade cable.

TPS Insulated Cables: TPS insulated cables shall be 0.6/1 kV type. Insulation shall be PVC and cable sheaths shall be TPS, TPS shall be specially compounded to ensure ease of stripping yet still resistant to mechanical damage.

PVC Insulated Cables: PVC single insulated cables shall be 0.6/1 kV and V.75 type unless otherwise specified.

Neutral Screen Cables: Multicore neutral screen cables shall be complete with PVC insulated copper conductors with fillers and PVD taped bedding, spiral copper neutral screen an PVC sheath, in accordance with AS/NZS 4961: 2003 and AS/NZS 5000.2: 2006.

XLPE Cables: Cross linked polyethylene (XLPE) 0.6/1 kV cables with PVC or nylon sheathing shall be used in lieu of PVC/PVC cables, installed in accordance with the manufacturer's recommendations.

Flexible Cables: Flexible cables shall be complete with 0.3 - 0.5 kV insulation. All heat resistant flexible cables shall be complete with Butyl or Silicon Rubber, or similar approved, insulation.

Installation & Termination: Within ceiling voids/spaces and floor voids all cables shall be installed in a workmanlike manner in the horizontal plane square and parallel to walls, floors and ceilings.

All cabling installed within walls shall drop vertically from the ceiling space direct to the associated outlet, or rise vertically from the floor void direct to the associated outlet.

Where horizontal cabling is unavoidable i.e. under windows, cables shall be provided with suitable additional mechanical protection or alternatively with 30mA RCD protection.

Horizontal cabling will not be accepted within walls, unless specifically approved by the Engineer.

Cables shall be concealed except where nominated otherwise, and shall be installed in neat lines.

Cables shall be installed in a manner eliminating any possibility of strain on the cable itself or on cable terminations.

Cables shall not be bunched on cable trays or on catenary wire, cables shall be installed in such a manner that adequate spacing is provided for fixing and for heat dissipation.

Cables shall be kept a safe distance from items liable to become hot. The distance shall be consistent with the maximum temperature possible and the cable type. Cables shall at no point make direct contact with such items.

Cables shall not be embedded in plaster, concrete, mortar or other finishes unless they are in conduit and capable of being fully withdrawn and replaced after the building is finished without damage to finishes.

Bunching of cables in any one run shall be avoided.

All conductors shall be coloured coded to comply with the NZ Wiring Rules.

PVC/TPS and all other PVC insulated cables shall not be installed in locations where they are in contact with polystyrene, in all such instances PVC / TPS cables shall be protected by enclosure within a system of high impact PVC conduit. Alternatively, non-migratory TPS cable may be used.

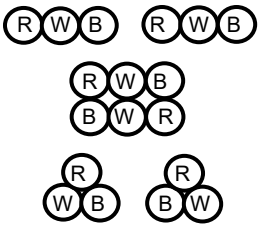
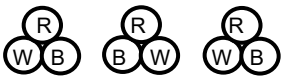
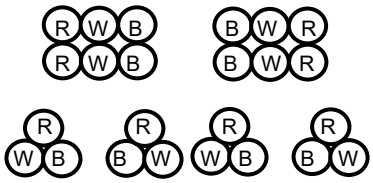
PVC/TPS and all other PVC insulated cables shall not be installed in locations where they are in contact with bituminised paper, in all such instances PVC / TPS cables shall be protected by enclosure within a system of high impact PVC conduit.

Cables originating from different distribution systems or switchboards shall not be installed in the same length of conduit, duct or in the same junction box.

Cables originating from different circuit breakers shall not be installed through any electrical accessory, outlet or luminaire with which they are not associated.

Where single core cables enter metal clad enclosures, switchboards isolators via drilled holes or 'knockout' these holes shall be interconnected via a 5mm slot to eliminate the effects of eddy currents.

Where parallel conductors are used all conductors shall be of the same length. Where single core cables are used they shall be grouped in 3 phase close trefoil formation. The phase sequences as indicated in the table below must be adhered to.

Arrangement	Phasing
Two sets of parallel conductors	
Three sets of parallel conductors	
Four sets of parallel conductors	

Where cables enter or terminate at metal clad enclosures, switchboards isolators and the like they shall terminate via the correctly sized cable glands. Cable glands shall be correctly sized and apply radial compression to the cable sheath.

All cables with an overall diameter greater than fifteen millimetres (15mm) shall be terminated via glands of brass or stainless steel construction.

All cables with an overall diameter less than fifteen millimetres (15mm) shall be terminated via glands of nylon / PVC construction. All glands shall be secured with lockrings or lock nuts.

Bending radii for bends set on site shall be not less than eight times the overall cable diameter for XLPE insulated cables and six times the overall cable diameter for PVC insulated cables or strictly in accordance with the manufacturer's recommendations

When drawing cables in through pipes, ducts, conduits etc., the following minimum bending radius shall apply:

Twelve times the overall cable diameter for XLPE insulated cables and nine times the overall cable diameter for PVC insulated cables.

Cables shall run straight for at least 300mm immediately prior to entering switchboards and other equipment.

Cables installed in cavity external walls shall be tied against the face of the inner skin of the masonry walls and kept clear of the outer skin.

400 / 230 volt cabling shall be completely segregated (300mm min) from all telecommunications, security, fire alarm, television aerial, audio/visual and low voltage control cables. In addition all low voltage control cables are to be segregated from telecommunications, security, television aerial and audio/visual cables by 150mm.

Cabling in False Ceiling Spaces: Cabling within false ceiling spaces shall not be fixed to metallic or timber ceiling support systems catenary support systems shall be used.

Catenary Support Systems	
2c + E TPS Size	**Max. No**
1.5 mm^2	10 No.
2.5 mm^2	7 No.
4.0 mm^2	5 No.
6.0 mm^2	4 No.
10.0 mm^2	2 No.
16.0 mm^2	2 No.

Catenary support systems shall be utilised to support all cables within ceiling voids/spaces. Cables shall be supported at intervals not exceeding 600mm using plastic ties. PVC tape is not an approved method of fixing cabling to the catenary wires. Catenary wires shall consist of pre-stressed PVC covered steel wire installed with a substantial eyebolt at one end and a wire strainer at the other to ensure the wire is tightly tensioned. The catenary wires shall not sag due to the weight of the cabling.

The Electrical Sub-Contractor shall note that the combined weight of combinations of cables shall not exceed 1kg / metre and that all catenary cables shall have intermediate supports where the span exceeds five metres.

Cables shall be neatly grouped together and at no point shall the cabling rest on the top side of the false ceiling, lighting fittings or other heat producing equipment.

Cabling Installed Vertically (Rising Cables): "Rising Cables" shall be interpreted to mean cables installed vertically or on a sufficiently steep incline for the dead weight of the cables to impose significant stress on the cables or terminations. Rising cables shall consist of various types of cable with or without enclosure.

An air gap of at least 12mm shall be maintained between any vertically rising cable and the wall to which it is attached.

Cables running in vertical accessible ducts shall be supported at intervals not exceeding 1200mm to prevent forces being exerted on terminal connections or on the cables changing direction from horizontal to vertical.

Acceptable methods of support shall include cable tray, cable ladder, or Unistrut channel (or equivalent) complete with cable and conduit clamps.

PVC insulated and PVC sheathed cables shall be clamped by means of cable clamps with selected hardwood paraffin impregnated timber installation brackets.

Cables running in vertically installed conduits over 5 metres in length shall be clamped every 5 metres and at changes of direction with an effective device designed to relieve stress due to weight.

Cables installed in vertical wiring ducts shall be supported at a maximum of 5 metre intervals using an efficient and approved method of clamping to the trough.

Cables in Conduits: In addition to the general requirements cables shall be fed into conduit in such a way as to prevent twisting and crossing.

Conduits shall be completely assembled and built in before drawing in cables. Do not use inspection fittings for drawing in cables. Kinked or damaged cables shall be replaced.

Cables on Trays: Cables shall be fixed neatly to the tray in a single layer or trefoil formation for three phase circuits and shall be installed parallel with the tray edge and to avoid unnecessary crossovers.

Cables shall be run in a manner allowing others to use space on the tray.

Cables shall be arranged to leave the tray either at an end or over the side. The tray shall be formed or protected to prevent damage to the cables where exits are made from the tray.

Cables shall be installed such that spare space capacity of not less than 20% of each tray shall be provided.

Cables shall be fixed at intervals not exceeding 1200mm by means of approved fastenings of non-corrosive materials.

Conduits shall be fixed to trays by means of saddles. PVC/PVC final sub circuit cables shall be fixed by means of nylon ties or by saddles. MIMS cables and PVC/PVC cables greater than 10 sq. mm shall be fixed by metallic saddles.

Mushroom, cheese or round head type bolts and metal threads with washers of suitable size to support the cables shall be provided. One type of nut shall be used throughout. Only the heads of bolts shall be installed on the tray. Self-tapping type screws shall not be used. Sharp protuberances on the supporting face of the tray shall be avoided.

Specific requirements for WS (Fire) Rated Cables: Cables shall be secured to cable trays utilising stainless steel cable ties / clips / straps vertically every 300mm and horizontally every 1000mm.

Cables secured direct to the building fabric shall be secured utilising galvanised steel saddles and steel expanding bolts not incorporating flammable materials such as nylon. Cables shall be secured vertically every 300mm and horizontally every 1000mm.

Unsupported spans of cable will not be allowed.

2.13 CONDUIT SYSTEMS

Conduits shall be coloured orange, except where exposed to view where they shall be grey and with no visible wording.

NB: ***Surface mounted conduits shall only be utilised in Plantrooms, or in areas specifically approved by the Architect on site***.

Separate conduits shall be used for light, power and each specified system.

All surface conduits shall be installed in a workmanlike manner parallel to walls, floors and ceilings as applicable, but all conduits cast into concrete pours shall be installed to the most suitable direct route.

Rigid PVC conduit shall be used in all areas other than plant areas and exposed external locations or where there is a risk of mechanical damage.

In plant areas conduits below 2100mm above floor level shall be galvanised steel. Above 2100mm above floor level galvanised steel or rigid PVC conduit shall be used.

All exposed external conduit shall be galvanised steel or rigid, UV Resistant, PVC conduit, painted with a water based acrylic paint, fade resistant and entirely compatible with the conduit.

Where conduits have been shown for future use conduits shall be complete with 1mm galvanised steel draw wires.

Oval conduit will not be allowed.

All bends shall be swept bends formed on site, the use of flexible conduit in lieu of formed bends shall not be allowed. Bends of 90 degrees shall be made with a radius of not less than three times the external diameter of the conduit. Conduit shall not be installed under mechanical stress sufficient to cause deformation. The number of 90 degree bends between boxes in any single conduit shall be limited to no more than 2.

Solid elbows shall not be used. Inspection fittings shall not be cased in concrete or installed in rendered walls or other inaccessible locations. Conduit shall be bent cold without altering its section by using an approved type of bending machine or bending block.

Conduits shall not be less than 19mm diameter. Surface conduits of size up to 25mm diameter shall be fixed within 150mm of its termination onto an enclosure. Surface conduits greater than 25mm diameter shall be fixed within 300mm of its termination onto an enclosure.

Conduits shall be installed not touching any other pipes and in all cases shall be at least 150mm from gas pipes and pipes containing hot fluids. Conduit shall not be installed above and parallel to hot pipes.

Conduits installed in external cavity walls shall be tied against the face of the inner skin of the masonry walls and kept clear of the outer skin.

Metallic conduits which have been cut and threaded shall be reamed with an approved industrial type reamer, plugged and kept dry during the installation programme. On completion of the conduit installation excessive conduit thread shall not be evident.

Non-metallic conduit shall be jointed using the manufacturer's recommended adhesive. Surface mounted non-metallic conduits shall be terminated in approved junction and surface mounting plastic boxes.

Metal wall boxes shall be used for all flush mounted accessories and shall incorporate fixings which enable alignment and adjustment of the face plate of the accessory.

Power points or switches shall not be located back to back and precautions shall be taken to avoid possible sound paths through the wall. Acoustic barriers shall be provided.

Conduit saddles shall be spaced a maximum of 1200mm apart for metallic conduit or 1000mm apart for non-metallic conduit. In areas subject to high ambient temperatures or other severe duty the saddle spacing for non-metallic conduit shall be reduced to 500mm.

For single conduits up to 25mm diameter metallic galvanised half saddles shall be used. Where two or more conduits are run in parallel they shall be grouped.

Where conduits cannot be fixed to suitable surfaces approved brackets shall be provided.

Vertical lengths of conduit runs shall not exceed 5 metres unless draw-in boxes are installed with entry and exit conduit off-set.

Horizontal lengths of conduit runs shall not exceed 25 meters before a cable draw-in box is installed. Wherever feasible these boxes shall be fixed so that conduits entering them shall have sufficient fall to allow condensate to flow towards drain plugs near any apparatus.

Where runs exceed 25 metres, tee boxes shall be inserted at the lowest points of the runs between draw-in boxes. The branches of the tee boxes shall be pointed downwards and shall be fitted with a drain plug.

Where it is not practicable to insert draw-in boxes in runs exceeding 25 metres, conduit shall be increased to the next size.

Immediately prior to drawing in of cables, the bore of the conduit shall be thoroughly swabbed.

Conduit terminations shall be securely screwed or clamped at metal clad apparatus. Fixed wiring to motors and other appliances requiring flexible connections shall be run in rigid conduit to a junction box adjacent to the item of equipment, and from there in flexible conduit to the equipment. Flexible conduit connections shall be limited to not less than 150mm or more than 450mm in length. Where isolating switches are required they shall replace junction boxes.

Where conduits terminate at free ends a coupling and male bush shall be attached. Where two or more conduits terminate together they shall be cut to equal lengths.

Conduit take-offs shall be rigidly fastened with locknuts to each side and conduit ends shall be bushed.

Conduits & Fittings - In Situ Concrete: Either PVC or metallic conduit shall be cast into concrete slabs. No conduit greater than 32 mm diameter shall be case into structural concrete or built into masonry.

Where metallic or PVC conduit is cast into floor slabs it shall be terminated in solid cast metal or PVC boxes. Pressed metal boxes shall not be used. Deep type conduit boxes shall be used in reinforced concrete slabs so that the conduit shall be run above the bottom layer of reinforcement.

All conduit running horizontally in load bearing concrete columns shall be steel.

Conduit shall be solidly fixed between the top and bottom reinforcing steel in concrete slabs. Where conduits tend to become bunched; e.g. at switchboard positions they shall be spaced to the approval of the Supervisor.

Where expansion or construction joints need to be bridged, the in-slab conduit installation shall make allowance for any likely movement between the adjacent slabs. The conduit in the first slab poured shall be finished to within 90mm of the joint and a 300mm long sleeve of the next largest conduit size shall be internally greased and fitted over the first conduit. The conduit in the second slab poured shall likewise be fitted into the larger conduit leaving a clearance of 100mm minimum between the conduit ends for movement. All joints shall be taped and made water proof prior to the concrete being poured.

The Electrical Contractor is to provide all necessary attendance on the pre-caster either on site or at their works to provide the required cable access and recessing of outlet boxes or blockouts.

Conduits & Fittings - External Use: Where exposed to the weather or dampness, junction boxes shall be provided with covers of heavy gauge material fitted with a neoprene gasket.

In damp and/or exterior locations, conduits shall be mounted on pre-painted galvanised or PVC saddle spacers to maintain a spacing of not less than 13mm from surfaces concerned.

2.14 CABLE TRAY SYSTEMS

A primary system of cable trays will be installed to support the service main, submains and major runs of final sub-circuit wiring.

Where cable tray is shown on the drawings, the routes and sizes are indicative only and Electrical Contractor shall be responsible for providing all cable tray required for a complete installation.

Cable tray systems shall be continuous.

Cable tray shall be ST3/LT3 hot dip galvanised steel cable tray.

Tray shall be not less than 1mm thick up to 300 wide and 1.6mm thick up to 600 wide. The folded edge shall be not less than 19mm deep and radiused.

Cable trays shall not be installed bridging seismic breaks, at seismic breaks cable tray shall be stopped at each side of the seismic gap with expansion loops on all cables such that up to 200mm of movement can be accommodated. Cable trays shall be supported with opposing diagonal bracing at drop rod locations.

Tees, crosses and joints shall be made by means of fish plates or splines. Bends shall be equal in strength to the original section at all points. Butted straight ends will not be accepted. Bends shall be sized to allow the installation of the largest cable necessary without bending it at a smaller radius than allowable while at times remaining parallel with the sides of the tray.

Brackets shall be constructed of galvanised mild steel suitably designed for the installation.

Cable trays shall be installed in a workmanlike manner parallel to walls, floors and ceilings as applicable prior to cable installation. Where routes are not specifically shown the trays shall be carefully located to approval.

Trays shall be fully supported over their entire width by suitable metal brackets. The brackets shall be equally spaced (spacing shall not exceed manufacturer's recommendations) to prevent sagging in horizontal lengths of tray. Where longer support spans are required use ladder tray ensuring that the maximum spacing between supports does not exceed the ladder tray manufacturer's recommendations.

Horizontal cable tray shall be mounted on suspended brackets such that the top of the tray can be accessed for the installation of cabling. Tray shall be mounted on 'trapeze' type brackets. Vertical cable tray shall be mounted to the wall, via brackets.

Installation methods, weight of cables and requirements for subsequent maintenance procedures shall be taken into account when designing supports and brackets.

Trays shall not be continuously mounted directly onto a flat surface. Sufficient space for air circulation around and through the tray shall be provided. The minimum mounting dimension of any cable tray from a wall or ceiling shall be 12mm.

Covers shall be provided over trays where the cables are liable to mechanical injury, falling objects or welding sparks.

Air circulation around cables shall be regarded as a prime factor when determining the location of cable trays.

In locations where dirt and other foreign matter are liable to be present in sufficient quantities to foul the tray, the tray shall be run vertically.

Specific requirements for cable trays supporting WS (Fire) Rated Cables: Cable trays supporting WS Rated cables shall be secured to fire rated elements of the building using expanding steel bolts or similar. Cable trays and fixings should be loaded according to the manufacturers recommendations for fire conditions.

2.15 TERMINATIONS AND JOINTING

General: A loop-in loop-out wiring system shall be used. No joints will be permitted except at outlet positions.

All single core or composite multi core cables shall terminate at surface mounted switchboards, sheet steel enclosures and accessories utilising proprietary glands and lock-rings via pre punched cable access points or steel / aluminium gland plates.

Cables with a nominal overall diameter of 14.0 mm or less shall terminate via nylon cable glands that apply radial compression to the sheath, cables with a nominal overall diameter of 15.0 mm or more shall terminate via brass or stainless steel cable glands that apply radial compression to the sheath.

Where unenclosed single core or composite multi core cables pass through sheet metal enclosures (this includes switchboards) they shall be glanded as outlined above terminating via the gland plates. The gauge of conductors shall not be changed

Externally all glands shall be of the waterproof type.

XLPE, PVC and TPS Insulated Cables: All cables 6.0mm^2 and above shall be terminated to bolts or studs, using compression type lugs.

Compression lugs, or ferrules shall be designed for the type of cable and shall be installed in accordance with the manufacturer's recommendation using the approved compression tool and die.

Where aluminium conductors are utilised provide bi-metallic termination lugs.

Protective sheath covering on all PVC insulated and sheathed cables shall be maintained between outlet boxes, conduits or equipment enclosures.

2.16 ACCESSORY MOUNTING HEIGHTS

Unless detailed elsewhere within this specification, or on the Architectural drawings, the following mounting heights for all electrical trades shall be adhered to. All mounting heights indicated are above finished floor level (AFFL) to the bottom of the flush box or mounting block etc. The Electrical Contractor shall seek advice from the Engineer where they are unsure or require further clarity.

These heights shall be confirmed with the architect prior to installation.

- Light Switches — Door Handle Height (between 900-1200mm)
- Socket Outlets — 500mm
- Permanent Connection Units — 500mm or as appropriate for appliance

♦ Proximity Card Readers	Install at door handle height (between 900-1200mm) adjacent to the door under control, no less than 500mm from an internal corner. Have sufficient time-delay for the door to be opened before the locking system re-activates
♦ Request / Push to Exit Buttons	Install at door handle height (between 900-1200mm) adjacent to the door under control, no less than 500mm from an internal corner. Have sufficient time-delay for the door to be opened before the locking system re-activates

2.17 ACCESSORIES, OUTLETS & APPLIANCES

General: Supply and install all accessories, outlets, appliances and appliance connections complete with required fixings and fastenings.

All accessories shall be either PDL 600, HPM Excel or Clipsal C2000 series. All accessories utilised on the project must be however of the same type, a mixture of different manufacturers fittings will not be acceptable. It is the Electrical Contractors responsibility to liaise with the Telecommunication system, installers to ensure that all outlets plates are coordinated in terms of location and make.

The colour of all accessories must be confirmed with the Architect.

The colour of all accessories must be confirmed with the Architect.

Accessories & Outlets: Accessory flush plates shall be of high impact polycarbonate construction except where metal accessories are nominated. Protected and/or weatherproof accessories shall be housed in non-corroding metal or polycarbonate enclosures

Mounting heights nominated are to the centre of the equipment. Accessories located in face brickwork or special finish walls shall be located to the nearest brick, panel, or tile course, as applicable. Accessories located on face brick walls shall be mounted vertically.

Where accessories are mounted back to back, precautions shall be taken to avoid possible sound paths through the wall. Acoustic barriers shall be provided where no other protection is provided.

Provide flush boxes for all flush mounted accessories, open backed mounting brackets are not approved. Flush boxes shall be fixed via two screws through the back to a dwang or support, two screw through the side to the stud, or two 100mm nails through the side to the stud. Screw shall have a minimum penetration of 20mm into the associated structure.

Flush boxes cast into concrete walls shall be of the deep metal type suitable for the application. Accessories mounted on timber strapped walls where limited recessing depth prevents the use of conventional boxes shall utilise Superlux mounting brackets, or similar.

Accessories surface mounted to walls shall utilise purpose made surface mounting blocks.

Label all accessories showing circuit number and DB, labelling shall consist of engraved traffolyte labels. 'P' Touch or hand drawn labelling is not acceptable.

For all accessories, labelling shall be provided via an engraved traffolyte label fitted to the wall above the accessory (up to a mounting height of 1800mm AFL), above this height the labels shall be fitted to the wall below the accessory.

Switches: Switches shall be of the rocker type suitable for inductive lighting loads and shall be flush wall mounted unless otherwise indicated.

Multi switch positions shall be ganged under one cover plate unless otherwise indicated. Switches in ganged boxes shall be arranged similar in plan to the lighting points controlled.

All switches shall be mounted on the latch side of all doors and adjacent to door handle. The arrangement of all door swings and the height shall be confirmed before installation of any conduit, cabling or wall box.

Switches supplied from different phases shall be totally segregated by appropriate physical barriers.

Switches shall be 15 amp capacity except where higher ratings are specified.

Provide red neon indicators above switch toggles, to be visible with switches 'on', where specified.

Switches shall be mounted at the same height above floor level as the local door handles (as required by the New Zealand Building code), unless indicated otherwise.

Power Outlets: Power outlets shall be of the same manufacture as for "Switches". Outlets shall be of the combination rocker switch/socket type flush wall mounted. Socket outlets shall be complete with safety shutters.

Rating shall be 10 amp single phase, unless indicated otherwise.

Outlets shall be horizontal type for above bench or trunking mounted outlets. All other outlets shall be vertical type. In addition trunking mounted outlets shall be of the narrow type.

Socket outlets shall be mounted at 500mm above floor level, unless indicated otherwise.

Double outlets shall be under one flushplate. Outlets with ratings greater than 10A 230V shall be supplied with matching plugs.

Socket outlets indicated as being weatherproof or IP rated shall be IP65 rated, PDL 56 Series. All PDL 56 series outlets shall be complete with a switch (i.e. PDL 56CV type) and all must contain a neutral. All IP65 rated outlets shall be supplied complete with purpose made mounting enclosures. Where IP65 rated outlets are flush fixed (internally) provide recessed enclosure and flush fixing bezel, all three phase sockets shall be five pin and incorporate a neutral.

Permanent Connection Units: Switched permanent connection units (PCU's) shall be provided for all equipment indicated. PCU's shall be located immediately adjacent to the equipment or appliance it connects such that the isolation point is readily accessible. PCU's must be located on the same side of the equipment or appliance as the associated termination point, to keep the length of the required flex to a minimum.

56 Series Outlets & Accessories: All outlets and accessories indicated as being weatherproof or IP rated shall be IP66 rated, PDL 56 Series chemical resistant type series or equal approved, standard grey type outlets are not approved. All IP65 rated outlets and accessories shall be supplied complete with purpose made mounting enclosures, locking rings and matching plug top of the same rating. Where IP65 rated outlets are flush fixed (internally) provide recessed enclosure and flush fixing bezel.

Anchoring arrangements shall be provided for the flexible cord within the outlet.

2.18 LUMINAIRES

Co-ordinate the exact positions of all light fittings with the Main Contractor, and associated sub-contractors, prior to installing any cabling. This is especially critical with respect of ceiling

mounted fittings, and their relation to mechanical grilles / louvers, fire protection equipment, ceiling construction, etc.

It is the Electrical Contractors responsibility to obtain from the manufacturers the cut out dimensions for all recessed luminaires.

The area above and immediately around all recessed luminaries shall be clear of insulation material, the Electrical Contractor shall ensure that this occurs.

All recessed troffer type luminaires within GIB lined ceilings shall have their apertures framed, recessed troffer type luminaires shall be securely fixed to the framing.

All recessed luminaires in suspended tile ceilings shall be provided with Tee rail mounting arms. All recessed luminaires in GIB or timber ceilings shall be provided with side arms suspensions.

The supply and installation of all downlights must comply with the requirement of AS/NZS 3000. The Electrical Contractor shall ascertain the manufacturer's classification for all recessed luminaires and ensure that the installation is carried out in accordance with the recommendations for the particular classification of luminaire.

Quantities and Types: The quantities of each type of lighting fitting and associated equipment shall be determined from the Drawings as identified by the letter symbol signifying type.

The lighting fittings and associated equipment shall be of the precise appearance, performance and detail specified.

External Fittings: For external fittings all ventilation openings shall be adequately shielded and meshed against the ingress of insects.

Manufacturer's Catalogue Numbers: The statement of a manufacturer's catalogue number or other identifying symbol does not remove the responsibility of ensuring that lighting fittings so identified comply with the requirements of the Specification. The fitting description and catalogue number are intended to be complementary in describing the proposed fitting.

Construction: Lighting fittings shall be visually free of light leaks from penetrations, around trims, etc when installed in their intended locations or where forming part of a ceiling system, and when viewed from normal occupancy areas.

All fascias and other parts shall be securely located and positioned using spring clips or similar devices such that under no circumstances can the fascias or other parts become dislodged or displaced.

The trims of all recessed lighting fittings shall be designed to be rigid and true and shall finish in contact with the ceiling at all points.

Clips and other devices wherever used shall be designed not to deform under in-service conditions.

Lamps shall be adequately supported to ensure that breakages do not occur through vibration or shock.

Surface mounted lighting fittings shall be fixed by means of a minimum of two screws or studs with nuts.

All screws, nuts, bolts, clips, washers and similar fittings shall be cadmium plated or of other non-corrodible metallic material.

LED Drivers: Each LED fitting shall be supplied with an individual driver matched to the LED and suitable for the purpose intended.

The LED driver and their enclosures shall be positioned in readily accessible locations where they can dissipate their generated heat and where replacement of internal fuses and resetting of protective devices can be easily performed. They shall not be covered or surrounded by any thermal insulation.

All LED drivers shall be complete with fused terminals and shall have insulated & shielded terminals. Where fittings are required to be dimmable, the driver shall be fully compatible with the lighting control system or the dimming method specified.

The enclosure shall be ventilated to ensure that in their normal operating condition and with all LEDS operating the drivers do not require to be de-rated.

Power Factor Correction: Power factor shall be not less than 0.90.

Terminal Blocks: Terminal blocks shall be mounted close to cable entry points using the continuous strip removable insert type, or an extended insulating base.

Each terminal block shall include a spare, insulated looping terminal and shall be suitable for 2 x 2.5 mm^2 conductors minimum.

An individual fuse integral with the terminal block shall be fitted to each non catalogue listed manufactured project lighting fitting.

Wiring: Inter component wiring shall be single core, 105 deg. C. 250V grade 0.75 sq. mm copper PVC insulated cable.

Wiring shall be neatly bunched and secured by clips and strapping with adequate slack to ensure that it is permanently retained clear of all hot parts.

Where fittings are designed for operation in high temperature areas, heat resistant type cables shall be used.

Cable entry holes in the fittings shall be located and bushed to keep sub-circuit wiring clear of hot parts. An approved cable clamp shall be installed inside the carcass of each fitting adjacent to the entry hole suitable for the clamping of up to 3 entering cables.

Packaging: Lighting fittings and components shall be supplied packed in robust and adequately sealed enclosures, fully suitable for conditions pertaining to despatch, transport, delivery, storage and hoisting until the lighting fittings and components reach their installed locations.

Faults in Service: If faults develop in any type of lighting fitting, it shall be required that tests be carried out. Where so requested, two such fittings shall be removed for testing and written test reports shall be submitted for approval before final rectification work is carried out.

All lighting fittings involved including temporary replacements shall be operable in the interim period.

2.19 LIGHTING CONTROL

The Electrical Contractor shall provide all lighting control systems as detailed herein or shown on the drawings. Lighting control shall be achieved by means of automatic lighting control.

The Electrical Contractor shall provide all necessary control wiring for dimmed circuits/luminaires, 0-10v / DALI control signals shall be reticulated on the manufacturers recommended/approved cabling. Electrical Contractors should note that 0-10v cabling is not indicated on the drawings.

2.20 EMERGENCY LIGHTING

The Electrical Contractor shall supply and install emergency self-contained battery luminaires and circuit cables to comply with the requirements of NZBC F6 (including applicable parts of

NZBC G9, AS2293 parts 1 and 3: 2005, AS/NZS 60598.2.22: 2005 and AS/NZS 2293.2: 1995.

The system shall comprise a single point system utilising Maintained (M), non-maintained (NM) or sustained (S) as defined in AS2293:2005 parts 1 and 3 and AS/NZS 60598.2.22: 2005.

Illuminated exit signs shall be fitted to all doors leading to the exit ways and shall be installed as shown on the drawings.

Emergency luminaires shall be supplied from the lighting circuit supplying general lighting in the area concerned. Emergency luminaries shall only be looped together where indicated. All wiring to sustained luminaires shall comprise 3E cable, otherwise 2E cable can be used if only emergency maintained and non-maintained luminaires are connected on the same cable run.

Combined Emergency Luminaires: Sustained units shall comprise two or more lamp luminaires or signs, the principle of operation shall be that under normal conditions a minimum of one lamp shall be energised from the emergency lighting supply and the other(s) be switched in conjunction with the general lighting, the emergency lighting lamp(s) shall be energised in the event of a power failure or under test conditions via its integral battery system. The emergency lamp(s) in a combined luminaire can be either maintained or non-maintained.

Compound Self-Contained Emergency Luminaires: Compound units shall be self-contained emergency luminaires providing maintained or non-maintained emergency lighting for the base emergency luminaire and also providing emergency supply for operating a remote satellite emergency luminaire.

Satellite Emergency Luminaires: Satellite units shall derive emergency operation supply from an associated compound self-contained emergency luminaire and can be for maintained or non-maintained operation.

Self-Contained Maintained Luminaires: Self-Contained Maintained units shall comprise single lamp luminaires or signs, the principle of operation shall be that under normal conditions the lamp shall be illuminated via the mains and in the event of a power failure or under test conditions via its integral battery system.

Self-Contained Non-Maintained Luminaires: Self-Contained Non Maintained units shall comprise single lamp luminaires or signs, the principle of operation shall be that under normal conditions the lamp shall be either extinguished or illuminated in conjunction with the general lighting (as specified) and in the event of a power failure or under test conditions via its integral battery system.

Emergency lights shall be rated for two-hour duration. Batteries shall be sealed non-venting high temperature Lithium type, suitable for operating lamp at its rated output for 2 hours. Lead acid or Nickel Cadmium type batteries will not be accepted. Battery life shall be at least 5 years when operating under normal conditions at an ambient temperature of 25 degrees Celsius and subjected to charging and discharging at 6 monthly intervals.

All Emergency lights shall be an approved classified type, as required by AS/NZS 60598.2.22, AS2293 and certificates for each luminaire (stating compliance with AS/NZS 60598.2.22) shall be provided on request. This includes combined standard / emergency luminaires.

All emergency lights shall have a Red LED indicator and local test switch, as specified within AS/NZS 60598.2.22.

Provide protection of the inverter system against damage in the event of failure, removal or replacement of lamp, while in normal operation.

All exit fittings shall be complete with 'Exit' labels and arrows as necessary to indicate the direction of exit.

Automatic self-test exit and emergency luminaires via Galaxy monitoring systemshall be manufactured and installed to comply with the requirements of AS/NZS2293.2 Section 3 – Inspection and Maintenance Procedures for Single Point Systems, AS/NZS2293.1 section 4.3.2 – Automatic Testing Facilities and be manufactured to comply with the requirements of AS2293.3 section 4.8 – Self Contained Automatic Discharge Facilities.

Automatic self-test exit and emergency luminaires shall have an LED indicator that provides distinctive indications of the various operational states – as a minimum

- Normal State
- Recently tested and complies – this indication shall be maintained for a minimum of 5 days following the test before reverting back to normal state indication
- Recently tested and failed – this indication shall be maintained until the fault is rectified and passes the subsequent required tests.

All exit and emergency fittings and system routers shall be labelled numerically and have permanent approved device reference labels with numbers corresponding with the log book and as installed drawings.

Emergency and exit luminaires shall be capable of reporting its status, test date, test results and faults to a monitoring system. The communication protocol shall be compatible with the BMS system being specified.

Individual lighting MCB's which are associated with the Emergency Lighting System shall be fitted with an engraved label (red on white) with lettering:

INTERRUPTING SUPPLY WILL DISCHARGE

EMERGENCY LIGHTING BATTERIES.

The test facility shall be similarly labelled:

EMERGENCY LIGHTING TEST

An operating and maintenance manual in a durable A4 hard-bound cover shall be provided for the emergency lighting installation, in addition to the test procedures and maintenance procedures this document shall incorporate test record sheets for each emergency luminaire and a copy of the lighting drawings cross referencing the emergency luminaires indicated on the drawings with the test record sheets.

The operating and maintenance manual shall be kept on the premises at all times, or at such other locations as may be approved by the inspecting authority.

Post installation, installing Contractor shall measure the illuminance levels achieve in accordance with Appendix B of AS/NZS 1680.1 & set up a Test Log Book & Maintenance Schedule.

The system shall be fully tested on completion as required by AS/NZS 2293. All results shall be recorded and the test record sheets kept within the Test Log Book. Any units that fail the commissioning test shall be rejected, replaced with new and be re-tested.

SECTION 3

PARTICULAR REQUIREMENTS

CONTENTS

SECTION 3

PARTICULAR REQUIREMENTS

This Section, section three, details the particular requirements for the Electrical Services installation.

3.1 PROJECT DESCRIPTION

The Electrical Works comprise the supply, installation, testing, commissioning, and maintenance of materials, labour and equipment for the completion of Electrical Services installation and associated site services, as indicated within this specification and on the drawings.

The project, Invercargill Central, Zone 1 – D.S Anchor, comprises the construction of a 3 level building with ground floor and level 1 department store (c/w amenity and office areas) & a childcare facility on level 2. The development is located 33 Esk Street in the city centre.

The works shall include, but shall not be limited to, the following:

- Provision of Main Switch Board
- Provision of Service Main cabling
- Provision of Sub-main Cabling
- Provision of Distribution Boards
- Provision of Luminaires
- Provision of Lighting Control systems
- Provision of Emergency Lighting systems
- Provision of Power accessories and all appliances required
- Provision of Sub-circuit wiring.
- Provision of Cable Support Systems
- Provision of Telecommunications Cabling System
- Provision of Access Control / CCTV Systems
- Provision of Coordination with other trades
- Provision of Earthing and Bonding systems
- Provision of Construction Drawings
- Provision of As Built drawings and Operating and Maintenance Manuals
- Provision of Testing, Commissioning and Certification
- Provision of Defects Liability
- Provision of Guarantees and Warranties

For the purposes of this specification the term, provision, shall mean the supply, installation, connection complete and commissioning of all systems and equipment as detailed in the specification including all necessary design, minor and incidental works required to implement the intent and meaning of the Specification and Drawings and to place the entire system into satisfactory operation.

Any temporary works necessary to erect items relating to this trade shall be provided. Include the preparation, application, inspection and payment of permits and fees associated with the works.

3.2 MAIN SUPPLY

The supplies to MSB.Z1.G within D.S Anchor and MSB.Z1.2 within the Childcare Centre shall originate from an existing Power Net transformer located adjacent to the development, approximately in the location indicated, Electrical Contractor to confirm exact location and make all due allowance for the Service Main Cables to these points.

The Electrical Contractor shall, immediately on being awarded the contract, contact one of Power Net's approved contractors and arrange for the supply to be provided and connected on the date required by the Construction works. Ensure the Power Net approves the design / build solution proposed by Power Net's approved contractor and that the Power Net is kept informed of the project and the progress of the new incoming supply.

MSB.Z1.G – D.S Anchor

The supply shall be rated at 400 amps three phase.

The new service main cable shall originate from the transformer and shall terminate at the Main Switchboard. Allow for all terminations required.

Termination to the Power Net transformer pillar will be by the nominated Power Net approved contractor, the Electrical Contractor shall supply cable lugs suitably sized for the service main cable and shall hand to Power Net's approved contractor, or their nominated sub-contractor, for termination.

The Electrical Contractor shall allow for all required liaison with the Power Net and their approved contractor, within the tender.

A copy of all correspondence between the Electrical Contractor and the above parties must be submitted to the Engineer.

Supply, install and connect the service main cable. Cable type shall be as indicated on the Drawings. Service main cable shall be buried beneath ground level and shall be enclosed within 2 x 150mm diameter high impact PVC pipe ducts throughout its length. Pipe ducts shall be complete with easy bend elbows and shall rise up through the floor slab in the location indicated. The cable shall rise to ceiling level and reticulate along cable tray the remainder of its length.

MSB.Z1.2 – Childcare Centre (Level 2)

The supply shall be rated at 63 amps three phase.

The new service main cable shall originate from the transformer and shall terminate at the Main Switchboard. Allow for all terminations required.

Termination to the Power Net transformer will be by the nominated Power Net approved contractor, the Electrical Contractor shall supply cable lugs suitably sized for the service main cable and shall hand to Power Net's approved contractor, or their nominated sub-contractor, for termination.

The Electrical Contractor shall allow for all required liaison with the Power Net and their approved contractor, within the tender.

A copy of all correspondence between the Electrical Contractor and the above parties must be submitted to the Engineer.

Supply, install and connect the service main cable. Cable type shall be as indicated on the Drawings. Service main cable shall be buried beneath ground level and shall be enclosed within a 150mm diameter high impact PVC pipe duct throughout its length under the slab. Pipe duct shall be complete with easy bend elbows and shall rise up through the floor slab. Cable shall continue to rise on cable tray to level 2 in the location indicated on the drawings.

3.3 SWITCHBOARDS & DISTRIBUTION BOARDS TO BE PROVIDED

The following main distribution board shall be provided under this section of the contract:

Refer section two for requirements associated with all switchboards.

Provide the main distribution board and distribution boards indicated on the drawings and detailed below.

The Electrical Contractor shall provide shop drawings that include a gland plate layout showing the termination point for each cable and a cable routing diagram showing the dressed cables within the proposed cable duct. Cables shall not be routed through switchboard compartments with which they are not associated.

Refer below for MSB and DB details.

The MSB's and DB's shall be a standard colour.

MSB.Z1.G (DS Anchor MSB)

Type	-	Form 2B or 2A
Constraints		
Length	-	5000 mm
Depth	-	400 mm
Height	-	2200 mm
Max. Cabinet Door size	-	600 mm
Cabinet enclosure	-	IPX4 (sprinklered building)
	-	Central Cable duct required
	-	Plinth required
Incomer	-	630 Amp MCCB c/w electronic tripping mechanism set to 400A
Bus work	-	Minimum 630 Amp rated
Metering	-	Clients Energy Retailer in segregated enclosure
CT's	-	Clients Energy Retailer in segregated enclosure
Instruments	-	Digital Analyser & CT's All in segregated enclosure
Mains Distribution	-	MCCB's c/w electronic tripping mechanism sized as indicated on the single line power diagram, locate in segregated enclosure
Termination Studs	-	Independently braced termination studs for all cables 70mm^2 and over.
Fixing	-	Mounted on ground and fixed to wall, refer section 2 for fixings and supports
Terminations	-	All main and sub-main cables terminated via compression glands. All cables with an overall diameter greater than fifteen millimeters (15mm) shall be terminated via glands of brass or stainless steel construction
Spatial capacity	-	Provide 25% spatial capacity for future in all controls enclosures and 20% spare ways within all DB's

MSB.Z1.2 (Childcare MSB)

Type	-	Form 1
Constraints		
Length	-	3000 mm
Depth	-	600 mm
Height	-	2100 mm

Max. Door size	Cabinet	- 600 mm
Cabinet enclosure		- IPX4 (sprinklered building) - Central Cable duct required - Plinth required
Incomer		- 63 Amp MCCB
Bus work		- Minimum 63 Amp rated
Metering		- Clients Energy Retailer in segregated enclosure
CT's		- Clients Energy Retailer in segregated enclosure
Mains Distribution		- MCCB's c/w electronic tripping mechanism sized as indicated on the single line power diagram, locate in segregated enclosure
Termination Studs		- Independently braced termination studs for all cables 70mm^2 and over.
Fixing		- Mounted on ground and fixed to wall, refer section 2 for fixings and supports
Terminations		- All main and sub-main cables terminated via compression glands. All cables with an overall diameter greater than fifteen millimeters (15mm) shall be terminated via glands of brass or stainless steel construction
Spatial capacity		- Provide 25% spatial capacity for future in all controls enclosures and 20% spare ways within all DB's

The following distribution boards are to be provided under this section of the contract:

Distribution Board (Ref DB.Z1.G-1) Location Integral to MSB.Z1.G

Cabinet enclosure		- IPX4 (sprinklered building)
Incomer		- 160 amp load break switch
Bus work		- Minimum 160 amp rated
Sub Circuit Distribution		- Contractor to determine refer drawings and circuit charts - All MCB's outgoing on composite 60 way TP-N pan assembly, refer specific schedule
MCB's		- Single pole 6kA/10kA as required, Contractor to determine quantity and rating based on the drawings and circuit charts
Controls Enclosures		- Electrical controls dedicated enclosure with lockable door
Controls		- Contractor to determine quantities. - Control circuit MCB's to be 6 amp rated - Provide all switches, interposing relays, contactors, transformers, power supplies, etc
Fixing		- Surface mounted metal clad complete with all doors, brackets, fixings and supports as art of MSB.Z1.G

Distribution Boards (Ref DB.Z1.G-2, Z1.1-1, Z1.1-2) Location as indicated on the drawing

Cabinet enclosure		- IPX4 (sprinklered building) - Central Cable duct required
Incomer		- 160 Amp load break switch

Bus work	-	Minimum 160 Amp rated
Sub Circuit Distribution	-	All MCB's outgoing on composite 60 way TP-N pan assembly refer specific schedule for size Additional 8 way TP-N pan assembly for Mechanical Services
MCB's	-	Single pole 6kA/10kA as required, Contractor to determine quantity and rating based on the drawings and circuit charts
Controls Enclosures	-	Electrical controls dedicated enclosure with lockable door
Mechanical Controls enclosure - DB.Z1.1-2 only	-	For pricing allow 500mm x 500mm mechanical controls enclosure c/w gear tray for mounting mechanical controls equipment to DB.Z1.1-2.
	-	Mounting of mechanical controls equipment shall be by the mechanical services contractor.
	-	Electrical Contractor shall confirm final cabinet size with mechanical contractor prior to ordering.
Controls	-	Contractor to determine quantities.
	-	Control circuit MCB's to be 6 amp rated
	-	Provide all switches, interposing relays, contactors, transformers, power supplies, etc refer schematic diagrams
Fixing	-	Surface mounted metal clad complete with all doors, brackets, fixings and supports

Distribution Board (Ref DB.Z1.2-1) Location Integral to MSB.Z1.2

Cabinet enclosure	-	IPX4 (sprinklered building)
Incomer	-	63amp load break switch
Bus work	-	Minimum 63amp rated
Sub Circuit Distribution	-	All MCB's outgoing on composite 36 way TP-N pan assembly, refer specific schedule
MCB's	-	Single pole 6kA, Contractor to determine quantity and rating based on the drawings and circuit charts
RCD's	-	Contractor to determine refer drawings and circuit charts: RCD's to be provided for: ♦ Socket Outlets (10mA for childcare areas) ♦ Socket Outlets (30mA where indicated)
Controls Enclosures	-	Electrical controls dedicated enclosure with lockable door
Controls	-	Contractor to determine quantities.
	-	Control circuit MCB's to be 6 amp rated
	-	Provide all switches, interposing relays, contactors, transformers, power supplies, etc
Fixing	-	Surface mounted metal clad complete with all doors, brackets, fixings and supports as part of MSB.Z1.2

Distribution Board (Ref DB.T.01, T.02, T.03, T.04, T.05) Location within Tenancies

Cabinet enclosure	-	IPX4 (sprinklered building)
Incomer	-	63amp SP isolator

Bus work	-	Minimum 63amp rated
Metering	-	Clients Energy Retailer in segregated enclosure
Sub Circuit Distribution	-	Contractor to determine refer drawings and circuit charts
	-	All MCB's outgoing on composite 16 way SP din rail assembly
MCB's	-	Single pole 6kA, Contractor to determine quantity and rating based on the drawings and circuit charts
Controls Enclosures	-	Electrical controls dedicated enclosure with lockable door
Controls	-	Contractor to determine quantities.
	-	Control circuit MCB's to be 6 amp rated
	-	Provide all switches, interposing relays, contactors, transformers, power supplies, etc
Fixing	-	Surface mounted metal clad complete with all doors, brackets, fixings and supports

Distribution Board (Ref DB.LL-2) Location BOH Zone 2 Store area

Cabinet enclosure	-	IPX4 (sprinklered building)
Incomer	-	63amp load break switch
Bus work	-	Minimum 63amp rated
Sub Circuit Distribution	-	Contractor to determine refer drawings and circuit charts
	-	All MCB's outgoing on composite 16 way SP din rail assembly
MCB's	-	Single pole 6kA, Contractor to determine quantity and rating based on the drawings and circuit charts
Controls Enclosures	-	Electrical controls dedicated enclosure with lockable door
Controls	-	Contractor to determine quantities.
	-	Control circuit MCB's to be 6 amp rated
	-	Provide all switches, interposing relays, contactors, transformers, power supplies, etc
Fixing	-	Surface mounted metal clad complete with all doors, brackets, fixings and supports

3.4 EARTHING

Supply and install the complete earthing system for the installation including all electrodes, cabling, clamps, test-links and all associated accessories and equipment.

The earthing system will be an L.V. multiple earthed neutral (MEN) earthing system.

At the MSB location the earthing system and arrangement of equipment shall comprise a MEN system this shall be achieved by means of a WRICON welded earth system. The Electrical Contractor shall supply and install a suitably sized WRICON welded main earth to the structural reinforcing bars of the building prior to pouring of the slab. In addition Electrical Contractor shall ensure that sufficient structural reinforcing bars are welded together to provide the required earth.

The Electrical Contractor shall contact the local Line Company and arrange for the testing and inspection of the earthing arrangement prior to pouring of the slab.

The Earthing Lead shall originate from the WRICON welded earth and be left with a 2.0 metre tail for final terminate to the main earth bar of the MSB. All connections shall be suitably labelled "SAFETY ELECTRICAL EARTH - DO NOT REMOVE".

Include for and submit an earth resistance test report to the Engineer detailing the testing of the earth resistance and the results of that test. Measure earth resistance from main earth bar.

All switchboards shall be earthed by means of earthing conductors provided with each sub-main cable.

An earth conductor shall be installed with all respective submain or sub circuit cables, for all sub-circuit cables the earth conductor shall be integral within the cable. **This includes 2 way switching 'straps', three phase sub-circuits and 230 volt control cables (ie. provide a 4 core cable for a two way switching 'strap' and a 5 core circular TPS cable for all three phase TPS sub-circuits)**.

No equipment shall be connected to earth via the neutral busbar or main neutral connection.

All metal work in the vicinity of switchboards shall be effectively earthed.

All switchboard and control cubicle doors shall be bonded to the main body of the cubicle via a tinned copper braided flexible cable sufficient in length to allow the door to open 180 deg. to the main cubicle. The braided cable shall be attached at each end by brass studs at least 5mm in diameter and 12mm in length. The studs shall be securely welded to each anchoring point prior to painting. Flat brass washers and lock washers shall be fitted beneath a brass nut for securing ends of the cable which shall be lugged.

Lighting fittings, socket outlets and fixed wiring to appliances shall be earthed by means of the earth conductor which forms part of the respective circuit cabling. A separate earthing conductor shall be used for each circuit.

Earthing conductors shall be run back to the earth bar within the switchboard from where the supply originated.

All exposed metal fittings associated with the electrical services shall be earthed. All metal door frames fitted with a switch shall be earthed.

The earthing system shall include but not limited to the following:

- Earthing and bonding of all metal work such as sinks, fixed metal benches, ventilation ductwork, heating pipes (flow & return) and the like.
- Earthing and bonding of all Structural metal.
- Earth clips shall be fitted to the cold water supply and these must be accessible after completion of the work.
- Earth clips shall be fitted to the gas supply and these must be accessible after completion of the work.
- Bonding of metal frame suspended ceiling grids.
- Earthing of all switchboards, accessories and equipment shall be in strict accordance with the requirements Section 5 of NZS 3000:2007, and the Electricity Regulations.
- All conductive reinforcing within a concrete floor or wall forming part of a shower or bathroom. Bonding conductor shall be selected in accordance with clause 5.6.3.

All cable tray, cable ladder and ladder tray systems shall be bonded, for each run of tray, ladder or ladder tray, corner, bends etc. provide an earth lead between each section, corner, bend etc. Each section of tray, ladder or ladder tray, including corners and bends, shall be connected

to the bonding lead by means of a nut and bolt (complete with star washers). Bonding system shall be such that if one nut and bolt arrangement becomes loose the remainder of the trunking run shall remain bonded.

3.5 RETICULATION AND DISTRIBUTION SYSTEMS

General: Supply, install, connect and terminate all required cabling and supply and install all cable support systems to complete the electrical reticulation and distribution system.

Note: Major cable tray routes are indicated on the drawings, minor cable tray runs and vertical cable trays are not, the Electrical Contractor must allow for all minor and vertical runs of cable tray required to ensure that all main and sub-main cables are supported on cable tray throughout their length. Where cable trays are exposed to touch (below 2000mm AFFL) provide galvanised metal cover plates to the full width of the cable tray.

Cable sizes for the mechanical services are based upon design loads. Obtain from the specialist installer a detailed schedule listing nameplate and consumed kilowatts for all equipment prior to ordering of cables or submission of switchboard shop drawings, and obtain direction if discrepancies appear.

It is the Electrical Contractors responsibility to site measure all cable lengths and include for the actual cable lengths required, cable lengths indicated within these documents are for design calculation purposes only.

All cabling described herein, detailed on the schedules and indicated on the drawings shall be the responsibility of the Electrical Contractor.

Project System Description:

Mains & Sub-Main Cables to be Provided

Service-Main Cable MSB.Z1.G	-	Cable originates at Power Net local sub-station 510 and terminates at MSB.Z1.G
	-	8 x 1c x 400mm^2 (Al) XLPE/PVC WS52 Fire Rated
	-	Independently braced terminals at both ends
	-	Installed in buried PVC Duct
	-	Installed in trefoil formation throughout
	-	Individual looms must be spaced to prevent derating
	-	If the cable length exceeds 80 metres refer to Engineer for confirmation of cable size
Service-Main Cable MSB.Z1.2	-	Cable originates at Power Net local sub-station 510 and terminates at MSB.Z1.2
	-	4 x 1c x 25mm^2 (Cu) XLPE/PVC
	-	Installed in underground duct and on cable tray
	-	Installed in trefoil formation throughout
	-	Individual looms must be spaced to prevent derating
	-	If the cable length exceeds 60 metres refer to Engineer for confirmation of cable size
Sub Main Cable DB.Z1.G-2	-	Cable originates at the development new MSB.Z1.G and terminates at DB.Z1.G-2
	-	1 x 4c x 35mm^2 (Cu) XLPE/PVC + PVC ECC Installed on tray
	-	If the cable length exceeds 80 metres refer to Engineer for confirmation of cable size

Sub Main Cable DB.Z1.1-1	-	Cable originates at the development new MSB.Z1.G and terminates at DB.Z1.1-1
	-	1 x 4c x 35mm^2 (Cu) XLPE/PVC + PVC ECC Installed on tray
	-	If the cable length exceeds 45 metres refer to Engineer for confirmation of cable size
Sub Main Cable DB.Z1.1-2	-	Cable originates at the development new MSB.Z1 and terminates at DB.Z1.1-2
	-	1 x 4c x 35mm^2 (Cu) XLPE/PVC + PVC ECC Installed on tray
	-	If the cable length exceeds 110 metres refer to Engineer for confirmation of cable size
Bus-Duct DB.T.02, 03, 04, 05	-	Bus-Duct sub main originates at the new MSB (Located in Zone 2) and terminates at bus duct termination enclosure. Installed as part of stage 2 works.
	-	1 x 2c+E x 16mm^2 (Cu) XLPE/PVC to each Tenancy DB Installed in cable tray and catenary wire
	-	If the cable length exceeds 20 meters refer to
	-	Engineer for confirmation of cable size.
Sub Main Cable MSSB.Z1	-	Cable originates at the development new MSB.Z1.G and terminates at MSSB.Z1
	-	1 x 5c x 120mm^2 (Cu) XLPE/PVC WS52 Fire Rated
	-	Installed on tray
	-	If the cable length exceeds 15metres refer to Engineer for confirmation of cable size
Sub Main Cable Lift 1.1	-	Cable originates at the new MSB.Z1.G and terminates at Lift 1.1 control panel
	-	1 x 5c x 16mm^2 (Cu) WS52-Fire Rated
	-	Installed on tray
	-	If the cable length exceeds 100 metres refer to Engineer for confirmation of cable size
Sub Main Cable Lift 1.2	-	Cable originates at the new MSB.Z1.G and terminates at Lift 1.2 control panel
	-	1 x 5c x 16mm2 (Cu) WS52-Fire Rated
	-	Installed on tray
	-	If the cable length exceeds 50 metres refer to Engineer for confirmation of cable size
Sub Main Cable Escalator 1.1	-	Cable originates at the new MSB.Z1.G and terminates at escalator 1.1 control panel.
	-	1 x 5c x 16mm^2 (Cu)
	-	Installed on tray
	-	If the cable length exceeds 90 metres refer to Engineer for confirmation of cable size

Sub Main Cable Escalator 1.2	-	Cable originates at the new MSB.Z1.G and terminates at escalator 1.2 control panel.
	-	1 x 5c x 16mm^2 (Cu)
	-	Installed on tray
	-	If the cable length exceeds 90 metres refer to Engineer for confirmation of cable size

Sub-Circuits:

Lighting & Power: Final sub-circuits shall comprise TPS cabling horizontally installed on cable tray systems and vertically within wall cavities or surface PVC conduits.

In areas with exposed cable tray systems where no cable tray is shown all exposed cables shall be enclosed in a rigid PVC Conduit system.

Telecommunications & Security: Refer relevant section for cabling type; all cabling shall be installed as detailed above.

Within the ceiling spaces cables shall be installed within rigid PVC conduit.

Sub-Circuit Cable Sizes

The following minimum sizes shall be used:

♦ Lighting Circuits	1.5 sq. mm Cu. TPS
♦ General Purpose Power Circuits	2.5 sq. mm Cu. TPS
♦ 230V Control Circuits including Bells, Alarms, etc.	1.5 sq. mm Cu. TPS
♦ Low voltage Control Circuits	2.5 sq. mm Cu. TPS
♦ Flexible Cords	30/0.25(1.5sq.mm) Cu.

Site conditions will ultimately determine the length of final sub-circuit cabling, therefore, irrespective of the cable sizes indicated on the circuit charts it is the responsibility of the Electrical Contractor to increase cable sizes where necessary for compliance with the requirements:

- ♦ Voltage drop
- ♦ De-rating
- ♦ Maximum Circuit Impedance.

All sub-circuits shall comply with AS/NZS 5000.2: 2006.

3.6 BUS DUCT

3.6.1 GENERAL

The busbar trunking system shall be Schneider Electric Canalis range, low impedance and air insulated typed technology. It shall be totally enclosed galvanised steel sheet with aluminium conductors; suitable for a 3 phase 4 wire 415 volts system with full neutral and continuous internal earth conductor of half size.

The system shall be complete with all necessary fittings, tap-off unit brackets, etc. and tap-off point on both sides of the busbar trunking system. All busbar trunking fittings (elbow, tees, end Cable Tap Box, etc.) shall be IP55 in accordance to IEC 60529 and from the same manufacturer as the busbar trunking system.

The busbar trunking system shall be capable of being mounted in any position without derating. Plug-in and feeder sections shall be interchangeable without the use of special adapter joint covers. The complete installation shall be coordinated throughout and where

possible, shall consist of standard 5m, 3m,2,5m, 1,5m, sections with special sections and fittings provided to suit the installation.

Horizontal runs of busbar trunking system shall be supported by hangers at every 3 meters. Vertical runs of busbar trunking system shall be supported by hangers not more than 4m apart.

Busbar trunking system shall be terminated by 'end closure'.

3.6.2 CONFORMITY TO STANDARD

It shall be constructed in accordance with the applicable requirements of the latest IEC 60439 Part 1 and Part 6.

Verification of fire barrier in accordance of the latest ISO 60834

Resistance to flame propagation conforming IEC 60332 Part 3.

Resistance of the materials to abnormal heat conforming IEC 60695 Part 2.

3.6.3 ENVIRONMENT

The busbar trunking system shall be suitable for continuous operation without derating at an average ambient temperature of 35° C for 24h (40°C maximum peak)

3.6.4 CONDUCTORS

Conductors shall be of hard drawn 99% purity Aluminium. Live conductors shall be air insulated and supported on fibreglass reinforced polyester isolators, at 250mm intervals.

Conductors shall be fitted with bimetal silver-plated copper/aluminium laminate riders, electrically welded to junctions and tap off positions.

Full size neutral of the same cross-sectional area as the phase conductor shall be provided for all ratings of the busbar trunking system.

The busbar trunking system shall have the following characteristics:

- Rated Insulation Voltage (A/C) 660 Volts
- Rated Operating Voltage (A/C) 660 Volts
- Frequency 50Hz

3.6.5 PROTECTIVE CONDUCTOR

Integral continuous internal copper conductor of cross-section area equal to 50% that of the corresponding phase conductor shall be provided.

3.6.6 SHORT CIRCUIT CAPACITY

The whole busbar trunking system shall be capable of withstanding the short circuit capacity of the electrical installation without damaging the electrical, mechanical and thermal stress under fault condition at a service voltage of 415V 50Hz. Co-ordinationofthedistributionshould be guaranteed such that the Circuit breaker / trunking combination will limit the peak current to a value less than the rated peak current of the busbar trunking.

3.6.7 TEMPERATURE RISE

The maximum hot-spot temperature rise at any point of the busbar enclosure at continuous rated load shall not exceed 40° C above the maximum ambient temperature of 50° C in any position, as required by IEC 60439.

3.6.8 JOINTS

All busbar joints shall be of silver-plated copper.

Electrical connection shall be via a joint with spring and silver graphite contacts. This joint shall absorb the differential conductor/casing expansion of each length equally.

For ratings from 100A to 400A, the joint shall automatically and simultaneously connect all the live conductors.

For ratings from 500A to 1000A, electrical connection shall be made by a ¼ screw turn for each conductor.

The joints shall be so designed as to allow removal of any length without disturbing adjacent lengths.

3.6.9 ENCLOSURE

The metal enclosure of the busbar trunking system shall be of hot dip galvanised steel painted to provide high protection and mechanical resistance for the phase conductors along the entire length.

In order to limit magnetic field around the busbar system, aluminium enclosures are not acceptable.

3.6.10 TAP-OFF-OUTLETS

Tap-off outlets on both sides of the trunking shall be at no more than 1m interval. It shall be possible to use them simultaneously.

Tap-off outlets shall be connected to the isolators to form a block, holding the bars. They shall have a shuttered outlet which is opened and closed automatically when tap-off units are plugged in or remove.

Protection level of the tap off outlet shall be at least IP55 by construction.

3.6.11 TAP-OFF-UNIT

Tap-off units shall be from the same manufacturer as the busbar trunking system and shall be provided with off-load isolator suitable for fuses or circuit breakers according to ratings as indicated in the drawings.

All circuit breakers used shall be able to operate normally when mounted upside down or at any angles. The tap-off units shall also have the provision to mount the earth fault relay together with the breaker. Tap-off units shall be of dust and damp-proof version, degree of protection IP55 with silver plated contacts suitable for all ratings of busbar and shall be suitably earthed.

The earthing contact of the tap-off unit shall always be made before that of the live conductors and the last to break during removal.

The MCCB used in the tap-off unit must comply to IEC 60947-2. All MCCBs shall have a rated service breaking capacity (I_{cs}) of RMS value at 415VAC equal or higher than the prospective fault level of installation. It shall have current limiting capabilities to protect the busbar trunking system and co-ordination table shall be furnished by manufacturer.

The tap-off unit and the busbar trunking system shall be interlocked to ensure that the MCCB is in the 'OFF' position prior to installation or removal of the unit.

The tap-off unit for MCCB shall have an interlock which prevents the cover from being opened

while the device is being opened and to prevent accidental closing of the device when the cover is opened.

Tap off units for fuses or MCB shall have an isolator. Isolation (AC22 to AC20) shall be achieved by opening the cover of the unit.

3.7 LIGHTING

General: Light fittings and emergency light fittings shall be supplied and installed by the Electrical Contractor as specified herein and indicated on the Drawings.

Allow for all costs associated with transport to site, offloading and storage of all luminaires including the disposal of all packaging materials.

The Electrical Contractors attention is drawn in particular to the section 2 specification clauses in regard to seismic restraints and that these must be strictly adhered to and installed as specified, no alternative methods will be considered. Should seismic restraints not be installed as specified, these shall be noted as a defect and corrected at the Electrical Contractors expense. They shall also note the requirement to detail the as installed methods/details of the restraints in the Maintenance and Operational Manual. Refer to section one specification clause "Maintenance and Operational Manual".

3.8 LIGHTING CONTROL

Internal lighting shall be controlled automatically as detailed below and indicated on the drawings.

D.S Anchor Retail Space

- Lighting shall master controlled via 3 position key switch's located at the staff entry and managers office. Three positions of key switch shall be "All Off", "50% of Lighting On" and "100% of Lighting On"
- Security lighting inside main entry and rear doors controlled via PIR sensors in conjunction with manual override switch.
- Signage lighting controlled via time clock & daylight sensor in conjunction with manual override switch.

Childcare Centre

- Manual one and two way switching.

WC's/Stores/Back of House/Corridor's/Amenity Area's/Stairwells

- Controlled via PIR sensors in conjunction with manual switching.

In addition to the above, the DS Anchor Retail lighting shall be controlled manually, via two way digital key switches via KNX Lighting Control System (LCS) as detailed below and indicated on the drawings.

The Electrical Contractor shall supply and install complete a low voltage programmable Lighting Control System, Lighting Control System shall be KNX system. NB: Alternative systems may be considered however any alternative system must be submitted as an alternative Tender Price for consideration during the Tender Reviews. The conforming Tender Price must however be based on a KNX system.

The Electrical Contractor shall engage the Lighting Control Supplier in the on-site positioning, set-up, programming and commissioning of the complete Lighting Control System. The Electrical Contractor shall provide shop drawings of the full Lighting Control System design and operation, prior to installation.

The system shall come complete with all control and interface devices such as:

- Power Supplies
- Digital key switches
- All interface devices (Changeover, KNX Control Relays,) and any other accessories, controls and equipment necessary for a full and working system.

The following is a summary of control methodology.

- Lighting circuits shall be arranged in a manner where the following percentages can be switched on from one central location; “All Off”, “50% of Lighting On” and ”100% of Lighting On”. The lighting Shall be controlled via 2 No. key switches located at the Staff Entry and Managers Office as indicated on the drawings.
- 12 no. luminaires per floor shall remain illuminated at all time. Fittings shall be spaced apart within the retail trading area to ensure a reasonable distribution of light.

3.9 EMERGENCY LIGHTING

This section of the specification shall be read in conjunction with the requirements of section two.

The emergency lighting system shall comprise a system of single point units connected to the live side of the local lighting circuits and connected via a wireless monitoring system.

Emergency lighting and illuminated signage shall be provided in accordance with the requirements of the Fire Report and the New Zealand Building Code.

The Electrical Contractor shall supply and install the Galaxy luminaires (as determined by the lighting layout), station(s) (after a site survey has been done to determine the best position of the station for maximum coverage and infiltration) and server. Galaxy utilises three wireless IOT technologies (Low Power Wide Area Communications, Bluetooth and WiFi) each to address a specific task of the system.

Wireless communications

This Project will be a wireless site.

This system shall employ a Low Power Wide Area Network communication utilizing the LoRa platform that links and manages communication between the Galaxy luminaries and the Galaxy station(s). All exit signs, system hardware, operating software and ancillary equipment necessary to ensure the proper functioning of the system shall be included. The Galaxy System is to be wired in accordance with the manufacturer’s specification, the NZ building Code, AS/NZS3000 and AS2293.

The Galaxy System architecture is in the form of a star communication topology for a more robust and faster data transfer between emergency luminaires and station(s).

The emergency luminaires and exit signs shall be Legrand Galaxy single point units (SPU’s) suitable for monitoring by the Galaxy web application.

The installing contractor MUST engage Legrand to organise a site survey for optimum positioning of the Galaxy station (s) for maximum coverage and infiltration. Building setup/commissioning will also be organised by Legrand.

For avoiding backbone duplication and for Multi-site/remote access, the Electrical Contractor must obtain permission from the Client to connect the Galaxy system onto the site IT infrastructure for internet access.

The Electrical Contractor shall allow in their tender price for:

The supply, cabling, installation, commissioning and documentation of key system components, including:

- Galaxy station(s)
- Galaxy server
- Galaxy single point units (SPU).
- A complete and positive hand-over test (as required by AS2293) of all SPU's.
- PDF plans with unique number (PLAN NUMBER) marked up of each Galaxy fitting. (PLAN NUMBER must be searchable in PDF viewer as a separate PDF layer).
- Galaxy devices must be installed as per Legrand guidelines (see installation Guide), accessible and visible and with Marked locations on PDF plans.

3.9.1 GALAXY SERVER

There are three options of servers:

- Small: up to 500 SPUs
- Medium: up to 2,000 SPUs
- Large: up to 15,000 SPUs

All servers have integrated Wifi for hotspot connectivity. The Galaxy server shall be connected to the site IT infrastructure. IT connectivity is vital for remote connectivity and to have the full flexibility of the Galaxy system.

The system software is embedded in the server and can operate on any device and operating system. The Galaxy web application is simple and easy to use capable of providing:

- Complete emergency lighting test results
- Exception reporting of SPU'S that need maintenance should they not pass the emergency lighting test
- Incorporate PDF plans with colour coded pins providing a status update of each SPU
- A status update of each SPU
- The system pings each SPU daily to ensure it is online
- Incorporate a fail safe function should one not conduct emergency lighting tests within 6 months

Note: The Galaxy server has an embedded DHCP server that will issue an IP address to the Galaxy station(s). Using IT infrastructure the Galaxy server checks if there is a DHCP server connected to it and will disable its own DHCP server, resulting in the Galaxy server taking an IP address from the main server it is connected to.

3.9.2 GALAXY STATIONS

The Electrical Contractor shall supply a data port (RJ45) and an unswitched mains power supply to the Small Station as well as a mains power to supply the POE injector which is to be positioned within 100m of the Medium or Large Station.

The Galaxy station positioning shall be determined after a site inspection has been conducted. Contact Legrand to organize a site inspection survey to determine the optimum position. Legrand will not be held responsible if a site survey has not been conducted.

Utilising Low Power Wide Area communications via the LoRa platform to communicate between Galaxy Station and Luminaires.

Communication is in the form of a star topology giving more robust communication between station and luminaires.

3.9.3 GALAXY LUMINAIRES (SPU'S)

The installing contractor shall supply and install all Galaxy SPU's in accordance with the schedule of luminaires and where indicated on the drawings.

Galaxy SPU's shall be supplied complete with RF antenna and integrated Bluetooth. SPU's shall meet the following minimum specification:

- Comply with the relevant clauses in the luminaires section of this specification.
- Comply with AS2293.1:2005.
- Classified by an approved authority in accordance with AS2293.1, with the classification being clearly identified on the luminaires label.
- Be marked and labeled in accordance with AS2293.1
- Complying with the requirements of the regulating authority.
- Be supplied with Lithium Iron Phosphate batteries. Each battery pack to be marked with the date of manufacture.
- Have incorporated iSmart temperature control for Lithium Iron Phosphate batteries.
- Be fitted with a mains isolated momentary push-button or magnetic test switch.
- Be supplied with a blue LED to indicate network communications.
- Be equipped with a microprocessor with a non-volatile memory sufficient to store serial number, SPU characteristics and its geographical location.
- To be independent and fail safe in the event of a network system failure.
- Be tested in accordance with AS2293 and be clearly marked with the luminaire classification for spacing purposes.
- Each Exit sign to be installed per AS2293 and the NZ building Code, and have a directional arrow as appropriate.
- Satellite SPUs shall have a Stand-by power consumption less than 1W for non-computerised system and 1.5W for Computerised system
- Satellite SPUs shall have at least 3 removable concentric rings to allow installation of different hole sizes.
- Each SPU's battery shall have a minimum installation life of 5 years and a guaranteed life of 3 years when operated in accordance with the manufacture's directions.

3.9.4 WIRELESS COMMUNICATION

Communication between the Station and SPU's shall be carried out using the LoRa communication with three layers of encryption:

- A unique Network key
- A unique Application key
- And a Luminaire specific key

The frequency of operation shall be of Industrial Scientific and Medical (ISM) band at 915-928Mhz. Power levels shall be in accordance with Australia Communications and Media Authority (ACMA) guidelines.

3.9.5 TECHNICAL ASSISTANCE PRE & POST PROJECT

The Electrical Contractor shall allow for commissioning of the Galaxy system in the tender price. The Electrical Contractor shall seek advice from Legrand at a pre install stage of the project for all aspects of the Galaxy Connected Emergency Lighting System.

The Contractor will seek advice and assistance from Legrand and provide system training at the time of installation and as part of the system hand-over to the building owner.

The service to be provided by Legrand shall include:

- Assistance with the overall system architecture design.
- Installation training for both the system and software.
- Technical support during installation.
- Technical support during warranty period
- Training of and technical support to the Building owners staff in operation and maintenance of the system.

3.9.6 EMERGENCY EVACUATION LIGHTING AND EXIT SIGNS

Supply and install an emergency luminaire and exit lighting system as follows:

- Emergency luminaires shall be of the self-contained type
- Complying with the relevant clauses in the luminaires section of this specification.
- Complying with AS2293.1:2005.
- Be classified by an approved authority in accordance with AS2293.1, with the classification being clearly identified on the luminaire label.
- Be marked and labelled in accordance with AS2293.1
- Complying with the requirements of the regulating authority.

3.10 OUTLETS, ACCESSORIES & APPLIANCES

General: All power outlets and accessories and all electrical supplies shall be provided by the Electrical Contractor. All outlets and accessories shall be as manufactured by PDL600 Series or Clipsal C2000, HPM Excel Series or Vynco Fusion and come complete with White cover plates.

All appliances are to be supplied internally wired and complete with control switches, controllers or connecting links. An isolator shall be provided adjacent to each appliance which is directly connected. Each three phase appliance shall be connected with a separate neutral and earth.

Where equipment is installed away from, but within 600mm of a wall or column, the final connection shall be enclosed in flexible PVC conduit. Where equipment is located greater than 600mm from the wall, cabling shall be installed within concealed conduit, infloor ducting cast into the slab or by service pole.

All equipment shall be checked immediately upon its arrival to site for its electrical loading and phase connections. Advise the Architect / Engineer in writing where the equipment is found to be unsuitable for connection to the building supply.

D.S Anchor Retail Store

Automatic Doors: The automatic doors will be supplied by others.

Supply and install a power supply to each and connect via an isolator adjacent to the unit's termination point. All cabling shall be concealed.

Liaise closely with the automatic door installers and Fire Alarm Contractor to ensure that that all doors fail safe in the event of a power failure or fire alarm.

Each Door shall be connected via a dedicated 2c+E TPS cable sized as indicated on the circuit charts.

Where a fire alarm interface is required provide a WS rated signal cable between the auto door and the Fire Alarm Panel interface module/relay. The fire alarm module/relay is to be supplied by the Fire Alarm contractor at the location as identified by automatic door contractor - i.e.

fire contractor will cable to the location of the automatic door and provide the alarm module/relay for the automatic door contractor to wire to. The protocol of normally open/closed is to be co-ordinated between the relevant services.

The 230 volt mains cable shall be protected by a 20 amp MCB.

Connect each unit via a switched PCU, located adjacent, and white circular heat resistant flex. PCU shall be located as close as possible to the termination point to keep the length of flex to a minimum.

Roller Shutter Grille: Each roller shutter grille shall be supplied by others.

Electrical Contractor shall supply and install a power supply to each and terminate into a 20 Amp isolator located in the ceiling adjacent to the door motor unit. Confirm exact height and location of this isolator with the door installer, prior to installing any cabling.

Each door shall be connected via a dedicated 2c+E x 4.0mm^2. TPS cable protected by a 20 amp MCB (D Curve type).

In addition to the above the Electrical Contractor shall allow to install the free issue starters, limit switches and any other control devices. All control wiring shall be carried out utilising a system of PVC insulated single core, stranded copper cables enclosed in a system of surface mounted high impact PVC conduit. Conduit systems shall terminate direct at the starter and isolator locations utilising smooth bore bushes and couplings. Final connection to motors and limit switches shall be carried out utilising PVC insulated single core, stranded copper cables enclosed in a system of flexible conduit complete with termination glands and lockrings.

The Door Installer shall hand to the Electrical Contractor for installation all starters, limit switches and any other control devices required.

Roller Shutter Doors: Each roller shutter door shall be supplied by others.

Electrical Contractor shall supply and install a power supply to each and terminate into a PDL 56 series 20amp triple pole isolator located adjacent to the door motor unit. Confirm exact height and location of this isolator with the door installer, prior to installing any cabling.

Each door shall be connected via a dedicated 4c+E x 4.0mm^2. TPS cable protected by a 20 amp MCB (D Curve type).

In addition to the above the Electrical Contractor shall allow to install the free issue starters, limit switches and any other control devices. All control wiring shall be carried out utilising a system of PVC insulated single core, stranded copper cables enclosed in a system of surface mounted high impact PVC conduit. Conduit systems shall terminate direct at the starter and isolator locations utilising smooth bore bushes and couplings. Final connection to motors and limit switches shall be carried out utilising PVC insulated single core, stranded copper cables enclosed in a system of flexible conduit complete with termination glands and lockrings.

The Door Installer shall hand to the Electrical Contractor for installation all starters, limit switches and any other control devices required.

Dishwasher: The Dishwasher shall be provided by the Client. Connect the unit via a socket outlet located at low level, adjacent to the unit. Control the socket outlet via an isolator located above bench height, isolator shall be located integral within the same flushplate as the local double switched socket outlet. Label isolator “D/Wash”.

Dishwasher shall be connected via the general purpose socket circuit within the kitchen area.

Water Cooler: The water cooler shall be provided by the Client. Connect the unit via a socket outlet located at low level, adjacent to the unit. Control the socket outlet via an isolator located above bench height, isolator shall be located integral within the same flushplate as the

local double switched socket outlet. Label isolator "D/Wash".

Water cooler shall be connected via the general purpose socket circuit within the kitchen area.

Hot Water Cylinders: Each Hot Water Cylinder shall be provided by the Plumber, complete with thermostat.

Connect to each unit via a switched PCU located adjacent, PCU to be rated at 20 amps, final connection to be carried out using white circular heat resistant flex. Provide all connections required between thermostat and element.

Each Hot Water Cylinder shall be connected via a dedicated 2c+E x 2.5mm^2 TPS cable protected by a 20 amp MCB.

NB: Confirm the element rating with the Plumber prior to installing cabling, advise the Engineer if a conflict between the element rating and the specified cable size arises.

Hot Water Boiler: Each Hot Boiler shall be provided by the Plumber.

Connect each unit via a switched PCU and white circular heat resistant flex. PCU shall be located adjacent the termination point, it is the Electrical Contractors responsibility to liaise with the plumber on the required termination point, outlets too low or on the wrong side will not be accepted.

Each Hot Water Boiler shall be connected via a dedicated 2c+E x 2.5mm^2 TPS cable protected by a 20 amp MCB.

Fridge: The Fridge shall be provided by the Client.

Connect the unit via a socket outlet located behind the unit.

Fridge shall be connected via the general purpose socket circuit within the kitchen area.

Vending Machine: The vending machine shall be provided by the Client.

Connect the unit via a socket outlet located behind the unit.

Vending Machine shall be connected via a dedicated 2c+E x 2.5mm^2 TPS cable protected by a 16 amp MCB.

Sump Pump: The Sump Pump shall be provided by others. Provide a power supply to the Sewer Pump sump location indicated on the drawings. Connect the unit via the control unit provided by others within the sump chamber, provide a PDL 56 series isolator adjacent to the control unit. For pricing purposes provide a dedicated 2c+E x 2.5mm^2 TPS cable installed within buried ducting and protected by a 20 amp MCB + 30mA RCD unit. Also provide a conduit for future controls/alarm cabling between the MSB switchboard room and the sump location.

NB: Confirm with the Sump Pump Supplier the pump loading and all required controls prior to installing cabling.

Illuminated Sign: Each Illuminated Sign shall be supplied by others.

Electrical Contractor shall supply and install a power supply to each and terminated via hard wired connection block within sign.

Illuminated Sign shall be connected via a 2c+E x 1.5mm^2 TPS and protected by 10 amp MCB.

Hand Driers: Supply and install all Hand Driers indicated. Hand Driers shall be 'Supreme Jet Dry Executive' 1.2 kW type, coloured pearl. Mounting heights for the Male, Female and Disabled WC Hand Driers shall be as recommended by the Supplier (refer http://www.splwashrooms.co.nz/ for recommended mounting heights). NB: If these heights differ from that shown on the Architectural Elevations refer to the Architect for direction

Connect each unit via an isolator, isolator shall be wall mounted at 1800mm above floor level and shall be located on the centre line of the unit.

Each Hand Drier shall be connected via a dedicated 2c+E x 2.5mm^2 TPS cable protected by a 20 amp MCB. Cabling between isolator and unit shall be concealed behind the wall lining.

Loading Dock Door Buzzer: Supply and Install a mains powered door buzzer/piezo complete with IP65 rated exterior bush button and internal buzzer/piezo. Locate the buzzer/piezo ns such location that as not to get damaged but is audible through out the loading dock.

Childcare Centre

Field Mounted Local 10mA RCDs: Supply and install all field mounted RCD devices as indicated. Field mounted RCD's shall be plate mounted 20 Amp 10mA rated devices providing downstream circuit protection as indicated. RCD's shall match balance of termination fittings.

Hot Water Cylinders: Each Hot Water Cylinder shall be provided by the Plumber, complete with thermostat.

Connect to each unit via a switched PCU located adjacent, PCU to be rated at 20 amps, final connection to be carried out using white circular heat resistant flex. Provide all connections required between thermostat and element.

Each Hot Water Cylinder shall be connected via a dedicated 2c+E x 2.5mm^2 TPS cable protected by a 20 amp MCB.

NB: Confirm the element rating with the Plumber prior to installing cabling, advise the Engineer if a conflict between the element rating and the specified cable size arises.

Fridge: The Fridge shall be provided by the Client.

Connect the unit via a socket outlet located behind the unit.

Fridge shall be connected via the general purpose socket circuit within the kitchen area.

Dishwasher: The Dishwasher shall be provided by the Client. Connect the unit via a socket outlet located at low level, adjacent to the unit. Control the socket outlet via an isolator located above bench height, isolator shall be located integral within the same flushplate as the local double switched socket outlet. Label isolator "D/Wash".

Dishwasher shall be connected via the general purpose socket circuit within the kitchen area.

Illuminated Sign: Each Illuminated Sign shall be supplied by others.

Electrical Contractor shall supply and install a power supply to each and terminated via hard wired connection block within sign.

Illuminated Sign shall be connected via a 2c+E x 1.5mm^2 TPS and protected by 10 amp MCB.

Washing Machine: The Washing Machine shall be provided by the Client.

Connect the unit via a socket outlet located behind the unit.

Washing Machine shall be connected via the general purpose socket circuit within the laundry area.

Dryer: The Dryer shall be provided by the Client.

Connect the unit via a socket outlet located behind the unit.

Dryer shall be connected via the general purpose socket circuit within the laundry area

Landlord Services

Pedestrian Warning Light: Supply and install Pedestrian Warning Light as indicated on the drawings. Warning light shall be activated via an inground vehicle detection loop and shall comprise both visual and audible warning advising pedestrians a vehicle is exiting the service lane.

Electrical Contractor shall supply and install a power supply terminated via an isolator and hard-wired connection block within the warning light.

Pedestrian warning light shall be connected via a 2c+E x 6.0mm^2 TPS and protected by 20 amp MCB.

3.11 ANCILLARY POWER SUPPLIES

The Electrical Contractor shall supply and install the power supplies to the following items of equipment:

- Security system
- CCTV System
- DS Anchor PABX System

Provide 230 volt power supplies to the above systems connection of the equipment shall be via a permanent connection unit or a standard plug and socket arrangement as required.

The Electrical Contractor shall liaise with the specialist system Installer on the final location of the 230v power supply and on the type of connection required.

Each system will require a dedicated circuit comprising a 2c+E x 2.5mm sq TPS cable originating from a 16 amp MCB.

3.12 MECHANICAL SERVICES

The supply and installation of the Mechanical Services shall be outside of the contract.

DS Anchor

The Electrical Contractor shall supply and install the specified submain cable to the Mechanical Services DB, at the DB position leave 1 metre of cable coiled for connection by the Mechanical Services Electrical Contractor.

In addition the Electrical Contractor shall provide 13 no. 16A D curve single phase MCB's and 2 No. 25A D curve three phase MCB's within DB.Z1.1-2 Mech.

Confirm specific requirements of MCB's to be supplied with the Mechanical Contractor prior to ordering.

Childcare Centre

The Electrical Contractor shall provide 13 No. 16A D curve single phase MCB's, 4 No. 16A D curve single phase MCB's and 2 No. 25A D curve three phase MCB's within DB.Z1.2-1

Confirm specific requirements of MCB's to be supplied with the Mechanical Contractor prior to ordering.

All cabling and associated connections, shall be by the Mechanical Services Contractor.

The Electrical Contractor shall liaise closely with the Mechanical Services Contractor, in particular with regard to the location of the outlets to be provided and in co-ordinating cable access, cable runs, etc.

3.13 FIRE ALARM SYSTEM

The Fire Alarm system does not form part of this contract.

The Electrical Contractor shall liaise closely with the fire alarm contractor, in particular with regard to the location of the outlets to be provided and in co-ordinating cable access, cable runs, etc.

3.14 FIRE ALARM INTERFACE TO SECURITY AND SMOKE FANS

Security doors on escape routes are to release from a locked state on any form of alarm. Emergency push button release / Digital Panic Bars are to be located on any automatic security doors. It is the contractor's responsibility to liaise and coordinate directly with the fire alarm contractor to complete this work.

Upon activation the fire alarm system will send a signal to the nominated doors which will open to provide makeup air. The fire protection contractor shall provide a clean contact relay which operates on activation of the fire alarm system. This shall be located in an enclosure adjacent to the security panel and smoke fan control.

Note: When the building is not occupied and the security system is set, the nominated doors will remain closed to maintain security and the smoke exhaust fan will not start. The fire alarm system shall operate the relay at all times.

It is the responsibility of security mechanical and fire alarm contractors to directly liaise with one another to test and commission the connection to the fire alarm system.

3.15 FIRE SPRINKLER SYSTEM

The Fire Sprinkler system does not form part of this contract.

The Electrical Contractor shall liaise closely with the fire sprinkler contractor in particular with regard to the location of the outlets to be provided and in co-ordinating cable access, cable runs, etc.

3.16 ACCESS CONTROL / CCTV SYSTEM

Introduction**:** This work shall be carried out by a specialist Security System installer who shall become a nominated sub-contractor to the Electrical Contractor.

The work described in this section of the specification covers the access control and CCTV being provided by the development, primarily external and stairwell doors only.

Further Security and Access Control / CCTV systems for the DS Anchor Retail shall be completed by the DS Anchor fitout Contractor.

The Electrical Contractor is fully responsible for the works by the Security System Installer and shall ensure the Security System Installer complies with all relevant sections of the electrical specification.

The Electrical Contractor shall provide dedicated power supplies for the security system components and shall arrange for a telecommunications cable to be run to the control panel/s. The Security System Installer will be responsible for identifying to the Electrical Contractor the final locations of all 230 Volt and telecommunications supplies.

Where a fire alarm interface is required provide a fire rated 2c+E x 1.5 mm signal cable between the security panel and the Fire Alarm Panel interface module/relay. The fire alarm module/relay is to be supplied by the Fire Alarm contractor at the location as identified by security system contractor - i.e. fire contractor will cable to the location of the security panel and provide the alarm module/relay for the security system contractor to wire to. The protocol of normally open/closed is to be co-ordinated between the relevant services.

The Security System Installer should note that this section of the specification is a Performance

Specification and it is the Security System Installer's responsibility to design, supply, install, connect complete, commission and certify the Security System, including all 'as built documentation' and client training.

The Security System Installer shall employ; experienced registered trades persons with level 3 security qualification to carry out the installation to the highest standard.

All works shall be carried out in accordance with the requirements of this specification and other internationally recognized standards applicable to the nature of these works. The standards applicable include, but are not limited to, the following:

- Current issue of relevant NZ Standards
- AS/NZS 2201.1.2007 (NZS4301:1993 Intruder detection Systems and associated codes of practice.
- AS/NZS 2201.5.2008. i ii iii Intruder alarm monitoring stations. Patrols & Guards service.
- NZS 4301:1993 Intruder Alarm Installations
- All Telecom requirements
- NZ Electrical Regulations and Associated Codes of Practise
- New Zealand Electricity Act 1992
- NZSA Codes of Practise
- New Zealand Building Act 2004
- New Zealand Health & Safety at Work Act 2015
- New Zealand Privacy Act 1993
- NZ Radio Interference Regulations
- AS/NZS 3000 Electrical Installations
- AS/NZS 1768:2007 Lightning Protection
- AS/NZS 61000:1999-2015 Electromagnetic Compatibility
- NZS 4104: Seismic Restraint of Building Contents

All wiring shall be concealed or installed in conduit, all cables shall be fully supported on independent catenary wires, refer relevant section for details.

All cable types shall be as nominated by the specialist sub-contractor and meet the minimum specification set out by the equipment manufacturer.

All cables to be installed externally underground shall be installed in ducts and shall comply with the relevant section two clause of this specification.

All field devices must be tamper proof.

The Installer shall liaise with all the other disciplines to establish the extent of any interface requirements and incorporate these requirements within their tender offer.

System Overview: The system shall comprise the design, supply, installation, connection, commissioning, user training, handover and certification of the following:

- Electronic Access Control System
- CCTV System

Testing & Commissioning: The Installer shall during the course of the installation perform regular quality control inspections to ensure that all workmanship, materials and methods of installation comply with the requirements of this specification.

This shall include regular reviews of the working drawings and cable ID systems for accuracy.

Pre Power up Checks: Prior to livening of the system, either in part or in whole, the Installer shall provide written confirmation of the following:

- All power systems have been checked for polarity
- All terminations have been checked for tightness
- Compliance of all cable and components identification with the 'AS Built' documentation
- Confirmation that a single earth point for the system has been maintained
- Confirmation that there are no earth loops or other sources of signal degradation

Post Power up Checks: Once the system has been livened the Installer shall provide written confirmation of the following:

- Stipulated voltage supplies to all devices have been provided
- All equipment is operating below its maximum operating temperature
- All equipment is adequately ventilated
- The system has been checked and is operating normally as it would 24 x 7 x 365
- The system operates under mains failure for the specified period.

As Built Documentation: In addition to the provision of 'As Built' documentation as described in section 1 of this specification the installer shall provide a Training Manual with step by step instructions, charts and help guides. This manual shall be non-technical with simple step by step instructions on how to use / operate the various systems on a day to day basis.

The installer shall allow to attend site on two separate occasions for 2 hours per occasion to instruct the principles staff in all aspects of the operation of these systems.

Access Control System: The system shall comprise the controlled access and/or egress of nominates doors identified on the drawing. All nominated doors shall be fitted with appropriate reader, lock and egress device. The system shall be provided with an appropriate user interface.

The system must be complete with a time based function to allow access controlled doors to be 'unlocked' during preset times.

Systems:

The Intruder Alarm / Access Control Systems shall comprise the following:

- Control panel/s.
- Expander units.
- Expander & Reader Modules.
- Sufficient Internal and external alarm sounder units.
- Arm / disarm key pads.
- Reed Switches.
- Movement Sensors.

- Proximity/ PIN type readers.
- Magnetic locks.
- Gate/ automated doors/barrier/roller shutter interfaces.
- Request to exit buttons (RTE).
- Emergency door release switched EDR.
- Proximity Cards or Fobs.
- User interface and software.
- Low voltage power supplies, battery backup and charging facility.
- Fire alarm interface cable (Fail safe).
- Fail safe system unlock when required by the evacuation plan.
- Battery backup for 8 hours.
- Door monitoring for forced, held and locked status.

System Control/User Interface: The system shall be configured to enable remote interrogation by the client and/or system maintainer. Provide all necessary software and field hardware for the graphical user interface (GUI) on the PC provided by the client. (provide details of the system parameters in order that the client can purchase the necessary hardware). The following minimum features are required from the GUI:

- Add/ remove card holder
- Add/ remove & Edit times and time zones
- Run reports and retrieve event log
- View system status
- Toggle door/ lock status

Control Panels: Provide fully monitored Control Panels along with the associated battery backup unit and charging facilities. The security system panel shall be located in a secure area as indicated on the drawings.

The control panel shall be housed in a wall mounted, tamper proof, sheet steel enclosure housing the control equipment, communications, integral batteries, charging unit and all other items necessary for a fully working system.

The batteries shall have the capacity to maintain the operation of the system for a minimum of 8 hours. Batteries shall be maintenance free sealed lead acid type, batteries shall be sized to provide for the quiescent load plus 20% for any future additions.

The Security & Access control system shall be connected to an offsite alarm monitoring station. The contract shall include the connection to Clients nominated monitoring station for a period of 12 months.

Expander Units: Provide any required expander units. These devices shall be housed in purpose built, surface mounted enclosures supplied and installed by the security system installer in a secure location.

Proximity Card & PIN Readers: Provide the type of readers required to service the system. Readers shall be complete with flush fixing boxes as required. Flush fixed devices shall be provided with a bezel surround or have a suitable flange to conceal the plaster gap.

The readers shall be located externally at each of the entrances indicated. Proximity card

readers shall be external rated quality and offer vandal resistance.

Electronic Locks: All locks and associated hardware installation shall be carried out by a professional locksmith and without compromise to the fire rating certification of fire, smoke stop doors, door closer or other mechanical locking devices.

The security services contractor is responsible for all payments related to the lock installation.

Magnetic (Mag) Locks: Provide the Mag locks necessary to the doors indicated on the drawings.

Mag locks shall:

- Be Assa Abloy/Lockwood or equivalent quality
- Be low voltage type compatible with the system supplied
- Have a withholding capacity of 500Kg.
- Have bond sensing, connected to a forced door alarm.
- Self-alignment: armature plate pivots to accommodate door drop
- Silent operation: no humming or buzzing
- Instantaneous release: smart electronics on the electromagnets eliminate residual magnetism.
- Be suitable for mounting on the types of doors they are associated with, provide all necessary brackets, fixings and supports required for mounting.

The installation shall ensure that the clearance height to the underside of any electromagnetic lock complies will all Building Codes and Territorial Authority requirements. (1965mm)

Where external, allow to use external quality stainless steel units complete with all brackets, fixings and supports required for mounting. All brackets shall be professionally manufactured, be anodized to match the magnetic lock or powder coated to match door surrounds' brackets must not be removable in the locked state. A sexbolt with the dome is required on the insecure side.

Egress Furniture: All doors on the fire route shall provide a failsafe means of egress. Either by use of a mechanical override of the lock or an interruption to the power supply to a failsafe lock by an Emergency Door Release (EDR) located immediately adjacent to the door or Digital panic bar on the inside of the door.

Where indicated on the drawings doors shall be fire dropped by fail safe interface with the fire alarm panel.

Request to Exit (RTE): Where necessary, provide request to exit buttons on controlled doors. Pushbuttons shall de-energise the locks and allow the doors to be opened from the inside; these devices shall be flush fixed. The pushbuttons shall be fully interfaced with the locks and card access system.

Emergency Door Release (EDR): Where necessary, provide the EDR immediately adjacent to the door to allow evacuation in an emergency, these devices shall be flush fixed, and of the break glass or resettable type. Operation of the EDR shall be monitored and generate a local audible alarm and a system alarm until the EDR is secured.

Digital Panic Bar: Where necessary, provide cabling to the digital panic bar to allow evacuation in an emergency. These devices shall installed by others. Operation of the digital

panic bar shall be monitored and generate a local audible alarm and a system alarm until the Digital Panic Bar is secured.

Emergency Access Route: Where controlled doors form part of an emergency engress route, allow to supply, and install a monitored emergency override key facility to allow access to the control equipment location.

All readers and egress devices are to be fixed to the wall surface at a consistent height between 850mm and 1200 mm unless otherwise directed. Whilst readers are to be located at a consistent height above FFL, where common sense dictates, the actual location of readers shall in agreement with all parties may be adjusted in the interests of safety or to improve overall performance.

Proximity Access Cards or Fobs: Provide and program:

100 No. Fobs

The cards/fobs shall be sequentially numbered with each having its unique number embedded. This number is for administration purposes only and shall have no bearing on its encoded number within the system. All cards and fobs shall carry a 5 year warranty against breakdown under normal fair wear and tear usage.

Reed Switches: Provide reed switches to all access controlled doors indicated on the drawings to monitor the doors status doors. Reed switches shall be recessed into the associated door frame close to the leading edge to detect any movement greater than 5mm.

Note: Reed Switches fitted to Fire/Smoke rated doors shall be fitted in accordance with the door supplier's requirements.

Fire Alarm Interface to Security System and Smoke Extract Fans: Security doors on escape routes are to release from a locked state on any form of alarm. Emergency push button release / Digital Panic Bars are to be located on any automatic security doors. It is the contractor's responsibility to liaise and coordinate directly with the fire alarm contractor to complete this work.

Upon activation the fire alarm system will send a signal to the nominated doors which will open to provide makeup air. The fire protection contractor shall provide a clean contact relay which operates on activation of the fire alarm system. This shall be located in an enclosure adjacent to the security panel and smoke fan control.

Note: When the building is not occupied and the security system is set, the nominated doors will remain closed to maintain security and the smoke exhaust fan will not start. The fire alarm system shall operate the relay at all times.

The security contractor shall allow to install an interface between the security panel and the smoke fan control system to prevent the operation of the smoke control fans when the security system is armed.

It is the responsibility of security mechanical and fire alarm contractors to directly liaise with one another to test and commission the connection to the fire alarm system.

Access Controlled Door Interface Matrix.

Door	Lock	Secured			Prox	Pin	RTE	EDR	Fire Drop (During Trade)	Landlord/DS Anchor Control
		Trading	Late	A/H						

EXD.07	Mag	Yes	Yes	Yes	Yes	Yes	Digital Panic Stair Side	Digital Panic Stair Side	No	Landlord
EXD.08	Mag	Yes	Yes	Yes	No	No	No	Retail Side	No.	DS Anchor
EXD.09	Mag	Yes	Yes	Yes	No	No	No	Digital panic Stair Side	No	DS Anchor
D1.01	Mag	Yes	Yes	Yes	Retail Side	Retail Side	No	Retail side	Yes	DS Anchor
D1.02	Mag	Yes	Yes	Yes	Both sides	Both Sides	No	Retail area side	Yes	DS Anchor
D1.16	Mag	Yes	Yes	Yes	Retail Side	Retail Side	Stair Side	Retail side	Yes	DS Anchor
D2.40	Mag	Yes	Yes	Yes	Both Sides	No	No	Childcare area side	Yes	Landlord
D2.36	Mag	No	Yes	Yes	Carpark Side	No	Secure Side	Secure Side	Yes	Landlord

CCTV System: The Installer is responsible for the design, supply installation and commissioning of all equipment and interfaces necessary to deliver an acceptable CCTV system. The system shall comprise the provision of a video recording, IP addressable cameras and Video management software/user interface.

- Digital video recorder or Network Video Recorder
- UPS unit with 2 hour battery back up
- Low voltage power supplies
- POE Network switch
- UTP Cabling
- Internal Cameras

CCTV Cameras: CCTV cameras shall be located in the locations as shown on the drawings.

UTP cables shall be installed by the Security Installer, Each CCTV camera shall be connected via a dedicated Cat 6A 4 pair UTP cable, originating from a patch panel within the Floor Distribution Frame (FDF).

A dedicated patch panel shall be provided for the CCTV cameras.

Liaise with the Telecommunications Cabling Installer and ensure the type of patch panel matches the balance of patch panels being installed by the Telecommunications Cabling Installer.

Cameras: Cameras will be selected to meet the needs of the environment and the following is a minimum performance specification against which cameras will be selected.

Internal Cameras

- Colour
- Cameras should be Domes/Full bodied with appropriate bracket/housing
- POE
- Discreet / Overt
- Offer vandal resistance
- Sensitive to 0.8 lux / F2.2
- 3 Axis gimbal bracket
- H.264, MPEG-4 and Motion JPEG Codec
- Minimum 12 IPS @ 5 mega pixel
- Minimum 20 IPS @ 3 mega pixel
- Minimum 30 IPS @ 2 mega pixel or 1080p
- Minimum 30 IPS @ VGA
- Flush/Surface mount.
- ONVIF Compliant
- Varifocal.
- Back light compensation mode/ Wide dynamic if required.

Video Storage: The network video recorder (NVR), shall be installed as part of the Zone 2 works.

3.17 ELECTRICAL REQUIREMENTS FOR LIFT INSTALLATION

NB: The following specification requirements are for pricing purposes only, confirm exact requirements with Lift Installer prior to carrying out any work.

For each lift the Electrical Contractor shall provide the following:

For each lift the Electrical Contractor shall supply and install the lift power supply to the Lift Controller, leave a 2M coil of the specified cable coiled within the lift machine space (top of lift shaft).

Lift Car Light, leave a 2M coil of the specified cable coiled within the lift machine space (top of lift shaft). Provide a 2E x 2.5mm sq. TPS sub-circuit, originating from the local distribution board and leave coiled in the lift machine space with the lift sub-main (for secondary lift car lighting supply).

The Electrical Contractor shall supply, install and connect complete for the lift pit lighting, lift shaft lighting, lift pit general socket outlet and the lift pit sump pump.

The Lift Shaft lighting shall comprise one number luminaire located in the lift pit and one luminaire located on the rear wall of the lift shaft positioned centrally opposite each landing entrance door.

Lift pit light shall comprise 1 No luminaire located in a position approved by the lift installer.

Luminaires shall be Trilux Oleveon 1200mm 2,600lm, 19W LED range IP66 rated. Lift pit light shall be controlled via a PDL 56 series switch adjacent to the lift pit access ladder.

The shaft lights shall be two way controlled via a PDL 56 series switch located at the top of the shaft and a second switch located in the pit.

The Lift Pit socket outlet shall be a standard pin configuration, 10 amp rated, surface fixed, PDL 56 Series socket outlet.

The socket outlet for the lift shaft sump pump shall be located within the Lift Pit, the outlet shall be a standard pin configuration, 10 amp rated, surface fixed, and be of PDL 56 Series manufacture.

All wiring shall be installed within high impact PVC conduit.

Pit / shaft lighting circuit 2E x 1.5mm sq. TPS originating from the local distribution board.

Pit socket outlet circuit 2E x 2.5mm sq. TPS originating from the local distribution board.

Pit lift pit sump pump circuit 2E x 2.5mm sq. TPS originating from the local distribution board.

Provide the associated 56 series plug to match the Socket Outlets.

The Electrical Contractor shall ensure a 4 pair Cat. 6 UTP cable is run from the local Building Distribution Frame to the lift machine space. Cable shall be left coiled as with the sub-main cable.

Final positions of all luminaires and all electrical items located within the Lift Shaft / Pit shall be agreed with the Lift Installer prior to installation.

Fit labels to the building main switch and any other switches / circuit breakers that will isolate the lift supply.

"WARNING"
"THIS SWITCH CONTROLS THE LIFT SUPPLY"

3.18 TELECOMMUNICATIONS SYSTEM

General: Refer to the Reticulation and Distribution section for details of cable installation.

Standards: The supply and installation of the Telecommunications system must comply with the following:

- AS/NZS 3080
- AS 3084: 2003
- AS/NZS 3085.1:
- ISO/IEC 11801

Testing of the installation shall be to:

- SAA./SNZ HB27: handbook for Testing Backbone Cable Installations
- TIA Draft Technical Services Bulletin 95 (TSB 95)

Definitions:

- BD Building Distributor Frame
- TRC Telecommunications Reference Conductor
- LAN Local Area Network
- UTP Unshielded Twisted Pair
- ATM Asynchronous Transfer Mode
- ISO International Standards Organisation
- AS Australian Standard
- NZS New Zealand Standard
- TIA Telecommunications Industry Association
- SCS Structured Cabling System
- IEEE International Electronics & Electrical Engineering Society

3.18.1 QUALITY

Communication Installer Qualifications: Installation and Testing shall be by an experienced specialist Voice and Data Cabling Contractor authorised by the selected SCS manufacturer to install, warrant and certify cabling systems of the type used. The communication Installer shall have local support for ongoing maintenance, and back-up for components used. Involve the Maintenance Personnel in installation to assist them to become familiar with the site.

Contractor's Submissions: Submit details of the following:

- Certification and Performance Documents
- Detailed product component data, including details of statutory approvals (as necessary) and evidence of components being satisfactory to the SCS manufacturer.
- Evidence of the SCS manufacturer's approval of the Communication Installer, and their agreement to warrant the Communication Installer's work, provided installation practices are met.
- Undertaking by the SCS manufacturer to physically inspect the work at least two times during installation. Inspection notes and comments are to be submitted from each inspection.

Coordination Documents: Schedule of labels

- Schedule of requirements for power and other services, where there is no existing provision or inadequate provision.
- Submit calibration certificates for all test equipment, prior to use.
- Submit certified test results for all cables in approved electronic format.

Shop Drawings: Submit shop drawings of:

- In coordination with the Electrical Installer indoor infrastructure drawings, complying with AS/NZS 3085.1, Appendix C.
- Elevations of each rack, showing equipment proposed, power requirements, heat output, cable management provisions for all services.
- Nominate suggested power circuit arrangements and equipment power ratings.
- Typical cable management arrangements

3.18.2 DESCRIPTION & EXTENT OF WORKS

General: The works comprise the detailed design, supply, delivery, installation, commissioning, testing, placing into service and maintenance of the Telecommunications Cabling services installation and includes:

- Floor Distributors
- Backbone cabling to TDF
- Horizontal UTP telecommunications cabling.
- Work area outlets.
- For the DS Anchor Retail; provide fibre lead in cable to ONT (optical network termination point) only. Any telecommunications services downstream of the ONT shall be by fitout Contractor.

Provision of the Following Additional Services:

- Operating and maintenance manuals and "As Installed" drawings, coordinated across all communication work.
- Testing, commissioning, warranty and preventative maintenance of the complete

Telecommunication cabling system.

- Training of the principal's staff on the usage and maintenance of Telecommunications Cabling systems
- Submission of commissioning programme, shop drawings schedule and programme, sample delivery and programme prior to commencement of the works.

3.18.3 PERFORMANCE GUARANTEES

Manufacturer's Standards

General: Use a proprietary structured cabling system. Use only components supplied by or approved by the SCS manufacturer.

Comply with the cabling system manufacturer's design and installation standards. Do not use a SCS where these are in conflict with any of the requirements specified herein.

Only use a SCS where the manufacturer will physically inspect the Communication Installers works at least twice to ensure the manufacturer's installation standards are met. The manufacturer should provide the contractor with a written inspection report. The Communications Installer shall facilitate these inspections.

Only use a SCS where the manufacturer backs the warranties provided. That is, if the original warranty is offered through the Communications Installer, and the Communications Installer becomes unwilling or unable to fulfil warranty provisions, the Principal can require the manufacturer of the SCS to fulfil the warranty provisions.

Certification: At Practical Completion, provide a certificate from the SCS manufacturer or their authorised representative or agent certifying that the system has been designed, supplied, installed, tested and documented in accordance with all of the requirements of the cabling system manufacturer for the particular cabling system offered.

System Performance Warranty: System Performance Warranty period: Minimum 15 years from Practical Completion. Provide a Warranty that the cabling system supplied and installed under these works will, for the duration of the System Performance Warranty period: Meet or exceed the minimum performance requirements specified herein. Meet or exceed toe SCS manufacturer's minimum performance specifications.

Support all data transmission standards which the cabling system manufacturer currently or at any time during the System Performance Warranty period states that this type of cabling system will support.

Should the system not meet the specified performance requirements, provide all labour and materials (including transport, duties and taxes or similar) required to rectify any faults on-site during the System Performance Warranty period.

Guarantee of Workmanship: Guarantee the complete Telecommunication Cabling installation against faulty installation workmanship of any kind, at a minimum, for the duration of the System Performance Warranty period.

During the System Performance Warranty Period, perform all work necessary to ensure that the system is on proper working order.

Provide all labour and materials (including transport, duties and taxes or similar) required to rectify any faults on-site during the System Performance Warranty period.

Guarantee of Materials: Material Warranty Period: Minimum 15 years form Practical Completion.

Guarantee the complete Communications Cabling installation against faulty materials and failure of materials (except where due to maltreatment after Practical Completion) of any kind for the duration of the Material Warranty period.

Provide manufacturer Guarantee(s) against faulty materials and failure of materials (except where due to maltreatment after Practical Completion) of any kind for the duration of the Material Warranty period.

During the Material Warranty period replace with new equipment all parts of equipment which fail under normal use or which are found to not provide performance as specified herein or which do not meet the manufacturer's published performance figures, or any combination of these.

Provide all labour and materials (including transport, duties and taxes or similar) required to rectify and faults on-site during the Materials Warranty period.

Application Warranty

Telecommunications

a) Telephone
b) Facsimilie
c) Telecom leased lines, including digital data services
d) ISDN services, up to 2.048 Mbps
e) Exchange line services
f) CCTV
g) MATV
h) Baseband Video
i) Broadband Video
j) CDDI
k) FDDI
l) 100Base-SX 1000Base-LX
m) 100Base-TX
n) 1000Base-T
o) 1000base-TX

Data Networks

a) IEEE 802.3
b) 10Base-T
c) 10Base-FL
d) 100Base-TX
e) 100Base-T4
f) 100Base-FX
g) TP-PMD
h) ATM
i) Frame Relay
j) 1000Base-T
k) 1000Base-TX

Application Warranty Period: Minimum 15 years from Practical Completion.

Guarantee that the complete Communication cabling installation shall support the application listed in the above table (at a minimum) for the entire Application Warranty Period. In addition, warrant that the complete Communication Cabling system shall support any new protocols that may be developed during the Application Warranty Period, where those new protocols/applications are designed to run on this grade of cabling.

Provide submissions (on both electronic and hard-copy formats) on the exact applications that will be warranted by the system offered, including limitations and restrictions to the warranty for specific applications.

During the Application Warranty Period, provide all labour and materials (including transport, duties, taxes or similar costs) required to rectify any deficiency of the system with respect to this clause.

3.18.4 BUILDING ENTRANCE FACILITIES

General: Incoming service lead-in shall be Chorus supplied. Sub-contractor shall arrange for this work to occur.

Incoming Cabling shall be installed within a PVC duct installed beneath ground level.

DS Anchor

1 No. lead in cable shall terminate at an ONT located within the DS Anchor office area

Fibre Optic lead in Cabling for DS Anchor

Fibre optic backbone cables shall be 12 core G652.d OS1/OS2 Single Mode fibre optic cables.

All cores of the fibre cable are to be spliced with LC pigtails at each end in an approved enclosure that is designed to present and splice Fibre optic cables. All the connector ends of the LC pigtails are to be presented at the front of the enclosure in "green" LC through adapters.

All UPC and APC Single Mode Connectors must comply with Telcordia GR-326-Core. All Fibre Connectors must be inspected and cleaned to IEC 61300-3-35.

Single Mode Optical Fibre cables must comply with AS / NZS 3080 with the following additional requirements:

Loss Budget = 0.75dB per mated connection, plus .35 dB / km maximum

Type = All Loose Tube cables shell have:

- Polyethylene outer jacket
- UV stabilized Nylon 12 outer sheath
- Polyethylene outer sheath (under Nylon)
- Solid PE fillers shall be used where glass fibres are not present
- 12 Fibres per tube with Thixotropic gel for water blocking
- Glass Reinforced Plastic to be used as a Central Strength Member
- No Metal elements to be used

Minimum length = 15m

Minimum core count per cable = 12 cores.

Childcare Centre

1 No. lead in cable shall terminate at an ONT located within the Childcare Centre.

Fibre Optic lead in Cabling for Childcare Centre

Fibre optic backbone cables shall be 2 core G652.d OS1/OS2 Single Mode fibre optic cables.

All cores of the fibre cable are to be spliced with LC pigtails at each end in an approved enclosure that is designed to present and splice Fibre optic cables. All the connector ends of the LC pigtails are to be presented at the front of the enclosure in "green" LC through adapters.

All UPC and APC Single Mode Connectors must comply with Telcordia GR-326-Core. All Fibre Connectors must be inspected and cleaned to IEC 61300-3-35.

Single Mode Optical Fibre cables must comply with AS / NZS 3080 with the following additional requirements:

Loss Budget = 0.75dB per mated connection, plus .35 dB / km maximum

Type = All Loose Tube cables shell have:

- Polyethylene outer jacket
- UV stabilized Nylon 12 outer sheath
- Polyethylene outer sheath (under Nylon)
- Solid PE fillers shall be used where glass fibres are not present
- 2 Fibres per tube with Thixotropic gel for water blocking
- Glass Reinforced Plastic to be used as a Central Strength Member

- No Metal elements to be used

Minimum length = 15m

Minimum core count per cable = 2 cores.

Retail Tenancies T.02 – T.05
1 No. lead in cable shall terminate at each ONT located within each retail tenancy (T.02-T.05).

Fibre Optic lead in Cabling for each retail tenancy

Fibre optic backbone cables shall be 2 core G652.d OS1/OS2 Single Mode fibre optic cables.

All cores of the fibre cable are to be spliced with LC pigtails at each end in an approved enclosure that is designed to present and splice Fibre optic cables. All the connector ends of the LC pigtails are to be presented at the front of the enclosure in "green" LC through adapters.

All UPC and APC Single Mode Connectors must comply with Telcordia GR-326-Core. All Fibre Connectors must be inspected and cleaned to IEC 61300-3-35.

Single Mode Optical Fibre cables must comply with AS / NZS 3080 with the following additional requirements:

Loss Budget = 0.75dB per mated connection, plus .35 dB / km maximum

Type = All Loose Tube cables shell have:

- Polyethylene outer jacket
- UV stabilized Nylon 12 outer sheath
- Polyethylene outer sheath (under Nylon)
- Solid PE fillers shall be used where glass fibres are not present
- 2 Fibres per tube with Thixotropic gel for water blocking
- Glass Reinforced Plastic to be used as a Central Strength Member
- No Metal elements to be used

Minimum length = 15m

Minimum core count per cable = 2 cores.

3.18.5 DS ANCHOR SPECIFIC REQUIREMENTS

Tenancy distribution frame, back bone cabling, horizontal cabling, telecommunications outlets, patch leads etc. shall be installed by the DS Anchor fitout contractor.

3.18.6 FLOOR DISTRIBUTORS

The tenancy distribution frame (TDF) located in the Childcare Centre shall be 12 RU and comprise of an internal quality enclosure located as indicated.

The TDF shall be complete with horizontal cabling patch panel and space for Client supplied active equipment at the bottom. Horizontal cabling patch panel shall consist of 3 rows of 24 RJ45 terminators.

FDF shall be c/w horizontal cable management (jumper bars) between horizontal and vertical cable management.

Installation of TDF shall be in accordance with AS/NZS 3080 Addendum 2 and ISO 11801 Addendum 2.

Terminate all horizontal cabling to associated patch panel. Terminate cabling sequentially onto patch panel.

3.18.7 HORIZONTAL CABLING & TELECOMMUNICATIONS OUTLETS

Telecommunications outlets (TO's) shall be provided as per the drawings.

Supply and install a dedicated cable from the BD (or FD) to each TO. Use Class EA (category 6A) 4 pair UTP cabling.

Maximum cable length shall be 90m and minimum cable length shall be 15m. Ensure the cable twist is maintained right to the termination point. All UTP cabling shall be fully segregated from all other services by a minimum of 300mm.

For outlets exceeding 85m in length cabling shall be optical fibre with Class E (category 6) converter(s). Allow all necessary equipment and terminations for a complete working 8-way Class EA (Category 6A) modular sockets at each location.

Telecommunications outlets shall use the same type of flushplate as the Electrical Accessories (colour to approval). All flush plates to be recessed type.

TO's to be c/w 8-way Class EA (Category 6A) modular sockets. Wiring scheme shall be to T568A.

All UTP cabling shall be marked as "Verified Category 6A" under the authority of either Underwriters Laboratories Inc or Electrical Testing Laboratories.

Cables run as part of a bundle of more than 5 cables shall be de-rated by 3dB.

Mark cable with indelible printing at not less that 1500mm intervals with:

- Manufacturer's name
- Model Number
- Batch Number

Mark cable at each end with the cable ID. Utilise an approved labelling system.

3.18.8 CONNECTIONS

Modular Sockets: Terminal strips:Provide insulation displacement type terminal strips permanently connected to modular sockets. Do not connect terminal strips using discrete flexible wiring.

Mechanical Performance: To AS/NZS3080 Class EA

Electrical Performance: To AS/NZS3080 Class EA.

Submit independent test laboratory test results to verify conformity with performance requirements. Test Methods: ISO 11801 Add 2 and standards referenced by ISO 11801.

Colour code to indicate performances category.

Pair assignments: To 568A.

3.18.9 PATCH LEADS

Patch Cables: Provide the following quantities of cable. Provide strain relief fitted to plugs. Label each cable at both ends, showing the cable ID. Use self-adhesive vinyl cable labels.

Type	Quantity	Length
4 pair patch leads	1 per outlet	1,500mm nom.

4 Pair Patch Leads: Connectors: terminate lead at each end in specified performance plugs to

suit the proprietary termination system used.

Cable: flexible, multi-stranded, 4 pair, specified performance UTP cable to AS/NZS3080.

Colour: green or grey.

Provide a mixture of lengths up to the length specified to suit the requirements of the layout, to approval.

Records: Provide cable records in both hard copy and soft copy form. Format to approval. Record details of all cabling system components installed as part of these works. Records shall be to AS3085.1 including Appendix D and Appendix E.

The records should indicate if a cable is run as part of a bundle, so it can be tested against the de-rated standard.

Provide hard copies records:

- At TDF
- In the Installation Manuals

Provide a records holder at BD

The records shall include the cable ID of the patch lead, fly lead and equipment lead used to form the channel when tested.

Soft copy records: Microsoft Excel or equivalent spreadsheet files in Windows format. Provide with the Installation Manuals.

3.18.10 PATCHING & JUMPERING

Allow to patch/jumper the following services, based on information provided by the Principal prior to commissioning:

- All outlets
- Security Panel

During all patching and jumpering, maintain all records.

3.18.11 LABELLING

General: Outlets: Each outlet shall be c/w a label fitted behind a purpose made plastic clip.

Hand drawn labels are not acceptable.

Fixed cables: label with cable labels 300mm from each end. Cable labels shall consist of wrap around vinyl adhesive tape, covered completely by a clear film.

Labelling Schemes: Use labels containing the following: Source Cabinet ID, Floor Number and Sequential Numbers.

Separate adjacent numerical identifiers with '-'.

Cable type abbreviations

Use the following cable and outlet type abbreviations:

VG	Voice Grade
U3	Class C UTP
U4	Category 4 UTP
U5	Class D UTP
U5e	Class De UTP
U6	Category 6 UTP

U6a	Category 6a UTP
S	STP
Sc	ScTP
MO	Multi mode optical fibre
SO	Single mode optical fibre

Submit label schedules prior to manufacture.

3.18.12 TESTS

General: Use suitably skilled and competent personnel to undertake all inspections and tests.

Furnish, for the duration of testing, all equipment required testing and commissioning the works.

Submit current calibration certificates for test equipment prior commencement of tests.

Calibrate test equipment in accordance with:

UTP link performance test equipment: To TIA TSB 67, TSB 95 or ISO 11801 requirements, whichever is stricter. Use Level 11 testers, or better as required.

Other test equipment: AS/NZS ISO 10012: 2004

Carefully pre-plan all testing and commissioning so that it is fully coordinated with other relevant trades. Carry out testing in a safe and efficient manner with a minimum of inconvenience to all concerned.

Submit an inspection and test plan (ITP) prior to commencement of installation.

Test the installation progressively as construction progresses and then finally on completion of the works.

Replace or repair all equipment or materials found to be faulty during testing. Re-test following rectification works.

Submit certified copies of all test results.

Categories of Tests: Pre-completion tests: Tests carried out before completion tests.

Type tests: Tests carried out on an item identical with a production item, before delivery to the site.

Production tests: Tests carried out on the purchased equipment, before delivery to the site.

Site Tests: Tests carried out on site.

Acceptance Tests: Tests carried out on completed installations or systems and, except for final tests before the date for practical completion, to demonstrate that the installation or system, including components, controls and equipment, operates correctly, safely and efficiently, and meets performance and other requirements.

Final Tests: Acceptance tests carried out before completion of the maintenance period.

Type Tests: Submit type test results for the following:

- Modular sockets
- UTP Cables

Sockets: perform electrical and mechanical performance compliance tests as per AS/NZS3080 Annex A.2 and Annex B.

Cable: perform 'Compliance' tests as listed in Table A.1 of Annex A of AS/NZS3080.

Production Tests: Perform production tests and submit test results for the following:

Modular sockets: Visual inspection

UTP cables: Nil.

Patch Leads: Test conductor continuity for all cables.

Submit manufacturer's test data.

Inspections: Inspect the installation at least once per week and prior to the building in of components to verify conformance of the installation with the requirements of the specification and with good work practices.

Submit weekly inspection reports.

Site Tests: Perform site tests on all installed cables and submit rest reports. Inspect the installation on completion of each floor or area to verify that all specified works have been undertaken. Submit a test report for each area.

Class E UTP Cables: To TSB95 and ISO 11801 test criteria. Reject cables indicated as FAIL, FAIL* OR PASS*. Use a Level II or better tester.

3.18.13 ACCEPTANCE TESTS

Perform acceptance tests, in the presence of the Principal's nominated representative, for the following:

Class EA UTP Cable

To: TIA TSB 95 and ISO 11801.

Reject cables indicated as FAIL, FAIL* or PASS*

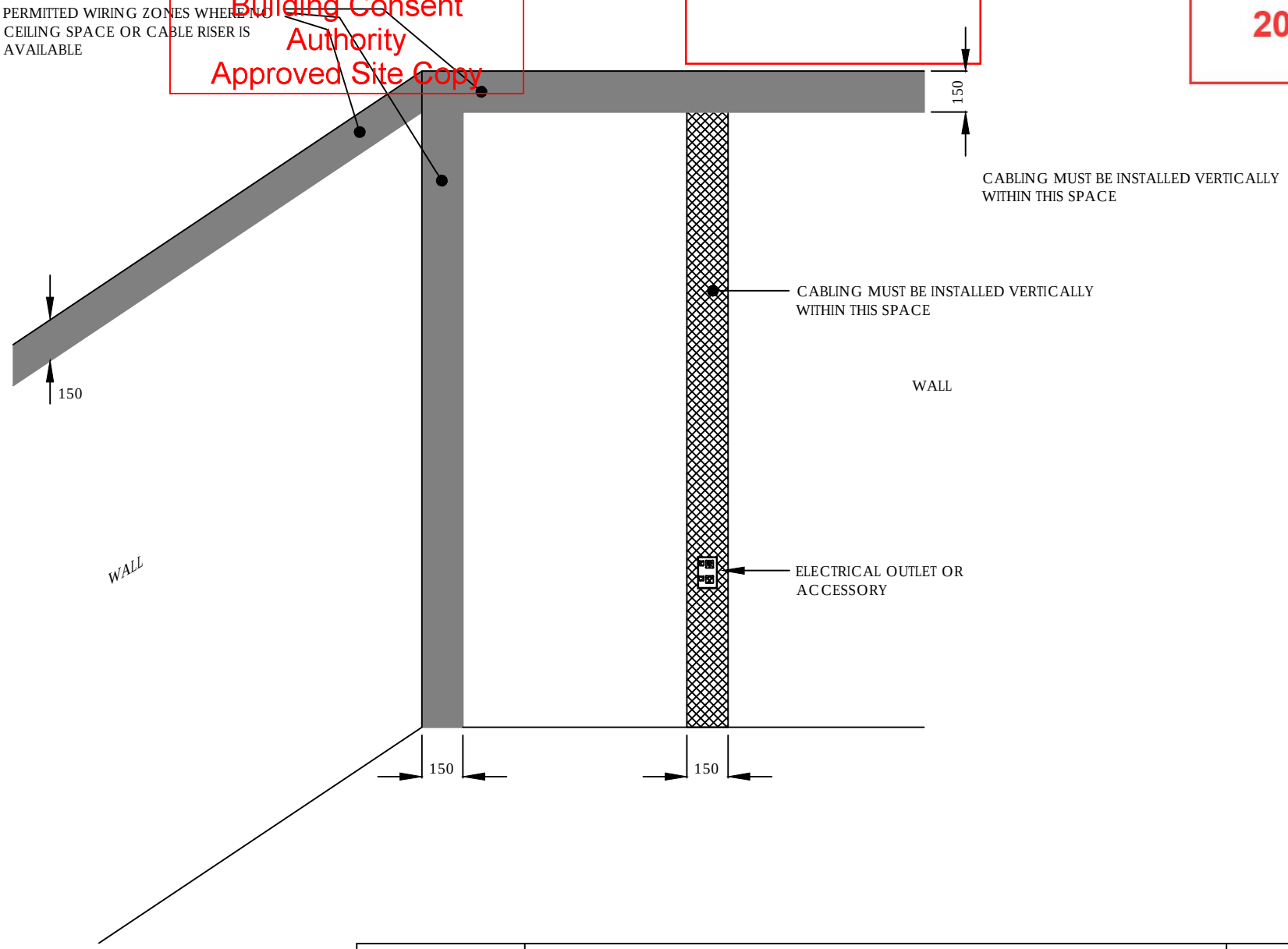
Test a random selection of at least 10% of the cables on each floor and in the backbone.

Repeat Site Tests for all cables on the floor or in a backbone if any cable fails Acceptance Testing.

APPENDIX A

Schedule of Drawings & Data Sheets

E0001	Standard symbols Legend
E1101	Lighting Layout Ground Floor 1 Part 1
E1102	Lighting Layout Ground Floor 1 Part 2
E1103	Lighting Layout Level 1 Part 1
E1104	Lighting Layout Level 1 Part 2
E1105	Lighting Layout Level 2 Part 1
E1201	Power, IT & Security Layout Ground Floor Part 1
E1202	Power, IT & Security Layout Ground Floor Part 2
E1203	Power, IT & Security Layout Level 1 Part 1
E1204	Power, IT & Security Layout Level 1 Part 2
E1205	Power, IT & Security Layout Level 2 Part 1
E1301	Cable Tray Layout Ground Floor Part 1
E1302	Cable Tray Layout Ground Floor Part 2
E1303	Cable Tray Layout Level 1 Part 1
E1304	Cable Tray Layout Level 1 Part 2
E1601	Electrical Services SLPSD
E1602	Electrical Services Lighting Controls Diagram
E0B	Recessed Cable Routes
E0H	Combined Faceplate Mounting Details



NOTES:

1. THIS DIAGRAM TO BE READ IN CONJUNCTION WITH SPECIFICATION CLAUSE "CABLING INSTALLATION METHODS".
2. TELECOMMUNICATION, DATA WIRING ALSO TO BE INSTALLED AS SHOWN.

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PROJECT
COSGROVES STANDARD DETAILS

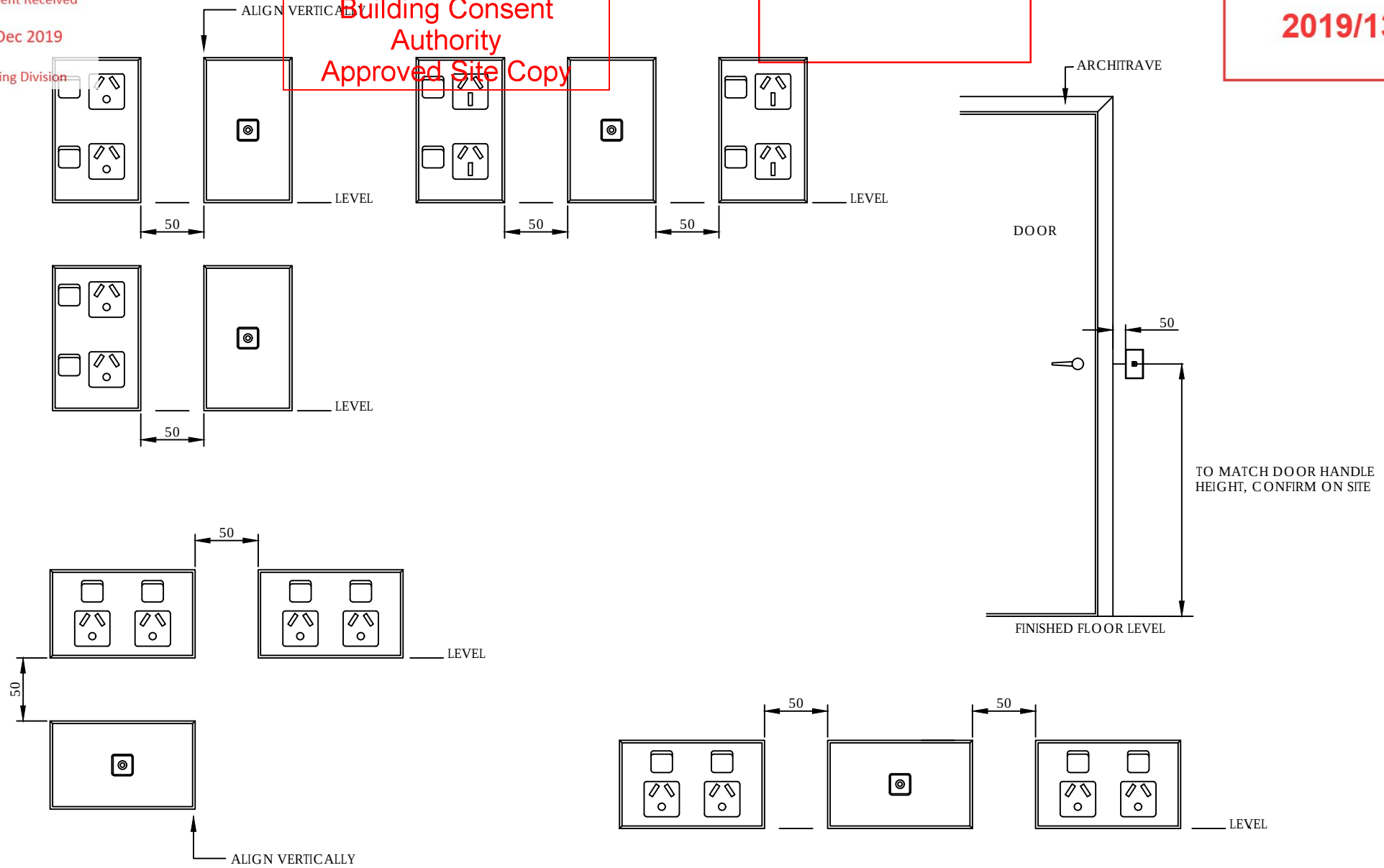
SHEET TITLE:
RECESSED CABLE ROUTES

ELECTRICAL SERVICES

DRAWN: CAD

SCALE: N.T.S. (A4)

SHEET No:
STD-EOB



cosgroves
PO Box 842
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Email: admin@cosgroves.com

PROJECT
COSGROVES STANDARD DETAILS

SHEET TITLE:
COMBINED FACEPLATE MOUNTING DETAILS

ELECTRICAL
SERVICES

DRAWN: CAD
SCALE: N.T.S. (A4)

SHEET No:
STD-EOH

APPENDIX B

Schedule of Luminaires

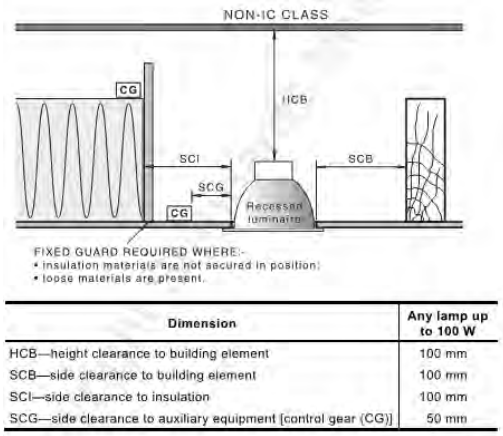
Appendix B

DS Anchor Schedule of Luminaires

Ref.	Description	Lamp Type	Installation	
A	Trilux Oleveon 1500mm LED-Surface-mounted weather-proof luminaire, IP66, impact resistant IK03 c/w polycarbonate body and PMMA diffuser, symmetric wide distribution & stainless steel fixing clamps, with 5-pole connecting terminal suitable for through-wiring	2,700lm, 19W, 4,000K, L80 @ 50,000h	Suspended 3,600mm AFFL to underside of Luminaire	
A1	Trilux Oleveon 1500mm LED-Surface-mounted weather-proof luminaire, IP66, impact resistant IK03 c/w polycarbonate body and PMMA diffuser, symmetric wide distribution & stainless steel fixing clamps, with 5-pole connecting terminal suitable for through-wiring	2,700lm, 19W, 4,000K, L80 @ 50,000h	Surface ceiling mounted	
B	Fagerhult – AllFive LED surface mount luminaire c/w: opal diffuser & integral LED driver. 1200mm long.	4900lm, 36W 4000K LED L80/B10 @ 100,000 hrs	Suspended 3,600mm AFFL to underside of Luminaire.	
C	Designation not utilised			
D	RZB Ledona Round IP65 LED recess mounted downlight 320mm (dia) 90 degree beem angle, IP65, impact resistant IK07 c/w DALI dimmable LED Driver, Recessed ring, luminaire housing and heat sink: die cast aluminium, powder coated. Faceted reflector: parabolic four-segment design, frosted aluminium, with highly polished light mixing chamber, transparent safety glass, with 5-pole connecting terminal suitable for through-wiring. Ceiling mount: spring system. Colour to be confirmed by the architect	4250lm, 40W, 4,000K, L80 @ 50,000h	Recess mounted to ceiling	
E	Designation not utilised			
F	LED gear tray for continuous line system E-Line 7651 Fix, with E-Line Fix 0765. continuous trunking (length as shown on drawing), very wide beam spread (C0: 107°, C90: 96°), PMMA lens optic with three matched, photometrically effective sections, 2211 mm gear tray 6300 lm, connected load 37W, luminous efficiency of luminaire 170 lm/W, & Self-	6300lm, 37W, 4000K, L80 @ 50,000hrs	Suspended 3,600mm AFFL to underside of Luminaire c/w continuous E-Line extrusion system	

actuating electrical connection via plug contacts with phase selection. Phase selection is without use of tools. With electronic transformer, digitally dimmable (DALI)

Colour: White

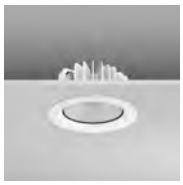
G	DS Anchor tenant supplied. Free Issue to electrical contractor. NSG Exmouth TC recessed LED downlight 225mm (dia), 105 degree beam, twin 40 / 28W setting Dip switch, colour temperature setting DIP switch, remote LED driver, Die-cast aluminium body & Opal polycarbonate diffuser. Note NON-IC rated  Dimension / Any lamp up to 100 W HCB—height clearance to building element — 100 mm SCB—side clearance to building element — 100 mm SCI—side clearance to insulation — 100 mm SCG—side clearance to auxiliary equipment [control gear (CG)] — 50 mm Colour: White	40/28W, 3800/2800lm, 4000K LED L70/B50 @ 50,000hrs	Recess mounted to ceiling	
H	Designation not used			
I	Designation not used			
J	Energylight Evala 600, 600x600mm recessed luminaire. c/w: DALI dimmable LED driver, aluminium body and seismic wire restraint kit.	28W, 3400lm LED 4000K, CRI: 80, L90 @ 50,000 hrs	Recessed into suspended ceiling grid	
K	Energylight Evala 600, 600x600mm recessed luminaire. c/w: DALI dimmable LED driver, aluminium body and seismic wire restraint kit.	22W, 2900lm LED 4000K, CRI: 80, L90 @ 50,000 hrs	Recessed into suspended ceiling grid	
L	Unios Titanium medium LED IP44 recess mounted downlight 100mm (dia), 36 degree beam angle c/w remote flicker free LED driver Colour: White	13W, 1225lm, 4000K LED L70 @ 100,000hrs	Recess mounted to ceiling	

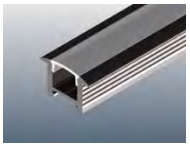
	1200mm IP54 LED batten luminaire complete with integral LED driver polycarbonate diffuser Philips, Thorn or similar approved.	30W, 3000 lm, 4000K LED. 50,000 hr (L80/B50) or better.	Surface mounted	
N	LED Flood Light, IP65, IK08, asymmetric forward throw distribution c/w integral LED driver. Philips, Thorn or similar approved	80W, 9000lm 4000K. L80 @ 50,000 hr or better	Wall mounted above roller door	
O	Designation not utilised			
P	Trilux Oleveon 1200mm LED-Surface-mounted weather-proof luminaire, IP66, impact resistant IK08 c/w polycarbonate body and PMMA diffuser, symmetric wide distribution & stainless steel fixing clamps, with 3-pole connecting terminal suitable for through-wiring	2,600lm, 19W, 4,000K, L80 @ 50,000h	Installed to back wall of lift shaft opposite each landing	
Q	Designation not utilised			
R	IBL Ridge Box surface mounted linear LED profile, IP65, Black aluminium profile frosted diffuser & remote LED driver. Length as indicated on the drawings.	240lm/m, 7.68W/m, 3000K, L70 @ 50,000h	Surface mounted	
S	Iguzzini Laser Blade InOut Recessed rectangular ceiling mounted IP65 luminaire, compact body 274x37mm, Warm White LEDs, Wide Flood optic.	2000lm, 20W, 3000K, L90/B10 @ 50,000h	Ceiling recessed	
T	Trilux Skeo Q-W1-D GT AM4R/20-830 ET, Cubic, decorative LED surface wall mounted luminaire, IP65, die cast aluminium body, narrow beam distribution, LED driver. Colour – Anthricite	20lm, 4W, 3000K, L80 @ 50,000h	Wall mounted	
E1	Legrand Galaxy E2 LED Exit Blade self-contained maintained, wall / ceiling mounted, single or double sided emergency luminaire c/w LED lamps, integral battery pack, Lithium Ion batteries, trickle charger test button, Red LED indicator, 'Running Man' legend with arrows where indicated. Luminaire classification shall be C12.5/ C12.5 or better on the C0/ C90 plane when ceiling or wall mounted	1 x 3 watt LED	Ceiling mounted in front of door	

	Luminaire to be designated 'M' Maintained.			
E2	Legrand Galaxy G2 LED slide connect Exit self-contained maintained, wall / ceiling mounted, single or double sided emergency luminaire c/w LED lamps, integral battery pack, Lithium Ion batteries, trickle charger test button, Red LED indicator, 'Running Man' legend with arrows where indicated. Luminaire classification shall be D3.2/ B3.2 or better on the C0/ C90 plane when ceiling or wall mounted Luminaire to be designated 'M' Maintained.	1 x 3 watt LED	Wall mounted above door (if practical) otherwise ceiling mounted in front of door	
E3	Legrand Galaxy G2 LED slide connect Exit c/w weatherproof IP65 enclosure self-contained maintained, wall / ceiling mounted, single or double sided emergency luminaire c/w LED lamps, integral battery pack, Lithium Ion batteries, trickle charger test button, Red LED indicator, 'Running Man' legend with arrows where indicated. Luminaire classification shall be D3.2/ B3.2 or better on the C0/ C90 plane when ceiling or wall mounted Luminaire to be designated 'M' Maintained.	1 x 4 watt LED	Surface mounted	 *c/w* 
E4	Legrand Galaxy Super Satellite Self-contained non maintained surface mounted IP65 IK07 LED circular emergency luminaire complete with battery pack, Lithium Ion batteries, trickle charger test button & Red LED indicator. Luminaires classification shall be D100 /D100 or better in the C0 /C90 planes when ceiling mounted	1 x 5.2W LED	Surface ceiling mounted	

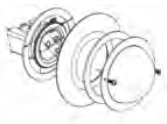
E5	Legrand Galaxy Satellite Self-contained non maintained recessed LED circular emergency luminaire complete with remote battery pack, Lithium Ion batteries, trickle charger test button & Red LED indicator. Luminaires classification shall be D63 /D63 Or better in the C0 /C90 planes. Colour White	1 x 2 Watt LED	Recessed into ceiling	
E6	Luminaire not used in DS Anchor Works			
E7	Legrand Galaxy Bulkhead R 360 LED. IP65, IK10 combination bulkhead and emergency luminaire c/w integral LED driver, die-cast aluminium body, frosted polycarbonate diffuser, Lithium Ion batteries, trickle charger. AS/NZS2293 compliant. Luminaires classification shall be D80 /D80 Or better in the C0 /C90 planes.	1,800lm, 22W, 4,000K, L70 @ 50,000h	Surface wall mounted	

Childcare Centre Schedule of Luminaires

Ref.	Description	Lamp Type	Installation	
AA	Trilux Oleveon 1500mm LED-Surface-mounted weather-proof luminaire, IP66, impact resistant IK03 c/w polycarbonate body and PMMA diffuser, symmetric wide distribution & stainless steel fixing clamps, with 5-pole connecting terminal suitable for through-wiring	2,000lm, 44W, 4,000K, L80 @ 50,000h	Surface ceiling mounted	
AB	Energy Light - Energyline 75H Continuous line aluminium LED extrusion direct/indirect luminaire c/w: reeded diffuser, end caps, integral LED drivers, flex, base and all fixing components for a working installation. DALI dimmable. Lengths as per drawings. Electrical Contractor to confirm length before ordering.	2500lm/m 4000K High efficiency LED, L80/B10 @ 50,000 hrs Supplier to determine quantity	Rod Suspended	
AC	RZB – FLAT POLYMERO KREIS. Base and canopy: metal, powder-coated, white. Diffuser: plastic (PMMA), opal, or plastic (polycarbonate). DALI LED Driver. 515mm Diameter.	10 x 2.2W 3650lm 4000K LED, L80/B10 @ 50,000 hrs	Surface Ceiling Mounted.	
AD	RZB Ledona Round IP65 LED recess mounted downlight 180mm (dia) 57 degree beem angle, IP65, impact resistant IK07 c/w DALI dimmable LED Driver, Recessed ring, luminaire housing and heat sink: die cast aluminium, powder coated. Faceted reflector: parabolic four-segment design, frosted aluminium, with highly polished light mixing chamber, transparent safety glass, with 5-pole connecting terminal suitable for through-wiring. Ceiling mount: spring system. Colour to be confirmed by the architect	1,950lm, 18W, 4,000K, L80 @ 50,000h	Recess mounted to ceiling	
E	Designation not utilised			
AF	Fagerhult – AllFive LED surface mount luminaire c/w: opal diffuser & integral LED driver. 1200mm long.	4900lm, 36W 4000K LED L80/B10 @ 100,000	Ceiling surface mounted.	

		hrs		
	Unios Titanium Large LED IP44 recess mounted downlight 134mm (dia), 60 degree beam angle c/w remote flicker free LED driver Colour: White	25W, 2540lm, 4000K LED L70 @ 100,000hrs	Recess mounted to ceiling	
AH	Unios Titanium medium LED IP44 recess mounted downlight 100mm (dia), 36 degree beam angle c/w remote flicker free LED driver Colour: White	13W, 1225lm, 4000K LED L70 @ 100,000hrs	Recess mounted to ceiling	
I	Designation not used			
AJ	Concealed LED strip light, within wall mount joinery to illuminate benchtop area below 13mm deep complete with remote driver. Length as per drawing. Energy Light, Brightlight or similar approved.	17W p/m fine pitch LED 4000K	Mounted to underside of joinery unit	
E1	Legrand Galaxy E2 LED Exit Blade self-contained maintained, wall / ceiling mounted, single or double sided emergency luminaire c/w LED lamps, integral battery pack, Lithium Ion batteries, trickle charger test button, Red LED indicator, 'Running Man' legend with arrows where indicated. Luminaire classification shall be C12.5/ C12.5 or better on the C0/ C90 plane when ceiling or wall mounted Luminaire to be designated 'M' Maintained.	1 x 3 watt LED	Ceiling mounted in front of door	
E2	Legrand Galaxy G2 LED slide connect Exit self-contained maintained, wall / ceiling mounted, single or double sided emergency luminaire c/w LED lamps, integral battery pack, Lithium Ion batteries, trickle charger test button, Red LED indicator, 'Running Man' legend with arrows where indicated. Luminaire classification shall be D3.2/ B3.2 or better on the C0/ C90 plane when ceiling or wall mounted Luminaire to be designated 'M'	1 x 3 watt LED	Wall mounted above door (if practical) otherwise ceiling mounted in front of door	

	Maintained.			
E3	Legrand Galaxy G2 LED slide connect Exit c/w weatherproof IP65 enclosure self-contained maintained, wall / ceiling mounted, single or double sided emergency luminaire c/w LED lamps, integral battery pack, Lithium Ion batteries, trickle charger test button, Red LED indicator, 'Running Man' legend with arrows where indicated. Luminaire classification shall be D3.2/ B3.2 or better on the C0/ C90 plane when ceiling or wall mounted Luminaire to be designated 'M' Maintained.	1 x 4 watt LED	Surface mounted *c/w*	
E4	Legrand Galaxy Super Satellite Self-contained non maintained surface mounted IP65 IK07 LED circular emergency luminaire complete with battery pack, Lithium Ion batteries, trickle charger test button & Red LED indicator. Luminaires classification shall be D100 /D100 or better in the C0 /C90 planes when ceiling mounted	1 x 5.2W LED	Surface ceiling mounted	
E5	Legrand Galaxy Satellite Self-contained non maintained recessed LED circular emergency luminaire complete with remote battery pack, Lithium Ion batteries, trickle charger test button & Red LED indicator. Luminaires classification shall be D63 /D63 Or better in the C0 /C90 planes. Colour White	1 x 2 Watt LED	Recessed into ceiling	
E6	Legrand Galaxy G2 LED slide connect dynamic Exit/Do Not Enter self-contained maintained, ceiling mounted, single or double sided Dynamic Exit/ Do Not Enter emergency luminaire c/w LED lamps, integral battery pack, Lithium Ion batteries, trickle charger test button, Red LED indicator, 'Running Man' legend with arrows and Negative reinforcement where indicated.	*1 x 3 watt LED*	ceiling mounted	

	Do Not Enter Mode Inputs: An input shall be wired to the to the sign to trigger the Do Not Enter mode. This input shall be supplied and installed via a separate contact from the Fire alarm contractor. Interface shall be normally closed, non latched, 12/24V, voltage free contact. Luminaire classification shall be D3.2/ B3.2 or better on the C0/ C90 plane when ceiling or wall mounted Luminaire to be designated 'M' Maintained.			
E7	Designation not used for childcare centre			
E8	Legrand Galaxy Satellite Self-contained non maintained recessed LED circular emergency luminaire complete with remote battery pack, Lithium Ion batteries, trickle charger test button & Red LED indicator. Complete with IP dome gasket kit (SPEC7741) for satellite Luminaires classification shall be D40 /D40 Or better in the C0 /C90 planes. Colour White	1 x 2 Watt LED	Recessed into ceiling	 

This Schedule of Luminaires must be read in conjunction with the balance of the Contract Documents and Drawings in order to interpret the requirements correctly. Catalogue numbers, physical sizes and cut outs must be confirmed by the Electrical Contractor with the manufacturer.

The Electrical Contractor shall submit their quotation based on the luminaires specified.

The Electrical Contractor may submit an alternative price based on alternative luminaires to those specified however the price submitted must be based on the luminaires specified with any alternative clearly offered as such, alternative luminaires must have the same characteristics and ratings as the specified luminaires in all respects.

Any alternative luminaires proposed must be identified and detailed for approval when submitting a tender.

Where a specific emergency luminaire manufacturer is not detailed, the Electrical Contractor **MUST** advise the type of luminaire to be used for each designation, when submitting their tender price.

Confirmation of the above types and quantities MUST BE OBTAINED from the Architect or the Engineer prior to any fitting being ordered.

The Electrical Contractor is fully responsible for ensuring that all relevant information is supplied to their suppliers and or manufacturers.

APPENDIX C

Circuit Charts

Sheet3

DB..Z1.G-1
0

Ze @ MDB 0

No.	ph	Type	Design Amps	Rating Amps	Description	Cable Size		Zs Impedence Ohms
R1	1	MCB	2.17	6	Control	1.50	Internal	0.05
W1								
B1								
R2	1	MCB	2.17	10	Ltg and Em ltg Reserve & MSB	1.50	mm sq x 3c+E x PVC/TPS	0.00
W2	1	MCB	2.17	10	Ltg and Em ltg Store and loading	1.50	mm sq x 3c+E x PVC/TPS	0.00
B2	1	MCB	2.17	10	Ltg and Em ltg Stair	1.50	mm sq x 3c+E x PVC/TPS	0.00
R3	1	MCB	0.43	10	Em ltg shop area	1.50	mm sq x 3c+E x PVC/TPS	0.00
W3	1	MCB	0.43	10	Em ltg shop area	1.50	mm sq x 3c+E x PVC/TPS	0.00
B3	1	MCB	2.17	10	Ltg Escalators	1.50	mm sq x 2c+E x PVC/TPS	0.00
R4	1	MCB	2.17	10	Lt Lift Shaft	1.50	mm sq x 2c+E x PVC/TPS	0.00
W4	1	MCB	2.17	16	Sign (Mall Entry)	2.50	mm sq x 2c+E x PVC/TPS	0.00
B4	1	MCB	2.17	16	Exterior Ltg	1.50	mm sq x 2c+E x PVC/TPS	0.00
R5								
W5								
B5	1	MCB	4.35	16	GPO - Reserve	2.50	mm sq x 2c+E x PVC/TPS	0.59
R6	1	MCB	4.35	16	GPO - Stair 1.2	2.50	mm sq x 2c+E x PVC/TPS	0.59
W6	1	MCB	4.35	16	GPO Lift Pit	2.50	mm sq x 2c+E x PVC/TPS	0.59
B6	1	MCB	4.35	16	GPO - Lift Sump Pump	2.50	mm sq x 2c+E x PVC/TPS	0.59
R7								
W7								
B7								
R8	1	MCB	0.00	16	Retail Floor Lighting 24Hr		By Fitout Contrctor	#N/A
W8	1	MCB	0.00	16	Retail Floor Lighting 50%		By Fitout Contrctor	#N/A
B8	1	MCB	0.00	16	Retail Floor Lighting 50%		By Fitout Contrctor	#N/A
R9	1	MCB	0.00	16	Retail Floor Lighting 50%		By Fitout Contrctor	#N/A
W9	1	MCB	0.00	16	Retail Floor Lighting 50%		By Fitout Contrctor	#N/A
B9	1	MCB	0.00	16	Retail Floor Lighting 100%		By Fitout Contrctor	#N/A
R10	1	MCB	0.00	16	Retail Floor Lighting 100%		By Fitout Contrctor	#N/A
W10	1	MCB	0.00	16	Retail Floor Lighting 100%		By Fitout Contrctor	#N/A
B10	1	MCB	0.00	16	Retail Floor Lighting 100%		By Fitout Contrctor	#N/A
R11	1	MCB	4.35	16	Retail Entry Downlights	1.50	mm sq x 2c+E x PVC/TPS	0.96
W11	1	MCB	4.35	16	Retail Entry Downlights	1.50	mm sq x 2c+E x PVC/TPS	0.96
B11	1	MCB	4.35	16	Retail Entry Downlights	1.50	mm sq x 2c+E x PVC/TPS	0.96
R12	1	MCB	4.35	16	Retail Entry Downlights	1.50	mm sq x 2c+E x PVC/TPS	0.96
W12	1	MCB	4.35	16	Retail Entry Downlights	1.50	mm sq x 2c+E x PVC/TPS	0.96
B12	1	MCB	4.35	16	Retail Entry Downlights	1.50	mm sq x 2c+E x PVC/TPS	0.96

R13	1	MCB	4.35	16	Retail Entry Downlights	1.50	mm sq x 2c+E x PVC/TPS	0.96
W13	1	MCB	4.35	16	Retail Entry Downlights	1.50	mm sq x 2c+E x PVC/TPS	0.96
B13	1	MCB	4.35	16	Retail Entry Downlights	1.50	mm sq x 2c+E x PVC/TPS	0.96
R14	1	MCB	4.35	16	Retail Entry Downlights	1.50	mm sq x 2c+E x PVC/TPS	0.96
W14								
B14								
R15								
W15								
B15								
R16	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contrctor	#N/A
W16	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contrctor	#N/A
B16	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contrctor	#N/A
R17	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contrctor	#N/A
W17	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contrctor	#N/A
B17	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contrctor	#N/A
R18	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contrctor	#N/A
W18	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contrctor	#N/A
B18	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contrctor	#N/A
R19								
W19								
B19								
R20								
W20								
B20								
R21								
W21								
B21								
R22	1	MCB	0.00	20	RSG Mall Entry	4.00	mm sq x 2c+E x PVC/TPS	0.59
W22	1	MCB	0.00	20	RSG Mall Entry	4.00	mm sq x 2c+E x PVC/TPS	0.54
B22	1	MCB	0.00	20	RSG Mall Entry	4.00	mm sq x 2c+E x PVC/TPS	0.50
R23					}	}		
W23	3	MCB	1.44	25	}RSD Bin Store	}4.00	mm sq x 4c+E x PVC/TPS	
B23					}	}		
R24					}	}		
W24	3	MCB	1.44	25	}RSD Loading	}4.00	mm sq x 4c+E x PVC/TPS	
B24					}	}		
R25								
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Sheet3

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No.	ph	Type	Design Amps	Rating Amps	Description	Cable Size		Zs Impedence Ohms
R1	1	MCB	2.17	6	Control	1.50	Internal	0.05
W1								
B1								
R2	1	MCB	2.17	10	Ltg and Em ltg Wind lobby	1.50	mm sq x 3c+E x PVC/TPS	0.96
W2	1	MCB	0.43	10	Ltg and Em ltg External light	1.50	mm sq x 3+E x PVC/TPS	0.96
B2	1	MCB	2.17	10	Ltg and Em ltg Stair	1.50	mm sq x 3c+E x PVC/TPS	0.72
R3	1	MCB	2.17	10	Ltg Lift Shaft	1.50	mm sq x 2c+E x PVC/TPS	0.48
W3								
B3								
R4	1	MCB	3.48	20	GPOs wind lobby	2.50	mm sq x 2c+E x PVC/TPS	0.59
W4	1	MCB	3.48	20	Automatic Door	2.50	mm sq x 2c+E x PVC/TPS	0.59
B4	1	MCB	3.48	20	Automatic Door	2.50	mm sq x 2c+E x PVC/TPS	0.59
R5	1	MCB	4.35	20	Lift Pit Socket outlet	2.50	mm sq x 2c+E x PVC/TPS	0.22
W5	1	MCB	4.35	20	Lift Pit Sump Pump	2.50	mm sq x 2c+E x PVC/TPS	0.22
B5	1	MCB	4.35	20	GPO's Stair 1.1	2.50	mm sq x 2c+E x PVC/TPS	0.37
R6	1	MCB	2.17	10	Façade Lighting	1.50	mm sq x 2c+E x PVC/TPS	0.72
W6	1	MCB	2.17	10	Façade Lighting	1.50	mm sq x 2c+E x PVC/TPS	0.72
B6	1	MCB	2.17	10	Future Façade Lighting	1.50	mm sq x 2c+E x PVC/TPS	0.72
R7	1	MCB	2.17	10	Future Façade Lighting	1.50	mm sq x 2c+E x PVC/TPS	0.72
W7	1	MCB	2.17	10	Sign	1.50	mm sq x 2c+E x PVC/TPS	0.72
B7								
R8	1	MCB	0.00	16	Retail Floor Lighting 24 Hr		By Fitout Contractor	#N/A
W8	1	MCB	0.00	16	Retail Floor Lighting 50%		By Fitout Contractor	#N/A
B8	1	MCB	0.00	16	Retail Floor Lighting 50%		By Fitout Contractor	#N/A
R9	1	MCB	0.00	16	Retail Floor Lighting 50%		By Fitout Contractor	#N/A
W9	1	MCB	0.00	16	Retail Floor Lighting 50%		By Fitout Contractor	#N/A
B9	1	MCB	0.00	16	Retail Floor Lighting 100%		By Fitout Contractor	#N/A
R10	1	MCB	0.00	16	Retail Floor Lighting 100%		By Fitout Contractor	#N/A
W10	1	MCB	0.00	16	Retail Floor Lighting 100%		By Fitout Contractor	#N/A
B10	1	MCB	0.00	16	Retail Floor Lighting 100%		By Fitout Contractor	#N/A
R11								
W11								
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R14								
W14								
B14								
R15								
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R16	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contractor	#N/A
W16	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contractor	#N/A
B16	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contractor	#N/A
R17	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contractor	#N/A
W17	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contractor	#N/A
B17	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contractor	#N/A
R18	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contractor	#N/A
W18	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contractor	#N/A
B18	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contractor	#N/A
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Sheet3

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No.	ph	Type	Design Amps	Rating Amps	Description	Cable Size		Zs Impedence Ohms
R1	1	MCB	2.17	6	Control	1.50	Internal	0.05
W1								
B1								
R2	1	MCB	2.17	10	ltg and Em ltg Reserve	1.50	mm sq x 3c+E x PVC/TPS	0.00
W2	1	MCB	2.17	10	ltg and Em ltg Carpark Entry	1.50	mm sq x 3c+E x PVC/TPS	0.00
B2		MCB		10	Spare	1.50		
R3		MCB		10	Spare	1.50		
W3	1	MCB	0.43	10	Em Ltg Shop area	1.50	mm sq x 3c+E x PVC/TPS	1.20
B3	1	MCB	0.43	10	Em Ltg Shop area	1.50	mm sq x 3c+E x PVC/TPS	1.20
R4	1	MCB	3.48	20	GPOs Reserve	2.50	mm sq x 2c+E x PVC/TPS	0.00
W4	1	MCB	3.48	20	GPOs Reserve	2.50	mm sq x 2c+E x PVC/TPS	0.00
B4		MCB		20	Auto Door	2.50	mm sq x 2c+E x PVC/TPS	
R5		MCB		20	Auto Door	2.50	mm sq x 2c+E x PVC/TPS	
W5		MCB		20	Sign	2.50	mm sq x 2c+E x PVC/TPS	
B5		RCBO		20	GPO - External Roof	2.50	mm sq x 2c+E x PVC/TPS	
R6								
W6								
B6								
R7								
W7								
B7								
R8	1	MCB	0.00	16	Retail Floor Lighting 24Hr		By Fitout Contractor	#N/A
W8	1	MCB	0.00	16	Retail Floor Lighting 50%		By Fitout Contractor	#N/A
B8	1	MCB	0.00	16	Retail Floor Lighting 50%		By Fitout Contractor	#N/A
R9	1	MCB	0.00	16	Retail Floor Lighting 50%		By Fitout Contractor	#N/A
W9	1	MCB	0.00	16	Retail Floor Lighting 50%		By Fitout Contractor	#N/A
B9	1	MCB	0.00	16	Retail Floor Lighting 100%.		By Fitout Contractor	#N/A
R10	1	MCB	0.00	16	Retail Floor Lighting 100%.		By Fitout Contractor	#N/A
W10	1	MCB	0.00	16	Retail Floor Lighting 100%.		By Fitout Contractor	#N/A
B10	1	MCB	0.00	16	Retail Floor Lighting 100%.		By Fitout Contractor	#N/A
R11								
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R16	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contractor	#N/A
W16	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contractor	#N/A
B16	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contractor	#N/A
R17	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contractor	#N/A
W17	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contractor	#N/A
B17	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contractor	#N/A
R18	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contractor	#N/A
W18	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contractor	#N/A
B18	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contractor	#N/A
R19								
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Sheet3

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No.	ph	Type	Design Amps	Rating Amps	Description	Cable Size		Zs Impedence Ohms
R1	1	MCB	2.17	6	Control	1.50	Internal	0.05
W1								
B1								
R2	1	MCB	2.17	10	Lighting Offices + Emergency	1.50	mm sq x 3c+E x PVC/TPS	0.60
W2	1	MCB	2.17	10	Lighting Offices + Emergency	1.50	mm sq x 3c+E x PVC/TPS	0.60
B2	1	MCB	2.17	10	Lighting WCs + Emergency	1.50	mm sq x 3c+E x PVC/TPS	0.60
R3	1	MCB	2.17	10	Lighting Corridor + Emergency	1.50	mm sq x 3c+E x PVC/TPS	0.60
W3	1	MCB	2.17	10	Lighting Corridor + Emergency	1.50	mm sq x 3c+E x PVC/TPS	0.60
B3	1	MCB	0.43	10	Emergency Lighting Retail Area	1.50	mm sq x 3c+E x PVC/TPS	0.60
R4	1	MCB	2.17	10	Façade Llighting	1.50	mm sq x 2c+E x PVC/TPS	0.72
W4	1	MCB	2.17	10	Future Façade Lighting	1.50	mm sq x 2c+E x PVC/TPS	0.72
B4	1	MCB	2.17	10	Future Façade Lighting	1.50	mm sq x 2c+E x PVC/TPS	0.72
R5	1	MCB	3.48	20	GPOs Meeting Room	2.50	mm sq x 2c+E x PVC/TPS	0.37
W5	1	MCB	3.48	20	GPOs Management Office	2.50	mm sq x 2c+E x PVC/TPS	0.37
B5	1	MCB	3.48	20	GPOs Main Office	2.50	mm sq x 2c+E x PVC/TPS	0.37
R6	1	MCB	3.48	20	GPOs Staff Room	2.50	mm sq x 2c+E x PVC/TPS	0.37
W6	1	MCB	3.48	20	GPOs Staff Room	2.50	mm sq x 2c+E x PVC/TPS	0.37
B6	1	MCB	3.48	20	GPOs WC	2.50	mm sq x 2c+E x PVC/TPS	0.37
R7	1	MCB	3.48	20	GPOs WC	2.50	mm sq x 2c+E x PVC/TPS	0.37
W7	1	MCB	3.48	20	GPO'S Corridor	2.50	mm sq x 2c+E x PVC/TPS	0.37
B7	1	MCB	8.70	20	HWB	2.50	mm sq x 2c+E x PVC/TPS	0.37
R8	1	MCB	3.48	20	GPO'S Kitchen	2.50	mm sq x 2c+E x PVC/TPS	0.37
W8	1	MCB	10.43	20	GPOs Kitchen	2.50	mm sq x 2c+E x PVC/TPS	0.37
B8	1	MCB	10.43	20	GPO's Manager & Secure room	2.50	mm sq x 2c+E x PVC/TPS	0.37
R9	1	MCB	10.43	20	Hand Drier - Accessable WC	2.50	mm sq x 2c+E x PVC/TPS	0.37
W9	1	MCB	10.43	20	Hand Drier - Female WC	2.50	mm sq x 2c+E x PVC/TPS	0.37
B9	1	MCB	10.43	20	Hand Drier - Male WC	2.50	mm sq x 2c+E x PVC/TPS	0.37
R10	1	MCB	3.48	20	CCTV	2.50	mm sq x 2c+E x PVC/TPS	0.37
W10	1	MCB	3.48	20	Security Panel	2.50	mm sq x 2c+E x PVC/TPS	0.37
B10	1	MCB	3.48	20	PBX	2.50	mm sq x 2c+E x PVC/TPS	0.37
R11	1	MCB	2.17	20	Sign	2.50	mm sq x 2c+E x PVC/TPS	0.37
W11		RCBO		20	GPO - External Roof	2.50	mm sq x 2c+E x PVC/TPS	
B11								
R12	1	MCB	0.00	16	Retail Floor Lighting 24Hr		By Fitout Contractor	#N/A
W12	1	MCB	0.00	16	Retail Floor Lighting 50%		By Fitout Contractor	#N/A
B12	1	MCB	0.00	16	Retail Floor Lighting 50%		By Fitout Contractor	#N/A

R13	1	MCB	0.00	16	Retail Floor Lighting 50%		By Fitout Contractor	#N/A
W13	1	MCB	0.00	16	Retail Floor Lighting 50%		By Fitout Contractor	#N/A
B13	1	MCB	0.00	16	Retail Floor Lighting 100%		By Fitout Contractor	#N/A
R14	1	MCB	0.00	16	Retail Floor Lighting 100%		By Fitout Contractor	#N/A
W14	1	MCB	0.00	16	Retail Floor Lighting 100%		By Fitout Contractor	#N/A
B14	1	MCB	0.00	16	Retail Floor Lighting 100%		By Fitout Contractor	#N/A
R15								
W15								
B15	1	MCB	3.48	20	GPOs Management Office	2.50	mm sq x 2c+E x PVC/TPS	0.37
R16	1	MCB	3.48	20	GPOs ICT equipment	2.50	mm sq x 2c+E x PVC/TPS	0.37
W16	1	MCB	3.48	20	GPOs ICT equipment	2.50	mm sq x 2c+E x PVC/TPS	0.37
B16	1	MCB	4.35	20	Printer/Xerox	2.50	mm sq x 2c+E x PVC/TPS	0.37
R17	1	MCB	4.35	20	Printer/Xerox	2.50	mm sq x 2c+E x PVC/TPS	0.37
W17								
B17								
R18								
W18								
B18	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contractor	#N/A
R19	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contractor	#N/A
W19	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contractor	#N/A
B19	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contractor	#N/A
R20	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contractor	#N/A
W20	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contractor	#N/A
B20	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contractor	#N/A
R21	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contractor	#N/A
W21	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contractor	#N/A
B21	1	MCB	0.00	20	Retail Floor Socket Outlets		By Fitout Contractor	#N/A
R22								
W22								
B22								
R23								
W23								
B23								
R24								
W24								
B24								
R25								
W25								
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R58									
W58									
B58									
R59									
W59									
B59									
R60									
W60									
B60									

Sheet3

DB.Z1.1-2(MECH)
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No.	ph	Type	Design Amps	Rating Amps	Description		Cable Size	Zs Impedence Ohms
R1	1	MCB (D Curve)	13.04	20	AC 1.AS/OU 1.AS		By Mechanical Contracor	#N/A
W1	1	MCB (D Curve)	0.26	20	AC 1.A1		By Mechanical Contracor	#N/A
B1	1	MCB (D Curve)	0.39	20	AC 1.A2		By Mechanical Contracor	#N/A
R2	1	MCB (D Curve)	0.30	20	AC 1.A3		By Mechanical Contracor	#N/A
W2	1	MCB (D Curve)	1.04	20	AC 1.A4		By Mechanical Contracor	#N/A
B2	1	MCB (D Curve)	0.57	20	BC 1.A		By Mechanical Contracor	#N/A
R3					}			
W3	3	MCB (D Curve)	8.63	20	}OU 1.A		By Mechanical Contracor	
B3					}			
R4	1	MCB (D Curve)	0.26	20	EF 1.03		By Mechanical Contracor	#N/A
W4	1	MCB (D Curve)	0.26	20	EF 1.04		By Mechanical Contracor	#N/A
B4	1	MCB (D Curve)	4.35	20	HRV 1.01		By Mechanical Contracor	#N/A
R5					}			
W5	3	MCB (D Curve)	10.10	20	}EDH 1.01		By Mechanical Contracor	
B5					}			
R6								
W6								
B6								
R7								
W7								
B7								
R8								
W8								
B8	1	MCB	0.65	20	Controls		By Mechanical Contracor	#N/A

Sheet3

DB.Z1.2-1
0

Ze @ MDB 0

No.	ph	Type	Design Amps	Rating Amps	Description	Cable Size		Zs Impedence Ohms
R1	1	MCB	2.17	6	Control	1.50	Internal	0.05
W1								
B1								
R2	1	MCB	2.17	10	Ltg and Em ltg Corridor	1.50	mm sq x 3c+E x PVC/TPS	0.84
W2	1	MCB	2.17	10	Ltg and Em ltg BoH	1.50	mm sq x 3c+E x PVC/TPS	0.84
B2	1	MCB	2.17	10	Ltg and Em ltg BoH	1.50	mm sq x 3c+E x PVC/TPS	0.84
R3	1	MCB	2.17	10	Ltg and Em ltg play area 1	1.50	mm sq x 3c+E x PVC/TPS	0.84
W3	1	MCB	2.17	10	Ltg and Em ltg Child area 2, 3 and quiet	1.50	mm sq x 3c+E x PVC/TPS	0.84
B3	1	MCB	2.17	10	Ltg and Em ltg play area 2	1.50	mm sq x 3c+E x PVC/TPS	0.84
R4	1	MCB	2.17	10	Ltg and Em ltg carpark entry	1.50	mm sq x 3c+E x PVC/TPS	0.01
W4								
B4								
R5	1	MCB	2.17	20	GPO Child area 1	2.50	mm sq x 2c+E x PVC/TPS	0.52
W5	1	MCB	2.17	20	GPO Child area 2	2.50	mm sq x 2c+E x PVC/TPS	0.52
B5	1	MCB	2.17	20	GPO Child Quiet Room	2.50	mm sq x 2c+E x PVC/TPS	0.52
R6	1	MCB	2.17	20	GPO Child area 3	2.50	mm sq x 2c+E x PVC/TPS	0.52
W6	1	MCB	2.17	20	GPO Child area 4	2.50	mm sq x 2c+E x PVC/TPS	0.52
B6	1	MCB/RCD	2.17	20	GPO Milk prep	2.50	mm sq x 2c+E x PVC/TPS	0.52
R7	1	MCB/RCD	2.17	20	GPO WC / Change	2.50	mm sq x 2c+E x PVC/TPS	0.52
W7	1	MCB	2.17	20	GPO Reception	2.50	mm sq x 2c+E x PVC/TPS	0.52
B7	1	MCB	2.17	20	GPO Office	2.50	mm sq x 2c+E x PVC/TPS	0.52
R8	1	MCB/RCD	2.17	20	GPO Storage, Sick, laundry, Washroom	2.50	mm sq x 2c+E x PVC/TPS	0.52
W8	1	MCB/RCD	2.17	20	GPO laundry	2.50	mm sq x 2c+E x PVC/TPS	0.52
B8	1	MCB	2.17	20	GPO Staff	2.50	mm sq x 2c+E x PVC/TPS	0.52
R9	1	MCB	2.17	20	GPO Staff	2.50	mm sq x 2c+E x PVC/TPS	0.52
W9	1	MCB	2.17	20	GPO Cleaners	2.50	mm sq x 2c+E x PVC/TPS	0.52
B9	1	MCB	2.17	20	GPO Cleaners	2.50	mm sq x 2c+E x PVC/TPS	0.52
R10	1	MCB/RCD	2.17	20	GPO Play area 1	2.50	mm sq x 2c+E x PVC/TPS	0.52
W10	1	MCB/RCD	2.17	20	GPO Play area 2	2.50	mm sq x 2c+E x PVC/TPS	0.52
B10	1	MCB/RCD	2.17	20	GPO Staff	2.50	mm sq x 2c+E x PVC/TPS	0.52
R11	1	MCB	2.17	20	ONT/FDF	2.50	mm sq x 2c+E x PVC/TPS	0.37
W11	1	MCB	2.17	20	Sign	2.50	mm sq x 2c+E x PVC/TPS	0.37
B11	1	MCB	2.17	20	Sign	2.50	mm sq x 2c+E x PVC/TPS	0.52
R12	1	MCB	4.35	20	Window Actuators Child Area 1	2.50	mm sq x 2c+E x PVC/TPS	0.37
W12	1	MCB	4.35	20	Window Actuators Child Area 2	2.50	mm sq x 2c+E x PVC/TPS	0.37
B12	1	MCB	4.35	20	Window Actuators Child Area 3	2.50	mm sq x 2c+E x PVC/TPS	0.37

R13	1	MCB	4.35	20	Window Actuators Child Area 4	2.50	mm sq x 2c+E x PVC/TPS	0.37
W13	1	MCB	13.04	20	HWC	2.50	mm sq x 2c+E x PVC/TPS	0.30
B13	1	MCB	13.04	20	HWC	2.50	mm sq x 2c+E x PVC/TPS	0.30
R14								
W14								
B14								
R15	1	MCB(D Curve)	0.26	16	EF 1.05		By Mechanical Contracor	#N/A
W15	1	MCB(D Curve)	0.26	16	EF 1.06		By Mechanical Contracor	#N/A
B15	1	MCB(D Curve)	0.30	16	HRV 1.02		By Mechanical Contracor	#N/A
R16	1	MCB(D Curve)	3.91	16	HRV 1.03		By Mechanical Contracor	#N/A
W16	1	MCB(D Curve)	0.70	16	BC 1.C		By Mechanical Contracor	#N/A
B16								
R17					}			
W17	3		7.22		}EDH 1.03		By Mechanical Contracor	
B17					}			
R18	1	MCB(D Curve)	0.22	16	AC 1.C1		By Mechanical Contracor	#N/A
W18	1	MCB(D Curve)	0.22	16	AC 1.C2		By Mechanical Contracor	#N/A
B18	1	MCB(D Curve)	0.22	16	AC 1.C3		By Mechanical Contracor	#N/A
R19	1	MCB(D Curve)	0.22	16	AC 1.C4		By Mechanical Contracor	#N/A
W19	1	MCB(D Curve)	0.22	16	AC 1.C5		By Mechanical Contracor	#N/A
B19								
R20					}			
W20	3	MCB(D Curve)	15.68	20	}OU1.C		By Mechanical Contracor	
B20					}			
R21	1	MCB(D Curve)	13.04	20	EPH 1.01 - 1.03		By Mechanical Contracor	#N/A
W21	1	MCB(D Curve)	8.70	20	EPH 1.04 - 1.05		By Mechanical Contracor	#N/A
B21	1	MCB(D Curve)	8.70	20	EPH 1.07 - 1.08		By Mechanical Contracor	#N/A
R22	1	MCB(D Curve)	6.96	20	EPH 1.06 & 1.10		By Mechanical Contracor	#N/A
W22	1	MCB(D Curve)	13.04	16	HWC 4		By Mechanical Contracor	#N/A
B22	1	MCB(D Curve)	0.03	16	HRRP 1		By Mechanical Contracor	#N/A
R23	1	MCB(D Curve)	0.08	16	UV 1		By Mechanical Contracor	#N/A
W23	1	MCB(D Curve)	13.04	20	HWC 4		By Mechanical Contracor	#N/A
B23								
R24								
W24								
B24								
R25								
W25								
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R26								
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R27									
W27									
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B33									
R34									
W34									
B34									
R35									
W35									
B35									
R36									
W36									
B36									

Sheet3

DB.LL-2
MSB

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No.	ph	Type	Design	Rating	Description	Cable Size		Zs Impedence
			Amps	Amps				Ohms
R1	0	0	PHASE!!	0	0	0.00	0	FALSE
W1	0	0	PHASE!!	0	0	0.00	0	FALSE
B1	0	0	PHASE!!	0	0	0.00	0	FALSE
R2	1	MCB	4.35	10	Lighting + Em - Cleaners	1.50	mm sq x 3c+E x PVC/TPS	0.72
W2	1	MCB	4.35	10	Lighting + Em - Storeage S.01-S.03	1.50	mm sq x 3c+E x PVC/TPS	0.72
B2	1	MCB	4.35	10	Lighting + Em - Storeage S.04-S.06	1.50	mm sq x 3c+E x PVC/TPS	0.72
R3	1	MCB	4.35	10	Lighting + Em - Storeage S.07 & Services	1.50	mm sq x 3c+E x PVC/TPS	0.72
W3	1	MCB	4.35	10	Lighting + Em - Exterior	1.50	mm sq x 3c+E x PVC/TPS	0.72
B3	0	0	PHASE!!	0	0	0.00	0	FALSE
R4	0	0	PHASE!!	0	0	0.00	0	FALSE
W4	0	0	PHASE!!	0	0	0.00	0	FALSE
B4	0	0	PHASE!!	0	0	0.00	0	FALSE
R5	0	0	PHASE!!	0	0	0.00	0	FALSE
W5	0	0	PHASE!!	0	0	0.00	0	FALSE
B5	0	0	PHASE!!	0	0	0.00	0	FALSE
R6	1	MCB	4.35	20	Socket Outlets - Cleaners	2.50	mm sq x 2c+E x PVC/TPS	0.44
W6	1	MCB	4.35	20	Socket Outlets - Storeage S.01-S.03	2.50	mm sq x 2c+E x PVC/TPS	0.44
B6	1	MCB	4.35	20	Socket Outlets - Storeage S.04-S.06	2.50	mm sq x 2c+E x PVC/TPS	0.44
R7	1	MCB	4.35	20	Socket Outlets - Storeage S.07	2.50	mm sq x 2c+E x PVC/TPS	0.44
W7	1	MCB	4.35	20	Socket outlets - Services	2.50	mm sq x 2c+E x PVC/TPS	0.44
B7	1	MCB	4.35	20	Pedestrian Warning Light	6.00	mm sq x 2c+E x PVC/TPS	0.91
R8	0	0	PHASE!!	0	0	0.00	0	FALSE
W8	0	0	PHASE!!	0	0	0.00	0	FALSE
B8	0	0	PHASE!!	0	0	0.00	0	FALSE
R9	0	0	PHASE!!	0	0	0.00	0	FALSE
W9	0	0	PHASE!!	0	0	0.00	0	FALSE
B9	0	0	PHASE!!	0	0	0.00	0	FALSE
R10	0	0	PHASE!!	0	0	0.00	0	FALSE
W10	0	0	PHASE!!	0	0	0.00	0	FALSE
B10	0	0	PHASE!!	0	0	0.00	0	FALSE
R11	0	0	PHASE!!	0	0	0.00	0	FALSE
W11	0	0	PHASE!!	0	0	0.00	0	FALSE
B11	0	0	PHASE!!	0	0	0.00	0	FALSE
R12	0	0	PHASE!!	0	0	0.00	0	FALSE
W12	0	0	PHASE!!	0	0	0.00	0	FALSE
B12	0	0	PHASE!!	0	0	0.00	0	FALSE

R13	0	0	PHASE!!	0	0	0.00	0	FALSE
W13	0	0	PHASE!!	0	0	0.00	0	FALSE
B13	0	0	PHASE!!	0	0	0.00	0	FALSE
R14	0	0	PHASE!!	0	0	0.00	0	FALSE
W14	0	0	PHASE!!	0	0	0.00	0	FALSE
B14	0	0	PHASE!!	0	0	0.00	0	FALSE
R15	0	0	PHASE!!	0	0	0.00	0	FALSE
W15	0	0	PHASE!!	0	0	0.00	0	FALSE
B15	0	0	PHASE!!	0	0	0.00	0	FALSE
R16	0	0	PHASE!!	0	0	0.00	0	FALSE
W16	0	0	PHASE!!	0	0	0.00	0	FALSE
B16	0	0	PHASE!!	0	0	0.00	0	FALSE
R17	0	0	PHASE!!	0	0	0.00	0	FALSE
W17	0	0	PHASE!!	0	0	0.00	0	FALSE
B17	0	0	PHASE!!	0	0	0.00	0	FALSE
R18	0	0	PHASE!!	0	0	0.00	0	FALSE
W18	0	0	PHASE!!	0	0	0.00	0	FALSE
B18	0	0	PHASE!!	0	0	0.00	0	FALSE
R19	0	0	PHASE!!	0	0	0.00	0	FALSE
W19	0	0	PHASE!!	0	0	0.00	0	FALSE
B19	0	0	PHASE!!	0	0	0.00	0	FALSE
R20	0	0	PHASE!!	0	0	0.00	0	FALSE
W20	0	0	PHASE!!	0	0	0.00	0	FALSE
B20	0	0	PHASE!!	0	0	0.00	0	FALSE
R21	0	0	PHASE!!	0	0	0.00	0	FALSE
W21	0	0	PHASE!!	0	0	0.00	0	FALSE
B21	0	0	PHASE!!	0	0	0.00	0	FALSE
R22	0	0	PHASE!!	0	0	0.00	0	FALSE
W22	0	0	PHASE!!	0	0	0.00	0	FALSE
B22	0	0	PHASE!!	0	0	0.00	0	FALSE
R23	0	0	PHASE!!	0	0	0.00	0	FALSE
W23	0	0	PHASE!!	0	0	0.00	0	FALSE
B23	0	0	PHASE!!	0	0	0.00	0	FALSE
R24	0	0	PHASE!!	0	0	0.00	0	FALSE
W24	0	0	PHASE!!	0	0	0.00	0	FALSE
B24	0	0	PHASE!!	0	0	0.00	0	FALSE

Sheet3

Typical Tenancy DB
0

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No.	ph	Type	Design	Rating	Description	Cable Size		Zs Impedence
			Amps	Amps				Ohms
1	1	MCB	2.39	10	Sign	1.50	mm sq x 2c+E x PVC/TPS	0.00
2	1	MCB	2.17	10	Lighting & Emergency Lighting Store Front	1.50	mm sq x 2c+E x PVC/TPS	0.00
3	1	MCB	2.17	10	Lighting WC	1.50	mm sq x 2c+E x PVC/TPS	0.00
4	0	0	PHASE!!	0	0	0.00	0	FALSE
5	0	0	PHASE!!	0	0	0.00	0	FALSE
6	1	MCB	5.22	20	Socket Outlet Below DB	2.50	mm sq x 2E x PVC/TPS	0.22
7	0	0	PHASE!!	0	0	0.00	0	FALSE
8	0	0	PHASE!!	0	0	0.00	0	FALSE
9	0	0	PHASE!!	0	0	0.00	0	FALSE
10	0	0	PHASE!!	0	0	0.00	0	FALSE
11	0	0	PHASE!!	0	0	0.00	0	FALSE
12	1	MCB	0.26	16	EF T.02	0.00	By Mechanical Contractor	#N/A
13	1	MCB	1.43	16	AC T.02.1 - T.02.3	0.00	By Mechanical Contractor	#N/A
14	1	MCB	0.53	16	BC 1.D	0.00	By Mechanical Contractor	#N/A
15	1	MCB	13.04	16	HWC 1	0.00	By Mechanical Contractor	#N/A
16	1	MCB	2.17	6	Control	1.50	Internal	0.24

APPENDIX D

Electrical Test Record Sheets

Emergency Lighting Test Record Sheet
Single Point System

Building Owner:……
Address:……
……
……
Building Description:……

Installation Engineer / Inspector:……
Installation Date:……
Telephone:……

Area Description:……

LUMINAIRE DETAILS				INSTALLATION REPORT		OPERATIONAL TEST							
Luminaire Location	Luminaire No.	Type NM / M / S	Duration 1hr – 2hr	Charge Indicator Shows	Full Discharge Test	Year 1		Year 2		Year 3		Year 4	
						6m	12m	6m	12m	6m	12m	6m	12m
Ground Floor G01													

Emergency Lighting Test Record Sheet
Single Point System Continuation Sheet

LUMINAIRE DETAILS				INSTALLATION REPORT		OPERATIONAL TEST							
Luminaire Location	Luminaire No.	Type NM / M / S	Duration 1hr – 2hr	Charge Indicator Shows	Full Discharge Test	Year 1		Year 2		Year 3		Year 4	
						6m	12m	6m	12m	6m	12m	6m	12m
Ground Floor G01													

RCD Test Record Sheet

Project:	**DB Reference:**	**Instrument Model**
Tested By:	**Test Date:**	**Instrument Serial Number**
Note: All trip tests to be carried out on the Positive Cycle		

Circuit Reference	Circuit Details	RCD No.	Outlet No.	RCD Rated Trip Current mA	Trip Type	Positive Cycle Trip Time ms	Overcurrent Test Current mA	Positive Cycle Trip Time ms	Ramp Trip Current mA (Sensitivity)

Electrical Services Test Record Sheet

Project:	**DB Reference: DB Reference G (typical)**	**Instrument Model**
Tested By:	**Test Date:**	**Instrument Serial Number**

Note: All circuits to be tested and results recorded

Circuit Reference	Circuit Description	Visual Inspection	Continuity Test	Polarity Test	Earth Continuity Test	Insulation Resistance			Earth Loop Impedance
						P - N	P - E	N - E	
R1									
Y1									
B1									
R2									
Y2									
B2									
R3									
Y3									
B3									
R4									
Y4									
B4									
R5									
Y5									
B5									
R6									
Y6									
B6									
R7									
Y7									
B7									
R8									
Y8									
B8									

Electrical Services Test Record Sheet
(continuation sheet)

R9									
Y9									
B9									
R10									
Y10									
B10									
R11									
Y11									
B11									
R12									
Y12									
B12									
R13									
Y13									
B13									
R14									
Y14									
B14									
R15									
Y15									
B15									
R16									
Y16									
B16									
R17									
Y17									
B17									

Electrical Services Test Record Sheet
(continuation sheet)

R18									
Y18									
B18									
R19									
Y19									
B19									
R20									
Y20									
B20									
R21									
Y21									
B21									
R22									
Y22									
B22									
R23									
Y23									
B23									
R24									
Y24									
B24									

APPENDIX E

Submittal Requirements Checklist

Appendix E

Submittal Requirements Check List

The Contractor is required to complete and submit the following table at time of tender	
Item	**Attached Y/N**
A signed Statement of Compliance with the provisions of the Specifications	
Provide details of all areas of non-compliance	
Provide details of any discrepancies between the Schedule and this specification and the associated drawings	
Full details of any alternative luminaires proposed. Details to include aesthetic comparison, design calculations, specification and performance characteristics	
Full details of any alternative materials or construction techniques proposed. Details to include aesthetic comparison, design calculations, construction, capacities and performance characteristics	
Details of proposed Switchboard Manufacturer	
Confirmation that the Switchboards have the correct clearances	
Details of proposed Telecommunications Contractor	
Details of proposed Security Contractor	
Agreement to provide all necessary shop drawings required for the execution of the works	
Agreement to provide all necessary As Built drawings and Operating and Instruction Manuals (O&M) as set out in the specification	

Signed……..

Date……

On Behalf Of……

APPENDIX F

Acceptance of Specification Sections & Clauses

Appendix F

Acceptance of Specification Sections and Clauses

The Tendering Electrical Contractor is to ensure this page - "Acceptance of the Electrical Specification Sections and Clauses" is complied with, signed, dated and included with their Tender Return.

It is a pre-condition of Tender Acceptance that this Certificate is included with the Tender Return.

The purpose of this certificate is to clarify to all parties involved that the Tender specifications, All sections, contents and requirements have been duly read, noted and accepted by the tendering contractor and any items of non acceptance, ambiguity or misinterpretation, have been duly listed and tagged out, or clarification sought from the Consulting Engineer and or the parties issuing the Tender, prior to return of Tender.

No extra to Contract payments will be entertained or accepted as a result of non compliance with the specification sections and clauses.

For all of the individual clauses in the particular Sections 1, 2 & 3, the tenderer must clearly state "Noted and Agreed" or alternatively indicate non agreement of any particular clause, giving reasons. If no 'Non agreement' items are listed or returned, then it will be deemed that the Tenderer has read and accepted all sections and their relevant clauses.

The tenderer must clearly state whether their Tender return meets all of the requirements of this Specification. For each clause of the Specification the Tenderer shall state "Compliant" or "Non Compliant".

The tenderer shall suggest an alternative solution to requirements for any items deemed Non Compliant.

I/We…… (Print name(s)

of …… (Company tendering)

Confirm compliance with the "Acceptance of Specification Sections and Clauses" detailed above.

Signed …… Dated: ……

APPENDIX G

Schedule of Monetary Allowances

Appendix G

Schedule of Monetary Allowances

The Electrical Contactor is to include the monetary allowances listed below.

Suppliers invoices shall be submitted, relating to expenditure against these allowances and the actual amount finally expended will be adjusted accordingly.

No money can be expended against these sums without the written approval of the Architect.

Sum No.1	Nil	Nil

APPENDIX H

Compliance Documents

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DECLARATION OF CONFORMITY
(in accordance with ISO/IEC 17050-1)

DECLARATION NO: (Job No/1)

OBJECT OF DECLARATION:

The proposed electrical design covered by this Declaration of Conformity is described on **COSGROVES'** drawings titled Invercargill Central 33 Esk Street – Zone 1 and numbered CS18007-1 E-0001 – E1602 together with the specification and all Consultant Advice Notices issued by Cosgroves Ltd during the contract period.

The purpose of the declaration described above is to confirm the design conforms with the requirements of the following documents and/or other relevant Standards:

Document No.	**Title**	**Revision/Date of Issue**
AS/NZS 3000:2007 Part 2	Electrical Installations Part 2	2007

ADDITIONAL INFORMATION:
This installation is compatible with 400V 3-phase 50Hz supply.

SIGNED BY…… **……ON BEHALF** OF Cosgroves Ltd

NAME: Evan Owens

POSITION: Associate Electrical Engineer

DATE: 28 October 2019

Original To:- (client)

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Fire Design Coordination Statement for Electrical Services
(in accordance with IPENZ Practice Note 22)

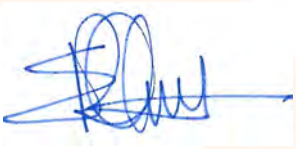
PROJECT: Invercargill Central Zone 3 – DS Anchor & Childcare Centre
JOB NO: CS18007-1
Revision: D

STATEMENT OF COORDINATION:

This Design Coordination Statement is to be provided to the Building Consent Authority, and is intended to accompany the documents submitted in the building consent application

The full relevant set of Holmes Fire Strategy documentation, as detailed on their document transmittal and supplied on A360, including the Fire Engineering Strategy Report, prepared by Holmes Fire LP Titled '**Zone 1 D.S. Anchor & Childcare Centre, Fire Engineering Strategy'** Version B, plus the Fire Alarm Interface Matrix and the transfer drawings, including all associated revisions, have been reviewed by Cosgroves Ltd

We believe on reasonable grounds that the relevant elements of the Fire Strategy report detailed above have been incorporated into our design of the electrical services systems proposed, as described on **COSGROVES'** drawings titled Invercargill Central Zone 1 – DS Anchor and Childcare Centre and numbered E-0001 – E-1602, together with the specification CS18007-1 issued by Cosgroves Ltd as per the attached drawing register.



SIGNED BY

ON BEHALF OF Cosgroves Ltd

NAME: Evan Owens

POSITION: Associate Engineer - Electrical

DATE: 28 October 2019

Building Code Clause(s) F6, F8.3.3, G8, G9, H1.3.5

PRODUCER STATEMENT – PS1 – DESIGN

(Guidance on use of Producer Statements (formerly page 2) is available at www.engineeringnz.org)

ISSUED BY: COSGROVES LIMITED
(Design Firm)

TO: HWCP MANAGEMENT LIMITED
(Owner/Developer)

TO BE SUPPLIED TO: INVERCARGILL CITY COUNCIL
(Building Consent Authority)

IN RESPECT OF: INVERCARGILL CENTRAL ZONE 1 - DS ANCHOR & CHILDCARE CENTRE
(Description of Building Work)

AT: 33 ESK STREET
(Address)

Town/City: INVERCERGILL **LOT** 2 **DP** 540342 **SO**
(Address)

We have been engaged by the owner/developer referred to above to provide:

ELECTRICAL ENGINEERING SERVICES

(Extent of Engagement)

services in respect of the requirements of Clause(s) F6,F8.3.3,G8,G9, H1.3.5 of the Building Code for:

☑ All or ☐ Part only (as specified in the attachment to this statement), of the proposed building work.

The design carried out by us has been prepared in accordance with:

☑ Compliance Documents issued by the Ministry of Business, Innovation & Employment F6, F8 & G8/AS1, G9/VM1 or
(verification method/acceptable solution)

☐ Alternative solution as per the attached schedule

The proposed building work covered by this producer statement is described on the drawings titled:

INVERCARGILL CENTRAL ZONE 1 - DS ANCHOR & CHILDCARE and numbered Z1-E001 - E1602;
together with the specification, and other documents set out in the schedule attached to this statement.

On behalf of the Design Firm, and subject to:
(i) Site verification of the following design assumptions NONE
(ii) All proprietary products meeting their performance specification requirements;

I believe on reasonable grounds that a) the building, if constructed in accordance with the drawings, specifications, and other documents provided or listed in the attached schedule, will comply with the relevant provisions of the Building Code and that b), the persons who have undertaken the design have the necessary competency to do so. I also recommend the following level of construction monitoring/observation:

☐ CM1 ☐ CM2 ☑ CM3 ☐ CM4 ☐ CM5 (Engineering Categories) or ☐ as per agreement with owner/developer (Architectural)

I, BRYCE SAWYER am: ☑ CPEng 1004793 # ☐ Reg Arch ..... #
(Name of Design Professional)

I am a member of: ☑ Engineering New Zealand ☐ NZIA and hold the following qualifications: B.E. (ELEC)
The Design Firm issuing this statement holds a current policy of Professional Indemnity Insurance no less than $200,000*.
The Design Firm is a member of ACENZ: ☑

SIGNED BY BRYCE SAWYER (Signature) 
(Name of Design Professional)

ON BEHALF OF COSGROVES LIMITED Date 28.10.2019
(Design Firm)

Note: This statement shall only be relied upon by the Building Consent Authority named above. Liability under this statement accrues to the Design Firm only. The total maximum amount of damages payable arising from this statement and all other statements provided to the Building Consent Authority in relation to this building work, whether in contract, tort or otherwise (including negligence), is limited to the sum of $200,000.*

This form is to accompany **Form 2 of the Building (Forms) Regulations 2004** for the application of a Building Consent.