MCV Design Ltd

P R O J E C T S P E C I F I C A T I O N

Wilson & Thompson Project

11 Carrickmore Cres
Northlake
Wanaka

Issued for Construction

62593

PROJECT OVERVIEW

Scope

Construct New Residential Dwelling

Address

Site Address	11 Carrickmore Cres
Suburb	Northlake
Region	Wanaka
Lot #	510
DP #	607419

Site Conditions

Wind Zone	H - High Wind Speed
Earthquake Zone	Zone 3
Exposure Zone	Zone B - Low
Snow Loading Zone	Zone N5

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1 PRELIMINARIES & GENERAL

1.1 Project Overview

1.1.1 Site

Relevant site conditions are believed to be correctly represented in the Contract Documents, however the Contractor (and Subcontractors where appropriate) are requested to inspect the site to ascertain for themselves the nature and extent of the works and the rights and interests that may be interfered with in the execution of the works, as no claims for additional payment will be recognised on the grounds of insufficient description.

1.1.2 Adjacent Owners

Carry out whatever actions or precautions are required to avoid or to absolutely minimise noise, dirt, dust, access, etc. inconvenience or disruption of any nature to the adjacent owners or tenants. Indemnify the Principal against any claims arising from this source.

1.1.3 Protection

Take all appropriate precautions to protect all third party property, services, etc., and indemnify the Principal against any claims arising from the construction operations. Any damage to third party property caused by construction activities or failure to protect shall be rectified as soon as possible by the person causing the damage, or by appropriately qualified trades-persons employed by the person responsible for the damage if necessary.
Suspend operations during weather which would affect the quality of work in progress. Secure the works as soon as possible against adverse weather, dust and vandals. Avoid structural damage that is caused by overloading.
Adequately protect all finished work and maintain until the date of Practical Completion. Each trade shall protect the work of all other trades, and each trade is responsible for making good any damage they cause to finished works. Arrange special protection as required for windows and doors, finished timber work, plumbing fittings and hardware, cabinets and other joinery, and similar items.

1.1.4 Responsibility

The Contractor will be held responsible for the full period of their legal responsibility in connection with this Contract for ensuring that all work execution, materials, and fittings, are completely in accordance with Contract requirements.
The Contractor is responsible to the Principal for the appropriateness and fitness, in relation to a reasonable expectation or requirement, of all of the materials and workmanship incorporated into the works by themselves or their subcontractors; for this reason few specific guarantees are required in these contract documents. The terms and conditions of any warranty or guarantee required or provided shall not in any way negate the minimum remedies available under common law as if no warranty or guarantee had been furnished.
No apparent expression of the Architect's/Designer's reasonable satisfaction shall be deemed to be acceptance of defective materials or workmanship within the terms of the Contract or to be an authority for any Variation except where such Variation is authorised as provided for in the Contract.
Instructions that are given verbally are deemed to be instructions for proper execution of the works and do not involve extra charges.

Workmanship in all trades is required to be equal to or better than recognised good trade practice. The Contractor shall provide all necessary setting out information and component dimensions for subcontractors and shall check and be responsible for the accuracy of their work.

Should any tradesperson consider that the surface finish or general conditions of previous work are unsatisfactory to ensure a proper finish for their own work thereon, that tradesperson shall give immediate notice to the Contractor or Architect/Designer as appropriate and shall not proceed until all necessary improvements have been made. Failing such notice the trade concerned will not be relieved of responsibility for a poor finish due to such unsatisfactory condition.
Specialist Finishes Subcontractors are responsible for ensuring that substrates are completely appropriate for them to achieve first class results, and to this end shall, in sufficient time, instruct the Contractor with regard any fixings, primings, sealings or whatever for the substrate that vary in any way from the substrate manufacturer's standard recommendations. The Contractor shall advise the Architect/Designer with regard these variances, and not proceed until the Architect/Designer has agreed to them.

The Contractor and all Subcontractors affected shall be jointly and severally responsible for completion of the whole of the works in a completely watertight condition and shall therefore examine all details to be satisfied that this condition can be achieved. If any detail is considered unsatisfactory the Architect/Designer shall be notified immediately and he/she will then either interpret the detail to the Contractor's satisfaction, or accept responsibility for watertightness at the points in question, always assuming reasonable workmanship.

Ensure that all materials or items incorporated into any particular construction or finish are compatible and that their individual use is approved by the manufacturers and/or suppliers of the other parts of the system.
For all electronic/electrical/mechanical operating systems all work and all necessary materials and items incidental to the primary item specified, that are incorporated into the works, shall be such as to leave a neat, efficient, easily maintained and robust installation, completely in accordance with all of the recommendations of the primary items' manufacturers. Where appropriate, source all parts of a system from a single supplier or manufacturer.

The Contractor shall make provision for all temporary works and services required for the satisfactory completion of the contract works. The Contractor shall pay all associated costs and fees; carry out all necessary maintenance, alterations and servicing requirements; and remove temporary works and services on completion of the contract works. Temporary works and services shall comply with the requirements New Zealand Building Code.

1.1.5 Specification

This Specification covers contract administration, standards, materials quality, workmanship and the scope of works only: the exact nature of the works and all specialist items, descriptions, etc., are contained on the drawings, which also take full precedence.
All clauses in all specification sections apply to their full extent and meaning to the entire Contract. Trade sections and paragraphs have been introduced into this specification for reference only and it shall not be construed that each trade section is a complete segregation of the materials and labour of that trade. The onus is on all trades to be conversant with any and all clauses which in any way affect their work.
(Be aware that the ‘scope’ noted in the ‘Project Overview’, and scope and general extent clauses within

this specification, are included to provide a general indication only and must NOT be interpreted as schedules of quantities - the exact nature and extent of all aspects of the works are shown on the drawings).

1.1.6 Standards

New Zealand Standards (NZS), Australian Standards (AS), Joint Standards (AS/NZS), British Standards (BS), Acts of Parliament, Regulations made thereunder, Codes of Practice, and any specific Manufacturer's Instructions or Manufacturer's Recommendations that are referred to in these Contract Documents shall all be deemed to be the latest published edition thereof at the time of drawings issue, and shall be followed by the Contractor and all Subcontractors to the full extent applicable consistent with the intent of this Contract. Documents cited within other cited publications are deemed to form part of this specification.
Where Standards have a number of Divisions, e.g. AS/NZS 3500.1, AS/NZS 3500.2, etc., each of the Divisions relevant to this project is deemed to form part of this specification.
Retain current copies of significant cited documents and manufacturer's technical literature on the site.

1.1.7 Authorities and Charges

Comply with all relevant provisions of the NZ Building Code, and with all relevant territorial or statutory authority regulations, by-laws, obligations, etc. Give all required notices.

The Principal has obtained a Land Use Consent. The Principal has applied for and paid for the Project Information Memoranda, the Building Consent and other approvals required for the works to start. The PIM and Building Consent will be forwarded to the Contractor as quickly as possible after they are issued by the Territorial Authority. Note: It is an offence under the Building Act to carry out work not in accordance with a Building Consent.
Should the Building Consent be subject to any conditions which modify the requirements of the Contract Documents in any way, the Architect/Designer reserves the right to negotiate any or all of these modifying conditions with the Building Consent Authority. If after these negotiations additional work is required, it will be handled as a Variation to the Contract.

1.1.8 Code Compliance Certificate

The Principal will apply for the Code Compliance Certificate (CCC) and any other licenses or approvals for the building to be used. However, Practical Completion will NOT be certified until the CCC inspection has occurred and any additional works required by the local Building Consent Authority have been completed. To this end it is recommended that the Contractor obtains all required certificates, guarantees, Producer Statements, as-built drawings, etc., required for the CCC application as work proceeds, to facilitate application for the CCC as soon as the works are completed. For their part, the Principal hereby undertakes to apply for the CCC within one day of all required material being in hand. Likewise, the Contractor should have capacity available to attend as quickly as possible to any items identified by the Building Consent Authority as being required prior to the issue of the CCC.

1.1.9 Coordination of the Works

Coordinate the works of all trades to ensure efficient progress of the works. Ensure that all holes, sleeves, penetrations, supports, etc., that are required for services are correctly incorporated as work proceeds. Identify and sufficiently forward-notify the appropriate persons of all deadlines for the supply of fittings, components, information, etc.

1.1.10 Documents Interpretation

Except where they are clearly to the contrary, all dimensions are deemed to be to the bare surface of concrete, masonry, timber framing or other basic construction material. All figured dimensions take precedence over scaled sizes. Where any detail is included in more than one drawing the larger scale detail takes precedence. Where any ambiguity exists refer to the Architect/Designer for interpretation.
The word ‘provide' and the word ‘fix' used separately in the Documents shall be taken to mean ‘provide and fix' unless otherwise stated.
When the term ‘allow' occurs in the Documents, except with reference to Monetary Allowances, the cost of the item shall be at the risk of the Contractor.
The terms ‘approved', ‘directed', and ‘selected' when used in the Documents refers to the approval, direction or selection of or by the Architect/Designer. Please give adequate notice of when these decisions are required. ‘Architect/Designer' shall mean the Architect or Designer, their representative or any Consulting Engineer engaged by the Architect/Designer.

1.1.11 Site Safety

Comply with the Health and Safety at Work Act 2015 (HSWA), and with all relevant Health and Safety at Work Regulations 2016, and with all relevant WorkSafe New Zealand (WorkSafe) Approved Codes of Practice and WorkSafe Information and Guidance, particularly those for construction and building maintenance. Comply with the relevant provisions of the New Zealand Building Code, in particular Clause F5.

So far as is reasonably practicable and according to a PCBU's (person conducting a business or undertaking) primary duty of care, take all necessary steps required to make the site and the contract works safe, and to provide and maintain a safe working environment. Ensure that all those working on or visiting the site are aware of the site safety rules and are not unnecessarily exposed to hazards.

Each PCBU, so far as is reasonably practicable, must ensure the health and safety of workers, and that other people are not put at risk by its work. If more than one PCBU has a duty in relation to the same matter, each PCBU with the duty must, so far as is reasonably practicable, consult, co-operate with, and co-ordinate activities with all other PCBUs who have a duty in relation to the same matter. PCBUs can enter reasonable agreements with other PCBUs to meet their duties, but cannot contract out of their duties.

Notify WorkSafe as soon as possible when a notifiable event occurs. Take all reasonable steps to preserve the site of the notifiable event in accordance with WorkSafe requirements. Ensure that the site of the event is not disturbed until authorised otherwise by WorkSafe. Keep records of all notifiable events.

Scaffolding shall comply with all Statutory and Local Authority Regulations, with the WorkSafe 'Best Practice Guidelines for Scaffolding', AS/NZS 1576 (Scaffolding equipment), AS/NZS 4576 (Guidelines for Scaffolding), and AS/NZS 4994 (Roof edge scaffolding), and shall be maintained for the duration and removed on completion.

The use of ballistic fixings must absolutely comply with all relevant safety recommendations at all times. No rubbish fires are allowed on site. Portable/personal disc/tape players, radios and iPods must not be used anywhere on the site. No smoking on site, except in the designated location in accordance with the Smoke Free Environments Act 1990, the location of which will be determined by the Contractor, with the approval of the Principal.

Before commencing work on the site, the Contractor shall prepare and submit to the contract administrator a health and safety plan. The health and safety plan shall include, but not be limited to:
- the health and safety of all people on the site and on other properties, and the general public;
- identification of existing and potential construction hazards and risks;
- safety procedures to eliminate, isolate or minimise construction hazards;
- the equipment to be used to minimise the hazards;
- the maintenance of a register of hazards for the site;
- the name and qualifications of the site safety person;
- emergency procedures;
- first aid facilities and safety equipment;
- the methodology for notifying, recording and investigating accidents and injuries.

Carry out all construction operations in accordance with the submitted health and safety plan.

1.1.12 Cleaning and Completion

Clear construction debris and rubbish from the works at regular intervals, and additionally if so instructed by the Architect/Designer. Clean each space thoroughly before commencing any finishing works.

In preparation for the Practical Completion inspection carry out the following:
- Clean the works thoroughly, removing all debris, surplus materials, splashes, marks, temporary markings, etc. (All cleaning methods and materials shall be as recommended by the manufacturer of the item being cleaned).
- Remove protective wrappings and coverings unless otherwise directed.
- Touch up minor painting faults, carefully matching colour, and brushing out edges. Repaint any badly marked surfaces back to suitable break-lines.
- Adjust, ease and/or lubricate as required all doors, drawers, controls and other moving parts to ensure their efficient operation.
- Any other works required to leave all spaces ready for immediate occupation and all electronic/electrical/mechanical systems fully operational.
- Clean out all spoutings, gutters, downpipes, and gullies and flush out all drains.
- Clean all sanitary appliances and check all aspects of the water services.
- Thoroughly re-inspect all aspects of the works (and have any defects fully rectified) to be certain that the works are completely ready for the Practical Completion inspection - if an unreasonable number of items are noted by the Architect/Designer during the inspection it will be terminated and then rescheduled for at least a week forward to allow proper completion to be achieved.

(Note that a Code Compliance Certificate must be obtained before Practical Completion will be certified. Obtain all required certificates, guarantees, as-built drawings, etc., as work proceeds to enable the CCC application to be submitted as soon as construction is completed).

2 SITEWORKS

2.1 Preliminary

Refer to General Conditions of Contract and the Special Conditions in this Specification as appropriate. Read this section in conjunction with all other trade sections.

2.2 Compliance

Comply with the New Zealand Building Code 1992 including all revisions and amendments, Verification Methods where appropriate, and construction principles that are embodied in the Acceptable Solutions.

2.3 Site & Scope

2.3.1 Site

Take great care to excavate exactly for the wall foundations to avoid any damage to adjacent property.

2.4 Excavation & Siteworks

2.4.1 Excavation

Excavation work shall be carried out in accordance with the WorkSafe NZ Excavation Code of Practice. Co-ordinate with other trades as to set-out and timing to ensure that all cut faces are covered or finished etc. as soon as possible after the excavation is complete.

Plan the excavation carefully to ensure that stockpiles will not interfere with concrete construction, to stockpile just sufficient material for the filling, backfilling and reshaping required later, and to avoid overlaying areas outside the works area with material.

As the bulk scope of excavations works will have been carried out prior to commencing work on site, advise and co-ordinate with the separate contractor to ensure that the main building platform is consistent with what is expected. If any concerns are raised please immediately advise the Architect for direction.

Cease machine excavation above final levels and trim to the finish profiles by hand where appropriate. Any over excavation in critical foundation, etc. areas made up with 10MPa concrete unless otherwise approved. Trim slab benches exactly to the required level to allow for hardfill and blinding.

Noisy excavation equipment shall be used only during hours which will avoid undue nuisance to the occupants of adjacent properties.

Excavate accurately in position and true to line and minimum sizes and to levels and grades required for all slabs, footings and foundations, and over the rest of the areas shown for levels adjustment.

Excavations down to firm undisturbed ground, and footings and foundations 200mm minimum into solid, except where shown otherwise.

Below slabs on ground the general intent is to excavate to a stable undisturbed subgrade (of 300 kPa ultimate bearing capacity).

Batter all excavation cuts at a stable slope.

From the excavated material select the most appropriate material for compacted filling and stockpile it in appropriate positions sufficient for filling and backfilling (but NOT for hardfilling).

Remove all surplus material from the site as soon as it is excavated, taking care to avoid damaging the footpath or streets or spilling material on to them.

Remove individual boulders from the excavated material and stockpile them where noted for future landscaping use by others.

Report for instruction when any unexpected voids, made-up ground or similar are encountered.

Keep excavations free of water - remove foundation trench material which becomes water-softened.

Ensure that rainwater runoff from excavated surfaces does not carry material onto adjacent properties.

2.4.2 Excavation Completion

As soon as excavation and filling is complete and before any concrete is placed or other work proceeded with the foundation material will be inspected by the Engineer, and any necessary changes to foundation widths or details will be directed.

2.4.3 Filling

Filling with salvaged material (of appropriate moisture content) shall be compacted in 150mm layers with mechanical rammers, to 95% relative compaction. All work generally in accordance with the provisions of NZS 4431.

On completion clean up the stockpile areas and the site.

2.4.4 Hardfill & Blinding

Hardfill under slabs on grade shall be a 100mm of granular fill material complying with NZS 3604: 7.5.3.2, compacted to 95% relative compaction.

3 CONCRETE

3.1 Preliminary

Refer to General Conditions of Contract and the Special Conditions in this Specification as appropriate. Read this section in conjunction with all other trade sections.

3.2 Compliance

Comply with the New Zealand Building Code 1992 including all revisions and amendments, Verification Methods where appropriate, and construction principles that are embodied in the Acceptable Solutions.

Comply with all relevant provisions and recommendations of:

1554.3:2014(AS/NZS)	Structural steel welding - Part 3: Welding of reinforcing steel
3101.1&2:2006(NZS)	Concrete Structures Standard
3104:2003(NZS)	Specification for concrete production
3109:1997(NZS)	Concrete construction
3112.1:1986(NZS)	Methods of test for concrete - Tests relating to fresh concrete
3112.2:1986(NZS)	Methods of test for concrete - Tests relating to the determination of strength of concrete
3114:1987(NZS)	Specification for concrete surface finishes
3121:2015(NZS)	Water and aggregate for concrete
3122:2009(NZS)	Specification for Portland and blended cements (General and special purpose)
3125:1991(NZS)	Specification for portland-limestone filler cement
3404.1&2:1997(NZS)	Steel Structures Standard
3604:2011(NZS)	Timber-framed buildings
4672.1:2007(AS/NZS)	Steel prestressing materials - General requirements
4680:2006(AS/NZS)	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles

3.3 Concrete

3.3.1 Scope

Supply and install Concrete systems, as specified herein, to the locations and details shown on the design drawings, complete with all necessary components and accessories required for proper installation and performance. All aspects of this work shall comply with the NZ Building Code, related technical standards and other relevant product manufacturers' recommendations.

For the purposes of this specification, Concrete Systems are referred to as 'Concrete', and installation instructions and drawings, are collectively referred to as the 'technical literature'.

This specification sets out the requirements for the supply, forming, casting and finishing of all concrete and concrete elements, including precast concrete elements if required, and the building in of all cast-in items, required for the satisfactory completion of the works.

- The supply and fixing of reinforcing for concrete is not covered by this specification.
- The supply and placing of blockwork grout is not covered by this specification.
- The supply and placing of below ground tanking systems are not covered by this specification.

Extent of work (including in-situ and Pre-cast concrete works):

The following is a list and/or general description of the extent of the Concrete system works, which are more specifically defined in the contract documents, required for the completion of the contract works:

3.3.2 Requirements

3.3.2.1 Safety:

Comply with the Health and Safety at Work Act 2015 (HSWA), and with all relevant Health and Safety at Work Regulations 2016, and with all relevant WorkSafe New Zealand (WorkSafe) Approved Codes of Practice and WorkSafe Information and Guidance, refer http://www.worksafe.govt.nz

Precast concrete shall be handled in accordance with the WorkSafe requirements, refer http://www.worksafe.govt.nz/search/SearchForm?Search=precast+concrete

Carry out all construction operations in accordance with the Contractor's project-specific Health and Safety Plan.

3.3.2.2 Inspections:

All stages of the concrete construction work shall be reviewed in accordance with the requirements of NZS 3109: Section 1.3, and the conditions of the Building Consent.

All inspections shall be properly documented by the Contractor. Provide all necessary quality control checklists prior to pouring and in sufficient time for pre-pour inspection.

Give notice and provide reasonable opportunity to inspect the section of work prior to pouring. Give at least 1 working day's notice of intent to place concrete in any area.

Any instructions issued shall be carried out before concrete placing commences. Unless approval is given by the Contract Administrator and/or BCA, no concrete shall be placed in that section of work. Any concrete placed without authorisation may require removal from the works at the Contractor's expense.

3.3.2.3 Quality Assurance:

Ensure that the construction of all concrete work complies in all respects with the design drawings and the specifications.

Prepare and submit details of the quality assurance procedures for concrete work for approval. These procedures should encompass all aspects of concrete construction.

The quality assurance procedure shall encompass all aspects of concrete construction including, but not limited to:

- concrete quality

- formwork quality
- construction tolerances
- reinforcing steel placement
- cast-in items
- concrete finishes.

Notify the name of the concrete construction representative to be responsible for the quality control of concrete work. The nominated representative shall complete and sign a written quality control checklist for each on-site concrete pour. A copy of each completed checklist shall be submitted to the Contract Administrator before pouring commences, and in sufficient time for pre-pour inspections to be carried out. The format and detail of the checklist shall be agreed to prior to the commencement of any concrete work.

Supply evidence of concrete production quality standards in advance of construction in accordance with the requirements of NZS 3109. The quality assurance procedures for concrete construction shall comply with AS/NZS ISO 9001.

The Quality Assurance Plan (when required) should set out in detail how the quality control of all aspects for concrete construction shall be achieved. Submit the Quality Assurance Plan for review prior to commencing construction work.

The Quality Assurance Plan shall include, but not be limited to:

- objectives of the plan
- key personnel, their qualifications and responsibilities
- communication paths
- the management of documents, including receiving and recording of amended drawings
- the preparation and approval of any shop drawings, including review and coordination of Architectural, Structural and Building Services drawings
- testing facilities
- checking and recording procedures for elements of work, including subcontractor's work\
- reporting

The procedures of the Quality Assurance Plan shall be maintained by the Contractor. Ensure to follow the procedure set out in the plan at all times, and that all subcontractors and suppliers do.

Before pouring concrete, all aspects of the materials, formwork, and reinforcing shall be checked by the Contract Administrator. The following items, where applicable, shall be checked and signed-off by the person responsible, and records of these shall be kept on site:

- formwork set-out
- construction joints
- damp proof membrane (DPM)
- reinforcing requirements - size, location and cover
- cast-in items

- concrete mix requirements - strength and slump
- surface finish requirements
- proposed curing system
- a record of all Engineer/Designer and Building Consent Authority comments if applicable.

3.3.2.4 Tolerances:

Unless specified otherwise, dimensional tolerances of concrete work shall conform to NZS 3109: Table 5.2 - 'Tolerance for insitu construction', and NZS 3109: Table 5.1 - 'Tolerance for precast components', and to NZS 3114 for off-the-form and unformed surface tolerances.

To ensure that elements such as external cladding, precast items, and lifts will properly fit the building, maintain responsibility for the accurate control of the overall set-out of the concrete structure and concrete elements.

An absolute tolerance on the position of all structural elements of 15mm shall be maintained over the full height of the structure in all directions.

Employ a registered surveyor to reset all gridlines and column positions at every second floor. Column locations, slab edge positions and positions of openings shall be adjusted to ensure that each in within 10mm of the correct position through the height of the building.

Take particular care to ensure that individual members and the building structure as a whole do not twist over the height of the building.

3.3.2.5 Erection & Temporary Works:

Maintain responsibility for all erection, propping and temporary support of the works, and any other works required for the completion of the contract works, including lifting design, rigging analysis, propping and shoring design.

The extent and details of the erection systems, propping, etc., will be dependent on proposed construction methods, transport and handling methods, and construction programme. Where required, engage a Chartered Professional Engineer experienced in this type of work to undertake the design and supervision of erection systems, propping, etc. Provide written confirmation that this has been done to the Contract Administrator.

Any additional reinforcement to suit temporary erection or support methods shall be the responsibility of the Contractor.

3.3.2.6 Materials & Workmanship:

Adhere to the requirements of NZS 3109, except where specified otherwise or instructed by the Contract Administrator.

3.3.3 Co-operation

3.3.3.1 Co-operation:

Co-operate with other trades to ensure that all preliminary and preparatory works are completed to specification and as shown on the drawings.

Coordinate with other trades, as required, the assembly and installation of the concrete to the required layout, details and tolerances.

3.3.4 Formwork

Formwork shall conform to NZS 3109: Section 5, and comply with the provisions of NZS 3114 applicable to the class of surface finish specified.

Formwork and falsework shall have sufficient strength to retain and support the wet concrete being placed to the required profiles and tolerances.

The formwork surface finish shall be of suitable quality necessary to produce the specified concrete finish. Any formwork with a deteriorated or damaged surface that does not meet the requirements of the surface finish shall not be used.

Fair-faced concrete formwork shall be constructed so as to provide straight and true angles and so as to produce cast surfaces within a maximum tolerance of 5mm of the given dimensions, and without visible offsets, bulges, or misalignment of the concrete. Form neat, clean arrised edges, except where chamfers are indicated on the drawings or required to match existing detail - in which case the fillets shall form part of the mould and not be loosely placed.

Plywood formwork shall be constructed from Formply plywood sheets or C-grade faced standard plywood sheets (according to concrete finish), placed in a regular pattern and tightly butted together to avoid grout loss. The joints shall be sealed to prevent grout loss. Plywood formwork shall not be permitted to stain visually exposed concrete. Unless indicated otherwise on the drawings, timber or plywood formwork shall have 20mm fillets at the inside corners of beams, columns and walls.

The formwork face shall be adequately clean and treated with a general purpose concrete form release agent in accordance with the manufacturer's requirements. Diesel oil based products are not permitted. Care shall be taken to ensure that the release agent is kept out of contact with the reinforcement and is compatible with any subsequent paint or finish system applied to the finished concrete.

All ties and spreaders shall be of an approved type and placed so as to leave a regular, neat pattern on the concrete surface when withdrawn and filled. The ends of cast-in ties shall be set at least 40mm from the concrete surface. Wire ties are not permitted for the purpose of restraining, securing or supporting formwork.

Steel formwork shall be used where specified or appropriate, with all joints welded and ground smooth and flush to a uniform surface. All internal corners shall be formed by folding the steel, not butting. Any surface required with a ribbed or grooved surface shall be formed by adhering battens of the appropriate profile to the form bed and/or mould, and treated generally as above.

Erected formwork shall be set and checked for dimensional accuracy and alignment before, during and after concreting, and any damaged formwork replaced. All debris shall be removed from the formwork immediately before concrete is placed.

When not in use, formwork shall be cleaned, oiled and stored flat on an even surface, and protected from exposure to moisture and contamination on all sides.

Formwork shall be removed without shock or vibration and in such a manner as to prevent damage and to permit the concrete to take the imposed stresses gradually. Do not permit bars or other tools to lever against set concrete when removing formwork. Any damage to the concrete occurring during removal shall be repaired by an approved method at the Contractor's expense.

Removal of formwork in multi-storey structures shall conform to NZS 3109: Section 5.4.5.

3.3.5 Finishes

3.3.5.1 NZS 3114:

Unless specified otherwise in this specification or on the drawings, concrete finishes shall comply with the provisions of NZS 3114 applicable to the surface finish class specified.

Concrete surface finishes not specified in this specification or on the drawings shall be in accordance with Table 1 or Table 2 of NZS 3114 according to surface type, location and application/use.

3.3.5.2 Slab Finishes:

Refer to the Schedule of Surface Finishes below for the finishes required unless specified otherwise in the contract documents.

Arrange the pouring to allow adequate time for floating and finishing.

Floating and any subsequent finishing shall be at the correct time to obtain the quality of compaction and finish required. No finishing work shall be carried out on any area where there is free surface water. The application of dry cement or sand to absorb free water is not permitted.

All trowelling ridges shall be removed while soft, or by subsequent light grinding. Slabs not fulfilling the standard of finish required shall be ground smooth or otherwise treated to the satisfaction of the Contract Administrator. Care shall be taken to avoid ridges where a newly poured slab meets existing edges.

3.3.6 Concrete

3.3.6.1 Normal Concrete:

Unless specified otherwise herein, all concrete except for 'no fines' concrete shall be Normal Concrete (N) Grade as defined by NZS 3109, produced in accordance with NZS 3104 from a New Zealand Ready Mixed Concrete Association audited plant, with sufficient cement quantity to ensure satisfactory finish and durability.

Normal Concrete maximum aggregate size shall be 19mm. Calcium chloride shall not be used.

Cement shall comply with:

- NZS 3122: 'Specification for Portland and blended cements (General and special purpose)';
- NZS 3125: 'Specification for portland-limestone filler cement'.

Chemical admixtures use in Normal Concrete shall comply with AS 1478.

'No fines' concrete shall be coarse aggregate/cement/water mix without sand but with selected aggregate where necessary.

The aggregate used, and overall mix design (including the use of additives) of Normal Concrete, shall meet the provisions of Section 2 of CCANZ TR 3 Alkali Silica Reaction. Evidence of this may be required by the Contract Administrator. Use of low alkali cements or aggregates from an alternative source may be required where the aggregate contains deleterious material.

Normal Concrete used in the works shall have the following minimum strengths at 28 days unless noted otherwise on the drawings:

- Blinding concrete: *10 MPa.*
- 'No fines' concrete: no minimum strength.
- Bored piles: *25 MPa*.
- Foundation pads and strip footings: *25 MPa*.
- Floor slab-on-grade: *30 MPa*.
- Superstructure generally: *30 MPa*.
- Precast concrete: *30 MPa*.
- Toppings to proprietary suspended floor systems: *30 MPa*.
- All other structural concrete not specifically mentioned: *25 MPa*.
- Driveways, pavements, landscaping: *20 MPa*.

Supply details of Normal Concrete mix designs for review prior to the ordering of any concrete.

3.3.7 Concreting

3.3.7.1 Handling, Placing & Compaction:

All concreting shall conform to NZS 3109 unless modified in this specification.

Concrete shall be transported, handled, placed and compacted so as to:

- Prevent segregation or loss of materials
- Produce a monolithic mass between planned joints or the extremities of members, or both
- Completely fill the formwork to the intended level, expel entrapped air, and closely surround all reinforcement, tendons, ducts, anchorages and embedments
- Provide the specified finish to the formed surfaces of the member
- Ensure there is no contamination of the concrete
- Ensure that the transporting, handling, placing and compaction of the concrete is complete before setting reactions have passed the point which prevents the concrete from attaining its potential fully cured properties.

Concrete shall not be pumped without the Contract Administrator's approval. Where such approval is given, only a standard 'structural' concrete mix design may be used - the use of a pump mix design will not be accepted.

Vibrators shall be used for the compaction of all concrete, including floor slabs. Immersion vibrators shall be moved to new positions as frequently as necessary to ensure uniform vibration of the whole mass and fully compacted concrete. On no account shall immersion vibrators be allowed to come into contact with the face of formwork. Vibrators shall not be used to transport concrete along the forms.

3.3.7.2 Curing & Protection:

All concrete shall be cured in accordance with NZS 3109:Section 7.8.

The use of concrete curing compounds shall be only as agreed with the Contract Administrator (specifically for each occasion before it is used). Ensure that any agreed concrete curing compound is compatible with subsequent floor coverings or surface treatments, including any sealers, paints, waterproofing membranes, etc.

All concrete elements shall be protected from damage at all times. Any damaged items shall be repaired or remade to the satisfaction of the Contract Administrator.

3.3.7.3 Unfavourable Conditions:

Take all necessary precautions and measures during unfavourable conditions, as required by NZS 3109: Section 7.2, to ensure quality and finish of the concrete is not compromised or reduced in any manner.

3.3.8 DPM

3.3.8.1 Polyethylene DPM - Concrete Slab-on-Ground:

Concrete Slab-on-Ground Damp Proof Membrane. Minimum 0.25mm (250µm) thick, tear resistant, polyethylene film sheet as per NZS 3604 7.5.6.

Installed as a moisture vapour barrier under concrete slabs on-ground (prior to concreting), over a properly prepared sub-base as required by NZS 3604: 7.5, by a Licensed Building Practitioner (LBP), in accordance with the manufacturer's requirements and as shown on the drawings.

All joins shall be lapped minimum 150mm and continuously sealed with a 48mm wide pressure sensitive PVC jointing tape. Tape-seal around DPM-penetrating pipes and sleeves. Take all reasonable measures to protect the DPM from damage during construction. Inspect DPM immediately before pouring concrete, and repair any perforations or damage in accordance with the manufacturer's instructions.

Installed Location:

3.3.9 Penetrations and Detailing

Form all penetrations, rebates, fillets, nibs, upstands, and other detailing as shown on the drawings. Sleeves, conduits, pipes, cores or other penetrations shall not be cast in concrete unless they are indicated on the drawings. If not indicated, they must be approved by the Contract Administrator. All penetrations and concrete detailing shall be accurately positioned and formed at the time of pouring the concrete (without movement or displacement).

Set concrete shall not be cut, hacked or cored unless specific approval is obtained from the Contract Administrator.

3.3.10 Building In

As the work proceeds, build in all anchors, bolts, fixings, and other built-in items as shown on the drawings and as necessary for the satisfactory completion of the works.

Build in all necessary pockets, chases, grooves, pipe and cable sleeves, conduits, fixings, fittings, etc., required by other trades. Liaise with other trades and confirm the requirements and supply of all built-in items related to their work, and shall ensure that such items are supplied and/or positioned.

Unless specified as supplied by another trade or other party, all items specified or indicated on the drawings as built-in shall be supplied by the Contractor.

Where an item is not specified or shown on the drawings as built-in, submit all necessary details for approval before proceeding. Such items shall only be built-in when approved by the Contract Administrator.

Built-in items shall not be repositioned or eliminated from the locations shown on the drawings without prior approval.

Ensure that all built-in items are correctly positioned and that they are not displaced during concreting. Ensure suitable personnel are on call during concreting to correct any displacement that may occur. Advise the Contract Administrator immediately if any built-in item has been positioned incorrectly or left out.

No claim will be recognised for cutting away or drilling concrete work already executed as a result of not conforming to these requirements and making the necessary provisions beforehand.

3.3.11 Foundations

Form concrete foundations to the layout and details shown on the drawings. Concrete foundations shall be cast against formwork on each side unless otherwise approved by the Contract Administrator. Where approval is given to cast against ground, an additional 25mm thickness of concrete will be required on each unformed face to provide additional cover.

Allow to underpin or otherwise support adjacent foundations as necessary to ensure complete stability and no damage to adjacent structures at all times.

Cast in sleeves for all pipes and cables that pass through foundations - coordinate the location of each sleeve with the relevant trade.

Give notice and provide reasonable opportunity to inspect all foundation excavations before placing any tidy concrete or hardfill.

3.3.12 On-Ground Floor Slabs

3.3.12.1 Concrete Floor Slab-on-Grade:

Unless specified or shown otherwise, cast ground-bearing concrete floor slabs on a damp proof membrane (DPM) sheet concrete underlay, laid over maximum 25mm thick layer of compacted sand blinding.

The concrete mix should be designed to ensure durability and shrinkage. The use of low sand percentage, a low water content, superplasticiser and air entrainment is required.

Cement content shall not be less than 300 kg/m³, regardless of the minimum specified concrete strength.

The slab shall be constructed between formed construction joints as shown on the drawings, and in a sequence so that two adjacent sections are not poured one after the other.

Immediately after screeding the slab shall be smoothed using a bull float. Finishing shall be carried out with the use of a power float; initially operated with the blades flat, and finally operated with the blades slightly tilted.

All slabs shall have construction joints or saw-cuts at not more than 5.0m intervals in each direction, unless shown otherwise on the drawings.

Along lines of saw-cuts accurately cut out alternate bars of the floor reinforcement and mark the proposed line of saw-cut from outside the pour area. The time of sawing will vary depending on weather conditions, and shall be such as to prevent uncontrolled cracking of the slab. Sawing of the joints shall commence as early as possible, typically within 12-18 hours, and when the concrete has sufficiently hardened to permit cutting without excessive chipping, spalling and tearing. Saw-cuts shall be to the depth shown on the drawings and shall be made using a self-propelled diamond-tipped floor saw machine.

3.3.12.2 Under-Slab Insulation:

Under-Slab Insulation - refer to separate specification section - Insulation.

Where thermal insulating material is indicated under the concrete slab-on-grade, it shall be accurately positioned so that there is no reduction of any concrete thickness dimension (as indicated on the drawings). Tape-seal sheet joints with a suitable pressure-sensitive tape.

3.3.12.3 Shrinkage-Control Joints - Saw Cutting:

Shrinkage-control joints shall be formed in concrete slab-on-grade floors by saw-cut grooves to the layout and details shown on the drawings.

Saw cutting shall be carried out as soon as possible, after the concrete has set and before shrinkage cracking has occurred - typically within 24 hours of pouring, and without excessive chipping, spalling or tearing of the concrete. Saw cuts shall be straight and true and within 10mm of the true joint alignment.

Unless shown otherwise on the drawings, saw cut grooves shall extend to one quarter of the of the slab thickness, and be between 3-5mm in width. Under no circumstances shall the reinforcement through the joint be cut by saw cutting.

3.3.13 Workmanship

3.3.13.1 Workmanship:

Where required by the NZ Building Act 2004 it is the building contractor's responsibility to ensure that all restricted building work is carried out by a Licensed Building Practitioner.

All work shall be carried out to the latest and best trade practise standards by experienced and competent tradesmen, familiar with the materials specified and installation techniques.

Installation of the concrete shall only be carried out installers, familiar with the specified products and their installation techniques, in accordance with the manufacturer's requirements and 'technical Literature', and with the warranty requirements.

All work shall be such as to leave a neat, efficient, robust and structurally sound installation, to the required standard and free from damage and defects.

Take all reasonable measures during fabrication and installation to protect the concrete components from damage and surface marking.

Make all necessary provisions to protect adjacent finished work and surfaces from damage during installation.

3.3.14 Completion, Repair & Cleaning of Concrete

3.3.14.1 Completion & Proposed Remedial Works:

When the exposed concrete surfaces of the building are complete, they shall be closely inspected for faults in surface finish, damage to corners or edges, dirty marks, splashes or dribbles and visible imperfections of every kind.

Submit any proposed remedial work procedures to the Contract Administrator for approval. If proposed remedial work procedures are not approved, remedial work shall be as specified herein.

3.3.14.2 General Repair & Cleaning:

All defects and imperfections shall be removed and rectified to the satisfaction of the Contract Administrator.

The removal of surface markings shall be carefully carried out with the use of wire brushing, pumice stone, carborundum stone, or washing and scrubbing - such as will remove the marks without scratching, discolouring or otherwise affecting the surrounding or underlying concrete.

Patching or filling of fair faced concrete and making good broken edges and corners shall be done with coloured sands and cement where necessary to match the colour of the surrounding concrete when dry.

Epoxy or similar adhesives shall be used when required.

3.4 Reinforcing Steel

3.4.1 Scope

Supply, bend, tie, place, fix, etc. all reinforcing steel required for concrete work and reinforced blockwork, as indicated on the approved drawings and as required for proper completion of the works, complete with accessories. All aspects of this work shall be carried out to comply with the requirements of the New Zealand Building Code and relevant Standards, and in accordance with the approved project design documentation, and with any relevant product manufacturers' recommendations.

All materials and workmanship shall conform to the requirements of NZS 3109, the New Zealand Building Code, and conditions of the Building Consent.

Reinforcing steel for concrete work shall be placed by the Reinforcing Steeworker.
Reinforcing steel for concrete blockwork shall be placed by the Concrete Blockworker.
Reinforcing steel and stressing strand/wire for precast concrete and prestressed precast concrete shall be placed by the Precast Concrete Manufacturer.

3.4.2 Requirements

3.4.2.1 Safety

Comply with the Health and Safety at Work Act 2015 (HSWA), and with all relevant Health and Safety at Work Regulations 2016, and with all relevant WorkSafe New Zealand (WorkSafe) Approved Codes of Practice and WorkSafe Information and Guidance, including WorkSafe's General Risk and Workplace Management - Part 1 and Workplace and Facilities Requirements guidance.

Carry out all construction operations in accordance with the Contractor's project-specific Health and Safety Plan.

3.4.2.2 Quality Assurance

Ensure that the reinforcement placed complies in all respects with the design drawings and specification. The reinforcing steelworker shall nominate a foreman reinforcing steel placer, or equivalent, for approval by the Contract Administrator before commencement on site. The foreman reinforcing steel placer shall inspect all completed sections of reinforcing steelwork and confirm that the work has been carried out in accordance with the design drawings and specification.

The foreman reinforcing steel placer will be required to sign a pre-pour reinforcing check list prepared by the Contractor prior to concrete being placed for that section of the works. A copy of the completed pre-pour checklist must be given to the Contract Administrator prior to observing the finished section of work.

During pouring, the reinforcing steelworker shall be available to correct any displaced or damaged reinforcing.

3.4.3 Reinforcing Steel

3.4.3.1 Reinforcing Steel

Reinforcing bars shall conform to AS/NZS 4671 Grade 300E or Grade 500E, except that the use of Grade 250N or Grade 500N is permitted where specifically indicated in the drawings and specifications. The use of Grade 500L bars is not permitted.

Grade 500E reinforcement shall be manufactured by Pacific Steel micro-alloy process. Alternative manufacturers of Grade 500E reinforcement will only be approved if written evidence is provided, including test certificates, verifying the product. The use of Grade 500E reinforcement manufactured by a quench and tempered process is not permitted.

All mesh shall be factory made and machine welded and conform to AS/NZS 4671.

Hard-drawn reinforcing mesh shall be Grade E complying with AS/NZS 4671.

Ductile reinforcing mesh shall be Grade E complying with AS/NZS 4671 in accordance with the requirements of NZBC B1/VM1.

Mill certificates must be provided to the Contract Administrator for all reinforcing steel used.

All bundles of reinforcing steel supplied to the job shall be clearly marked with numbers relating to the Bending Schedule and related drawing.

3.4.4 Bending of Bars

3.4.4.1 Bending of Bars

Bars shall be cut and bent in accordance with NZS 3109:Section 3 and to the dimensions and shapes indicated on the drawings.

Bend diameters for main reinforcing bars and of stirrups shall be as given by NZS 3109:Table 3.1.

Stirrups shall be bent to standard shapes as shown in NZS 3109.

Cranks or sets at laps shall have their inclined portions 12 diameters or a minimum of 300mm long unless specifically shown otherwise on the drawings.

Bars with bends or kinks not shown on the drawings shall not be used.

Bent bars shall not be rebent in the reverse direction unless specifically called for on the drawings. Rebending of steel reinforcement must be carried out to the steel manufacturer's requirements and only with approval of the Contract Administrator. Rebending of Grade 500E reinforcing steel is not permitted.

3.4.5 Laps, Cover & Tolerances

3.4.5.1 Laps in Reinforcing

The positions of reinforcing bar laps shall be as shown on the drawings. The positions of reinforcing bar laps other than those detailed must be approved in writing by the Engineer/Designer before cutting and bending commences. All lapping bars shall be tied to each other.

Lap lengths shall generally be as detailed on the drawings, but in any case not less than 400mm. Where laps have not been specifically detailed, laps shall comply with the table below.

Bar Diameter	Grade 300E Deformed	Grade 500E Deformed
10mm	400mm	600mm
12mm	480mm	720mm
16mm	640mm	960mm
20mm	800mm	1200mm
25mm	1000mm	1500mm
32mm	1280mm	1920mm

Lap lengths for plain round bars shall be two times the length given in the table above for the corresponding grade of deformed bar.

Laps to reinforcing mesh shall fully comply with the requirements of NZS 3101 but shall not be less than 225mm at all edges, and in any case give a minimum of 2 overlapping cross wires plus 50mm. Where Ductile 500E mesh is lapped, the lap length between outer cross bars shall be to the manufacturer's requirements.

3.4.5.2 Cover

Minimum cover shall be as specified on the drawings or otherwise as specified in NZS 3109. Covers specified on the drawings shall take precedence over those specified in NZS3109.

The ends of wire ties shall be turned away from the concrete face to maintain cover. Wire ties shall not be tied to formwork.

3.4.5.3 Tolerances

Tolerances for bending and fixing of reinforcing steel and fixing of prestressing tendons, ducts and strands shall comply with NZS 3109.

Unless tighter tolerances are specified the following tolerances shall apply:

Bending tolerances:
- Cranks stirrups and ties where -
  the member depth is less than 200mm: +0mm, -5 mm;
  the member depth is 200mm or more: +0mm, -10mm;
- Other steel: +0mm, -15mm;
- Length of straight bars: +0mm, -15mm;
- Length of straight bars where length fitment is not critical: +20mm.

Tolerances on bar spacing/position:
- Spacing of main bars in beams and columns: ±10mm;
- Distance between layers of main steel except it shall not be less than 25mm: ±5mm;
- Distance between bars along the face of walls or slabs: ±20mm;
- Spacing of stirrups or ties in beams and columns: ±20mm;
- Longitudinal position of splice: ±30mm.

Tolerances on concrete cover relative to the values specified and shown on the drawings are:
- In slabs and walls: +10mm; -0mm;
- In beams and columns: +10mm; -0mm;
- At ends of members: +25mm; -0mm.

3.4.6 Welding of Bars

3.4.6.1 Welding Procedures & Personnel

All welding procedures, consumables and personnel as a minimum shall be prequalified in accordance with AS/NZS 1554.3. If requested, supply a list of nominated welders and their welding certificates prior to any welding being carried out. No welder shall carry out work for which he/she is not certified.

Welding supervisors shall hold Welding Supervisor qualifications from the New Zealand Institute of Welding or an equivalent qualification recognised by HERA NZ Welding Centre. In addition all personnel involved in welding shall only be employed on the types of weld for which they are suitably

qualified and they shall hold current Welding Certificates in accordance with AS/NZS 2980. Should qualification testing be required it shall be the Contractor's responsibility for arranging and payment of such tests.

3.4.6.2 Welding of Bars

Welding of all reinforcing bars shall comply with the requirements AS/NZS 1554.3. No welding of reinforcing bars is permitted unless specifically detailed on the drawings, or where not specifically detailed, without the prior approval of the Contract Administrator. Approval will not be given for welding of reinforcement which does not comply with AS/NZS 4671.

Welding of Grade 500E reinforcement not manufactured by Pacific Steel is prohibited. Welding of Grade 500E reinforcement will require a welding procedure test to be conducted using a portion of the reinforcement to be welded.

The acceptance level for welds shall be in accordance with the requirements of AS/NZS 1554.3. Site welding shall only be undertaken using hydrogen controlled electrodes. Site welding is not permitted in winds exceeding 10m/s, or in rain, and shall only be undertaken with proper protection.

Welds to reinforcing bars shall not be made less than 3 x bar diameter distance from the commencement of bends or to any part of a bar that has been bent and re-straightened.

3.4.7 Placing & Fixing

3.4.7.1 Fixing

Reinforcement shall prior to commencement of concrete placement, be placed, supported and secured against displacement in accordance with the specified tolerances.

Metal supports and tie wires to the reinforcing shall not extend into the concrete cover zone.

Reinforcement shall be supported by appropriate proprietary chairs or spacers, or tied up with wire, such that the durability and strength of the structure is not compromised. The types of distance pieces and spacers to be used shall be such as to firmly hold the steel against displacement. Cementitious spacers shall at least match the quality of the concrete being cast and shall have a minimum compressive strength of 40 MPa.

Fixing of reinforcing steel shall conform to NZS 3109. Bars shall be positioned accurately according to the drawings and securely tied with wire ties to form a rigid cage. Particular attention shall be paid to the correct lapping of all steel and laps shall be checked after fixing.

Take all necessary care when handling and fixing Grade 500E reinforcing bars. Do not use or place any excessively damaged Grade 500E bar, such damaged bars shall be rejected and replaced.

Reinforcing steel shall not be cut or bent on site without the Contract Administrator's specific approval.

All starters shall project the minimum distance prescribed for lap lengths unless detailed otherwise. All starters and other reinforcing protruding from a concrete pour shall be securely braced to prevent any movement during concreting. Starters shall NOT be placed into concrete after it has been poured.

Clean reinforcement prior to concreting to remove any dirt, release agent, slurry and other contaminants likely to affect bonding to concrete. Thoroughly clean all projecting cast-in starter bars before installing subsequent reinforcing steel.

3.4.7.2 Concrete Slab-on Grade Floor

Supply and place mesh to the slab-on-grade or the toppings over precast concrete floor units as detailed. Mesh laps shall fully comply with NZS 3101 but shall not be less than 225mm minimum at all edges, and in any case give a minimum of 2 overlapping cross wires plus 50mm. Sheets shall be cut at 4-sheet overlapping corner junctions so as to limit the overlapping to two of the four sheets.

All mesh is to extend to within 75mm of the perimeter of the building floor edges.

Mesh shall be continuous over pads and foundation beams unless additional compensating lap bars are placed across the top to lap with the mesh reinforcement each side. Unless noted otherwise, all saddle bars and other steel shown over the beams on the drawings are additional to the mesh and cannot be included in the required area of compensating steel.

Place topping tie bars as detailed on the drawings.

4 STRUCTURAL STEELWORK

4.1 Preliminary

Refer to General Conditions of Contract and the Special Conditions in this Specification as appropriate. Read this section in conjunction with all other trade sections.

4.2 Compliance

Comply with the New Zealand Building Code 1992 including all revisions and amendments, Verification Methods where appropriate, and construction principles that are embodied in the Acceptable Solutions.

Comply with all relevant provisions and recommendations of:

1163:2016(AS/NZS)	Cold-formed structural steel hollow sections
1252.1:2016(AS/NZS)	High-strength steel fastener assemblies for structural engineering - Bolts, nuts and washers - Part 1: Technical requirements
1252.2:2016(AS/NZS)	High-strength steel fastener assemblies for structural engineering - Bolts, nuts and washers - Part 2: Verification testing for bolt assemblies
14341:2012(AS/NZS)	Welding consumables – Wire electrodes and weld deposits for gas shielded metal arc welding of non alloy and fine grain steels – Classifications
1554.1:2014 (AS/NZS)	Structural steel welding - Part 1: Welding of steel structures
1554.2:2003(AS/NZS)	Structural steel welding - Stud welding (steel studs to steel)
1554.4:2014(AS/NZS)	Structural steel welding - Part 4: Welding of high strength quenched and tempered steels
1554.5:2014(AS/NZS)	Structural steel welding - Part 5: Welding of steel structures subject to high levels of fatigue loading
1554.6:2012(AS/NZS)	Structural steel welding - Part 6: Welding stainless steels for structural purposes
1554.7:2014(AS/NZS)	Structural steel welding - Part 7: Welding of sheet steel structures
16834:2013(AS/NZS)	Welding consumables - Wire electrodes, wires, rods and deposits for gas shielded arc welding of high strength steels - Classification (ISO 16834:2012, MOD)
1897:1976(AS)	Electroplated coatings on threaded components (metric coarse series)
21952:2012(AS/NZS)	Welding consumables - Wire electrodes, wires, rods and deposits for gas shielded arc welding of creep-resisting steels - Classification
2312.1:2014(AS/NZS)	Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings - Part 1: Paint coatings
2312.2:2014(AS/NZS)	Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings - Part 2: Hot dip galvanizing
3404.1&2:1997(NZS)	Steel Structures Standard
3404:2018(SNZ TS)	Durability requirements for steel structures and components
3678:2016(AS/NZS)	Structural steel - Hot-rolled plates, floorplates and slabs
3679.1:2016(AS/NZS)	Structural steel - Part 1: Hot-rolled bars and sections
3679.2:2016(AS/NZS)	Structural steel - Part 2: Welded I sections
3750(AS/NZS):Parts 1-23	Paints for steel structures

4600:2018(AS|NZS)	Cold-formed steel structures
4680:2006(AS/NZS)	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
4781:1973(NZS)	Code of practice for safety in welding and cutting
5131:2016(AS/NZS)	Structural steelwork - Fabrication and erection

4.3 Structural Steelwork

4.3.1 Scope

Supply, fabricate, install and erect all Structural Steelwork as shown on the drawings and as required for the satisfactory completion of the works, complete with accessories, including all necessary weld plates, cleats, bolts, etc., for building into concrete and concrete blockwork. All aspects of this work shall be carried out to comply with the requirements of the New Zealand Building Code and relevant Standards, and in accordance with the project design documentation, and with any relevant product manufacturers' recommendations.

4.3.2 Requirements

4.3.2.1 Safety

Comply with the Health and Safety at Work Act 2015 (HSWA), and with all relevant Health and Safety at Work Regulations 2016, and with all relevant WorkSafe New Zealand (WorkSafe) Approved Codes of Practice and WorkSafe Information and Guidance, including WorkSafe's General Risk and Workplace Management - Part 1 and Workplace and Facilities Requirements guidance.

Carry out all construction operations in accordance with the Contractor's project-specific Health and Safety Plan.

4.3.2.2 Quality Assurance - Option 1

Construction of all structural steelwork shall comply in all respects with the design drawings and the specifications.

Prepare and submit details of the fabrication and erection quality assurance procedures for approval. These procedures should encompass all aspects of fabrication.

The quality assurance procedures shall encompass all aspects of the structural steel construction including, but not limited to:
- compliance of materials; and
- welding procedures; and
- steel preparation prior to painting; and
- quality of painting/coatings; and
- erection of structural steelwork.

Maintain and adhere to the quality control procedures for the fabrication and erection of structural steelwork at all times, and ensure that work is performed to the required standard in accordance with the contract documents.

Notify the name of the Structural Steelworker's representative responsible for the quality control of all structural steelwork.

4.3.2.3 Shop Drawings

Prior to commencing steelwork fabrication, prepare and submit for review shop drawings of structural steelwork. The drawings shall provide complete details of each assembly in the steelwork together with all information relative to their fabrication, surface treatment and erection. Each component and connection shall show the relevant work points.

Allow 10 working days for the review of shop drawings. The review of shop drawings shall not relieve the Contractor of the responsibility for the accuracy of the shop drawings and for the correctness of the fabrication, setting out and erection of the steelwork. The cost of rectifying any errors shall be at the Contractor's expense.

Shop drawings shall be coordinated between disciplines and incorporate specific requirements shown on the Architectural, Structural and Building Services drawings.

Shop drawings shall include, but not be limited to:
- Design calculations;
- Fully dimensioned plans, elevations and sections of all structural steelwork elements relative to project grid and levels (at a suitable scale);
- Complete details of construction, connections and support systems relative to project grid and levels (at a suitable scale);
- Dimensions of all elements;
- Jointing details and method of fixing between individual elements and adjacent work;
- Provision for thermal movement;
- Provision for seismic movement and movement under wind loads;
- Installation sequence;
- Coordination requirements with other work and trades, including penetrations, fixings, etc.
- A full schedule of materials, finishes, and fasteners.

4.3.2.4 Materials & Workmanship

Adhere to all relevant requirements of NZS 3404, AS/NZS 1554.1 and AS/NZS 1554.2 for the supply of all materials and in workmanship both on and off site. The use of materials complying with any other Standard equivalent to those stated herein shall only be permitted with the prior approval of the Contract Administrator.

4.3.2.5 Welding Qualifications

All welders shall be suitably qualified to AS/NZS 2980, and familiar with the specified materials and welding techniques required in accordance with AS/NZS 1554. No welder shall carry out work for which he/she is not certified/qualified.

On request, provide evidence of welding qualifications, including a list of proposed welders and their welding certificates, prior to any welding being carried out.

4.3.2.6 Inspections

Provide opportunity to inspect the work on site, and give at least 24 hour's notice for the work to be inspected. Should further inspections and tests by a specialist inspector be required due to concerns about the quality of workmanship, then these shall be at the Contractor's expense.

4.3.3 Materials

4.3.3.1 Steel

All mild steel shall comply with the requirements of AS/NZS 3679.1.

Except where specified otherwise on the drawings, hot-rolled steel sections shall be Grade 300 complying with OneSteel 300PLUS specification and AS/NZS 3679.1. OneSteel 300PLUS specification shall take precedence where conflict exists with AS/NZS 3679.1.

Except where specified otherwise on the drawings, cold-formed structural steel hollow sections shall be Grade C350, and shall comply with AS/NZS 1163.

Except where specified otherwise on the drawings, structural steel welded I sections (welded beams and welded columns) shall be Grade 300, and shall comply with AS/NZS 3679.2.

Structural steel hot-rolled plate shall comply with AS/NZS 3678.

All structural steel to be welded shall be suitable for welding in accordance with the specified welding procedures of AS/NZS 1554: Parts 1, 2, 5 and 7.

The surface condition of steel shall be no worse than Rust Grade C in accordance with International Standard ISO 8501-1 or Swedish Standard SIS 05 5900.

Any unidentified steel shall not be used unless approved by the Contract Administrator. When the use of unidentified steel is approved for use, it shall only be used as specified in NZS 3404: Section 2.2.3.

Submit all mill certificates to the Contract Administrator prior to fabrication for all steel to be used.

4.3.3.2 Alternative Sizes

The substitution and use of alternative steel section sizes is not permitted under any circumstance without prior written approval from the Contract Administrator. Any additional cost resulting from the use of alternative sizes shall be at the Contractor's expense.

4.3.3.3 Bolts, Nuts & Washers

Mild steel (black) bolts, nuts and washers shall comply with the requirements of AS 1110, AS 1111 and AS 1112.

High-strength bolts, nuts and washers shall comply with AS/NZS 1252.

Bolts, nuts and washers which form a permanent part of a structure subject to weather exposure shall be hot-dipped galvanised. Hot-dipped galvanised bolts shall be limited to those received from the bolt manufacturer. Where these are not available, the bolts, nuts and washers shall be electro-galvanised, but only in accordance with AS 1897.

Where necessary to ensure even bearing, tapered washers complying with BS 4320 shall be used.

Bolts and bolting procedures to be used shall be as noted on the drawings in abbreviated form, in accordance with the abbreviation list shown on the drawings.

All bolts shall be installed with one washer and one nut unless specified or shown otherwise on the drawings. A washer shall be placed under the rotating component.

Hardened or plate washers shall be used under both the bolt head and nut for any slotted and oversize holes.

Methods of tensioning bolts shall conform to the requirements of AS/NZS 5131.

4.3.3.4 Shear Studs

Steel shear studs shall be proprietary shear connector 'headed' studs appropriate for use in weld through deck applications. Shear stud material shall comply with AS/NZS 1554.2: Section 2.

4.3.3.5 Welding Consumables

Welding electrodes shall comply with the requirements of AS/NZS 1554.1 or AS/NZS 1554.5 as appropriate for the grade of steel being welded.

Welding wire type shall be as recommended by the manufacturer of the steel being joined and for the welding position. Wire showing signs of rust or contaminated with oil shall not be used.

Welding flux used from sealed containers must be dry. The use of unused flux recovered from welds shall only be as approved by the Contract Administrator. The use of reground flux is not permitted.

Material and welding of studs shall comply with AS 1554.2.

4.3.4 Fabrication

4.3.4.1 General

Fabrication of steel structures shall comply with the requirements of AS/NZS 5131.

Verify design dimensions against site measurements prior to fabrication of steelwork. Where new steelwork is being installed on or connecting to an existing structure, check and verify site dimensions and levels prior to fabrication of new steelwork. Refer any discrepancy between the drawings and the site dimensions to the Contract Administrator.

Fabrication tolerances shall be as given in AS/NZS 5131 Appendix F unless specified otherwise on the drawings.

As necessary and required, coordinate with other trades with regard to dimensions and setting-out of built-in items and fixings, etc., for peripheral elements. Supply and install all associated sundry fixings, weld plates, brackets, etc., necessary for the satisfactory completion of the contract works.

All steel members capable of holding water shall be provided with weep holes to prevent accumulation of water during construction or of condensation afterwards.

4.3.4.2 Holing

Comply with AS/NZS 3404.1 requirements for holing, including round and slotted holes, nominal sizes, alignment, finishing, punching and flame cutting of holes. Hand flame-cutting of a bolt hole is not permitted, except only when authorised by the Contract Administrator as a site rectification measure for holes in column base plates.

4.3.4.3 Splices

All members shall be in one length with splices only at positions shown on the drawings. If the Contractor requires additional splices or wishes to relocate a splice from the design position, formally submit such proposals to the Contract Administrator for review. Do not proceed with fabrication until the review has been completed and approval from the Contract Administrator given.

4.3.4.4 Camber

Beams and trusses without a specified camber shall be fabricated so that after erection any camber due to rolling or shop fabrication is upward.

4.3.5 Welding

4.3.5.1 Welding Quality Management System (WQMS)

The structural steelworker shall implement and maintain a Welding Quality Management System (WQMS) for all welding procedures as recommended by NZS 3404.1 and in accordance with AS/NZS ISO 3834 according to the appropriate quality level. A copy of the WQMS shall be submitted to the Contract Administrator for review prior to commencing fabrication.

4.3.5.2 Welding

Weld quality shall be Category Structural Purpose (SP) unless specific reference is made on the drawings for a specific weld to be Category General Purpose (GP).

Welding shall comply with AS/NZS 1554.1 or AS/NZS 1554.5, as appropriate and in conjunction with AS/NZS 5131.

Submit for approval, details of the welding procedures to be used including details of the equipment and consumables before any welding is carried out.

All welding shall be shop-welds unless specified otherwise on the drawings. Shop-welds shall be welding carried out under controlled conditions, in an approved facility, by certified welders under the continuous supervision of certified welding inspectors.

Any field-weld made without prior written approval from the Contract Administrator will be deemed defective and subject to rejection - refer to Requirements clause.

All weld runs shall be as specified and not finish with a concave surface. Welds shall have proper penetration, with all slag deposits removed as work proceeds and the runs are completed. Welds shall be continuous around joints to prevent the ingress of moisture.

Butt welds shall be full penetration unless specified otherwise on the drawings, and shall be ground flush.

Welding of hollow sections shall incorporate internal sections or backing plates as necessary to complete the specified weld.

Open-ended hollow sections shall be capped using 3mm plate and seal welded unless specified otherwise on the drawings.

4.3.5.3 Qualification of Welding Procedures and Personnel

All welding procedures as a minimum shall be in accordance with AS/NZS 1554.1 or AS/NZS 1554.5 as appropriate. Welding of studs shall comply with AS/NZS 1554.2.

Welding supervisors shall hold Welding Supervisor qualifications from the New Zealand Institute of Welding or an equivalent qualification recognised by HERA NZ Welding Centre. In addition all personnel involved in welding shall only be employed on the types of weld for which they are suitably qualified and they shall hold current Welding Certificates in accordance with AS/NZS 2980. Should qualification testing be required it shall be the Contractor's responsibility for arranging and payment of such tests.

4.3.5.4 Welding Testing & Inspection

The minimum extent of inspection of welding shall be as specified below and in accordance with AS/NZS 1554.1, AS/NZS 1554.5, and AS/NZS 5131 Appendix I. All welds shall be subject to inspection and testing. The testing of welds will commence with the first joints to be fabricated. Test inspections shall be carried out by a CBIP Certified Welding Inspector (CWI). The cost of testing shall be borne by the Contractor. Give at least 24 hour's notice of any welding that will be closed in by subsequent work that will prevent its inspection afterwards.

Non-Destructive Testing (NDT) and Non-Destructive Examination (NDE).
Visual Scanning:
- The minimum level of testing shall be 100% visual scanning as defined by AS/NZS 1554: Parts 1 and 5.
- At the completion of the work, the welding supervisor shall complete and submit a written statement verifying that the visual scanning has been carried out and completed.

Visual Examination:
- A visual examination shall be carried out in accordance with AS/NZS 1554.1 to determine whether the required weld quality has been achieved.
- Where the proportion of visual examination required is less than 100%, agree on a programme of testing with the Contract Administrator prior to the commencement of any welding.
- The programme shall involve full testing a specified percentage of welds, in order to pick up and correct the cause of any major defect at the commencement of welding.
- The frequency of testing may be progressively reduced on the basis of continuing compliance with the agreed testing programme and this specification.
- Welds with a Category A weld-failure-consequence shall be subject to a 100% visual examination in accordance with AS/NZS 1554.1.
- A record of all welds examined and tested shall be kept and made available on request.

Extent of Non-Destructive Examination (%)			
Weld Category	**Weld Failure Consequence Category**	**Visual Means**	
		Visual Scanning	**Visual Examination**
GP	C	100%	25% min.
SP	B or C	100%	25% min.
SP	A	100%	100%

Other Means:
- Other means of NDE include ultrasonic or radiographic (UT), magnetic particle (MT), liquid penetrant (LP).
- The extent of other means of non-destructive examination of welds shall be as indicated on the drawings and in accordance with AS/NZS 5131 and AS/NZS 1554.1.
- Agree on a programme of testing by other means with the Contract Administrator prior to the commencement of any welding.
- A record of all welds examined and tested shall be kept and made available on request.

4.3.5.5 Repair of Welding Defects

When a welding defect is disclosed by inspection or other investigation, the weld shall be cut out, remade and re-tested. The repair and re-testing of defective welds shall be carried out in accordance with AS/NZS 1554.1 or AS/NZS 1554.5, as appropriate, and to the satisfaction of the Contract Administrator. The cost of testing and repairs to all welding defects shall be at the Contractor's expense.

The welding inspector shall examine all seams from which defects have been cut out and their approval obtained prior to re-welding. Re-welding shall be carried out in a manner and by practices acceptable to the Contract Administrator, and where practicable, shall be by the same process used in the original welding.

The inspection records and re-testing records of all repaired welding defects shall be kept and made available on request.

4.3.6 Erection

4.3.6.1 Delivery & Handling

All steelwork components shall be suitably stacked clear of the ground, on bearers aligned so as to prevent any twisting, bending or other distortion of the items. Keep steelwork dry and protected from damage, moisture and contamination at all times while stored.

Store fasteners in watertight premises. Handle and store electrodes, electrode wire and flux in accordance with the manufacturer's recommendations.

As necessary, make all provisions to protect steelwork components from distortion during delivery and handling.

Do not use damaged, distorted or defective steelwork components, materials and accessories.

Handle steelwork components in a manner that prevents distortion and damage. Ensure that components maintain their manufactured shape and the integrity of corrosion protection at all times during handling.

Handlers shall be familiar with and comply with safe handling requirements, and shall use appropriate safety gear while handling steelwork.

Steelwork riggers and installers shall conform with all relevant WorkSafe NZ Guidelines and Codes of Practice.

4.3.6.2 Assembly

Erection of steel structures shall comply with the requirements of AS/NZS 5131.

Structural steelwork components shall be assembled free of damage and distortion, and so that any specified camber is maintained.

Erection tolerances shall be as given in AS/NZS 5131, Appendix F unless specified otherwise on the drawings.

Check all seatings for steelwork to ensure that they are at the correct level, truly flat and in a condition to receive the steelwork.

Field errors must not be corrected by gas cutting except with the approval of the Contract Administrator.

Each component of the structure shall be aligned as soon as practicable after it has been erected. Permanent connections shall be made when sufficient structure has been erected and the components temporarily connected and accurately aligned, levelled and plumbed, and to ensure that the structure will not be displaced during the erection or alignment of subsequent stages.

4.3.6.3 Temporary Bracing

Provide sufficient temporary bracing to keep the structure plumb and in true alignment until the structure is permanently braced. Failure to make proper and adequate provision against damage during erection shall be the full responsibility of the Contractor. All temporary bracing and guying shall be capable of resisting all loading, Including wind, liable to occur on the structure during the erection period.

Submit for review the method of erection and assembly of structural steelwork. The review shall not limit the Contractor's responsibility to ensure the safety and accurate alignment of the structure.

Connections for temporary bracing and temporary members shall be made so as not to weaken the permanent structure or reduce its performance.

Bracing shall not be used to force the structural frame into its correct position. Tighten bracing only after the frame has been squared, aligned and plumbed or, if inserted at an earlier time, loosen to permit these operations and tighten on completion.

4.3.6.4 Temporary Support of Existing Structure

Where the steelwork of an existing structure is to be removed or strengthened, provide all the necessary support required to prevent distortion of the existing structure and excessive loads being placed on other parts of the structure.

4.3.6.5 Holding Down Bolts

Unless specified on the drawings, holding down bolts shall be of the size, number and length required to achieve the correct embedment and allow the final fixing to the base plate. To ensure correct placement and alignment, a template for each holding down bolt type and configuration shall used for placement. The bending or displacing of holding down bolts is not permitted.

All holding down bolts, nuts and washers which form a permanent part of a structure subject to weather exposure or contained within exterior wall framing shall be galvanised.

4.3.6.6 Bolting

Comply with AS/NZS 3404.1 requirements for bolting. All bolts and associated nuts and washers shall comply with the material properties specified - refer to Materials clause. All material within the grip of the bolt shall be steel and no compressible material shall be permitted in the grip.

Unless specified otherwise on the drawings, all bolts shall be:
- Strength Grade 8.8, Bolting Category 8.8S, complying with AS/NZS 1252; and installed to a snug-tight condition as specified in NZS 3404.1:Section 4.2.6.2(a).
- At least one clear thread run out shall be clear beneath the nut after tightening the bolts.
- Each bolt and nut shall be assembled with at least one washer.

Bolted connections specified on the drawings with the suffix /TB (bearing-type) or /TF (friction-type) shall be fully tensioned in accordance with NZS 3404.1:Sections 4.2.5 and 4.2.6.
- Bolts used for a fully tensioned bearing-type (/TB) connection shall be Strength Grade 8.8, Bolting Category 8.8/TB, complying with AS/NZS 1252
- Bolts used for a fully tensioned friction-type (/TF) connection shall be Strength Grade 8.8, Bolting Category 8.8/TF, complying with AS/NZS 1252.
- The contact surfaces of fully tensioned connections shall be prepared in accordance with NZS 3404.1:Section 4.2.4.3.

For fully tensioned bolts, the minimum number of clear threads run out beneath the nut after tightening shall be:
- Five threads for a bolt length up to and including 4 diameters;
- Seven threads for a bolt length over 4 diameters but not exceeding 8 diameters;
- Ten threads for a bolt length over 8 diameters.

The tightening pattern of fully tensioned joints shall proceed from the stiffest point, typically the centre, towards the outer free edges of the joint, to ensure that all bolts carry an equal proportion of the load.

The re-tensioning of Strength Grade 8.8 bolts that have been fully tensioned is not permitted without the written approval of the Contract Administrator, and shall only be carried out in accordance with the Contract Administrator's instruction.

4.3.6.7 Proprietary Fasteners

Proprietary fasteners shall be as specified on the drawings and installed strictly in accordance with the manufacturer's requirements.

4.3.7 Corrosion Protection

4.3.7.1 General

Comply with the requirements of NZS 3404.1 and SNZ TS 3404 for corrosion protection. Surface preparation and application and inspection of coating systems shall be in accordance with the requirements of AS/NZS 2312.1 and/or AS/NZS 2312.2 as appropriate.

All welds shall have slag removed, and welds exposed in the finished work shall have spatter removed and be ground to a neat, clean finish.

Steelwork to be sprayed for fire protection or to be cast more than 50mm into concrete shall have all rust and mill scale, etc., removed by power or manual wire brushing and shall be left unprimed.

Surface preparation shall be carried out after the fabrication of components has taken place, and the specified coating shall be applied as soon as possible after preparation in accordance with the manufacturer's specification. Surfaces that will be in contact or near-contact after fabrication or erection should receive the specified surface preparation and treatment prior to assembly. In all cases, the total coating shall be applied in the workshop in accordance with the manufacturer's instructions.

Where site-welds are necessary, protect adjacent surfaces during welding procedures, and prepare and coat site-welds in accordance with the coating manufacturer's instructions and as approved by the Contract Administrator.

4.3.7.2 Thermal Metal Spray Coated Steelwork

Thermal metal spray coated steelwork, as indicated on the drawings, shall be zinc metal sprayed in accordance with the requirements of AS/NZS 2312

The thermal metal spray coating system designation (TSZ-; TSZ-S; TSA-S), coating thickness, and sealer coatings shall be as specified below:

The application of thermal metal spray coatings shall include the following:
- Abrasive blast cleaning to AS 1627.4 Class Sa 2½, and as required by AS/NZS 2312.
- Spray coating is to be applied before any discolouration has occurred, and no later than 4 hours after blasting.
- Steel must be 3°C (min) above dew point and no greater than 150°C.
- The application shall be in accordance with ISO 2063.

Do not apply thermal metal spray coatings under the following conditions:
- If any discolouration of the cleaned surface has occurred;
- When the surface temperature of the substrate to be sprayed is below the dew point.
- When the substrate metal surface temperature to be sprayed, or the operating temperature, is above 230°C for zinc and its alloys.

Remove oil and grease from steelwork with the use of solvents. Clean steelwork by abrasive blasting to remove mill scale, rust, and foreign particulars without producing a polished surface. Remove all burrs and sharp edges to ensure the full coating thickness is achieved.

The thermal metal spray coating prior to sealing shall have a uniform appearance, and defects in the metal spray coating shall be limited to small modules not exceeding 1mm in diameter and shall not exceed 0.5mm in height above the sprayed surface. Four test samples are required to be produced to check for coating thickness, adhesion, evenness and appearance.

A minimum thermal metal spray coating adhesion strength of 10 MPa is required, measured in accordance with ASTM C633 'Test Method for Adhesion or Cohesion Strength of Thermal Spray Coatings'. Any test result that indicates the metal spray coating does not achieve the required adhesion value, then the steelwork component shall be abrasive blasted clean and resprayed to specification.

Unless specified otherwise, all metal spray coated steelwork shall be seal-coated with a pigmented satin or gloss sealer coat as specified. Sealer coatings shall be applied in complete accordance with the manufacturer's specification sheet and technical data sheets.

Thermal metal spray and sealer coatings shall be fully protected at all stages of fabrication, storage and installation/erection. Spot touch-up of damaged areas is not permitted. Repair of damaged areas shall be carried out using methods recommended by the Contractor and approved by the Contract Administrator. Damaged components may be required to be re-prepared and resprayed in full to the required specification.

Zinc metal spray coating system designation (AS/NZS 2312) and thickness (microns):
Sealer coating (manufacturer, brand, gloss level, colour):

5 BLOCKWORK

5.1 Preliminary

Refer to General Conditions of Contract and the Special Conditions in this Specification as appropriate. Read this section in conjunction with all other trade sections.

5.2 Compliance

Comply with the New Zealand Building Code 1992 including all revisions and amendments, Verification Methods where appropriate, and construction principles that are embodied in the Acceptable Solutions.

Comply with all relevant provisions and recommendations of:

3103:1991(NZS)	Specification for sands for mortars and plasters
3104:2003(NZS)	Specification for concrete production
3112.1:1986(NZS)	Methods of test for concrete - Tests relating to fresh concrete
3121:2015(NZS)	Water and aggregate for concrete
4210:2001(NZS)	Masonry construction: Materials and workmanship
4229:2013(NZS)	Concrete masonry buildings not requiring specific engineering design
4230:2004(NZS)	Design of reinforced concrete masonry structures
4455.1:2008(AS/NZS)	Masonry units, pavers, flags and segmental retaining wall units - Masonry units
4455.3:2008(AS/NZS)	Masonry units, pavers, flags and segmental retaining wall units - Segmental retaining wall units
CCANZ CP 01:2011	Code of Practice for Weathertight Concrete and Concrete Masonry Construction
NZBC E2/AS3	Concrete and concrete masonry buildings

5.3 Concrete Blockwork

5.3.1 Scope

Supply and construct all concrete blockwork elements, including laying block, placing reinforcement and grout filling, to the locations and details shown on the approved drawings. All aspects of this work shall be carried out to comply with the requirements of the New Zealand Building Code and relevant Standards, and in accordance with the approved project design documentation, and with any relevant product manufacturers' recommendations.

5.3.2 Requirements

5.3.2.1 Safety

Comply with the Health and Safety at Work Act 2015 (HSWA), and with all relevant Health and Safety at Work Regulations 2016, and with all relevant WorkSafe New Zealand (WorkSafe) Approved Codes of Practice and WorkSafe Information and Guidance, including WorkSafe's General Risk and Workplalce Management - Part 1 and Workplace and Facilities Requirements guidance.

Carry out all construction operations in accordance with the Contractor's project-specific Health and Safety Plan.

5.3.2.2 Workmanship

Where required by the NZ Building Act 2004 it is the building Contractor's responsibility to ensure that all restricted building work is carried out by a Licensed Building Practitioner.

All work shall only be carried out by Licensed Building Practitioners - Bricklaying and Blocklaying. Submit evidence on request of experience, relevant qualifications, LBP Licence - Bricklaying & Blocklaying, New Zealand Masonry Trades Association (NZMTA) Member Registration.

Blockwork materials and workmanship shall comply with the requirements of NZS 4210.

All work shall be by or under the direct supervision of a Registered Structural Mason, registered with NZ Masonry Trades Registration Board, and carried out by competent, experienced tradespersons who are fully conversant with the detailed provisions of NZS 4210.

Tolerances of blockwork construction shall conform to NZS 4210: Table 2.2, except where specified otherwise on the drawings.

5.3.2.3 Observation Types

Blockwork shall be constructed and supervised in accordance with NZS 4230: Table 3.1 in respect to the observation type applied to the blockwork. The observation type(s) of all blockwork elements shall be as specified on the drawings.

Type C Observation:
- Observation Requirement: May be built without construction observation by a design engineer or a nominated representative thereof.
- Admissible Use: Elastic and nominally ductile structures. Face loaded walls designed for limited ductility.
- Maximum Specified Compressive Strength: 4 MPa.

Type B Observation:
- Observation Requirement: Shall be inspected by a design engineer or by a nominated representative thereof, who may be a mason deemed to comply with the competency requirements of NZS 4210. Such inspection shall establish that the design is being interpreted correctly and that the work is being carried out generally as specified.
- Admissible Use: Elastic, nominally ductile, limited ductile or ductile structures.
- Maximum Specified Compressive Strength: 12 MPa.

Type A Observation:
- Observation Requirements: In addition to the inspection required of Type B, Type A observation of masonry shall require construction supervision at all critical stages by a person approved by a design engineer, having appropriate knowledge/experience of correct masonry trade practices and reporting to a design engineer, such as to ensure that the standards of materials and workmanship applying on the job are of a consistently high quality commensurate with the achievement of superior strengths. Masonry shall be constructed using a mason deemed to comply with the competency requirements of NZS 4210.
- Admissible Use: Elastic, nominally ductile, limited ductile or ductile structures.
- Maximum Specified Compressive Strength: ≥12 MPa.

5.3.2.4 Inspections

Blockwork construction shall be inspected in accordance with NZS 4210: Clause 1.4, as appropriate for the specified type of masonry (observation type).

Before grouting of any section of blockwork, give at least 24 hour's notice for the inspection of the blockwork. Any instructions issued shall be carried out before grouting any blockwork.

5.3.2.5 Temporary Bracing

Provide and maintain temporary support to block walls until the walls have been filled, the grout filling has cured, and the walls are adequately built into the final structure. Any damage resulting from failure or neglect to provide adequate support to concrete block walls during construction shall be repaired at the Blocklayer's expense.

5.3.2.6 Co-operation

Co-operate with other trades to ensure that all preliminary and preparatory works are completed to specification and as shown on the drawings.

Coordinate with all trades to accurately position and build in all required starters, anchors, bolts, fixings, sleeves, conduits, chases, electrical and/or plumbing fixtures and fittings, etc. (conduits shall be vertical only unless approved otherwise). Coordinate with all trades to form all necessary holes, openings, etc., with positions and sizes exactly as required.

Remove all rubbish and waste material from the site as the work progresses. On completion of the work, leave the site clear of all associated rubbish, waste and excess material.

5.3.3 Blocks

All concrete blocks shall be of hollow type masonry units from an approved manufacturer, in accordance with AS/NZS 4455. Blocks shall be of an approved standard grey colour, properly cured, square and true to shape and size. Blocks shall be manufactured from standard aggregates to NZS 3121. Lightweight aggregate blocks shall NOT be used.

Suppliers of masonry units shall provide the following information:
- Unconfined compressive strength as determined by AS/NZS 4456: Part 4.
- Work size tolerances as determined by AS/NZS 4456: Part 3.

Excessively damaged or otherwise irregular blocks will NOT be accepted. Where block types are shown on the drawings, the blocks used shall be such as to achieve the joint patterns shown on the drawings and be capable of being placed to suit reinforcing steelwork already in place.

Blocks shall be cut as necessary, to fit dimensions or to suit reinforcing. Cutting shall be done by means of a special hydraulic block cutting machine or carborundum saw, and exposed edges shall be clean, square and even.

5.3.4 Mortar

Mortar shall conform with the requirements of NZS 4210: Section 2.2.

The minimum 28 day compressive strength of mortar shall be 12.5 MPa. Allow to test mortar in accordance with Appendix 2.A of NZS 4210. A test sample of at least three cylindrical specimens shall be taken for every 200m² of wall, and the test results submitted for review.

Sand for mortar shall comply with NZS 3103, and water for mortar shall comply with NZS 3121. Sands used for mortar exposed to the weather shall not have a chloride content in excess of 0.04 % by mass.

Chemical admixtures shall comply with NZS 3113 or AS 1478, and used in accordance with the manufacturer's requirements. Calcium chloride based accelerators shall not be used in any mortar exposed to weather.

5.3.5 Grout

Grout shall be coarse grout in accordance with NZS 4210: Section 2.3. Grout shall be mixed at an approved ready mix plant in accordance with NZS 3104. Site mixing will only be permitted with the express and prior approval of the Contract Administrator.

The minimum 28 day compressive strength of the grout shall be 17.5 MPa for all durability zones except Seaspray (B2), where the minimum compressive strength shall be 25 MPa. Allow to test grout in accordance with Appendix 2.A of NZS 4210. A test sample of at least three cylindrical specimens shall be taken for every 200m² of wall filled, and the test results submitted for review.

5.3.6 Reinforcement

Refer to separate section Reinforcing Steel for specification of reinforcement.

Reinforcing steel for blockwork shall comply with the requirements of NZS 4210, be bent and installed as detailed on the drawings, and fixed by the Blocklayer.

Vertical reinforcing shall be positioned in advance of laying, and horizontal reinforcing positioned when the appropriate block course is laid. Vertical steel, including starters shall be central, unless noted otherwise on the drawings. Vertical reinforcement shall be fixed to starter bars before block laying commences.

Ensure correct location of reinforcing starter bars according to the required block layout. Starter bars cast out of position shall NOT be bent over into the correct position. In the event of starter bars being out of position, the Contract Administrator shall be notified and instruct any remedial work required.

Lap lengths shall be a minimum of 450mm long and not less than that specified below, unless specified otherwise on the drawings:
- Grade300E reinforcing: 40 bar diameters;
- Grade500E reinforcing: 70 bar diameters.

Lapping bars shall be tied to each other. The position of laps other than those detailed shall be as approved by the Contract Administrator before placing reinforcing steel.

5.3.7 Block Laying

5.3.7.1 Block Laying

Block laying shall comply with NZS 4210, Section 2.7. Except where shown otherwise on the drawings, all blocks shall be laid running bond (stretcher bond) pattern.

The base shall be scored, scabbled or otherwise mechanically roughened to a minimum amplitude of 1.5mm prior to laying of blocks. It shall be clean and free from all laitance, loose mortar or any other material which would prevent the mortar bonding to it.

Unless otherwise indicated on the drawings, all blockwork shall be laid in running (stretcher) bond throughout and all panels shall be carefully set out so as to avoid use of cut blocks wherever possible.

No blocks shall be laid during inclement weather. No blocks shall be laid on a partially built wall which has been exposed to rain until the wall has dried out. Alternatively, provide adequate cover to the top of block walls under construction during inclement weather.

To facilitate cleaning out of mortar droppings and other debris, the first course of each lift shall be laid using inverted knock-in bond beam blocks. Sand shall NOT be sprinkled at the bottom of the grout space.

Build blockwork to vertical reinforcing with open-end type blocks and end closers. Provide bond beam and open ended bond beam type blocks and end closures for horizontal reinforcement. Where blockwork is not course-bonded at wall junctions, cut blocks at all levels to allow horizontal reinforcing and grout to pass through. Blockwork shall be constructed so that filling grout is fully contained within the grout spaces and does not leak from these.

All newly laid concrete blockwork shall be protected from drying winds and from sunshine. The top surface of the grout shall be protected from premature drying for a minimum of 24 hours by covering with moist hessian or by other approved means.

5.3.7.2 Building In

The Blocklayer shall coordinate as necessary with other trades and make all necessary provisions for built-in items.

Refer to and coordinate with the Architectural Drawings to ensure all blocks around openings, etc., are correctly laid with sills, reveals and rebates as necessary.

As work proceeds, allow to drill and cut out neat rectangular holes in the concrete blocks for flush boxes for cable services outlets, switches and controls, etc., as shown on the Architectural and/or Building Services drawings. Holes shall be accurately positioned and carefully cut to exact sizes.

As the work proceeds, build into blockwork all necessary bolts, steelwork and metalwork items and other fittings and fixings as shown on the drawings or otherwise required for the work.

5.3.7.3 Cleaning Out

All walls shall have clean-out ports at the bottom with inverted open ended blocks for the length of the wall. Clean-out ports shall be spaced to match all wall starter locations and at no greater than 800mm centres.

Cleaning out of grout spaces shall include the removal of any mortar from ties and reinforcing bars, the removal of any mortar protruding into cells or cavities at joints, and the removal of all mortar droppings and other loose material.

Clean-out openings shall be left open for the inspection of tied laps in the reinforcement.

Clean-out openings shall be closed after inspection and prior to grouting by boxing with timber on concealed surfaces and by mortaring-in face shells at visible surfaces. Clean-out boxing shall be braced, and supports shall be provided to closure units at ends of walls and at openings as required to resist grout pressure.

5.3.7.4 Pointing & Finishing

As the work proceeds, blockwork joints shall be neatly and expertly pointed with joints of mortar as specified on the drawings in accordance with NZS 4210: Section 2.7.7.

Concave tooled to a depth not exceeding 6 mm and burnished after the initial stiffening has occurred.

Raked out pointed and tooled to a depth not exceeding 6 mm after the initial stiffening has occurred

Blockwork to be covered or plastered in the finished work shall have joints compacted by tooling and left flush with the block surface. Add additional mortar before tooling to ensure joints are completely full.

On completion of walls, clean down and remove all mortar projections and irregularities. Patch and make good around all pipes, conduits, etc., penetrating the blockwalls. Make good any defects in the pointing.

5.3.8 Grout Filling

5.3.8.1 General

Grouting shall not commence until the mortar joints have attained sufficient strength to resist blow-outs and grout spaces have been cleaned out. The height of individual lifts in any pour should be limited so as to prevent blow-outs.

All block cells shall be filled, unless specified otherwise on the drawings. Cells that are not to be filled shall be covered to prevent the entry of grout, provided that this shall be done in such a manner that the mortar bond between courses is not impaired.

Grout in each lift shall be thoroughly compacted in order to fill all voids and ensure bond between grout and masonry or construction joints.

Ensure all face shells, supports, forms, etc., are adequate to prevent bursting of the wall during filling. Do not pour grout until spaces to be filled have been checked for debris and restrictions.

During grout filling around reinforcement ensure that the position of reinforcing is correctly maintained. Prevent any movement of projecting reinforcement while the grout is setting.

6 C A R P E N T R Y

6.1 Preliminary

Refer to General Conditions of Contract and the Special Conditions in this Specification as appropriate. Read this section in conjunction with all other trade sections.

6.2 Compliance

Comply with the New Zealand Building Code 1992 including all revisions and amendments, Verification Methods where appropriate, and construction principles that are embodied in the Acceptable Solutions.

Comply with all relevant provisions and recommendations of:

1170.2:2011(AS/NZS)	Structural design actions - Wind actions
1604.3:2012(AS/NZS)	Specification for preservative treatment - Part 3: Plywood
2269.0:2012(AS/NZS)	Plywood - Structural - Part 0: Specifications
2295:2006(NZS)	Pliable, permeable building underlays
2588:2018(AS|NZS)	Gypsum plasterboard
2589:2017(AS/NZS)	Gypsum linings - Application and finishing
2904:1995(AS/NZS)	Damp-proof courses and flashings
2908.2:2000(AS/NZS)	Cellulose-cement products - Flat sheets
3601:1973(NZS)	Metric dimensions for timber
3602:2003(NZS)	Timber and wood-based products for use in building
3603:1993(NZS)	Timber Structures Standard
3604:2011(NZS)	Timber-framed buildings
3617:1979(NZS)	Specification for profiles of weatherboards, fascia boards, and flooring
3622:2004(NZS)	Verification of timber properties
3631:1988(NZS)	New Zealand timber grading rules
3640:2003(NZS)	Chemical preservation of round and sawn timber
4200.1:2017(AS|NZS)	Pliable building membranes and underlays - Part 1: Materials
4389:2015(AS/NZS)	Roof safety mesh
4534:2006(AS/NZS)	Zinc and zinc/aluminium-alloy coatings on steel wire
AS/NZS 1080.1:2012	Timber - Methods of test - Method 1: Moisture content
NZBC B2/AS1	Durability
NZMRM Code of Practice	NZ Metal Roof and Wall Cladding Code of Practice - Version 2.2

6.3 General

This section includes the receiving, stacking and storage of all Carpenter's materials and the fabrication, erection and fixing of all framing, sheathings and finishing timbers, including all work incidental to neatly finishing in other trades and all temporary work and temporary bracing.

The Carpenter shall attend upon all trades, and shall supply and fix all obviously necessary but not specifically mentioned fixings and materials.

6.4 Plasterboard Sheet Linings

6.4.1 Scope

Supply, install and finish the selected Plasterboard Sheets as interior linings to the walls, ceilings, and other elements identified on the drawings, to the specified finish level, complete with accessories. All aspects of this work shall be in complete accordance with the Plasterboard Manufacturer's technical literature and installation guidelines, other relevant product manufacturers' recommendations, and as shown on the drawings.

6.4.2 Performance

To the areas noted as 'Bracing' on the drawings; additionally comply with all relevant aspects of the Plasterboard Manufacturer's installation requirements to the specified bracing unit rating, complete with all system accessories, and other relevant product manufacturers' recommendations.

6.4.3 Fixings

Fix sheets with adhesive and bugle-head drywall screws in accordance with the Plasterboard Manufacturer's requirements.

Plasterboard adhesive. Use to adhere the sheets and accessories to the framing in accordance with the Plasterboard manufacturer's requirements.

6.4.4 Plasterboard Finish Level

Level 3 Finish, in accordance with AS/NZS 2589. As a plasterboard finish in areas that do not require decoration (hidden and visually non-critical surfaces).
All joints and interior angles shall have paper jointing tape embedded in jointing compound and at least one coat of jointing compound applied over all joints and fastener heads.
Jointing and finishing compounds shall be applied and finished smooth in accordance with the manufacturer's requirements.

6.4.5 Jointing Tape

Plasterboard sheet joints shall be reinforced with a suitable paper jointing tape compatible with the jointing and finishing compounds.

6.4.6 Co-operation

Co-operate with other trades to ensure that all preliminary and preparatory works are completed to specification and as shown on the drawings.
Co-ordinate with other trades to ensure that appropriate clearances are allowed from adjacent internal linings, fixtures, products, and associated services, etc, that the sheets correctly allow for door and window installation, and that services penetrations are correctly handled to maintain sheet integrity.
Co-operate with the Decorator to ensure that the specified plasterboard finish level has been achieved before decoration commences.

6.4.7 Workmanship

Plasterboard installation and finishing work shall be carried out by experienced tradesmen familiar with the techniques and materials specified and in accordance with the manufacturer's installation requirements.
Plasterboard linings shall be finished to the specified finish level in accordance with AS/NZS 2589.
Make all necessary arrangements for the quality assessment of plasterboard finishes prior to commencing decorating.
Protect surrounding surfaces from jointing compound splashes and sanding dust.

6.4.8 Delivery & Handling

Store plasterboard sheets undercover inside a watertight building and keep sheets dry at all times. Stack sheets flat on a dry level surface in accordance with the manufacturer's recommendations. Avoid damage to sheet edges, ends, and surfaces. Carry all sheets on edge. Do not use damaged or faulty sheets.
Handle and store plasterboard finishing materials and accessories in accordance with the manufacturer's requirements. Keep products dry and protect from damage. Do not use damaged or faulty products or products beyond their expiry date.

6.4.9 Preparation

Check that any timber framing elements are in accordance with NZS 3604, or in accordance with NZS 3603 and AS/NZS 1170 for specific design, and in accordance with the Plasterboard Manufacturer's requirements.
Check that the building has been completely finished to all penetrations including doors, windows, services, etc. so that the sheets can be installed without being affected by any weather conditions.
Check junctions to all other building elements and ensure that all necessary works have been completed, eg; flooring, set-out of services, etc. that will enable the sheets and accessories to be installed.

Framing shall be plumb and in true alignment, complete and suitable for the sheets, with a maximum moisture content 18% or as recommended by the Plasterboard Manufacturer. Check that the framing is true to line and plane and with no projections due to structural and bracing bracketry etc. Ensure that framing brackets, plates, braces and hold-downs etc. are correctly installed.
Clear building debris and rubbish from framing voids and keep clean until plasterboard sheet linings are installed.

6.4.10 Installation

Install the sheets, complete with all accessories, to the framing in accordance with the Plasterboard Manufacturer's requirements, and as noted and detailed on the drawings.
Install all necessary metal beads and trim to corners and edges and control joints as required and as shown on the drawings.
Apply jointing and finishing compounds to the required build and specified finish level in accordance with the manufacturer's instructions. Reinforce joints with the selected jointing tape. Where required sand top coats smooth and even with fine sandpaper, as recommended by the manufacturer, when completely dry.

6.4.11 Completion

Ensure that the plasterboard sheets have been installed correctly and finished to the specified finish level. Check for damage and replace as necessary. Ensure that assessment of the plasterboard finish level has been carried out and that agreement that the finish level is acceptable for subsequent decorating has been provided.
Clean up thoroughly on completion and remove all waste and rubbish from site.

6.5 Timber Framing

6.5.1 Scope

Supply and install timber framing to the floors, walls, roofs, and other timber framed elements, as identified and detailed on the drawings. All aspects of this work shall be in accordance with NZS 3604, product manufacturers' recommendations, and as shown on the drawings and the specification.

6.5.2 Workmanship

Where required by the NZ Building Act 2004 it is the building contractor's responsibility to ensure that all restricted building work is carried out by a Licensed Building Practitioner.

All work shall be carried out to current best trade practise by experienced and competent tradesmen, familiar with the materials and installation techniques, in accordance with NZS 3604 and as shown on the drawings.

Co-operate with other trades to ensure that all preliminary and preparatory works are completed to specification and as shown on the drawings prior to installing timber framing.
Co-ordinate with other trades to install timber framing as required.

6.5.3 Timber Framing

6.5.3.1 Timber Grade and Quality

Unless otherwise noted or specified on the drawings or specification, all framing timber shall be minimum structural grade SG 8 Radiata pine in accordance with NZS 3622.
Framing timber shall be seasoned or kiln dried, and be straight and true and free from wind, warp and distortion, and in lengths suitable for the members required, and shall have a moisture content of between 12% and 18% before installation.
Do not used damaged, faulty or defective materials.

6.5.3.2 Timber Treatment

All non-durable timber framing shall be appropriately treated against moisture and/or insect decay by treatment plants with recognised quality assurance systems that are administered by the Timber Preservation Council (NZTPC). Treatment of timber and wood-based building products shall be to the requirements of NZS 3602 as an absolute minimum, and all treated timber shall be identified and marked as required.
Carefully manage treated framing during installation to avoid accidental use of timber with a lower performance or durability treatment than that required or specified.

6.5.3.3 Framing Installation

All timber framing members, including all dwanging, strutting, blocking, bracing etc, shall be sized, setout, fitted and fixed to the requirements of NZS 3604 and as shown on the drawings to

accommodate structural loadings, cladding and lining setout and support, and the installation of other building components, fixtures and fittings.

All framing shall be erected without deviation, true to line, level, angle and plumb, and evenly aligned and square, and within the tolerances allowed in NZS 3604 Table 2.1. Framing members accurately cut, lapped, housed, joined, and seated so as to provide full contact over the bearing surfaces.

Temporarily prop, brace, tie, and secure framing members and elements as required until the framing is complete and self supporting. Leave in place for safety purposes as long as required.

Protect timber framing as required during installation against damage and moisture, and against significant variation of moisture content until ready for lining. Avoid ponding of water around floor plates.

6.5.3.4 Concrete Separation

Separate timber framing with an approved continuous damp proof course when in direct contact with concrete or masonry. Ensure that the DPC material is compatible with the timber treatment.
Free draining separations to external vertical faces shall be 12mm minimum and as noted on the drawings.

6.5.3.5 Framing Protection

Protect timber framing as required during installation against damage and moisture, and against significant variation of moisture content until ready for lining. Avoid ponding of water around floor plates.

6.5.3.6 Built-up Framing Members

Except for jack studs, bottom plates and top plates, framing members may be substituted with built-up members in accordance with the limitations of NZS 3604 2.4.4.7 with the prior approval of the Architect/Designer only.

6.5.4 Steel Fixings

6.5.4.1 Fastenings and Connectors

Unless otherwise noted or specified, timber framing fastenings and connectors shall be as specified in the relevant fixing schedules of NZS 3604 or have an equivalent capacity as specified therein. Timber framing connectors and fixings shall comply with the product information as required in NZS 3604 2.4.6, and shall be used and installed in accordance with the manufacturer's recommendations. Pre-drill nail holes in split-prone framing as necessary.

6.5.4.2 Durability of Fixings & Fastenings

Unless otherwise noted or specified, the minimum durability of timber framing fixings and fastenings, excluding nails and screws, shall comply with the durability requirements of NZS 3604 Table 4.1.
Galvanised steel fixing components, excluding nails and screws, shall have galvanised coating masses in accordance with NZS 3604 Table 4.2.
Unless noted or specified otherwise, the materials for nails and screws shall be as given in NZS 3604 Table 4.3.
Steel fixings and fastenings in contact with timber treated with copper based timber preservatives (H3.2 or higher) shall be in accordance with NZS 3604 4.4.4.
Stainless steel nails shall be minimum Grade 304 unless otherwise specified or noted.

6.5.4.3 Bolts and Coachscrews

Unless specified or shown otherwise, all bolted and coach screwed connections shall be M12 or M16 in accordance with the relevant fixing requirements given in NZS 3604.
Bolted and coach screwed connections shall have either a 50mm x 3mm square, or a 55mm x 3mm round, washer to each head and nut for M12 and M16 fixings. Washers shall be of the same material and durability as the bolt or coach screw.

6.5.5 Floor Framing

Unless specified or shown otherwise, timber floor joists shall be to the dimensions and spacings given in NZS 3604 Table 7.1.
Floor joists shall be laid on edge true to line and level, have a minimum support bearing of 32mm (except when cantilevered), and so that any crook will straighten under load.
Floor joists shall be jointed over supports (except when cantilevered beyond the support) in accordance with NZS 3604 7.1.1.7.

6.5.6 Wall Framing

6.5.6.1 Plates

Top and bottom plates shall be to the dimensions and layout shown on the drawings. Unless specified or shown otherwise, top and bottom plates shall be fixed in accordance with NZS 3604 7.5.12 and Tables 8.18 and 8.19, true to line and level or angle.
Joints in top plates shall be made over a stud or over blocking between studs, and all top plate connections shall be in accordance with NZS 3604 8.7.3. Form all holes and edge notches in top and bottom plates in accordance with NZS 3604 8.7.5.

6.5.6.2 Studs

Studs shall be to the dimensions and spacings shown on the drawings, and installed true to line and plumb in both directions between top and bottom plates.
Unless noted otherwise, non-load bearing wall studs shall be to the spacings given in NZS 3604 Table 8.4, stud width as shown on the drawings.
Form all holes and edge notches in studs in accordance with NZS 3604 8.5.1.5. Do not notch, check, cut, or bore holes in the middle third of any trimming stud.
Should the need arise, studs shall be straightened in accordance with NZS 3604 8.5.3 with prior approval from the Architect/Designer only.

Unless noted otherwise, studs in loadbearing walls for 3 kPa floor loads shall be in accordance with NZS 3604 Table 14.10.

6.5.6.3 Lintels

Lintels shall be to the dimensions and locations shown on the drawings, and installed true to line and level, and shall be supported by a 45mm thick doubling stud or jack stud fixed to a trimming stud, and secured against uplift in accordance with NZS 3604 8.6.1.8 as required.
The thickness of a lintel may be made from two or more members, where each member is the length of the lintel, in accordance with NZS 3604 2.4.4.7.

6.5.6.4 Sill & Head Trimmers

Unless specified or shown otherwise, sill and head trimmers to openings shall be the same width as the wall stud and to the thickness given in NZS 3604 Table 8.15, and installed at the required opening

height true to line and level, and supported by a 45mm thick doubling stud or jack stud fixed to a trimming stud.

6.5.6.5 Dwangs

Dwangs shall be the same width and thickness as the wall stud, and installed at the centres noted on the drawings, and accurately cut and fixed in place true to line and level and flush with stud edges. Dwangs fixed in accordance with NZS 3604 Table 8.19.

6.5.7 Posts

Timber posts shall be to the sizes and locations shown on the drawings, and installed true to line and plumb each way, and supported at the base by steel post brackets as detailed.

Base bracket brand name & type:

6.5.8 Roof Framing

6.5.8.1 Rafters

All rafters (including hip, valley and jack rafters) shall be to the dimensions, spacings, pitch, and layout shown on the drawings.
Rafters shall be aligned and paired at the required spacings to ridge boards, ridge beams, hip rafters and valley rafters, and as shown on the drawings, and installed parallel, true to line, pitch and plane, and fixed in accordance with NZS 3604 Table 10.1.
Any required jointing of rafters shall be made over supports shown on the drawings only.
Unless shown otherwise, rafter seating to top plates, beams, and lintels shall have a minimum bearing of 32mm without reducing the rafter depth to less than 65mm, or 80%, at the birds mouth.
Extend rafter ends to form eaves as detailed on the drawings and in accordance with NZS 3604 10.2.1.14.
Fly rafters and outriggers installed to form gable verges as detailed on the drawings and in accordance with NZS 10.2.1.15.3

6.5.8.2 Ridge Beams

Ridge beams shall be to the dimensions and locations shown on the drawings, and installed true to line and level.
Unless specified or shown otherwise, ridge beam ends shall be secured by and fixed to wall framing in accordance with NZS 3604 Table 10.2.

6.5.8.3 Verandah Beams

Verandah beams shall be to the dimensions and locations shown on the drawing and installed true to line and level. Unless shown otherwise, all verandah beam jointing and connections to timber posts shall be in accordance with NZS 3604 Table 9.2.

Tie bracket brand name & type:

6.5.8.4 Valley Boards

Valley boards shall be sized to the dimensions and installed to the supporting framing as detailed on the drawings.

6.5.8.5 Ceiling Joists

Unless specified or shown otherwise, ceiling joists shall be to the dimensions and spacings given in NZS 3604 Table 10.3.
Ceiling joists shall be installed parallel true to line and plane, and shall be joined directly over framing supports and lapped minimum 300mm, or butted and flitched, in accordance with NZS 3604 10.2.1.6.5.
Do not support ceiling joists from a strutting beam.

6.5.8.6 Purlins

Purlins shall be to the dimensions and spacings shown on the drawings and as required by the cladding material, and fixed to rafters and/or trusses in accordance with NZS 3604 Table 10.10 (purlins on their flat) and/or Table 10.11 (purlins on their edge).
Purlins on their flat shall be continuous over a minimum of two spans.
Provide all necessary blocking and lateral support to purlins laid on edge in accordance with NZS 3604 10.2.1.16.6, and as detailed.
Extend purlins to form gable verges as detailed and in accordance with NZS 3604 10.2.1.15.

6.5.8.7 Roof Trusses

Roof trusses shall be Specific Engineering Design (SED) in accordance with NZBC B1/VM1 and manufactured by an accredited fabricator, and shall comply with all aspects of NZS 3604 10.2.2. Roof trusses shall be fabricated to meet the specific design requirements of the roof including, but not limited to; roof layout, pitch, and details, in accordance with the drawings and specification.
Roof trusses shall be supported and fixed to the truss fabricator's specifications but shall be no less than that required by NZS 3604 Tables 10.14 and 10.15. Roof trusses shall be braced as shown on the drawings and in accordance with NZS 3604 10.3.

6.5.8.8 Roof Bracing

Roof bracing shall be as shown on the drawings and in accordance with NZS 3604 10.3 and 10.4 as necessary.

6.5.9 Ceiling Framing

Unless specified or shown otherwise, timber ceiling battens shall be to the dimensions and spacings shown on the drawings and in accordance with NZS 3604: Table 13.1, and shall be installed true to line, level and plane, and fixed to the underside of floor joists, rafters, ceiling joists or truss chords in accordance with NZS 3604: Table 13.3.

Ceiling battens shall be of Merchantable grade or better timber complying with NZS 3631.

6.6 James Hardie Eaves & Soffits

6.6.1 Scope

Supply and install the specified James Hardie products as a fibre-cement sheet lining material to the eaves and soffits identified on the drawings, complete with all accessories. All aspects of this work shall be in complete accordance with James Hardie Eaves And Soffits Installation Manual (check www.jameshardie.co.nz, or call 0800 808 868 for the latest edition) and other relevant product manufacturers' recommendations.

6.6.2 Eaves & Soffit Lining

Hardie™ Flex Eaves Lining - 4.5mm. 4.5mm thick fibre-cement sheet lining with an un-sanded surface finish. The sheets are to be finished with a paint system. Installed in accordance with the James Hardie Eaves And Soffits Installation Manual to the locations shown on the drawings.

6.6.3 Co-operation

Co-ordinate with other trades to ensure that the panels correctly allow for fascia and wall cladding installation and associated flashings etc., and that services penetrations are correctly handled to maintain full weathertightness and sheet integrity.

Ensure that other trades are aware of the James Hardie Safe Working Practices.

6.6.4 Preparation

Check that the timber framing elements are in accordance with NZS 3604, or in accordance with NZS 3603 and AS/NZS 1170 for specific design, and in accordance with James Hardie requirements. The fascia and framing shall be in true alignment, complete and suitable for the sheets, and maximum moisture content as per NZS 3602. Ensure that the framing is true in line with no projections due to structural and bracing bracketry etc. Ensure that any hold-downs from the roof framing to the wall framing are correctly installed.

Check that the building underlay or rigid air barrier to the wall framing has been installed in full accordance with the manufacturer's requirements and the drawings. Check junctions to all other building elements and ensure that all necessary works have been completed eg. flashings etc that will enable the sheets and all accessories to be installed.

6.6.5 Flexible Sealant

Flexible silicone sealant to be SIKA Silaflex MS. Use to seal the sheets and accessories in accordance with the sealant manufacturer's recommendations and to James Hardie requirements. Ensure sealant compatibility with selected finish.

6.6.6 Workmanship

All installation work shall be carried out by an LBP, or supervised by an LBP, in accordance with James Hardie Eaves And Soffits Installation Manual and other relevant product manufacturers' recommendations.

6.6.7 Delivery & Handling

Carry all sheets on edge. Stack sheets flat on a level platform off the ground ie. use the supplied delivery pallet on level ground (if no pallet then evenly spaced bearers on level ground at 600mm crs maximum). Keep sheets and accessories dry at all times. Avoid damage to sheet edges, ends, and surfaces. Keep uPVC flashings etc. out of direct sunlight, and store all accessories on flat and avoid damage. All installers to be familiar with and comply with the James Hardie Safe Working Practices in the Installation Manual, to use appropriate safety gear, and in particular to be aware to avoid breathing silica dust. Do not use any damaged or blemished sheets or accessories.

6.6.8 Installation

Install the sheets to the framing in accordance with the Installation Manual, complete with all accessories eg. mouldings, sealant, underflashings, etc.

Ensure that all cut edges of panels are primed prior to installation with Dulux 1 Step Prep, Resene Quick Dry, or similar. Ensure that the bottom edge of the fascia forms a drip edge of 15mm minimum to the sheet. Seal around services penetrations to maintain weathertightness and air pressure resistance.

6.6.9 Fixings

Hardie™ Flex Sheet 4.5mm sheets with galvanised nails in accordance with James Hardie requirements.

6.6.10 Completion

Ensure that the sheets have been fixed correctly, that all joints and accessories have been completed correctly, and that all penetrations have been taped correctly. Check that no damage has occurred to any installed sheet element or associated component, replace as necessary. Ensure that the sheets are painted within 90 days of the sheet installation, complete with all accessories and flashings. Hand over a copy of the latest edition of the James Hardie Hardie™ Flex Eaves Lining Product Warranty to the client. Hand over a copy of the latest James Hardie Eaves And Soffits Installation Manual to the client for their maintenance information.

6.7 Underlay, Foil & DPC

6.7.1 Scope

Supply and install Underlays, Foil and DPC materials, as specified herein, to the locations identified on the drawings, complete with all accessories required for proper installation and performance. All aspects of this work shall be in accordance with the product manufacturer's technical literature and installation requirements, other relevant product manufacturers' recommendations, and as shown on the design drawings.

This specification should be read in conjunction with other relevant specification sections as they are interrelated.

6.7.2 Requirements

6.7.2.1 Safety

Comply with the Health and Safety at Work Act 2015 (HSWA), and with all relevant Health and Safety at Work Regulations 2016, and with all relevant WorkSafe New Zealand (WorkSafe) Approved Codes of Practice and WorkSafe Information and Guidance, particularly those for construction and building maintenance.

6.7.2.2 Inspections

Inspections shall take place at each of the stages as scheduled in the Building Consent. Confirm a written programme to facilitate these inspections, including notification when each stage of the work is ready for inspection.

6.7.2.3 Co-operation

Co-operate with other trades to ensure that all preliminary and preparatory works are completed to specification and as shown on the drawings.

Coordinate with other trades as required to install underlays, foils and DPC.

6.7.2.4 Workmanship

Where required by the NZ Building Act 2004 it is the building contractor's responsibility to ensure that all restricted building work is carried out by a Licensed Building Practitioner.

All installation work shall be carried out by experienced and competent tradespersons, familiar with the specified products and installation techniques, in accordance with the manufacturer's requirements, and to fully comply with all warranty requirements.

All cutting, joining, fixing and sealing techniques shall be exactly as recommended by the manufacturer, and carried out with the use of suitable tools and equipment appropriate for the application. All work shall be such as to leave a neat, efficient, and weathertight installation.

6.7.2.5 Delivery & Handling

Inspect materials for damage and defects upon delivery; reject any damaged or defective products, and immediately contact the supplier for replacement. Do not used damaged or defective products, or products that are beyond their designated shelf life.

Store underlay rolls on end, under cover in a clean, dry environment, in accordance with the manufacturer's recommendations. Keep stored products dry, out of direct sunlight, and protected from damage, moisture and contamination at all times.

Handle products in accordance with the manufacturer's requirements, and in a manner that prevents damage to the product and does not reduce its performance.

Installers shall be familiar with and comply with the manufacturer's safe handling requirements and precautions for use, and shall use appropriate safety gear when handling materials.

Installers shall conform with all relevant WorkSafe NZ Guidelines and Codes of Practice - including the Best practice guidelines for working on roofs and the General risk and workplace management - part 1.

6.7.2.6 Completion

Check underlay, flashing tape, etc., have been installed correctly, and that all edges, joins and ends are correctly finished prior to closing off with wall/roof cladding.

Check for damage and defective work - replace and/or repair as necessary to the required standard in accordance with the manufacturer's requirements.

Leave all of this work complete, free of damage and defects, and to the standard required for the installation of subsequent cladding and/or roofing, and in accordance with all warranty requirements.

Remove all associated rubbish and excess material from the site.

6.7.3 DPM

6.7.3.1 DPM

250 micron thick or greater, tear-resistant, polyethylene (polythene) film used as a damp-proof membrane in accordance with NZS 3604 Section 7.5.6.

6.7.4 DPC

6.7.4.1 Bituminous DPC

Bituminous Damp Proof Course. Heavy-weight kraft paper saturated with and coated with high grade bitumen surfaced with talc or other suitable non-stick material, manufactured to AS/NZS 2904 and tested to AS/NZS 4347.0.

Used for separating timber and wood-based products and metal from concrete, masonry, brick, and stone surfaces; or for concealed flashings in masonry veneer cladding to NZBC E2/AS1; in accordance with the manufacturer's requirements and as shown on the drawings. Do not use bituminous DPC under LOSP treated timber materials.

6.7.5 Wall Underlay

6.7.5.1 Absorbent Synthetic Wall Underlay - Fire Retardant

Absorbent Synthetic Wall Underlay - Fire Retardant. NZS 2295 Type W4 - absorbent, breathable, fire-retardant, synthetic wall underlay, tested to NZS/AS 1530.2.

Installed as a flexible wall underlay in accordance with the manufacturer's requirements and NZBC E2/AS1. The installation of wall underlay must be considered as part of the overlaying cladding system, not in isolation. Do not leave installed underlay exposed to weather and UV light any longer than the maximum period specified by the manufacturer - replace with new underlay if the exposure period has been exceeded.

6.7.6 Roof Underlay

6.7.6.1 Bituminous Kraft Roof Underlay - Heavy Weight

Bituminous Heavy Weight Kraft Roof Underlay. NZS 2295 Type R1 Heavy Grade Kraft. A self-supporting, breathable, absorbent, non-fire retardant, bituminous roof underlay. Installed as a roof underlay in accordance with the manufacturer's requirements, AS/NZS 2295:2006 and NZBC E2/AS1. Roofing underlay must be supported with galvanised wire netting or safety mesh (as specified). The installation of roof underlay must be considered as part of the overlaying cladding system, not in isolation.

6.7.7 Installation - Under-Slab DPM

6.7.7.1 Under-Slab DPM

Install under-slab damp proof membrane (DPM) in accordance with the manufacturer's requirements and as shown on the drawings.

Unless otherwise specified on the design drawings, under-slab DPM shall be laid in a single layer, over sand blinding, with all edges lapped minimum 150mm and sealed with minimum 50mm wide PVC sealing and joining tape, so as to achieve a continuous waterproof barrier over the entire area.

Seal all pipe, duct, and other services penetrations in the DPM using PVC sealing and joining tape.

Protect installed DPM as required during all stages of slab construction, and avoid puncturing or damaging. Tape-repair damaged DPM as soon as it occurs - tape over small punctures; patch large punctures and damaged areas with a DPM overlay section sealed all sides with PVC tape.

Inspect the DPM for damage just prior to concrete pouring and repair as necessary.

6.7.8 Installation - Wall Underlay

6.7.8.1 Wall Underlay

Install wall underlay in accordance with the manufacturer's requirements, to the locations and details shown on the design drawings.

Unless otherwise specified on the design drawings, wall underlay shall be installed printed face out, in horizontal runs over the exterior face of the wall, starting from the bottom edge and finishing at the top edge, extending 35mm or as detailed below the bottom plate or floor structure, and lapped such that any water will be shed to the outside of the underlay, with minimum 150mm side-laps and end-laps, and pulled taught and sufficiently tensioned to prevent sagging or warping. All end-laps shall be made over solid framing.

Fix wall underlay at maximum 300mm centres to framing or substrate using 6-8mm stainless steel staples, or 20mm long large-head galvanised clouts, or proprietary underlay fasteners, or self-drilling wafer head screws.

Carefully cut wall underlay at window and door openings just prior to joinery installation; cut underlay at 45º angle away from each corner and return full framing depth and fasten to inside of frame. Install flexible window flashing tape to window and door openings in accordance with the manufacturer's installation guidelines and to comply with the requirements of NZBC E2/AS1.

For drained cavity wall construction where studs are spaced more than 450mm apart, install 19-25mm wide polythene embossed strap as additional restraint, run horizontally at 300mm vertical spacings, to prevent insulation and underlay billowing into the cavity space.

Install all necessary flexible flashing tapes required to seal the underlay at openings, around pipes, ducts and other services penetrating the underlay, at parapet and balustrade junctions, along head flashings and inter-storey flashings, and as shown on the design drawings.

Make every effort to cover wall underlay with cladding the same day. Do not leave installed underlay exposed to weather and UV light any longer than the maximum period specified by the manufacturer - replace with new underlay if the exposure period has been exceeded.

6.7.9 Installation - Roof Underlay

6.7.9.1 Supported Roof Underlay - profiled metal roof

Install supported roof underlay in accordance with the manufacturer's requirements, to the locations and details shown on the design drawings.

Roof Pitches above 10º:
Unless otherwise specified on the design drawings, lay roof underlay horizontal or vertical to the roof slope, starting from the gutter/lowest point up to the ridge/highest point, overhanging fascia boards 20-25mm, and with minimum 150mm side-laps and end-laps, lapped away from the prevailing wind, and sufficiently tensioned to prevent ponding of condensation. All end-laps must be made over solid framing. Individual lengths shall not exceed the maximum run length permitted by NZS 2295.

Fix roof underlay at maximum 300mm centres across the width of the underlay and capturing all edges using 8mm stainless steel staples, or 20mm large-head galvanised clouts, or proprietary underlay fasteners, or self-drilling wafer head screws.

Finish roof underlay along roof edges and junctions, valley gutters, and at the ridge as shown on the drawings. Extend the underlay over ridges by at least 150mm.

Carefully cut roof underlay at openings and penetrations, at 45º angle away from each corner, and lap-tape closed to framed up-stands, ducts and other services penetrating the underlay, in accordance with the manufacturer's requirements and as detailed.

Flue penetrations in the roof must have a minimum distance of 50mm from the outer liner to the underlay.

6.8 Timber Weatherboard Cladding

6.8.1 Scope

Supply and install the selected Timber Weatherboard Cladding type(s) to the locations shown on the drawings, complete with all accessories. All aspects of this work shall be carried out to comply with the requirements of the New Zealand Building Code, relevant Standards, and in accordance with any specific manufacturer's requirements, other relevant product manufacturers' recommendations, and as noted and detailed on the drawings.

6.8.2 Vertical Weatherboard Profile

Vertical Shiplap Weatherboard: ex.150mm x 25mm, machined to NZS 3617 and/or BRANZ Bulletin 411. Manufactured from the selected timber species to the finish specified.

6.8.3 Preparation

Co-operate with other trades to ensure that all preliminary and preparatory works are completed to specification and as shown on the drawings.
Co-ordinate with other trades to ensure that the weatherboards correctly allow for door and window installation, and for the locations of pipes, outlets, and fittings installed by others.

Vertical Weatherboards Cavity-Fixed on Timber Framing - check all aspects of preparatory works, including, but not limited to:
- Check that the timber wall framing complies with the approved design drawings, is plumb and in true alignment, has studs at maximum 600mm centres and nogs/dwangs at maximum 480mm centres for vertical cladding, that any additional framing required for fixing at corners, openings and soffits is correctly in place, and has a maximum moisture content of 20% at the time of weatherboard cladding installation.
- Check that the flexible wall underlay, as specified, has been installed in accordance with the manufacturer's recommendations and NZBC requirements, with all finishing tapes, flashings, etc., at windows, doors, corners and penetrations all correctly incorporated to give a continuous seal, and that all preparatory materials are lapped such that any water will run down to the exterior
- Check that the fluted/castellated horizontal cavity battens and base vent strip are correctly installed and appropriate for the weatherboard cladding installation.
- For cavity construction without a rigid wall underlay and where the studs are at greater than 450mm centres, check that appropriate additional restraint is correctly installed against the underlay to prevent

bulk insulation from pushing the underlay into the cavity space.
- Check junctions to all other building elements and cladding systems and ensure that all necessary works have been completed that will enable the weatherboards to be installed, and that the work of other trades does not negatively impact on or reduce the minimum clearances required by the NZ Building Code between the cladding and ground, roof and/or deck junctures.

6.8.4 Flashings

Flashing materials shall be in accordance with the requirements of NZBC E2/AS1 Sections 2.2 Materials, 4.0 Flashings, Table 20 - Material Selection, Table 21 - Compatibility of Materials in Contact, and Table 22 - Compatibility of Materials Subject to run-off, and as noted on the drawings.
All flashings around windows, doors and other openings and apertures, at internal and external corners, inter-storey junctions, soffit junctions, and at junctions with other building elements and cladding systems, etc., shall all be carefully constructed, fixed and finished to the details shown on the drawings.

6.8.5 Installation

6.8.5.1 Vertical Shiplap Weatherboard - Cavity Fix

Back flash all internal and external corners as detailed.
Carefully set-out Vertical Shiplap Weatherboard cladding vertically over the fluted/castelated horizontal cavity battens, to straight plumb lines, and fix to the framing with side laps directed away from prevailing weather and with the base overhang 50mm minimum, or as detailed, below the bottom plate or floor structure. Install full length weatherboards boards where possible. Where joints are unavoidable, scarf the weatherboards at 45º and fix to solid framing through the top overlapping board above the joint (not through the joint). Where boards are coated, ensure all cut ends and fresh timber is double coated with a suitable sealer/primer.
Check for and eliminate any creep and/or spread of shiplap weatherboards during installation.
Finish Standard Vertical Weatherboards, weatherboard trim, flashings and accessories at internal and external corners, window and door openings, parapets, and at junctions with other building elements and cladding systems exactly to the details shown on the drawings.

6.8.6 Delivery & Handling

6.8.6.1 Delivery & Handling

Upon delivery to site, inspect weatherboards and accessories and reject any items found to be damaged, defective or substandard. Contact the manufacturer/supplier for replacement.

Store weatherboards, flashings and accessories undercover, flat and true, clear of the ground by at least 150mm and supported on dry, clean timber bearers at maximum 900mm centres, or as recommended by the weatherboard manufacturer. Keep stored materials and accessories dry and protected from damage and contamination at all times, and free from bending, distortion or excessive compression. Do not allow water to enter the stack.

Do not use damaged or defective weatherboards or accessories. Dock any oversized knots, unacceptable grade characteristics or damaged areas of weatherboard.

Weatherboards must be dry prior to installation. Do not install weatherboards during periods of wet weather. Seal all cut ends and fresh-cut timber with two coats of the selected exterior primer or coating.

Handle weatherboards in accordance with the manufacturer's recommendations and in a manner that prevents damage to or deterioration of the material, including surface marking.

Installers shall be familiar with and comply with the manufacturer's safe handling requirements and precautions for use, and shall use appropriate safety gear when handling materials.

Installers shall conform with all relevant WorkSafe NZ Guidelines and Codes of Practice, including Best practice guidelines for working at height in New Zealand and General risk and workplace management – part 1.

6.9 Rigid Air Barriers

6.9.1 Scope

Supply and install the selected products as Rigid Air Barriers to the walls identified on the drawings, complete with all accessories. All aspects of this work shall be in complete accordance with the Manufacturer's technical literature, other relevant product manufacturers' recommendations, and as shown on the drawings.

No substitutions are permitted for the specified Rigid Air Barriers.

6.9.2 Elements

To the areas noted as 'Bracing' on the drawings; additionally comply with all relevant aspects of the manufacturer's Bracing Manual and other relevant product manufacturers' recommendations.

6.9.3 Co-operation

Co-operate with other trades to ensure that all preliminary and preparatory works are completed to specification and as shown on the drawings.
Co-ordinate with other trades to install the specified Rigid Air Barriers as required.

6.9.4 Workmanship

Where required by the NZ Building Amendment Act 2012 it is the building contractor's responsibility to ensure that all restricted building work is carried out by a Licensed Building Practitioner.

All work shall be carried out by experienced and competent installers, familiar with the materials and installation techniques, in accordance with the manufacturer's installation requirements, other relevant product manufacturers' recommendations, and as shown on the drawings.

6.9.5 Delivery & Handling

Store rigid air barrier sheets off the ground on a flat level surface undercover, keep dry and protect from damage at all times. Store uPVC accessories and sealants out of direct sunlight and protect from damage. Do not use damaged or faulty materials, or products beyond the designated shelf life.
Handle sheets and accessories in accordance with the manufacturer's recommendations.

6.9.6 Preparation

Check that the timber framing elements are in accordance with NZS 3604, or in accordance with NZS 3603 and AS/NZS 1170 for specific design, and in accordance with the rigid air barrier manufacturer's requirements and as shown on the drawings.
Framing shall be plumb and in true alignment, complete and suitable for the rigid air barrier sheets, be minimum 45mm thick, and have a maximum moisture content as per NZS 3602.
Check that the framing is true to line and plane with no projections due to structural and bracing bracketry etc., and that any bottom plate hold-downs are correctly installed.

Check that the ground levels are sloping away from the building in accordance with E1/AS1, with no ponding water against the building, and that the ground will be remain clear of the sheets by at least 100mm at all times.

6.9.7 Plywood RAB - Plain Uncoated

Plywood: 7mm thick, H3.2 CCA treated, DD Grade, structural plywood panel.
Installed as a rigid air barrier in accordance with the manufacturer's requirements and as shown on the drawings, and over-clad with a flexible wall underlay and absorbent or non-absorbent claddings installed over a minimum 18mm drained cavity, or masonry veneer construction, as per E2/AS1.
Do not paint the plywood panels.

6.9.8 Installation

Install the selected plywood panels vertically and fix directly to the framing in accordance with the manufacturer's installation requirements and as shown on the drawings.

Do not install end-cut sheets facing down, where sheets are end-cut, place the cut end to the top, where exposed. Treat site cut plywood prior to installation with a manufacturer approved timber preservative treatment.

Ensure that the bottom edge of the panel finishes flush with the underside of the bottom plate or bearer as detailed, and is clear of the ground surface by at least 100mm; the finished ground clearance shall be in accordance with E2/AS1.

Butt-joint sheets with 2-3mm gaps over solid framing, including internal and external corners.

Form horizontal inter-storey joints at floor joist level with folded aluminium Z flashing or proprietary uPVC in accordance with the manufacturer's requirements and as shown on the drawings. Ensure that the sheets are not fixed to the inter-storey joists or blocking, and are spaced apart in accordance with the manufacturer's requirements.

Fix the specified flexible wall underlay over the plywood in accordance with E2/AS1 9.1.7.2, and install the selected flexible flashing tape to framed opening reveals and building element junctions, with the addition of a self-adhesive pipe bandage for pipes and conduits that penetrate the rigid air barrier to maintain weathertightness and air pressure resistance to the wall cavity as per E2/AS1.

6.9.9 Fixing

Fix the plain uncoated plywood panels with 40 x 2.5mm hot dip galvanised flat head nails, or power driven 50 x 2.8mm hot dip galvanised round head ring nails, in accordance with the manufacturer's requirements. Unless otherwise noted, fixings shall be spaced at maximum 150mm centres at sheet

edges and maximum 300mm within the sheet body in accordance with the manufacturer's requirements.

6.9.10 Completion

Ensure that the rigid air barrier sheets have been fixed correctly, that vertical joints and horizontal joints have been completed correctly, and that framed openings, penetrations, and vertical joints have been taped and sealed correctly.
Check that no damage has occurred to any installed sheet element or associated component, replace as necessary.
Remove rubbish and excess material from site.

Issue to the Owner a copy of the product and installation warranties where applicable.

7 EXTERNAL WINDOW & DOOR JOINERY

7.1 Preliminary

Refer to General Conditions of Contract and the Special Conditions in this Specification as appropriate. Read this section in conjunction with all other trade sections.

7.2 Compliance

Comply with the New Zealand Building Code 1992 including all revisions and amendments, Verification Methods where appropriate, and construction principles that are embodied in the Acceptable Solutions.

Comply with all relevant provisions and recommendations of:

1734:1997(AS/NZS)	Aluminium and aluminium alloys - Flat sheets, coiled sheet and plate
1866:1997(AS/NZS)	Aluminium and aluminium alloys - Extruded rod, bar, solid and hollow shapes
2208:1996(AS/NZS)	Safety glazing materials in buildings
4211:2008(NZS)	Specification for performance of windows
4223.1:2008(NZS)	Code of practice for glazing in buildings - Glass selection and glazing
4223.2:2016(NZS)	Glazing in buildings - Part 2: Insulating glass units
4223.3:2016(NZS)	Glazing in buildings - Part 3: Human impact safety requirements
4223.4:2008(NZS)	Glazing in buildings - Part 4: Wind, dead, snow, and live actions
4667:2000(AS/NZS)	Quality requirements for cut-to-size and processed glass
4668:2000 (AS/NZS)	Glossary of terms used in the glass and glazing industry
AS/NZS 4666:2012	Insulating glass units

7.3 Aluminium Windows & Doors

7.3.1 Scope & Design Performance

7.3.1.1 Scope:

Supply and install Aluminium Windows and Doors, as specified herein, to the locations and details shown on the design drawings, complete with all necessary components and accessories required for proper installation and performance.

All aspects of this work shall comply with the NZ Building Code, related manufacturer's technical literature and other relevant product manufacturers' recommendations. test

7.3.1.2 Wind Performance - Wind Zone - High:

Aluminium Windows & Doors shall comply with the requirements of NZS 4211 for all relevant clauses.

Wind Load - Non-Specific Design Wind Zone Classification:

- Aluminium Window and Door joinery installation is located in a NZS 3604 Wind Zone: H - High; with a maximum pressure of 0.97kPa SLS and 1.36kPa ULS.

7.3.1.3 Thermal Performance - Climate Zone 6:

Aluminium Window & Door joinery installation is located within the boundaries of Climate Region Zone 6 as defined in NZBC - H1/AS1. Unless specified otherwise, the combination of glazing and window/door frame shall have a minimum required R-Value in accordance with this Climate Zone. Refer to drawings and schedules.

7.3.1.4 Durability Performance - Exposure Zone B - Low:

Aluminium Window and Door joinery installation is located in a NZS 3604 Exposure Zone B: Low - within an inland area with little risk from wind-blown sea-spray salt deposits.

ISO 9223 Category: C2 Low: Characterised by no obvious marine influences. Typically, more than 1000 metres from the exposed coasts or more than 500 metres from industrial emissions.

All aspects of the Aluminium Window and Door joinery, including hardware, shall meet the durability requirements for the given Exposure Zone in accordance with NZBC B2.

7.3.2 Requirements

7.3.2.1 Safety:

Comply with the Health and Safety at Work Act 2015 (HSWA), and with all relevant Health and Safety at Work Regulations 2016, and with all relevant WorkSafe New Zealand (WorkSafe) Approved Codes of Practice and WorkSafe Information and Guidance, particularly those for construction and building maintenance.

7.3.2.2 Shop Drawings:

Prepare and submit to the Main Contractor for verification and approval prior to the commencement of fabrication works, Shop Drawings describing the general arrangement and connection to the building envelope of the specified window & door systems.

These shall include, but not be limited to:

- Design calculations - where required;
- Dimensioned elevations of all joinery elements (typical scale = 1:50; minimum scale = 1:100);
- Complete details of the installation construction, connections and all support systems (typical scale = 1:2; minimum scale = 1:5);
- Sealant types and backing rods, etc;
- Provision for movement, thermal, wind load and/or seismic - where required;
- Coordination requirements/issues with other works and trades - where applicable;
- A schedule of materials, finishes, componentry, fittings, fixings and fastenings - where required.

7.3.3 Aluminium Windows

7.3.3.1 Aluminium Windows:

Aluminium Windows shall be manufactured to manufacturer's standard details.

Specification:

- Mullions and transoms, with or without external fins, shall be thermally broken, and in accordance with the manufacturer's Span Tables for compliance with the project wind load.
- Sashes shall be box sashes - glass captive, or beaded sash - capable of reglazing without dismantling sashes.
- Thermal breaks are to be provided as indicated on the Window & Door schedule.
- Glass: Refer to Glazing and Glass clauses.
- Finish: Refer to Aluminium Finish clause
- Furniture: Refer to Hardware clause.

Configuration (as indicated on the drawings):

- Casement
- Awning
- Sliding
- Double hung
- Bi-fold

Refer to the Window & Door Schedule drawings for specific requirements of individual elements.

Manufactured and installed in accordance with the manufacturer's requirements to the locations, configurations and details shown on the drawings and schedules.

7.3.4 Aluminium Doors

7.3.4.1 Aluminium Doors:

Aluminium Doors shall be manufactured to standard manufacturer's requirements.

Specifications:

- Frames shall be manufactured, in accordance with the manufacturer's Span Tables, and to suit joinery configurations and opening swings.
- Stiles and rails shall be box sections - glass captive, or beaded - capable of reglazing without dismantling doors.
- Thermal breaks are to be provided as indicated on the Window & Door schedule.
- Glass: Refer to Glazing and Glass clauses.
- Finish: Refer to Aluminium Finish clause.
- Furniture: Refer to Hardware clause.

Configurations (as indicated on the drawings):

- Hinged Doors (single): Inward opening; outward opening. Left-hand swing LH; Right-hand swing RH. With coupled overlight; with coupled sidelight.
- French Doors (double): Inward opening; outward opening. Single-paired; double-paired (open-out fold-away). With coupled overlight; with coupled sidelight.
- Bifold door - 2-Panel Layback, 3-Panel Layback, 2-/2-Panel Layback. Can be combined with 1-Panel Hinged, 1-Panel Fixed.
- 'S' sliding panel, and 'F' fixed panel: F-S, S-F, F-S-F, F-S/S-F. Moving panels slide inside/behind fixed panels.

Refer to the Window & Door Schedule drawings for specific requirements of individual elements.

Manufactured and installed in accordance with the manufacturer's requirements to the locations, configurations and details shown on the drawings and schedules.

7.3.5 Glazing Platform

7.3.5.1 Standard Double Glazing:

Maximum 22mm thick, air-filled and sealed insulating glass units (IGUs); with 4mm thick clear float glass in accordance with NZS 4223.1 and NZS 4223.3. Double glazed IGUs shall be manufactured and installed in accordance with AS/NZS 4666. Factory-fitted to Aluminium Windows & doors, as identified on the drawings and schedules.

7.3.6 Glass

7.3.6.1 Clear Float Glass:

Clear annealed float glass, complying with AS/NZS 4667 and in accordance with NZS 4223.1. Installed to the locations identified on the drawings and schedules.

7.3.6.2 Toughened Safety Glass:

Toughened Grade 'A' Safety Glass, complying with AS/NZS 2208 and AS/NZS 4667 and in accordance NZS 4223.1. Installed to the locations identified on the drawings and schedules. All cutting and drilling and other processing requirements must be done prior to toughening.

7.3.7 Finish

7.3.7.1 Powder Coated Aluminium:

Polyester powder coating in accordance with WANZ Powder Coating Quality Assurance System and AAMA 2603-98 performance is required.

7.3.8 Flashing & Support Bars

7.3.8.1 Aluminium Head Flashing:

Aluminium Head Flashings shall be manufactured from extruded aluminium, suitably sized to suit the claddings and construction types in accordance with NZBC E2/AS1 and as shown on the drawings.

Except where specified otherwise, aluminium head flashings shall be powder coated and colour-matched to the aluminium joinery.

7.3.8.2 Aluminium Sill Support Bar - Cavity Fix:

Extruded mill-finish aluminium sill support bar, with built-in drainage and ventilation, for continuous support to the window or door unit. Sill support bars shall be used and installed in accordance with the requirements of NZBC E2/AS1, and comply with BRANZ Evaluation Method EM6, and be sized to suit the cladding thickness and weight of the window or door.

7.3.9 Hardware

Hardware as selected in the 'Door and Window' schedule is to be installed to Manufacturers requirements. Where not specified hinges, stays, catches, fasteners, latches, locks and furniture as offered by the window and door manufacturer shall be used. Factory fit all required and scheduled hardware.

Where specified, all lockable window & door hardware is to be keyed alike. Provide all keys with the joinery and provide to Client as required.

7.3.10 Fabrication

7.3.10.1 Fabrication:

Fabricate Aluminium Windows & Doors in accordance with the approved window schedule, approved workshop drawings and other project documentation.

Unless noted otherwise, the approved window schedule, joinery fabrication shall include the installation of all glazing, hinges, stays, running gear, and other hardware items scheduled on the approved shop drawings.

As necessary, provide protection and temporary bracing required for the general handling of the joinery elements. Ensure that all opening doors and windows are temporarily secured for transportation and general handling.

7.3.11 Co-operation

7.3.11.1 Co-operation:

Co-operate with other trades to ensure that all preliminary and preparatory works are completed to specification and as shown on the drawings.

Coordinate with other trades, as required, on the installation of the Aluminium Windows & Doors to the required layout, details and tolerances.

7.3.12 Workmanship

Aluminium Windows & Doors will be manufacturerd in workshops containing all mechanical equipment appropriate for the work, and by experienced and competent tradesmen who are familiar with the techniques and materials specified.

The manufacturer will co-ordinate with other trades to establish the exact sizes for all frames before fabrication. Frames and sashes will be fabricated true, square, rigid, and ‘out of wind’, with all joints

strongly mechanically fixed, and with mitres tight and fully sealed. Potential thermal, wind and seismic movements will be accommodated within the construction. All cavities will drain to the exterior, and all drilling swarf etc. will be removed during fabrication.

Stays, hinges, running gear and glazing will be installed as scheduled (the Designer will be notified if any scheduled hardware of fixing position appears to be inappropriate for this project).

Hardware will be fixed true to line and position, and adjusted and oiled as required for correct operation.

Glass will be cut true and square, sized to provide correct edge clearances, blocked into place as required, and all units will be delivered either pressure fit, pocket glaze, or beaded/wedged, unless site glazing is required. Glazing gaskets will be compatible with all adjacent materials, and cut 1% over-length to absolutely avoid stretching during installation. Frames will be braced etc. as necessary for transportation to the site.

Flashings as detailed will be supplied. Flashing materials will be compatible with the Aluminium Windows & Doors.

7.3.13 Preparation

7.3.13.1 Preparation:

Prior to installation, carry out all necessary inspections of the supporting structure to ensure all preliminary work is complete. Do not commence installation until all necessary preliminary work by others is complete and to the required standard. The commencement of work on each section of the installation shall be deemed to indicate full acceptance by the Installer that all preliminary work by other trades is complete and to the required standard.

Supporting structures shall comply with the NZ Building Code, and must be structurally sound and dimensionally stable and in the correct alignment, true to line and level (and grade for sloped balustrades).

Confirm the location of all movement control joints prior to the commencement of the works.

Concrete:
- Supporting reinforced concrete elements shall comply with NZS 3101, or NZS 3604.
- New concrete must have aged for a minimum of 28 days prior to installation.

Concrete Masonry:
- Supporting reinforced concrete masonry elements shall comply with NZS 4229, or NZS 4230 and AS/NZS 1170.

Timber Framing:
- Supporting timber-framed structures shall comply with NZS 3604, or NZS 3603 and AS/NZS 1170.

Structural Steel:
- Supporting steel structures shall comply with NZS 3404.

7.3.14 Delivery and Installation

Comply with the New Zealand Building Code 1992 including all revisions and amendments, Verification Methods where appropriate, and the construction principles that are embodied in the Acceptable Solutions.

Arrange for delivery of the Alumnium Windows & Doors to the site only when a suitable storage situation is available for them, handle the joinery in accordance with the manufacturers requirements, avoid any frame distortion, avoid rubbing damage, avoid contact with concrete, plaster, mud etc. and keep them dry. Retain protective coverings for as long as possible, and remove them at completion.

Experienced and competent tradesmen who are familiar with the techniques and materials specified shall carry out all installation work. Fix in accordance with the manufacturer's instructions. Take utmost care to avoid damage to anodized or powder coated surfaces - correction of any such disfigurement requires written authority - replace any badly damaged items.

Use fixings compatible with the materials involved, as recommended by the windows manufacturer and to comply with the DWP requirements, basically aluminium or Type 316 stainless steel where exposed externally; galvanized to AS/NZS 4680, 610g/m2, may be used where not exposed.

Thoroughly check all preparatory work to openings prior to installation, including underlay, corner seal tapes, adjacent cladding, pre-installed flashings, waterproofing systems etc. as appropriate. Use inert barriers or coatings to prevent contact between dissimilar metals or between aluminium and concrete.

Install flashings as detailed and supplied by the manufacturer, installed tightly and neatly with absolute minimum tolerances, with head weathering jamb, jamb weathering sill, and sill open (draining) to exterior. Except where the window is recessed all head flashings shall extend 30mm minimum beyond the frame.

Air-seal all frame perimeters to adjacent structure to a depth of 15 - 20mm with expanding foam or appropriate sealant including a PEF rod at head, sill and jambs to retard the spread of sealant.

Weather-seal frame jambs etc. to adjacent surfaces (or to each other) as detailed or as required by the windows manufacturer, to achieve a fully watertight installation. In preparation for sealant the joints shall be clean, dry, and primed if necessary. Insert closed cell polyethylene backer rods or a polyethylene tape slip layer if required. Mask adjacent surfaces if appropriate, install the sealant fully in accordance with the sealant manufacturer's recommendations, and finish to even smooth surfaces.

Remove trade debris progressively, appropriately clean any affected adjacent surfaces, thoroughly clean the Aluminium Windows & Doors, check that all hardware is in full working order, and provide safety indication of the glass for the balance of adjacent works.

7.3.15 Completion

7.3.15.1 Completion:

Check the Aluminium Windows & Doors have been correctly installed in accordance with the manufacturer's requirements to the locations, layout and details shown on the design drawings.

Check the installation for damage and defects, including surface marking. Carry out any necessary repairs in accordance with the manufacturer's requirements to the required standard. Replace Aluminium Window and Door elements where repair is not possible or will not be accepted.

Leave all of this work complete, clean and free from damage and defects, and to the required standard in accordance with the manufacturer's requirements.

Leave surrounding surfaces clean and free of rubbish and debris. Remove all rubbish and excess material from the site.

Issue to the Owner a copy of the manufacturer's maintenance requirements and a copy of the manufacturer's Warranty. test

8 GLAZING

8.1 Preliminary

Refer to General Conditions of Contract and the Special Conditions in this Specification as appropriate. Read this section in conjunction with all other trade sections.

8.2 Compliance

Comply with the New Zealand Building Code 1992 including all revisions and amendments, Verification Methods where appropriate, and construction principles that are embodied in the Acceptable Solutions.

Comply with all relevant provisions and recommendations of:

1170.0:2002(AS/NZS)	Structural design actions - Part 0: General principles
2208:1996(AS/NZS)	Safety glazing materials in buildings
3604:2011(NZS)	Timber-framed buildings
4211:2008(NZS)	Specification for performance of windows
4223.1:2008(NZS)	Code of practice for glazing in buildings - Glass selection and glazing
4223.2:2016(NZS)	Glazing in buildings - Part 2: Insulating glass units
4223.3:2016(NZS)	Glazing in buildings - Part 3: Human impact safety requirements
4223.4:2008(NZS)	Glazing in buildings - Part 4: Wind, dead, snow, and live actions
4232.2:1988(NZS)	Performance criteria for fire resisting enclosures - Part 2: Fire resisting glazing systems
4667:2000(AS/NZS)	Quality requirements for cut-to-size and processed glass
4668:2000 (AS/NZS)	Glossary of terms used in the glass and glazing industry
AS/NZS 4666:2012	Insulating glass units

8.3 Non-Structural Glazing

8.3.1 Scope

Supply and install the selected glass products to the windows, doors, curtain wall systems, roofs and canopies, balustrades and barriers, partitions and screens, and other non-structural glazing elements, as noted and shown on the drawings. All aspects of this work shall be in accordance with the glass manufacturer's installation requirements and recommendations, other relevant product manufacturers' recommendations, and as shown on the drawings.

8.3.2 Co-operation

Co-operate with other trades to ensure that all preliminary and preparatory works are completed to specification and as shown on the drawings.

Coordinate with other trades for all necessary holes and cut-outs, etc., for glass-mounted hardware, fittings and fixtures, and to install all glass and glazed elements as required.

8.3.3 Workmanship

All installation work shall be carried out by experienced and competent tradesmen familiar with the products specified and installation techniques, to the manufacturer's requirements and recommendations, and the requirements of the relevant Glazing Standards, and to the layout and details shown on the drawings.
Handle and store glass in accordance with the manufacturer's recommendations.
Provide temporary safety markings to all glass panes as the installation work progresses.
Finish all external glazing wind and watertight.
Do not use damaged, marked or faulty materials.

8.3.4 Glass Type

8.3.4.1 Clear Float Glass

Clear Float Glass. Clear annealed float glass, complying with AS/NZS 4667 and in accordance with NZS 4223.1. Installed to the locations identified on the drawings and schedules.

8.3.4.2 Low-E Glass

Low Emissivity Glass. Heat-reflective coated surface, annealed float glass, complying with AS/NZS 4667 and in accordance with NZS 4223.1. Installed to the locations identified on the drawings and schedules.

8.3.4.3 Obscure & Patterned Glass

Obscure and Patterned Glass. Surface patterned glass and/or obscure glass, complying with AS/NZS 4667 and in accordance with NZS 4223.1. Installed to the locations identified on the drawings and schedules.

8.3.4.4 Toughened Safety Glass

Toughened Safety Glass. Toughened Grade 'A' Safety Glass, complying with AS/NZS 2208 and AS/NZS 4667 and in accordance NZS 4223.1. Installed to the locations identified on the drawings and schedules. All cutting and drilling and other processing requirements must be done prior to toughening.

8.3.5 Insulating Glass Units

8.3.5.1 Standard Double Glazing

Standard Double Glazing. Air-filled and sealed insulating glass units (IGUs) complying with NZS 4223.2, with clear float glass complying with NZS 4223.1. Double glazed IGUs shall be manufactured and installed in accordance with AS/NZS 4666. Factory-fitted to the windows and doors identified as 'double glazed' on the drawings and schedules.

8.3.6 Components & Accessories

8.3.6.1 Aluminium Framed Glazing

Provide all necessary glazing components and accessories including glazing tape, setting and distance blocks, sealants, gaskets, etc., to complete aluminium framed glazing as required.

8.3.7 Installation

8.3.7.1 Aluminium, Double Glazed (IGU's)

Install Insulated Glass Units into aluminium frames in accordance with the glazing manufacturer's recommendations and NZS 4223.1, and as detailed.

8.3.8 Frameless Doors & Screens

Frameless glass doors and screens shall be safety glass in accordance with NZS 4223.3.

Frameless glass doors and screen panels cut to the dimensions shown on the drawings, and factory pre-drilled and cut as required for all necessary fixings, brackets, cleats, hinges, locks, latches, closers and other hardware or fixtures, and edge finished as specified, prior to installation.

Install frameless glass doors and screen panels to the layout and details shown on the drawings and in accordance with any proprietary fixing manufacturer's requirements.

Glass screen panels set straight, true to line and plumb. Panel joints plumb and parallel as detailed.

Fixings, clamps, brackets, and hardware etc. neatly set-out and aligned as detailed.

Note: where relevant, new structural glass barriers shall comply with NZBC B1/AS1 (Amendment 13) and must have an interlinking rail, unless the barrier is laminated safety glass and has features to retain panes of glass or prevent collapse, in the event of breakage. The interlinking rail shall be designed to resist serviceability limit state (SLS) loads, specified in AS/NZS 1170 and B1/VM1, in the event that a glass pane of the barrier breaks.

8.3.9 Completion

Check that all glass has been installed correctly to the required standard and as shown on the drawings. Check for damage and surface marking and replace as necessary. Clean off and remove all temporary safety markings, as programmed and when instructed, and leave glass trade clean. Remove all rubbish and waste material from site.
Issue to the Owner a copy of the Glass Manufacturer's maintenance requirements and all necessary Manufacturer Warranties.

9 INSULATION

9.1 Preliminary

Refer to General Conditions of Contract and the Special Conditions in this Specification as appropriate. Read this section in conjunction with all other trade sections.

9.2 Compliance

Comply with the New Zealand Building Code 1992 including all revisions and amendments, Verification Methods where appropriate, and construction principles that are embodied in the Acceptable Solutions.

Comply with all relevant provisions and recommendations of:

3604:2011(NZS)	Timber-framed buildings
4218:2009(NZS)	Thermal insulation - Housing and small buildings
4220:1982(NZS)	Code of practice for energy conservation in non-residential buildings
4243.1:2007(NZS)	Energy efficiency - Large buildings - Building thermal envelope
4246:2016(NZS)	Energy efficiency - Installing bulk thermal insulation in residential buildings
4859.1:2018(AS|NZS)	Thermal insulation materials for buildings - Part 1: General criteria and technical provisions

9.3 Thermal Insulation

9.3.1 Scope

Supply and install the selected products as thermal insulation to the specified R-values, complete with all accessories, to the floors, walls, ceilings, roofs, and other thermally insulated building elements, as noted and shown on the drawings. All aspects of this work shall be in accordance with the product manufacturer's technical literature and installation requirements, other relevant product manufacturers' recommendations, and as shown on the drawings.

9.3.2 Co-operation

Co-operate with other trades to ensure that all preliminary and preparatory works are completed to specification and as shown on the drawings.
Co-ordinate with other trades to install all thermal insulation as required.

9.3.3 Workmanship

All installation work shall be carried out by experienced and competent tradesmen, familiar with the specified products and installation techniques, in accordance with the manufacturer's installation requirements, and as noted and detailed on the drawings.
Store and handle products in accordance with the manufacturer's recommendations, keep dry and protect from damage. Do not compress fibre insulation bales. Do not use damaged or defective insulation products and accessories.
The building must be completely enclosed and water tight before installation commences with the exception of roof insulation when installed with roofing. Ensure the moisture content of timber framing is no greater than 18% prior to installing insulation to timber framed elements. Always

maintain the full insulation thickness to ensure the required thermal values are achieved. Do not install insulation pads or blankets into closed cavities that are less than the stated insulation nominal thickness.

9.3.4 Product

9.3.4.1 Wool Fibre Pads

Natural or recycled sheep's wool thermal insulating pads.

9.3.5 Installation

9.3.5.1 Wall Insulation - Wool Fibre Pads

Install wool fibre insulation pads, complete with accessories, friction fitted between wall studs and dwangs etc. and held in place in accordance with the manufacturer's installation recommendations. Completely fill the framing voids, leave no gaps at the edges or at penetrations etc, and maintain full insulation pad thickness. Support external wall insulation with vertical strapping tape at 400mm centres to the outside face, stainless steel stapled to the framing.

9.3.5.2 Ceiling Insulation, Truss/Framed Roof - Wool Fibre Pad

Install wool fibre insulation pads, complete with accessories, friction fitted between the ceiling joists, over the ceiling lining in accordance with the manufacturer's installation recommendations. Leave no gaps along the insulation pad edges and joints, and at the ceiling perimeter/wall junction.

For recessed luminaires LEDs & Control-gear, rated IC, IC-F & IC-4 to cover, follow manufactures instruction on insulation in line with NZS4246.

For all other separate ceiling insulation 200mm from recessed light fittings and other recessed electrical fittings; refer to the drawings for containment requirements around recessed electrical fittings.

9.3.5.3 Ceiling Insulation, Skillion Roof - Wool Fibre Pad

Install wool fibre insulation pads, complete with accessories, friction fitted between the rafters and behind the ceiling battens in accordance with the manufacturer's installation recommendations. Maintain a minimum 25mm clearance between the top of the insulation and the roof underlay. Leave no gaps along the insulation pad edges and joints, and at the roof/wall junction - cover at least 50% of the exterior top plate width (except where obstructed by other framing).

For recessed luminaires LEDs & Control-gear, rated IC, IC-F & IC-4 to cover, follow manufactures instruction on insulation in line with NZS4246.

For all other separate ceiling insulation 200mm from recessed light fittings and other recessed electrical fittings; refer to the drawings for containment requirements around recessed electrical fittings.

9.3.6 Completion

Check that all insulation has been installed correctly and is correctly supported and that all edges, joins and ends are fully closed without gaps. Check for damage and faults and repair or replace as necessary. Collect and remove from site all rubbish and waste material.
Issue to the Owner a copy of any product maintenance requirements and a copy of the Thermal Insulation Product and Installation Warranties for the completed works.

10 ROOFING

10.1 Preliminary

Refer to General Conditions of Contract and the Special Conditions in this Specification as appropriate. Read this section in conjunction with all other trade sections.

10.2 Compliance

Comply with the New Zealand Building Code 1992 including all revisions and amendments, Verification Methods where appropriate, and construction principles that are embodied in the Acceptable Solutions.

Comply with all relevant provisions and recommendations of:

1170.2:2011(AS/NZS)	Structural design actions - Wind actions
1397:2001(AS)	Steel sheet and strip - Hot-dip zinc-coated or aluminium/zinc-coated
1562.2:1999(AS/NZS)	Design and installation of sheet roof and wall cladding - Corrugated fibre-reinforced cement
1562.3:1996(AS/NZS)	Design and installation of sheet roof and wall cladding - Plastic
2295:2006(NZS)	Pliable, permeable building underlays
3604:2011(NZS)	Timber-framed buildings
4200.1:2017(AS|NZS)	Pliable building membranes and underlays - Part 1: Materials
4200.2:1994(AS/NZS)	Pliable building membranes and underlays - Installation requirements
4389:2015(AS/NZS)	Roof safety mesh
4534:2006(AS/NZS)	Zinc and zinc/aluminium-alloy coatings on steel wire
NZMRM Code of Practice	NZ Metal Roof and Wall Cladding Code of Practice - Version 3.0

10.3 Rainwater Goods

10.3.1 Prefinished Steel Rainwater Goods

Standard 'half round' (or equal) profile longrun prefinished steel spouting as for the roofing with flanged downpipe droppers siliconed into the gutter to take 65mm dia. PVC downpipes. Standard external spouting brackets at approximately 600mm centres.

10.4 Workmanship

10.4.1 Guarantees

The whole of the roof covering work shall be complete in all respects and absolutely watertight. Commencement of roofing works by any Subcontractor indicates their full agreement to and acceptance of an unwritten guarantee to maintain the whole of their work in a satisfactory and watertight condition, and to arrange and pay for any damage consequential upon the failure of their materials or workmanship, for the periods stated below, irrespective of the 90 day general maintenance period.

- Butyl roofer - ten years from completion.
- Galvanised steel roofer - two years after completion.

- Aluminium roofer - ten years after completion.
- Acrylic/f.glass roofer - ten years after completion.

10.4.2 Co-operation

Co-operate with other trades to ensure that framed roofing substrates have appropriate spacings, alignments and fixings, and to ensure that sheet roofing substrates have the correct edge and central fixings, appropriate alignments and gradients, edge priming if necessary, and are completely clean.

Ensure that each section is waterproofed as soon as possible after preparatory work is complete; allow to carry out the works in several operations if necessary to comply with this condition.

10.4.3 Alternatives

Tenderers are invited to submit a price variation for similar roofing products. Consideration of finished roofs in the alternative product and the extent that drawings will need to be modified to incorporate it will be the main items in the decision on the alternative proposed.

10.5 Profiled Metal Roofing

10.5.1 Scope

10.5.1.1 Inland Moderate (ISO 9223 Category: C2)

Supply and install profiled metal rigid-sheet roofing, as specified herein, to the locations identified on the drawings, complete with all accessories required for proper installation and performance. All aspects of this work shall be in complete accordance with the roofing manufacturer's technical literature and installation requirements, the NZ Metal Roof and Wall Cladding Code of Practice, other relevant product manufacturers' recommendations, and as shown on the drawings.

10.5.2 Requirements

10.5.2.1 Safety

Comply with the Health and Safety at Work Act 2015 (HSWA), and with all relevant Health and Safety at Work Regulations 2016, and with all relevant WorkSafe New Zealand (WorkSafe) Approved Codes of Practice and WorkSafe Information and Guidance, particularly those for construction and building maintenance.

10.5.2.2 Warranty - Roofing Material

Roofing Material Product Warranty. Warrant this work against failure of materials under normal use and environmental conditions:
- 15 Years for Perforation: according to the roofing material manufacturer/supplier warranty conditions.
- 15 Years for Coatings: according to the roofing material manufacturer's warranty conditions.
- Provide the Product Warranty on the roofing manufacturer's Standard Warranty Form.
- Commence the warranty from the date of practical completion of the contract works.

10.5.2.3 Warranty - Installation

Installation Warranty. Warrant this work under normal environmental conditions and use against waterproofing failure:
- 15 Years for Workmanship.

- Provide the Installation Warranty on the roofing installer's Standard Warranty Form.
- Commence the warranty from the date of practical completion of the contract works.

Include a copy of the roofing manufacturer's maintenance requirements with the Installation Warranty.

10.5.3 Roofing Profile

Trapezoidal Profiled Metal Roofing. Symmetrical or asymmetrical trapezoidal profile, with a minimum crest height of 19mm. Asymmetrical profiles shall have a flat or lightly profiled pan width of 210mm maximum between crests. Profile depth, crest pitch, crest width and pan width as specified below or as shown on the drawings. Manufactured from the material type, thickness and finish specified.

Minimum roof pitch: 4° (1:14) where the crest height is less than 27mm, or 3° (1:20) where the crest height is 27mm or higher.

Trapezoidal metal roofing shall be fixed with self-drilling screws through the profile crest in accordance with the requirements of the NZMRM Code of practice.

Sheets shall be continuous from ridge to gutter, or where a step is designed into the roof, sheets shall be continuous from ridge to step and step to gutter. Sheet ends must be stop-ended under flashings.

Installed in accordance with the requirements of the roofing manufacturer's technical literature and the NZMRM Code of Practice, to the locations and details shown on the drawings.

Profile Dimensions:
Installed Location:

10.5.4 Roofing Material

10.5.4.1 COLORSTEEL® Endura - 0.4mm - Trapezoidal Profile

Trapezoidal profiled metal roofing shall be manufactured from COLORSTEEL® Endura - 0.4mm BMT. Pre-painted, hot-dipped zinc/aluminium alloy coated steel coil conforming with AS/NZS 2728. 550 MPa minimum yield strength. 150gms/m² coating weight. Atmospheric Classifications C1-C4.

Colour:

10.5.5 Components & Accessories

10.5.5.1 Galvanised Netting Underlay Support

Galvanised Netting Underlay Support. Woven flat hexagonal roof netting, manufactured from galvanised mild steel wire, with reinforcing wires at 113mm centres. 1.0mm diameter wire with 2 x 1.2mm reinforcing wires twisted together. 380-550 kPa tensile strength. Galvanised in accordance with AS/NZS 4534, Class W02.

Installed in accordance with the manufacturer's requirements and as shown on the drawings. Do not use galvanised netting with aluminium roofing materials.

10.5.5.2 Screw Fasteners - Corrugated/Trapezoidal Profiles

Screw Fasteners - Corrugated and Trapezoidal Profiles. Screw fasteners shall be self-drilling screws complying with AS 3566 Class 4 or Class 5, as appropriate, and be no less than the durability of the roofing material being fixed.

Fastener type and placement (frequency) shall be appropriate for the environmental conditions, and the specified roofing profile and material, and the supporting structure material; all in accordance with the NZMRM Code of Practice.

Screw fasteners for pre-painted roofing must be pre-painted prior to installation for an accurate colour match.

10.5.5.3 Coated Steel Flashings

Coated Steel Flashings. Metal roof flashings shall comply with the lap, cover, expansion and compatibility provisions of the NZMRM Code of Practice. Flashings shall be formed to suit the details shown on the drawings, and shall include all folded metal sections required to make the profiled metal roofing weathertight at:

- the building periphery,
- roof and wall junctions,
- changes of direction in the roof,
- intersections with other buildings,
- any wall penetration,
- junctions with other materials.

Coated steel flashings shall be fabricated from ductile grade metal of same material and coating as the roofing material - to maintain durability and compatibility requirements. Flashings shall be designed for lateral strength by folding, stiffening or ribbing on external edges, and have a maximum un-stiffened width of 300mm. The minimum thickness for coated steel flashings shall be 0.55mm.

Flashing fasteners and fastening frequency shall be in accordance with the NZMRM Code of Practice. Do not fix flashings to timber with a moisture content greater than 18%.

Do not construct flashing joints and flashing junctions in a manner that rely entirely on sealant to maintain weathertightness.

Where a flashing is hidden, or is otherwise difficult to access or replace, it shall have a durability of the life of the building or not less than 50 years.

10.5.5.4 Profiled Foam Closure Strip

Profiled Foam Closure Strip. Non-bituminous, compressible, closed-cell foam strips profiled to fit the metal roofing profile. Installed to the details shown on the drawings and in accordance with NZMRM Code of Practice recommendations.

10.5.5.5 Sealant

Sealant. Use only neutral-curing silicone sealant that is compatible with the specified metal roofing and flashing materials and finishes, and suitable for the required application and use, in accordance with the sealant manufacturer's instructions and to the NZMRM Code of Practice recommendations. All sealed joints must be mechanically fastened, and excess sealant neatly removed to prevent

unnecessary dirt buildup. Sealant shall only be used to seal between two metal surfaces, do not fill holes or gaps with sealant.

10.5.6 Co-operation

Co-operate with other trades to ensure that all preliminary and preparatory works are completed to specification and as shown on the drawings.

Coordinate to ensure that all roof members required for ridges, hips, valleys, barges, penetrations, junctions with vertical faces, etc. are correctly installed.

Coordinate with the roof drainage system, and generally with other trades as required, to install the specified profiled metal roofing.

Ensure that each section of roof is waterproofed as soon as possible after preparatory work is complete; allow to carry out the works in several operations if necessary to comply with this condition.

10.5.7 Workmanship

Where required by the NZ Building Act 2004 it is the building contractor's responsibility to ensure that all restricted building work is carried out by a Licensed Building Practitioner.

All installation work shall be carried out by experienced and competent tradespersons, familiar with the specified products and installation techniques, in accordance with the requirements of the NZMRM Code of Practice, and to fully comply with all warranty requirements. All work shall be such as to leave a neat, efficient, robust and weathertight installation.

All cutting, fixing and installation techniques, fasteners and sealants shall be exactly as recommended by the roofing manufacturer in accordance with the NZMRM Code of Practice, and with the use of suitable tools and equipment appropriate for the application.

Always maintain isolation of dissimilar materials in accordance with the NZMRM Code of Practice. Isolate dissimilar materials (metal and nonmetal) in close proximity as necessary by painting the surfaces or fitting separator strips. Place isolators between metals and treated timber or cement-based materials. Do not use unpainted lead-sheet or copper materials to come in contact, or allow runoff from these, with galvanised or Zincalume® materials.

10.5.8 Delivery & Handling

Upon delivery to site, inspect roofing materials and reject those items that are found to be damaged, defective or contaminated. Contact the manufacturer/supplier for replacement of rejected items at time of delivery to site.

Store profiled metal roofing, flashings and accessories undercover, clear of level ground, on bearers at evenly spaced centres as recommended by the roofing manufacturer. Keep stored materials and accessories dry and protected from damage and contamination at all times.

Handle materials in accordance with the manufacturer's requirements and in a manner that prevents damage to or deterioration of the material, including surface marking. Do not used damaged or defective materials or products, or products that are beyond their designated shelf life.

Installers shall be familiar with and comply with the manufacturer's safe handling requirements and precautions for use, and shall use appropriate safety gear when handling materials.

Installers shall conform with all relevant WorkSafe NZ Guidelines and Codes of Practice - including the Best practice guidelines for working on roofs and the General risk and workplace management - part 1.

For all work undertaken on the roof, installers shall always wear soft, clean footwear with a light-coloured sole. Do not walk on translucent/natural lighting sheet.

10.5.9 Preparation

10.5.9.1 General

Prior to installation, carry out all necessary inspections and preparatory work required, and ensure that all preliminary works by other trades has been completed to specification and as shown on the approved drawings.

Do not commence installation until all necessary preliminary works by others is complete and to the required standard. The commencement of work shall be deemed to indicate full acceptance by the installer that all preliminary works by other trades is complete.

Supporting timber structures shall comply with NZS 3604, or with NZS 3603 and AS/NZS 1170 for specific design, and have a maximum moisture content in accordance with the requirements of NZS 3603 at the time of installation.

Supporting lightweight steel framed structures shall meet the requirements of AS/NZS 4600 or the NASH Standard for Residential and Low-rise Steel Framing, Part 1: Design Criteria.

Supporting steel structures shall comply with NZS 3404.

10.5.9.2 Roof Structure Check

Roof Structure - check all aspects of preparatory works, including but not limited to:
- Check that the purlins are set-out to the required set-out and spacings, are straight and true to line and plane, and are securely fixed.
- Check that barge and fascia boards have been installed to the correct line and plane, with all edge blocking complete and secure.
- Check that valley gutter and hidden gutter framing is to the required dimensions, with solid backing supports securely fixed, true to line and plane.
- Check that internal gutter membrane linings are properly dressed back and adhered to a solid substrate along the roof edge as shown on the drawings.
- Check that trimming for roof penetrations, and roof/wall junction blocking, and all necessary work by other trades is complete.
- Check that solid backing required for fully supported roofing is complete and securely fixed in accordance with the approved drawings.

10.5.10 Installation

10.5.10.1 Roof Underlay

Install roof underlay in accordance with the underlay manufacturer's requirements with minimum 150mm side and end laps, and lapped such that any water will be shed to the outside of the underlay.

Non self-supporting underlay must be supported by hexagonal galvanised wire mesh, safety mesh or alternative support, as specified and/or shown on the drawings, in accordance with the underlay manufacturer's recommendations.

Underlay shall be installed in a manner so that it is sufficiently tensioned without sagging, overhangs fascia boards 20mm - 25mm, and finished along roof edges, ridges, valley gutters, roof/wall junctions and at penetrations to the details shown on the drawings.

Underlayment for fully-supported roofing shall be in accordance with NZMRM Code of Practice - Sections 4.3.11 Separation, 11.4.2 Substrate, and 11.5.1 Ventilation.

10.5.10.2 Roofing - Corrugated/Trapezoidal Profile

Install profiled metal roofing in accordance with the NZMRM Code of Practice and as shown on the drawings, and to fully comply with all warranty requirements. As shown on the drawings, confirm any specific roofing detailing requirements prior to installation.

Accurately set-out roofing sheets exactly square to the building axis and with sheets lapped away from the prevailing wind; maintain this accurate set-out throughout installation. Check for and eliminate any creep and/or spread of sheets during installation.

Cut metal roofing and flashings by shear only – do not use abrasive cutting tools on or near the roof. Do not use black lead pencils for marking pre-finished roofing and flashings.

Prevent contact with, or run-off from, incompatible materials in accordance with the recommendations in the NZMRM Code of Practice. Observe the roofing material manufacturer’s recommendations where flues discharge above roofs, and for the installation of solar heating panels.
Protect roofing surfaces from damage at all times; replace the whole sheet where a significant depth of the material or coating has been damaged (including flashings).

Screw-fixed sheets shall be fixed with fasteners appropriate for the roofing profile and material, substrate/structure and the environment in accordance with the Roofing Industries Profile Technical Summary and the NZMRM Code of Practice recommendations (minimum Class 4).

Screw fastening placement and spacings shall be strictly in accordance with the roofing manufacturer's requirements and the NZMRM Code of Practice, to fully comply with the Wind Zone requirements, purlins spacings, etc.

Use fixing systems that will accommodate thermal expansion for long lengths and/or dark colours.

All roofing jointing techniques and sealants shall be in accordance with the roofing manufacturer's recommendations and the NZMRM Code of Practice, and shall be compatible with the roofing material and finish. Joints shall be sealed with an approved neutral-cure sealant or approved closed-cell lap tape.

Ridges, hips, barges and flashings generally, shall be in accordance with the NZMRM Code of Practice and the roofing manufacturer's requirements.

10.5.10.3 Flashings

Install flashings to roof edges, ridges, roof/wall junctions, parapets and roof penetrations as detailed on the drawings and in accordance with the NZMRM Code of Practice and the roofing manufacturer's requirements.

All flashings shall be neatly formed and finished, securely fastened to the structure, weatherproof and have falls set to avoid water ponding.

For highly visible flashings, plan each flashing joint and/or junction with specific regard to aesthetic requirements.

10.5.10.4 Penetrations

Penetrations greater than 150mm in any direction must have support framing installed around the perimeter of the penetration. Penetration flashings shall not rely solely on silicone sealant to achieve weathertightness of the flashing.

Flash pipes penetrating the roofing with a proprietary pipe collar flashing.

10.5.10.5 Cleaning

Completely clean off all drill and other swarf and pop-rivet shanks as the work proceeds (at least daily), and keep them and other rubbish out of the spoutings.

Remove associated trade debris from the roof and from the site progressively, and on completion leave the roof and rainwater system completely clean.

10.5.11 Fixing

10.5.11.1 Trapezoidal Profile - Steel material, fixed to Timber

Trapezoidal Profile Roofing - manufactured from steel-based material: Crest-fix roofing to timber framing using minimum AS 3566 Corrosion Class 4, 12g-11, Type 17, Hex. Head-with-Seal, Self-drilling Screws, in accordance with the NZMRM Code of Practice and the roofing manufacturer's requirements.

Primary screw fastener embedment into timber framing shall be a minimum of 35mm and greater than 6 times the screw thread diameter.

Where battens, sarking or insulation is installed over the structure being fixed to, increase the screw length by the thickness of such material.

10.5.12 Completion

Check that the profiled metal roofing and associated components and flashings have been installed and finished correctly.

Check for defective work and materials - replace and/or repair as necessary.

Sweep down the completed roof and clean out spouting, gutters and rainwater pipes.

Leave all of this work complete and weathertight in accordance with the roofing manufacturer's requirements and the NZMRM Code of Practice, and to fully comply with all warranty requirements.

Leave the completed works and surrounding surfaces clean and free of debris and rubbish. Remove all rubbish and excess material from the site.

Issue to the Owner a copy of the roofing manufacturer's maintenance requirements on completion.

Issue to the Owner the roofing material manufacturer/supplier 'Product Warranty', and a copy of the installer's 'Installation Warranty'

11 TILING

11.1 Preliminary

Refer to General Conditions of Contract and the Special Conditions in this Specification as appropriate. Read this section in conjunction with all other trade sections.

11.2 Compliance

Comply with the New Zealand Building Code 1992 including all revisions and amendments, Verification Methods where appropriate, and construction principles that are embodied in the Acceptable Solutions.

Comply with all relevant provisions and recommendations of:

2358:1990(AS)	Adhesives - For fixing ceramic tiles
3103:1991(NZS)	Specification for sands for mortars and plasters
3122:2009(NZS)	Specification for Portland and blended cements (General and special purpose)
3661.2:1994(AS/NZS)	Slip resistance of pedestrian surfaces - Part 2: Guide to the reduction of slip hazards
3740:2010(AS)	Waterproofing of domestic wet areas
4586:2004(AS/NZS)	Slip resistance classification of new pedestrian surface materials
4858:2004(AS/NZS)	Wet area membranes
BRANZ Good Practice Guide	Tiling
NZBC B2/AS1	Durability
NZBC D1/AS1	Access Routes
NZBC E3/AS1	Internal Moisture

11.3 Tiling

11.3.1 Scope

Supply, install and finish all Tiling works, complete with all necessary components and accessories required for proper installation and performance, as specified herein and to the locations, layouts and details shown on the approved drawings. All aspects of this work shall be carried out to comply with the New Zealand Building Code and relevant standards, and in accordance with the approved project design documentation, and with any relevant product manufacturers' technical literature.

11.3.2 Requirements

11.3.2.1 Quality Assurance

Maintain and comply with industry-recognised quality control and assurance procedures to ensure that all stages of Tiling work are carried out to the highest standard.

11.3.2.2 Inspection & Acceptance of Tiling Work

Carry out all necessary pre-installation, installation and finishing inspections of Tiling for each area of work in accordance with the requirements of industry best practice recommendations and code of practice guidelines.

Complete all necessary Pre-Installation/Application Checklists prior to installing proprietary under-tile waterproofing systems and heating systems and floor levelling systems, and relevant Installation/Application Checklists.

Complete all necessary Installation/Application Sign-Off Certificates and before undertaking subsequent work or handing over.

11.3.3 Performance

11.3.3.1 Slip-Resistance Performance of Access Routes

Slip-Resistance Performance of Access Routes. The slip-resistance performance of tiled access routes, ramps and stairs shall comply with the requirements of NZBC D1/VM1 and NZBC D1/AS1.

11.3.3.2 Interior Wet Area Performance

Interior Wet Area Performance. The performance of tiled interior wet areas shall comply with the requirements of NZBC E3/AS1.

11.3.4 Interior Wet Area Tiles

11.3.4.1 Floor Tile - Selection 1

Interior Wet Area Tiles - Floor Tile, Selection 1 - as specified below. Tiles shall be true to shape; free of warp; accurate in dimensions to facilitate laying with minimum joint width; free of imperfections; and true to samples. Tiles shall be from the same batch where possible, and delivered with the original packaging and labeling intact.

Installed in accordance with AS 3958.1, as an interior wet area floor tile, to the locations, layout and details shown on the drawings.

11.3.5 Undertile Waterproofing

11.3.5.1 Interior Wet Area Tiles - 1-Part Liquid-Applied Membrane

Interior Wet Area Tiles - Undertile Waterproofing System: 1-Part Liquid-Applied Undertile Waterproofing Membrane - as specified below. A proprietary, 1-part, flexible liquid-applied waterproofing membrane system suitable for interior wet area tiling applications - including showers. Complete with all system components and accessories required for proper installation and performance. Applied to properly prepared substrates in strict accordance with the manufacturer's instructions to the locations and details shown on the approved drawings.

Brand & Product:

11.3.6 Co-operation

Co-operate with other trades to ensure that all preliminary and preparatory works are completed to specification and as shown on the drawings.

Coordinate with other trades to install tiling as required, and to ensure that:
- appropriate tolerances and clearances allow for adjacent finishes, fixtures and fittings, etc; and
- penetrations for piped and cabled services are correctly located to maintain tile integrity and tiling performance.

11.3.7 Workmanship

Where required by the NZ Building Act 2004, it is the building contractor's responsibility to ensure that all restricted building work is carried out by a Licensed Building Practitioner.

All Tiling work shall be carried out to best trade practice by qualified and experienced tradespersons, familiar with the specified materials and installation and finishing techniques, in accordance with AS 3958.1 and relevant product manufacturers' technical literature, to the layout and details shown on the approved drawings, and to fully comply with all warranty requirements.

Submit evidence of experience on request, e.g. National Certificate in Floor and Wall Tiling, or certified member of Master Plasterers and Tilers Association.

All substrate preparation, tile laying and tiling accessories application and finishing techniques shall be exactly as recommended by the specified product manufacturer. All work shall be such as to leave a neat, efficient and robust installation.

Interior wet-area tiling shall be waterproof and installed over a waterproof membrane as shown on the drawings.
Exterior floor tiling shall be waterproof and weathertight, and where necessary installed over a waterproof membrane as shown on the drawings.

As recommended by the tile manufacturer, use only an approved adhesive that is compatible with the specified tile, its substrate and its application/use.

Where necessary, delay tiling to allow maximum curing and settling and initial creep of the substrates, particularly to load bearing structural elements.

Do not cover or bridge movement control joints with tiles and tile underlay.

Tiling shall not be undertaken when the ambient and surface temperatures are outside the specified product manufacturer's permissible temperature range.

Where necessary, mask off and protect from contamination adjacent surfaces, joinery, fixtures and finished work before commencing.

Exterior tiling shall not be undertaken during inclement weather. As necessary and in accordance with the manufacturer's requirements, protect exterior tiling from rain, hot dry winds and direct sunlight to aid proper drying and curing.

Leave all tiled surfaces clean, sound, and free from blemishes of any kind.

11.3.8 Delivery & Handling

Upon delivery to site, inspect the tile packs and reject those items that are found to be damaged, defective or contaminated. Contact the supplier for replacement of rejected items at time of delivery to site.

Do not use damaged, defective or contaminated materials, or products that are beyond their designated shelf life.

Store all tiling materials undercover, in a weatherproof environment, off the floor, on a flat, even and level surface in accordance with the manufacturer's requirements. Keep products and materials dry, out of direct sunlight and protected from damage, moisture and contamination at all times.

Handle tiling materials in accordance with the manufacturer's requirements and in a manner that prevents damage to and contamination of the materials and works.

Installers shall be familiar with and comply with all associated product Safety Data Sheet precautions for use, and use appropriate safety gear when handling materials.

Installers shall conform with all relevant WorkSafe NZ Guidelines and Codes of Practice - including General risk and workplace management - part 1.

11.3.9 Completion

Check that all Tiling work has been correctly installed to the required layout, and that all tile joints, edge-trimming and other detailing is correctly finished, grouted and sealed.

Check all Tiling installations for damage, marks and defects - repair or replace as necessary. Carry out any repairs to the required standard.

Thoroughly clean tiled surfaces in accordance with the manufacturer's recommended procedures and techniques. Lightly buff where appropriate.

Leave this work complete and to the required standard, and in accordance with the associated warranty requirements.

Clean up thoroughly, and leave adjacent surfaces and finished work clean and free of damage and contamination. Remove all associated rubbish from site.

Protect the completed installation from damage, trafficable dirt and grime, and stains as necessary until hand-over as scheduled or directed.

Issue to the Owner a copy of all relevant product manufacturers' maintenance requirements, and a copy of relevant manufacturer Product Warranties and the installer/applicator Installation Warranty for the installed products and completed works.

12 PLUMBING

12.1 Preliminary

Refer to General Conditions of Contract and the Special Conditions in this Specification as appropriate. Read this section in conjunction with all other trade sections.

12.2 Compliance

Comply with the New Zealand Building Code 1992 including all revisions and amendments, Verification Methods where appropriate, and construction principles that are embodied in the Acceptable Solutions.

Comply with all relevant provisions and recommendations of:

3500.2:2021 (AS|NZS)	Plumbing and drainage Part 2: Sanitary plumbing and drainage
NZBC G13/AS1	Sanitary Plumbing

12.3 General

Carry out all works necessary to leave the water, waste, vent and soil systems serving the sanitary fittings and the plumbing hardware shown on the drawings or specified below in correct working order complete with all ancillary systems (safetrays, floor drains, overflows, relief valves, etc.) required, and with all normal incidentals customarily installed by this trade.

Comply with the Building Code, Territorial Authority By-laws and statutory authority Regulations as appropriate. Obtain all necessary permits and consents, serve all necessary notices, arrange for all tests and pay all fees and customary charges in connection with the required works.

12.4 Materials

12.4.1 Materials

Materials shall be delivered with packaging and labeling intact. Incidentals (jointing compounds, PTFE tape, seals, washers, silfos, solvent cements, etc.) shall be completely appropriate for the application involved. The use of imperfect items or items damaged in any way is always subject to approval.

12.4.2 Materials Separation

Separate dissimilar metals in any circumstances which could produce contact or electrolytic action by a water film, with thick plastic tape, bituminous felt or other inert material. Pipes in contact with or built into concrete or masonry shall be fully spiral wrapped in Denso tape or equal.

12.5 Workmanship

12.5.1 Co-operation

Co-operate with all other trades. Attend upon Concretor, Drainlayer and Carpenter to set out the exact positions of pipe runs before adjacent work is put in hand, and to ensure that all pipes, sleeves, fixings, flashings etc. are correctly incorporated into the structure as construction proceeds.

12.5.2 Workmanship

All plumbing work shall be carried out by, or under the direct control of, properly qualified tradesmen, and shall be to recognised high standards.

Observe best local trade practice to avoid problems which arise from freezing winter conditions.

The cutting away and checking of timbers shall be limited to such dimensions as will not prejudice the purpose for which the timber is used; observe NZS 3604 restrictions on the holing and checking of joists and beams. Chasing and checking of other materials only to approval. Install seismic restraints to storage tanks and HWCs.

Weatherseal wherever pipes, screws, bolts or other fastenings penetrate an external surface, and particularly roofing; seal with gaskets, flashings (and overflashings if necessary) or mastic as appropriate - any damage that results from failure of such seals will be made good at the Plumber's expense.

Adequately protect all surfaces. Any damage to fittings or surfaces made good by the appropriate trade at the Plumber's expense.

12.5.3 Pipework

Joints between pipes of different materials shall always be to the approval of the TA Plumbing Inspector.

Pipework set-out neatly with a minimum number of bends, and more or less parallel to and at right angles to structural elements - avoid diagonal piping.

All internal pipework shall be concealed except where otherwise is either shown or approved. Exposed pipework shall be accurately and neatly run. Arrange all pipework (and particularly traps) in a manner which will allow maximum future accessibility for repairs or maintenance. Arrange for access panels to any primary maintenance positions, and install conveniently located isolating valves for each group of fittings. Wingbacks securely and squarely fixed. Crox unions usually acceptable only at the final connection to fittings. Install white plastic flanges where pipes penetrate linings in visible locations.

Where pipes are covered with nail fixed linings and trim ensure that their positions are marked on the linings to minimise the risk of subsequent nailings penetrating the pipe. Any such damage shall be rectified immediately, with all consequential damage made good.

Set pipework out in straight runs to even gradients. Fix all pipes to the structure sufficiently to fully support and to prevent sagging or vibration. Clips and saddles shall be the same material as the pipe. Exterior pipes on stand-off brackets. Fixings to the exterior or damp locations shall all be hot dip galvanized unless otherwise noted. Sleeves for pipes or drains penetrating concrete or masonry shall be uPVC, 20mm minimum larger internal diameter than the external diameter of the pipe, finished flush with concrete or masonry, and packed and mastic sealed.

Close open ends of the systems during construction to prevent the entry of foreign matter.

12.5.4 Temperature Movement

All work shall respect in full all probable thermal movements - layouts, fixings and jointings shall be arranged to allow thermal movement without risk of prejudice to watertight conditions, or risk of damage from straining of the pipes which will generate failures.
In particular, observe best local trade practice to avoid problems arising from freezing conditions.

12.5.5 Excavation

Allow to carry out all excavation that is required to suit the services installed by this trade. Check for other services before excavation. Trenches true to line and level, base of trenches clear of loose material, and shore trenches as required to suit the ground conditions. Backfilling shall be carried out by this trade, and be to the requirements specified in Siteworks.

12.5.6 Testing

All plumbing services shall be completed in stages which will allow for proper testing under normal working pressures prior to the application of insulation, concealment or other enclosure. Testing of piped water services shall be by hydrostatic testing in accordance with AS/NZS 3500.1 and shall not show any leakage when subjected to a hydrostatic pressure of 1500kPa for a period of not less than 30 minutes. All leaks remedied and retested. On completion the whole of the plumbing services to be subjected to full operational tests in the presence of the plumbing inspector, with any defects revealed in these tests properly remedied.

13 DRAINAGE

13.1 Preliminary

Refer to General Conditions of Contract and the Special Conditions in this Specification as appropriate. Read this section in conjunction with all other trade sections.

13.2 Compliance

Comply with the New Zealand Building Code 1992 including all revisions and amendments, Verification Methods where appropriate, and construction principles that are embodied in the Acceptable Solutions.

Comply with all relevant provisions and recommendations of:

1254:2010(AS/NZS)	PVC-U pipes and fittings for stormwater and surface water applications
1260:2017(AS|NZS)	PVC-U pipes and fittings for drain, waste and vent applications
1546.1:2008(AS/NZS)	On-site domestic wastewater treatment units - Septic tanks
1547:2012(AS/NZS)	On-site domestic wastewater management
2032:2006(AS/NZS)	Installation of PVC pipe systems
3500.0:2003(AS/NZS)	Plumbing and drainage - Glossary of terms
3500.2:2018(AS|NZS)	Plumbing and drainage Part 2: Sanitary plumbing and drainage
3500.2:2021 (AS|NZS)	Plumbing and drainage Part 2: Sanitary plumbing and drainage
3500.3:2018(AS|NZS)	Plumbing and drainage Part 3: Stormwater drainage
7643:1979(NZS)	Code of practice for the installation of unplasticized PVC pipe systems
NZBC G13/AS2	Foul Water Drainage

13.3 General

Carry out all required works to leave the sewer and stormwater systems shown on the drawings in correct working order complete with all normal incidentals.

Comply with Local Authority By-laws and Health Department Regulations as appropriate. Obtain all necessary permits and consents, serve all necessary notices, arrange all tests and pay all fees and customary charges in connection with the works.

13.4 Workmanship

13.4.1 General

Carry out all required works to leave the sewer and stormwater systems shown on the drawings in correct working order complete with all normal incidentals. Comply with Local Authority By-laws and Health Department Regulations as appropriate. Obtain all necessary permits and consents, serve all necessary notices, arrange all tests and pay all fees and customary charges in connection with the works.

13.4.2 Co-operation

Cooperate with all trades and attend upon the Concretor and Plumber to set out exact pipe runs before any adjacent work is put in hand and ensure that all sleeves etc. are correctly incorporated as work proceeds.

13.4.3 Materials

All pipes and other materials shall comply with the appropriate Standards, and shall be protected from damage of any kind until installation is complete. All incidentals appropriate for the applications involved. Concrete shall be 17.5MPa and as specified under Concretor, Mortar shall be as specified in Blocklayer.

13.4.4 Workmanship

All drainlaying shall be carried out by, or under direct control of, properly qualified tradesmen, and shall be to recognised high standards. Ensure cast-in items are installed when required so that no delay is caused by this trade. Adequately protect all adjacent surfaces - clean down to remove dirt etc., and any damage shall be made good by the appropriate trade at the Drainlayer's expense.

On completion of drainlaying clean up full area affected by this trade to the condition it was in before drainlaying commenced.

Site is to be returned as close as possible to its present condition on completion of the contract.

13.4.5 Excavation

As required for sewer and stormwater. Check for other service lines before excavation - the Drainlayer is responsible for making good any damage. Trenches true to line and with even gradients between gullies, soil stack terminations or downpipes, etc.

Keep the bottom of trenches clear of loose material. All pipes shall be laid in appropriate bedding material, compacted as required. Shore trenches if required to suit ground conditions. Backfilling shall be by this trade, to the standards required in Siteworks.

13.5 Drainlaying Elements

13.5.1 Drainlaying

Commence drainlaying at the low end of even fall sections of drains and proceed in a continuous sequence to the fittings connections.

Sumps, gullies, etc. solidly bedded. Lay 110mm uPVC drains to connect gullies, sumps, stacks, and downpipes through to the street edge connections.

Every junction and bend shall be an inspection position. Temporarily seal the open ends of incomplete drains to prevent entry of foreign matter. Make appropriate provision for any anticipated differential settlement. Place signal strip above all drains.

Ensure that stormwater drains are very accurately positioned so that downpipes can drop directly into them, without offsets.

13.5.2 Testing

The sewer and stormwater systems shall both be fully tested to the approval of the Territorial Authority Inspector before being covered in. If any defects show rectify and then fully retest.

13.5.3 As Built Drawings

During drainlaying plot the location of all bends and changes in direction and all cleaning access positions. Locate each item by two diagonal measures from structure corners, etc. and record on a blank plan copy (supplied by Architect/Designer when requested).

Note that Practical Completion of the contract will not be certified until this as-built drawing has been produced (made available to the Contractor in time for the Code Compliance Certificate application.

13.6 Foul Water Drainage

13.6.1 Scope

Supply, install, test and commission new, gravity-flow foul water drains on the site, to the locations, layout and details shown on the drawings, complete with all necessary components and accessories required for satisfactory completion and performance of the foul water drainage system. All aspects of this works shall comply with the requirements of the NZ Building Code, related compliance Standards, Regulations and Acts, and to the requirements of the Territorial Authority, and as specified herein and on the approved drawings and schedules. Ancillary work and/or services not specifically mentioned but necessary to complete the work to specified levels of performance shall be deemed included.

Install foul water drains in natural ground, beneath and external to the building, for the distances indicated on the drawings. Allow for all ventilation requirements, inspection openings, bends, branches, manholes, inspection chambers, overflow gully traps, etc., as required and indicated on the drawings. Unless shown otherwise, the foul water drains shall be connected to the building's sanitary drainage system, and discharge to the foul water network.

The foul water drainage plans are diagrammatic only. Allow for all necessary vents, inspection fittings, cleaning eyes, traps and venting in accordance with AS/NZS 3500.2 and to comply with the New Zealand Building Code, and as required by the Territorial Authority. Refer to the drawings for the dimensioned locations of sanitary waste pipes and outlets.

13.6.2 Requirements

13.6.2.1 Safety

Comply with the Health and Safety at Work Act 2015 (HSWA), and with all relevant Health and Safety at Work Regulations 2016, and with all relevant WorkSafe New Zealand (WorkSafe) Approved Codes of Practice and WorkSafe Information and Guidance, including WorkSafe's General Risk and Workplace Management - Part 1 and Workplace and Facilities Requirements guidance.

Carry out all construction operations in accordance with the Contractor's project-specific Health and Safety Plan.

13.6.2.2 Compliance

Obtain all necessary permits and consents, serve all necessary notices, arrange all tests and pay all fees and customary charges in connection with the foul water drainage works.

The Drain Layer shall be deemed to have allowed for all work associated with the safe and orderly execution of the foul water drainage work, including complying with all Territorial Authority requirements, Building Consent, Building Act, Health and Safety requirements, and all other acts, laws, by-laws and regulations that may affect the execution of the work.

13.6.2.3 Inspections

Inspections of foul water drainage works shall take place at each of the stages as scheduled in the Building Consent. Confirm a written programme to facilitate these inspections, including notification when each stage of the work is ready for inspection.

Obtain and pay all fees for any required inspections which are additional to the Building Consent.

13.6.2.4 Testing

Carry out all necessary testing of the foul water drainage installations, and demonstrate to the Contract Administrator and the controlling Territorial Authority that the installations are watertight and comply with the requirements of the New Zealand Building Code, related compliance Standards, and the design documents.

13.6.2.5 Co-operation

Co-operate with other trades to ensure that all preliminary and preparatory works are completed to specification and as shown on the drawings.

Coordinate with other trades as necessary to install foul water drains to the required locations and layouts.

13.6.2.6 Workmanship

Foul water drainage work shall be carried out by qualified and experienced tradespersons, familiar with the required installation requirements, under the direct supervision of a NZ certified Registered Drainlayer, in accordance with AS/NZS 3500.2 in compliance with the New Zealand Building Code, and all local codes and regulatory authority requirements, and the conditions of the Building Consent.

All pipe cutting, jointing, and supporting techniques shall be exactly as recommended by the pipe manufacturer. Pipes, fittings and accessories shall be handled and installed in such a manner that prevents any damage to the component.

All work shall be such as to leave a neat, efficient, robust and watertight installation.

Carry out all necessary inspections and tests during installation to ensure compliance with the design specifications and regulatory requirements. Provide test result sheets to the Contract Administrator to show compliance has been achieved.

Take all necessary measures during installation to protect the foul water drainage system from damage, and to prevent the entry of:
- extraneous water;
- soil, sand, or rock,
- the contents of any septic tank; or
- any other substance, the discharge or which could impede the operation of the foul water drainage network.

Ensure that any installed drain is adequately protected from any damage and excessive loading during the remaining construction period.

Protect adjacent finished work and surfaces from damage and contamination during installation. Any damage to fittings or finished surfaces shall be made good by the appropriate trade at the Drain Layer's expense.

Any associated electrical wiring and prescribed electrical work (by others) shall be carried out by a qualified electrician in accordance with the electrical standards and regulations and the Electrical specification.

13.6.2.7 Delivery & Handling

Store foul water drain pipes and accessories undercover, out of direct sunlight, clear of the ground, on an even surface, and protected from damage and contamination in accordance with the manufacturer's requirements. Keep pipes and accessories out of direct sunlight and protected from damage and contamination at all times.

Where possible, store pre-packed PVC pipes in the original delivery crate.
Store loose PVC pipes on evenly spaced bearers at maximum 1.0m centres, with pipe sockets alternated so the the sockets do not bear on each other, and with side supports if pipes are stacked more than two layers high. When loose PVC pipes are stacked in a pyramid, the maximum stack height shall be 1.0m and the bottom pipes shall be chocked.

Do not used damaged or faulty materials or products, or products that are beyond their designated shelf life. Do not use PVC materials that have been exposed to or stored in direct sunlight longer than the period specified by the manufacturer.

Handle all products and materials in accordance with the manufacturer's requirements, and in a manner that prevents damage or deterioration of the material/product.

Installers shall be familiar with and comply with manufacturer's Material Safety Data Sheet precautions for use, and use appropriate safety gear when handling materials.

Comply with the Health and Safety at Work Act 2015 (HSWA), and with all relevant Health and Safety at Work Regulations 2016, and with all relevant WorkSafe New Zealand (WorkSafe) Approved Codes of Practice and WorkSafe Information and Guidance, including WorkSafe's General Risk and Workplace Management - Part 1 and Workplace and Facilities Requirements guidance.

13.6.2.8 As-Built Drawings

On completion and before application for Code Compliance Certificate, prepare As-Built Drawings of the foul water drainage system, that accurately record the new and/or modified foul water drainage installation.

Information shall include, but not limited to, type, class and size of all pipes, the location, grade and direction of flow of all pipes, the location of all bends, changes in direction, cleaning access positions, manholes, and all dimensions, levels, inverts, etc.

Submit prepared as-built drawings to the Contract Administrator for review. Issue as-built drawings in accordance with the Contract Administrator's instruction, and in the required format.

13.6.3 Trench Excavation

13.6.3.1 Clearing of Surfaces

Where trenches are to be excavated in a grassed area, garden or a berm, the topsoil shall be stripped from the area of the excavation and stockpiled separately adjacent to the trench for use in reinstating the surface.

Where trenches are to be excavated in existing concrete or asphalt paved areas, the paving shall be cut to neat, straight lines, parallel to the trench prior to excavation, with a nominal 100mm trimming allowance either side of the excavation width. The excavation shall be carried out with minimal damage to the existing paved surface.

Where trenches are to be excavated in existing segmental paved areas, the pavers shall be removed by hand, cleaned and set aside for later reinstatement.

Subsequent trench backfill shall be adequately compacted to avoid subsidence of reinstated surfaces.

13.6.3.2 Excavation

Locate all existing buried services before commencing excavation work in any area.

Excavations for trenches and pits shall be properly executed and supported in accordance with the requirements of AS/NZS 3500.2.

Carry out excavation work to comply with all relevant health and safety regulations and guidelines, including the 'Excavation Safety - Good Practice Guidelines' where appropriate.

Unless specified otherwise, the excavation of trenches shall be taken out by open cut to the levels and grades shown or implied on the drawings. Excavate trenches to the depths which will provide for the appropriate type of bedding.

Trench excavations shall be of sufficient width to allow all operations necessary for the jointing of pipes and placing of the specified backfill. The bottom width of the trenches shall at least the combined measurement of the outside diameter of the pipe plus 200mm - with a minimum clearance of 100mm on each side of the drain barrel. The trench width at the top of the pipe shall not exceed the outside diameter of the pipe plus 600mm unless the pipe in the trench is covered with concrete. The trench above the top of the pipe may be cut wider, either by excavating a wider bench or by battering the trench wall.

13.6.3.3 Shoring

Make all necessary provisions for shoring trench walls to comply with all regulations and for health and safety measures.

Trench shoring materials and equipment must be suitable for the purpose for which they are to be used, of sound quality, and adequate in strength for the particular use.

Shoring shall be placed by experienced operators under competent supervision, and shall not be altered, dismantled, or interfered with except on the instruction of the authorised supervisor.

Ensure no voids are left in the backfill when shoring is removed, and the required compaction density of the backfill is achieved.

13.6.3.4 Dewatering

Take all necessary precautions to keep trenches and pits free from water. Provide all necessary pumps, drainage pipes and other equipments required for dewatering. Install all necessary filtering and detention measures required by the Territorial Authority.

If the bottom of the trench is likely to be adversely affected by rain, remove the final 80mm of excavation as a separate operation immediately before placing the bedding material.

13.6.4 Pipe Laying

13.6.4.1 Bedding Pipes

Provide a minimum 75mm thick underlay layer of well compacted bedding material for all pipes. A chase shall be excavated in the bedding to accommodate any jointing socket or fitting in the drain. The pipe embedment material shall be laid and compacted so that the pipe is evenly and continuously supported along its length on either side of the pipe, and with an overlay layer minimum 150mm thick.

When trench support systems are used, the bedding material shall be placed and compacted in a manner so that no loss of compaction results from removal of the trench side support systems. The trench support shall be removed in such a way as to ensure that the placing and compaction of the bedding material occurs below the trench supports and directly against the undisturbed ground of the trench walls.

After completion of the jointing and inspection of drain pipes, place and compact the bedding surround material around the pipe to the required depth over the pipe. The material shall be carefully placed around and over the pipe using hand tamping and in a manner that ensures the pipe is uniformly supported all round its perimeter and without voids. Take care during placement and compaction to ensure the pipe is not displaced or damaged.

13.6.4.2 Laying Pipes

Install foul water drains in accordance with AS/NZS 3500.2 to the layout, levels and grades shown on the drawings Drain pipes shall be laid to provide maximum falls, in straight lines and at an even grade, without obstruction to flow, and with full allowance for bedding.

Before installing the pipes, check the bore of each pipe is free from foreign matter and that the pipe exterior and the socket have not been damaged in handling or storage. All pipelines shall be kept clean and free of dirt and debris at all times during installation, testing and commissioning.

PVC-U foul water drain pipes shall be properly jointed (rubber ring joint or solvent welded joint) to produce a watertight seal in accordance with the manufacturer's instructions.

Start laying main drains at the point of outfall and insert junctions for branch drains as the work proceeds. Pipes shall be laid with the least number of bends, in the centre of the trench, in straight lines between bends, and to the grades and locations shown on the drawings.

Install all necessary fittings, including vents, inspection openings and access points, bends and junctions, to the locations shown on the drawings and in accordance with the manufacturer's

instructions. Where not specified on the drawings or schedules, fittings for inspection openings, bends, junctions, etc., shall be selected from the PVC pipe system range of products and installed in accordance with the manufacturer's instructions.

Other than precautions against damage by displacement or floating pipes, no bedding surround material or backfill shall be placed until the laying of the drain has been inspected by the Territorial Authority.

13.6.4.3 Underground Drains Near & Under Buildings

Protect underground drains near and under buildings against damage in accordance with AS/NZ 3500.2 where the minimum cover specified cannot be provided.

13.6.4.4 Concrete Support

Concrete pads used to support foul water drains, gully traps, risers, etc., shall be minimum 100mm thick and in accordance with AS/NZS 3500.2: Section 5.3.

13.6.4.5 Jointing - Solvent Cement Welded Joints

Solvent welded joints shall only be used for jointing PVC-U pipes and fittings where rubber-ring jointed fittings are not manufactured. Use only cleaner primers and solvent cements specified by the manufacturer for the application and socket type. Only sockets complying with the relevant Standard shall be installed. Do not use cleaner primers or solvent cements if the 'use by' date has expired. The marking of pipes by scoring is not permitted. All joints shall be watertight and prevent the infiltration of groundwater and the intrusion of tree roots.

Solvent welded joints shall be assembled in accordance with the manufacturer's instructions and generally as follows:
- Solvent welding shall only be carried out in dry conditions above 5°C.
- Ensure the components are dry, clean and free of dust, dirt, grease and surface contaminants during all stages of the jointing process.
- Prior to welding, the components shall be assembled dry and checked for position and alignment to ensure accurate re-assembly in the correct position.
- Mark the spigot with a witness mark (pencil, not scored) at a distance equivalent to the internal depth of the socket.
- Dry the spigot end, up to the witness mark, and the socket interior, then clean and degrease with a clean cloth moistened with the pipe or fitting manufacturer’s specified priming fluid.
- Apply an even coating of solvent cement to the internal surface of the socket for the full engagement length, and to the external section of the spigot up to the witness mark.
- Only use the minimum amount of solvent cement in the socket necessary for a fully solvent-welded joint.
- Insert the spigot close to, but not beyond, the witness mark. Do not use excessive force. Firmly restrain the joint for the minimum period recommended by the pipe manufacturer.
- Wipe off excess solvent cement from the outside of the joint, and where possible from the inside.
- Adhere to the manufacturer's specified procedures and time frames for filling and testing pipework.
- Allow all solvent welded joints to fully cure before subjecting pipework to any imposed load or testing.

13.6.4.6 Pipe Cover

Unless specified otherwise on the drawings, the minimum pipe cover (finished surface to top of pipe) shall be:

- where not subject to vehicular loading: 300mm.
- where subject to vehicular loading - not in roadways: 500mm.
- where subject to vehicular loading - in sealed roadways: 500mm.
- where subject to vehicular loading - in unsealed roadways: 500mm.
- pipes in embankment conditions or subject to loading from heavy construction equipment: 750mm.

13.6.4.7 Marking Tape

Install marking tape on top of the pipe embedment zone and centred over the pipe before commencing backfilling.

13.6.5 Connection

13.6.5.1 Public Network - Boundary Connection

Connect to discharge the foul water drainage line directly to the public mains street-edge/boundary connection in accordance with the requirements of the Territorial Authority and as shown on the drawings.

13.6.6 Testing

13.6.6.1 Foul Water Drains

Test the foul water drainage installation, including all drains, connections and system components, for water tightness in accordance with the requirements of the Territorial Authority (TA).

Where required by the Territorial Authority, the testing shall be undertaken in the presence of a representative of the TA. Demonstrate to the Contract Administrator and the Territorial Authority that the installation complies with the requirements of the contract documents, related standards and regulatory bodies. Lodge all certificates of approval with the Contract Administrator.

Unless specified otherwise by the Territorial Authority, the test method shall be the Water Test procedure for non-pressure pipelines as defined in AS/NZS 2302. Where appropriate, the procedures in NZBC E1/VM1 may be used as an alternative. The acceptability of other test methods are be subject to the approval of the Territorial Authority and the Contract Administrator.

Provide all necessary plant, equipment and instruments required for the specified testing procedure. All testing and commissioning shall be undertaken by suitably skilled and experienced technicians.

Pressure testing shall be carried out after the pipes have been laid and the bedding material has been placed over the pipes as specified.

Prior to testing ensure that all pipe junctions and inspection eyes are exposed, and pipelines have been flushed and all residual debris cleaned out.

Foul water manholes shall be tested for watertightness by plugging all pipes and filling with water. After absorption has taken place the water level shall remain constant for thirty minutes.

Test results shall be recorded clearly on properly formatted Test Result sheets, and submitted to the Contract Administrator within 48 hours of completion of testing.

Repair or replace any materials or workmanship found to be defective or faulty during testing, and repeat the test until a satisfactory test result is achieved.

Leave the installation watertight and free of defects, and operating to the required performance standard.

The work shall be deemed incomplete unless all required testing and commissioning has been carried out and has passed the requirements of the testing specification and the Territorial Authority.

13.6.6.2 Water Test Procedure - to AS/NZS 2302

Water test procedure of foul water drains (non-pressure) - to AS/NZS 2302: Section 7.3.2.
- The pipeline shall be filled with water to a height of not less than 1m above the natural ground level at the highest point of the section being tested, or to the flood level of the lowest sanitary fixture, but not exceeding 5m at the lowest point of the test section.
- The pressure shall be maintained without leakage for at least 15 minutes.
- The source of any leaks shall then be ascertained and any defects repaired.
- The pipeline shall then be retested.

Note: Testing should not be carried out if groundwater is present above the pipeline. If groundwater is present, the test pressure should be increased to compensate for the depth of groundwater at a rate of 10 kPa for every 1m of groundwater depth.

13.6.7 Backfilling

13.6.7.1 Backfilling

Trenches shall be backfilled as soon as possible after the laying, inspecting and testing of the pipeline.

Where required, lay marker tape along the length of the drain, just above the top of the pipe embedment zone, before backfilling.

Trench backfill materials shall be placed over the pipe embedment, and compacted to restore the trench as near as practicable to the normal surrounding ground surface level and reduce the likelihood of subsidence. Backfill material shall be placed in uncompacted layers not exceed 300mm, then mechanically compacted to the required density.

Temporary trench support systems shall be lifted progressively above each layer of backfill to ensure each layer is compacted against undisturbed ground.

Any deficiencies of trench filling exposed by settlement shall be corrected to the required standard.

13.6.8 Reinstatement of Surfaces

13.6.8.1 Reinstatement of Surfaces

Refer to separate specification section - Siteworks - Reinstatement of Surfaces.

Ground and paved surfaces above excavated foul water drainage trenches shall be reinstated to the standard specified. Reinstatement shall generally achieve a standard equal to or better than the pre-existing situation - in no case will a lower standard be accepted.

Hedges, fences and other features to be retained that have been damaged or removed during the work shall be reinstated to the satisfaction of the Contract Administrator.

13.7 Stormwater Drainage

13.7.1 Scope

Supply, install, test and commission new, gravity-flow stormwater drains on the site, to the locations, layout and details shown on the drawings, complete with all necessary components and accessories required for the satisfactory completion and performance of the stormwater system. All aspects of this works shall comply with the requirements of the NZ Building Code, related compliance Standards, Regulations and Acts, and to the requirements of the Territorial Authority, and as specified herein and on the design drawings and schedules. Ancillary work and/or services not specifically mentioned but necessary to complete the installation shall be deemed included.

Install stormwater drains in natural ground, beneath and/or external to the building, for the distances indicated on the drawings. Allow for all inspection openings, bends, branches, manholes, inspection chambers, etc., as required and indicated on the drawings. Unless shown otherwise on the drawings, the stormwater drains shall be connected to the roof and surface stormwater installations, and discharge to the stormwater network.

The stormwater drainage plans are diagrammatic only. Allow for all necessary inspection fittings, cleaning eyes, and traps in accordance with AS/NZS 3500.3 and to comply with the New Zealand Building Code, and as required by the Territorial Authority. Refer to the drawings for the dimensioned locations of roof drainage system rainwater pipes and outlets, and surface drainage outlets, etc.

13.7.2 Requirements

13.7.2.1 Safety

Comply with the Health and Safety at Work Act 2015 (HSWA), and with all relevant Health and Safety at Work Regulations 2016, and with all relevant WorkSafe New Zealand (WorkSafe) Approved Codes of Practice and WorkSafe Information and Guidance, including WorkSafe's General Risk and Workplace Management - Part 1 and Workplace and Facilities Requirements guidance.

Carry out all construction operations in accordance with the Contractor's project-specific Health and Safety Plan.

13.7.2.2 Compliance

Obtain all necessary permits and consents, serve all necessary notices, arrange all tests and pay all fees and customary charges in connection with the stormwater drainage works.

The Drain Layer shall be deemed to have allowed for all work associated with the safe and orderly execution of the stormwater drainage work, including complying with all Territorial Authority requirements, Building Consent, Building Act, Health and Safety requirements, and all other acts, laws, by-laws and regulations that may affect the execution of the work.

13.7.2.3 Work on Public Property

Excavation and reinstatement of public property shall comply with the requirements of the relevant controlling authorities.

Obtain all necessary approvals and permits from the controlling authorities before commencing work on public property.

Arrange and pay for any excavation and reinstatement inspections of public property required by the controlling authorities.

Before commencing any excavation in or reinstatement work to public footpaths, driveway crossings, roads or other public property, make all necessary enquiries to the relevant controlling authority for their standards for excavation and reinstatement.

Provide at all times, adequate safeguards to the public in respect of temporary fences, signals, signs and lights. Where traffic signs are necessary, these shall be provided and operated in accordance with the Regulatory Authority or NZ Transport Agency (NZTA) guidelines, as applicable, but erected only with the prior written approval of the Regulatory Authority or NZTA and the Contract Administrator.

Where a Traffic Management Plan (TMP) is required, prepare, operate and update this plan as necessary throughout the duration of the works. The TMP shall conform to the requirements of the Regulatory Authority or NZTA, as applicable. Obtain TMP prior-approvals, and maintain the TMP for the entire construction duration.

Remove dirt and contamination deposited on public property to the satisfaction of the controlling authorities.

13.7.2.4 Inspections

Inspections of stormwater drainage works shall take place at each of the stages as scheduled in the Building Consent. Confirm a written programme to facilitate these inspections, including notification when each stage of the work is ready for inspection.

Obtain and pay all fees for any required inspections which are additional to the Building Consent.

13.7.2.5 Testing

Carry out all necessary testing of the stormwater drainage installations, and demonstrate to the Contract Administrator and the Territorial Authority that the installations are watertight and comply with the requirements of the New Zealand Building Code, related compliance Standards, and the design documents.

13.7.2.6 Co-operation

Co-operate with other trades to ensure that all preliminary and preparatory works are completed to specification and as shown on the drawings.

Coordinate with other trades as necessary to install stormwater drains to the required locations and layout.

13.7.2.7 Workmanship

Stormwater drainage work shall be carried out by qualified and experienced tradespersons, familiar with all required installation requirements, under the direct supervision of a NZ certified Registered Drain Layer, in accordance with AS/NZS 3500.3 and to comply with the New Zealand Building Code, and all local codes and regulatory authority requirements, and the conditions of the Building Consent.

All pipe cutting, jointing, and supporting techniques shall be exactly as recommended by the pipe manufacturer. Pipes, fittings and accessories shall be handled and installed in such a manner that prevents any damage to the component.

All work shall be such as to leave a neat, efficient, robust and watertight installation.

Carry out all necessary inspections and tests during installation to ensure compliance with the design specifications and regulatory requirements. Provide test result sheets to the Contract Administrator to show compliance has been achieved.

Take all necessary precautions during installation to protect the stormwater drainage system from damage, and to prevent the entry of:
- soil, sand, or rock;
- sewage, including the contents of any septic tank, or trade waste; or
- any other substance that could damage or impede the operation of the stormwater drainage network.

Ensure that any installed drain is adequately protected from any damage and excessive loading during the remaining construction period.

Protect adjacent finished work and surfaces from damage and contamination during installation. Any damage to fittings or finished surfaces shall be made good by the appropriate trade at the Drain Layer's expense.

Any associated electrical wiring and prescribed electrical work (by others) shall be carried out by a qualified electrician in accordance with the electrical standards and regulations and the Electrical specification.

13.7.2.8 Delivery & Handling

Store stormwater drain pipes and accessories undercover, out of direct sunlight, clear of the ground, on an even surface, and protected from damage and contamination in accordance with the manufacturer's requirements. Keep pipes and accessories out of direct sunlight and protected from damage and contamination at all times.

Store loose PVC-U pipes on evenly spaced bearers at maximum 1.0m centres, with pipe sockets alternated so the the sockets do not bear on each other, and with side supports if pipes are stacked more than two layers high. When loose PVC-U pipes are stacked in a pyramid, the maximum stack height shall be 1.0m and the bottom pipes shall be chocked.

Do not used damaged or faulty materials or products, or products that are beyond their designated shelf life. Do not use PVC-U materials that have been exposed to or stored in direct sunlight longer than the period specified by the manufacturer.

Handle all products and materials in accordance with the manufacturer's requirements, and in a manner that prevents damage or deterioration of the material/product.

Installers shall be familiar with and comply with manufacturer's Material Safety Data Sheet precautions for use, and use appropriate safety gear when handling materials.

Comply with the Health and Safety at Work Act 2015 (HSWA), and with all relevant Health and Safety at Work Regulations 2016, and with all relevant WorkSafe New Zealand (WorkSafe) Approved Codes of Practice and WorkSafe Information and Guidance, including WorkSafe's General Risk and Workplace Management - Part 1 and Workplace and Facilities Requirements guidance.

13.7.2.9 As-Built Drawings

On completion and before application for Code Compliance Certificate, prepare As-Built Drawings of the stormwater drainage system, that accurately record the new and/or modified stormwater drainage installation.

Information shall include, but not limited to, type, class and size of all pipes, the location, grade and direction of flow of all pipes, the location of all bends, changes in direction, cleaning access positions, manholes, and all dimensions, levels, inverts, etc.

Submit prepared as-built drawings to the Contract Administrator for review. Issue as-built drawings in accordance with the Contract Administrator's instruction, and in the required format.

13.7.3 Trench Excavation

13.7.3.1 Clearing of Surfaces

Where trenches are to be excavated in a grassed area, garden or a berm, the topsoil shall be stripped from the area of the excavation and stockpiled separately adjacent to the trench for use in reinstating the surface.

Where trenches are to be excavated in existing concrete or asphalt paved areas, the paving shall be cut to neat, straight lines, parallel to the trench prior to excavation, with a nominal 100mm trimming allowance either side of the excavation width. The excavation shall be carried out with minimal damage to the existing paved surface.

Where trenches are to be excavated in existing segmental paved areas, the pavers shall be removed by hand, cleaned and set aside for later reinstatement.

Subsequent trench backfill shall be adequately compacted to avoid subsidence of reinstated surfaces.

13.7.3.2 Excavation

Locate all existing buried services before commencing excavation work in any area.

Excavations for trenches and pits shall be properly executed and supported in accordance with the requirements of AS/NZS 3500.3.

Carry out excavation work to comply with all relevant health and safety regulations and guidelines, including the 'Excavation Safety - Good Practice Guidelines'.

Unless specified otherwise, the excavation of trenches shall be taken out by open cut to the levels and grades shown or implied on the drawings. Excavate trenches to the depths which will provide for the appropriate type of bedding.

Trench excavations shall be of sufficient width to allow all operations necessary for the jointing of pipes and placing of the specified backfill. The bottom width of the trenches shall at least the

combined measurement of the outside diameter of the pipe plus 200mm - with a minimum clearance of 100mm on each side of the drain barrel. The trench width at the top of the pipe shall not exceed the outside diameter of the pipe plus 600mm unless the pipe in the trench is covered with concrete. The trench above the top of the pipe may be cut wider, either by excavating a wider bench or by battering the trench wall.

Where a trench has been excavated deeper than required without authorisation, the excess depth shall be filled either with bedding material compacted to achieve a density as near to the original soil density as possible, or with concrete.

13.7.3.3 Shoring

Make all necessary provisions for shoring trench walls to comply with all regulations and for health and safety measures.

Trench shoring materials and equipment must be suitable for the purpose for which they are to be used, of sound quality, and adequate in strength for the particular use.

Shoring shall be placed by experienced operators under competent supervision, and shall not be altered, dismantled, or interfered with except on the instruction of the authorised supervisor.

Ensure no voids are left in the backfill when shoring is removed, and the required compaction density of the backfill is achieved.

13.7.3.4 Dewatering

Take all necessary precautions to keep trenches and pits free from water. Provide all necessary pumps, drainage pipes and other equipments required for dewatering. Install all necessary filtering and detention measures required by the Territorial Authority.

If the bottom of the trench is likely to be adversely affected by rain, remove the final 80mm of excavation as a separate operation immediately before placing the bedding material.

13.7.4 Pipe Laying

13.7.4.1 Bedding Pipes

Provide a minimum 75mm thick underlay layer of well compacted bedding material for all pipes. A chase shall be excavated in the bedding to accommodate any jointing socket or fitting in the drain. The pipe embedment material shall be laid and compacted so that the pipe is evenly and continuously supported along its length on either side of the pipe, and with an overlay layer minimum 150mm thick.

When trench support systems are used, the bedding material shall be placed and compacted in a manner so that no loss of compaction results from removal of the trench side support systems. The trench support shall be removed in such a way as to ensure that the placing and compaction of the bedding material occurs below the trench supports and directly against the undisturbed ground of the trench walls.

After completion of the jointing and inspection of drain pipes, place and compact the bedding surround material around the pipe to the required depth over the pipe. The material shall be carefully placed around and over the pipe using hand tamping and in a manner that ensures the pipe is uniformly

supported all round its perimeter and without voids. Take care during placement and compaction to ensure the pipe is not displaced or damaged.

13.7.4.2 Laying Pipes

Install stormwater drains in accordance with AS/NZS 3500.3 to the layout, levels and grades shown on the drawings. Drain pipes shall be laid to provide maximum falls, in straight lines and at an even grade, without obstruction to flow, and with full allowance for bedding.

Before installing the pipes, check the bore of each pipe is free from foreign matter and that the pipe exterior and the socket have not been damaged in handling or storage. All pipelines shall be kept clean and free of dirt and debris at all times during installation, testing and commissioning.

PVC-U stormwater drain pipes shall be properly jointed (rubber ring joint or solvent welded joint) to produce a watertight seal in accordance with the manufacturer's instructions.

Start laying main drains at the point of outfall and insert junctions for branch drains as the work proceeds. Pipes shall be laid with the least number of bends, in the centre of the trench, in straight lines between bends, and to the grades and locations shown on the drawings.

Install all necessary fittings, including inspection openings, bends and junctions, to the locations shown on the drawings and in accordance with the manufacturer's instructions. Where not specified on the drawings or schedules, fittings for inspection openings, bends, and junctions shall be selected from the PVC-U pipe system range of products and installed in accordance with the manufacturer's instructions.

Other than precautions against damage by displacement or floating pipes, no bedding surround material or backfill shall be placed until the laying of the drain has been inspected by the Territorial Authority.

13.7.4.3 Jointing - Solvent Welded Joints

Solvent welded joints shall be used for jointing PVC-U pipes and fittings where rubber-ring jointed fittings are not manufactured. Use only cleaner primers and solvent cements specified by the manufacturer for the application and socket type. Only sockets complying with the relevant Standard shall be installed. Do not use cleaner primers or solvent cements if the 'use by' date has expired. The marking of pipes by scoring is not permitted. All joints shall be watertight and prevent the infiltration of groundwater and the intrusion of tree roots.

Solvent welded joints shall be assembled in accordance with the manufacturer's instructions and generally as follows:
- Solvent welding shall only be carried out in dry conditions above 5°C.
- Ensure the components are dry, clean and free of dust, dirt, grease and surface contaminants during all stages of the jointing process.
- Prior to welding, the components shall be assembled dry and checked for position and alignment to ensure accurate re-assembly in the correct position.
- Mark the spigot with a witness mark (pencil, not scored) at a distance equivalent to the internal depth of the socket.
- Dry the spigot end, up to the witness mark, and the socket interior, then clean and degrease with a clean cloth moistened with the pipe or fitting manufacturer’s specified priming fluid.
- Apply an even coating of solvent cement to the internal surface of the socket for the full engagement length, and to the external section of the spigot up to the witness mark.

- Only use the minimum amount of solvent cement in the socket necessary for a fully solvent-welded joint.
- Insert the spigot close to, but not beyond, the witness mark. Do not use excessive force. Firmly restrain the joint for the minimum period recommended by the pipe manufacturer.
- Wipe off excess solvent cement from the outside of the joint, and where possible from the inside.
- Adhere to the manufacturer's specified procedures and time frames for filling and testing pipework.
- Allow all solvent welded joints to fully cure before subjecting pipework to any imposed load or testing.

13.7.4.4 Pipe Cover

Unless specified otherwise on the drawings, the minimum pipe cover (finished surface to top of pipe) shall be:
- where not subject to vehicular loading: 300mm.
- where subject to vehicular loading - not in roadways: 450mm.
- where subject to vehicular loading - in sealed roadways: 600mm.
- where subject to vehicular loading - in unsealed roadways: 750mm.
- pipes in embankment conditions or subject to loading from heavy construction equipment: 750mm.

13.7.5 Connection

13.7.5.1 Public Network - Street Kerb Connection

Connect to discharge the stormwater drainage line directly to the street kerb outlet in accordance with the requirements of the Territorial Authority and as indicated on the drawings.

13.7.6 Testing

13.7.6.1 Stormwater Drains

Test the stormwater installation, including all drains, connections and system components, for water tightness in accordance with the requirements of the Territorial Authority (TA).

Where required by the Territorial Authority, the testing shall be undertaken in the presence of the representative of the TA. Demonstrate to the Contract Administrator and the Territorial Authority that the installation complies with the requirements of the contract documents, related standards and regulatory bodies. Lodge all certificates of approval with the Contract Administrator.

Unless specified otherwise by the Territorial Authority, the testing procedure shall be the Water Test procedure as defined in AS/NZS 3500.3: Section 9. Where appropriate, the procedures in NZBC E1/VM1 may be used as an alternative. The acceptability of other test methods are be subject to the approval of the Territorial Authority and the Contract Administrator.

Provide all necessary plant, equipment and instruments required for the specified testing procedure. All testing and commissioning shall be undertaken by suitably skilled and experienced technicians.

Pressure testing shall be carried out after the pipes have been laid and the bedding material has been placed over the pipes as specified.

Prior to testing ensure that all pipe junctions and inspection eyes are exposed, and pipelines have been flushed and all residual debris cleaned out.

Stormwater manholes shall be free of visible faults, or permeable zones, and jointing or penetration repairs shall be to best trade practice and standards.

Test results shall be recorded clearly on properly formatted test result sheets, and submitted to the Contract Administrator within 48 hours of completion of testing.

Repair or replace any materials or workmanship found to be defective or faulty during testing, and repeat the test until a satisfactory test result is achieved.

Leave the installation watertight and free of defects, and operating to the required performance standard.

The work shall be deemed incomplete unless all required testing and commissioning has been carried out and has passed the requirements of the testing specification and the Territorial Authority.

13.7.6.2 Water Test Procedure - to AS/NZS 3500.3

Water test procedure of stormwater drains (non-pressure) - to AS/NZS 3500.3: Section 9.4: The head of water on any section of drain shall not exceed 3m.

The procedure shall be as follows:
- Seal all openings except the top of the section of the below-ground drain to be tested.
- Fill the below-ground drain with water to the highest level in that section.
- 10 minutes for vitrified clay drains; or
- 5 minutes for drains of any other material.

The drain shall be deemed to have passed the test if no make-up water is required.

13.7.7 Backfilling

13.7.7.1 Backfilling

Trenches shall be backfilled as soon as possible after the laying, inspecting and testing of the pipeline.

Where required, lay marker tape along the length of the drain, just above the top of the pipe embedment zone, before backfilling.

Trench backfill materials shall be placed on the pipe embedment, and compacted to restore the trench as near as practicable to the normal surrounding ground surface level and reduce the likelihood of subsidence. Backfill material shall be placed in uncompacted layers not exceed 300mm, then mechanically compacted to the required density.

Temporary trench support systems shall be lifted progressively above each layer of backfill to ensure each layer is compacted against undisturbed ground.

Any deficiencies of trench filling exposed by settlement shall be corrected to the required standard.

13.7.8 Reinstatement of Surfaces

13.7.8.1 Reinstatement of Surfaces

Refer to separate specification section - Siteworks - Reinstatement of Surfaces. Ground and paved surfaces above excavated stormwater drainage trenches shall be reinstated to the standard specified. Reinstatement shall generally achieve a standard equal to or better than the pre-existing situation - in no case will a lower standard be accepted.

Hedges, fences and other features to be retained that have been damaged or removed during the work shall be reinstated to the satisfaction of the Contract Administrator.

14 ELECTRICAL

14.1 Preliminary

Refer to General Conditions of Contract and the Special Conditions in this Specification as appropriate. Read this section in conjunction with all other trade sections.

14.2 Compliance

Comply with the New Zealand Building Code 1992 including all revisions and amendments, Verification Methods where appropriate, and construction principles that are embodied in the Acceptable Solutions.

Comply with all relevant provisions and recommendations of:

2053.1:2001(AS/NZS)	Conduits and fittings for electrical installations - General requirements
2201.1:2007(AS/NZS)	Intruder alarm systems - Client's premises - Design, installation, commissioning and maintenance
2293.2:2019(AS|NZS)	Emergency lighting and exit signs for buildings - Part 2: Routine service and maintenance
3000:2018(AS|NZS)	Electrical installations - Known as the Australian/New Zealand Wiring Rules
3100:2009(AS/NZS)	Approval and test specification - General requirements for electrical equipment
3112:2011(AS/NZS)	Approval and test specification - Plugs and socket-outlets
5000.1:2005(AS/NZS)	Electric cables - Polymeric insulated - For working voltages up to and including 0.6/1 (1.2) kV
60335.2.30:2015(AS|NZS)	Household and similar electrical appliances - Safety - Part 2.30: Particular requirements for room heaters
60335.2.30:2015(AS|NZS)INCIEC	Household and similar electrical appliances - Safety - Part 2.30: Particular requirements for room heaters
60335.2.35:2013(AS/NZS)	Household and similar electrical appliances - Safety - Part 2.35: Particular requirements for instantaneous water heaters
60598.2.2:2016(AS|NZS)	Luminaires - Part 2.2: Particular requirements - Recessed luminaires
6104:1981(NZS)	Specification for emergency electricity supply in buildings

14.3 Workmanship

14.3.1 General

Supply and install all materials, including all necessary minor and incidental items, for proper completion of all of the electrical services specified or shown on the drawings. The contract will not be deemed to be complete until the Electrician has provided an Electrical Certificate of Compliance (made available to the Contractor in time for the Code Compliance Certificate application).

The position of switches, light and power outlets and other fittings, although shown specifically in some instances, are in general only shown diagrammatically. The exact location of each of these items will be as directed on site by the Architect/Designer; the Electrician shall give reasonable notice of when this information is required. Items positioned in contravention of this shall be repositioned if directed, including rewiring if necessary, all at the Electrician's expense.

Unless drawn (on 1:20 wall elevations) or specified otherwise the mounting height to the centreline of the following items above the floor shall be:

-1000mm for lighting switches;
-2000mm for wall mounted lights;
-2100mm for the bayonet of pendant lights;
-300mm for power points, except at benches.

(Notify the Architect/Designer if either the actual fitting or mounting position seem to make the mounting height noted above inappropriate).

Warranty cards and manufacturers guarantees for items supplied and installed by this trade shall be filled in correctly and handed over at Practical Completion. Arrange all circuits to obtain an optimum balance of the system, and check and reconnect where necessary to achieve this on completion. Leave the works clean and tidy and in full operational order.

14.3.2 Co-operation

Co-operate with all other trades and attend upon the Concretor and Carpenter to set out all required penetrations and to ensure that all wiring and fittings are correctly incorporated as work proceeds. The Carpenter will provide and fix all necessary dwangs and timber supports in locations determined by the Electrician.

14.3.3 Workmanship

All electrical work shall be carried out by, or under the direct control of, registered tradesmen, and shall be to recognized high standards. All work shall be such as to leave a neat, efficient and robust installation. Neatly label switchboards to identify each circuit.

The cutting away and checking of timbers shall be limited to such dimensions as will not prejudice the purpose for which the timber is used; observe NZS 3604: 2011 restrictions on the holing and checking of joists and beams. Chasing and checking of other materials shall be only to approval.

Adequately protect all surfaces. Any damage to fittings or surfaces made good by the appropriate trade at the Electrician's expense.

14.3.4 Wiring

Joints within cable runs will not normally be accepted. TPS cable shall be adequately supported, and clipped at regular intervals. At terminations all strands of conductors shall be fully secured in a terminal block or clamped under a screw head washer; do not cut away any strands. Wiring which terminates in enclosed fittings and/or where subject to heat liable to cause deterioration, shall be high temperature type, with the tails made off with heat resisting sleeves, to protect the permanent wiring.

Wire lights in 1.5mm 3 core - 7.5 amps loading max per circuit (allow for 100w to all light fittings unless identified otherwise).
Wire power outlets in 2.5mm 3 core - 7 maximum GPO singles or doubles per circuit. Assess power outlets for specific equipment and allow accordingly.

Conceal all wiring except as noted on drawings or below. All wiring cast into concrete shall be run in conduit pipes. All cables shall be stranded (single core is unacceptable).

Wire more or less parallel to and at right angles to the structural elements - avoid any diagonal wiring. Layout of the principal distribution wiring shall be to approval. Position all wires to minimise the risk of damage from subsequent nailing of linings etc.

Generally, do not run TPS horizontally within timber walls except in the area up to 300mm above floor. Wire in the ceiling framing and drop vertically to outlets and switches.

Wire exterior lighting in screened cable.

14.4 Systems

14.4.1 Earth

Provide a driven main earth suitable for the full installation, close to the meterboard, complying fully with all appropriate regulations and to the complete approval of a certified inspector. Bond all exposed metals, including light fittings and piped services and provide earth conductors for the entire system. Sheathing to any neutral screened cables may be used for earthing.

14.4.2 Mains

Install a neutral screened 16mm main cable underground (depth, cover/protection, backfilling, signal strip etc. to comply with all relevant regulations) from the grid connection position noted on the Site Plan along the route indicated to the meterboard, positioned where shown on the Floor Plan, and make appropriate arrangements for the grid connection. Install pilot as required. The meterboard shall be metalclad with a meter reading window, recessed maximum depth into the wall and at 2m to the top of the board, with the meters and water heater controllers by the supply company nominated by the Principal. Install all switches and fuses that are necessary. From the meterboard run (route to approval) a neutral screened 16mm main plus controllers etc. to the switchboard.