

APARTMENT DEVELOPMENT

11-13 WEST STREET, HINDMARSH SA

Project No: LCE13404

Hydraulic Services Specification

Tender Issue

Revision T2

SPECIFICATION ISSUE REGISTER

REVISION	DESCRIPTION	DATE ISSUED	AUTHOR	REVIEWED
T1	Tender Issue	01.04.2019	EM	KR
T2	Tender Issue	12.07.2019	EM	KR

PROJECT DIRECTORY

Client

Cavaton MC Projects

5 First Street

Brompton SA 5007

ARCHITECT

Milne Architects

Level 1, 124 Franklin Street

Adelaide SA 5000

**MECHANICAL, ELECTRICAL, HYDRAULIC AND
FIRE PROTECTION SERVICES**

Lucid Consulting Australia

Level 3/169 Pirie Street

Adelaide, SA 5000

CONTENTS

1	GENERAL.....	1
1.1	CROSS REFERENCES.....	1
1.2	PROJECT DETAILS.....	1
1.3	DEFINITION OF TERMS	1
1.4	CONTRACT.....	2
1.5	DRAWINGS	2
1.6	SCOPE	3
1.7	ASSOCIATED WORKS	7
1.8	STANDARDS.....	7
2	CONTRACT SUBMISSIONS.....	11
2.1	GENERAL.....	11
2.2	TENDER SUBMISSIONS.....	11
2.3	PRE-CONSTRUCTION SUBMISSIONS.....	11
2.4	CONSTRUCTION SUBMISSIONS	13
3	WORKMANSHIP	17
3.1	GENERAL.....	17
3.2	QUALITY ASSURANCE	17
3.3	EXISTING SITE CONDITIONS.....	17
3.4	WARRANTIES	18
3.5	INSTALLATION COORDINATION	18
3.6	SALVAGED EQUIPMENT AND DEMOLITION.....	19
3.7	INSTALLATION REQUIREMENTS	19
3.8	PENETRATIONS.....	20
3.9	PROTECTION.....	21
3.10	FLUSHING OF SERVICES	21
3.11	CLEANING UP	22
3.12	SEISMIC RESTRAINT, EARTHQUAKE BRACING, FIXINGS AND SUPPORTS.....	22
3.13	GENERAL PIPING INSTALLATION REQUIREMENTS	23
3.14	PIPE SUPPORTS.....	23
3.15	INSTALLATION REQUIREMENTS FOR PVC PIPING AND FITTINGS	24
3.16	INSTALLATION REQUIREMENTS FOR HDPE/PVC PIPING AND FITTINGS INGROUND.....	24
3.17	INSTALLATION REQUIREMENTS FOR POLYETHYLENE NON-PRESSURE PIPEWORK SYSTEM.....	25
3.18	INSTALLATION REQUIREMENTS FOR 'REHAU RAUPIANO' SANITARY PLUMBING DRAINAGE SYSTEM.....	27
3.19	INSTALLATION REQUIREMENTS FOR COPPER PIPES	27
3.20	INSTALLATION REQUIREMENTS FOR CROSS LINKED POLYETHYLENE PIPES	28
3.21	SLEEVES.....	28
3.22	BRAZING	28
3.23	CHROMIUM PLATING.....	28
3.24	DISSIMILAR METALS	28
3.25	JOINTS IN PIPEWORK	29
3.26	GRADES	29
3.27	INSPECTION AND TESTS	30
3.28	TRENCH EXCAVATION, BACKFILLING AND COMPACTION	32
3.29	TREATMENT OF PIPEWORK PENETRATIONS	34
3.30	ACOUSTIC REQUIREMENTS	35
4	PIPING AND MATERIALS	36

4.1	GENERAL MATERIALS	36
4.2	UNIFORMITY AND QUALITY	37
4.3	PIPE AND ISOLATION VALVE/METER IDENTIFICATION.....	43
5	SANITARY FIXTURES AND TAPWARE	45
5.1	GENERAL.....	45
6	SOIL, WASTE AND VENT PIPES	46
6.1	GENERAL.....	46
6.2	PIPEWORK AND FITTINGS	46
6.3	MATERIALS	48
6.4	PIPEWORK FINISHES	48
6.5	FIRE STOP COLLARS	49
6.6	ACOUSTIC INSULATION TO ALL SUSPENDED DRAINAGE	49
6.7	AIR ADMITTANCE VALVES.....	49
7	COLD WATER SERVICE.....	51
7.1	GENERAL.....	51
7.2	TAPS AND VALVES.....	51
7.3	TESTING	52
7.4	VALVE IDENTIFICATION.....	52
7.5	BACKFLOW PREVENTION VALVES	52
7.6	PURGING	53
8	HOT WATER SERVICE.....	54
8.1	GENERAL.....	54
8.2	HOT WATER PIPING INSULATION.....	54
8.3	TAPS AND VALVES.....	54
8.4	TESTING	54
8.5	TEMPERATURE PRESSURE RELIEF AND EXPANSION VALVES FOR HOT WATER STORAGE VESSEL	54
8.6	TEMPERING VALVES	54
8.7	DOMESTIC HOT WATER UNITS	54
8.8	DOMESTIC HOT WATER CIRCULATING PUMPS	54
8.9	PURGING	55
9	NATURAL GAS SERVICE.....	56
9.1	GENERAL.....	56
9.2	BUILDING ISOLATION	56
9.3	ISOLATION FOR SPECIFIC INSTALLATIONS.....	56
9.4	FIRE SERVICES INTERFACE.....	56
9.5	PIPEWORK AND JOINTING.....	57
9.6	INSTALLATION	57
9.7	TESTING	57
9.8	COMPLETION	58
10	EQUIPMENT	59
10.1	DOMESTIC HOT WATER UNITS	59
10.2	DOMESTIC HOT WATER CIRCULATING PUMP ASSEMBLY.....	59
10.3	BALANCING VALVES	60
10.4	PULSE OUTPUT WATER METERS.....	60
10.5	STAINLESS STEEL FLOOR DRAIN.....	61

10.6	PRESSURE REDUCTION VALVES.....	61
APPENDIX A - SECTION COSTS AND UNIT RATES - SANITARY AND HYDRAULIC SERVICES.....		0
APPENDIX B - TECHNICAL DATA SCHEDULES – HYDRAULIC SERVICES.....		2

1 GENERAL

1.1 CROSS REFERENCES

All work covered within this specification shall be read in conjunction with the following trade packages and contracts. Should any discrepancy occur between the references the larger/greater shall be assumed and referred to the Engineer prior to proceeding with any works.

- Preliminaries and General Contract Conditions.
- Architectural Documentation
- Mechanical Services Documentation
- Electrical Services Documentation.
- Fire Services Documentation.
- Structural Services Documentation.
- Civil Documentation.

The above documentation shall be made available upon request through the head contractor.

1.2 PROJECT DETAILS

The works described within this specification pertain to the Hydraulic Services installation at 13 West Street, Hindmarsh SA.

The works involve the construction of a new four storey apartment development including Ground Floor car parking area, 4 apartments per level on Levels 1-3, and Roof level plant area. Each apartment is to be provided with kitchen, laundry, and amenities facilities.

The contractor should note the specific requirement for connection of services off the adjacent site located at 17 West Street. All access is to be arranged in conjunction with the builder and strata manager for the property.

1.3 DEFINITION OF TERMS

Consulting Engineers	- Lucid Consulting Engineers
Proprietor	- Client or end user of the proposed building
Principal/Architect	- Milne Architects
Head Contractor/Builder	- Registered Building Contractor appointed to carry out the construction of the building. Hydraulic Contractor shall enter contact to undertake the Hydraulic Services installation with the successful builder.
Contractor	- Installer undertaking the works.
Works	- As described within this specification
Provide	- Supply, install, commission and place into service
Equal Approved	- Alternative product/method of installation which is presented to the consulting engineer and written approval is received.

- Local Gas Authority - Envestra (Local Gas Authority)
- Local Water Authority - SA Water Corporation
- Local Technical Regulator - SA Water Trade Waste Department
Office of the Technical Regulator
- Local Fire Authority - South Australian Metropolitan Fire Services (SAMFS)
- Local Power Authority - SA Power Networks

1.4 CONTRACT

Fixed Price Lump Sum Contract

The Hydraulic Contractor is to enter into a fixed price lump sum type contract. The following specification and accompanying drawings outline the general scope of works and have been prepared to enable specialist Plumbing Contractors to submit fixed sum tender prices for the plumbing installation. The drawings are intended to indicate the principles of design and should not be taken to define all offsets, bends etc which may be required to complete the installation and or be coordinated with other services. The Plumbing Services Contractor will be responsible for final coordination with other trades and for final coordination with Architectural Drawings and building structure.

The tender drawings are not to be used for architectural or structural work but are to be read in conjunction with architectural, structural and other relevant drawings.

Coordinate all pipe runs with Mechanical, Electrical, Fire and Sustainability Services trades to ensure non-clashing of services.

Deviation from the design principals shown will not be permitted without the written consent of the Superintendent.

Any discrepancies which may affect the installations shall be brought to the Superintendents attention before the work proceeds.

The Contractor shall also familiarise themselves with the location of existing pipe and cable runs. No variation will be issued for any damage caused to existing services.

1.5 DRAWINGS

Tender Drawings

Drawings associated with and forming part of this specification are scheduled below:

Drawing No	Drawing Title
LCE13404-H00	General Notes, Locality Plan, Drawing Index and Legend of Symbols
LCE13404-H01	Site Plan, Ground Floor Water and Gas Reticulation and Sanitary Drainage Arrangements
LCE13404-H02	First and Second Floor Sanitary Drainage Arrangements

LCE13404-H03	Third Floor and Roof Level Sanitary Drainage Arrangements
LCE13404-H04	First and Second Floor Water and Gas Reticulation Arrangements
LCE13404-H05	Third Floor and Roof Level Water and Gas Reticulation Arrangements
LCE13404-H06	Details

The Hydraulic Services drawings and associated specification along with the architectural drawings are intended to define the principles of design and scope of the Hydraulic Services installation. The drawings are intended to indicate the principles of design and should not be taken to define all offsets, bends etc which may be required to complete the installation and avoid other services. The Plumbing Services Contractor will be responsible for final coordination with other trades and for final coordination with Architectural Drawings and building structure.

The tender drawings are not to be used for the purpose of defining the Architectural intent however are to be read in conjunction with architectural, structural and other relevant drawings.

Coordinate all pipe runs with all other trades to ensure non clashing of services.

Deviation from the design principals shown will not be permitted without the written consent of the Superintendent.

Any discrepancies which may affect the installations shall be brought to the Superintendents attention before the work proceeds.

The Contractor shall also familiarise himself with the location of existing pipe and cable runs. No variation will be issued for any damage caused to existing services.

1.6 SCOPE

The work covered by this section of the specification includes the following:

General Requirements

The work covered by this specification includes the following:

- The provision of a Hydraulic Services installation that satisfies all statutory legislative and code requirements and satisfies the general details herein.
- The planning, scheduling, procurement of components and installation to meet the programme, coordination and liaison with the head contractor and other trade packages.
- Full responsibility for the execution of the complete installation in accordance with the specification and drawings.
- The installation, testing, commissioning, maintenance, service and warranty and all sundry and material items, whether mentioned in detail or not, required to complete the installation and place into working order.
- Compliance with all relevant Work Health and Safety legislation and best practice including any site specific requirements or regulations such as attendance at site inductions and adherence to the procedures covered in such inductions.

- Full responsibility for the execution of the complete installation in accordance with the specification and drawings, and related authority requirements. Provide all manufactured items, materials, labour, cartage, tools, plant, appliances, and fixings necessary for the proper execution of the works, together with all minor and incidental works.
- Final co-ordination, manufacture, supply, installation, testing, commissioning and subsequent maintenance service and warranty for the stipulated period, of the work specified herein and shown on the accompanying drawings.
- The whole of the works shall comply with all relevant Regulations and to all Local Authority requirements. The cost of any materials or equipment required to meet such regulations and requirements shall be included in the Tender whether specifically shown or described in the documents or not.

Infrastructure Requirements

Make application to Local Water Authority including payment of associated fees for the following works.

- For the removal of the redundant one (1) off 100 mm sewer connection.
- For the upgrade of existing 100 mm to a 150 mm sewer connection.
- For the removal of the redundant 20 mm water meter connection.
- For the upgrade of the existing 20mm water meter to a below ground 40 mm water meter connection within below cast iron valve box complete with heavy duty lid.

Note - Temporarily maintain existing water, sewer and stormwater connections for connection to Builder's Amenities, with final scope of works to be resolved with Main Contractor.

Note- Contractor shall bear full responsibility for verifying and establishing sewer connection location and depth prior to commencement of any works. Abortive work caused due to failure to verify the above shall be at the cost of the plumbing contractor.

Note – Contractor shall confirm locations of new services with utilities personnel prior to commencement of works.

Note – Natural gas is to extend from neighbouring property to service the development as shown on the drawings.

Waste Drainage System

- External sewer drainage system extending from upgraded sewer connection point in accordance with AS/NZS 3500.2.
- Plumbing and drainage systems installed in reactive soils to comply with Australian Standard AS2870 -2011.
- Establishment of flood gully to site drainage system, top of gully to be
 - 150mm below finished floor level
 - 20mm above surrounding ground surface, with paving falling away from gully
 - 75mm above natural earth or garden bed
- Establishment of reflux valve at boundary in lieu of complaint flood gully, finish at surface with
 - Cast iron cover at finished surface level with screwed cap below
 - Bolted trap screw lid finished surface

- Air admittance valves to drainage branch vents where indicated on drawings.
- Sewer stack and vent system
- Waste drainage and vent system in accordance with AS/NZS 3500.2 and the local Authority requirements.
- Acoustic lagging to all suspended sanitary drainage pipework within the ceiling space above habitable areas including apartment common areas, and in accordance with the Acoustic Engineers requirements. Also refer to further details within this specification. Acoustic lagging shall extend to soil and waste stacks located within plumbing all service ducts.
- Identification Labels to pipework and detectable in ground identification tape to drainage systems.

Water and Gas Reticulation

- Drinkable cold water reticulation system in accordance to AS/NZS 3500.
- Drinkable hot water reticulation system in accordance to AS/NZS 3500.
- Pressure reducing valves to hot and cold water branch take-offs as required to maintain maximum operating pressure of 500 kpa.
- Supply and installation of Tempering Valves as indicated on drawings.
- Backflow prevention assembly to the incoming drinkable cold water supply located adjacent to the SA Water Corporation Water Meter connection.
- Miscellaneous backflow prevention devices to zones or individual fixtures in accordance with AS3500 and SA Water Corporation Trade Waste requirements.
- Extension of Natural Gas pipework from capped provision within 17 West St to service the new development. Coordination of natural gas supply in accordance with supply metering strategy as proposed by Savant.
- Natural gas reticulation system in accordance to AS 5601.
- Identification Labels, tags to all valves, and detectable inground tape.

Plant and Equipment

- Gas fired hot water plant to be provided and installed by Savant in accordance with the manufacture's recommendations. Hot and cold water, hot water return and natural gas connections to central hot water plant to be by hydraulic services contractor.
- Supply and install drinkable hot water circulating pumps in accordance with the manufacture's recommendations.
- Supply and installation of all sanitary fixtures and tapware as scheduled in the Architectural Sanitary Fixture and Equipment Schedules.
- Provision for commissioning by the manufacture of all plant supplied and installed.

General Requirements

- Provision and installation of timber trimmers in walls for securing of fixtures and water pipework connection points.
- Fire stop collars to all PVC and HDPE pipework penetrations associated with the sanitary drainage systems where pipework penetrates fire rated floors including where located within plumbing ducts and/or service rooms.

- Fire stopping all pipework penetrations at floor level and where penetrating fire rated bounding walls.
- Trenching and backfilling associated with service connections to the site. All compaction shall be strictly in accordance with the requirements of Local Council. Apply for permits and pay all necessary fees for temporary road and/or footpath closure.
- Set-out or cause set-out of all plumbing penetrations, including the installation of all necessary sleeves. The plumber shall be responsible for this set-out and any rectification works necessary by incorrect set-out.
- Seismic restraint to all equipment, tanks, and pipework to AS1470.
- Provision of roof over flashing (dektites) to all pipe penetrations through roof where applicable.
- Provision of roof over flashing to all pipe penetrations through roof where applicable, under flashing to be provided by roofing contractor
- Allow for trenching and backfilling necessary to complete the work. Upon completion of backfilling, the work area and its surrounds shall be left tidy and level, and all surplus soil removed from site and disposed of by the plumber and at the plumbers entire cost.
- All rubbish is to be disposed of in the designated waste disposal area as directed on site. All rubbish is to be disposed of in this manner the same day that it is generated.
- Apply for all necessary approvals to perform the described works and pay all relevant and required fees.
- Provide compaction testing of service trenches as per the civil and structural engineer's approval and as noted in the specification.
- Provide traffic control/management to works required.
- Temporary service connections to site amenities. Refer to Builder's scope of works in relation to temporary connections required during the construction period.
- Maintenance and Defects Liability Period of 12 months.

Variations to the Scope

Instructions may be issued throughout the project which may alter the scope of works. Any aspects of any such works which are not specifically mentioned in any instruction are to comply with this specification.

Any claims for any additional costs or credits for any such variations must be submitted with a complete breakdown of costs including quantities and rates for all labour, materials and equipment. Variation Claims submitted without breakdowns will be rejected.

Substitutions

Where a substitution to the specification is proposed, the contractor shall submit each substitution, incorporating technical details and a cost breakdown, to the head contractor. The substitution shall be reviewed by the consulting engineer and the client for consideration. Unless approved by the consulting engineer and the client, the substitution will not be acceptable as an equal or approved approach to the specification.

1.7 ASSOCIATED WORKS

The following works related to the Hydraulic Services installation shall be carried out under other trade packages at the direction of the head contractor unless otherwise indicated. Cabling is to be terminated by the trade responsible for running the cable. Coordinate all cable locations, runs / routes, terminal strip locations and ensure that information is provided to other trades to facilitate cabling and termination for connection to plant.

Electrical Services Trade

- Provision of 240V single phase power supply to Central Gas Fired Domestic Hot Water Plant and connection to pre-wired assembly via a weatherproof isolating switch.
- Provision of power supply and connection to Domestic Hot Water Return Pump Assembly controller located on the Roof Level plant platform.
- 240 volt GPO located adjacent to each dishwasher within cupboard space adjacent dishwasher recess, within each apartment. Arrange with Joiner for cable and plug access via joinery divider.
- 240 volt GPO located under gas hot plate within each apartment.

Mechanical Services Trade

- Mechanical services pipework to drain to tundishes provided.

Structural Services

- Casting in to footings and band beams.
- Coordination with Delta Core Slab including confirmation of slab penetration locations and core holes with structural engineer.

Builders Related Trades

- Construction of non-fire rated plumbing ducts with fire collars to be retrofitted at penetrations for services reticulation and subsequent re-grouting of penetration to maintain floor fire rating.
- Supply and installation of Bathroom Hardware ie towel rails, soap holders etc.
- Roof pipe penetration up stands.
- Builders related trades are to supply sanitary fixtures for installation by hydraulic services contractor.
- Supply and installation of access panels.

1.8 STANDARDS

GENERAL REQUIREMENTS

Comply in all respects with the requirements of the current standards applicable to the works in respect to equipment, material, workmanship and installation techniques.

Comply with the following standards and regulations:

- Building Code of Australia
- Australian Standards

- Local Water Authority Regulations
- Local Trade Waste Technical Regulator
- Local Gas Authority Regulations
- Local Health Department
- Local Power Authority Regulations
- Local Government Acts governing the works
- Office of the Technical Regulator (OTR) or Local Authority Regulations
- Work Health and Safety Regulations
- Local Council
- Occupational Health, Welfare and Safety Regulations

Note - The whole of the sanitary plumbing and water supply shall be carried out by, or under the direct supervision of, a registered fully Licensed Contractor Plumber and licensed Gas Fitter. All work shall be done in accordance with the relevant provisions of AS/NZS 3500, AS 5601:2002 – AG 601:2002, the regulations and directions of the Local Water Authority, Office of the Technical Regulator (OTR) and to the complete satisfaction of the Superintendent.

Approvals

The documents evidencing approval of such authorities, which are to be forwarded to the Superintendent before final payments and the notice of Practical Completion is issued, shall include the Certificates of Compliance or statutory certification which shall be completed and issued by the contractor.

Works by Authority

If the responsible authority is required to or, pursuant to the statutory powers vested in it, elects to perform or supply part of the works or to inspect or test the Works during construction, make the necessary arrangements with the authority and pay and bear the fees payable in connection therewith.

Australian Standards and Codes

Australian Standards, Codes and Statutory Authority Requirements current at the date of tendering are applicable in respect of all workmanship except where they conflict with the provisions of this Specification.

The following codes which specifically form part of this specification insofar as they are appropriate together with such other codes as required by the Authorities having jurisdiction shall be complied with:

Hot Water and Cold Water and Natural Gas Services	
AS1345	Identification of the contents of piping, conduits and ducts.
AS1432	Copper tubes for water, gas and sanitation.
AS1585	Capillary and brazing fittings of copper and copper alloy.
AS1590	Copper alloy threaded pipe fittings for use with tubes threaded with pipe threads of Whitworth form.

AS1628	Copper alloy gate valves and non-return valves for use in water supply and hot water services.
AS1645	Copper and copper alloy compression fittings for use in water supply and hot water services.
AS1718	Copper alloy draw-off taps, stop taps, and ferrule or main taps for use in water supply and hot water services.
AS2129	Flanges for pipes, valves and fittings.
AS2845	Water Supply backflow prevention devices.
AS/NZS3500-1.2	Water Supply – acceptable solutions.
AS2492	Crosslinked polyethylene (XLPE) pipe for hot and cold water applications.
AS2537	Mechanical jointing fittings for use with crosslinked polyethylene (XLPE) pipe for hot and cold water applications.
Sanitary Plumbing and Drainage	
AS1260	Unplasticised PVC (UPVC) pipes and fittings for sewerage applications.
AS1289	Methods of testing soils for engineering purposes.
AS1304	Welded wire reinforcing fabric for concrete.
AS1415	Unplasticised PVC (UPVC) pipes and fittings for soil, waste and vent (SWV) applications.
AS1432	Copper tubes for water, gas and sanitation.
AS1589	Copper and copper based alloy fittings for use in sanitary plumbing installations.
AS1650	Galvanised coatings.
AS2032	Code of practice for installation of UPVC pipe systems.
AS2129	Flanges for pipes, valves and fittings.
AS2870-2011	drainage Design Requirements, Residential Slabs and Footings
AS2887	Plastic waste traps.
AS/NZS3500-2	National Plumbing and Drainage Code.
AS3879	Solvent - welding cements for use with rigid PVC pipe and fittings.
HDPE - Codes	
AS2033	Installation of polyethylene pipe systems
AS4401	Plastics piping systems for soil and waste discharge (low and high temperature) inside buildings— Polyethylene (PE)
AS5065	Plastics piping systems for soil and waste discharge (low and high temperature) inside buildings— Polyethylene (PE)

Stainless Steel - drainage	
EN 10088	Stainless steels
Water Heating	
AS1308	Thermostats and over-temperature energy cut-outs for automatic electric water heaters (metric units).
AS/NZS3500-4	Hot Water Supply Systems.
Gas Service	
AS5601:2013 –	Gas Installation Code.
AG601:2013	

2 CONTRACT SUBMISSIONS

2.1 GENERAL

The contractor shall prepare and submit the items in each section identified below to the consulting engineer for approval.

2.2 TENDER SUBMISSIONS

The submissions required at Tender shall incorporate, as a minimum, all information defined within the Appendices of this Specification. Any appendices not completely filled out will be rejected.

In addition to the Appendices the Manufacturer's selections data shall be provided incorporating the following:

- Electrical full load amps, voltage and phase data
- Performance data relevant to the equipment specification clause
- Acoustic data measured in Sound Power as per the equipment specification clause
- Size and weight information including maintenance clearance

Identical equipment to that approved by the consulting engineer must be installed on site. Equipment will only be considered "equal approved" if it has been approved by the consulting engineer. Approval of equipment does not override the requirement to comply with the requirements of the specification.

Select manufacturers with local representation, technical support and expertise, proven local long-term performance and readily-available spare parts.

2.3 PRE-CONSTRUCTION SUBMISSIONS

2.3.1 SAMPLES

Submit the following sample fittings and accessories to obtain approval prior to ordering:

Note: Samples to be provided upon contract commencement

- Sanitary Fixtures and tapware, A4 colour print out showing items specified including product codes, Note, physical samples may be requested and supplied at Nil cost to the contract
- Acoustic pipe sample and technical data.
- Identification labels and stickers -physical sample.
- Cabinets Housing Hydraulic Services, manufacture shop drawings in PDF format.
- Bracketing systems, A4 colour print including product codes.
- Tundish boxes, A4 colour -sample.
- Powder coated Inwall tundish -sample.
- Backflow device Valve box. -sample
- Piping expansion loops.

- Acoustic wrapping.
- Thermal lagging
- Deliver the samples to the project site office at least 14 days before approval is required and notify the Head Contractor of their arrival.

2.3.2 SHOP DRAWINGS

Prepare and submit for approval before commencing manufacture or installation, 1 copy of shop drawings from which the contract works shall be built to be provided within 2 working weeks of contract commencement. Further copies shall be required upon review of the preliminary issue of workshop drawings

Shop drawings shall all be on the same size drawings sheets and shall be of a scale not less than 1:100 and larger where necessary.

AutoCAD version 2016 files in DWG format of the tender drawings will be provided from Lucid Consulting Engineers via the Head Contractor (one single coordinated electronic transfer to the Head Contractor). Under no circumstances shall it remove obligation from the contractor to produce a construction set of documents for the proposed installation as nominated within this specification.

Shop drawings shall cover the following parts of the work.

- All wall, ceiling and roof penetrations, location of ceiling access panels including full dimensions.
- Plant, Duct work and pipework layouts including manufacturer's equipment details.
- Major equipment support details including details of loads imposed on the building structure.
- Location of other building engineering services for coordination purposes.
- Dimensioned Penetration layouts of all pipe work.

Examination of shop drawings shall not remove from the Contractor the responsibility for the correctness of the dimensions on such drawings nor compliance with Statutory Regulations.

The Hydraulic Services Contractor shall supply Drawings in up-to-date CAD files to the Mechanical Services contractor to ensure coordination so that non-clashes of services.

The Mechanical Services Contractor shall take the lead role in the shop drawings process and produce a combined services formed slab and pre-cast wall penetration drawing for review and use by the concrete trade contractor.

Submit shop drawings with due account for the construction programme. Allow for 10 working days for the return of such drawings. Complete shop drawings ordering of equipment and accept responsibility for dimensions and configuration of equipment ordered to suit the spatial restrictions of the project.

2.3.3 AUTHORITIES, PERMITS, FEES, CERTIFICATES AND APPROVALS

Make applications, obtain all permits, and arrange testing, as necessary for the installation and placing into operation of the works where required by any Authority including:

- Local Power Authority
- Local Water Authority
- Local Gas Authority
- Local Council
- Workplace Services
- Office of the Technical Regulator

Provide all associated documentation required for the applications and pay all associated fees.

The hydraulic contractor shall co-ordinate approval of equipment (hot water plant and the like) on behalf of the proprietor as required to comply with federal, state and local legislation.

2.3.4 MANUFACTURERS TEST CERTIFICATION

Provide manufacturers test certificates for the following:

- Hot Water Plant
- Fire Collars
- Backflow prevention devices

2.4 CONSTRUCTION SUBMISSIONS

General

The Contractor shall instruct the Proprietor's representative in the correct practice, routine adjustment and maintenance of the installation before it has reached practical completion.

Instructions shall continue as required during the period of operation preceding the date of issue of the Certificate of Practical Completion during which time the Contractor shall be responsible for operation supervision and correcting faults.

2.4.1 OPERATING AND MAINTENANCE INSTRUCTIONS

General

The Contractor shall instruct the Proprietor's representative in the correct practice, routine adjustment and maintenance of the installation before it has reached practical completion.

The contractor shall confirm instruction of Proprietor's representative by completing training record and incorporating into Operating and Maintenance manual.

Instructions shall continue as required during the period of operation preceding the date of issue of the Certificate of Practical Completion during which time the Contractor shall be responsible for operation supervision and correcting faults.

Operating and Maintenance Manuals

Within 30 days prior to reaching Practical Completion hand over one (1) hard copy in A4 levered folder and three (3) soft copies in PDF format on a write protected USB 'flash drive' of an Operating and Maintenance Manual.

Initially one copy shall be prepared and submitted to the Consulting Engineer for approval.

The Manual shall contain the following documents:

- Index
- General Description of Hydraulic Services Installation
- Operating Instructions for Equipment Installed
- Maintenance Instructions
 - Routine
 - Preventative
- List of Equipment Suppliers
- Schedule of Technical Data
- Manufacturer Warranties
- Equipment Suppliers Literature
- Construction Test Records for Installation of Pipe Services
- Acceptance Certificates, Commissioning Certificates of Compliance, Testing Records
- Compaction Test Results
- Work-as-executed Drawings
- Copy of completed training record
- USB with the full PDF copy of Operating and Maintenance manual (including CAD 'As-Installed' drawings)

The manual shall be professionally prepared and bound in a vinyl hard-back folder with insert sleeves on the front to an approved format.

In addition, the project title and "Hydraulic Services" shall be inserted vertically along the spine insert sleeve of the folder.

The manual cover format shall be considered with the other services trades and shall be submitted for approval prior to ordering.

In addition to the above, the Plumbing Contractor shall allow to laminate the buildings hot and cold water, rainwater and natural gas schematic diagrams and mount within the Basement where directed on site.

The Plumbing Contractor should note that the certificates of practical completion will not be issued and final payment will not be made until the above requirements have been complied with.

Operating Instruction Summary

Provide a brief summary of plant operating instructions including project specific features and control procedures on a single laminated card to be handed to the client's representative. Submit a draft of the Operating Instruction summary with the Installation Manual.

Equipment Registration

Ensure registration and certification of all equipment as required. As a minimum comply with the following:

- Equipment Registration & Certification

Provide all associated documentation required for the applications and pay all associated fees.

2.4.2 USER TRAINING

Carry out training on systems as nominated within this specification with user groups and other parties as nominated by the Superintendent. Provide a program for user training for approval by the Superintendent and Building Services Consulting Engineer.

The contractor shall confirm instruction of Proprietor's representative by completing training record and incorporating into Operating and Maintenance manual.

2.4.3 COMMISSIONING & WITNESSING PLANS

The contractor shall submit for approval a detailed commissioning plan indicating step by step testing strategy for all equipment. The commissioning plan shall be developed in conjunction with the building trade construction programme and shall be required to be submitted to the head contractor and consulting engineer for review prior to any commencement of commissioning. The hydraulic services contractor shall be responsible for providing commissioning duration period to head contractor for inclusion in the construction programme.

Any witnessing of commissioning required by the consulting engineer, prior to practical completion, shall be allowed for within the commissioning plan. The consulting engineer will hold the right to refuse witnessing any plant until the Hydraulic contractor provides all commissioning results in accordance with this specification.

2.4.4 AS-INSTALLED DRAWINGS

Prior to the date of practical completion "as-installed" drawings shall be provided with the Operating and Maintenance Manuals. These drawings are to be prepared on AutoCAD computer aided drafting system version 2009 or later. Hard copies of the work-as-executed drawings along with copies of the AutoCAD Drawings are to be included on USB within the Operation and Maintenance Instructions. The work-as-executed drawings must indicate the full installation within the area of the works as it exists at the completion of the project including any design modifications which occurred during the project and any existing equipment.

The following minimum shall be included in the As-Installed drawings by modifying the Consultant's "For Construction" drawings:

- All set ups and set downs including invert levels and locations for underfloor drains.
- Location of all above ground piping and drains.
- Installed grades.
- Locations of all isolating valves in ceilings.

- Piping schematics for the buildings hot and cold water, and natural gas pipework reticulation systems.

3 WORKMANSHIP

3.1 GENERAL

This section of the Specification shall be read in conjunction with all other sections of this specification and the drawings.

Workmanship shall be of a high standard and each section of the work shall be properly and neatly executed to the best trade practice.

Untidy work whether exposed to view or concealed will not be accepted and rectified at nil cost.

3.2 QUALITY ASSURANCE

Implement a Quality Assurance System for the works in accordance with the following Australian Standards:

- ISO 9001 Quality Management Systems
- ISO 14001: 2004 Environmental Management Systems
- OHSAS 18001: 2007 Occupational Health and Safety Management Systems
- Australia's Building Code (previously the National Code of Practice for the Construction Industry)

The Quality Assurance System shall cover the following minimum aspects:

Detailed plan setting out supervision, quality control and checking (witness point) procedures.

Details of the Plumbing Contractor's Quality Assurance Plan shall be submitted to the Superintendent upon request.

3.3 EXISTING SITE CONDITIONS

The Plumbing Contractor shall check with all relevant authorities as to possible locations of any underground services in adjacent footpaths and locate same before commencing excavation.

The Plumbing Contractor shall determine the location of all existing services on site before commencement of demolition. The Plumbing Contractor shall allow to terminate redundant services as necessary to allow demolition to commence.

The Contractor shall verify the depths of existing sewer connections on site prior to commencement of drainage works on site.

The Contractor shall employ a pipe location service contractor to detect all existing services below the ground.

The Contractor shall also carry out their own investigations of the existing services reticulation to verify the details indicated on the tender drawings.

The Contractor shall visit the site to familiarize themselves with the extent of work. No extras shall be considered arising from neglect of this provision.

Any loss or damage arising from negligence in not carrying out the above requirements shall be made good in a manner acceptable to the proprietor and no claim shall be made for costs incurred due to this negligence.

The Contractor shall allow to seal off all existing services that may become redundant during the progress of the works. All such services shall be sealed off at the connection to the associated supply main and removed where practicable. Any associated redundant penetrations are to be sealed and fire rated in accordance with this specification.

The Contractor shall allow for satisfactory supervision on site to prevent any damage to new or existing (still in use) plumbing services as a result of the contract works.

3.4 WARRANTIES

Warranties shall extend for a minimum of 12 months.

All equipment and workmanship to be provided with a warranty.

Warranty to commence at date of practical completion, not the date of installation.

3.5 INSTALLATION COORDINATION

Check on site at regular intervals the building working dimensions, tolerances and the setting out of the associated works. Immediately report any discrepancy.

General

The positions of equipment shown on Drawings accompanying the Specification are for Tender purposes and are diagrammatic only. Check on site for positions and obtain approval and verification of all locations with the Principal prior to installation.

When any relocating is required to conform to the above, undertake such relocation without additional costs to the Principal. Allow relocation of accessories and equipment a distance of 3m without variation to the contract.

Verify locations of all equipment, including controls to ensure:-

- Co-ordination with final layouts;
- Co-ordination with other trades construction workshop drawings;
- The work of any other trade does not interfere with the hydraulic installation;
- Equipment is not obstructed by door swings and tracks, furniture or equipment;
- Full compliance with relevant Authorities and Australian Standards.

Discrepancies

Promptly report any discrepancies, for consideration and instructions. Work proceeding without obtaining approval, and subsequently rejected by the Superintendent shall be made good at nil additional expense to the Principal.

Co-ordination

Ensure all equipment has been coordinated with other trades and reviewed by the consulting engineer and architect before placing orders and before commencement of the relevant trade construction workshop drawings.

3.6 SALVAGED EQUIPMENT AND DEMOLITION

Salvaged Equipment

All salvaged equipment remains the property of the Principal unless classified as redundant. Obtain approval for the definition of redundant equipment. Remove all redundant equipment from the site.

Undertake salvage and demolition procedures in accordance with local safe work practices requirements to ensure timely and safe removal of equipment.

Demolition Works

Disconnect and remove asbestos containing equipment where scheduled for replacement or as required by demolition. Remove from site in compliance with local safe work practices requirements. Provide documentation evidencing the correct removal of this equipment.

Disconnect and remove equipment made redundant by the works and identified on the drawings. Hydraulic Contractor shall take full responsibility for all equipment stored on site.

Refurbishment Works

Identify any latent conditions such as seized pumps, block drainage, damaged equipment and the like as appropriate.

3.7 INSTALLATION REQUIREMENTS

The following clauses set out the general requirements for the works. These requirements are not intended to cover all aspects of the installation and must be read in conjunction with the Conditions of Contract, Special Conditions of Contract, other sections of the Specification and the drawings.

Working Dimensions and Tolerances

Check on site at regular intervals the building working dimensions, tolerances and the setting out of the associated works. Immediately report any discrepancy.

Core Holes and Penetrations Set out

Set out and provide all sleeving and/or core holes as required for the passage of pipes and/or conduits throughout the structure.

NOTE: Coring and cutting of concrete elements to be approved by structural engineer.

Equipment, Materials and Installation

Obtain approval for and maintain uniformity of the manufacturer and type of all materials and equipment. Use only new, current manufacture, first quality materials and equipment.

Comply with the manufacturer's recommendations in respect to installation techniques and the requirements for associated materials, access clearances, equipment, components and devices.

Ensure compatibility of materials and equipment with the installed environment in respect of ambient temperatures, utilities supplies and vibration.

Support all Hydraulic services equipment including pipework, cabling and the like, independently of other services and/or non-structural building elements.

Electrical Interference

Design and use electrical equipment which will not cause interference with electronic and electrical equipment in the vicinity. In the event that the inherent characteristics of equipment make interference possible, fit effective suppressors to eliminate the interference.

Maintain radio and television interference level within the limits set out in Australian/New Zealand Standard 1044 – Limits and methods of measurement of radio disturbance characteristics of electrical motor-operated and thermal appliances for household and similar purposes, electric tools and similar electric apparatus.

Maintain electrical disturbances within the limits set out in Australian Standard 2279 – Disturbances in mains supply networks. Comply with Australian Standard 4252 – Electromagnetic compatibility – Generic immunity standard.

Balancing and Phase Rotation

Balance each section of the installation evenly over all phases and ensure that phase rotation is correct throughout.

3.8 PENETRATIONS

Provide treatment to the penetrations as follows. Refer to architectural drawings for indication of all fire walls, floors ceilings, and the like, for allowance required to fire rated penetrations throughout:-

Penetrating Fire Rated Walls and Floors

Provide fire rated insulation to pipework or equipment and the like, where installed within fire rated wall as applicable, with an approved fire retardant insulation as required to maintain the fire wall/floor integrity. Maintain vapour seal to pipework insulation in accordance with the "Pipework" section of this specification. Pack around the insulation at both sides of the penetration with an approved fire collar. Fire collar shall be appropriate to maintain the integrity of the fire barrier. Obtain certification from manufacturer for the installation on completion. Refer to treatment of penetrations in this section for further details.

Flashing Through Roof

Supply and install weatherproof under flashing and over flashing to all penetrations.

Supply and install weatherproof over flashing to all penetrations, under flashing to be provided by nominated roofing contractor.

The over flashing shall be of the same material as the pipe passing through the roof and shall be securely fixed to it.

On completion the Plumbing Services Contractor shall test all penetrations for leaks to the satisfaction of the Architect.

Exposed Penetrations

In addition to the above, flash pipework and penetrations where exposed to view with colourbond sheet metal escutcheon plates. Sheet metal shall be to the architects approved colour

Protection of Penetrations

All floor and wall penetrations shall be protected to ensure no personnel can fall through or be injured from the penetration at all times during works.

Concealed Services

Conceal all services in areas other than plant or utility areas. Install services as follows:

- Cavity walls, hollow block and dry walls – install services concealed within cavity.
- Single leaf brickwork, concrete – surface mounted conduit or “mini-duct” and seek approval prior to installation.
- Do not chase walls or floors without prior approval from structural engineer.

3.9 PROTECTION

All pipework shall be protected against the entry of foreign matter at all times. Temporarily seal wastes, open ends of pipes, tundishes with fitted covers of pressed steel or UPVC. Rags, paper or wood plugs are not acceptable.

Sanitary fixtures are to be adequately protected against damage. Any item not considered to be in first class condition at the completion of the work shall be removed and replaced at no additional cost upon receipt of notice from the Architect.

3.10 FLUSHING OF SERVICES

All hydraulic services shall be thoroughly flushed to remove all foreign matter including silt, metal particles, etc. Valves, taps and washers shall be inspected and repacked or rewashed if necessary.

- Sewer service – ensure floor traps and waste drainage pipes are clear of debris and construction material during and upon practical completion of the project. Floor trap shall be tested to ensure they run at full volume.
- CCTV inspection of sewer may be requested during construction or upon practical completion of the project if sewer blockages occur, work shall be carried out and NIL cost to rectify the pipework
- Water service – ensure all services are flushed and made clear of debris prior to commissioning of equipment. Ensure all aerators, strainers and filters have been cleaned prior to final handover.
- Flushing of water services shall be carried out according to volume capacity

- Gas service – ensure all services are purged and made clear of debris prior to commissioning of equipment.

3.11 CLEANING UP

Thoroughly clean all fixtures and fittings and leave the installation in a first class working condition.

Remove all floor grates and inspection covers, clean all threads, grease and refit.

3.12 SEISMIC RESTRAINT, EARTHQUAKE BRACING, FIXINGS AND SUPPORTS

All plant, equipment and piping systems, shall comply with the requirements of Australian Standard 1170.4 - SAA Loading Code – Earthquake, AS2670 – Vibration, AS2625

Where greater incorporate the Design, Selection and Installation with requirements of ASHRAE Handbook 2011, Applications Chapter 48.

For further information regarding earthquake restraining, refer to following:-

- Gripple Seismic Installation Manual
- Tyco flow control, 2002, unistrut seismic bracing systems
- Fema e-74, January 2011, reducing the risks of non-structural earthquake damage - a practical guide.

Provide restraints and supports designed and certified by a structural engineer, to all plant, equipment, tanks pipework and isolation mounts in accordance with Australian Standard 1170.4-2007 Section 8, incorporating the following:-

Criteria	Unit	Factor
Importance Level	I	2
Annual Probability of Exceedance	yr	1:500
Soil Classification		De
Hazard Factor	Z	0.1
Probability Factor	Kp	1.0
Structural Classification	EDC	II

All restraints and supports shall be issued to the structural engineer to review the adequacy of the structure to support the services loads, including seismic forces.

The following do not require seismic bracing:

- Piping less than 32mm internal diameter in plant rooms.
- All other piping less than 64mm internal diameter
- All piping suspended by individual hangers 300mm or less in length from the top of the pipe to the bottom of the support for the hanger

Spacing of the bracing may need to be reduced for example:

- Brace both sides of piping, conduit at flexible connections

- Brace to avoid collision between piping, conduit and other non-structural components
- Brace within 600mm of changes in direction, whether it be horizontal or vertical changes
- Brace where components penetrate floors or ceilings
- Brace in both directions at the top of all risers where risers exceed 900mm

The spacing of bracing along a run of piping, conduit should not vary greatly in order to ensure uniform deflection and loading.

Equipment connected to a run of piping, conduit shall be individually and independently braced. Thermal expansion and contraction forces, where present, must be considered in the layout of transverse and longitudinal braces. Flexibility should be provided where pipes pass through seismic or expansion joints or connect to equipment with vibration isolators.

Bracing of pipework shall be at every second support.

Services braced in accordance with AS 1170.1-2007 section 8 shall have a minimum of 50mm clearance from all ceiling hangers and the ceiling grid.

Do not core through, cut through or otherwise damage steel reinforcement in concrete slabs, beams or columns when installing seismic bracing.

3.13 GENERAL PIPING INSTALLATION REQUIREMENTS

All screwed joints shall be made with the best quality pipe jointing compound, carefully placed on the threads of the pipe and not through fittings.

All cut and threaded pipe shall have the cutting burrs and sharp edges reamed out.

When erecting pipework, care shall be taken to protect the pipe. Dented or otherwise damaged pipework shall be replaced at the Contractors expense.

The general pipework arrangements shall be as indicated on the Drawings.

Pipework shall be installed as directly as possible between connecting points and run parallel to walls or ceilings.

All hot, cold, and warm water pipework shall be segregated to prevent heat transfer to conform with legionella control guidelines.

All connections between pipework and isolation valves and balance, pressure limiting valves shall be provided with flared compression joint unions or barrel unions for ease of removal.

Provide flared compression joint unions on all connections to equipment and plant.

3.14 PIPE SUPPORTS

All pipes shall be adequately supported and appropriately restrained by proprietary hangers and brackets designed to suit the requirements of each piping system. All pipework shall be fixed clear of each other with galvanised or stainless steel pipe clamps fitted with 4mm thick uni-cushion or equal approved. Between pipe clamps and copper tube, wrap tube with approved EPDM rubber.

PVC coated steel pipe clamps shall not be approved for use.

All piping concealed in roof spaces or above ceilings shall be supported from common supports where practicable and shall be run in neat pipe groups.

Pipework must be free to move without causing stresses in the pipework or pipe joints. Where provision has been made for movement in mains, the branch lines shall be unrestrained and in the case of copper tube, annealed for a minimum of 1800mm from the main. Where this is not achieved, some other approved provision for movement shall be made. Vertical pipes passing through floors shall be supported at a maximum of 1800mm centres.

Any noise from movement shall be rectified during the maintenance period.

All steel supports and associated fittings exposed to moisture, condensation or external elements shall be hot dip galvanised after fabrication. Dissimilar metals shall be isolated from one another as specified elsewhere in this specification.

3.15 INSTALLATION REQUIREMENTS FOR PVC PIPING AND FITTINGS

The installation of UPVC pipe and fittings shall be in accordance with Office of the Technical Regulator requirements and AS/NZS 3500 as amended and AS2032.

Pipes and fittings must not be stressed by straining into grade or alignment. Pipe ends must be cut square. Butts and swarf shall be removed.

Care must be taken to ensure that the end of the pipe is entered into the socket squarely and in correct alignment to match the grade of the preceding pipes or fittings.

Joints shall be solvent welded joint to AS2032 and in accordance with manufacturer's specifications and recommendations.

Surplus solvent cement is to be cleaned off.

All UPVC pipes cast in concrete shall be wrapped in 40mm thick minimum FORMFLEX polyethylene foam expansion material and shall be over wrapped in plastic surround. Thickness of foam wrap shall be 40 mm unless otherwise directed by structural engineer.

3.16 INSTALLATION REQUIREMENTS FOR HDPE/PVC PIPING AND FITTINGS INGROUND

All HDPE/UPVC pipes cast in concrete shall be wrapped in 40mm thick FORMFLEX polyethylene foam expansion material and shall be wrapped in plastic surround.

Where HDPE/UPVC Piping and Fittings are installed in soils of moderately, highly or extremely reactive classification the following shall apply:

The base of trenches shall be sloped away from the building. Trenches shall be

- Backfilled with clay in the top 300 mm within 1.5 m of the building. The clay used for backfilling shall be compacted.
- Where pipes pass under the footing system, the trench shall be backfilled full depth with clay or concrete to restrict the ingress of water beneath the footing system.
- Where pipes pass under the footing system, the trench shall be backfilled full depth with clay to act as a barrier to the ingress of water beneath the footing system. Alternatively, a

plastic membrane across the cross-section of the trench, taped to the pipe and keyed into the sides and base of the trench may be used.

- Penetrations of the edge beams of a raft and perimeter strip footings shall be avoided where practicable, but where necessary shall be detailed to allow for movement. Closed-cell polyethylene lagging shall be used around all sanitary plumbing drain pipe penetrations through footings. The lagging shall be a minimum of 20 mm thick on Class H1 sites and 40 mm thick on Class H2 and Class E sites. Vertical penetrations do not require lagging.
 - NOTE: Sleeves allowing equivalent movements may be used as an alternative to the lagging.
- Drains attached to or emerging from underneath the building shall incorporate flexible joints immediately outside the footing and commencing within 1 m of the building perimeter to accommodate a total range of differential movement in any direction equal to the estimated characteristic surface movement of the site (ys). In the absence of specific design guidance, the fittings or other devices that are provided to allow for the movement shall be set at the mid-position of their range of possible movement at the time of installation, so as to allow for movement equal to 0.5ys in any direction from the initial setting. This requirement applies to all sanitary plumbing drains and discharge pipes.
- Drainage risers under slab shall be provided with flexible joints and where piping systems are reduced below 100mm long expansion joints shall be fitted.
 - NOTES:
 - HDPE pipes may be encased in concrete or in recesses in the slab when provided with 40mm lagging and flexible joints at the exterior of the slab and lagged for entire length encased.
 - Methods used should comply with the AS/NZS 3500 series.
 - Refer to structural documentation for soil type classifications.

3.17 INSTALLATION REQUIREMENTS FOR POLYETHYLENE NON-PRESSURE PIPEWORK SYSTEM

All pipework to be jointed shall be new, current manufacture, first quality materials and equipment.

Preparation:

- Ensure hands and tools are free from surface contaminants, including creams oils, detergents and surfactants.
- Equipment shall be in suitable working order protected from inclement weather.
- Trenches shall be excavated to ensure a minimum clearance of 150mm surrounding the pipework.
- The pipe to be fusion jointed may be washed with clean water if necessary and dried with lint free material.
- Pipe ends shall be cut square to the axis and burrs and swarf shall be removed.
- Clean the fitting and bore the external surface of the pipe to be jointed with clean manufacturer approved alcohol wipes to remove traces of dirt and other contaminants. Do not use detergent or surfactants to clean the pipe surfaces.

- Fittings shall remain clean, place along the pipe and insert first witness mark on the pipe at half the fitting length with additional secondary witness mark placed 40mm further along pipework to enable visual checking of scrapped area after jointing is complete.
- Ensure pipe clamps or restraints are suitable for the pipes to be jointed.
- Jointing tools shall be clean of dirt prior to use.
- Using a manufacturer approved peeling device remove the surface of the pipe to the first witness mark. Note: Rasps or emery papers shall not be approved for use.
- Jointing process shall be undertaken at temperatures within the range of -10°C to +45°C.

Jointing Method:

- Ensure the prepared surfaces are completely dry before proceeding.
- Wipe the prepared surface with only the manufacturer approved alcohol wipe to the area about to be welded to remove any dust residue and contaminants. Methyl ethyl ketone or other solvents including rags are not approved for use. Note: one alcohol wipe shall be used per joint to avoid contamination of the fusion zone area.
- Ensure the fitting is clean and where required wipe with an approved isopropyl wipe as necessary.
- Ensure all surfaces are clean and dry before fitting the pipe ends with fittings in place.
- Insert the pipe on to the fitting and align with the first witness mark.
- The pipe end must be correctly aligned and free from any bending stress.
- Install pipe restraints to ensure the pipework cannot move and the fitting is satisfactory supported to prevent sagging during the fusion procedure.
- Fit the control box output leads to the fitting terminals ensuring they are fully inserted.
- Where automatic or manual control boxes are used and fusion times are entered or barcode scanners are provided jointing times shall be as per manufacturer's data.
- Press the start button on the control panel and check that the heating cycle is proceeding as indicated on the display.
- On completion of the heating cycle both melt indicators within the processed part of the fitting should have risen.
- Where indicator pins have not risen the contractor shall refer to the manufacturer's guidelines or control box indicators for faults. Re-welding the fitting after the cooling off period shall be only as recommended by the manufacturer.
- The complete joint should be left in the clamps for cooling. The time needed will be specific on the fitting, or by its manufacturer data, or in the display of the automatic control box.
- When the joint has cooled remove joint restraints from the pipework.

Equipment:

- Equipment shall be well maintained and cleaned at all times.
- The welding apparatus should be serviced and calibrated regularly and should not exceed 12 months from last calibration.
- The sharpness of the peeling tool cutter head shall be checked on a monthly basis or as required to ensure even removal of piping services.

3.18 INSTALLATION REQUIREMENTS FOR 'REHAU RAUPIANO' SANITARY PLUMBING DRAINAGE SYSTEM

Note: The contractor may supply and install the REHAU RAUPIANO system above ground and suspended sewer drainage. Hot relief discharges from the central roof top mounted hot water plant shall be provided with acoustically lagged HDPE pipework for the first 10 meters of pipework as indicated on drawing.

3.19 INSTALLATION REQUIREMENTS FOR COPPER PIPES

Copper pipework shall be installed in accordance with AS4809.

The copper tube system shall comprise of MM Kembla Copper Tube, MM Kembla Copper Brazed Fittings and MM Kembla KemPress® Copper Press-Fittings or equivalent, for use in plumbing, gasfitting and drainage applications for the transfer of water, gas and other manufacturer approved media. Installation shall be in accordance with current versions of AS/NZS 3500, AS 4809, AS 5601 and MM Kembla KemPress® Copper Design and Installation guidelines.

The copper tubes shall be seamless MM Kembla Copper tube or equivalent, complying with AS 1432, made from high residual phosphorous deoxidised copper classified as C12200 Alloy, Watermark approved and supplied as straight 6m lengths or annealed coils with nominal outside diameters in the range DN15-DN250.

Pipes and fittings must not be stressed by straining into grade or alignment.

Copper pipe runs shall be fabricated from the longest possible lengths and building up sections with short lengths will not be accepted.

Where copper pipes terminate in walls, eg. at taps or traps, a suitable anchor is to be used to securely fasten the fitting in position.

All copper pipes and fittings installed below building footprint and where penetrating footings up to 2.0 meters in length shall be wrapped with two layers of Denso Type 600 tape and 10mm formflex or equal approved unless otherwise noted to allow vertical and lateral movement. Pipework installed more than 2.0meters below building footprint shall be placed within PVC sleeve.

All domestic water pipes and fittings installed underground shall be protected from corrosion by encasing in polyethylene sleeving. Refer Piping and Materials section for details. Incoming building services shall be provided with approved flexible expansion loops to withstand potential soil movement.

Heated water piping shall be installed in accordance with AS3500 including provisions for expansion loops, offset or bends.

The supplier shall have a system of manufacturing and quality control traceability for individual tubes and fittings, including the ability to trace back to base material via mill test certificates.

The supplier shall operate a Quality Management System which is certified to comply with the requirements of ISO9001.

The supplier shall provide documented competency based training to the installer and regular on site verification to ensure the system is installed as required by manufacturer in order to meet warranty requirements.

A written 25-year warranty, specific to this project, including full conditions, shall be provided by the one supplier for tube and fittings. This warranty documented shall take into account the medium, pressures, temperatures and operating environment for the particular application.

3.20 INSTALLATION REQUIREMENTS FOR CROSS LINKED POLYETHYLENE PIPES

Supporting of pipework in both horizontal and vertical direction shall be in accordance with manufacturer's recommendations and in any case shall not exceed AS/NZS 3500,

Pipework and fittings shall be mechanically joined by proprietary compression sleeves. Bends shall be formed and held utilising proprietary bend bracket (bending radius = 8 x outer diameter).

Note: The pipework supplier's representative shall be required to inspect the first fix installation and certify in writing that the system has been installed to their recommendations.

3.21 SLEEVES

All service piping passing through walls, floors and footings shall be provided with sleeves, the location of which shall be accurately determined and installed to the approval of the Structural Engineer during construction. Provide shop drawings indicating location and size of all service penetrations for approval by the Structural Engineer.

3.22 BRAZING

At completion of all joints, residual flux shall be removed by quenching in water and cleaning with a steel wire brush.

3.23 CHROMIUM PLATING

Any pipes exposed within buildings excluding store rooms, are to be heavily nickel plated and then chromium plated. Where such pipes pass through walls or floors, a chromium plated wall plate is to be fitted unless otherwise detailed. All basin wastes and traps are to be chrome plated where exposed.

Chromium plating not required to specialised fixture such as laboratory sinks etc as nominated.

Chromium plated pipework shall be secured by chromium plated clips. Screws and bolts shall be chromium plated brass or be manufactured from 316 gauge stainless steel.

3.24 DISSIMILAR METALS

Where clips, brackets, and pipe supports are of dissimilar metal to the actual piping used, completely insulate the piping at all fixing points with at least four layers of 50mm wide black polyethylene tape wrapped around the pipe prior to fixing in position.

3.25 JOINTS IN PIPEWORK

COPPER PIPING

All joints in copper pipework shall be made by brazing with low temperature silver brazing alloy containing not less than 5% silver. Use oxy-acetylene heating for all low temperature brazing.

Flux shall be as recommended by brazing alloy manufacturer. Slip joints shall be permitted to join lengths of copper pipes and shall be made by annealing and expanding ends with a proper tool to form a slip (capillary) joint in accordance with the following table.

Pipe Size OD	Min Length of Slip Joint
15mm to 20mm	10mm
25mm to 32mm	15mm
40mm to 65mm	15mm
80mm to 100mm	20mm

Where straight sections of pipe of different diameter are to be joined, proprietary reducer fittings shall be utilised. Crimped joints will not be permitted.

Fabricated tees or junctions in copper pipes will not be permitted.

The copper brazed fittings shall be MM Kembla Copper Brazed Fittings or equivalent complying with AS 3688 and shall have the Watermark approval.

The copper tube system used shall be from the one supplier only.

Valves shall not be brazed direct onto pipes. Valves shall be indirectly joined to the pipes by the use of flanged or screwed adaptors, which shall be silver brazed onto the pipe and then screwed to the valve. Care shall be taken to prevent distortion to the valve and/or valve seat.

PRESSFIT JOINTS

All pressfit jointing shall be in accordance with manufacturer's guidelines and requirements. Contractor shall ensure fittings used are suitable for the fluid or gas to be transported. Contractor shall request manufacturer certificate of installation on completion.

The copper press-fittings shall be KemPress® Copper or equivalent, be of press fit type, complying with AS 3688. All fittings, excluding GAS fittings with HNBR type o-rings, shall have Watermark approval.

3.26 GRADES

All grades and inverts indicated on the drawings shall be established with the use of approved surveying instruments. Check the topography and finished floor elevations before commencing any excavation work.

The setting of all inverts, etc. at correct elevations is a prime and definite requirement of this Specification. Grades to drains shall generally be as shown on the drawings or where this information is not provided, as required by the relevant authorities and plumbing standards.

3.27 INSPECTION AND TESTS

During Manufacture

- Every facility is to be afforded the authorities and/or the Superintendent's representative for the inspection of any part of the work or apparatus during the course of manufacture and, upon completion, testing is to be undertaken in the manufacturers workshop if applicable.

Hydrostatic Tests – Water Services

- All pipework shall be hydrostatically tested to a head of one and a half times the working head and not less than 1500 kPA. Hydraulic (testing) pumps shall be disconnected immediately after pressurisation and all test heads shall be maintained until the Superintendent's representative or Regulatory Authority has satisfied himself as to the soundness of the pipework and equipment.

In no case shall the period of test be less than 2 hours.

Before applying specified test head, all air shall be expelled from the piping being tested.

Equipment is not to be connected to the respective services while hydrostatic tests are being carried out.

Provide a suitable pump and gauge and do all necessary work for carrying out the tests.

All testing of pipework is to be carried out before:

- Ceilings are installed.
- Service ducts are clad.
- Pipework insulated prior to testing shall have the ability to inspect joints to confirm compliance.

At completion of testing cold water lines shall be kept charged full of water at all times.

Air Testing – Sewer Services

- Air testing of drains shall or may be carried out to all drainage pipework where domestic mains water used for a hydrostatic test is not recycled or stored on site for reuse. Contractor shall perform an air pressure test by pressurising the drains as follows:
 - The sewer drainage pipework shall be pressurised to the initial pressure of 20KPA for sewer drains to 0- 1.5 meters in depth and 25KPA for sewer drains 1.5metres - 3.0meters in depth for a minimum of 3minutes to stabilise the temperature.
 - After the 3 minute stabilisation period the pressure shall be dropped to the test pressure of 15KPA for sewer drains to 1.5meters in depth and 20 KPA for sewer drains 1.5meters – 3.0 metres in depth and the test timing for the particular sewer shall then commence.
 - A pressure of not more than 5kpa pressure drop over 3 minutes shall be achieved prior to the test procedure being passed.

- All pressure tests to be inspected and passed in accordance with AS3500 and Office of the Technical Regulator requirements.

All drainage pipework above ground shall be tested at a test pressure of 15KPA.

Hydrostatic Tests – Sanitary Services

All sanitary drains shall be water tested by plugging at the lowest or other approved positions, and filling with water to the overflow level, minimum 1 metre head above the highest point of the graded drain.

Tests shall be maintained until the authorities, including Engineer and Architect, have satisfied themselves to the soundness of the pipework.

In no case shall the period of test be less than one hour.

Fixtures are not to be connected to the respective services while tests are being carried out.

Provide all necessary plugs and do all necessary work for the carrying out of these tests.

All testing of the above systems shall be carried out before:

- Finishing trades have commenced their work.
- Backfilling has commenced.

Gas Pipework Pressure Testing

All gas services are to be tested in accordance with AS 5601.2013 section 2 and table E.

Tests shall be maintained until the authorities, including Superintendent, have satisfied themselves to the soundness of the pipework.

In no case shall the period of test be less than one hour.

Appliances are not to be connected to the respective services while tests are being carried out.

Provide all necessary plugs and do all necessary work for the carrying out of these tests.

All testing of the above systems shall be carried out before:

- Finishing trades have commenced their work.
- Backfilling has commenced.
- Appliances are connected.

Fixtures

Fixtures shall be filled to spill level with water after installation and visually checked for leaks.

Test of Completion

Upon completion the Hydraulic works shall be tested under normal working conditions and as directed by the Superintendent's representative. Such tests shall continue until

Superintendent's representative is satisfied that the terms of this specification has been complied with and that the Hydraulic works are capable of meeting all requirements.

All defects disclosed during the tests shall be remedied immediately and, if required by the Architect, additional tests shall be carried out.

The duration of the tests will be decided by the Superintendent's representative and the maximum duration of any one test will not exceed eight hours.

The Superintendent's representative shall be given two (2) days clear notice that any system is ready for test.

Provide all equipment and labour required for tests.

The Superintendent reserves the right to check any aspect with his own equipment.

All tests shall be carried out in the presence of, and to the satisfaction of, all local authorities, as well as the Superintendent's representative.

Record Keeping

Contractor shall keep a record of all tests completed and inspection requested by the Local Technical Regulator with dates the tests were performed, pressure applied to the relevant pipe being tested and end result as a pass or fail. Records shall include the name of the operator performing the test and witness of the result. Records shall be inserted within manuals for future reference.

3.28 TRENCH EXCAVATION, BACKFILLING AND COMPACTION

Trench Excavation

The Contractor shall do all excavation of whatever substances encountered to the required depths, lengths, breadths, grades and alignment as may be necessary for the construction of the pipe drains in accordance with the Drawings.

Where trenches are to be in bitumen or concrete paving, the surface shall be saw-cut where paving consists of unit pavers, blocks shall be removed.

Trenches are to be excavated to the correct line and level with vertical sides at least 300 mm wider (150 mm on each side) than the external diameter of the pipes to be laid in them. Sufficient extra width and depth is to be excavated at each joint to allow the pipes to be properly jointed. Excavation shall be 75mm lower than required for 75mm thick compacted sand base or 10mm sieve metal screenings for pipework bedding.

Trenches must be kept clear of water at all times and timbered where necessary to prevent collapse. They shall be excavated only sufficiently in advance of pipe laying to allow that work to proceed without delay.

Excess excavation below the required level shall be backfilled at the Plumbing Contractor's expense with sand, gravel or other material as directed by the Superintendent, and thoroughly compacted. Any soft or yielding material shall be removed and replaced with sound material and compacted to the satisfaction of the Superintendent.

Suitable safety barriers shall be provided around the excavation at all times. The barriers shall be suitably defined by approved lighting during the appropriate light up time for the area.

The barriers shall not be removed until completion of all work.

Excavated material shall be removed off site. All cartage costs and tipping fees shall be paid by the Plumbing Contractor.

Pipe Bedding/Support

Pipes shall have a minimum 75mm bed of compacted sand base or 10mm sieve metal screening provided in accordance with AS3500.

The bedding surface shall provide a firm foundation, carefully shaped true to line and grade.

Laying Pipes

Pipes shall bear evenly on the bed prepared as specified above and laid with the sockets pointed up-grade. All pipes shall be laid in straight lines, to true invert levels. A maximum of 10 mm deviation in alignment shall be permitted.

Trench Backfilling

No joints shall be covered or trench backfilled until pipe laying and jointing has been approved by Superintendent's representative.

It shall be the Plumbing Contractor's responsibility to ensure the inspection and approval of the pipe drains prior to the backfilling.

Failure to observe this clause shall render the Plumbing Contractor liable for re-opening at his own expense any trench backfilled without approval.

Backfill material shall comply with the relevant services specification section. Generally backfill, including the overlay zone shall be:

- In paved areas or under buildings - quarry sand

Backfill shall be placed in layers not greater than 150 mm thick and compacted to:

- In paved areas or under buildings - 98% Modified Compaction Maximum Dry Density
- Note: Contractor shall engage independent engineer to perform compaction testing of trenches on completion. Test results shall confirm 95% compaction has been achieved. A minimum of 4 compaction tests are required for the ground floor drainage with test sheets inserted within manuals for review.

Weather Damage and Flooding of Excavations

Keep excavations free from water and seepage and take all necessary precautions throughout the duration of the Contract to maintain the safety and stability of the excavation.

Over Excavation

Backfill over-excavated trenching with approved granular material or concrete as directed by Superintendent's representative and/or the Local Technical Regulator.

Barriers and Accessibility

Provide all necessary barricades and lighting to excavations to protect the public, as well as the work during the course of all excavations.

All necessary arrangements for access over trenches and safety lighting shall be made so that paths and doorways are trafficable at all times.

Shoring of Trenches

Where necessary and/or required by the Authorities for safe and efficient completion of the work, supply, erect shoring, timbering, planking, etc. of sufficient strength and quality to prevent earth and other materials entering the excavations, tunnels, etc.

Work shall be carried out in accordance with Local Authority Safe Work requirements.

Remove all shoring and timbering in an approved manner on completion of the work and after the inspections have taken place.

Minimum Cover to All Pipes

All service pipes shall be installed with the minimum cover as noted hereafter or in excess of these as noted on the drawings or specified elsewhere.

Sewer	600mm in areas subject to vehicular traffic
	450 elsewhere
Water	450mm minimum
Gas	600mm
Separation	100mm for services up to and equal to 50mm
	300mm for services above 65mm

3.29 TREATMENT OF PIPEWORK PENETRATIONS

Where hot and cold water pipework penetrates fire rated walls or plumbing ducts, penetrations shall be fire stopped, utilising a resilient gunnable compound to comply with the minimum requirements specified in the Building Certifiers/Surveyors report. Where no report has been made available during the tender period, a minimum -/180/180 minute fire rating is to be included.

Where hot and cold water pipework penetrates non fire rated bounding walls or plumbing ducts, penetrations shall be sealed, utilising a pipe manufacturer approved resilient gunnable compound.

Where copper hot and cold water pipework penetrates concrete floor slabs the fire rating of the floor shall be maintained. The annular space between the outside of the pipe and the floor penetrations shall therefore be filled with a fire rated grout, fire rated mastic or IBS foam strip. Note: All copper pipework shall be spirally wrapped with plastic film through penetration to prevent contact with fire rated grout.

Where UPVC, HDPE, CROSS LINKED POLYETHYLENE or any plastic pipework penetrates fire rated bounding stud walls or plumbing ducts, penetrations shall be fire stopped utilising an approved Retro-fit fire stop collar.

Where UPVC, HDPE, CROSS LINKED POLYETHYLENE or any plastic pipework penetrates concrete floor slabs the fire rating of the floor shall be maintained. The penetration shall be fire stopped utilising an approved fire stop collar.

Resilient gunnable compound or fire rated grouts are not permitted to contact PE-X pipework or polymer fittings regardless of the reticulation system. Contractor is to use an approved fire collar installed as per the manufacturers requirements on PE-X pipework penetrating fire walls and fire rated elements.

Note: Any pipe penetrations with an open floor grate above, must be protected with an approved floor waste fire stop collar in accordance with the BCA and AS1530.4

All pipework penetrations must be treated utilising a fire rated product designed for the application and material. The contractor is required for the fire stop manufacturer's representative to inspect the installation and certify in writing that the correct product has been installed to their recommendations.

All pipework installed within fire rated walls shall be fire rated with approved fire rated compound or collar as directed by manufacturer to maintain the integrity of the wall.

3.30 ACOUSTIC REQUIREMENTS

Refer to Specification for details of approved proprietary acoustic pipe lagging systems.

Support of Pipework

Drainage pipework in ceilings must be supported off the slab above and must not contact any lightweight ceiling support members, stud wall framing or other services.

Drainage pipes in plumbing ducts must be fixed with approved isolations pipe clamps and gaskets. Approved isolated pipe clamps and gasket systems include:

"Kwik-smart" pipe clips by Binder Engineering

"Ezyclip" pipe clamps by Flexistrut

Rehau Raupiano bracketing system for acoustic piping.

Hot and Cold Water Pipes and Plumbing Fittings

To control structure borne sound from water supply pipes, flexible water supply pipe such as "Rehau" or equal approved product shall be used.

The flexible pipework can be fixed direct to the slab soffit or be run in wall cavities without special acoustic treatment, except at the metal connectors. Where the pipe is fixed to a common partition such as the slab soffit or within a bounding wall, the metal connectors must be isolated using non-setting flexible acoustic sealant.

Flexible connections are required to be fitted to drain pipes serving dishwashers, washing machines etc.

4 PIPING AND MATERIALS

4.1 GENERAL MATERIALS

Type	Application	Joining	Bracketing	Insulation	Location
UPVC- Ø100 - SN6 Ø150-225 -SN8	Sewer	Cleaning Fluid. Solvent cement. (Type N).	Hanging/offset brackets.	Acoustically wrapped	Internal, external, suspended, inground
HDPE - 40-56mm PN6 63-160mm PN4	Sewer Stacks	Electrofusi on welded coupling	Hanging/offset brackets.	Acoustically wrapped	Internal, external, suspended, inground
Copper - Type B Minimum	Domestic Water, Gas, Drainage.	Welded or Compressi on.	Hanging/offset / Unistrut system.	Thermal/aco ustic as required per this specification	Internal, external, suspended, inground
Cross linked Polyethylene - PN20	Domestic Cold and Hot water	Compressi on	As per the manufactured bracketing system.	Thermal/aco ustic as required per this specification	Suspended, internal in concealed areas only
Cross Linked Polyethylene – Aluminium lined	Natural Gas	Compressi on	As per the manufactured bracketing system.	N/A	Suspended, internal in concealed areas only. Not for external use.
Medium Density Polyethylene Blue Stripe - PN12.5 min.,	Domestic Cold water	Electrofusi on welded coupling	In-ground only	N/A	External, inground
Medium Density Polyethylene Yellow Stripe - SDR11	Gas	Electrofusi on welded coupling	In-ground only	N/A	External, inground
Polypropylene	Waste Fixture traps only	N/A	As per the manufactured bracketing system.	N/A	
Acoustic Drainage	Suspended drainage	Rubber ring	As per the manufactured bracketing system.	N/A	Internal

4.2 UNIFORMITY AND QUALITY

Obtain approval for and maintain uniformity of the manufacturer and type of all materials and equipment. Use only new, current manufacture, first quality materials and equipment. Only use one (1) brand/manufacturer per system of installation. Multiple types shall not be permitted.

Comply with the manufacturer's recommendations in respect to installation techniques and the requirements for associated materials, access clearances, equipment, components and devices.

Ensure compatibility of materials and equipment with the installed environment in respect of ambient temperatures, utilities supplies and vibration.

Support all equipment including pipework, cabling and the like, independently of other services and/or non-structural building elements.

Copper Pipes - Sanitary Plumbing, Domestic Hot and Cold Water, Gas Service

Copper pipes are to be solid drawn tubes, manufactured in accordance with AS 1432-1973, and to be of the gauges specified or as shown. The use of Table 5 copper tube will NOT be permitted.

Type 'B' tube or heavier shall be used below ground and above ground.

Wall thickness for hot water pipes shall be the same as those required for the cold water piping, but shall be not less than Table 'B' of AS 1432 - 1973 with a minimum wall thickness of 1.0mm.

Fittings shall be approved by the Local Technical Regulator and all joints shall be silver soldered.

Fittings for copper tubing shall be used in accordance with the following schedule:

- For Sanitary Plumbing
 - Brass, as approved for use by the Local Technical Regulator, AS3500 and local authority or equal approved.
- For Hot and Cold Water
 - Brass or copper acceptable to the tapware manufacturer, in order to maintain tapware guarantees and suitable for silver soldering.

All brazing shall be carried out with a suitable silver brazing alloy containing not less than 2% silver and 6% phosphorous such as S.B.A. No. 115 or Handley's No 15. Only one brand may be used throughout the job. Bronze welding will NOT be permitted. Remove all flux on completion of brazing.

Cross Linked Polyethylene - Domestic Hot and Cold Water Service (extending from isolation valves, assemblies and where concealed within wall frames and/or ceiling space)

Cross linked polyethylene equal to 'Rehau HIS311' system PN20.

Cross linked polyethylene pipework and fittings shall conform to AS2492 and AS2537 respectively.

Pipe materials shall be PE-Xa/PE construction, consisting of PE-Xa inner layer and a PE outer marking layer

Minimum design service life of 50 years at 70degC – 1000kPa

Compression sleeves of sizes between 16 and 40mm shall be bidirectional polymer sleeves manufactured from PVDF.

Brass fittings quality shall have a permitted dezincification depth of no greater than 100µm.

The pipes shall have a fire resistance level (FRL) rating of up to 240 minutes on the integrity and up to 180 minutes on insulation using PROMAT Unicollar.

Note: Pipe sizes nominated on drawings are equivalent copper sizes and where PEX is used the internal bore shall be equal or larger.

Supporting of pipework in both horizontal and vertical direction shall be in accordance with manufacturer's recommendations and in any case shall not exceed AS/NZS3500.

Perform jointing only on a straight pipe sections and joints are not permitted on pipe bends. Straight sections of pipe section shall extend a minimum of three (3) times the compression sleeve length prior to any pipe deflections or bends to comply with manufacturer requirements.

Pipework and fittings shall be mechanically joined by proprietary compression sleeves. Bends shall be formed and held utilising proprietary bend bracket (bending radius = 8 x outer diameter).

Note: The pipework supplier's representative shall be required to inspect the first fix installation and certify in writing that the system has been installed to their recommendations.

Note: Refer to the manufacturer installation requirements for further details.

Medium Density Polyethylene - Gas Services (External To Building)

Medium density polyethylene pipework shall be SDR 11 PE 100 to AS4130 outside diameter as indicated on drawings. Jointing shall be by the electrofusion system strictly in accordance with the manufacturer's instructions.

Pipework shall be H.D.P.E type 50 with electro-fusion joints.

All electron fusion work shall be carried out by and experienced and trained person, provide proof of training as provided by manufacturer.

All equipment shall be calibrated at commencement of works with proof of recalibration as per manufactures requirements during the course of the works.

All materials are to be installed in accordance with manufactures requirements and utilizing equipment as outline in manufactures technical data and installation requirements, including but not limited to fusion equipment, cleaning material, scrapping tools, and pipe brackets.

Above Ground-(Internal)

Cross linked polyethylene aluminium polyethylene multilayer pipe complying with AS4176.8 RAUTITAN gas stabil gas pipe, Rautitan gas fittings and compression sleeves or equal approved and installed in compliance with AS5601.

Where pipework is installed within wall cavities and inaccessible areas Rauguard flexible metal conduit shall be placed over the pipe for protection.

UPVC Pipes - Sanitary Plumbing and Sewer Drainage (in non acoustic areas only)

All unplasticised polyvinyl chloride pipes and fittings shall conform with AS1415 and the type 'N' heavy duty non-pressure pipe and shall conform with the requirements of Local Technical Regulator, and be as manufactured by Iplex Plastics, or equal approved and shall be installed in accordance with AS2032 and AS2870.

Fittings shall be by the same manufacturer as the pipe and shall be compatible in every respect and be in accordance with AS1260-Moulded Rigid UPVC Fittings and be certified in accordance with the NCPDP scheme.

All UPVC pipes cast in concrete where permitted shall be wrapped in polyethylene foam and all shall be wrapped in plastic surround.

Joining a Method: Solvent Cement Joints to AS2032

Acoustic Piping- Sanitary plumbing drainage

The piping shall conform to the following criteria:

Polypropylene (PP-MD), mineral-filled, halogen free

Pipe materials shall be composite polypropylene, consisting of polypropylene inner layer, mineral-filled polypropylene middle layer and UV-stabilized polypropylene outer layer, complying with AS/NZS 7671 for gravity drainage system in residential and commercial applications, colour white (RAL 9003).

The pipes shall be designed for a temperature of 90°C and can temporarily withstand temperatures of up to 95°C and marked with ice crystal to indicated suitability for installations under extreme low temperatures up to -10°C. The pipes shall have excellent chemical resistance, withstanding acidity level from pH 2 - 12.

The pipes shall be certified under WaterMark scheme for dimensions

DN (OD) 40 – 50 – 75 – 90 – 110 – 125 – 160 – 200mm.

Available lengths shall be from 150 to 3000 mm.

Ring stiffness: > 4 KN / m² Mean elongation: 0.09 mm / (m.K) Resistant: up to 100kPa = 10m water column (pressure test certificate on request)

The pipe materials shall be packaged to reduce UV-radiation effect to the pipe materials themselves and to protect the pipe materials from dirt and other foreign materials.

Fitting – Polypropylene (RAU-PP), mineral-filled

Fitting materials shall be mineral-filled polypropylene for acoustic performance enhancement, complying with AS/NZS 7671 for gravity drainage system in residential and commercial applications, colour white (RAL 9003). The fittings shall have an inserted SBR sealing ring

The fittings shall be designed for a temperature of 90°C and can temporarily withstand temperatures of up to 95°C and suitable for installations under extreme low temperatures up to -10°C. The fittings shall have excellent chemical resistance, withstanding acidity level from pH 2 - 12.

The fitting materials shall be certified under Standards Mark scheme for dimensions

DN (OD) 40 – 50 – 75 – 90 – 110 – 125 – 160 – 200mm.

Floor-gully – Acrylonitrile Butadiene Styrene (RAU-ABS)

Floor gully material shall be the Acrylonitrile Butadiene Styrene. The floor gully shall have 1 main inlet in dimension DN (OD) 110mm and 3 additional inlets in dimension DN (OD) 50mm. The outlet shall be of dimension DN (OD) 75mm. Each inlet and outlet shall have an inserted SBR sealing ring. The floor gully shall have a removable access plug. The height shall be 250 mm.

Floor-gully – Polypropylene (RAU-PP), mineral-filled

Floor gully material shall be the Polypropylene. The floor gully shall have 1 main inlet in dimension DN (OD) 110mm and 3 additional inlets in dimension DN (OD) 50mm. The outlet shall be of dimension DN (OD) 75mm. The main inlet (DN 110mm) shall have an inserted SBR sealing ring. All other inlet and outlets shall be male connector type. The floor gully shall have a removable inserted trap. The height shall be 222 mm minimum.

Sound-dampening bracket

Sound-dampening bracket shall be rubber-lined with vibration-decoupling system to reduce the structure-borne noise transmitted from the DWV system. Material shall be galvanized steel, including hanger bolt.

Hot and Warm Water Piping Insulation

All internal hot water flow and return mains and riser piping where indicated shall be insulated with 19mm thick (minimum) 'Armaflex' or, approved equal insulation, fitted in accordance with the manufacturer's instructions

All hot water flow and return mains and riser piping installed externally shall be insulated with 25mm thick (minimum) 'Armaflex' or, approved equal insulation, fitted in accordance with the manufacturer's instructions- refer below for further details on pipe and fitting insulation installed internally and externally.

- Provide removable insulated casings to all valves comprising insulation, metal covers and quick release type hinge and catches. Accurately shape insulation to closely fit all valves and fittings. Ensure that the insulation can be removed and replaced to provide a vapour seal upon replacement.

- Complete the vapour seal around all bends, joints and fittings utilising proprietary sealing compound in accordance with the manufacturer's recommendations.
- Replace the insulation material with non-compressible ferrules (pipe support blocks) such as "Insulco - Insubloc", or equal approved, at all support points

All hot water and warm water branch piping (dead legs) shall be insulated with 13mm thick (minimum) 'Armaflex' or, approved equal insulation, fitted in accordance with the manufacturers instructions.

Insulation shall possess the following characteristics or a minimum – Spread of Flame Index – 0, Smoke Developed Index – 3, Thermal Conductivity 0.038w/mk at 0 °C mean temperature.

All hot water pipework insulation exposed to weather shall be metal clad utilising galvanised sheet metal, custom formed to the pipework profile and securely fixed utilising 6mm x 8 gauge Stainless Steel screws. Alternative UV resistant wrap such as Arma-chek D or equal approved may be provided.

All joints and caps to be made watertight and bends rolled and formed to completely cover all hot water pipework insulation. Installation is to be left in a tradesman like manner with all pipework plumbed and securely fixed.

Note: All sealants and adhesives used on insulation where PEX piping is utilised shall be a neutral cure sealant only- Acetone based adhesives or sealants shall not be approved for use.

Cold Water Insulation

Cold water pipework built in masonry walls shall be wrapped in two layers of non adhesive plastic film.

Note: Domestic cold water services pipework mains traversing in ceiling and walls shall be provided with acoustic pipe lagging or thermal lagging as indicated in this specification.

All external domestic cold water mains and riser pipework where indicated shall be insulated with 19mm thick (minimum) 'Armaflex' or, approved equal insulation, fitted in accordance with the manufacturer's instructions. Refer below for further details on pipe and fitting insulation installed internally and externally.

- Provide removable insulated casings to all valves comprising insulation, metal covers and quick release type hinge and catches. Accurately shape insulation to closely fit all valves and fittings. Ensure that the insulation can be removed and replaced to provide a vapour seal upon replacement.
- Complete the vapour seal around all bends, joints and fittings utilising proprietary sealing compound in accordance with the manufacturer's recommendations.
- Replace the insulation material with non-compressible ferrules (pipe support blocks) such as "Insulco - Insubloc", or equal approved, at all support points

Insulation shall possess the following characteristics or a minimum – Spread of Flame Index – 0, Smoke Developed Index – 3, Thermal Conductivity 0.038w/mk at 0°C mean temperature.

All cold water pipework insulation exposed to weather shall be provided with 'Arma-Chek D' or equal approved ultra-violet resistant insulation fitted in accordance with the manufacturer's instructions.

All joints and caps to be made watertight and bends rolled and formed to completely cover all hot water pipework insulation. Installation is to be left in a tradesman like manner with all pipework plumbed and securely fixed.

Note: All sealants and adhesives used on insulation where PEX piping is utilised shall be a neutral cure sealant only- Acetone based adhesives or sealants shall not be approved for use.

Valves

Generally

Provide and install as a minimum all valves indicated on the drawings and as required for correct operation, servicing, and drainage of all piping systems.

All valves shall be of approved types suitable for the temperature, working pressure, testing pressure and, particular service in which they are installed.

Where possible all valves shall be by the same manufacturer and one type of valve shall be used for different systems.

Valves 65mm or greater shall have flanged ends and valves 50mm or less shall have screwed ends, unless otherwise specified.

Valves installed in the Hydraulic Services shall be approved by the local Authorities.

All stop and check valves shall have an arrow cast into the body to indicate direction of flow.

All isolation valves sized 15mm > 50mm installed above ground shall be ISIS D.R ball valves with Stainless steel handles or equal approved.

All isolation valves sized 15mm > 50mm installed below ground shall be Stainless Steel Fratelli ball valves or equal approved.

The RMC Pressureguard® Compact Pressure Reducing Valve is used in water systems to limit the downstream pressure to the pre-set maximum. 15mm PRV15, 20mm PRV20 and 25mm PRV25.

Copper Pipe Services

- General
 - All valves shall be of all brass or stainless steel construction unless otherwise specified tested and stamped for the duty.
- Cold Water
 - Full bore D.R. brass or stainless steel ball valves less than 65mm the same nominal diameter as the pipe to which they are fitted.
 - Valves to be installed with a brass tube bush brazed to the pipe on the inlet side with a flared type K.G.L. union connection on the outlet side.
 - Valves 65mm and greater shall be flanged butterfly type.

- Hot Water Units
 - Refer to manufacturer's schematic diagram and installation guide for details on valves and fittings associated with hot water systems.
- Check Valves
 - Zinc free bronze spring loaded check valves shall be fitted to hot water units.
 - Check valves to other equipment up to and including 50mm NB shall be Johns spring loaded type or approved equivalent.
- Hose Cocks
 - Hose cocks shall be 20mm chrome plated brass with flanged bib extension fitted with hose connection vacuum breaker devices.
 - Location: Refer drawings for details.
- WC Cisterns
 - WC Cisterns shall have 15mm right angle cistern cock with chrome plated wall plate and chrome plated copper connector, unless noted otherwise. Note: Exposed stainless steel braided hose connections shall not be approved for use.

Concrete

- All concrete used in plumbing work shall conform to the requirements of the Structural engineer and as listed in AS3500 or as indicated on the drawings.

Alternative Materials and Equipment

- Should the Plumbing Services Contractor wish to consider alternative materials or equipment to specified requirements, details of same shall be included in the tender offer for consideration. The alternative material or equipment shall not be built into the works unless written approval for its use has been received from the Superintendent. Approval for use of an alternate product shall include certification from the manufacturer the piping system has been installed in accordance with manufacturer guidelines and the contractor is sufficiently trained in the use of the product.

4.3 PIPE AND ISOLATION VALVE/METER IDENTIFICATION

Pipework

All accessible and exposed pipework shall be identified and colour coded by colour bands fitted at 3000mm intervals. Coloured bands shall be located in a visible position, with a corresponding arrow indicating the direction of flow and label identifying the services.

Pipe identification colour code shall be in accordance with Australian Standard 1345.

All inground pipework shall be provided with detectable identification tape identifying the service.

Detectable tape shall be minimum 75mm wide and extend to within valve box or access chamber.

Valves and meters

All isolation valves and meters installed in the hydraulic services installation shall be identified with engraved plates (white lettering on black background fixed to hand wheel).

Submit samples of all labelling and engraved plates for approval prior to ordering.

Valve Identification

All isolating valves shall be clearly marked by service and function served.

Labels shall be black on white engraved laminated plastic labels securely attached to the valve.

5 SANITARY FIXTURES AND TAPWARE

5.1 GENERAL

Sanitary fixtures and equipment are to be supplied by builder as per the architectural sanitary fixture and tapware schedule and are to be installed by hydraulic services contractor. Install sanitary fixtures and tapware, complete with chrome plated on brass outlet, brackets, fixing bolts and screws wherever required etc, as required to complete the installation.

All fixing shall be plumb and level, neatly finished in a tradesmanlike manner and without damage.

Upon taking delivery, if any of the Sanitary fixtures are damaged during installation, the Hydraulic Services Trade shall replace the fixture at no expense to the proprietor.

Except where otherwise specified, all vitreous sanitary fixtures shall be white or as specified.

White sanitary fixtures where inset or vanity shall be sealed with white non-setting mastic.

Fixing of Fixtures and Fittings in Cupboards etc

Where fittings and fixtures are fixed in vanity units, cupboards etc, the Contractor shall co-operate with and allow for attendance of the Joiner to ensure:

- That the fixtures, fittings and taps are on site to allow the Joiner to cut holes in the bench tops before the benches or cupboards are permanently fixed and sealed in position.
- That the fixtures are fixed and sealed as recommended by the manufacturer and to the satisfaction of Superintendent's representative.
- That no sealant shall be visible beyond the sealing rim of the fixture.
- Note: Sanitary grade sealants shall be utilised where approved by manufacturers in lieu of neutral grade sealants.

Fixing of Fixtures to Walls

Supply and install timber trimmers as necessary for the fixing of sanitary fixtures to walls.

Fixing of Tapware

All equipment and tapware shall be fitted with individual isolation valves in accessible locations. All isolation valves shall be chrome plated or stainless steel where visible and watermarked approval. Stainless steel braided hoses shall be watermarked approval and not concealed in walls or ceilings.

Sanitary Fixtures and Tapware Schedule

Refer to Architectural Sanitary Fixtures and Tapware Schedules for details of fixtures to be supplied as part of these works. Install Sanitary fixtures where shown ready for connection to drainage system.

The Plumbing Contractor shall allow to provide suitable secure storage on site for same.

6 SOIL, WASTE AND VENT PIPES

6.1 GENERAL

Supply and install all soil, waste and vent pipes as detailed on the drawings and in accordance with the Directions of the Local Technical Regulator and AS/NZS 3500 Part 2 and as specified in Materials and Workmanship Subsections.

The whole of the work shall be carried out by, or under the direct supervision of a Fully Licenced Plumber in strict accordance with the regulations and requirements of the Local Technical Regulator, Local Authorities and to the entire satisfaction of the Architect.

The systems shall be complete with all necessary bends, junctions, expansion joints, traps, fixed points, clips, bolts and inspection openings provided with screwed or bolted covers.

Set all floor traps, inspection openings tops and gully grates flush with the finished floor level or as indicated on the drawings.

6.2 PIPEWORK AND FITTINGS

Material Types

Install all pipework as shown on the drawings and as scheduled.

Waste Pipes

Provide and fix waste branch lines, which shall be in UPVC to all sanitary fixtures, except where noted otherwise. All waste pipe risers within all wet areas through all floors shall be fitted with approved puddle floor flange, fully sealed to riser and structural floor.

Plug and Washers

Provide plug and washers to fixtures in accordance with the manufactures requirements and ad required to ensure correction operation of the fixture

- Hand Basin - chrome plated brass or stainless steel plug and washer, unless integral or stated otherwise.
- Kitchen Sink, stainless steel to manufactures requirement

Floor Wastes

Provide floor wastes adjacent to sanitary fixtures of the sizes indicated on the drawings and provide risers as required to accommodate the wastes shown discharging into riser. Riser shall be complete with 100mm (shower) or 100mm (floor) chrome plated brass grating. Grates shall be set at a level to enable floor to be graded to same.

The set-out of the floor wastes shall be closely coordinated with the tiling layout. Refer Architectural Drawings for specific set-out requirements.

Floor Grates

HDPE

All floor grates shall be connected to drainage pipework utilising approved connections, puddle flanges and provide water tight seal.

Vinyl:

All floor grates used covered with vinyl shall be provided with approved clamping and grate.

Vent Pipes

All sanitary vents where applicable shall be UPVC unless otherwise indicated.

All roof penetrations shall be sealed waterproofed utilising 'Dektite' over flashing, zincalume/lead approved flashing suitable for roof type or where concrete upstands are utilised an approved weather apron shall be provided over upstand. The vents shall terminate with approved UPVC cowl.

All sanitary vents shall be fitted with PVC cowls.

On completion, the Hydraulic trade shall test all penetrations for leaks to the satisfaction of the Superintendent.

Tundishes

Inwall tundishes to serve air conditioning discharges as indicated shall be of 'Stratco' or equal approved comprising copper, stainless steel or polypropylene in-wall section with removable flush mounted powder coated stainless steel cover plate. (Contractor shall ensure Colour selection of cover panel shall match tiled or painted wall surround). Cover plate shall be fixed in place with powder coated stainless steel screws. Cover plate to be vented type to allow overflow to discharge through fascia in the event of blockage. Submit sample of cover plate prior to ordering.

Box type tundishes for receipt of fire, mechanical, refrigeration or hydraulic services discharges shall be of stainless steel construction and set at 50mm above finished surface level with rolled edge grooves and bevelled edges unless otherwise noted. Refer to drawings for tundish dimensions and outlet diameters. Where the tundish is not dimensioned the Hydraulic trade shall coordinate with other services trades and documented drawings to identify the expected discharge rate and provide details to consultant for approval prior to installation.

Tundishes located in joinery cupboards may be PVC with cone opening and waterless trap located in the vertical plane at a minimum 150mm below tundish. Fix tundish securely in joinery cupboard with air gap to mechanical services drain. Tundish drains positioned within cupboards that limit the access or available space shall be rejected and relocated to the rear of the joinery.

Note: Waterless traps shall be accessible.

Provide tundishes to the following items

- Mechanical Services Plant

- Hydraulic Services Plant
- One tundish per common area air conditioning units. Final location of tundish shall be confirmed with the Mechanical Services Trade prior to first fix installation.

Inspection Points

Inspection points shall be approved brass, chrome plated brass, stainless steel or cast iron suitable for application required.

In the following positions these shall be:

- (a) 150mm brass traps screws where set in external concrete paving and subject to foot traffic only. Non slip type shall be provided where locations are susceptible to water or moisture.
- (b) As for (a) but 100mm chrome plated non slip type, in internal tiled floor areas, set flush with finished tile level. Note: Stainless steel maybe permitted where approved.
- (c) Inspection openings within vinyl surface areas shall be vinyl clamp type and non slip.
- (d) Cast iron where located in carparks, roadways, landscape or gardens areas or subject to vehicular traffic (Marked 'S').

Note: Concrete type covers shall not be permitted.

6.3 MATERIALS

Shall be generally as noted on drawings and as follows:

- All sewer drains below ground shall be HDPE pipe as shown on drawings.
- All suspended sanitary drains above ground shall be UPVC as shown on drawings and acoustically wrapped.
- All suspended sanitary drains above ground within habitable areas shall be Rehau Raupiano pipe as shown on drawings and acoustically wrapped UPVC where required.
- Soil stacks shall be Rehau Raupiano and minimal acoustically wrapped HDPE pipe where serving roof top hot water plant.
- Fixture traps to hand basins, shall be 40mm polypropylene P-Trap or S-Trap where concealed and chrome plated copper traps and waste pipes where visible.
- Fixture traps to sinks, etc. shall be 50mm Polypropylene where concealed and chrome plated copper traps and waste pipes where visible.

Note: Contractor may submit cost for use of UPVC with acoustic wrap for above ground suspended drainage for approval.

6.4 PIPEWORK FINISHES

In addition to the protective coating specified in the Materials and Workmanship Subsection of this Section provide the following:

Pipework Finishes Schedule

Specification Cross Reference: PAINTING

There is no requirement to paint exposed pipework in carpark.

6.5 FIRE STOP COLLARS

Provide 'PROMASEAL' (as supplied by Promat) or equal approved fire stop collars to all UPVC pipework penetrations through floors and plumbing ducts throughout the building. Fire collars must be tested and approved for use with the piping material being used.

For the HDPE material soil stacks, the fire stop collars must be a Drop In, Cast In or Retrofit type that has been tested and approved with HDPE (as supplied by Promat). Only one brand of manufacturer shall be used throughout the project.

All fire stop collars must be installed to manufacturer's specification.

Contractor shall refer to the architectural drawings for details on fire rating requirements for floor/walls at individual floors. Note: Ground and level one penetration shall be provided with 3 hour fire rating.

Note: Any pipe penetrations with an open floor grate above, must be protected with an approved floor waste fire stop collar in accordance with the BCA and AS1530.4

All pipework penetrations must be treated utilising a fire rated product designed for the application. The contractor is required for the fire stop manufacturer's representative to inspect the installation and certify in writing that the correct product has been installed to their recommendations.

6.6 ACOUSTIC INSULATION TO ALL SUSPENDED DRAINAGE

Sanitary drainage pipework shall be acoustically wrapped in locations scheduled below. Acoustic lagging shall comprise with 'SOUNDLAG 4525C' comprising 25mm thick convoluted hydrolysis-resistant foam acoustic insulating material, with a flexible loaded vinyl (5kg/m2 unless otherwise noted below) and protective layer of reinforced foil with a Four Zero fire rating to AS1530.3.

For this project, in addition to the 'SOUNDLAG 4525C' by Pryotek, the following alternative makes are considered equal and may be offered;

- Thermotec – NuWrap 5

The Hydraulics Services Trades shall arrange for the Acoustic Insulation Manufacturer's Technical Representative to attend site prior to ceilings being installed and provide written confirmation that the insulation has been installed in accordance with the product requirements.

Schedule of Areas/Pipework Sections which require Acoustic Lagging installed

- Sanitary Drainage Pipework suspended over habitable areas such as kitchens, living spaces, and bedrooms within apartments, and lobby areas.
- Soil stacks installed within the apartment plumbing ducts in habitable areas.

6.7 AIR ADMITTANCE VALVES

Air Admittance Valves of 'Studor' or equal approved manufacturer shall be incorporated in the sanitary drainage system where indicated on the drawings.

The Air Admittance Valves must be installed vertically in accessible locations, strictly in accordance with the manufacturer's recommendations.

7 COLD WATER SERVICE

7.1 GENERAL

Make application to Local Water Authority and pay all associated fees for a the upgrade of the existing 20mm to a 40mm water meter connection off West St within cast iron footpath box.

The incoming cold water supply shall be fitted with a testable type double check valve assembly which shall be mounted as indicated in landscaping. The incoming cold water supply shall reticulate inground via backflow prevention valve within the carpark, extend adjacent column, and continue at high level within the carpark prior to rising within plumbing ducts to serve each apartment.

Multiple cold water risers located within builder's plumbing ducts will be utilised to reticulate cold water to each floor. The cold water branch feed off the respective riser will reticulate to each cold water isolation valve and pulse output water meter capable of connection to a Building Management System and compatible with SAVANT equipment, which is located in the ceiling space adjacent the plumbing duct.

Pressure reducing valves shall be installed to cold water branch take-offs to floors where required to limit the maximum water supply pressure to a maximum 500 kPa (approx). Flow device shall ensure that equal flows are maintained to hot and cold water inlet point for each fixture. Each flow device shall be rated at the static pressure of each floor level to ensure that the correct flows as stated above are maintained.

General

Not more than one outlet shall be taken from a 15mm supply branch and no service pipe shall reduce to 15mm diameter in excess of 2m of the fitting it is to serve.

With the exception of chromium plated connections to fixtures, no other water pipes are to be exposed within the Buildings (unless otherwise noted on drawings).

Where services are to be exposed the contractor shall raise an RFI with the project manager to identify the potential exposed services.

The cold water system shall be complete with connection to upgraded water meter, piping, fittings, valves etc, and as further specified under this part and as generally shown on the drawings.

Label all accessible above ground water pipework with an approved self adhesive marker, at not greater than 3 metres centres indicating the nature of the service and the direction of flow.

7.2 TAPS AND VALVES

Generally

Sanitary fixtures and equipment are to be supplied by builder as per the architectural sanitary fixture and tapware schedule and are to be installed by hydraulic services contractor. Fix taps and valves to all cold water points and as scheduled elsewhere in this specification. All taps and valves are to be of the same nominal diameter as the pipes to which they are fitted and to be tested and stamped by water mark approval.

Tapware, Cocks and Outlets

Unless specifically stated otherwise all taps and associated fittings shall be of manufacture as nominated in Tapware Schedule.

Water cocks shall be high pressure type unless otherwise specified, and of approved manufacture with brass bodies and water marked approval.

External hose cocks shall be polished chrome plated brass keyed head type.

All cocks are to be of the same nominal diameter as the pipes to which they are fitted and to be tested, approved and stamped by the water marked approval and be manufactured to AS1628 and 1718.

Tapsets shall be complete with concealed breeching pieces or as specified.

All tapsets built in walls to have fluid aprons fitted at wall junction and installed as per manufacturer requirements. Silicone sealed tap spindles shall not be approved.

Cocks and outlets serving fixtures shall be chromium plated with vandal-proof heads and colour coded red, blue, green, yellow or labelled H, C, or RW buttons as applicable.

Outlets shall match cocks.

7.3 TESTING

Allow for subjecting the domestic water service to a pressure test as previously specified.

Provide test sheets recording section tested, date of test, and pressure to which pipework is tested. Test sheets shall be included in the Operating and Maintenance Manual.

7.4 VALVE IDENTIFICATION

All isolating valves shall be clearly marked by service and function served.

Labels shall be black on white engraved laminated 2mm thick plastic labels 100mm x 20mm with minimum 5 mm lettering securely attached to the valve with non corrosive rings or chain.

7.5 BACKFLOW PREVENTION VALVES

Provide approved backflow prevention devices to all items of equipment scheduled for backflow prevention valves as included in the tapware schedule and below, or as shown on the drawings.

Location	Type
Main Incoming Water Supply	40mm Zurn Wilkins 350 XCLU testable double check valve assembly.
Irrigation Supply	25mm Zurn Wilkins 350 XCLU testable double check valve assembly.

All backflow prevention devices shall be installed in accordance with AS/NZS3500.1 complete with isolating valves to inlet and outlet, strainer to inlet and test cocks complete to accept hose kit connections.

All backflow prevention valves are to be tested and commissioned prior to practical completion by an appropriately licensed person. Test certificates to be included within Operating and Maintenance Manual. Testing shall be repeated at the end of the Defects Liability period and the relevant documentation lodged with Office of the Technical Regulator or local authority and copied to the Proprietor.

In addition to the above, all screwnose hosecocks are to be fitted with hose connector type syphon breakers.

7.6 PURGING

Every care shall be taken during the installation to minimise the entrance of sand, grit or foreign matter in the supply piping.

Cold water supply pipes to the hot water heaters, fixtures and equipment are to be purged prior to the installation of all items and all water supply are to be purged prior to installation and connection.

The installation to be left charged and ready for use when occupied.

8 HOT WATER SERVICE

8.1 GENERAL

The works shall include the whole of the Domestic Hot Water Service to the outlets where shown, including connection to the central hot water assembly supplied and installed by Savant.

8.2 HOT WATER PIPING INSULATION

All hot water pipework shall be insulated as specified in the 'Materials' clause of this section of this Specification.

8.3 TAPS AND VALVES

Refer to "DOMESTIC COLD WATER SERVICE" clauses for details.

8.4 TESTING

Allow for subjecting the hot water system to a pressure test as previously specified. Isolate the water heater from the hot water service being tested.

8.5 TEMPERATURE PRESSURE RELIEF AND EXPANSION VALVES FOR HOT WATER STORAGE VESSEL

The relief drain from the temperature/pressure relief and cold water expansion valve, shall be in copper tube discharging to the adjacent tundish. The overflow drain line shall fall continuously to the tundish, terminating over the top with a 20mm air gap. Drain lines shall not discharge into water heater safety trays.

8.6 TEMPERING VALVES

Tempering valves shall be RMC adjustable type and sized to suit size of pipework as noted below:

20mm – RMC Model Heat Guard Ultra complete with Insulated Jacket 20mm

Tempering valves shall be supplied complete with check valve and stainless steel disc strainers on both hot and cold water inlets.

General

Tempering valves shall be provided to the hot water supply within each apartment which shall be located in accessible location within ceiling space adjacent service isolation valves and access panel unless otherwise indicated.

8.7 DOMESTIC HOT WATER UNITS

Refer to Equipment section of this specification.

8.8 DOMESTIC HOT WATER CIRCULATING PUMPS

Refer to Equipment section of this specification.

8.9 PURGING

Every care shall be taken during the installation to minimise the entrance of sand, grit or foreign matter in the supply piping.

Cold water supply pipes to hot water systems, valves and tapware are to be purged prior to the installation of items and all hot water supply pipes from the hot water system to hot water draw off points are to be purged prior to the installation of taps, cocks etc. The installation to be left charged and ready for use when occupied.

9 NATURAL GAS SERVICE

9.1 GENERAL

Locate and connect to existing capped natural gas provisions within adjacent apartment complex to serve the new development. Allow to extend gas pipework at high level within carpark before rising within apartment plumbing ducts as well as central plumbing riser to service:

- Roof level central hot water unit assembly.
- Apartment hot plates.

Reticulate from the gas meter to the respective item of equipment or appliance served as indicated on the drawings.

The installation shall comply with AS5601:2013 – AG601:2013.

9.2 BUILDING ISOLATION

Gas supplying more than one building from a gas main or gas storage vessel shall be provided with an accessible manual shut off valve at the point of entry to each building. The valve is to be installed externally to the building and provided with permanent signage. The sign shall include the wording 'GAS VALVE'.

The consumer piping should be designed to ensure that when a valve is turned off, the gas supply to only one building is affected in compliance with AS5601.

Note: Exempt for cases of single occupancy residential premises.

9.3 ISOLATION FOR SPECIFIC INSTALLATIONS

In installations where a number of appliances without flame safeguard systems are used, a safety shut off system as a means of isolation shall be fitted in a readily accessible location and if required shall be key operated to reset. An adjacent sign shall be installed indicating its purpose.

Example: 'GAS ISOLATION: Turn off when gas is not in use or in the case of emergency. Before turning on, ensure all the appliances (e.g., Bunsen burners) are turned off'.

9.4 FIRE SERVICES INTERFACE

Where operation of automatic fire-extinguishing equipment could extinguish a gas appliance flame all burners of the gas appliance shall have a flame safeguard system or the installation shall be fitted with a system which will shut off the gas supply when the fire extinguishing system operates. The system shall require pressure proving of the downstream installation prior to restoration of the gas supply.

9.5 PIPEWORK AND JOINTING

Below Ground (External of Building)

Polyethylene to AS1667 Part 1, Class 250 and 575. Electrofusion jointing method to be carried out by an installer authorised by Local Gas Authority in accordance with AS5601:2013 – AG601:2013.

Above Ground (External - Internal)

Type B copper tube to AS1432 (hard drawn). Silver brazed jointing method in accordance with AS5601:2013 – AG601:2013. Connections to all appliances to be flared compression fittings to AS3688 and as approved by relevant Australian Standards.

Kinko nut compression fittings will not be permitted.

Above Ground - (Internal)

Cross linked polyethylene aluminium polyethylene multilayer pipe complying with AS4176.8 RAUTITAN gas Stabil gas pipe, Rautitan gas fittings and compression sleeves or similar approved and installed in compliance with AS5601.

Where pipework is installed within wall cavities and inaccessible areas Rauguard flexible metal conduit shall be placed over the pipe for protection.

A system identification label shall be installed in the gas meter box.

Note: The pipework supplier's representative shall be required to inspect the first fix installation and certify in writing that the system has been installed to their recommendations.

9.6 INSTALLATION

General

Refer Workmanship Subsection.

Labelling

Label all accessible or exposed natural gas pipework with an approved self adhesive marker, at not greater than 3 metre centres. Labels to comply with AS1345.

Valves

Provide non corrosive tags to all valves complete with Black and White or Yellow lettering in 8 mm upper case. Provide non corrosive rings fitted to tags to secure the tags to the valve and not to impede valve operation.

9.7 TESTING

Allow for subjecting the gas pipework installation to pressure tests. Provide test sheets recording section tested, date and pressure to which pipework tested.

9.8 COMPLETION

On completion of installation and testing, turn on isolating and control valves and purge and charge the installation.

10 EQUIPMENT

10.1 DOMESTIC HOT WATER UNITS

Hot water plant including hot water heating units is to be supplied and installed by Savant as part of an embedded energy network offer. The Plumbing Contractor shall provide the incoming hot and cold water, hot water return and natural gas connections to the assembly terminating with isolation valves where directed by Savant's Installer.

Hot water plant is to be of equal approved performance to Rheem Commpak 3 burner unit CPE03, with modified reduced height manifold.

The Plumbing Contractor shall also provide a waste tundish adjacent the hot water plant and a duty/stand-by hot water circulating pump assembly as part of the hot water return piping installation.

It shall be a pre-requisite for the contractor to engage and pay all associated costs for the manufacturer to attend site before installation of the systems, instruct the method and piping sequence of installation and commission the systems on completion.

The Plumbing Contractor shall be the liaison between Savant and the Builder and coordinate with builder for construction of a suitably sized structural plinth for secure mounting of the hot water heater assembly to the plant deck. Contractor shall also provide stainless steel straps to secure hot water tanks to galvanised support frame to comply with AS 1170.

10.2 DOMESTIC HOT WATER CIRCULATING PUMP ASSEMBLY

Primary Circulating Pump

The primary circulating pump for circulating of hot water from the Central Hot Water Plant storage tank shall be supplied as part of the SAVANT Energy Bulk Hot Water System assembly and form an integral part of the hot water package.

Domestic Hot Water Circulating Pump Assembly

The domestic hot water system circulating pump assembly shall be supplied and installed by the Plumbing Contractor and shall comprise a twin pump assembly configured as duty/stand-by operation. The pump assembly shall be supplied pre-plumbed including pipework, fittings, check valves, valves etc. as necessary, ready to connect to the hot water return pipework. The system controller shall automatically alternate duty pumps on a 24 hour basis.

The hot water circulating pump shall be a Rheem Redi-set dual hot water auto changeover circulator 20-60N number 890665.

The hot water circulation pump assembly shall be provided with weatherproof vented colour bond cover to protect pumps from weather. Colour to be confirmed with architect prior to order.

Contractor shall provide galvanised support stand to pump package and fix to hot water plant platform provided by builder.

Installation Pumps

Pumps shall be mounted strictly in accordance with manufacturer's recommendation. Installation to include isolation valves, check valves and be installed complete with weatherproof colour bond cover. Contractor shall engage manufacturer for final commissioning and pay associated costs.

Electrical Contractor

The Electrical Services Trade shall provide a weatherproof isolating switch adjacent to each pump or pump control panel as applicable.

10.3 BALANCING VALVES

Hot water return pipe balancing valves shall be Tour Andersson, TA-Therm 15mm or equal approved.

Allow to fully commission the hot water recirculation system making required valve adjustments in accordance with the valve manufacturers' instructions. All balancing valves shall be fitted with isolation valves either side of the valve with barrel unions or compression joints fitted to permit easy removal. Provide commissioning certificate on completion for insertion into manuals.

Note: Contractor shall confirm final size of the hot water balance valves prior to order to suit the required hot water return flow rate. Estimated flow rate per riser shall be set at 0.03L/sec. Contractor shall confirm flow rates prior to commissioning.

10.4 PULSE OUTPUT WATER METERS

Pulse output water meters shall satisfy AS3565.3 and IOS4064. The meters shall be fitted with remote data collection, including consumption, leak detection, usage patterns, and enabled to be read from designated meter area. Final water meter model is to be compatible with SAVANT monitoring system.

Wiring of meters to central data location shall be undertaken by the electrical contractor.

The system shall enable data generated by the meter to be transmitted to the 'EMS' Energy Management System via cabling. Data collected by the RDC, is uploaded and remotely accessed via software and an internet connection.

- As part of system installation, the hydraulic contractor shall include:
- Install meters and reed switches according to local authority requirements.
- Provide accurate meter serial number / location list.

Meters to be provided:

Apartment Water Meters

Elster V100(PSM-T) - 20 mm Cold Water Meter

RMC Endurance Multijet - 20 mm Hot Water Meter

Note: The contractor may provide alternative submission with pulse output water meters and "Enware" or equivalent Hydrometer RDC system back to the building management system.

10.5 STAINLESS STEEL FLOOR DRAIN

Supply and install "Stratco" or similar approved 200mm stainless steel floor drain complete with stainless steel dry basket arrestor with 3mm holes.

Floor drain shall be constructed of 1.6mm x 316 2B stainless steel. Provide 200mm wide flush fitting stainless steel non slip cast grating to floor drain.

Floor drain shall provide with a 150mm diameter dry basket with handle to suit the sump diameter.

The sump shall be constructed with a 110mm diameter outlet at base of sump, a 2% minimum fall shall be provided within the floor drain and concrete fixing tags shall be installed at 500mm centres.

Refer to architectural drawings for grate lengths.

Submit shop drawings to superintendent prior to order placement.

10.6 PRESSURE REDUCTION VALVES

Supply and install "Wilkins" or equal approved Pressure Reduction Valves to apartment DCW supply pipework together with operating equipment where supply pressures exceed 500 kPa.

Pressure Reduction Valves shall be Wilkins: model-BR4, complete with integral bypass, check valve and strainer.

APPENDIX A - SECTION COSTS AND UNIT RATES - SANITARY AND HYDRAULIC SERVICES

This schedule is to be completed and submitted with Tender submissions. The amounts indicated in the total tender price including administration costs and profit for sections of the work are as follows:

ITEM	AMOUNT TENDERED
Common Services	
Site Establishment and Preliminaries	\$
Authority Fees	\$
Drainage Services	\$
Incoming Cold Water Services	\$
Domestic Cold Water Services Infrastructure including Water Meter installation and site containment backflow prevention device	\$
Roof Level plumbing installation including water supply points to equipment and drain points to Hydraulic and Mechanical Services equipment	\$
Soil, waste and vent pipework installation within Carpark Level	\$
Natural gas reticulation extending from capped provision within adjacent development at 17 West St to roof level hot water plant	\$
Building	
Domestic cold water, hot water flow and return pipework reticulation extending to apartment isolation valves	\$
Domestic hot and cold water reticulation within each apartment including tempering valves	\$
Natural gas reticulation extending from high level within carpark to apartment cooking appliances	\$
Acoustic insulation to suspended drainage – supply and installation	\$
Soil, waste and vent pipework including suspended drainage and vertical stacks	\$
General	
Maintenance and Defects Liability Period	\$
Shop Drawings	\$
Work-as-executed drawings and manuals	\$
Miscellaneous (specify)	\$
GST 10%	\$
TOTAL TENDER AMOUNT INCLUDING GST	\$

Rates

Plumber	Per/hr	\$
4th Yr Apprentice	Per/hr	\$
Backhoe	Per/hr	\$
100mm Sewer Drains	Per/m	\$
150mm Sewer Drains	Per/m	\$
32/40 HDPE DCW/NG	Per/m	\$
40 Copper NG	Per/m	\$
Gas Fitter	Per/hr	\$

Tenderer **Date**

APPENDIX B - TECHNICAL DATA SCHEDULES – HYDRAULIC SERVICES

The following schedule is to be completed at time of tender submission.

TEMPERING VALVES

Make and Model

.....

FIRE STOP COLLARS

Make

.....

ISOLATION VALVES

Make

.....

Type

.....

AIR ADMITTANCE VALVES

Make and Model

.....

HOT WATER PIPEWORK INSULATION

Make

.....

Material Thickness

.....

SUSPENDED DRAINAGE ACOUSTIC INSULATION

Make

.....

Material Thickness

.....

HOT & COLD WATER SERVICE PIPEWORK (from outlet of isolation valves)

Make

.....

Material Thickness

.....

SUSPENDED DRAINAGE ACOUSTIC PIPEWORK

Make

.....