

WET FIRE SERVICES

1 GENERAL

1.1 WET FIRE SERVICES

Fire Mains and Connections

- Make application and pay all fees for 100 dia SA Water dedicated fire water service. Application and fee to include isolation valves in the Towns Main on each side of the connection.
- Provide necessary thrust blocks and anchors at unrestrained joints.
- Buried metallic pipes protected against corrosion by continuous wrapping in petrolatum tape to AWW C217.

Fire Brigade Booster

- Metal cabinet to South Australian Metropolitan Fire Service (SAMFS) booster arrangement including lockable hinged access doors. Cabinet size to comply with SAMFS requirements to ensure clearances around valves. Provide concrete base to cabinet with gap between metal and concrete. Cabinet to be painted in a colour nominated by the Architect. Provide lettering to face of the cabinet to SAMFS approval.
- All pipework upstream of the single testable check valve to be stainless steel.
- Refer to drawings for booster details.

Fire Hydrant System

- Internal single headed fire hydrants
- Australian Industrial Pump System hydrant diesel pump system ref# 10323 including support frame, diesel tank, switchboard, plinth, batteries, electrical wiring and controls.
- Pump to be mounted on a 150mm plinth, pump area to be protected by sprinklers according SAMFS approved alternative solution.
- Drenchers to protect openings along emergency exit as per drawings and SAMFS approved alternative solution.
- Pipework, valves, fittings and supports.

Fire alarm system

- . Refer to electrical specification and drawings for Fire Alarm Panel (FIP)

Fire Hose Reel System

- Fire hose reels including swing arm and isolating valve on the ground floor inside metal cabinet, fire hose reel connect to the hydrant system.
- Other Fire hose reels including swing arm and isolating valve inside cabinets by architect, fire hose reels connect to the hydrant system.
 - . Signage for fire hose reels.
- Backflow prevention valves.
- Pipework, valves, fittings and supports.

Drencher and sprinkler protection

- Drencher protection above openings wall along fire exit according SAMFS approved alternative solution.
- Sprinkler protection above fire diesel pump area according SAMFS approved alternative solution.
- Pipework, valves, fittings and supports.

Portable Fire Extinguishers

- Portable fire extinguishers including signage as per drawings.

General

- Equipment concrete plinths.
- Identification and labelling of pipework, valves and equipment.
- Painting of equipment.
- Sealing of wall and floor penetrations with approved fire rated sealant.
- Contractor to provide appropriate approved safety barriers and signage around excavations.

- Cutting and removing concrete paving and making good.
- Cutting and removing bitumen paving and making good.
- Trenching, backfilling and compaction as required for above services.
- Allow to revisit the site twelve months after the installation or when directed by the Client to recompact, fill and grade any trenches that have subsided.
- Provide traffic control in accordance with AS 1742 by an accredited person who shall possess a statement of attainment in Work zone Traffic Management issued by Transport SA. A copy of the certificate or card must be presented prior to commencement of work. The traffic control shall include signage and safety barriers around excavations to the Highways Department and Council approvals
- Electrical wiring and controls associated with above equipment.
- Noise and vibration control associated with above systems.
- Testing and Commissioning of the above systems.
- Allow for water truck to take water flow during main sprinkler and hydrant testing. Water to be disposed to suit EPA regulations.
- Operating and Maintenance Manuals.
- Shop drawings and detailed design.
- "As-Installed" drawings.
- Hoisting of all equipment.
- All required scaffolding.
- Coordination of installation with other trades.
- Craneage as required for the installation of new equipment.
- Remove all redundant equipment, rubbish, etc from site.
- Remove all cuttings, swarth and rubbish from roof and gutters.
- Associated building works such as penetrations, openings, chasing, trenching, making good, manufacturer's access requirements unless detailed elsewhere in documents to be provided by other trades.
- Other works as shown on the drawings or in the specification.
- Equipment warranty, maintenance and servicing of the above systems for 12 months from the date of practical completion.

1.2 DOCUMENTS ISSUED

The arrangements and details shown on the drawings are indicative only. Allow to check all dimensions and building details prior to commencement of any work. To that end the documents have been prepared to provide the fire services concept and intent of the systems design only and are not considered as built documents. The requirement of the contractor is to provide for a fully designed, automatic durable and trouble free system of fire services, including matters of minor design not specifically included in this document.

Drawing No:	Description:
B8014-F01	Wet Fire Services: Legend, Drawing List, Basement and Ground Floor Layout
B8014-F02	Wet Fire Services: First and Second Floor Layout
B8014-F03	Wet Fire Services: Third Floor Layout, Schematic and Details
B8014-F04	Wet Fire Services: Details

1.3 ASSOCIATED WORKS

Apart from items scheduled below, provide everything necessary for successful and economical operation and to meet the intent of the Contract Documents for a fully automatic durable and trouble free system, including matters of minor design not specifically included in this document.

The Builder shall be deemed to have inspected the site, made allowances for all difficulties of access, installation, staging, testing commissioning, procurement, noise and vibration control etc and shall utilise their own experience and expertise to arrive at detailed design and installation allowances to achieve the objectives of the Contract Documents.

2 DESIGN AND COORDINATION INFORMATION

2.1 DESIGN BASIS

Fire Sprinkler System

Standard: To Australian Standard 2118 “Automatic fire sprinkler systems”

Occupancy Hazard:

- Diesel Pump Area in car park : Ordinary Hazard Group 2 (OH2)

Standard: To Australian Standard 2118 “Automatic fire sprinkler systems”

Hydrant System

Standard: To the Building Code of Australia and Australian Standard AS2419 Fire Hydrant Installation.

Fire Hose Reels

Standard: To AS1221 and 2441.

SA POWER NETWORKS Main Supply System

Equipment shall be designed for operation on the SA Power Networks electrical supply system rated at 415V, 3 phase, 4 core (3phase + neutral), 50Hz and/or 240V, 1 phase, 50 Hz.

Noise Emissions

Noise emissions shall comply with data stated in “Noise and Vibration” section.

Vibration Transmission

Vibration transmission characteristics shall comply with data stated in “Noise and Vibration” section.

Town Mains Water Pressure

Water pressure at the street main in King William Street, Kent Town was tested by SA Water on the 10-04-2016 using a McCrometer Meter.

Static Pressure	
Flow (l/sec)	Pressure (MH)
0	60
4.7	50
8.3	40
11.0	30
13.4	20
15.3	10
17.0	0

2.2 EQUIPMENT WEIGHTS, SIZES, POWER REQUIREMENTS

Equipment ratings, weights, sizes and power requirements have been transmitted to architectural, structural, and electrical engineering designers during the design phase of the project for inclusion in design and estimating processes.

Check all weights, sizes and electrical loads of relevant equipment proposed to be installed on the site and brands nominated in the Tender documents prior to committing to final reticulation sizes and equipment selections. Coordinate with relevant trades to ensure proper provisions and interface arrangements have been made, and include all due allowances for such coordination and perform without charge any minor adjustments.

2.3 SPACING OF PLANT AND EQUIPMENT

Ensure that plant and equipment items are readily accessible for operation and maintenance and that sufficient space is provided to comply with the manufacturer’s recommendations for overhaul, maintenance or repair.

Where other Contractors are operating in the areas concerned, determine the extent of their work and coordinate the layout of plant and equipment to be installed under this Contract, with that to be installed by the other Contractors.

2.4 QUALIFICATIONS AND EXPERIENCE

The Tenderer is deemed to have sufficient experience and expertise in Contracts of this nature and to have allowed all contingencies and minor works necessary to fulfil the intent of this Contract. Variation orders will not be issued for other than changes to the scope of works or scheduled capacities as

initiated by the Architect.

2.5 LICENSED PERSONNEL

Fire Services: The work shall be performed by a company experienced in the installation and maintenance of Fire services using qualified and licenced tradespersons.

Electrical Services: The work shall be performed by or under direct supervision of an 'A' Class Electrician.

2.6 AUSTRALIAN STANDARDS

Australian Standards: Unless otherwise specified, materials and workmanship shall be in accordance with the relevant standard of the Standards Association of Australia.

Current Edition: A standard applicable to the works shall be the edition last published prior to the closing date for tenders unless otherwise specified.

Other Standards: Overseas standards and other standard documents named in the specification shall be applicable in the same manner as Australian Standards to relevant materials and workmanship.

2.7 NATIONAL CONSTRUCTION CODE (NCC)

Unless otherwise specified, the entire installation including the supply of equipment and materials shall be in accordance with the current NCC and all clauses within associated to these works.

The NCC applicable to the works shall be the edition last published prior to the closing date for tenders unless otherwise specified.

2.8 SETTING OUT

Drawings show the design intent and indicate the locations of equipment. Set out each item of equipment in its optimum location for efficiency, appearance and maintenance access and to the approval of the Architect.

Ensure that plant and equipment items are readily accessible for operation and maintenance and that sufficient space is provided to comply with the manufacturer's recommendations for overhaul, maintenance and repair.

2.9 COORDINATION WITH OTHER TRADES

Determine the extent of their work and coordinate the layout of plant and equipment to be installed under this section of the specification with that to be installed by the other trades to ensure there are no interface problems before installation commences.

2.10 GUARANTEES

Guarantee that the complete system within specified termination points shall safely, reliably, and efficiently provide the specified full load design capacity and performance throughout the full 12-month period following the date of issue of the Certificate of Practical Completion.

2.11 SPECIFICATION AND TENDER DRAWINGS

Ensure you have a full understanding of the technical and physical requirements of the system described in this specification and accompanying drawings, all appropriate codes, regulations and standards, manufacturer's data, requirements of regulatory and statutory authorities, and instructions issued by the Architect.

These drawings must not be used for architectural or structural work, but shall be read in conjunction with architectural, structural and all other relevant drawings.

Layouts: The services show the general layout of the fire services and do not include details of sets and bends required for the coordination between the structure and other trades. Due allowance shall be made in the tender price for all sets and bends.

2.12 TENDER DOCUMENTS

Ensure you have a full understanding of the technical and physical requirements of the system described in this specification and accompanying drawings, all appropriate codes, regulations and standards, manufacturer's data, requirements of regulatory and statutory authorities, and instructions issued by the Architect.

These drawings must not be used for architectural or structural work, but shall be read in conjunction with architectural, structural and all other relevant drawings.

Layouts: The services show the general layout of the fire services and do not include details of sets and bends required for the coordination between the structure and other trades. Due allowance shall be made in the tender price for all sets and bends.

2.13 SHOP DRAWINGS AND DETAILED DESIGN

The tender drawing show the intent of the design. The Contractor is responsible for the final sprinkler layouts and locations to comply with AS 2118 and the manufactures requirements, for the pipework layout and checking the sizes of all pipes taking into account the actual installation layout, bends, fittings and proposed sprinkler head against the site water flow and pressure to ensure the system meets all code requirements. Any changes from the tender drawings required to meet the above will not constitute a variation.

Engineering CAD drawings will not be made available for the basis of the contractor's construction drawings.

Hydraulic Calculations

Requirement: Submit hydraulic calculation of the pipework system using an approved hydraulic analysis program (Hyena or Equal approved).

Shop drawings

Any items which the Architect may require to be detailed prior to installation shall be provided to shop drawing standard within seven calendar days of request. Note that Shop Drawings are deemed to include the detailed design and coordination with other trades and services to enable final selection of equipment, final detail design of all items and to enable fabrication and installation to proceed, including all necessary site measurement and coordination with existing and new works.

Shop Drawings shall include the following:-

- Fire Hydrant and Hose Reel Layout
- Fire Sprinkler Layouts to fully comply with AS 2118
- Pump installation details
- Equipment location and supports
- Pipework locations, sizes and details
- Wall, floor, ceiling and roof penetrations
- Electrical wiring and controls
- Control Panel details

CAD: Drawings shall be prepared using CAD drafting format – AutoCAD Version 12 or later.

Drawings shall be to a scale of not less than 1:50 and larger as required and shall be on B1 sheets.

Submit: Submit (4) four copies allowing 10 working days for the drawings to be examined and returned.

Compliance: The drawings will be examined for general compliance with the contract drawings and specification. Notwithstanding any endorsements, the Builder is not relieved of his responsibility for the adequacy of the installation.

Resubmission: Where drawings are returned for amendment, amended and re-submitted in sufficient time to prevent delays to the completion of the work.

All required shop drawings shall be prepared with all equipment, service lines, ductwork, cable runs and the like fully coordinated with those of all other trades and building elements. This requires locations and routes of the other engineering services (plumbing, fire, electrical etc) to be shown on the shop drawings to ensure there are no clashes prior to installation. Shop drawings shall incorporate sectional views (vertical) through ceiling and duct cavities to indicate the order of installation, and offsets required, for a fully coordinated installation.

Shop drawings may be submitted on a floor-by-floor basis but, in any case in adequate time to allow for examination by the Superintendent prior to commencement of ordering and fabrication.

2.14 AS INSTALLED DRAWINGS

Make AutoCAD V12 or later drawings of 'as installed' of all work. Show accurately the installed positions of all pipes, valves, ducts, motors, controls, access points, electrical connections, etc.

Submit progressively during the Contract at the end of each calendar month for work installed to that time. Submit as one transparency hard copy and one disk copy.

'As-Installed' drawings will be reviewed for quality and content in a similar manner as for shop

drawings review. Where drawings are determined to be of sufficient quality and content for their purpose, they will be forwarded to the Principal for acceptance. Where errors, discrepancies or omissions are identified, they will be returned for correction.

Where drawings or calculations are returned for amendment, allow for amendments to be carried out and re-submitted in sufficient time to prevent delays to the completion of the work or awarding of Practical Completion.

The review of installed drawings is not intended to be a checking process, and the Contractor remains responsible at all times for the content, accuracy and scope of submitted documents.

Tender drawings may be made available for the preparation of As Installed Drawings at a cost of \$20.00 + GST per Drawing. These drawing shall have Secon Consulting Engineers name removed from the title block and shall be upgraded to as installed. A direct copy is not acceptable for an As Installed Drawing.

2.15 SAMPLES

Submit samples of all items as Scheduled for approval.

Samples may, after approval by the Architect, be installed on the project provided they are suitably identified and their location is recorded and agreed to by the Architect.

For certain items where requested by the Builder, the first installed of each type may be accepted by the Architect as a sample.

Samples submitted during the Tender stage to determine style and appearance are not regarded as samples in relation to the Quality System, and will require to be resubmitted and approved by the Architect during the Contract.

2.16 AUTHORITIES TESTING

Carry out all tests required by the relevant authorities and perform without charge any making good necessary to obtain approvals. Give the Architect 48 hours' notice of such tests. Hand over test certificates and approvals on completion, leave a copy of all such items in the Maintenance Manual. Give sufficient notice for interruptions to supply.

2.17 AUTHORITIES, NOTICE OF ALTERATIONS AND CERTIFICATES

Carry Out Work: Carry out the work to the requirements of all relevant authorities, including:

- Office of the Technical Regulator
- SA Water Corporation
- Local Council
- Safe Work SA
- Insurance Council of Australia
- Building Code of Australia
- South Australian Metropolitan Fire Service (SAMFS)
- SA Power Networks Utilities
- Any other Authorities having jurisdiction over the Works

Make Application: Make formal application for supply or submit notice of alteration for each installation, pay all charges, obtain a Certificate on completion of the work and present to the Architect prior to Practical Completion. Include a copy of all such items in the Maintenance Manual.

Pipes, fittings, accessories and electrical items shall bear approval marks where and as required by the regulatory authority.

2.18 AUTHORITIES AND APPROVALS

Authorities: The public and other authorities whose requirements shall apply to the work in accordance with the general conditions and the ordinances, regulations, by-laws and the like specifying those requirements, shall include the following:

- Office of the Technical Regulator
- SA Water Corporation
- Local Council
- Safe Work SA
- Insurance Council of Australia

- Building Code of Australia
- South Australian Metropolitan Fire Service (SAMFS)
- SA Power Networks
- Gas Authorities
- Any other Authorities having jurisdiction over the Works

Lodgement: Complete and lodge all necessary forms (including technical sections) for the submission of applications and approvals to the relevant authorities.

Approvals: The documents evidencing approval of such authorities, which are to be surrendered before the certificate or notice of Practical Completion is issued, shall include the authority's official certificate of completion.

Authorities Mark: Pipes, fittings, accessories and the like used shall bear approval marks where and as required by the regulating authority.

2.19 MAINTENANCE LIFTING

Where an item greater than 20 kg requires to be removed for maintenance or replacement, provide the following:-

- Suitable attachments on the item for connection of lifting equipment.
- Suitable attachments from the roof structure or roof slab, such as eye bolts or lifting beams, for the equipment to be removed and positioned over a fork lift, trolley or sled. Alternatively provide purpose built lifting frames. Show all proposed maintenance lifting arrangements on shop drawings and submit to the Architect for approval.

2.20 INSPECTIONS

Give 48 hours written notice to the Architect of all items requiring inspection, including prior to the sealing of shafts and risers.

2.21 WARRANTIES

Obtain and supply to the Architect at Practical Completion the warranties offered by the manufacturers of the equipment and accessories used in the Works.

2.22 CERTIFICATE OF COMPLIANCE

A certificate of compliance shall be supplied before each section of the finished work is handed over to the client, and at the completion of the project.

2.23 EXTRANEIOUS INTERFERENCE

Requirement: The electrical wiring and equipment shall operate without interference to radio, television, computer, communications or other systems within this and other local area installations.

2.24 OBVIOUS WORK

Minor Parts: If neither the specification nor drawings contain any mention of minor parts of work which in the opinion of the Architect is reasonable and obviously necessary for the satisfactory completion of the works, such parts shall be supplied and installed without extra charge.

2.25 EXISTING SERVICES

Requirement: Existing services must be maintained at all times. Before cutting into existing services confer with the Architect for suitable times to carry out the work and allow for temporary services required to carry out the above.

2.26 EARTHQUAKE PROTECTION

Mount plant and equipment to withstand earthquake forces of 0.2 g horizontally and 0.2g vertically in addition to normal restraining forces.

Design of the mountings shall be such as to limit the dynamic force on equipment to 1.0 g.

3 MATERIALS AND WORKMANSHIP

3.1 MATERIALS

Provision of Materials: Supply everything necessary for the proper completion of the work and for the

proper performance of the systems.

Manufacturer's Recommendations: Unless otherwise specified, use manufactured items in accordance with current published recommendations of the relevant manufacturer.

Quality of Materials: Unless otherwise specified, materials to be incorporated in the works shall be new.

Protection of Materials: Store and protect material so as to preserve their quality and fitness for the Works.

Uniformity: Uniformity of type and manufacture of fittings, equipment and accessories shall be maintained throughout the installation.

3.2 LABOUR

Provision of Labour: Provide all qualified labour necessary for the proper completion of the work.

3.3 WORKMANSHIP

Best Practice: Properly and neatly execute all work to a high standard and best practice. Untidy work whether exposed to view or concealed will not be accepted.

Straight Lines: Run reticulated services in straight lines parallel or square to building surfaces with minimum joints and neat supporting systems.

Changes of Direction: Use long radius elbows or bends where practicable in preference to short radius elbows. Do not use mitered fittings.

Arrangement: Arrange pipework runs adjacent to and horizontally parallel with each other and with walls, ceilings, beams and the like. Keep at least 150mm above ground surface if under suspended ground floors. Provide adequate spacing, of at least 25mm between pipes, 50mm between pipes and electrical cables. Take off branches at right angles unless otherwise specified or shown on drawings.

Earthing: Pipework shall be electrically earthed adjacent to the source of gas supply.

3.4 CORROSION PREVENTION

Dissimilar Metals: Do not install copper in contact with steel, zinc, or other materials likely to generate electrolytic, galvanic or corrosive action. Make junctions between dissimilar metals with special fittings manufactured in suitable compatible material.

3.5 ACCESSIBILITY

Concealment: Where practical, conceal reticulated services so they are accessible within ducts or non-habitable enclosed spaces and ensure witnessed tests are conducted before enclosing. Obtain prior approval for the location of exposed services.

Enclosed Services: If services are to be enclosed so as to be not accessible after completion, obtain prior approval and record the actual locations on work as executed drawings, prior to enclosing.

Maintenance Access: Install plant items so they are accessible to manufacturer's recommendations for access, maintenance and servicing purposes, and comply with Occupational Health and Safety Regulations and Guidelines.

Access Hatch Locations: Plan the location and layout of plant and reticulated services to minimise the number and impact of maintenance access hatches. Where installation of these is unavoidable, obtain prior approval for the location and size and coordinate with the Builder for hatches to be provided.

Access Hatch Sizes: Unless noted otherwise, access hatches shall be 600 x 600 for full body access, and 300 x 300 for hands only access.

3.6 CLEANING

Pre-Cleaning: Before installation, clean reticulated services and equipment by a suitable method. Remove loose scale, burrs, fins and obstructions.

Capping Off: During construction, temporarily seal open ends and equipment to prevent the entry of foreign matter. Provide purpose-made covers of pressed steel or rigid plastic. Do not use wood plugs, rags, paper or the like.

Cleaning Out: Remove loose scale, dirt and the like from the pipework by flushing with clear water at a velocity sufficient to remove foreign matter and until clear water discharges at outlets. Leave the system free from foreign matter on completion.

Cleaning of Plant, Equipment, Reticulated Services: On completion of the work, clean all items externally and internally and leave free of dust, dirt, overspray, finger-marks, etc.

Storage: Store pipes on site in a suitable location to ensure the integrity of factory sealing up to the time of installation.

3.7 CHASES AND ENCASING

Approvals: Cut chases with a power saw unless otherwise approved. Do not chase reinforced concrete work without approval.

Expansion and Contraction: Services chased into masonry or encased in concrete shall not cross any movement joint, and shall be insulated so that expansion and contraction can take place without damage to the services or to the material or surface finish of the surrounding element.

Minimum Cover: Chased services shall have a minimum of 10mm mortar cover.

3.8 COVER PLATES

Requirement: Where pipework emerges from finished wall, floor or ceiling surfaces (other than surfaces within concealed spaces, plant rooms and the like) provide ornamental cover plates of matching colour where possible of non-ferrous metal or stainless steel, of nominal diameter 50mm greater than the diameter of the pipe, close-fitting and firmly fixed in place to the satisfaction of the Architect.

3.9 WALL, BEAM, FLOOR AND CEILING PENETRATIONS

Notification: Notify the Architect of the location and size of all penetrations.

General

Requirement: If different from those shown on service drawings, obtain approval from the Architect before proceeding.

Formwork Sleeves: Fabricated from 0.6mm galvanised steel, 20mm larger all round than the service and shall extend 50mm beyond finished surface. Position and fix these prior to wall, beam or floor construction, and remove on completion.

Making Good: Make good all penetrations to maintain the fire and/or acoustic rating of structure penetrated.

Fire Rated Wall Penetrations (other than UPVC Pipes and Conduits)

Requirement: Penetrations through Fire/Smoke wall shall be sealed with an approved epoxy seal and filled with an approved fire rated material to FRL rating of penetrated structure. Use Fyreguard, Fyre-Seal-IBS, Fyre-Mortar, or Fyre-Pillows together with Fyre-Seal-Mastic

Fire Rated Floor Penetrations (other than UPVC Pipes and Conduits)

Requirement: Seal the space between the services and the penetration with an approved epoxy seal and filled with an approved fire rated material. Use Fyreguard, Fyre-Seal-IBS, Fyre-Mortar, or Fyre-Pillows together with Fyre-Seal-Mastic

Fire Rated Wall and Floor penetrations (UPVC Pipes and HDPE Pipes)

Requirement: Fire Prevention Collars to UPVC and HDPE pipes passing through floors and fire/smoke walls.

Approval: Fire Prevention Collars tested and approved to AS 1530.4 and AS 4072.1 with fire resistant rating equal to the floor or wall.

Installation: Floor Fire Prevention Collars cast into floor.

Manufacturer: "Hilti" or approved alternative.

Fire and Vapour Sealed Penetrations through fire rated walls and floors

Requirement: Use Fyreguard galvanised steel encased Fyre-Sleeves with pipework vapour seal lapped 50mm over each end of the steel sleeve.

Cable Penetration of Fire Rated Ceiling

Fyre-Spring: Use Fyreguard Fyre-Spring system.

Light and Power Switches in Fire Rated Walls

Fyre-Seal: Use Fyreguard Fyre-Seal-IBS strips to maintain fire integrity of wall.

Core Holes

Core Holes: Core holes through existing floors, slabs and walls. Prior to coring holes obtain approval for the location from the Structural Engineer. Seal penetration with approved fire rating material.

3.10 EARTHQUAKE BRACING (PIPEWORK)

Requirement: Provide lateral bracing installed both along the line of the pipe and at 90° to the pipe. The bracing shall be capable of preventing sideways and longitudinal movement of the pipe. Support bracing same size members as the normal support. Longitudinal bracing at every second support bracket, in alternating directions along the pipe. Lateral bracing at every support bracket and alternating from side to side along the drain.

3.11 EARTHQUAKE BRACING (EQUIPMENT)

Requirement: Provide support brackets from equipment to walls sufficient to ensure the equipment does not move in the event of earthquake forces of 0.2g horizontal and 0.2g vertically in addition to normal restraining forces. Provide details of supports for approval.

3.12 SUPPORTS

Generally: Provide supports including hangers, saddles, bolted clips, anchor blocks to buried pipe and the like, sufficient to secure the pipework to adjacent surfaces, to restrain the internal forces of pressure pipings, and to support it at joints, at changes of direction, and at intervals suitable to the size and type of pipe, and as necessary to prevent sagging of pipework and vibration. Make provision for adjustment of gradient as required.

Proprietary Supports: Approved proprietary support systems shall be used.

Support Material: The same material as the pipe, or galvanised or non-ferrous metals, with bonded PVC or fibreglass woven tape sleeves to separate dissimilar metals. Provide fixing of compatible material.

Support Spacing: Space pipe supports, both vertical and horizontal, in accordance with the requirements of Australian Standard AS 2118 Automatic Fire Sprinkler Systems.

Additional Supports: Locate supports not more than 600mm either side of any change in direction, valve or piece of equipment.

3.13 FLEXIBILITY

Expansion and contraction: Install the services with sufficient bends, expansion loops or expansion devices so that it can absorb its own expansion and contraction without developing excessive stresses in the pipework itself, in connected equipment, or in the supporting structure.

Vibration Isolation: Provide flexible connection between pipework and any equipment where vibration may be transmitted to the pipework.

3.14 JOINTS

Generally: Keep the number of joints and junctions to a minimum. Use joints applicable to the materials used. Use demountable joints where permanent joints are impractical and at connections to all equipment and components.

Joints: Fit joints tightly, seal and make leakproof, with no internal projections, burrs or obstructions.

Permanent Joints: Provide welded or brazed joints where practicable, otherwise compression or screwed joints.

4 PIPEWORK ---

4.1 GENERAL

Requirement: Supply and erect pipework and equipment in accordance with the requirements of this Specification and associated drawings. Include all incidental and ancillary equipment necessary for the complete installation, the safe and efficient operation and the maintenance of the system.

4.2 STEEL PIPEWORK (BLACK STEEL)

General: Steel tubes in general manufactured from Carbon Steel complying with medium grade black steel to AS 1074 or AS 1835 as applicable.

Bends: Bends and tees to have a radii of not less than 1.5 times the diameter of the pipe. Where these radii cannot be obtained use long radius bends and elbows as manufactured by Tubemakers of Australia.

Joints: Joint fully welded to AS CB15 or made using mechanical groove suitable for Victaulic couplings. Pipes shall be rolled grooved using on approved rolled grooving machine. Fittings,

gaskets, etc, approved for use in fire service.

4.3 GALVANISED STEEL PIPEWORK (ROLLED GROVE)

General: Steel tubes in general manufactured from Carbon Steel complying with medium grade black steel to AS 1074 or AS 1835 as applicable and AS 1650 galvanised coating. Bury below ground in accordance with AS2419.

Bends: Bends and tees to have a radii of not less than 1.5 times the diameter of the pipe. Where these radii cannot be obtained use long radius bends and elbows as manufactured by Tubemakers of Australia.

Joints: Joint fully welded to AS CB15 or made using mechanical groove suitable for Victaulic couplings. Pipes shall be rolled grooved using on approved rolled grooving machine. Fittings, gaskets, etc, approved for use in fire service.

Support Spacing: Space pipe supports, both vertical and horizontal, in accordance with the requirements of Australian Standard AS 2118 Automatic Fire Sprinkler Systems.

Additional Supports: Locate supports not more than 600mm either side of any change in direction, valve or piece of equipment

4.4 GALVANISED STEEL PIPEWORK

General: Steel tubes in general manufactured from Carbon Steel complying with heavy duty thickness up to DN 80 and medium duty thickness over DN 80 to galvanised steel to AS 1074 and AS 1650 galvanised coating. Bury below ground in accordance with AS2419.

Bends: Bend and tees to have a radius of not less than 1.5 times the diameter of the pipe. Where these radii can not be obtained, use long radius bends and elbows as manufactured by Tubemakers of Australia.

Joints: Bends and fittings galvanised screwed complying with AS 1074 and AS 3673. Fittings, gaskets, etc, approved for use in fire service.

Pipework 65dia and over shall be joined using screwed flanges to AS 2129 Table "E" with M12 bolts and suitable gasket. Threads shall be taper-taper.

4.5 COPPER PIPEWORK

Tubes: To AS 1432.

Fittings: Shall be de-zincification resistant.

Flanges: Bronze brazing flanges (boss or plate type) and blind or blank flanges; full face flanges to AS 2129.

- Flange material: Not inferior in joining properties to alloy C92610 to AS 1565.

Joints: Make silver brazed slip joints. Either use a capillary fitting or expand one tube over the other leaving a minimum of clearance and an effective overlap not less than the following table:

Pipe Size:	Overlap (mm):
All	12

Brazing

To AS 1167 Clause 3.7. Use a minimum of heat and avoid damage to pipe and fittings.

Brazing alloy: To AS 1167 Part 1.

- Brazing copper to copper: Alloy B4 to Table 2
- Brazing copper to brass: A suitable copper to brass alloy

Pulled Bends: to AS 1135 Clause 3.4.3.

4.6 DUCTILE IRON

Ductile iron pipes manufactured in accordance with AS 2280. Pipes shall be cement lined Class K9.

Fittings complying to AS 1724 and AS 2544.

Fittings: Cast grey iron to AS 2544.

Underground: Wrap pipes and fittings installed underground with 250 micrometre polyethylene film to AS 1326 for high impact resistance (IR3) and medium density (C2).

Spigot and Socket Jointing: With rubber joint rings to AS1646.

Flange Jointing: With bolted screw-on flanges to AS 2129, Table E, and rubber-type gaskets. Bolts to AS 2129 Section 6, galvanised for cast iron to cast iron joints. Use gunmetal bolts for cast iron to

copper joints, with an ultimate tensile strength of 580Mpa.

Spigot and Jointing: Use Gibault type or other approved clamp type fittings and galvanised iron bolts.

Off-takes: Use tees or tapping saddles. Drill the pipe to the same size as the off-take. Ensure that the off-take ferrule does not protrude into the pipe.

4.7 CHLORINATED POLYVINYL CHLORIDE (CPVC) PIPE AND FITTINGS

Materials

Pipe and fittings shall be manufactured from a compound which meets or exceeds the class requirements of 23447-B as outlined in ASTM D1784 (the material is known commercially as CPVC). CPVC is characterised as having a high deflection temperature. The colour shall be orange.

Compound from which pipe is produced shall have a design stress of 12780kPa at 23⁰C and 3445 kPa at 82⁰C for water services.

Pipe

Pipe shall conform to the requirements of ASTM F442.

Pipe shall carry the marks of Factory Mutual (FM) and Underwriters Laboratories (UL).

Fittings

Fittings shall conform to the requirements as outlined in ASTM F438 (Schedule 40 dimensions from 20mm to 40mm and Schedule 80 for 50mm to 75mm). All female threaded adaptors for sprinkler head connections shall have brass inserts.

Fittings shall carry the listing marks of Factory Mutual (FM) and Underwriters Laboratories (UL).

Solvent Cement

All socket type connections shall be jointed with CPVC solvent cement meeting ASTM F438 and NSF requirements.

Installation Procedures

Installation practices, including support spacing, compensation for thermal expansion and contraction and solvent cementing shall be in compliance with the NFP code and manufacturer's recommendations.

Approvals

Pipe and fittings shall carry the listing marks of FM and UL.

Special Requirements

CPVC pipework shall not be installed where temperatures exceed 65⁰C. Pipework in roof spaces shall be wrapped in semi rigid glass fibre batts. CPVC piping must be located so the pipe is not exposed to excessive temperatures from heat producing sources such as light fittings, ballasts, steam pipes, etc.

4.8 LIGHT WALL STEEL PRESSURE PIPES

Light Wall steel pipes manufactured in accordance with AS 4118. Pipes externally protected with galvanised coating (tape all joints).

Joints shall be made using an approved method.

4.9 STAINLESS STEEL

General: Pipe to ASTM A312/A312M, or spiral butt welded from stainless steel sheet.

Grade: 316L. All pipework to be degreased.

Wall thickness:

Piping ≤ DN 150: At least 1.6 mm.

Piping > DN 150, < DN 305: At least 2 mm.

Outside diameter tolerance: ± 1.5 mm.

Jointing: Select from the following except where a specific jointing method is shown on the drawings or specified:

Butt welded.

Welded-on flanges

Fittings material: Stainless steel of the same grade and wall thickness as the pipe.

Unions: Grade 316 stainless steel, proprietary manufacture, with ground or accurately machined face joints.

Flanges: Angle face rings, galvanized steel backing flanges and reinforced neoprene gaskets. Fabricate so that only stainless steel or the gasket material is in contact with the fluid within the pipe.

Bends: Long radius type.

Welding

Fully butt weld using gas tungsten arc welding process. Passivate joints after welding.

4.10 PIPEWORK, DRAINS AND VENTS

All pipework shall be installed to enable the system to be drained. All drains and vent outlets shall be valved, plugged, clearly labelled and installed in easily accessible locations.

Pipework shall be graded and drained in accordance with AS 2118.

Adequate air bleeding facilities shall be provided to ensure a minimum of time between the operation of any sprinkler head and the operation of the control switch.

The air cocks shall be located in positions convenient to operation. The aircocks shall be connected to drain pipework which shall discharge into the drain pipework. Suitable signs shall be provided

4.11 UNDERGROUND PIPEWORK

Requirement: Buried metallic pipes protected against corrosion by continuous wrapping in petrolatum tape to AWW C217. Protect underground water piping, valves and fittings utilising the "Denso" Superbond CPT 750 system installed to the manufacturers recommendations.

Cleaning: Prior to application clean the surface thoroughly to AS 1627-2 Class 2 Standard.

Primer: Prime the cleaned substrate with Superbond Cleaner.

Mastic: Where necessary, contour all sharp and irregular profiles with "Denso" Butyl Mastic Strip.

Tape: Spirally apply "Denso" Superbond tape without stretching with a 55% overlap to achieve consistent full double thickness. Select a tape width roughly equal to pipe diameter.

Manufacturer's Recommendations: Ensure system is applied in accordance with manufacturer's recommendations and arrange manufacturer to inspect application and forward written evidence of correct application.

Verification: Provide inspection and verification of all protective wrapping.

5 VALVES AND FITTINGS

5.1 GENERAL

Requirement: Valves shall have SA Water Corporation and SAMFS approvals. All valves and associated equipment shall be the standard product of approved valve manufactures. Sample valves may be required to be submitted for approval.

Suitability: Ensure valves are entirely suitable and correctly sized for each application and unless otherwise shown shall be of pipeline size. Valves and fittings shall be selected for an operating pressure of 1000kPa. And a working pressure of 1400kPa.

Accessibility: Install valves and accessories in positions easily accessible for operation and maintenance. Pressure gauges and similar instruments shall be readily visible after installation.

Valve packing: Ensure valve packing is suitable for the service and such packings shall be examined prior to installation and where necessary replaced.

Connections: The connection between each valve and adjacent pipes shall be made with either flange or union to permit removal of the valve without dismantling piping. Flanges shall not be lighter than Table "E" and shall in any case be heavier if working pressures so require. All isolating valves controlling water supplies and not monitored shall be secured with padlocked chain.

5.2 ISOLATING VALVES

- Gate Valves: Kitz FCL cast iron or approved alternative (outside screw and yoke).
- Butterfly Turnflo TICS3 or approved alternative (Gear operated).

5.3 TESTABLE SINGLE CHECK VALVE (BOUNDARY & BOOSTER ASSEMBLY)

Single Check valves shall be:-

- Tyco / Pentair Single Check Valve Testable 16 kPa spring setting water marked approved
- Gear operated butterfly valves padlocked in open position with padlock keyed to Lockwood "003"

5.4 NON RETURN VALVES (CHECK VALVES)

Check valves shall be:-

- Mission TRW "Duo Check" or approved alternative, spring loaded split plate type. Bodies shall be cast iron with stainless steel or bronze plates.
- Kitz bronze bodied swing check or approved alternative.

5.5 STRAINERS

Type: Strainers shall be bronze bodied Y type selected to suit the working pressure and temperature of the system installed.

Connections: Strainers up to 50mm diameter shall have screwed end connections and flanged connections over 50mm diameter.

Size: Strainers shall be of the same nominal size as the line in which it is installed.

Filter Screen: Strainers shall be provided with renewable bronze or stainless steel perforated filter screen (1.4mm hole x 2.5mm pitch).

Drain: Provide a valve drain connection on all strainers over 50mm. Drain shall discharge over tundish.

5.6 PRESSURE GAUGES

Type: Gauges shall be dial type of National or equivalent manufacture and be of the bourdon tube type, with an integral hexagonal connection and shall comply with AS 1349. Gauges shall be installed with a gauge cock.

Gauge cocks: Provide with all pressure gauges.

Scale: Instrument scale ranges shall be selected for the specific duty and the normal operating point shall be approximately mid-scale.

5.7 GAUGE COCKS

Requirement: Install with all pressure gauges.

Type: Brass plug type with screw connections of 10mm nominal diameter.

Construction: Brass body, brass plug and sealing ring coated with TFE.

6 TRENCHING, BACKFILLING AND COMPACTION ---

6.1 SERVICE TRENCHES

Excavation: Excavate to the lines, levels and grades as required for underground services. Unless otherwise specified make the trenches straight between inspection points, junctions and the connection.

6.2 SPOIL

Surplus Excavated Material: Remove from the site excavated material not reusable as backfilling.

Disposal: The Contractor shall be solely responsible for the safe and harmless disposal of surplus excavated material away from the site.

Re-Useable Spoil: Store where directed.

6.3 FLOORS AND PAVEMENT

Approval: Mark the edges of floors or pavement to be removed and obtain approval prior to the execution of work.

Cutting: Cut floors and pavement with a concrete saw to a minimum depth of 100mm then remove the floor/paving.

Disposal: Remove floor/paving from site and dispose in an approved manner.

6.4 PIPELAYING

Generally: Lay pipelines straight between required changes of direction, properly supported, with watertight joints aligned flush at internal surfaces.

6.5 BEDDING

Pipe Bedding: Unless otherwise specified bed the pipework on a continuous underlay of pipe bedding material, compacted if granular, of minimum thickness after compaction as required by the relevant standard, but in any case not less than 75mm. Grade the bedding evenly to the required gradient of the pipework.

Underlay Material

Requirement: Sand or selected excavated material free from hard or sharp objects or lumps, to AS 2032 Clause 4.2.1.2.

For Plastic Pipes: Fine aggregate graded as follows to AS 1152 sieves:-

Sieve aperture (mm):	Percentage passing (by mass):
6.7	100
4.75	90 to 100
2.36	60 to 100
1.18	40 to 100
0.6	20 to 90
0.3	8 to 50
0.15	0 to 20
0.075	0 to 10

6.6 MINIMUM COVER OVER PIPE

Unless overridden by regulatory authority requirements or otherwise specified, the following table shall apply:-

- pipes not subject to vehicular loading: 450mm
- pipes subject to vehicular loading - not in roadways: 600mm
- under sealed roadways: 600mm
- under unsealed roadways: 750mm
- pipes in embankments or subject to construction equipment loading: 750mm

6.7 THRUST BLOCKS

Thrust blocks shall be provided to transmit the loads imposed on the pipeline to adjacent soil or rock.

Thrust blocks are required wherever the pipeline:-

- Changes direction
- Terminates
- Changes diameter
- Is expected to develop a thrust, eg at a valve, etc.

Thrust blocks shall be designed as recommended by the manufacturer and to suit the trenching and soil condition on the site.

6.8 BACKFILLING SERVICE TRENCHES

Pipe Trenches: Compact so that the pipe is buttressed by the walls of the trench.

Backfill Material: Unless otherwise specified, backfill with general filling, with no stones retained on a 25mm sieve occurring within 150mm of the service.

Topsoil: Where service excavations occur in topsoil areas, complete the backfilling using the topsoil.

6.9 PIPE IDENTIFICATION SERVICE MARKER

Provide continuous detectable service marker tape over the pipe for the full length of the underground pipework system. The plastic marker tape shall incorporate metal strip. The marker tape shall comply with AS 2648.1. The marker tap shall be installed between 150mm and 300mm below finished ground level.

6.10 PLACING FILLING

Extent: Place and compact filling so that the surface is constantly self-draining.

Layers: Placing filling in layers not exceeding the thickness stated below measured loose and compact

each layer.

Maximum Layer Thickness: 150mm.

6.11 COMPACTION

Compaction: To AS 1289.

Cohesive Material: Not less than 90% modified maximum dry density.

Non-Cohesive Material: Not less than 95% modified maximum dry density.

Protection: Protect the works during compaction from damage by compaction operations, compact by hand if necessary to prevent damage or disturbance to services, pipe joints and the like.

7 PAINTING, CORROSION PROTECTION AND IDENTIFICATION

7.1 SCOPE

Corrosion protection, painting and identification of all items to ensure the following:-

- Protection against moisture or corrosive agents which may be encountered during the service life of installed items.
- Painting to provide an attractive durable and cleanable surface in all areas.
- Identification of all plant, controls, valves, wires, terminals, controls, pipes, ducts, etc with durable labels and painted markers.

7.2 EXCLUSIONS

The following surfaces shall not be painted:-

- Fibreglass, PVC, stainless steel, chrome plated surfaces.
- Bearings, motor rails, adjusting screws, valve bodies and actuators etc.
- Proprietary equipment if supplied in manufacturer's standard paint colours and finishes and if not specified elsewhere to suit Architectural finishes.

7.3 CORROSION PROTECTION

Equipment and the total installation shall be designed to prevent the accumulation of moisture. Sharp corners shall be radiused and crevices shall be sealed by continuous seal welds, or use of an approved filler.

Dissimilar metals shall be prevented from contact by a 3mm air gap or 1.5mm of PVC insulator. Bolts, rivets and clips shall have a corrosion resistance equal to the component to which they are attached and shall be of the same noble metal.

Surface Preparation

Surfaces shall be prepared as follows:-

- Black Steel
 - Shall be degreased and loose rust, scale and other matter removed by hand or power tool cleaning. The surface shall immediately be given one coat of zinc based primer.
- Galvanised Steel, Copper, Aluminium
 - Shall be degreased and coated with vinyl etch primer.
- Zincanneal
 - Shall be degreased and etch primed.
- Surfaces Subject To Oil Spillage
 - Shall be degreased and coated with oil resistant undercoat and finishing coat.

Metal Coatings

Repair steel surfaces damaged by welding, or rust, by the application of a cold phosphating (phosphoric acid) solution. Wash off residue after the reaction is complete.

Galvanised steel pipe supports, fabricated components, bolts, nuts etc. installed in damp locations, in the ground, or exposed to the weather.

7.4 PAINTING PROCEDURES

Protect all adjacent surfaces from paint splatter and remove all spillage or spots so that adjacent finishes are in a clean and unmarked condition.

Use first quality lead free paints pre-mixed and delivered to site clearly labelled in the manufacturers sealed containers.

Thinning, mixing or adding of other colours or brands will not be accepted.

Paints for priming, undercoating, finishing and re-coating shall be compatible with each other and the surface conditions to be painted.

Primers shall be an approved zinc chromate or other metal work primer.

Steel surfaces shall be cleaned of oil and other manufacturing lubricants and etch primed prior to applying finishing coats. Galvanised surfaces are not required to be painted.

Damage to a manufacturer's surface finish shall be restored to the original corrosion resistance of the finish. Epoxy coated surfaces shall be lightly abraded followed by an active solvent wipe and restoration of original coating thickness.

Weld spatter, slag, burrs and other surface irregularities shall be removed or repaired before surface protection is applied.

Submit details of paint materials and samples of surface preparation and paint finish to the Architect prior to proceeding. Surface preparation and paint finish samples may be the first installed items of each type.

7.5 PAINT COLOURS

Paint systems shall be full-gloss, solvent-borne paint appropriate to the pipework material and its location (interior, exterior or hot surface).

Paint colours shall be:-

Fire Services - Signal Red No. 537

Drains - Black

Submit colours to the Architect for approval prior to proceeding.

7.6 PLANT, EQUIPMENT AND VALVE IDENTIFICATION

Provide the following identification systems.

Equipment Nameplates: Engraved plates permanently fixed by mechanical means to factory-assembled items of equipment.

Lettering: Except for plant items shall be 5mm upper case engraved black lettering on a white background.

Lettering for plant items shall be 50mm high or appropriate smaller lettering if approved by the Architect.

Specific: Labelling for specific SAMFS facilities such as boosters, etc shall be to the size, type and colour approved by the authority.

7.7 PIPE IDENTIFICATION

Pipework shall be identified to AS 1345.

Identification shall be by means of the basic identification colours of AS 1345, applied to the pipework either as full-length painting, or as painting in bands at intervals to AS 1345 clause 6, or as securely attached pipeline markers to AS 1345 clause 6 and figs. 1 and 2.

Location of Bands or markers shall be to AS 1345 clause 6.2

7.8 FINISHES SCHEDULE

Item	Colour
Sprinkler, Hydrant Pipework/Valves:	Signal Red No 537
Drains:	Black
Standard colour schedule to AS K185	

8 TESTING AND COMMISSIONING

8.1 TESTING

Requirement: Apparatus, material, equipment and instruments shall be properly calibrated and all labour necessary, and carry out the tests required by the Specification, Standards or regulatory authorities, in the presence of the client's representative and the authorised representative of the relevant authority for the service under test.

Compliance: On successful completion of tests, if required for identifiable elements of the installation, supply a certificate of compliance and affix a compliance plate.

Hydrostatic Tests: Fill the pipework with water and test at the pressure and for the duration stated in the HYDROSTATIC TEST TABLES, unless overridden by regulatory authority requirements.

8.2 HYDROSTATIC TEST TABLES

Service	Test Fluid	Test Pressure	Duration	Allowable Loss
Fire Services Copper or Steel	Water	1800 kPa	2 hrs	Nil
CPVC Pipework	Water	1200 kPa	2 hrs	Nil

8.3 TESTING PLASTIC PRESSURE PIPES

This document includes the requirements set out for hydrostatic testing of pressure pipeline for Blue Brute (PVC) and PE.

All pressure pipeline shall be properly calibrated in the presence of the client's representative and the authorized representative of the relevant authority for the service under test.

Compliance: On successful completion of tests, if required for identifiable elements of the installation, supply a certificate of compliance and affix a compliance plate.

PVC HYDROSTATIC testing method

- Testing of Blue Brute (PVC) pipe work shall be in accordance with AS 2566.2:2002.

The procedure shall be as follows:

- Close all valves apart from the test pump input and pressurize the test length to the specified test pressure.
- Apply and then maintain the test pressure by the addition of measured and recorded quantities of make-up water at regular intervals over a 2 hour period.
- Where pressure measurements are not made at the lowest part of the test length, make an allowance for the static head, between the lowest point of the pipeline and the point of measurement, to ensure that the test pressure is not exceeded at the lowest point.
- The allowable quantity of make-up water shall be calculated from Equation 6(1)

The test length shall be acceptable where

- there is no failure of any thrust block, pipe, fitting, joint or any other pipeline component;
- there is no visible leakage; and
- The quantity of make-up water necessary to maintain the test pressure shall comply with the following Equation:

$$Q \leq 0.14LDH \dots 6(1)$$

where

Q = allowable make-up water, in litres per hour

D = nominal diameter of the test length, in metres

L = length of the test length, in kilometres

H = average test head over length of pipeline under test, in metres

Test pressure = pipe class + 25%

Blue brute class 20 installed, test pressure = 2000kPa + 500kPa = 2500 kPa. Use 1800 kPa

Service	Test Fluid	Test Pressure	Duration	Allowable Loss
Blue Brute Class 20	Water	1800 kPa	2 hrs	As per above
Blue Brute Class 16	Water	1800 kPa	2 hrs	As per above

The make-up water is not a leakage (loss) allowance, but is an allowance to cover the effects of the test head forcing small quantities of entrapped air into solution.

The makeup water requirement should reduce with time as air goes into solution. Where, after 12 h the makeup water still exceeds the allowable limit, testing should cease and the cause of loss investigated.

8.4 SOLENOID OPERATED PIPEWORK (DRY PIPE)

Requirement: Do not allow water to enter pipework downstream of solenoid valve. If water does not completely drain then dry with compressed air.

Testing: Test pipework with compressed air to 1800kPa.

8.5 COMPLETION

Completion: Check pipe joints, valve seats, strainers and the like. Replace if damaged and re-test.

Commissioning: After satisfactory completion, turn on control and isolating valves and leave the systems in full operating condition.

8.6 COMMISSIONING

Installation: Carry out tests necessary to prove that the installation meets the specified requirements and all the tests required by Authorities during an on completion of the works, and furnish details in writing of the tests carried out, test results and all certificates of approval issued.

Operation: Test all control equipment, pressure switches, alarms and similar equipment for correct sequence of operation and adjust as necessary.

General: In general, the operation of each piece of equipment individually and each completed service as a whole, shall be tested and correctly balanced to achieve the required satisfactory performance.

8.7 FIRE TEST

Arrange and pay all fees for the South Australian Metropolitan Fire Service to test the Fire Brigade Booster.

8.8 FINAL ACCEPTANCE TESTING

Carry out final acceptance testing in the presence of a GAPS representative. The tests shall demonstrate that the pumping system will perform in accordance with the manufacturers certified characteristics curve and that the driver, accessories, all alarms and ancillary equipment are correctly arranged and in proper working order.

Contact GAPS to arrange testing and obtain guidance on the appropriate test procedure.

9 ELECTRICAL

9.1 GENERAL

Requirement: Supply and install the complete electrical installation necessary for the satisfactory operation of all plant and equipment.

Ambient Temperatures: Materials, equipment, components and devices rated for the ambient temperatures within its immediate area.

9.2 STANDARDS

Regulation: Comply with the requirements of the SAA Wiring Rules AS 3000 and the Supply Authority having jurisdiction over the installation.

Supply: Equipment suitable for operation on, and clearly marked for, its respective electrical supply. Unless otherwise specified, all equipment suitable for 415V 50Hz, 240V 50Hz supply or 24V low voltage as required.

9.3 EARTHING

Requirement: Earthed in accordance with the requirements of the SAA Wiring Rules AS 3000 and the Supply Authority having jurisdiction over the installation. In addition earth exposed metal of all electrical equipment.

9.4 CABLING

Requirement: Fire Protection equipment wired in TNS red sheathed.

TNS: TNS cables PVC insulated and sheathed.

Standard: Cables multi-stranded copper conductors minimum sized 1.5mm and sized to suit the rating of the circuit and allowable voltage drop unless otherwise specified use AS 3008.1 to determine current rating and voltage drop.

Supports: Support all cables clear of ceiling tiles and support from structural members at 1000mm intervals in horizontal and 2000mm intervals in vertical runs. Use cable tray or catenaries. DO NOT SUPPORT FROM CEILING HANGERS.

Excess: Remove excess cables from ceiling spaces.

Exposed: Where unavoidably exposed to view or installed in plantrooms, install wiring in metal conduit.

9.5 ISOLATING SWITCHES

Requirement: Metal clad isolating switches supplied and installed adjacent items of equipment and as required by regulations.

Location: Isolating switches mounted to fixed structures so that removal of equipment for service or replacement is possible without switch removal.

9.6 CONTROL SWITCHBOARD CABINETS

Manufacturer: Switchboards constructed by an approved switchboard manufacturer.

Requirement: Provide a metal enclosure comprising of panels, lockable hinged doors, and the like, giving the required enclosure, segregation and degree of protection.

Construction: To AS 3947.1

Degree of Protection: To AS 1939.

Dust Seals: Provide resilient strip seal, of foam neoprene or the like, around each door, housed in a suitable channel or housing and fixed with an approved industrial adhesive.

Escutcheon Plates: Provide removable escutcheon plates with neat cut-outs for circuit breakers handles and the like. Fit chrome plated lifting handles or knobs to each escutcheon plate.

Floor mounting: Provide a metal plinth channel, not less than 75mm high, for mounting the complete control switchboard cabinet assembly on site. Securely fix plinth to floor and control switchboard cabinet.

Wall mounted: For flush or semi-flush control switchboard cabinets: provide a facing flange, of the same material and finish as the enclosure, and of a section that incorporates a return allowing the outside edge to fit neatly against the wall. Min flange width 32mm.

General: Equipment grouped on the control board according to function and type, with due regard to convenience of operation and maintenance. Layout of equipment within boards to allow adequate spacing for provision of labelling. Spare room capacity of 25% in all compartments shall be allowed in the cabinet for future expansion.

Definition: Switchboards and control boards for the purpose of this specification shall be classed as switchboards as defined by the SA Wiring Rules.

Wiring: Wiring within the control switchboard cabinets neatly grouped and loomed, except where enclosed in ductwork.

Fuses: Fused switch units provided with HRC cartridge fuses complying with AS 2005 and of suitable current rating for the plant installed. A set of three spare fuses for each fuse size installed, housed in suitable racks, shall be provided.

Fuse labelling: Fused switch units labelled with the fuse size installed in a visible position on the unit.

Main Switch: The Main switch(es) on control switchboards cabinets either of the circuit breaker type or on-load isolator type.

10 FIRE HYDRANT AND HOSE REEL SYSTEM

10.1 MAIN CONNECTION

Requirement: Connect the fire service to the supply authorities main, all in accordance with the supply authorities requirements and using components approved by authority. Extend from connection to hydrants, diesel pump system, drenchers, sprinklers and hose reels shown on the drawings.

10.2 PUMPS GENERAL

The pump set shall incorporate Diesel engine driven centrifugal pump on a fully welded galvanised steel support frame with fuel tank, batteries, control panel and controls, etc.

The system shall fully comply with AS2941-1995.

10.3 PUMPS

The pumps shall be Australian Industrial Pumps Model no. 1D CPFPS300/850-B or equal approved (ref no.10323). Pumps shall be end suction centrifugal. Pump selection shall be based on providing maximum operational flexibility and efficiency, with due consideration to materials of construction, local availability of spare parts and provision of after sale service.

Pump and motor bearing shall be heavy duty designed for a minimum of 40,000 hours life.

Flow detection shall be fitted to each pump to avoid sustained operation at zero flow or overheating.

Pumps and motor shall be suitable for mounting outdoors in all weather conditions.

Pumps shall be constructed as follows:-

Casing:	Cast iron
Impeller:	Zinc free bronze

Each pump shall have a minimum capacity of 5l/s against an estimated system head of 845kPa.

Note: The above figures do not include for a margin for pump deterioration as required by AS2118. Ensure the pumps selected include the margins.

The pumps shall deliver 130% of maximum flow at not less than 80% pressure.

Prior to ordering the pumps confirm the pump requirements with pipework flow and head calculations using Hyena or equal approved hydraulic calculation program.

10.4 DIESEL ENGINES

The diesel engine shall be a Crossley 3 cylinder model 380NC or equal approved.

The engine shall be heat exchanger cooled.

Provide engine exhaust and silencer.

The Diesel engine shall have a maximum speed of 3000rpm, selection speed shall not exceed a maximum 2800rpm.

The Diesel shall be complete with a 30 litre fuel tank.

The diesel engine shall have the following features:-

- Engine overspeed shut down
- On/Off function connected to the FIP
- Provide main battery contactors to allow manual start of the diesel in case of a control failure.

10.5 SUPPORT FRAME

The pumps and engine shall be mounted on a fully welded galvanised steel support frame. The frame shall be supported from the slab via anti-vibration spring mounts.

10.6 FUEL TANK

The system shall incorporate a minimum 30 litre free standing fuel tank.

10.7 UNDERGROUND PIPEWORK

Requirement: Protective Wrap.

10.8 PIPEWORK

Requirement: Refer to schedule.

10.9 VALVES

General: Valves approved by SA Water Corporation and SAMFS.

Install: To AS 2419

Maintained: To AS 1851.4

Hydrant Valves: Millcock 90 degree valve incorporating 65mm dia. Quick coupling outlet connection approved by the relevant Fire Authority, together with plastic cap and captive chain.

Isolating Valves: Proprietary Item: Gate - Kitz FCC cast iron outside screw and yoke or, Proprietary Item: Butterfly - Turnflo.

Check Valves: Proprietary Items: Tyco / Pentair Testable Check Valves 16kPa.

Booster Inlet: Female 65mm SAMFS incorporating non-return valves.

10.10 BOOSTER ASSEMBLY

Description: Assembly incorporating hydrant valves, booster inlets, isolating valve and check valve as detailed. Strap and lock isolating valve in open position.

Photo Etched Diagram: Install within the booster cabinet a photo etched schematic diagram showing protected building, water supply sizes, location of SA Water Corporation mains, pipework, control valves, hydrants and hose reels and any unusual features of the installation.

Pressures: Permanently fix to the booster cabinet a red plate with white 25mm block lettering with the wording:

Safe Working Pressure: 1.2MPa

Test Pressure: 1.8MPa

Boost System To: Mpa for l/m at 0.7MPa

Boost system pressure to be filled in after Fire tests.

10.11 FIRE BOOSTER CABINET

Requirement: Install weatherproof metal cabinet to cover the booster assembly. Design the cabinet to SAMFS requirements.

Manufacture: Fully welded angle iron frame to provide rigid support for 1.6mm galvanised sheet cover. Cabinet to incorporate brass hinged doors to enable full access to all components. Budget type locks (square 8mm to 5mm taper key) to doors. Incorporate hold open device to doors.

Plinth: Mount cabinet on a 75mm concrete plinth graded to ensure water shed. Finish cabinet sheetmetal cover 25mm above top of plinth.

10.12 FIRE HOSE REELS

Requirements

Design: To AS 1221

Installed: To AS 2441

Maintained: To AS 1851.2

Hose: 36 metres of 19mm dia with 6mm dia nozzle and operating handle.

Supply Pipe: Incorporating a gate valve with a device to secure the hose nozzle when the valve is shut.

Instruction Plate: Permanently attach to the hose reel an instruction plate.

10.13 FIRE HOSE REEL BACK FLOW PREVENTION

Backflow prevention: Install Double Check Valve (DCV) to incoming water supply to fire hose reel.

10.14 FIRE HOSE REEL CABINET

The fire hose reel shall be mounted in a metal fire hose reel box with hinged door (car park).

10.15 PORTABLE FIRE EXTINGUISHER

Existing Portable Fire Extinguishers

Existing: Existing portable fire extinguishers were removed from the demolished building and are stored on site. Take possession on site of existing portable fire extinguishers and install where shown. Provide new fixing brackets and signage

- Prior to any building work taking place collect all existing portable fire extinguishers and associated signage and store. Reinstall existing portable fire extinguishers including signage at completion of building program. Refer to drawings for type and size.

Allow for the servicing of the existing portable fire extinguishers to be carried out by a qualified servicing contractor including updating service disk.

Locations

The drawings show the general location of the portable fire extinguishers. Prior to installing the portable fire extinguishers or signage obtain approval for the final locations.

New Portable Fire Extinguishers

Refer to drawings for type and size.

Classification and Fire Tests: To AS 1850.

Maintained: To AS 1851.1

Signage: Provide signs for portable fire extinguishers

Portable Fire Extinguishers

- Dry Chemical 4.5kg: To AS 1846.

Locations

The drawings show the general location of the portable fire extinguishers. Prior to installing the portable fire extinguishers or signage obtain approval for the final locations.

Installation

Mount on purpose made brackets and provide instruction plates all to requirements of AS 2444. during the 10-minute "hold" period rest under this Contract.

The system(s) shall be actuated by a combination of ionization and/or photoelectric detectors installed in both the room, underfloor and above ceiling protected spaces. Select the detector type and spacing to suit the room conditions

Detectors shall be Cross-Zoned detection requiring two detectors to be in alarm before release.

Operation of one (1) detector, within the system, shall:

- Illuminate the "ALARM" lamp on the control panel face.
- Energize an alarm bell and visual indicator.
- Transfer auxiliary contacts which shall perform auxiliary system functions
 - . Transmit a signal to a fire alarm system FIP
 - . Shutdown Air Conditioning, exhaust equipment and motorised dampers.

Operation of a 2nd detector, within the system, shall:

- Illuminate the "PRE-DISCHARGE" lamp on the control panel face.
- Energize a pre-discharge horn/strobe device.
- Start time-delay sequence (not to exceed 60 seconds).
- System abort sequence is enabled at this time.
- Light an individual lamp on an optional enunciator.
- After completion of the time-delay sequence, the FM-200 Clean Agent system shall discharge and the following shall occur:
 - . Illuminate a "SYSTEM ACTIVATED" lamp on the control panel face.
 - . Energize a visual indicator outside the hazard in which the discharge occurred.
 - . Energize a "System Fired" audible device.

The system shall be capable of being actuated by manual discharge devices located at the exit door. Operation of a manual device shall duplicate the sequence description above except that the time delay and abort functions shall be bypassed. The manual discharge station shall be of the electrical actuation type and shall be supervised at the main control panel.

10.16 MATERIALS AND EQUIPMENT

General

The FM-200 Clean Agent System materials and equipment shall be standard products of the supplier's latest design and suitable to perform the functions intended. When one or more pieces of equipment must perform the same function(s), they shall be duplicates produced by one manufacturer.

All devices and equipment shall be UL Listed and/or FM approved.

Cylinders

Cylinders shall be manufactured of high-strength low alloy steel.

Cylinder shall be actuated by a resettable electric actuator with mechanical override.

Each cylinder shall have a pressure gauge and low pressure switch to provide visual and electrical supervision of the cylinder pressure. The low-pressure switch shall be wired to the control panel to provide an audible and visual "Trouble" alarms in the event the cylinder pressure drops below 17 bar. The pressure gauge shall be colour coded to provide an easy, visual indication of container pressure.

Each cylinder shall have a pressure relief provision that automatically operates before the internal pressure exceeds 51.7 bar.

DISCHARGE NOZZLES

Discharge nozzles shall be provided within the manufacturer's guidelines to distribute the FM-200 agent throughout the protected spaces. The nozzles shall be designed to provide proper agent quantity and distribution.

Ceiling plates can be used with the nozzles to conceal pipe entry holes through ceiling tiles.

PIPING

Distribution piping, and fittings, shall be installed in accordance with the manufacturer's requirements, AS14520 and approved piping standards and guidelines. All distribution piping shall be installed by qualified tradespersons using accepted practices and quality procedures. All piping shall be adequately supported and anchored at all directional changes and nozzle locations.

All piping shall be reamed, blown clear and swabbed with suitable solvents to remove burrs, mill varnish and cutting oils before assembly.

Control System

The control system and its components shall comply with AS14520.

The control system shall perform all functions necessary to operate the system detection, actuation and auxiliary functions.

The control system shall include battery standby power to support 24 hours in standby and 5 minutes in alarm.

The control system shall be microprocessor based utilizing a distributed processing concept. A single microprocessor failure shall not impact operation of additional modules on the system.

Detectors

The detectors shall be spaced and installed in accordance with the manufacturer's specifications and AS14520.

Manual release

The electric manual release switch shall be a dual action device which provides a means of manually discharging the Suppression System when used in conjunction with the control system.

The Manual Release switch or Manual Pull station shall be a dual action device requiring two distinct operations to initiate a system actuation.

Manual actuation shall bypass the time delay and abort functions shall cause the system to discharge and shall cause all release and shutdown devices to operate in the same manner as if the system had operated automatically.

A Manual Release switch shall be located at each exit from the protected hazard.

Audible and visual alarms

Alarm audible and visual signal devices shall operate from the control panel.

The Alarm Bell, Alarm Horn and Horn/Strobe devices shall be Kidde or equal approved.

The visual alarm unit shall be Kidde or equal approved.

A Strobe device shall be placed outside, and above, each exit door from the protected space. Provide an advisory sign at each light location

Caution and advisory signs shall be provided as follows.

Entrance sign:

- required at each entrance to a protected space.

Manual discharge sign:

- required at each manual discharge station.

Flashing light sign:

- required at each flashing light over each exit from a protected space.

System and control wiring

Provide all system and control wiring.

Provide interconnecting wiring and alarms between control panel and building Fire Indicator panel.

Comply with the requirements of the SAA Wiring Rules AS 3000 and the Supply Authority having jurisdiction over the installation.

Fire Protection equipment wired in TNS red sheathed.

TNS cables PVC insulated and sheathed.

Standard: Cables multi-stranded copper conductors minimum sized 1.5mm and sized to suit the rating of the circuit and allowable voltage drop unless otherwise specified use AS 3008.1 to determine current rating and voltage drop.

Supports: Support all cables clear of ceiling tiles and support from structural members at 1000mm intervals in horizontal and 2000mm intervals in vertical runs. Use cable tray or catenaries. DO NOT SUPPORT FROM CEILING HANGERS.

Excess: Remove excess cables from ceiling spaces.

Exposed: Where unavoidably exposed to view install wiring in metal conduit.

All system components shall be securely supported independent of the wiring. Runs of conduit and wiring shall be straight, neatly arranged, properly supported, and installed parallel and perpendicular to walls and partitions.

The sizes of the conductors shall be those specified by the manufacturer. Colour coded wire shall be used. All wires shall be tagged at all junction points and shall be free from shorts, earth connections (unless so noted on the system drawings), and crosses between conductors.

Testing

After the system installation has been completed, the entire system shall be checked, inspected and functionally tested by qualified, trained personnel, in accordance with the manufacturer's recommended procedures and AS14520.

All containers and distribution piping shall be checked for proper mounting and installation.

All electrical wiring shall be tested for proper connection, continuity and resistance to earth.

The complete system shall be functionally tested, in the presence of the owner representative, and all functions, including system and equipment interlocks, must be operational at least five (5) days prior to the final acceptance tests.

Each detector shall be tested in accordance with the manufacturer's recommended procedures, and test values recorded.

All system and equipment interlocks, such as door release devices, audible and visual devices, equipment shutdowns, local and remote alarms, etc. shall function as required and designed.

Each control panel circuit shall be tested for trouble by inducing a trouble condition into the system.

A room pressurization test shall be conducted to AS14520 to determine the presence of openings which would affect the agent concentration levels. If the first room pressurization test fails the openings shall be sealed and the test redone until the test is successful.

Training

Prior to final acceptance, the installing contractor shall provide operational training to the owners personnel. The training session shall include control panel operation, manual operation, trouble procedures, supervisory procedures, auxiliary functions and emergency procedures.

Inspection

Carry out a minimum of two (2) inspections or more if required by AS14520 or recommended by the manufacturer during the one-year warranty period. Inspections shall be conducted in accordance with the manufacturer's guidelines and AS14520.

Documents certifying satisfactory system(s) operation shall be submitted to the owner upon completion of each inspection.

Warranty

The full system and equipment installed under this contract shall be warranted against defects in design, materials and workmanship for the full warranty period.

11 MAINTENANCE

11.1 SCOPE

Provide a comprehensive maintenance service from the date of Practical Completion during the 12 months Defects Liability Period for all items in the Contract, including regular preventative maintenance and attendance at breakdown call-outs on 24 hours per day, 7 days per week.

Maintenance shall include routine servicing in accordance with manufacturers recommended procedures to achieve safe and reliable operation, the attendance at all emergency call outs, and the repair of break downs including provision of associated consumables and replacement components.

Maintenance shall be at manufacturer's recommended intervals or 3-monthly, whichever is the most frequent.

Service Contract: Prior to the expiration of the Defects Liability Period, prepare and submit an annual service contract for consideration.

Shut Down: Where it is necessary to shut down any part of the installation for service, the procedures laid down by the SAMFS in their "Conditions of Connection" shall be strictly adhered to.

11.2 MAINTENANCE REQUIREMENTS

Service Visits: Make service visits at the specified intervals and carry out the regular maintenance procedures.

Emergency Calls: Attend emergency calls within 24 hours of the time of a generated call.

Faults: Make good faults or damage cause by defects in the installation, and replace defective parts.

Materials: Supply the necessary maintenance materials including lubricants and cleaning materials.

Program: Before the start of the maintenance period, submit to the Architect a maintenance program showing the proposed dates of required service visits. State the contact telephone numbers of the service operators to be provided, and describe the arrangements for the prompt attention to emergency calls.

Results: Record the result of each service visit in the log book, including comments on the functioning of the system, work carried out, items requiring corrective action, adjustments made, name of service operator and obtain the signature of the Principal's designated representative.

Report: Report to the Principal's designated representative on arriving and before leaving the site.

End of Defects: At the end of the defect's liability period, make a final service visit and upon satisfactory completion of the above procedures, certify in writing that the system is operating correctly and has been fully and properly maintained during the Maintenance Period.

11.3 MAINTENANCE SCHEDULE

Routine Maintenance: The following minimum routine maintenance shall be carried out together with additional maintenance necessary to ensure optimum performance and correct operation of all equipment installed under this Contract.

Equipment shall be tested and maintained in accordance with:-

- AS 2118 Automatic Fire Sprinkler System
- AS 1851 Part 1 Portable Fire Extinguishers and Fire Blankets
- AS 1851 Part 2 Fire Hose Reels
- AS 1851 Part 4 Hydrants
- Building Code of Australia
- The requirements of the SAMFS

11.4 SERVICE REPORTS

Requirement: Submit a written report not later than (7) seven days following regular visits and each visit to site to investigate an abnormality. The report shall include dates, diagnosis of fault, repairs or adjustments made and replacement parts and materials used.

11.5 OPERATING AND MAINTENANCE MANUALS

Requirement: Prior to Practical Completion submit for approval one (1) digital copy of the Operating and Maintenance Instructions.

Operation: Include all necessary demonstrations and explanations of the correct sequence of operation and the function of each piece of equipment under both automatic and manual control.

Size: Pages shall be reinforced loose leaf A4 size.

Plans: "As Installed" plans (hard copy and computer disc copy) showing the layout and location of all equipment installed.

Submission: Following submission and approval of draft copies, prepare three (3) copies including computer disc copy of an approved manual.

Typed: The manuals shall be written in clear concise English, printed or typed on durable printing paper with each page consecutively numbered. Provide dividers between sections with plastic covered labelled tags.

Binding: Bind the manual in a black vinyl hardback A4 folder with gold lettering. The front cover to include the following wording:-

- 97 KING WILLIAM STREET, KENT TOWN
- Fire Services
- Secon Consulting Engineers
- "Contractors Name"

The spine to include the following wording:-

- 97 KING WILLIAM STREET, KENT TOWN
- Fire Services

Components: The components of the manuals shall include the following:-

- Title page with telephone numbers of maintenance personnel.
- Index and sub-index for each section.
- Description of each system and operating instructions. Include setting up, control, alarm, test and emergency procedures.
- Schedule of inspection and preventative maintenance and repair instructions for each item of equipment.
- Parts list and equipment details and source of supply of replacement components.
- Set points of controls and test sheets.
- Test results including settings.
- OTR Test Certificate
- SAMFS Test Certificate
- Corrected "As-Installed" drawings on DWG CAD format (print copies and one disc copy).
- Safety in maintenance issues

Technical Manuals: The Manuals shall include but not be limited to the following items:-

- Fire sprinklers
- Valves and fittings
- Pumps
- Fire hose reels
- Portable fire extinguishers

Manufacturer's Catalogue: Manufacturer's catalogues, instructions and generally descriptive pamphlets as appropriate shall be included, both to reduce the text and to provide prime source information.

11.6 SERVICE BOOK

Arrange all service personnel whether for routine or breakdown maintenance to:-

- 'log in' in the log book on arrival in site.
- provide a written report in the log book describing nature of the call out, problems identified and action taken.
- have the report witnessed by the Principal Representative or his delegate.
- 'log off' on completion of the work.

11.7 PRINCIPAL'S INSTRUCTION

At times to be agreed instruct the Principal's operational maintenance staff in the recommended methods of operation and maintenance of the systems.

11.8 LOG BOOK

Requirement: Prepare and maintain a Log Book.

12 SCHEDULE OF MATERIAL ---

12.1 PIPEWORK

Hydrants

Below Ground - Blue Brute Class 20 or Ductile iron or Copper Type A or "Medium Grade" Galvanised steel.

Above Ground Black Steel "Medium Grade" or Copper Type A or "Medium Grade" Galvanised steel.

Sprinkler Pipework

Below Ground : Blue Brute Class 20 or Copper Type B

Above Ground: Medium Wall Steel Pressure Pipes or "Medium Grade" Black steel.

Downstream from solenoid valves: "Medium Grade" Galvanised steel.

Drainage Pipework (Underground)

From Tank Overflow: UPVC 5H Class

Stormwater from Gutters: UPVC 5H Class

Drain Pipe from Box Tundish in Pump House: UPVC 5H Class

Hydrant Risers/Pillars

Pipe: "Medium Grade" Galvanised Steel

Note: Paint riser pipe and hydrant red "Medium Grade" Galvanised Steel

STAINLESS STEEL

General: Pipe to ASTM A312/A312M, or spiral butt welded from stainless steel sheet.

Grade: 316L. All pipework to be degreased.

Wall thickness:

Piping \leq DN 150: At least 1.6 mm.

Piping $>$ DN 150, $<$ DN 305: At least 2 mm.

Outside diameter tolerance: \pm 1.5 mm.

Select from the following except where a specific jointing method is shown on the drawings or specified:

Butt welded.

Welded-on flanges

Fittings material: Stainless steel of the same grade and wall thickness as the pipe.

Unions: Grade 316 stainless steel, proprietary manufacture, with ground or accurately machined face joints.

Flanges: Angle face rings, galvanized steel backing flanges and reinforced neoprene gaskets.

Fabricate so that only stainless steel or the gasket material is in contact with the fluid within the pipe.

Bends: Long radius type.

Fully butt weld using gas tungsten arc welding process. Passivate joints after welding.

13 FIRE SERVICES TENDER FORMS**13.1 TENDER PRICE**

We the undersigned hereby provide our Fixed Lump Sum Tender Offer to carry out the entire works in accordance to the specification, drawings, addenda's and general conditions of contract

TENDER PRICE: \$.....

ADDENDA'S No: \$.....

GST: \$.....

TOTAL TENDER PRICE:..... \$

Amount in words:

.....

.....

COMPANY:.....

ADDRESS & CONTACT Ph:

SIGNED BY:

TITLE:

DATE:

FIRE SERVICES TENDER FORMS**13.2 SUMMARY OF COSTS**

The costs indicated below make up the "Tender Price", including supply, delivery, installation, testing and warranty maintenance, overhead and profits for the various sections of the work.

Item	Fixed Lump Sum
Fire Drencher protection c/w pipework	\$
Fire hydrant pump system	\$
Fire hydrant Pipework labour & materials	\$
Fire Booster Cabinet	\$
Electrical installation	\$
Automatic Controls	\$
O & M manuals incl client tuition	\$
Testing, Commissioning & balancing	\$
52 Weeks Preventative Maintenance & service	\$
Sundries / Misc	\$
GST where applicable	\$
TOTAL TENDER PRICE	\$