

Development Specifications

C401 WATER SYSTEM CONSTRUCTION

Version 2
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SPECIFICATION C401 - WATER SYSTEM

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WATER SYSTEM

SPECIFICATION C401: WATER SYSTEM

GENERAL

C401.01 SCOPE

1. This Specification applies to the construction of:
 - mains up to DN600 nominal size;
 - pumping stations.

C401.02 REFERENCE DOCUMENTS

1. Documents referenced in this specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated.

**Documents
Standards Test
Methods**

(a) Council Specifications

- | | | |
|------|---|--------------------------------------|
| C201 | - | Control of Traffic |
| C211 | - | Control of Erosion and Sedimentation |
| C271 | - | Minor Concrete Works |

(b) Australian Standards

- | | | |
|---------------|---|-------------------------------------------------------------------------------------------------------------|
| AS 1159 | - | Polyethylene pipes for pressure applications |
| AS 1214 | - | Hot-dip galvanized coatings on threaded fasteners |
| AS 1289.5.7.1 | - | Compaction control test (Rapid method) |
| AS 1432 | - | Copper tubes for plumbing, gas fitting and drainage applications |
| AS 1460 | - | Fittings for use with polyethylene pipes |
| AS 1565 | - | Copper and copper alloys - Ingots and castings |
| AS 1627 | - | Metal finishing - Preparation and pre-treatment of surfaces |
| AS 1646 | - | Elastomeric seals for waterworks purposes |
| AS 1650 | - | Hot-dipped galvanized coatings on ferrous articles |
| AS 1830 | - | Iron castings - Grey cast iron |
| AS 1831 | - | Iron castings - Spheroidal or nodular graphite cast iron |
| AS 1939 | - | Degrees of protection provided by enclosures for electrical equipment |
| AS 2032 | - | Code of practice for installation of MPVC pipe systems |
| AS 2129 | - | Flanges for pipes, valves and fittings |
| AS/NZS 2280 | - | Ductile iron pressure pipes and fittings |
| AS/NZS 2544 | - | Grey iron pressure fittings. |
| AS 2638 | - | Sluice valves for waterworks purposes |
| AS/NZ 4765 | - | Modified PVC (MPVC) pipes for pressure applications - Compatible with cast iron pipe outside diameters |
| AS 3000 | - | Electrical installations (SAA Wiring Rules) |
| AS 3439 | - | Low-voltage switchgear and control gear assemblies |
| AS 3578 | - | Cast iron non-return valves for general purposes |
| AS 3688 | - | Water supply - Copper and copper alloy body compression and capillary fittings and threaded-end connectors. |
| AS 3952 | - | Water supply - DN80 spring hydrant valve for general purposes. |

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(c) Other

PWD-EDS E101	General Requirements for Building Services (Electrical Installations)
PWD-B AWSSA	General Requirements for Water Supply, Section B Australian Water Supply and Sewerage Authorities Specification of Technical Requirement
WSA-03	Water Supply Code of Australia, Water Services Association of Australia

MATERIALS

C401.03 MODIFIED PVC

1. Modified PVC (MPVC) pipes and fittings shall be manufactured in accordance with AS/NZ 4765 Class 16 blue in colour suitable for rubber ring joints. **Standard**
2. Rubber rings shall comply with AS 1646. **Rubber Rings**

C401.04 DUCTILE IRON

1. Ductile iron (DI) pipes and fittings shall be manufactured and cement mortar lined in accordance with AS/NZS 2280 Class K9 suitable for the patented "Tyton" type rubber ring joint. **Standard**
2. Flanges shall comply with AS 2129 Table D. Bolts and nuts for flanged joints shall be in accordance with AS 2129 and galvanised in accordance with AS 1214. **Flanges**
3. The type of external corrosion protection of buried pipelines shall be as shown on the Drawings. **Corrosion Protection**

C401.05 COPPER PIPE

1. Copper tube shall be manufactured in accordance with AS1432 Type B. **Standard**
2. Fittings shall comply with AS3688 and de-zincification resistant. Capillary fittings shall have silver brazed joints. Soft solder or solder insert capillary fittings shall not be used unless approved by Council. **Fittings**

C401.06 HIGH DENSITY POLYETHYLENE PIPE

1. High Density Polyethylene (HDPE) pipe shall be manufactured in accordance with AS1159 Class 12. **Standard**
2. Fittings shall comply with AS1460. **Fittings**

C401.07 STOP VALVES

1. Stop valves of DN80 to DN300 nominal size shall be "OBE/Elypso" or equivalent resilient seat gate valves manufactured in accordance with AS2638. The Council's approval shall be obtained for the use of equivalent stop valves. **Standard**
2. Flanges shall comply with AS2129 Table C. **Flanges**
3. Stop valves shall be closed by rotating the spindle in a clockwise direction. **Spindle Rotation**

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- | | | |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| 4. | Valves shall be operated by a removable key. | <i>Operation</i> |
| 5. | Stop valves shall be protected internally and externally with Rilsan Nylon 11 powder coating applied at an average thickness of 350-400 microns or equivalent protection approved by Council. | <i>Corrosion Protection</i> |

C401.08 NON-RETURN VALVES

- | | | |
|----|------------------------------------------------------------------------------------------------------------|------------------------------------|
| 1. | Non-return valves shall be full-bodied swing flap type manufactured in accordance with AS 3578. | <i>Standard</i> |
| 2. | Flanges shall comply with AS 2129 Table C. | <i>Flanges</i> |
| 3. | The type of external corrosion protection of buried non-returned valves shall be as shown on the Drawings. | <i>Corrosion Protection</i> |

C401.09 SPRING HYDRANTS

- | | | |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| 1. | Spring hydrant bodies shall be manufactured in accordance with AS/NZS 2544 or AS 3952. | <i>Standard</i> |
| 2. | Spring hydrants shall be protected internally and externally with Rilsan Nylon 11 powder coating applied at an average thickness of 350-400 microns or equivalent protection approved by Council. | <i>Corrosion Protection</i> |

C401.10 PRESSURE REDUCING VALVES

- | | | |
|----|--------------------------------------------------------------------------------------------------------|----------------------------|
| 1. | Pressure reducing valves shall be Bermad style or an equivalent approved by the Council. | <i>Type</i> |
| 2. | Pressure reducing valves shall be installed in accordance with the manufacturers written instructions. | <i>Installation</i> |

C401.11 STEELWORK

- | | | |
|----|-----------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| 1. | Structural steelwork, ladders, brackets, covers etc shall be abrasive blast cleaned to AS1627 Class 3 and hot dip galvanised to AS1650. | <i>Corrosion Protection</i> |
|----|-----------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|

PIPELINE CONSTRUCTION

C401.12 LOCATION

1. The location of the mains and pumping stations, sizes of mains, types of chambers and covers and the classes of pipes are shown on the Drawings. The pipelines shall be laid to grades and locations shown on the Drawings unless directed otherwise by the Water Authority's Representative.

C401.13 COVER OVER PIPELINES

- | | | |
|----|--------------------------------------------------------------------------|-----------------------------|
| 1. | The minimum depth of cover to be provided for mains shall be as follows: | <i>Minimum Cover</i> |
|----|--------------------------------------------------------------------------|-----------------------------|

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LOCATION OF PIPE	MAINS	
	MPVC	DI
1. Areas not subject to vehicular loading:	450mm	450mm
2. Areas subject to vehicular loading:		
a) not in roadway	600mm	600mm
b) in sealed roadway	600mm	600mm
c) in unsealed roadway	750mm	600mm

2. Lesser covers may be permitted where special protection of the pipelines has been specified or directed by the Water Authority.

Special Protection

C401.14 CROSSINGS

1. Where a pipeline crosses a road, creek or involves features under the control of any Authority, the affected work shall be carried out in accordance with the requirements of that Authority. The Developer shall obtain approval from the Authority concerned for the work, and complete written notification to the Authority of the intention to carry out the work.

Crossings of other Authorities

C401.15 EARTHWORKS

1. All excavations for structures and pipelines shall be to the lines, grades and forms shown on the Drawings within the specified tolerances.

2. The Contractor shall leave a clear space of 600mm minimum between the edge of any excavation and the inner toe of spoil banks. No excavated materials shall be stacked against the walls of any building or fence without the written permission of the owner of such building or fence. Topsoil from excavations shall be kept separate and utilised to make good the surface after backfilling.

Excavated Material

3. At completion of work each day, safety fencing shall be installed along edges of open excavations to isolate them from the public. Where necessary, fenced walkways and vehicular crossways shall be provided across trenches to maintain access from carriageway to individual properties or within individual properties. All such installations shall be of adequate size and strength and satisfactorily illuminated.

Public Safety

4. The Developer shall provide traffic control in compliance with Section C201 of Council's place based DCP's.

Traffic Control

5. The Water Authority will not be liable for any claims (including delays) from the Developer or Contractor or any other party for non-inspection due to apparent non-compliance with any requirements, whether or not that non-compliance is subsequently proved to be true or false.

Claims

6. Erosion and sedimentation control shall be carried out in accordance with the requirements of Section C211 of Council's place based DCP's.

Erosion Control

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C401.16 MINIMUM TRENCH WIDTH FOR PIPELINES

1. The minimum clear width of trench (inside internal faces of timbering or sheet piling, if used) to a height of 150mm above the top of the pipe shall be as shown in Table C401.1.

NOMINAL SIZE OF PIPE (DN)	MINIMUM CLEAR WIDTH OF TRENCH (mm) (inside timbering or sheet piling, if any)	
	PIPE OTHER THAN MPVC	MPVC PIPE
100	400	350
150	450	400
200	500	450
225	550	500
250	550	500
300	600	550
375	700	
400	700	
450	750	
500	850	
525	850	
600	950	

TABLE C401.1

2. Where a trench is excavated across a paved surface, the width of the trench shall be kept to a minimum. Bitumen and concrete surfaces shall be carefully cut by saw cutting or other approved means, so as to provide a neat straight line free from broken ragged edges.

Minimum Disturbances

C401.17 EXCAVATION DEPTH

1. For mains to be laid on other than rock foundation (other than MPVC pipe), excavation shall be carried out such as to ensure solid and uniform support for each pipe over the whole length of barrel. Holes shall be excavated beneath joints to enable jointing and inspection of the joints to be carried out and to ensure that each pipe is supported on the barrel and not on the joint.

Other Than Rock Foundations

2. For mains to be laid on rock foundation (other than MPVC pipe), excavation shall be carried out to a depth of not less than 100mm below the underside of the pipe barrel and socket or coupling.

Rock Foundation

3. For all MPVC mains, irrespective of foundation, excavation shall be carried out to a depth of not less than 75mm below the underside of the pipe barrel and socket or coupling.

MPVC Pipe

C401.18 SUPPORT OF EXCAVATION

1. The Contractor shall adequately support all excavations as the works proceed. When withdrawing supports, the Contractor shall exercise every precaution against slips or falls by means of intermediate shoring, planking or props. Backfilling shall be performed

Precautions Against Slips or Falls

WATER SYSTEM

simultaneously with the withdrawal of supports.

2. The Water Authority may order timber to be left in place where in Water Authority's Representative's opinion its removal may endanger structures in the vicinity of the excavation.

Timber Left in Place

C401.19 PIPE BEDDING

1. Pipes (excluding MPVC pipes) may be laid directly on other than rock foundation. The Contractor shall ensure solid and uniform support for the whole length of the barrel with chases provided for joints. Where rock or other hard material occurs in the bottom of the trench or where specified, non-cohesive granular bedding having a minimum thickness of 100mm below the barrel and socket of the pipe shall be provided.

Pipes other than MPVC

2. For MPVC pipes, other than in water charged ground, the material to be used for pipe bedding (underlay a minimum of 75mm below the underside of the pipe barrel and socket, side support and overlay to a depth of 150mm above the top of the pipe) as specified in Australian Standard for aggregate (5mm aggregate blue metal).. In water charged ground the bedding material is to be approved by the Water Authority's Representative.

MPVC Pipes

3. All mains laid on grades steeper than 50 percent shall be encased in concrete as detailed on the Drawings.

Grades Greater Than 50%

C401.20 LAYING AND JOINTING OF PIPES

1. Before being laid, all pipes, fittings, valves, etc shall be cleaned and examined by the Contractor. Refer WSA-03 Part 2 Section 15. If required, the Contractor shall oil valves and repack valve glands.

Examination

2. The Contractor shall provide and use approved drag scrapers or "detectors" to ensure that the interior of the pipeline is clean and free from obstructions. Approved plugs shall be used to prevent foreign matter entering sections of pipeline that are left uncompleted overnight.

Cleaning

3. The Contractor shall take all necessary precautions to prevent flotation of pipes during laying, backfilling and initial testing. Any temporary supports shall be removed prior to completion of backfilling.

Flotation

4. Joints in pipelines shall be flexible rubber ring joints or mechanical joints (either fixed flange or bolted gland type). The joint type shall be as shown on the Drawings.

Joint Type

5. For pipes with rubber ring joints, spigots and sockets shall be clean and dry. Only the lubricant specified in writing by the manufacturer shall be applied in making the joint. When the joint is made, the witness mark shall at no point be more than 1mm from the end of the socket. After making the joint, a feeler gauge shall be used to check that the rubber ring has rolled in evenly, and if not, the pipe shall be withdrawn and the joint remade.

Rubber Ring

6. Pipes shall be cut as needed to suit closing lengths, to remove damaged pipe or fittings or to remove sockets if necessary when jointing a socketed fitting.

Cut Pipes

7. For field cuts, only an approved mechanical pipe cutter shall be used, except that MPVC pipes may be cut using a power saw or a fine toothed hand saw and mitre box.

Pipe Cutting

8. Any pipes cut in the field shall have their ends prepared in accordance with the manufacturer's written instructions.

End Preparation

9. Where pipes are cut in the field, a witness mark shall be made on the pipe at the length specified by the manufacturer from the end of the pipe. Scoring of MPVC pipes shall not be permitted. Where the same manufacturer does not make spigots and sockets,

Witness Mark

WATER SYSTEM

reference shall be made to the socket manufacturer for the correct marking depth.

10. Flexibly jointed pipelines with gradual changes in alignment or grade shall be laid with the joint being deflected after it has been made. The manufacturer's written recommendations in respect of maximum deflection for each joint shall be complied with provided that no joint shall be deflected to such an extent as to impair its effectiveness.

Joint Deflection

11. Unless otherwise directed by the Water Authority, pipes shall be laid on continuously rising grades from scour valve to air release valve, notwithstanding any minor irregularities in the ground surface.

Grade

C401.21 TRENCH STOPS AND BULKHEADS

1. Bulkheads and trench stops are partitions built across a water main trench to prevent or impede the migratory flow of surface and ground water through the embedment material and the consequent transport of fine embedment material along the trench. Bulkheads have the additional task of retaining the pipe to prevent longitudinal and lateral movement of the pipe particularly on steeper gradients.

Where the natural transfer of water from the trench into the surrounding ground will not provide sufficient drainage, trench drainage shall be provided to divert the water to a suitable watercourse. Refer WSA-03 Part 2 Section 15

2. Trench stops are normally in the form of a wall of bags of cement stabilised sand packed around the pipe and spanning the trench. The bags are stacked around the pipe and extend to within 150 mm of the finished surface level.

3. Bulkheads are normally in the form of a wall of concrete poured around the pipe and spanning the trench. The bulkhead is keyed into the trench walls to form a pipe anchor and extends to within 150 mm of the finished surface level. Drainage holes, through the wall, are located in the lower part of the embedment zone to control the flow of water past the bulkhead.

4. Table 4.4 provides bulkhead and trench stops installation criteria for all pipe materials at various gradients.

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**TABLE 4.4
REQUIREMENTS FOR TRENCHSTOPS AND BULKHEADS**

Grade %	Requirement	Spacing m
5-14	Trench stop	100/Grade
15-29	Concrete bulkheads.	L/Grade where L = 80 x Pipe length, m = 450 m max If L>100 m use intermediate trench stops at spacing <100/Grade
30-50	Concrete bulkheads. Embedment may need to be specially designed	100/Grade
> 50	Special design	

5. In addition to the gradient, the location of the trench, the annual rainfall, occurrence of underground streams and Water Agency criteria will need to be taken into consideration when determining the use of bulkheads and trench stops. Trench stops are not required if native fill embedment is used.

6. Where the requirement for bulkheads and trench stops is identified during the design process these requirements shall be detailed on the Design Drawings (Refer WSA-03 Part 2 Section 15).

C401.22 CORROSION PROTECTION OF STEEL BOLTS AND NUTS

1. All galvanised steel bolts and nuts used for installation below ground of flanges, bolted gland joints, Gibault joints, tapping bands, etc, shall be thoroughly coated, after the nuts have been tightened, with at least one coat of plasticised coat-tar compound applied cold, such as "Tarnamel TE50" or equivalent. Bolts and nuts shall be dry, clean and free from rust immediately application of the coating.

Tar Coating

C401.23 VALVE CHAMBERS

1. The Contractor shall construct around each valve and hydrant a chamber of the type and to the details shown on the Drawings.

Type

2. The concrete shall comply with Specification C271 - MINOR CONCRETE WORKS.

Concrete

3. Valve chambers are to have a red pigment added to the concrete while hydrant chambers are to be painted with yellow road paint.

Pigment

4. Where the type of valve chamber is such that the body or part of the body, of the valve is to be backfilled before the valve chamber is constructed, the Contractor shall apply at least one coat of corrosion preventing material to the valve body after the valve has been installed but before backfilling. The coating material shall be compatible with the coating material that has been applied to the valve prior to delivery. Acceptable alternative to the field coating is wrapping the valve using an approved tape consisting of synthetic fibre open weave cloth impregnated with saturated hydro-carbons, such as "Denso" tape, applied in accordance with the manufacturer's written instructions.

*Corrosion
Protection*

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C401.24 CHAMBER COVERS AND FRAMES

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|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| 1. Covers and frames shall not be warped or twisted. Surfaces shall be finished such that there are no abrupt irregularities and gradual irregularities shall not exceed 3mm. Unformed surfaces shall be finished by approved methods to produce a surface that is dense, uniform and free from blemishes. Exposed edges shall have a minimum 4mm radius. | Finish |
| 2. Tolerances for the dimensions on the COVER shall be - 3mm + NIL. | Cover
Tolerance |
| 3. Tolerances for the dimensions on the SURROUND shall be - 3mm + 3mm. | Surround
Tolerance |
| 4. Covers shall be seated on a layer of "Compriband" or similar approved material, having a cross-section of 25 x 25mm. Alternatively another seating material of a cross-section and composition approved by the Superintendent may be used. | Cover Seating |
| 5. Covers shall be finished flush with the surface in roadways, footpaths and paved surfaces. Elsewhere, covers shall be finished 25mm above the surface of the ground, or such other level as directed by the Superintendent, in a manner designed to avoid as far as possible, the entry of surface water. | Cover Levels |
| 6. Cast iron covers and surrounds shall be installed and filled with concrete in accordance with the manufacturer's written requirements. | Installation |

C401.25 SERVICE CONNECTIONS

- | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| 1. The Contractor shall provide service connections to all proposed lots being serviced by the new water main. | Service
Connections |
| 2. Services shall extend no further than 450mm into the property and the meter valve should protrude no higher than 125mm to the centre of the valve above ground. | Location |
| 3. All services shall have a water meter box of a type acceptable to the Water Authority installed before commissioning of the water main. | Meter Box |
| 4. Council shall undertake all service connections to live mains. Developer /contractor to make application and pay appropriate fees. | Live Mains |

C401.26 THRUST AND ANCHOR BLOCKS

- | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| 1. Thrust and anchor blocks shall be constructed where shown on the Drawings to the dimensions depicted therein. The blocks shall be provided at valves, flexibly jointed bends, tees, enlargers and reducers or any other point where unbalanced forces resulting from internal pressures will occur. | Location |
| 2. The Contractor shall provide permanent thrust blocks of Grade 20 concrete complying with Specification C271 - MINOR CONCRETE WORKS such that the thrust blocks bear against undisturbed material normal to the direction of thrust resulting from internal pressures over a bearing area not less than that shown in WSA-03 Part 2 Section 15 | Thrust Blocks |
| 3. The Contractor shall provide permanent anchor blocks of Grade 20 concrete complying with Specification C271 - MINOR CONCRETE WORKS of a volume not less than that shown in WSA-03 Part 2 Section 15 | Anchor Blocks |
| 4. The Contractor shall provide temporary anchorages adequate to restrain the pipe | Temporary |

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when under test. The cost of providing such anchorages shall be deemed to be included in the rates tendered for laying and jointing rising mains.

Anchorage

C401.27 CONCRETE ENCASEMENT

1. Where pipes have less than 450mm of cover above the top of the pipe barrel and also where directed by the Water Authority's Representative, they shall be encased in concrete. The developer should obtain prior approval from Council. Concrete shall be of Grade 20 complying with Specification C271 - MINOR CONCRETE WORKS and comply with the requirements of WSA-03 Part 2 Section 15

Location

2. In trenches of other than rock or fissured rock, a contraction joint consisting of a layer of bituminous felt 12mm thick shall be formed in the concrete encasement at the face of each socket or at one face of each coupling.

**Contraction
Joint**

3. Reinforcement in concrete encasement shall be as shown on the Drawings.

Reinforcement

PIPELINE DISINFECTION, TESTING AND RESTORATION

C401.28 TESTING OF PIPELINES

1. Backfilling of mains shall not occur until a visual inspection shall be made by the Water Authority and the Contractor has been advised by the Water Authority that the main may be backfilled.

**Visual
Inspection**

Hold Point

2. Mains shall be pressure tested to detect excessive leakage and defects in the pipeline including joints, thrust and anchor blocks.

3. Pipelines shall be tested as soon as practicable after the main has been laid, jointed and backfilled, provided that:

Timing

(a) if so specified or if the Contractor so desires, some or all of the pipe joints shall be left uncovered until the whole of the section has been successfully pressure tested; and

(b) The pressure testing shall not be commenced earlier than seven days after the last concrete thrust or anchor block in the section has been cast.

4. For the purpose of this sub-clause, a section shall be defined as a length of pipeline which can be effectively isolated for testing, eg by means of main stop valves.

**Section
Definition**

5. Pressure testing shall not be carried out during wet weather.

Wet Weather

6. During pressure testing, all field joints that have not been backfilled shall be clean, dry and accessible for inspection.

Field Joints

7. During the pressure testing of a pipeline, each stop valve shall sustain at least once, the full test pressure on one side of the valve in closed position with no pressure on the other side for at least 15 minutes.

Stop Valves

8. Before testing a pipeline section, it shall be cleaned and filled slowly with water, taking care that all air is expelled. Purging of air from rising mains shall be promoted by opening air valves. In order to achieve conditions as stable as possible for testing by allowing for absorption, movement of the pipeline and escape of entrapped air, the section shall be kept full of water for a period of not less than 24 hours prior to the commencement of the pressure testing.

**Filling with
Water**

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9. The hydrostatic test pressure which shall be applied to each section of the pipeline shall be such that at each point of the section the test head shall be equal to or greater than the design head specified or shown on the Drawings, but shall not exceed same by more than 20 per cent. **Test Pressure**

10. The specified test pressure shall be maintained as long as required by the Water Authority, while the whole section is examined, and in any case not less than 8 hours. For the purpose of determining the actual leakage losses, the quantity of water added in order to maintain the pressure during the period of testing shall be carefully measured and recorded. **Duration of Test**

11. The pressure testing of a section shall be considered to be satisfactory if:

(a) there is no failure of any thrust block, anchor block, pipe, fitting, valve, joint or any other pipeline component;

(b) there is no visible leakage; and

(c) the measured leakage rate does not exceed the permissible leakage rate as determined by the following formula:

$$Q_1 = 0.0105 D.L. (H)^{0.5}$$

where:

Q_1 = permissible leakage rate (litres per hour)

D = nominal diameter of pipe (mm)

L = length of section tested (km)

H = average test head (m)

12. Any failure, defect, visible leakage and/or excessive leakage rate, which is detected during the pressure testing of the pipeline or during the Defects Liability Period shall be made good by the Developer at his expense. This includes failure of a thrust block or anchor block that has been constructed in accordance with the Drawings. **Rectification**

C401.29 CONNECTION TO EXISTING

1. Disinfection of mains shall occur in accordance with the procedure described in the Water Authorities specification. **Disinfection**

1. Connections to existing pipes carrying water shall be made by the Water Authority after payment of the appropriate fees and supply of all materials and fittings required for this work. **Connection to existing Mains**

2. Commissioning and connection of water mains will only occur after a commissioning inspection has been requested by the Developer. The commissioning inspection may take the form of a Pressure test as described above or such other method as the Water Authority may approve. **Commissioning Request**

C401.30 BACKFILL AND COMPACTION

1. When laying and jointing of a pipeline has been completed and before backfilling is commenced, the Contractor shall notify the Water Authority's Representative for an inspection **Notification**

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2. Backfill shall not be placed until the Water Authority's Representative has given approval. **Approval**
3. Material for the side support and overlay of the pipe shall comply with Clause C401.19. The material shall be compacted in layers of not more than 150mm to 95 per cent of the standard maximum dry density of the material used when determined in accordance with AS1289.5.7.1. **Side Support and Overlay**
4. The remainder of the excavation shall be backfilled with excavated material. The backfill shall be compacted in layers of not more than 150mm thick to 95 per cent of the standard maximum dry density of the material used when determined in accordance with AS1289.5.7.1. Flooding of cohesive material shall not be permitted as a means of compacting backfill. **Remainder of Trench**
5. Backfilling and compaction shall be carried out without damaging the pipe or its external coating or wrapping, or producing any movement of the pipe. **Care**

C401.31 MARKING PLATES

1. Opposite each stop valve, scour valve, air valve and hydrant the Contractor shall fix a marking plate in a manner and position as approved by the Water Authority. Please refer to council's valve and hydrant marking standard document. This document shall supersede any other standard.

C401.32 RESTORATION OF SURFACES

1. Restoration of all surfaces to their original shall occur in accordance with the requirements of WSA-03 Part 3 Section 25 **Original Condition**
2. All restored surfaces shall be maintained until the expiry of the Defects Liability Period applicable to those surfaces, notwithstanding that any deterioration of the restored surfaces and the need for their maintenance may or may not be due to defects that become apparent or arise from events that occur during the Defects Liability Period. **Maintenance**

PUMPING STATIONS

C401.33 PUMPS

1. Pumps shall be centrifugal end suction pumps complying with the Australian Water Supply & Sewerage Authorities (AWSSA) Specification of Technical Requirements. **Type**
2. Pump construction materials shall be: - **Materials**

DESCRIPTION	MATERIAL
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WATER SYSTEM

PUMP	
Casing and suction bend	Cast iron AS 1830 Gr T200
Wear rings	Cast iron AS 1830 Gr T200
Impeller	316 Stainless steel
Impeller nut	Gunmetal AS 1565-905C
Shaft	316 Stainless steel
Shaft sleeve	Phosphor bronze AS 1565-9060/316
Neck bush, lantern ring	Phosphor bronze AS1565-9060
Gland	Cast Iron AS1830 Gr T200
Gland studs	316 Stainless steel
Gland nuts	316 Stainless steel
Fixing nuts and bolts handhold	316 Stainless steel
Covers	316 Stainless steel
Fitted bolts and nuts, casing and	316 Stainless steel
Forcing screws	316 Stainless steel
Water thrower and drip tray	316 Stainless steel
Pump set base plate	Cast iron AS 1830 Gr T200/Fabricated
MOTOR	
Motor frame and end shield	Cast iron/Mild steel
Motor terminal box	Cast iron/Mild steel
Motor fan cover	Mild steel
Motor fan	Metal
HOLDING DOWN BOLTS	316 Stainless steel
MECHANICAL SEALS	
Seal faces	Tungsten carbide or equal
Springs	Nickel chrome steel
Secondary seal	Fluoro carbon or nitrile rubber

WATER SYSTEM

C401.34 ELECTRICAL COMPLIANCE

1. The works shall be in accordance with the Department of Public Works General Requirements for Building Services (Electrical Installations) dated June, 1984, including amendment 1 August 1987 (known as EDS E101) and General Requirements for Water Supply - Section B except where this Specification or the Drawings indicate otherwise. **Standards**
2. PWD-EDS E101 covers the Department's general requirements for materials, workmanship, and methods of installation as follows: **EDS 101**
 - Part 0 Generally
 - Part 1 Reticulation and Wiring
 - Part 2 Switchboards and Equipment
 - Part 3 Accessories
 - Part 4 Luminaries - Supply and Installation
 - Part 5 Electric Motors
 - Part 6 Painting, Colour Coding and Labelling
3. Except where PWD-EDS E101 and PWD-B requires a higher standard, works shall be carried out in accordance with AS 3000, the Service Rules of the Supply Authority and all relevant Statutory Authorities. **Compliance**
4. Proof of compliance with a standard or specified test may be required. Where requested, such proof shall comprise a test certificate from an approved independent testing authority. **Proof of Compliance**
5. The Contractor shall submit all designs and material to each Authority having jurisdiction for approval, as required. The Contractor shall arrange for each Authority having jurisdiction to inspect the works. The Water Authority's Representative shall be advised a minimum of 7 working days in advance of the date of any inspection by an Authority. **Approval**

C401.35 SWITCHGEAR AND CONTROL GEAR ASSEMBLY (SCA)

1. The switchboard shall be designed and assembled by a manufacturer approved by the Water Authority. **Manufacturer**
2. The SCA shall be of outdoor, stationary, free standing, metal-enclosed, cubicle type series with a minimum degree of protection of IP56D as specified in AS 1939. **Type**
3. All equipment shall be securely mounted on suitable mounting panels and comprise individual compartments. A steel galvanised channel base shall be provided. **Construction**
4. Starter contactors shall have a minimum rating sixty (60) Amps to AC3. **Starter Contactors**
5. All necessary terminals with terminal and cable numbers shall be supplied and installed in accordance with the Drawings. **Terminals**
6. The Water Authority will supply padlocks for use on the SCA. **Lock Barrels**
7. The electrical characteristics of the SCA shall be:- **Characteristics**
 - Main Circuit: 415/240 V, 50 Hz, 3-phase, 4-wire.
 - Motor Control Circuit: 240 V, 50 Hz.

WATER SYSTEM

Common Control Circuit: 240 & 24 V, A.C.

Prospective short-circuit current:
14kA for 1 second.

Peak Factor: 2.2

Earthing (M.E.N. system)

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| 8. | All cables shall enter the SCA from below. | Cable Entry |
| 9. | Data from the switchgear supplier confirming Type "2" co-ordination between contactors, motor protection relays and corresponding circuit breakers shall be submitted to the Superintendent. | Switchgear Data |
| 10. | Install telemetry equipment for automatic control signals. | Telemetry |
| 11. | The "AUTO" mode shall be capable of being overridden by turning the starter selector switch to the "ON" position. Manual operation would normally be used in the event of failure of the telemetry system or for function testing. A warning label (R/W/R) advising <u>selector switches to be left in the "AUTO" mode</u> shall be fitted to common control cover. | Operation |
| 12. | Factory tests shall be carried out in the presence of the Water Authority's Representative and in accordance with Schedule EDS-E101 and shall comprise all routine Tests specified in AS3439. The Water Authority shall be given seven (7) days notice of the proposed date of such tests. | Factory Tests |
| 13. | Functional tests referred to in Schedule EDS-E101 shall include electrical function tests as defined in AS3439. | Functional Tests |
| 14. | After satisfactory final factory inspection and tests, the equipment shall be packed for transport. Any relays and fittings likely to be adversely affected during delivery shall be adequately protected or shall be removed and packed separately in protected containers. Where equipment has been removed, cover plates shall be provided. | Packing |
| 15. | The Contractor shall be responsible for any damage that may occur during transit and unloading at site. | Damage |
| 16. | Spare parts, tools etc, shall be packed separately from the main plant and shall be marked "Spare Parts," "Tools" etc, as applicable. | Tools |
| 17. | Supply three spare globes for every ten indicating lamps (together with removal tool); one (1) spare coil and one (1) three phase set of contacts (or complete contactor) within the SCA together with two (2) off each of the following 240V and a.c. relay; 240V a.c. timer; 24V a.c. relay; 24V a.c. timer and thermistor relay. | Spare Parts |

C401.36 ELECTRICAL INSTALLATION

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| 1. | The Contractor shall liaise with the Supply Authority for the electricity supply to the pumping station site. | Liaison |
| 2. | All facilities required by the Supply Authority for revenue metering equipment and the payment of all associated connection, inspection fees and capacity charges shall be the responsibility of the Contractor. | Contractor's Responsibility |
| 3. | All cabling including consumer mains, motor, control and flow meter cables, conduits and electrical pits shall be supplied and installed by the Contractor. | Cabling |
| 4. | All wiring shall be installed in HD-MPVC underground conduits laid a minimum | Conduits |

WATER SYSTEM

500mm below the finished ground level in non-trafficable areas and 600mm below the finished ground level in trafficable areas. The trench and backfill material shall be free of rocks and other foreign matter likely to damage the conduits.

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| 5. Electrical marker tape shall be run 150mm below the finished ground level directly above the conduits for the entire length of the conduits. Marker tape shall be orange in colour, 150mm wide and stamped with the words "DANGER - ELECTRIC CABLES BELOW" or similar. | Marker Tape |
| 6. The Water Authority shall approve the route of all underground cabling prior to commencement of trenching. | Route |
| 7. The Points of Attachment shall be determined on site by the Contractor and any consumer's connection poles for the consumer mains required by the Supply Authority shall be supplied and installed by the Contractor. | Point of Attachment |
| 8. The consumer mains shall be generally run underground and commence at the Point of Attachment on a steel consumers pole (if applicable), installed near the property boundary and run in conduit to the switchboard. | Consumer Mains |
| 9. The minimum size of the consumers mains shall be sized to satisfy the following requirements:

(a) Current carrying capacity to suit the maximum demand with an excess current carrying capacity of 30% minimum.
(b) Be sized for a voltage drop less than 1.5% to the maximum demand as calculated.
(c) Be single core PVC/PVC cables. XLPE insulated cable may also be used.
(d) Comply with the requirements of the Supply Authority.
(e) Pole termination method shall be as shown on the Drawings. | Size |
| 10. In addition to the requirements of the Supply Authority and EDS E101 the main earthing conductor shall be run in conduit to the main earthing electrode. The main earthing connection shall be contained in an earthing electrode connection box similar to ALM type ERB-1 up to 50mm ² cable and a Type 4 pit for larger cable. | Earthing Conductor |
| 11. A separate earthing conductor and electrode shall be provided for the surge diverters. Each electrode shall be bonded and suitably labelled with an engraved brass label. | Surge Diverters |
| 12. The pumping station pipework shall be bonded to the main earth. | Pipework |
| 13. Metering facilities shall be installed within the SCA. The metering facilities and panel shall be Energy Authority approved and suitable for the installation of the metering equipment required by the Supply Authority. | Meters |
| 14. The following metering equipment shall be supplied and installed: -

(a) Plug-in meter bases.
(b) Service potential fuses.
(c) Current transformers metering equipment (if required).
(d) All necessary wiring and other accessories as required by the Supply Authority.
(e) Key locking facilities for Supply Authority access. | Metering Equipment |

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15. Cables entering the outdoor SCA compartment shall be glanded using non-ferrous metallic or plastic glands with neoprene compression seals. Connect the on-flow switch and pump motor cables to the appropriate terminals. Cables shall not be jointed. **Cable Entry**

16. At the completion of commissioning tests all conduits into the outdoor SCA shall be sealed with a non-setting sealing compound to prevent the ingress of vermin. **Sealing**

C401.37 TESTING AND COMMISSIONING OF PUMPING STATION

1. All materials, equipment, installation and workmanship shall be tested and/or inspected to prove compliance with the Specification requirements. **Compliance**

2. Tests and inspections shall comply with relevant Australian Standards. **Standards**

3. Testing shall include pre-commissioning, field-testing and performance testing of each part of the whole installation. **Testing**

4. Pre-commissioning is the preparation of plant or equipment so that it is in a safe and proper condition and ready for commissioning and operation. It includes all aspects of plant operation such as safety, electrical, mechanical and instrumentation. **Pre-Commissioning**

5. Pre-commissioning shall be conducted in a logical sequence in accordance with the programme prepared by the Contractor and approved by the Water Authority. **Sequence**

6. The Contractor shall prepare pre-commissioning record sheets for each item of equipment to ensure results of tests are satisfactorily recorded and that all necessary checks or tests have been performed. **Record Sheets**

7. Specific requirements for pre-commissioning shall include, but are not limited to:- **Requirements**

(a) Initial charges of lubricant in addition to any special lubricant requirements for initial flushing or treatment of the system or for "running in".

(b) Physical checks and tests such as completeness of assembly, rotational tests (including checking that the rotation of electrical motors is in the correct direction), alignment checks, balancing and vibration checks, temperature, pressure and flow measurements, clearances, belt alignment and tension, etc, depending on the type of equipment.

(c) Electrical and instrument installation tests, including motor insulation tests, checking instruments against certified instruments and correcting as necessary.

(d) Tests of the correct functioning of automatic and manual control and protection equipment, including simulating danger conditions, mal-operations or failures, to check that all instruments and controls function correctly. These tests shall also include adjusting instrument set points and alarm settings and proving correct operation of alarms.

(e) Equipment and system operating tests. The Contractor shall certify compliance of each item and submit a signed copy to the Water Authority prior to commissioning.

8. Pre-commissioning tests shall be carried out to the satisfaction of the Water Authority and shall be recorded on the appropriate Pre-commissioning Record Sheet. **Recording**

WATER SYSTEM

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| 9. The Contractor shall furnish the Water Authority with one signed copy of each completed Pre-commissioning Record Sheet countersigned by the Water Authority's Representative who witnessed the test. | Submission |
| 10. Commissioning is the running of the plant and equipment to ensure flow through the pumping system, carrying out any necessary testing and adjustments until it is ready and suitable for normal starting and running under service conditions. | Commissioning |
| 11. The Water Authority shall be given five (5) working days notice of the Contractor's intention to undertake commissioning. | Notification |
| 12. Commissioning shall be conducted in a logical sequence in accordance with a programme prepared by the Contractor and approved by the Water Authority. | Sequence |
| 13. Throughout commissioning the Contractor shall be responsible for the test programme. | Responsibility |
| 14. The Contractor shall provide continuous supervision by personnel experienced in the operation of the equipment and shall have qualified personnel in attendance to carry out all necessary adjustments and/or remedial work during the commissioning tests. | Supervision |
| 15. The Contractor shall prepare schedules, test record sheets and programmes for approval by the Water Authority prior to each stage of the overall commissioning. | Documentation |
| 16. Final testing and commissioning (min 1 day duration) of the electrical services in conjunction with the mechanical equipment (e.g. pump, etc) including setting and adjustment of equipment shall be carried out in accordance with EDS E101. | Final Testing |
| 17. The Contractor shall arrange for all testing, commissioning and any adjustments to be carried out by qualified personnel. | Qualified Personnel |

C401.38 COMPLETION OF PUMPING STATION

1. The following requirements shall be fulfilled before the Subdivision Certificate or Occupation Certificate is issued: -
- Certificates of approval from the relevant statutory authorities have been received by the Water Authority.
 - Pumping station is in working order as demonstrated by the testing and commissioning.
 - The Water Authority's Representative has approved operating and maintenance manuals.
 - As-built drawings of the pumping station have been submitted to the Water Authority.

C401.39 TELEMETRY

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| 1. Equipment to link the pumping station to the existing telemetry network is to be provided by the appropriate supplier used by Council at the Developer's expense. | Contractor's Cost |
| 2. The pumping station shall operate automatically by control signals from the telemetry system. In addition, either one or any combination of pumps may operate at any one time by control signals from the telemetry system. | Operation |

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C401.40 OPERATION AND MAINTENANCE MANUALS

1. Manuals shall contain the following information:
 - a) Developer and Contractor's name address and telephone number.
 - b) Developer's Contract number, job name.
 - c) Pumping station general arrangement drawing showing pumps, motors, valves, pipework, switchboard and electrical installation.

2. Manuals for pumps shall contain the following information: ***Pumps***
 - (a) Manufacture.
 - (b) Type and model number.
 - (c) Serial number.
 - (d) Dimensioned general arrangement drawing of pump and motor.
 - (e) Sectional arrangement drawing with parts and list.
 - (f) Dimensioned sectional arrangements detailing:
 - (i) Maximum and minimum shaft/bearing clearance (radial)
 - (ii) Maximum and minimum impeller/bowl clearance (axial)
 - (iii) Maximum and minimum impeller/bowl clearance (axial)
 - (iv) Impeller/bowl wear rings.
 - (v) Motor/pump coupling - type, make and model number.
 - (vi) Mechanical seals where applicable.

3. Manual for motors shall contain the following information: ***Motors***
 - (a) Manufacture.
 - (b) Type and model number.
 - (c) Serial number.
 - (d) Dimensioned general arrangement drawing.
 - (e) Sectional arrangement drawing for submersible motor power cabling where applicable.
 - (f) Gland sealing arrangement drawing for submersible motor power cabling where applicable.
 - (g) Cables where applicable.
 - (h) Terminal block arrangement drawing where applicable.

4. Manuals for valves shall contain a dimensioned sectional arrangement drawing with parts and material list for all valves. ***Valves***

5. Manuals shall contain the following test curves:- ***Test Curves***
 - (a) Pump witnessed test curves.
 - (b) Motor test curves.

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(c) Motor torque/speed/efficiency characteristic curves.

6. The operating and maintenance manual shall include:-

***Operation and
Maintenance***

- Safe working procedures: For switching and isolating the supply and distribution system;
- Description of Operation;
- Maintenance procedures: Recommended maintenance periods and procedures;
- Tools: Particulars of maintenance equipment and tools provided, with instructions for their use.
- Equipment: A technical description of the equipment supplied, with diagrams and illustrations where appropriate;
- Dismantling: Where necessary, procedures for dismantling and reassembling equipment;
- Spare parts: A list of the spare parts provided.

7. Trouble shooting instructions shall be included for pumps, motors, valves and SCA.

***Trouble
Shooting***

8. Step by step procedures for dismantling and reassembly of pumps, motors and valves using any special tools shall be detailed together with step by step procedures for replacement of wearing parts such as bearing, seals, wear rings, etc.

***Replacement
Procedures***