

## TECHNICAL SPECIFICATION – PART B – WATER MAIN WORKS

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## **1. GENERAL**

### **1.1 SCOPE OF SPECIFICATION**

This specification is for the construction and testing of pressure mains, trunk mains, reticulation mains and associated appurtenances which will become part of the Local Council's water supply system. All work shall conform to this specification to the satisfaction of the Superintendent and Local Authorities. Should details of work not be covered by this specification or the drawings then work shall comply with the requirements of the Local Authority.

### **1.2 CONFORMITY OF SPECIFICATION**

Notwithstanding the requirements of this specification, the whole of the works shall be executed in conformity with the relevant sections of the Water Supply Code of Australia (WSA 03) latest revision, and the relevant By-Laws and formally adopted resolutions of policy of the relevant Local Authority.

### **1.3 STANDARD DRAWINGS**

The standard drawings referenced in this contract form part of this specification.

### **1.4 AUSTRALIAN STANDARDS**

All dates of issue of Australian Standards quoted in this specification were the applicable dates at the time of this specification preparation. Notwithstanding any dates quoted, the latest revisions of any standard will apply.

## **2 MATERIALS**

### **2.1 GENERAL**

Unless otherwise specified, materials shall conform to the relevant Australian Standard specification.

The Contractor shall inform the Superintendent of the source from which the various materials will be supplied or of the place of their manufacture and afford the Superintendent every facility to inspect such supply or manufacture at any stage.

The Contractor shall give sufficient notice to the Superintendent to enable any materials brought upon the site to be examined and all materials shall be stacked as directed, to facilitate this examination. All materials which, in the opinion of the Superintendent, are unsuitable for the work, shall be immediately removed from the site and, in the event of the Contractor refusing or failing to effect this removal within twenty-four hours from the time that he receives instructions so to do, the Superintendent shall have the power to effect the removal at the Contractor's expense.

The Superintendent shall have the right to enter, for the purpose of inspection and testing, at any time during working hours, any premises where the articles are being manufactured or are stored.

### **2.2 QUALITY ASSURANCE**

Materials used in all work shall be supplied from a formally accredited company in accordance with ISO 9000 latest revisions.

Where a supplier has not been accredited in accordance with the relevant section of the Australian Standard, the Superintendent may exempt them from the above requirements provided that the supplier has a quality system in place based on acceptable audited quality system standards.

### **2.3 STORAGE OF MATERIALS**

All materials shall be handled and stored in a manner, which will prevent damage, deterioration or intrusion of foreign matter.

In particular, steel materials shall not be stored on the ground.

Aggregates shall be stored so as to prevent the mixture of one size with another.

## **2.4 GALVANISED STEEL**

All steel shown or specified to be galvanised shall be prepared and cleaned by immersion in an approved acid bath, thoroughly rinsed in clean water, dried in a suitable oven or chamber and immersed in a bath of pure molten zinc, fluxed with a covering of chloride of ammonia and of a capacity sufficient to permit the work to be completely immersed. The quality of the zinc shall be similar to that of an approved sample and may be tested from time to time by the Superintendent. The quantity of the zinc shall be not less than 1kg per square metre. When the steel is coated thoroughly and evenly all over and all seams and joints are filled completely with zinc, it shall be removed from the bath, washed in clean fresh water, dried, cleaned and stacked. Any distortion that may have occurred during galvanising shall be removed by machine pressure and not by hammering.

All galvanised sheet steel shall be in accordance with AS 1397 Steel Sheet and Strip - hot-dipped zinc-coated or aluminum/zinc-coated.

## **2.5 CONCRETE MATERIALS**

Cement shall comply with the requirements of AS 3972 Portland and Blended Cements. Portland Cement shall be used except where the use of High Early Strength Cement is specified, or approved, by the Superintendent.

Aggregates shall, in general, comply with the requirements of AS 2758.1 latest revisions. The Superintendent may approve of the use of other aggregate with appropriate strength, durability and freedom from harmful properties, which produce concrete of suitable workability and of the specified strength. Aggregate may be subjected to any or all of the tests detailed in AS 2758.1.

Reinforcing steel shall comply with the requirements of AS 4671 Steel Reinforcing Bars for Concrete. When placed, it shall be free of loose scale, loose rust and other coatings, which would destroy or reduce the bond.

Steel fabric reinforcement shall comply with the requirements of AS 4671 Welded Wire Reinforcing Fabric for Concrete.

Chemical Admixtures shall comply with the Australian Standard AS 1478.1. The Contractor must gain the Superintendent's approval prior to using any chemical admixtures in concrete.

All concrete, utilised in the scope of works covered by this specification, shall be ready-mixed concrete manufactured in accordance with the Australian Standard AS 1379. All strength grades shall be as nominated in the specification and/or shown in the standard drawings.

The use of concrete, other than ready-mixed concrete (i.e. site-mixed concrete) shall not be permitted without the express approval of the Superintendent.

If such approval is granted, the Contractor shall provide details of his mix proportions, mixing techniques and, finally, evidence of results of strength grade tests confirming his compliance with the specification.

## **2.6 FORMWORK**

All materials supplied for the construction of formwork shall be in accordance with the Australian Standard AS 3610.

## **2.7 PRESSURE PIPES AND FITTINGS**

Except where shown otherwise, all pressure pipes and fittings for water mains shall be supplied and installed by the Contractor, provided that: -

- (a) the fittings offered are compatible with the type and class of pipe offered;
- (b) the pipes and fittings conform with the relevant Australian Standard;
- (c) for each diameter of pipe, the same type of pipe and fittings must be used throughout the whole contract unless specifically stated on the drawings or in this specification;
- (d) fittings shall be of ductile iron, cement-lined, bitumen-dipped or fusion-bonded epoxy-coated with rubber ring joints as specified or as indicated on the project drawings.

#### 2.7.1 Ductile Iron (DI)

Ductile iron pipes and fittings shall comply with the following standard (with latest amendments):

- \* AS 2280 - Ductile Iron Pressure Pipes and Fittings

Ductile iron pipes shall be internally lined with a cement lining as set out in Table 7.1 of AS 2280, and shall be coated externally with a bituminous compound in accordance with AS 2280 Section 7.3.2.

DI pipes and fittings shall be rubber ring jointed and polyethylene sleeved, as specified in Clause F16.

#### 2.7.2 Minimum Cover Over Pipes

<b>Loading Conditions</b>	<b>Ductile Iron</b>	<b>Any Other Type of Pipe Approved for Use</b>
1. In footpaths/verges and areas subject to normal vehicular loading, including private property, but excluding roadways	450mm	600mm
2. In areas subject to construction equipment loading or in embankment conditions	750mm	900mm

NOTE: Minimum cover to Ductile Iron Road Crossings shall be 600mm.

## 2.8 RUBBER RINGS

Rubber rings shall comply with the following standards:

- AS 1646 - Rubber Joint Rings for Water Supply, Sewerage and Drainage Purposes

Rubber rings for water supply purposes shall not contain root inhibitor and shall be marked in accordance with AS 1646.

## 2.9 DUCTILE IRON FITTINGS

All ductile iron fittings shall be internally and externally coated with fusion-bonded epoxy (FBE).

## 2.10 DUCTILE IRON SOCKETED FITTINGS

Sockets shall be of a design, which provides an effective sealing length. The socket design shall be of a type approved by AS 2280. Care shall be taken when cutting pipes that the pipe ends are cut square and evenly, not excessively bevelled and that the end is fully inserted into the socket by use of the witness mark.

## **2.11 DUCTILE IRON FLANGED PIPE AND FITTINGS**

Flanged pipework shall be manufactured from AS 2280, minimum PN20 class wall thickness ductile iron pipe to which has been fitted threaded boss flanges, using an approved method. Pipes may be of flange/flange, flange/socket or flange/spigot configuration as specified. All flange faces shall be machined at right angles to and concentric with the axis of the internal diameter of the pipe. Flanges shall be drilled to Table E in accordance with AS 2129, unless otherwise specified. All pipes shall be cement mortar lined and coated with a bituminous compound in accordance with AS 2280 Section 7.3.2, unless otherwise specified.

Flanged Pipe Fittings shall be manufactured in accordance with AS 2280 Ductile Iron Pressure Pipes and Fittings. Flanges shall be drilled and machined in accordance with Figure 4.1 Table E, or as otherwise specified. Fittings shall be cement mortar lined and coated externally with a bituminous compound in accordance with AS 2280, Section 7, unless otherwise specified.

Puddle Flanges, where specified, shall comply to AS 2280, 5.3.

## **2.12 VALVES**

### **2.12.1 SLUICE VALVES**

Sluice valves shall be generally to AS 2638 Sluice Valves for Water Works Purposes. Valves shall be either metal seated or resilient seated, as specified, and be of the inside screw, non-rising stem design. The valves shall be clockwise close unless otherwise specified and operated by a removable key or handwheel, as required. Valves shall have a maximum working pressure and test pressure to comply with the AS 2638 class rating specified. End configurations shall be flanged or double socket. Sockets shall incorporate an elastomeric sealing ring manufactured to AS 1646 and to the manufacturer's design.

Sluice valves shall be tested to satisfy the requirements of AS 2638.

### **2.12.2 AIR VALVES**

Air valves shall be generally to AS 4956, Air Valves for Water Supply.

### **2.12.3 SPINDLES AND HAND WHEELS**

Spindles, extension spindles and hand-wheels, where required, shall be turned out of either high tensile brass or stainless steel.

## **2.13 JOINTING BOLTS**

Stainless steel bolts and nuts shall comply with the metric standards AS 1111.1 and AS 1112.1, with dimensions as set out below:-

<b>Bolt Size</b>	<b>DIMENSION ACROSS HEXAGONAL FLATS</b>	
	<b>Maximum</b>	<b>Minimum</b>
M16	24mm	23.16mm
M20	30mm	29.60mm
M24	36mm	35.00mm
M30	46mm	45.00mm

These dimensions do not apply to bolts, which form an integral part of an article.

Bolt lengths shall be equal to the sum of the thickness of the flanges, gasket and nut, and rounded up to

the nearest standard size.

Bolts shall exhibit a clean-cut thread with no burrs or torn peaks on the threads. Nuts must turn freely on the threads without binding.

#### 2.14 VALVE BOXES

Cast iron valve boxes and lids shall be manufactured in accordance with AS 1830 - Iron Castings - grey cast iron, and shall be grade T220.

A bitumastic-based coating shall be applied to the casting when it is clean, dry and free from rust.

Stop Valve box lids shall be marked as "SV".

#### 2.15 POLYETHYLENE PIPE SLEEVING

Wherever so specified, the Contractor shall encase a pipeline, or a section thereof, in polyethylene tubing in accordance with specifications for the polyethylene sleeving, as set out below: -

- manufactured from non-regenerated linear low density polyethylene with a polymer density of 195-930 Kg/m<sup>3</sup> to AS 2518.
- nominal film thickness not less than 200 microns.

PROPERTY	SPECIFICATION	RELEVANT STANDARD
Direct Impact Residence - 100% Pass		
a. On body of film	Not less than 435 grams	AS 2518
b. On fold	Not less than 350 grams	AS 2518
Co-efficient of Friction	0.4 minimum	AS 2518
Puncture Energy	85 J/mm thickness	UCAL-TC-5it (or equivalent puncture resistance)
Tensile Strength	MD & TD <sup>2</sup> , 30 MPa	ASIM-D-882
Tear Resistance	MD 100 N/MM, td 150 N/mm	ASIM-D-1922
Yield Strength	MD & TD, 9.5 MPa	ASIM-D-882
Elongation at Break	MD 700%, TD 750%	ASIM-D-882

NOTE: AS 2518 - High impact grade resistant film, non-transparent type. Drop weight 14.5% heavier than specified.

MD = Machine Direction

TD = Transverse Direction

This method of protecting the pipeline by film shall be in accordance with the manufacturer's recommendations or as may be approved in writing by the Superintendent.

Minimum lap of adjoining sheets shall be 300mm.

Installation shall be to the manufacturer's recommendations.

#### 2.16 APPROVED BEDDING AND SURROUND

"Approved Metal Bedding and Surround" material shall be of crushed metal complying with the following grading: -

AS Sieve Size	Percentage Passing by Mass for Each Nominal Size				
(mm)	16mm	14mm	10mm	7mm	5mm
19.00	100	100			
16.00	85-100				
13.20	0-60	85-100	100		
9.50	0-15	0-30	85-100	100	
6.70		0-5	0-30	85-100	100
4.75			0-8	0-30	85-100
2.36	0-0.5	0-0.5	0-1.0	0-10	0-30
1.18				0-5	0-5

"Approved Heavy Metal Bedding" shall be of crushed metal complying with the following grading: -

"Approved Sand Bedding" for use with Ductile Iron Pipes shall be of clean sharp sand complying with the following grading: -

- Amount passing 4.75mm sieve 100%
- Amount passing 2.40mm sieve 80-100%
- Amount passing 1.20mm sieve 20-80%
- Amount passing 600 m sieve 0-20%

A sample of the bedding and surround materials shall be submitted to the Superintendent for approval prior to construction commencing.

## **2.17 IMPORTED FILL AND BACKFILL**

Imported fill and backfill material shall be defined as any material brought from outside the contract area, such as from a quarry or other outside source, for the purpose of filling or backfilling. A sample of these materials shall be submitted to the Superintendent for approval prior to importation, if/as required.

Imported backfill material, unless otherwise approved by the Superintendent, will have a soaked CBR value of not less than 10% and shall be compacted to 100% (under pavements) and 95% (under footpaths, parks and allotments) of the maximum dry density as determined by Test E1.1 of AS 1289 (Standard Compaction).

## **3 CONSTRUCTION**

### **3.1 ACCREDITATION OF PIPE LAYERS**

Where the pipe manufacturer has a formal quality assurance program in place for the laying of their pipes and associated materials, only personnel, who have been accredited to that program, may supervise on behalf of the Contractor, any pipework to be laid.

### **3.2 SETTING OUT OF THE WORK**

Sufficient reference pegs and benchmarks to enable the Contractor to correctly set out the works will be established by the Principal. The Contractor will be responsible for the maintenance of all reference pegs and bench-marks during the course of this Contract.

All levels shown on the Drawings referring to existing levels and/or finished levels relate to Australian Height Datum - AHD.

The Contractor shall employ a competent surveyor, experienced in this class of work, to ensure that batters and their alignments and all levels are developing in accordance with the drawings and this Specification as the work proceeds. The Contractor shall ensure that the surveyor has adequate assistance to constantly maintain dimensional and level control of the work.

### 3.3 COMMENCEMENT AND EXTENT OF EXCAVATION

The Contractor shall obtain the written consent of the Superintendent before commencing the work of excavating the trenches in each section of pipeline, and shall not at any time during the progress of the work have a length of trench opened up in advance of the pipe laying greater than can be laid in one working day or which, in the opinion of the Superintendent, may be advisable or necessary.

If, in the opinion of the Superintendent, the length of trench opened up in advance of pipe laying is greater than is advisable or necessary, the Contractor shall immediately refill such length of trench as instructed by the Superintendent in writing and all costs associated with such refilling and subsequent re-excavating shall be borne by the Contractor.

If, in the opinion of the Superintendent, contingencies such as heavy rain may detrimentally effect the pipe line, other utilities or adjoining roads or footpaths, the Contractor shall immediately refill such trench, as instructed by the Superintendent in writing, and all costs associated with such refilling and subsequent re-excavating shall be borne by the Contractor.

In the event of the Contractor failing to comply with any written instruction of the Superintendent to refill a length of trench within one working day of the issue of that instruction, the Superintendent reserves the right to direct others to carry out such refilling as considered necessary and deduct any costs incurred from any moneys due, or to become due to the Contractor.

### 3.4 EXCAVATION

**"Excavation"** shall mean and shall include removal of soil, sand, clay, all growth, timber, igneous, metamorphic and sedimentary rock, concrete, made ground and any other obstruction, material, matter and substance which require excavating.

The tendered rate that includes trench excavation for water mains is deemed to include excavation in all materials. No additional payment shall be due to the contractor for excavation in rock unless an item has been included in the Bill of Quantities for this work.

**"Rock"** shall be defined as hard rock geologically in place which, in the opinion of the Superintendent, requires the use of explosives and pneumatic drills or breakers for its removal, and shall include any boulders of equal hardness exceeding 0.5 cubic metre in volume and any mass concrete exceeding 0.5 cubic metre in volume within the specified limits of the excavation, provided that, in the event of disagreement with any decisions made by the Superintendent in accordance with the above definition, rock shall be defined as material geologically in place of hardness, when first exposed, of three or greater in the scale of mineral hardness.

NOTE: "Pneumatic drills or breakers" does not include pneumatic spades.

**"Other than rock"** shall be defined as all strata irrespective of its appearance or its common description not included under the classification of rock.

Should any dispute or difference arise with regard to the proper classification of excavation under the above heading, the decision of the Superintendent as to the heading under which such excavation shall be classified shall be final and binding upon the Contractor and the Principal.

Excavation shall not be commenced on any portion of the contract until, in the opinion of the Superintendent, sufficient materials are on site, together with the necessary appliances and plant to ensure the uninterrupted progress and continuance of the works after they have been commenced.

Excavation shall be made to the lines, grades and forms shown on the drawings or given by the

Superintendent. Where excavation is carried out in asphaltic concrete sealed pavements, the asphaltic concrete at the limits of the excavation shall be cut prior to excavation with saws or other approved tools to near straight lines to facilitate restoration of the pavement as close as possible to its original state.

Where excavation is carried out through grassed areas, the Contractor, where directed by the Superintendent, will take up and stockpile for later relaying the turf within the disturbed area.

All trenches shall have vertical sides, except that the Superintendent may approve of open-cut trenches in which the sides, above a level of 300mm over the top of the pipe, are battered from the vertical. Such approval by the Superintendent will not be given except for shallow trenches clear of structures and improvements and such approval shall in no way relieve the Contractor of his responsibilities under the requirement of the Workplace Health and Safety Act.

If trenches are sheeted, the clear width between the inside faces of the vertical sheeting shall equal the width given in the appropriate columns in the standard drawings.

Trenches shall not be excavated wider than the standard widths shown in the standard drawings, except with the written approval of the Superintendent who will take into account the depth of trench, class of pipe and type of backfilling material. If the Contractor excavates the trench wider than the approved width (due to collapse of the trench wall or for any other reason), then the Contractor shall, where ordered by the Superintendent, provide stronger pipes and/or more effective bedding and consolidation without extra payment.

### **3.5 EXPLOSIVES**

Where approved, hard rock may be removed by blasting procedures. As a pre-requisite of blasting operations, the Contractor must obtain a blasting permit issued by Council under the relevant By-Law. It is essential that extreme care be taken during any blasting operations not to damage foundation rock or adjacent structures. The depth, spacing, location and type of explosive used, and the method of firing shall all be planned to avoid such damage and shall be to the approval of the Superintendent. In general, spacing of holes containing explosives shall not exceed 750mm; the depth of any hole to be loaded with explosive shall not exceed two-thirds the depth to the foundation level to which excavation is intended to proceed.

All blasting operation shall be carried out strictly in accordance with the requirements of AS 2187 "SAA Explosive Code" Part1, "Storage and Land Transport" and Part 2 "Use of Explosives", or the current editions thereof. The Contractor shall take all safety precautions specified therein and such other precautions as the Superintendent may require. The Contractor shall display at the site a copy of the Acts and Regulations governing the use of explosives.

The Superintendent may require that heavy blasting mats be used to protect persons, the works and services. The Superintendent may limit the size of explosive charges, and the number of explosive charges detonated, to prevent damage to existing structures.

The Superintendent may request the Contractor to provide a vibrograph measurement of the vibration of rock outside the limits of excavation. The Contractor shall provide the necessary labour and materials and pay all costs associated with recording such measurement.

The use of explosives may be prohibited or restricted by the Superintendent at such times and at such places as he considers that their use would be dangerous or cause unreasonable nuisance. The use of electric detonators will not be permitted where it cannot be proved by the Contractor that radio transmitters are not in such proximity to the site as to constitute a danger of accidental detonation.

In regard to the abovementioned operations in the use of explosives, the Contractor shall be held responsible for any injury or damage to life and property, and he shall take every precaution and carry on such operation at his own risk. The cost of any repairs to buildings, telegraph, telephone, gas mains and power lines and/or other private or public property, rendered necessary by the Contractor's operations, shall be deducted from monies due, or to become due, to the Contractor.

### **3.6 BEDDING CONSTRUCTION TYPES**

The standard construction types shall be as detailed on the project drawings, or referenced standard drawings. It is to be clearly understood that the actual bedding and construction type shall be as ordered by the Superintendent following consideration of actual conditions in the trench.

Excavated material from trenches shall not be used as bedding material unless authorised by the Superintendent.

Sand bedding material is only considered acceptable as bedding material when ductile iron pipes are used and mandatory polyethylene wrapping prohibits the use of metal bedding.

"Approved Metal Bedding", if required and approved by the Superintendent shall be crushed metal complying with the grading specified in Clause 21.1 and shall be considered as an alternative to the normal bedding requirements as previously stated when ductile iron pipes are used.

### **3.7 LAYING AND JOINTING OF PIPES**

All water main pipe laying shall be carried out by competent pipe-layers under the supervision of accredited personnel. All personnel are to be approved by the Superintendent before works are commenced. If, in the opinion of the Superintendent, pipe-layers are performing unsatisfactory workmanship, they shall be removed from the project.

All pipelines shall be constructed of pipes of types and sizes as shown on the drawings, or as directed by the Superintendent.

Pipes shall be sorted and matched prior to laying and shall be laid so that the inverts are continuous and true to line and grade with no part of the pipeline more than 6mm from its true position with respect to line. Spigots and sockets shall be cleaned and the interior of pipes shall be free from obstructions or any contamination.

Water shall not be allowed to lie in the trenches while the pipes are being laid and the trench shall be kept free from all water until after the completed pipeline has been inspected and backfilling has commenced.

Except as provided elsewhere in this Specification, all joints shall be approved flexible joints, incorporating synthetic or natural rubber rings. In jointing pipes with rubber ring joints, the pipes shall be cleaned before jointing and care shall be taken that the rubber ring is maintained in a plane at right angles to the axis of the pipe.

Where shown on the project drawings, bends shall be used to effect horizontal or vertical changes of direction. Where bends are not shown on the project drawings, and with the permission of the Superintendent, changes of direction may be effected by angling the joints, by means of short lengths of pipes, or by means of cutting pipes and using thimbles or collars to join them. All such changes of direction shall be effected in curves of uniform radius. No joint shall be angled to such an extent as to impair its effectiveness or tightness. The pipe shall be truly in line for jointing then deflected.

The maximum deflection for any type of pipe approved for use shall not, under any circumstances, exceed the recommendation of the Manufacturer.

### **3.8 BACKFILLING**

For the purpose of this specification, backfilling material shall consist of all material used in the trench above the bedding and surround material.

The Contractor shall ensure that no trench is left unattended unless adequate barriers, fences and night-lights as may be necessary, in the opinion of the Superintendent, are provided to protect the general public, land and property. Notwithstanding these requirements, the Contractor shall accept full responsibility for any accident arising from the neglect of any necessary precautions.

As soon as practicable after inspection and approval of beddings and surround, the remainder of the trench shall be backfilled.

Except under roadways or where ordered by the Superintendent, material excavated from the trench shall be used for backfilling, provided it is free from rocks larger than 150mm diameter and from lumps which may prevent adequate consolidation.

Where ordered by the Superintendent and, except where otherwise specified, imported backfilling material shall satisfy the requirements of Clause 22.2 of this Specification.

The backfilling shall be placed by approved methods, which will ensure the required compaction without damage to the pipes.

All backfilling shall be compacted as specified in layers not greater than 150mm.

Where approved by the Superintendent, flooding of the backfill may be used to achieve the required compaction. In such event, the backfilling shall be flooded with water after filling has been brought to within 300mm of the surface. After filling is consolidated and has dried out the additional filling shall be completed.

Backfilling of trenches across existing sealed pavements of roads shall be placed as shown on the project drawings or referenced standard drawings. The installation of required road pavement gravel materials shall finish flush with the existing surface with any re-excavation as or if required below the existing sealed pavement to facilitate the future placement of required surfacing materials.

Excavated material not required for backfilling remains the property of the Principal who reserves the right to direct its disposal off site to a place or places within 5km of the site works. Alternatively, the Superintendent may direct the Contractor to dispose of such material at a location of the Contractor's choosing and at their expense.

### **3.9 FITTINGS**

The laying and jointing of mains shall include the fixing in position of all valves, risers and all other fittings, including the supply and installation of concrete or brick supports, bedding and cast iron cover boxes and surrounds as specified.

The distance marked on the project drawings and the positions indicated thereon of pipes, valves and other fittings may be adjusted at the discretion of the Superintendent. If necessary, pipes shall be cut in order to secure the fixing of valves and other fittings in the correct position indicated, and no additional payment shall be made for such cutting.

All valves and fittings shall be carefully placed in position so as to be plumb and the correct distance from the surface. Risers shall be installed where necessary at air valves and fittings and, if required, trenches shall be deepened and graded in the vicinity in order to achieve the correct depth below the surface.

Except where the project drawings show that concrete pits are required, cast iron cover boxes shall be fixed over all valves.

Precast Concrete Surrounds or approved alternative surrounds shall be fixed around valve cover boxes.

At valves, the bedding depth shall be increased locally to provide support to the brickwork or concrete surround on which the valve box is founded so as to minimise the transference of weight or shock to the pipe.

### **3.10 THRUST BLOCKS**

Thrust blocks of adequate size shall be provided at all points along the reticulation system where thrust will develop, i.e bends, tees, valves, dead ends, etc. Reference should be made to the referenced standard drawings or Local Authority Standards for minimum sizes of thrust blocks.

### **3.11 AIR VALVES**

Air valves shall be of a type and size approved by the Superintendent and local Authority, to suite the particular location and application.

Air valves shall be installed as shown on the project drawings unless otherwise directed by the Superintendent.

### **3.12 MARKINGS FOR VALVES**

Where kerb and channel forms part of the road construction, it shall be marked by the Contractor to identify the location of valves and other associated installations. These markings shall be positioned directly opposite the fitting.

Where kerb and channel does not form part of the road, construction marker posts shall be installed by the Contractor to identify the location of valves and other associated installations. These marker posts shall be positioned against the front boundary of the property directly opposite the fitting. The marker plates must be of reflectorised aluminum, manufactured and supplied by an approved supplier. The type and markings are to comply with the requirements of State and Local authorities.

### **3.13 CONNECTIONS TO EXISTING RAW WATER MAIN**

All connections to the existing raw water main system shall be made by the Contractor under the supervision of Council and no person, other than authorised Council employees, shall operate any existing valve or draw water from any existing main without the written authority of the Superintendent.

It is the Contractors responsibility to organize and pay all necessary fees for the connection to existing mains.

## **4 INSPECTION AND TESTING**

### **4.1 GENERAL**

Unless covered by a separate item in the Bill of Quantities, payment for all works described under the Inspection and testing section of this specification shall be deemed to be included in the Contractor's respective tendered scheduled rate and/or lump sum amounts.

The Contractor is advised that Council's Inspector may witness all phases of construction and testing under this contract. All tests not attended by the Council's Inspector must be certified by the Superintendent.

Before backfilling, all water mains shall be inspected and passed by the Superintendent.

Structure bases shall not be poured until the excavations for same are inspected and passed by the Superintendent.

Before requesting an inspection of any pipeline or structure, the Contractor shall ensure that the pipeline or structure has been cleaned and is free from mud, sand and foreign matter and, in particular, that the pipes present a relatively clean bore. The Contractor shall also satisfy themselves that the pipeline or structure has been constructed in accordance with the contract.

### **4.2 INSPECTION AND TESTING OF WATER MAINS**

#### **4.2.1 Pre-Construction Inspection**

At least 48 hours prior to commencement of construction of any water main, the Contractor shall arrange with the Superintendent for a joint pre-construction inspection. Where considered necessary by the Superintendent, a test hole shall be dug by the Contractor, to determine the ground conditions. At this inspection, anticipated bedding and backfill types will be established.

These may be altered during construction, if ground conditions vary from those encountered in the test hole. Further, the Contractor shall, at this meeting, nominate his proposed order of works, method of construction and restoration program.

#### 4.2.2 Excavation Inspection

During the excavation of trenches for water mains, the type of bedding and backfill is to be confirmed by the Superintendent.

#### 4.2.3 Pipe-Laying Inspection

Once the water main has been laid and bedded, it shall be checked for alignment, bedding used, concrete surround etc, by the Superintendent and confirmed prior to backfilling.

#### 4.2.4 Hydraulic Pressure Testing

Pressure testing shall be undertaken as soon as possible after the Contractor provides evidence that the concrete thrust blocks have developed their design strength. The Contractor shall confirm the length of the test section as appropriate at each location or site.

Due to the nature of the cut-in works at particular locations and the need to have the raw water main back in operation as soon as possible, certain pipe sections and fittings may not be practical to pressure test after installation (or prior to cut-over). In these instances, the Contractor shall confirm the Superintendent an acceptable alternative arrangement.

The temperature of the piping material shall not exceed 40 degrees celsius during any test period. All tests shall be carried out under the supervision and in the presence of the Superintendent.

The sections of new mains, prior to testing, shall be initially filled with water.

The test head for water mains shall be 1,200 KPa.

Testing shall be carried out when sufficient material has been backfilled over the centre of each pipe to prevent movement but all joints exposed. The test pressure shall be maintained for one (1) hour minimum without any drop in the gauge reading and during this period the whole line shall be inspected for leakage or movement. Any defects shall be repaired and the main re-tested until the gauge pressure remains steady for one (1) hour minimum.

The tests shall be carried out by the Contractor at his own risk and expense, and he shall provide all the labour together with all pumps, engines, pipes, temporary valves, plugs or flanges as may be necessary.

Such plant shall remain the property of the Contractor and he shall make no charge for the use, installing and dismantling thereof. All tests shall be carried out under the supervision and in the presence of the Superintendent.

The length of main or mains under hydraulic pressure test shall be deemed to have passed the test provided there is no failure of any thrust block, anchor block, pipe, fitting valve, joint or any other pipeline component and there is no visible leakage.

Notwithstanding tests taken, the Superintendent may direct, at his own discretion that sections be re-opened for examination and if, after opening, any defects are disclosed, the Contractor shall repair same at his own expense.

Should the various works not be sufficiently completed to enable the pipelines and other work to be filled as soon as ready for testing, the time for testing will be postponed until such is the case, or should the Contractor prefer to adopt other measures for supplying water, he may do so.

The Contractor shall have no claim for compensation or damage in respect of any such postponement of the testing as hereinbefore provided or in respect of the retention of the final payment until the completion of the tests.

All expense in connection with testing and repairing and replacing defective work, including the supply of water, shall be met by the Contractor.

#### **4.3 REPLACEMENT OF DAMAGED PIPES, FITTINGS, OTHER ARTICLES**

Any pipe, valve or other fitting or article which, during the currency of the Contract, whether during the testing or prior thereto, or thereafter during the maintenance period, bursts, cracks or becomes damaged so as to render it unfit for service, shall be removed and repaired or replaced as directed by the Superintendent. Should such failure be attributable to the negligence of the Contractor, the costs of replacement and subsequent re-test shall be met by the Contractor.