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# DRAINAGE PIPES AND ASSOCIATED WORKS - GRAVITY SYSTEMS

## PROJECT SPECIFICATION

MP-06-DES-SP Drainage pipes and associated works – Gravity systems specifications

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# 1 Drainage pipes and associated works – Gravity systems

## 1.1 Scope

This section details the requirements for drainage pipes and associated works for gravity systems, the extent of which is shown on the Drawings. Requirements for cable ducting are not included in this specification.

Requirements for trenching, bedding and backfilling of pipes as well as for cable ducts are given in the specification for Trenching, bedding and backfilling for underground services.

## 1.2 Compliance

Construction work performed under this Section shall comply with the general requirements of the following documents and the specific requirements of this Section:

- AS 1074 - Steel tubes and tubular for ordinary service
- AS 1110 - ISO metric bolts and screws – Products A and B
- AS 1463 - Polyethylene pipe extrusion compounds
- AS 1646 - Elastomeric seals for waterworks purposes
- AS 1741 - Vitrified clay pipes and fittings with flexible joints - Sewer quality
- AS 2032 - Installation of uPVC Pipe Systems
- AS 2129 - Flanges for pipes, valves and fittings
- AS 3996 - Access covers and grates
- AS 4087 - Metallic flanges for waterworks purposes
- AS/NZS 1254 - PVC pipes and fittings for stormwater and surface water applications
- AS/NZS 1260 - PVC-U pipes and fittings for drain, waste and vent application
- AS/NZS 1477 - PVC pipes and fittings for pressure applications
- AS/NZS 1579 - Arc Welded Steel Pipes and Fittings for Water and Waste Pipes
- AS/NZS 2033 - Installation of polyethylene pipe systems
- AS/NZS 2280 - Ductile Iron Pressure Pipes and Fittings
- AS/NZS 2566 - Buried flexible pipelines
- AS/NZS 2638.2 - Gate valves for waterworks purposes – Resilient-seated
- AS/NZS 3725 - Design for installation of buried concrete pipes
- AS/NZS 4058 - Precast concrete pipes (pressure and non-pressure)
- AS/NZS 4129 - Fittings for polyethylene (PE) pipes for pressure applications
- AS/NZS 4130 - Polyethylene pipes for pressure applications
- AS/NZS 4131 - Polyethylene (PE) compounds for pressure pipes and fittings
- AS/NZS 4331.1 - Metallic flanges Part 1: Steel flanges
- AS/NZS 4331.2 - Metallic flanges Part 2: Cast iron flanges

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AS/NZS 4680	-	Hot dip galvanized (zinc) coatings on fabricated ferrous articles
BS 1387	-	Specification for screwed and socketed steel tubes and tubulars and for plain end steel tubes suitable for welding or for screwing to BS 21 pipe threads
BS 4504	-	Circular flanges for pipes valves & fittings
BS 5154	-	Copper alloy globe, globe stop and check, check and gate valves
BSI BS 2633	-	Class I Arc Welding of Ferritic Steel Pipework for Carrying Fluids
BS 5163	-	Valves for waterworks purposes
BS EN 1561	-	Founding. Grey cast irons
BS EN 295	-	Vitrified clay pipes and fittings and pipe joints for drains and sewers
EN-GJL-150	-	Grade of grey cast iron
NZS 3109	-	Concrete Construction
NZS 3114	-	Specification for concrete surface finishes
NZS 3302	-	Specification for ceramic pipes, fittings and joints
NZS 4442	-	Welded steel pipes and fittings for water, sewage and medium pressure gas
NZS 4452	-	Code of practice for the construction of underground pipe sewers and drains
NZS 7604	-	Specification for high density polyethylene drain and sewer pipe and fittings
NZS 7643	-	Code of practice for the installation of unplasticised pvc pipe systems
SNZ NZS/BS 2494	-	Elastomeric seals for Joints in Pipework and Pipelines
	-	Local Authority Standards

### 1.3 Materials

#### 1.3.1 General

Materials shall be stored, handled, and distributed on Site with care to avoid damage and in accordance with the manufacturer's recommendations. All materials to be used in the works shall be in new condition.

#### 1.3.2 Concrete pipes

Concrete drainage pipes shall be manufactured in accordance with the requirements of AS/NZS 4058 and shall be installed in accordance with AS/NZS 3725. The pipe sizes and strength classes shall be as shown on the Drawings.

#### 1.3.3 Ceramic pipes and fittings

Ceramic pipes and fittings shall be rubber ring jointed the drawings and comply with NZS 3302. The pipe sizes and strength classes shall be as shown on the Drawings.

#### 1.3.4 PE pipes and fittings

PE pipes and fittings shall comply with AS/NZS 4129 and AS/NZS 4130 and shall be manufactured from PE 80B or PE 100 compound as shown on the Drawings. Pipe pressure or SDR ratings shall be as shown on the Drawings.

PE pipes and fittings greater than 100 mm diameter shall be joined by fusion butt welding, electrofusion couplings or flanged connections unless otherwise specified or shown on the drawings.

Pipes and fittings 100 mm diameter or less may be joined with mechanical fittings approved by the Engineer.

Fittings shall have a wall thickness not less than the pipe wall thickness. Fittings with a thicker wall require the approval of the Engineer.

Bend and junction dimensions shall comply with the pipe manufacturer's requirements. All PE pipes and fittings shall be UV protected for above ground installations.

### 1.3.5 uPVC pipes and fittings

uPVC pipes and fittings shall comply with AS/NZS 1260. The pipe sizes and strength classes shall be as shown on the Drawings.

### 1.3.6 Steel pipes and fittings

#### a) Pipes less than 100mm diameter

Steel pipes less than 100 mm diameter shall be galvanised pipes complying with AS 1074 and BS 1387 and shall be of class and joint type shown on the Drawings.

Pipes and fittings shall be corrosion protected by being hot dip galvanized in accordance with AS/NZS 4680.

#### b) Pipes 100mm diameter and greater

Steel pipes and fittings 100 mm diameter and greater shall comply with NZS 4442 and shall be of wall thickness shown on the Drawings.

Pipe joints shall comprise hemispheric slip-in welded joints, be flanged or comprise joints with flexible couplings inserted over pipe plain ends. Screwed joints requiring threading of the pipe ends will not be permitted.

Pipes and fittings shall be corrosion protected as follows and as shown on the Drawings:

Internal protection: Cement or mortar lined complying with NZS 4442 and NZS 3114. Alternatively a fusion bonded epoxy system approved by the pipe manufacturer and by the Engineer shall be used.

External protection: PE tape wrapping system approved by the pipe manufacturer including sand blasting, application of a primer coat, application of a low density PE layer with adhesive backing, and the application of a mechanical wrap of high density PE with adhesive backing. Alternatively an epoxy system approved by the pipe manufacturer shall be used with a minimum dry film thickness of 200 micron. A bitumen protection system approved by the pipe manufacturer and by the Engineer may also be used in some circumstances.

### 1.3.7 Elastomeric rings

Elastomeric rings for pipe joints shall be manufactured in accordance with NZS /BS 2494. Rings shall be stored away from direct sunlight and shall be kept free of grease, oil, paint and other substances deleterious to rubber. Rings showing any signs of damage or fault shall be removed from the Site and replaced at the Contractor's expense.

### 1.3.8 Flanges

Flanges for pipework and valves shall comply with and be drilled to AS 4087, Figure B5 (PN 10).

The flanges shall be provided complete with approved gaskets, bolts, nuts and washers.

### 1.3.9 Gate valves

Gate valves 80 mm diameter and greater shall comply with AS/NZS 2638.2 and BS 5163 and shall be of pressure class shown on the Drawings. The valves shall be flanged, resilient-seated valves with non-rising spindles and cap tops or handwheels as indicated on the Drawings, unless otherwise stated. The valves shall be anti-clockwise closing.

Gate valves 50 mm diameter and smaller shall comply with BS 5154 and shall have BSP threaded ends and a handwheel. The valves shall be of pressure class shown on the Drawings and shall be clockwise closing.

The gate valves shall be protected externally with fusion bonded epoxy or nylon coating complying with the manufacturer's recommendations.

The use of so-called "light pattern valves" which do not conform with this Specification will not be permitted.

### 1.3.10 Fittings

Fittings shall be to the standards specified on the Drawings in this Specification. Cast iron fittings and specials shall be manufactured from high quality grey iron and coated with a proven bituminous compound. When no standard is specified on the Drawings, fittings shall be to the Local Authority standards. All bends and fittings shall be suitable for jointing with gibault and rubber ring joints unless otherwise indicated on the Drawings.

Fittings such as gibault joints, tapping straps and saddles not covered by standard specifications shall be approved types. Bolts used in these fittings shall be hot dip galvanised to AS 1650 after threading. Nuts shall be tapped after galvanising up to 0.4 mm oversize to enable them to mate with the bolts and the threads shall be oiled. The bolts shall be liberally coated with an approved anti-seize lubricant prior to assembly. Following assembly of the unit the nut and exposed thread on the end of the bolt shall be securely wrapped with at least two layers of Denso tape to form an impermeable cover.

Grade 316 stainless steel bolts and nuts can be used as an alternative to galvanized fasteners unless stated otherwise on the Drawings or by the Engineer. Neoprene washers shall be used to prevent the nuts and bolts making contact with other metals.

## 1.4 Manholes

### 1.4.1 General

Manhole risers shall comply with AS/NZS 4058.

The manholes shall be as shown on standard Drawing No. DR01 of the WCC Regional Standards unless shown otherwise on the Drawings. The manholes shall have precast flanged bases. Manhole sizes and depths shall be as shown on the Drawings. Access entry into the manholes shall be 600 mm diameter.

- i. Manholes shall be haunched to the top of the pipe soffit.

- ii. Pre-fabricated benching and haunching may be permitted at the discretion of the Council. The manholes shall be watertight.

### 1.4.2 Manhole system

For manholes with inverts less than 5.0 m deep and less than 2.0 m below the preconstruction groundwater level, the manhole system shall comprise a “conventional” system with flush jointed manhole risers as supplied by Humes Pipeline Systems and Hynds Ltd.

For manholes with inverts greater than 5.0 m deep and/or greater than 2.0 m below preconstruction groundwater level, a thicker walled, more rigorously sealed manhole system shall be used as the Hynds Hyseal sealed manhole system or equivalent approved.

### 1.4.3 Loadings

The manhole structure shall be suitable for the lateral and vertical loadings imposed on the manhole. The structural integrity of the manhole shall be maintained at pipe connections into the manhole.

- Covers, lids, risers and manhole installations shall be designed to withstand HN-HO-72 loadings
- Manhole lids in trafficked areas, or where there is the potential for vehicle loadings, shall be a minimum of 150mm thick.

### 1.4.4 Covers and frames

Castings shall be made either from grey iron of a quality not less than that specified as grade EN-GJL-150 in BS EN 1561 or from ductile iron and shall be free from all defects. Castings shall be hot dipped in bitumen. Covers shall not rock in their frames.

- The covers and frames shall, in addition to withstanding HN-HO-72 loadings, comply with Class D loadings of AS 3996.

Manhole cover frames shall be haunched with 30 MPa concrete and either plastered or trowelled off to a smooth surface. All manhole covers shall be set flush with and have the same cross-fall as the finished surfaces of the road, footway or ground. In sloping ground, the manhole access and cover shall be on the lower side, unless detailed otherwise.

### 1.4.5 Manhole foundation

The manhole structure shall be constructed or placed on a levelling course placed on top of the subgrade material.

The suitability of the subgrade material shall be confirmed by the Engineer. Where the material is not suitable for the manhole foundation, the Contractor shall upon receipt of an order from the Engineer over-excavate the material as necessary and backfill with an approved compacted granular bedding material.

### 1.4.6 Pipe connections

At pipe connections to manholes, two flexible joints shall be provided in the pipe at a distance not greater than one metre from the wall of the manhole, unless detailed otherwise on the Drawings or Local Authority standards.



### 1.4.7 Manhole rungs

- Manhole rungs are required for all manholes greater than 1 m in depth. They shall be suitable protected from corrosion (typically hot dip galvanised for stormwater or Council specified grade of stainless steel for wastewater) and be ‘dropper’ or safety type that do not allow the foot to slip sideways off the rung.
- The first rung shall be within 675 mm of the lid and the rungs shall be aligned below the manhole entry.
- The manhole entry (and rungs) shall be arranged such that the offset entry hole is above the outlet pipe.

The levelling course shall comprise a 100 mm minimum layer of compacted approved AP20 granular material.

### 1.4.8 Testing

The Engineer may require a watertightness test to be carried out at manholes.

The watertightness test shall be carried out after pre-soaking the manhole filled with water for one hour. The watertightness test shall comprise the filling of the manhole to its lid level after plugging manhole pipe connections and checking the water volume drop in the manhole for a period of one hour. The manhole shall be considered watertight if the drop does not exceed 0.2 litre per square metre of internal cross-section area per metre depth of the manhole.

## 1.5 Catchpits

### 1.5.1 General

Catchpits including surface componentry shall be constructed in accordance with the Drawings and the standards and drawings of the relevant Local Authority.

The catchpits shall be watertight from the ground surface to the bottom of the catchpit.

Precast manufactured catchpits shall comply with NZS 3109. Surface finishes shall comply with NZS 3114 and shall be F4 and U2 for formed and trowelled surfaces respectively.

At pipe connections to catchpits, two flexible joints shall be provided in the pipe at a distance not greater than one metre from the wall of the catchpit, unless detailed otherwise on the Drawings or Local Authority standards.

Unless otherwise specified or shown on the Drawings and Local Authority standards, the invert of the catchpit lead outlet shall be 450 mm minimum above the invert of the catchpit.

- Sump leads shall have a flexible connection within 300 mm of the sump. Standard single sumps shall be serviced by a 225 mm nominal diameter lead, and double sumps shall be serviced by a single 300 mm nominal diameter lead.

### 1.5.2 Catchpit foundation

The catchpit shall be constructed or placed on a levelling course placed on top of the subgrade material.

The suitability of the subgrade material shall be confirmed by the Engineer. Where the material is not suitable for the catchpit foundation, the Contractor shall upon receipt of an order from the Engineer over-excavate the material as necessary and backfill with an approved compacted granular bedding material.

The levelling course shall comprise a 100 mm minimum layer of compacted approved AP20 granular material.

### 1.5.3 Structural strength

The catchpit structure shall be suitable for the lateral and vertical loadings imposed on the catchpit. The structural integrity of the catchpit shall be maintained at pipe connections into the catchpit.

### 1.5.4 Testing

The Engineer may require a watertightness test to be carried out at catchpits.

The watertightness test shall be carried out after pre-soaking the catchpit filled with water for one hour. The watertightness test shall comprise the filling of the catchpit to its lid level after bunging catchpit pipe connections and checking the water volume drop in the catchpit for a period of one hour. The catchpit shall be considered watertight if the drop does not exceed 0.2 litre per square metre of internal cross-section area of the catchpit.

## 1.6 Construction

### 1.6.1 Setting out

The Contractor shall provide all equipment necessary to accurately set out pipelines in both the horizontal and vertical planes. The methods that are proposed to be used shall be submitted to the Engineer for approval prior to the commencement of the works.

### 1.6.2 Transport, handling and storage of materials

The Contractor shall be responsible for the transport (unless noted otherwise), handling, storage and security of all pipe and fittings which shall be handled and stacked strictly in accordance with the manufacturer's recommendations. uPVC pipe shall be handled and stored strictly in accordance with the requirements of NZS 7643.

Materials will be inspected by the Engineer at his discretion upon delivery to Site or as soon thereafter as practicable. The Contractor shall provide every assistance, including lifting and rotating pipes, to enable these inspections to be undertaken efficiently.

Damaged or unsatisfactory materials noted at that time will be marked and the Contractor shall either replace the item or if the Engineer permits, repair the defect in an approved manner. The costs of repair or replacement of damaged, unsatisfactory or repaired materials used or unused in the works shall be borne by the Contractor, whether the Engineer has inspected and approved the materials or not.

### 1.7 Pipe laying and jointing

#### 1.7.1 General

Pipes and fittings shall be thoroughly cleaned before lowering into the trench, and shall be kept clean throughout the jointing and testing procedures. Whenever work is discontinued or whenever there is any likelihood of entry of foreign matter, the open ends of the laid pipes shall be closed with suitable caps. If the excavations are likely to be flooded by stormwater, these end caps shall be watertight and effective precautions taken to prevent the pipeline from floating.

The jointing and laying of all pipes shall be carried out strictly in accordance with the manufacturer's written instructions.

Notwithstanding any tolerance given in this Section pipes shall be laid so that deviations at joints do not exceed 66% of the manufacturer's recommended maximum deviations.

All pipes and fittings shall be thoroughly cleaned before placing, and all scale, burrs, sand, slag and other obstructions shall be removed. All open ends of pipework shall be properly sealed by a metal or plastic cap at the end of each day's work or at the end of each section of work. The Contractor shall be liable for costs due to any damage caused by debris in pipes.

#### 1.7.2 Concrete pipe laying

Concrete pipes shall be laid with their collars pointing upstream.

#### 1.7.3 PE pipe laying and welding

The Contractor shall note the higher thermal expansion and contraction movements of PE pipe compared with other pipe materials. Pipe joint connections and pipe connections into structures shall be undertaken in accordance with the requirements of the Drawings and other specifications and after pipe thermal movements have been minimised.

Fusion butt welding of PE pipes shall be carried out by an approved certified welder with a recognised New Zealand certificate in accordance with NZS/AS 2033.

Pipes of dissimilar PE compound shall not be welded together. Pipes of dissimilar wall thickness shall not be welded unless otherwise indicated on the Drawings. In this case the Contractor shall chamfer the inside of the thicker walled pipe so the ends of the pipes to be welded have the same thickness. The chamfer shall commence 50 mm in from the end of the pipe.

#### 1.7.4 Steel pipe welding

Site welding of steel pipes shall be done by hand in accordance with the applicable requirements of BSI BS 2633 and shall be carried out by a welder qualified in terms of the approval test given in BSI BS 2633.

The welder shall have a unique number and each joint welded by the welder shall be marked.

All field welds shall be examined by a qualified inspector using an approved dye-penetrant or radiographic test method. A Certificate of Acceptance of each field weld shall be submitted to the Engineer.

### 1.7.5 Gravity lines

Each separate pipe shall be individually set to line and within 10 mm of the invert levels shown on the Drawings provided that the deviation from a string line extending over two pipe lengths shall not exceed 10 mm. Each joint shall be completed before the adjoining pipe is laid.

## 1.8 Pipe testing

### 1.8.1 General

Prior to the commencement of testing the Contractor shall submit for the Engineer's approval details of the Contractor's proposed methods, including details of test equipment and programme for testing and shall arrange for all tests to be witnessed by the Engineer.

The Contractor shall provide all equipment and temporary works necessary for the flushing of all debris from pipelines and to carry out the specified tests.

If any pipeline or manhole fails to meet the specified test acceptance criteria, the Contractor shall locate the faults, perform all necessary remedial work and retest the pipeline or manhole until the acceptance criteria are satisfied. This work shall be performed at no additional cost to the Principal.

### 1.8.2 Testing drainage lines

The drain line shall be checked by means of a mirror and lamp to ensure there are no obstructions in the barrel and to ensure the pipes are laid straight.

Pressure testing of the pipe systems shall be carried out in accordance with subsection 1.5, but it is strongly recommended the Contractor carry out its own intermittent testing during its drainlaying operations to ensure the final test requirements are satisfied. The Contractor shall submit for approval the method and equipment it proposes to use for any such intermittent testing. Care shall be taken when releasing water to avoid damage to the pipes and trench.

Prior to testing, the pipe system shall be completely cleaned out of all silt, rubbish and debris.

### 1.8.3 Testing of drainage pipe system (non PE pipes)

All pipelines, (excluding subsoil drainage lines) shall be filled with water and tested to a minimum head of 1.8 m head at the upstream end (except where this would produce a head in excess of 6 m at the downstream end). The test head shall be maintained for 30 minutes and the make-up water volume measured. The make-up water volume shall not exceed 0.5 litre per hour per linear metre of pipe per metre of internal diameter.

An air test for relatively smaller pipes may be considered by the Engineer if proposed by the Contractor.

### 1.8.4 Testing of drainage pipe system (PE pipes)

Testing of PE non-pressure pipelines shall be undertaken in accordance with the requirements of section 7.3 of AS/NZS 2033, Method 1 – Hydrostatic test, unless otherwise specified or directed by the Engineer.

Where pressure rated pipes are used for drainage purposes, pressure pipe system testing may be required as specified or directed by the Engineer. Such testing shall be undertaken in accordance with the Basic pressure test (Visual) of section 7.2 of AS/NZS 2033 unless otherwise specified or directed by the Engineer.

### 1.8.5 Leaks, cleaning and maintenance

Should any leaks develop in any pipes, catchpits or manholes, such portions shall be taken up and relaid and the cost of any repairs or damage done by breakages or otherwise in so doing shall be borne by the Contractor.

Foreign matter shall not be permitted to enter any existing drainage system.









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