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| AUSTROADS TECHNICAL SPECIFICATION ATS2210    Supply of Steel Reinforced Precast Concrete Pipes | A close up of a flag  Description automatically generated |

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# Scope

This Austroads Technical Specification ATS 2210 sets out the requirements for the supply and delivery of steel reinforced precast concrete pipes used for stormwater / drainage purposes. It excludes:

1. concrete pipes subject to internal pressure;
2. unreinforced concrete pipes; and
3. concrete pipes manufactured by wet cast techniques or not manufactured by a machine.

Further to the provisions of Section 6 of AS/NZS 4058, the required size, load class, environment, joint type and other information for steel reinforced precast concrete pipes must be as shown on the drawings or as specified.

Steel reinforced precast concrete pipes must comply with the requirements of AS/NZS 4058 and as stated in this Specification.

# Definitions

The definitions in AS/NZS 4058 apply to this Specification, and in addition:

**Aggressive environment**An underground or above ground environment which does not meet the requirements of a Normal environment or a Marine environment.

**Design life** The period for which a precast reinforced concrete pipe is required to perform its intended purpose with periodic maintenance and without replacement or major structural repairs.

# Referenced Documents

The following documents are referenced in this Specification:

**Australian / New Zealand Standards**

AS 1012.20.1 Methods of testing concrete Determination of chloride and sulfate in hardened concrete and aggregates - Nitric acid extraction method.

AS 1379 Specification and supply of concrete

AS/NZS 4058 Precast concrete pipes (pressure and non-pressure)

AS/NZS 4671 Steel reinforcing materials

AS/NZ/ISO/ 9001 Quality management systems – Requirements

**Australian Technical Infrastructure Committee**

ATIC SP43 Section SP43 Cementitious Materials for Concrete

**Austroads** (available from:<https://austroads.com.au/publications>)

AGBT T701 Austroads Test Method - Accelerated Mortar Bar Test - Alkali-Silica Reactivity of Aggregate

AGBT T702 Austroads Test Method - Alkali Aggregate Reactivity Assessment - Concrete Prism Test

ATS 5340 Cementitious Patch Repair of Concrete

**ASTM International**

ASTM C295 Standard Guide for Petrographic Examination of Aggregates for Concrete

**British Standards**

BS 6744 Stainless steel bars for the reinforcement of and use in concrete. Requirements and test method

# Quality System Requirements

The precast reinforced concrete pipes must be manufactured under a quality management system independently certified as fully complying with AS/NZS ISO 9001, by a JASANZ accredited organisation. Evidence of the certification must be provided prior to the delivery of the pipes to site.

The Hold Points and Witness Points applicable to this Specification are summarised in Annexure A.

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| **For precast reinforced concrete pipes to be installed in Queensland, the following additional requirements apply:**  Steel reinforced precast concrete pipes must be manufactured only by a Transport and Main Roads (TMR) registered supplier.  All cementitious materials, aggregates, chemical admixtures and reinforcing steel must be TMR registered materials. Further details are available from:  <https://www.tmr.qld.gov.au/business-industry/Business-with-us/Approved-products-and-suppliers> |

# Requirements in Addition to AS/NZS 4058

Further to the requirements specified in AS/NZS 4058, the Contractor must ensure that the manufacturer complies with the following additional requirements.

## **Scope and General**

Precast reinforced concrete pipes must be designed and manufactured to achieve a 100 year Design life when correctly installed in the specified environment.

Where a pipe has been designed and manufactured for an Aggressive environment, the pipe must also be marked “Aggressive”.

## **Materials**

### Verification of Materials Compliance

(Refer AS/NZS 4058 Clause 2.1)

If requested by the Principal, the documentary evidence of the system of control that provides verification that concrete pipe materials comply with AS/NZS 4058 and this Specification must be provided. This includes audit reports, surveillance records and test results.

### Concrete Materials

(Refer AS/NZS 4058 Clause 2.2)

### Concrete Mix Designs

Concrete mix designs used for the manufacture of steel reinforced precast concrete pipes must have been submitted to the Principal and approved by the Principal in the preceding 12 months.

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| **HOLD POINT 1** | |
| Process Held | Supply of precast reinforced concrete pipes. |
| Submission Details | Evidence that the manufacturer has submitted its concrete mix design to the Principal within the preceding 12 months must be provided at least 2 weeks prior to the delivery of the precast reinforced concrete pipes. |

The concrete mix design details must include the following:

1. Nominated range (diameter, load class, and environment) of applicable pipe products
2. Mix identifier
3. Nominated source materials
4. Cementitious material with CMRS registration number(s) in accordance with ATIC SP43
5. Aggregates (with quarry details)
6. Admixtures details and method of use
7. Nominated cementitious blend
8. Statement that the minimum cementitious content and maximum water cement ratio comply with Paragraph 5.7 of this Specification.
9. Water absorption test results (refer AS/NZS 4058 Clause 4.6)
10. Chloride ion content and sulphate ion test results (refer AS/NZS 4058 Clause 2.2.6)

### Cementitious Materials

(Refer AS/NZS 4058 Clause 2.2.1 and 2.2.2)

The minimum cementitious content of the mix must not be less than 330kg/m3 and the water cementitious ratio must not exceed 0.4.

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| **For precast reinforced concrete pipes to be installed in Queensland, the following applies:**  A cementitious blend in accordance with clause 5.11 must be used. |

The cementitious material used in the manufacture of the steel reinforced precast concrete pipes may be up to 100% GP Cement only if:

1. the steel reinforced precast concrete pipes is to be installed in a Normal environment; and
2. the aggregates are is classified as non-reactive when assessed in accordance with the following process:
3. The aggregates are assessed for any unstable silica minerals by petrographic examination in accordance with ASTM Test Method C295.
4. The potential alkali silica reactivity of all coarse and fine aggregates is determined using either AGBT T701 or AGBT T702.

Aggregates classified as slowly reactive or reactive may only be used if a cementitious blend in accordance with Paragraph 5.11 is used.

For a Marine or Aggressive environment, or where a cementitious blend for control of alkali silica reaction is required, the cementitious materials must comply with Table 5.11 with the combined total adding to 100%:

Table 5.11: Cementitious Blends

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Blend No. | GP Cement (%) | Fly Ash (%) | Ground Granulated Blast Furnace Slag (%) | Amorphous Silica (%) |
| 1 | 65 to 80 | 20 to 35 |  |  |
| 2 | 50 to 55 | 25 to 30 | 20 to 25 |  |
| 3 | 60 to 70 | 25 to 30 |  | 5 to 10 |
| 4 | 40 |  | 60 |  |

Type High Early (HE) cement which also satisfies the requirements of Type General Purpose (GP) cement may be substituted for Type GP Cement in any of the blends.

Cementitous materials must:

1. comply with the requirements of ATIC‑SPEC SP43;
2. be registered under the Cementitious Material Registration Scheme (CMRS) in accordance with ATIC‑SPEC SP43; and
3. not be used in the manufacture of pipes if it is more than 3 months old, unless it is re‑tested to demonstrate compliance with this Specification.

The tolerance for batching components must be in accordance with AS 1379 Table 4.1 with a batch size of 2 to 4 m3 regardless of actual batch quantity. However the amount of flyash in any individual batch must not be less than 20% under any circumstances.

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| **For precast reinforced concrete pipes to be installed in Victoria, the following applies:**  Any Geopolymer binder-based precast reinforced concrete pipes must comply with the requirements of AS/NZS 4058 and this specification, except that the concrete used must comply with the technical requirements specified in ATS 5330: Geopolymer Concrete for geopolymer concrete with compressive strengths appropriate to the nominated load class performance requirements. |

### Aggregates

(Refer AS/NZS 4058 Clause 2.2.3)

The water absorption of the aggregate must not exceed 2.5%.

Aggregates must be stored in such a manner that they will not segregate, become contaminated by foreign matter, or become intermixed. Stockpiles must be arranged to prevent entry of adjacent surface or ground water and allow free drainage of rain water.

### Admixtures

(Refer AS/NZS 4058 Clause 2.2.5)

Admixtures must conform to the requirements of AS 1478 and must be used in accordance with AS 1379. The total alkali contribution (measured as Na₂O equivalent) of all admixtures used in a mix must not exceed 0.2 kg/m³.

Admixtures in a single mix must be sourced from the one supplier, unless approved on the basis of satisfactory mix trials and evidence of performance.

### Restriction on chemical content

(Refer AS/NZS 4058 Clause 2.2.6)

Sulphate and chloride‑ion content must be determined by testing of hardened concrete in accordance with AS 1012.20.1.

### Reinforcement

(Refer AS/NZS 4058 Clause 2.3)

Steel reinforcement used in the manufacture of steel reinforced precast concrete pipes must be certified to a product conformity assessment scheme which is acceptable to the Principal. The Australasian Certification Authority for Reinforcing and Structural Steels (ACRS - refer to <http://www.acrs.net.au>) is acceptable to the Principal.

Welding of reinforcement must not substantially reduce the cross section of the reinforcement nor adversely affect the strength of the reinforcement and must be carried out by either:

1. Electrical resistance welding by automated or semi-automated processes; or
2. Manual welding of reinforcement complying with the requirements of AS1554.

Nibs and spacers used to maintain cover to reinforcement during manufacture must be one of the following:

1. Normal and Marine Environments – Steel Nibs or Stainless Steel Nibs
2. Aggressive Environments – Stainless Steel Nibs.

The physical and mechanical properties of stainless steel used in nibs must comply with   
BS 6744.

Plastic nibs or spacers must not be used.

## **Manufacture, Handling and Storage**

### Concrete

(Refer AS/NZS 4058 Clause 3.2.4)

The manufacturer must maintain a batch recording system which includes control and measurement of added mix water, and records details and quantities of all batch constituents foro each batch for all concrete mixes. These records must be available for inspection at the manufacturer’s batch plant by the Principal.

Curing of pipes must be by either wet or steam curing. If steam curing is used, the maximum enclosure temperature must not exceed 70 °C. Temperature monitoring must be conducted at least daily in each curing facility. Monitoring equipment must be calibrated.

### General

(Refer AS/NZS 4058 Clause 3.3.1)

Unless specified otherwise, the internal diameter must not be less than:

1. 95% of the nominal internal diameter for normal environment pipes up to Class 6
2. 90% of the nominal internal diameter for:
3. Class 8 and 10 pipes with 10 mm of cover
4. Pipes with 20 mm or more of cover.

Where an Aggressive environment has been specified, the manufacturer must submit a proposal for approval by the Principal describing the proposed method of achieving a 100 year Design life in the specified environment.

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| **HOLD POINT 2** | |
| Process Held | Supply of precast reinforced concrete pipes. |
| Submission Details | Proposed method describing how a 100 year Design life will be achieved in an Aggressive environment, at least 3 weeks before the supply of pipes is due to commence. |

### Concrete cover to reinforcement

(Refer AS/NZS 4058 Clause 3.3.2)

The minimum cover to steel reinforcement must be in accordance with the requirements of Table 3.1 of AS/NZS 4058. However, the minimum cover for pipes located in Aggressive environments must be as shown in Table 5.30, unless the Principal has accepted an alternative means of achieving a 100 year Design life.

Table 5.30: Minimum Cover in an Aggressive Environment

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| Environment | Minimum Cover to Reinforcement Barrel and Socket (mm) | Minimum Cover to Reinforcement Mating Surface of Spigot (mm) |
| Aggressive | 30 | 20 |

Cover to reinforcement on the external surface of jacking pipes must be increased by a further 5 mm over that specified in AS/NZS 4058 clause 3.3.2.1.

### Acceptability of pipe wall and joint surface defects in reinforced pipes

(Refer AS/NZS 4058 Clause 3.4.3)

Table 3.6 “Acceptability of Pipe Wall and Joint Surface Defects” of AS/NZS 4058 is replaced with Table 5.32:

Table 5.32: Acceptability of Pipe Wall and Joint Surface Defects

|  |  |  |  |
| --- | --- | --- | --- |
| **Defect type (AS/NZS 4058)** | **Pipe Wall** | **Joint Surface** | |
| Drainage Pipes | Drainage Pipes Flush Joints | Drainage Pipes Rubber Ring Joints |
| 1 | Acceptable | Not applicable | Not applicable |
| 2 | Acceptable after repair | Not applicable | Not applicable |
| 3 | Not acceptable | Not acceptable | Not acceptable |
| 4 | Acceptable | Acceptable | Acceptable |
| 5 | Acceptable after repair | Acceptable | Acceptable after repair |
| 6 | Not acceptable | Not acceptable | Not acceptable |
| 7 | Not acceptable | Not acceptable | Not acceptable |

Where the manufacturer intends to a repair a defect (if permitted in accordance with Table 5.32), the manufacturer must submit a proposal for approval by the Principal with details of the proposed treatment, including:

1. evidence that the Design life of the pipe will be unaffected by the repair;
2. the manufacturer’s product specifications and warranties,
3. the area and thickness of repair treatment; and
4. detailed repair procedures, and inspection and test plans.

If the proposed repair treatment requires the application of cementitious repair materials, the repair must comply with ATS 5340: Cementitious Patch Repair of Concrete.

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| **HOLD POINT 3** | |
| Process Held | Repair of defect. |
| Submission Details | Submission of the proposed method of repair, including the details as specified in Paragraph 5.33, at least 7 days before the repair commences. |

## Performance Tests

### Verification of Finished Product Compliance

(Refer AS/NZS 4058 Clause 4.1)

Prior notification to the Principal of the testing of any nonstandard pipes manufactured to order for a specific project must be provided.

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| **WITNESS POINT 1** | |
| Process | Testing of any nonstandard pipes. |
| Notification | Notification of the scheduled testing must be submitted at least 3 days prior to the commencement of the tests. |

Testing for pipe performance must be undertaken at the frequency as shown in Table 5.36:

Table 5.36: Test Frequency

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| **Test Name** | **Normal Frequency** | **Reduced Frequency** |
| Proof Load | Monthly or 1 per 50 pipes | Bimonthly or 1 per 100 pipes |
| Ultimate Load | Quarterly | Six-monthly |
| Cover to Reinforcement | Monthly or 1 per 100 pipes | Three-monthly or one per 200 pipes |
| Dimensions | Monthly or 1 per 100 pipes | Three-monthly or 1 per 200 pipes |
| Water Absorption | Monthly per mix design | Three-monthly per mix design |
| Joint Assembly | Only if specified | Only if specified |

Testing must be on a per size and per class basis for:

1. Proof loads
2. Ultimate loads
3. Cover to reinforcement checks
4. Dimension accuracy checks
5. Joint assembly test (where appropriate).

Water absorption testing must be on a per mix and per process basis.

After 6 months of compliant, consistent results, a proposal may be submitted to the Principal seeking approval for the rate of testing to be changed to the Reduced Frequency specified in Table 5.36.

Rates of testing (per time or per volume) must be chosen such that the larger number of pipes are tested.

Acceptance of batches based on testing must be in accordance with AS/NZS 4058 Clause A4. The manufacturer must prepare a Non-conformance Report for any non-conforming pipes within 5 working days.

The manufacturer may submit a proposal to the Principal to accept a pipe used for proof load testing, which is subject to demonstrating that the pipe complies with all requirements of this Specification.

Pipes used for sampling for water absorption may be accepted provided the core hole has been satisfactorily repaired with cementitious repair materials in accordance with the requirements of ATS 5340: Cementitious Patch Repair of Concrete. Note that results for water absorption testing may not be available at the time of installation. Previous results for the same mix designs can be accepted provided there is a demonstrated history of compliance and there has been no change to materials or mix designs.

## Ordering and Supplying Pipes

### Manufacturing Information to be Supplied Upon Request

(Refer AS/NZS 4058 Clause 6.3)

Precast reinforced concrete pipes must remain available for inspection at the place of manufacture for a minimum of 7 days from the date of manufacture.

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| **WITNESS POINT 2** | |
| Process | Delivery of precast reinforced concrete pipes. |
| Notification | Notification that Precast reinforced concrete pipes are available for inspection. |

Precast reinforced concrete pipes must not be transported from the place of manufacture until the pipes are at least 7 days old and all testing has been completed, or in the case of water absorption tests, samples have been taken and pipes repaired.

Prior to the delivery of the pipes to site, the following must be provided to the Principal:

1. the information specified in AS/NZS 4058 Clause 6.3.
2. a signed certificate stating that the materials used and the finished product conform to the requirements of this Specification; and
3. a corresponding load test report in accordance with AS/NZS 4058 Clause C7.2, which is representative of the batch of pipes delivered.

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| **HOLD POINT 4** | |
| Process Held | Installation of the precast reinforced concrete pipes |
| Submission Details | Certificate of Conformity, the information specified in AS/NZS 4058 Clause 6.3 and a load test report in accordance with AS/NZS 4058 Clause C7.2, at least 7 days prior to installation of the pipes. |

Annexure A: Summary of Hold Points, Witness Points and Records

The following is a summary of the Witness Points / Hold Points that apply to this specification and the Records that the Contractor must supply to the Principal to demonstrate compliance with this specification.

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| **Paragraph** | **Hold Point** | **Witness Point** | **Record** |
| 5.4 |  |  | Evidence of the system of control of concrete pipe materials (if requested by the Principal) |
| 5.5 | 1. Concrete production |  | Concrete mix design |
| 5.29 | 2. Supply of precast reinforced concrete pipes for installation in an Aggressive environment. |  | Proposal describing the proposed method of achieving a 100-year design / service life in an Aggressive environment |
| 5.34 | 3. Commencement of Pipe Defect Repair |  | Details of proposed rectification treatments |
| 5.35 |  | 1. Prior notification of the testing of any non-standard pipes |  |
| 5.44 |  | 2. Notice of availability for inspection |  |
| 5.46 | 4. Installation of the precast reinforced concrete pipes |  | Certificate of Conformity, the information specified in AS/NZS 4058 Clause 6.3 and a load test report in accordance with AS/NZS 4058 Clause C7.2 2. |

Amendment Record

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| --- | --- | --- | --- |
| Amendment no. | Clauses amended | Action | Date |
| - | New specification | New | January 2020 |
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| --- | --- |
| **Key** |  |
| Format | Change in format |
| Substitution | Old clause removed and replaced with new clause |
| New | Insertion of new clause |
| Removed | Old clauses removed |