



# **Construction Specification for Civil Works**

## **C305 – Trenchless Conduit Installation**

# TABLE OF CONTENTS

CLAUSE	CONTENTS	PAGE
	ORIGIN OF DOCUMENT, COPYRIGHT .....	2
	REVISIONS: C305 – TRENCHLESS CONDUIT INSTALLATION .....	2
	<b>GENERAL.....</b>	<b>3</b>
C305.01	SCOPE.....	3
C305.02	DEFINITIONS.....	3
C305.03	REFERENCE DOCUMENTS.....	4
C305.04	METHODOLOGY .....	5
	<b>CONSTRUCTION .....</b>	<b>6</b>
C305.05	CONDUIT.....	6
C305.06	INSTALLATION.....	7
C305.07	TOLERANCES .....	8
C305.08	PERMANENT AND TEMPORARY PITS .....	8
C305.09	BULKHEADS.....	8
C305.10	CONCRETE WORK.....	8



## GENERAL

### C305.01 SCOPE

This Specification covers the installation of any type of drainage or service conduit where trenchless techniques are to be used. Trenchless techniques minimise interference with existing features, facilities or traffic. These techniques may be by either jacking, ramming, bursting, thrust or auger boring, micro-tunnelling, directional drilling or other suitable technique as appropriate for the particular installation.

**Scope**

This Specification should be read in conjunction with the following specifications as appropriate:

**Associated Specifications**

*C220 – Stormwater Drainage.*

*C221 – Pipe Drainage.*

*C233 – Drainage Structures.*

*C303 – Service Conduits.*

*C401 – Water Reticulation.*

*C402 – Sewerage System.*

The work to be executed under this Specification consists of supply of the conduit, installation and all necessary ancillary work, whether such work is temporary or permanent, as shown on the approved design drawings.

The conduit and all aspects of the work shall meet the performance requirements detailed in this Specification.

### C305.02 DEFINITIONS

Some of the trenchless techniques available are described below in accordance with the International Society for Trenchless Technology Glossary of trenchless terms:

- a. **Jacking** - A system of directly installing pipes behind a shield machine by hydraulic jacking from a drive shaft such that the pipes form a continuous string in the ground.
- b. **Ramming** - A non-steerable system of forming a bore by driving a steel casing, usually open-ended, using a percussive hammer from a drive pit. The soil may be removed from an open-ended casing by augering, jetting or compressed air. In appropriate ground conditions a closed casing may be used.
- c. **Bursting** - A technique for breaking the existing pipe by brittle fracture, using force from within, applied mechanically, the remains being forced into the surrounding ground. At the same time a new pipe, of the same or larger diameter, is drawn in behind the bursting tool. The pipe bursting device may be based on a pneumatic impact moling tool to exert diverted forward thrust to the radial bursting effect required, or by a hydraulic device inserted into the pipe and expanded to exert direct radial force.
- d. **Thrust Boring** - A method of forming a pilot bore by driving a closed pipe or head from a thrust pit into the soil which is displaced. Some small diameter models have steering capability achieved by a slanted pilot-head face and electronic monitoring, generally in conjunction with a locator. Back reaming may be used to enlarge the pilot bore.
- e. **Auger Boring** - A technique for forming a bore from a drive pit to a reception pit, by means of a rotating cutting head. Spoil is removed back to the drive shaft by helically wound auger flights rotating in a steel casing. The equipment may have limited steering capability.
- f. **Micro-tunnelling** - Steerable remote control pipe jacking to install pipes of internal diameter.

- g. **Directional Drilling** - A steerable system for the installation of pipes, conduits and cables in a shallow arc using a surface launched drilling rig. Traditionally the term applies to large scale crossings in which a fluid filled pilot bore is drilled without rotating the drill string, and this is then enlarged by a washover pipe and back reamer to the size required for the product pipe. The required deviation during pilot boring is provided by the positioning of a bent sub. Tracking of the drill string is achieved by the use of a downhole survey tool.
- h. **Encasement Pipe** – Installed using trenchless methods to provide initial support to the excavated bore, prior to installation of the carrier pipe. The casing pipe may also be installed to provide additional protection to the carrier pipe.
- i. **Carrier Pipe** – A permanent pipe installed inside a casing pipe.
- j. **Jacking Pipe** – A pipe specifically design and manufactured for the purpose of being jacked into its final position.

**The Works** – Defined as follows:

**The Works**

- **Developer Infrastructure Works** - work includes subdivisions and any public infrastructure work associated with an approved Development in the ARC local government area requiring a construction certificate.
- **Contracted Works** – infrastructure work undertaken by a Principal Contractor or subcontractor formally appointed by ARC and supervised by ARC.
- **Internal Works** - infrastructure work undertaken by ARC’s day labour workforce.

**Constructor** – Defined as the organisation responsible for construction of the Works and the Principal Contractor as defined in the *Work Health and Safety Act 2011*.

**Constructor**

**ARC Representative** – Defined as follows:

**ARC Representative**

- **Developer Infrastructure Works** – Nominated ARC officer(s) for the approved Development.
- **For Contracted Works** – the Superintendent.
- **For Internal Works** – ARC Asset Owner.

**Constructor’s Representative** – Defined as follows:

**Constructor’s Representative**

- **Contracted Works** – the Principal Contractor’s nominated representative as per the relevant contract.
- **Internal Works** – ARC officer responsible for delivery.

**Developer’s Representative**– Defined as the person or organisation appointed by the Developer to administer the Constructor responsible for the delivery of Developer Infrastructure Works.

**Developer’s Representative**

### **C305.03 REFERENCE DOCUMENTS**

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**

Where not otherwise specified in the relevant Specifications or the approved design drawings, the Constructor shall use the latest versions of the Reference documentation, including amendments and supplements, listed in the Specifications at the time of the Works approval.

**Currency**

#### **(a) Armidale Regional Council (ARC) Specifications**

- C101 – Development Construction – General.
- C220 – Stormwater Drainage.
- C223 – Drainage Structures.
- C271 – Minor Concrete Works.
- C290 – Road Openings.

**ARC Specifications**

- C303 – Service Conduits.
- C401 – Water Reticulation.
- C402 – Sewerage System.

**(b) Australian Standards**

References in this Specification or on the approved design drawings to Australian Standards are noted by their prefix AS or AS/NZS. **Australian Standards**

- AS 3725 - Loads on buried concrete pipes.
- AS 4058 - Precast concrete pipes (pressure and non-pressure).

**(c) Other Standards**

- DIN 16869 - Design/Construction of Via Ferratas. **Other Standards**
- DIN 19565-1 - Pipes and Fittings of Glass Fibre Reinforced Plastics (UP-GF) for Buried Sewers and Drains.
- DIN 54815-1 - Pipes made of Filled Polyester Resin Moulding Materials.
- DIN EN14636-1 - Plastic Piping Systems for Non-Pressure Drainage and Sewerage – Polyester Resin Concrete (PRC) – Part 1: Pipes and Fittings with Flexible Joints.

**(d) Other Publications**

- CPAA - Concrete Pipe Association of Australia. **Other Publications**
  - Pipe Jacking, Design Guidelines.
  - Concrete Pipe Jacking, Technical Bulletin.
- ISTT - International Society for Trenchless Technology (Represented in Australia by the Australasian Society for Trenchless Technology) Glossary of Trenchless Terms

**C305.04 METHODOLOGY**

The Constructor shall submit a clear and detailed methodology for the execution of the trenchless conduit installation. This detailed methodology shall be included in the Constructor's Method Statement.

The Method Statement shall adequately address the following items as a minimum requirement: **Method Statement**

- (a) General description of method and sequence of operation.
- (b) Specialist sub-contractors and specialist equipment to be utilised.
- (c) Conduit type and specification, including compliance with relevant Australian Standard.
- (d) Jointing type and specification, including location, attachment and type of pipe spiders.
- (e) Grout type, if required, methodology and equipment for grout injection.
- (f) Mechanical description of any motorised pumping, jacking, horizontal boring, directional drilling or mining equipment intended for use.
- (g) Existing underground utility services:
  - Treatment at conflict locations;
  - Protection of services in zone of influence; and
  - Continual service location by radio locator and visual location via vacuum excavation is required, where possible.
- (h) Survey equipment and methods.
- (i) Direction of installation of conduit.

- (j) Size, depth and position of temporary access pits required.
- (k) Location of temporary spoil site for driller's mud and nature of haulage equipment. *(Note: the temporary spoil site will require environmental approval from the relevant authority).*
- (l) Programmed daily working hours and duration for the operation.
- (m) Strategy for dealing with noise pollution problems.
- (n) Traffic management.
- (o) Dewatering.
- (p) Environment and sedimentation control.

General requirements and design guidelines for jacking precast concrete and other rigid pipes are given in the *CPAA publications, Pipe Jacking - Design Guidelines and Concrete Pipe Jacking - Technical Bulletin*.

The "Dial Before You Dig" (DBYD) service shall be contacted to obtain current locations of water, sewer, stormwater, gas, electricity and telephone services etc, during the preparation of the Method Statement.

**Dial Before You Dig**

The relevant Utility Authorities shall be contacted to verify the location of services, during the preparation of the Method Statement.

**Contact Utility Authorities**

## CONSTRUCTION

### C305.05 CONDUIT

The materials used for the encasement pipe and carrier pipe are to fully comply with this Specification and the Constructor is responsible for sourcing and using the appropriate conduit for the work to the appropriate standard as detailed in Table C305.1.

**Approved Types**

Conduit Type	Application	Uses	Standard
Concrete	Encasement Pipe or Carrier Pipe	Stormwater / Sewer	AS 4058
Ductile Iron Cement Lined (DICL)	Encasement Pipe or Carrier Pipe	Stormwater / Sewer / Water Supply	AS 2280
Steel	Encasement Pipe or Carrier Pipe	Water Supply / Sewer	AS 1579
Glass Reinforced Plastic (GRP)	Encasement Pipe or Carrier Pipe	Stormwater / Sewer	DIN 16869 and DIN 19565
HDPE Line Concrete	Encasement Pipe or Carrier Pipe	Stormwater / Sewer	AS 4058
Polymer Concrete	Encasement Pipe or Carrier Pipe	Stormwater / Sewer	DIN 54815-1 and DIN EN14636-1

**Table C305.1 – Conduit Type**

For precast concrete pipes, the strength of the conduit shall be verified by the Constructor as adequate for the purpose utilising the methodology set out in AS 3725 with reference to AS 4058, for cracking load test parameters, and the Constructor's own determination of appropriate soil parameters. The ultimate load for the conduit is to exceed cracking load by a factor of safety of 50%.

**Strength Verification for Precast Concrete Pipe**

The Constructor shall provide similar and equivalent verification if the conduit does not comprise precast reinforced concrete pipe.

**Strength Verification for All Other Pipe**

The conduit shall not be installed until the Constructor has produced documentary evidence to the ARC Representative and/or the Developer’s Representative (for Developer Infrastructure Works) that appropriate load testing as required by Australian Standards and this Specification has been carried out and the representative specimens have satisfied the appropriate requirements. This action constitutes a **HOLD POINT**. The approval of the ARC Representative and/or the Developer’s Representative (for Developer Infrastructure Works) of the documentary evidence is required prior to the release of the hold point.

**HOLD POINT**

**Hold Point**

The Constructor shall provide documentary evidence to the ARC Representative and/or the Developer’s Representative (for Developer Infrastructure Works) at least two (2) working days prior to the installation of the conduit, that appropriate load testing as required by Australian Standards and this Specification has been carried out and the representative specimens have satisfied the appropriate requirements.

**Process Held:** Installation of the conduit.

**C305.06 INSTALLATION**

The installation shall provide for the following performance requirements:

- (a) The installation of any conduit by open trenching shall not be permitted over the length designated for trenchless techniques. (Note: Approval is required from the ARC Representative for any open trenching that may be required for the retrieval of the boring head in the case of failure). **Open Trenching**
- (b) The encasement pipe shall be as detailed on the approved design drawings. For an urban carriageway, the encasement pipe shall extend 1 metre behind the back of the kerb on either side of the carriageway unless otherwise approved by the ARC Representative. **Encasement Pipe for Urban Carriageway**
- (c) The carrier pipe shall be positioned on support cradles and the carrier pipe shall be centrally located within the encasement pipe. **Support Cradles**
- (d) The line and grade of the encasement pipe and carrier pipe shall comply with the approved design drawings within the tolerances indicated on the approved design drawings or stated in Clause C305.07 when not explicitly shown on the approved design drawings. **Line and Grade**
- (e) After installation, all joints shall be flush to the internal conduit walls and watertight. **Joints**
- (f) After installation of the encasement pipe and carrier pipe and prior to any grouting procedures, bulkhead walls shall be established at locations shown on the approved design drawings. Such bulkheads shall comply with Clause C305.09. **Bulkhead Walls**
- (g) After installation and pressure testing, voiding between the encasement pipe and natural earth as well as voiding between the encasement pipe and carrier pipe shall be eliminated by grouting prior, with material and methodology of grouting described in the Method Statement. The grouting mix shall be a high flow, low shrink cementitious grout. The grouting mix is to be approved by the ARC Representative prior to the commencement of any works. The Constructor is to ensure that the grouting pressure does not exceed the buckling capacity of the empty conduit. **Grouting**

Where the carrier pipe is ductile iron cement lined (DICL), any length of pipe which is enclosed within the encasement pipe need not be wrapped in polyethylene tubing. Where the carrier pipe is proposed to be PVC or similar, precautions need to be taken to prevent damage from excessive heat during curing of the grout. **Carrier Pipe Type**



The installation of the encasement pipe and carrier pipe shall not affect any adjacent building foundations and shall provide for consistent support prior to, during and after installation.

The installation of the encasement pipe and carrier pipe shall not endanger the stability or health of the root systems of trees to be retained as designated by ARC.

### **C305.07 TOLERANCES**

The carrier pipe shall be installed in accordance with the horizontal and vertical alignment as shown on the approved design drawings subject to the following definition of tolerances:

- |     |   |                            |
|-----|---|----------------------------|
| (a) | The position of both the inlet and outlet of the carrier pipe shall be determined by a registered Surveyor and shall comply with the approved design drawings for horizontal position to a tolerance of $\pm 30\text{mm}$ | <b>Horizontal Position</b> |
| (b) | Vertical tolerance at the inlet/outlet of the carrier pipe where installation commences shall be $\pm 10\text{mm}$  | <b>Vertical Position</b>   |
| (c) | The average grade of the carrier pipe shall comply with the grade ( $\pm 0.05\%$ ) as shown on the approved design drawings   | <b>Average Grade</b>       |
| (d) | The carrier pipe alignment at all joints will be true with a tolerance of $\pm 5\text{mm}$ deflection in any direction at 1.5m from the joint.  | <b>Joints</b>              |

### **C305.08 PERMANENT AND TEMPORARY PITS**

#### **(a) Excavation**

Any permanent and/or temporary pits established for purposes of installation shall be constructed in accordance with the excavation requirements of *C220 – Stormwater Drainage*.

#### **(b) Backfill**

Backfilling of temporary pits shall comply with the backfilling and compaction requirements of *C220 – Stormwater Drainage*.

**Temporary Pits**

The surface of temporary pits, after backfilling, shall be restored to pre-construction condition as in accordance with *C390 – Road Openings*.

Permanent pits or access chambers, located at the pits used for trenchless conduit installations, shall be constructed to the details as shown on the approved design drawings and in accordance with the appropriate Specification following demobilisation of the trenchless conduit installation equipment.

**Permanent Pits**

Backfill and compaction around permanent pits or access chambers shall be in accordance with the requirements of *C220 – Stormwater Drainage*.

### **C305.09 BULKHEADS**

Bulkheads shall be constructed in accordance with the approved design drawings or as nominated in the Method Statement submitted. They shall be built in reinforced concrete as detailed in the approved design drawings, and fabricated to bond to the conduit so as to exclude direct grout pressure loss at the conduit/soil interface.

**Reinforced Concrete Bulkheads**

Bulkheads shall be constructed, and any grouting undertaken, prior to construction of adjacent conduits installed under conventional trench techniques so as to prevent undermining of the previously installed trenchless conduit.

### **C305.10 CONCRETE WORK**

For all concrete work, the Constructor shall comply with *C271 – Minor Concrete Works* in relation to the supply and placement of normal class concrete and steel reinforcement, formwork, tolerances, construction joints, curing and protection.

**Concrete**

This is the last page of the document.