

SECTION 421

SUPPLY AND INSTALLATION OF PIPE CULVERTS

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421.01 SCOPE

This specification covers the requirements for the supply, installation and backfilling of factory fabricated pipe culverts, including the extension of existing culverts. Pipe culverts may be round or arched pipe.

Should end-treatments such as concrete headwalls, gabions or rip rap be required, then the requirements for these will be covered separately in other items and specifications.

421.02 MATERIALS

Pipe shall consist of aluminized steel pipe type 2 or polymer laminated in accordance with the Corrugated Steel Pipe Institute (CSPI) Performance Guideline for Corrugated Steel Pipe Culverts (300 millimetres to 3600 millimetres in Diameter), concrete, or corrugated polyethylene pipe of profile type and strength as specified in the unit price table. However,

Contractors are advised that consideration will be given to proposals to substitute aluminized steel type 2 pipe with corrugated polyethylene pipe for diameters of up to and including 600 millimetres. The pipe shall be of the type, strength and size specified in the Unit Price Table.

421.02.01 Aluminized or Polymer Laminated Steel Pipe Materials

Aluminized or polymer laminated corrugated steel pipe, couplers, wyes, tees, bends, adapters, nuts and bolts shall conform to the requirements of the most recent revisions of the following specifications: AASHTO M274 and M36, ASTM A760/A760M, ASTM A762/A762M, ASTM A929/A929M and CSA G401.

The pipe shall have a wall thickness of at least that specified in the Unit Price Table. However, should the wall thickness not be specified, then the wall thickness shall be at least the corresponding thickness given in the following table for pipe of the size and type required.

PIPE DIAMETER	MINIMUM WALL THICKNESS
100 mm to 1200 mm	2.0 mm for Any Corrugation
1400 mm to 1800 mm	2.0 mm for 125 mm X 25 mm Corrugation or 3.5 mm for 68 X 13 mm Corrugation
2000 mm to 2400 mm	2.8 mm for 125 mm X 25 mm Corrugation or 4.2 mm for 68 X 13 mm Corrugation
2401 mm to 3600 mm	3.5 mm for 125 mm X 25 mm Corrugation

The Contractor shall supply the pipe, couplers, nuts and bolts. Should strutting be required during backfill operations, then the Contractor shall provide the necessary timber.

Fill material to be placed within 300 millimetres of the top, bottom and the sides of corrugated pipe shall consist of clean well graded Other Material, or small sized shot rock. The maximum dimension of any stone in the Other Material, or in the shot rock, shall not exceed 75 millimetres

421.02.02 Plastic Pipe Materials

Polyethylene pipe, couplers, wyes, tees, bends, and adapters shall conform to the requirements of the most recent revisions of the following specifications: AASHTO M252 and M294, ASTM F667 and CSA B182.6 and B182.8.

Couplers and plastic pipe, consisting of corrugated polyethylene pipe, shall be of a type, profile, size and strength class acceptable to the Owner's Representative. The Contractor shall provide the plastic pipe and couplers.

Contractors are advised that should plastic pipe be used, then the pipe shall be installed in a Select Backfill Material consisting of well graded Other Material having no more than 10% passing the 0.075 millimetre sieve with a maximum particle size not exceeding 40 millimetres.

421.03 ENVIRONMENTAL PERMITS AND AUTHORIZATIONS

Authorization from the Fish and Fish Habitat Protection Program, Fisheries and Oceans Canada, is required for work in or near any watercourse or water body deemed to be viable fish habitat.

Where required by Fisheries and Oceans, a downstream pool shall be provided at the culvert outlet.

The Contractor shall provide such unwatering as is required to complete the culvert installation in the dry and to comply with all regulatory agency requirements. The unwatering shall be carried out in accordance with the requirements of Section 180.

The Contractor shall be aware of Division 8.

Where the stream is deemed to be viable fish habitat, then in order to assist fish passage during minimum flow periods, the culvert shall be installed such that the bottom of the culvert is at least 300 millimetres below the natural stream bed. In multiple culvert installations, then to assist fish passage, only one culvert need be installed with the invert at least 300 millimetres below natural stream bed.

421.04 PIPE INSTALLATION

Culvert pipes shall be laid to the alignment, length and grade staked by the Owner's Representative.

Driveway culverts will typically be: a minimum length of 7 metres if rip-rap end treatment is used, and a minimum length of 8 metres if no rip-rap is used.

The culvert shall be installed in accordance with the requirements given in Form 1236 for aluminized or polymer laminated steel pipe installation and with the requirements given in Form 1234a, 1234b or 1234c for polyethylene pipe installation.

Should excavation be required to install the pipe at the required grade, then excavation shall be carried out and paid for in accordance with Section 403.

Where unsuitable material is encountered at the proposed pipe invert grade, then the unsuitable material shall be excavated and replaced.

The replaced material shall be compacted to not less than 95% of Standard Proctor Density (ASTM D698).

The bed shall be shaped to conform to the bottom of the pipe and shall afford a uniformly firm bed throughout its entire length.

When extending an existing culvert, the Contractor shall brush off all soil sticking to that part of the existing pipe that will be lapped.

When laying pipe, should the required culvert length be unobtainable from a combination of pipe lengths available on the site, then the Contractor shall cut a piece of pipe to obtain the required length of culvert. The cut or short section shall be placed on the down stream end.

Pipe cuts shall be made neatly at right angles to the axis of the pipe.

Riveted or annular aluminized type II or polymer laminated corrugated steel pipe and plastic pipe shall be laid with the inside circumferential laps pointing in the direction of the flow. The longitudinal laps shall be located in the upper half of the pipe.

Helical corrugated plastic and aluminized type II or polymer laminated steel pipe shall be installed such that the helix angle is constant for the total length of the installation and each pipe section shall be installed next to the previous section such that the lock seam forms a continuous helix.

Should concrete headwall be installed under another item, then backfilling against the headwalls shall not commence until the concrete has been cured to the specified design strength at 28 days. Should the Contractor wish to commence backfilling before 28 days after pouring, then the Contractor will be required to prove that the 28 days specified design strength has been obtained before permission to commence backfilling will be granted.

The material shall be carefully placed so that the intended shape of the pipe is maintained and no damage or movement of the culvert occurs.

The backfill material shall be placed simultaneously on both sides of the pipe in layers not exceeding 200 millimetres in thickness. Each layer shall be thoroughly tapped to a compaction not less than 95% of Standard Proctor Density before a further layer is placed.

Backfilling shall be continued until all parts of the pipe culvert have not less than 300 millimetres of backfill cover.

Any pipe which is not in the alignment and to the grade required by the Owner's Representative after laying shall be taken up and re-laid at the Contractor's expense.

421.04.01 Aluminized or Polymer Laminated Corrugated Steel Pipe Installation

Where excavation for foundation is required before an aluminized or polymer laminated corrugated steel pipe may be placed in Other Material ground, then the excavation shall be to the proposed invert elevations and graded so as to provide a uniformly firm bed throughout the length of the culvert.

However, in solid rock, the excavation shall be carried out to a depth of 150 millimetres below the proposed invert elevations so that fill material may be placed to provide a bed for the culvert. The fill material shall be placed and graded so as to provide a uniform bed throughout the length of the culvert.

Where an aluminized or polymer laminated corrugated steel pipe is cut, drilled or welded, the pipe shall be thoroughly cleaned with a wire brush to remove scale, rust, slag residue, weld splatter, and wiped clean. The clean surface shall receive at least one application of metal conditioner to de-oxidize, de-grease and phosphatize the metal surface to be treated if the surface is oily. Pre-mixed, ready-to-apply, liquid-zinc compound shall be applied to the prepared clean dry metal surface. The cold galvanizing compound must be of a type that imparts cathodic action against corrosion. The cold galvanizing compound should have a minimum 50 millimetres overlap of the surrounding undamaged aluminized metal and have a minimum dry thickness of 75 μ m.

When applying metal conditioner and cold galvanizing compound near a watercourse or water body, the Contractor shall ensure that the application is carried out carefully so as to prevent leakage or spillage.

Any damage to aluminized coatings shall be repaired in accordance with the latest version of CSA G401.

Uncoated areas wider than 50mm shall be replaced with new material or re-dipped in accordance with CSA G401.

Any damage to polymer coatings shall be promptly repaired in accordance with CSPI Technical Bulletin Number Two. The damaged area shall receive a zinc rich coating with a minimum dry thickness of 75µm, Denso Butyl Spray Primer and Denso Tape. For coating damage exceeding 50mm in width; the Contractor shall submit an engineered repair plan which ensures a 75 year design life and is manufacturer approved. The acceptance of the repair procedure shall be at the sole discretion of the Department. Should the Department find the repair procedure unacceptable then the damaged pipe culvert will be rejected and shall be replaced with a new, undamaged pipe culvert. All costs associated with preparation of repair procedures and repairing or replacing the damaged pipe culvert shall be borne entirely by the Contractor.

Corrugated pipe sections shall be jointed together by means of couplers. The couplers shall be installed to lap approximately equal portions of the pipe being connected and such that the corrugations or projections of the coupler properly engage the pipe corrugations. As the coupler is being tightened, it shall be tapped with a mallet to take up the slack.

Strutting will be required for corrugated steel pipe culverts of diameter or span greater than 1500 millimetres in order to ensure that the original shape of the culvert is retained after completion of backfilling operations.

Strutting shall be placed to the satisfaction of the Owner's Representative. Struts shall be placed such that they bear onto longitudinally placed members. Under no circumstances shall struts be placed so that they bear directly onto the walls of the pipe.

Struts shall be left in place until ordered removed by the Owner's Representative at the completion of backfilling operations. For aluminized or polymer laminated corrugated steel pipe of diameter 2400 millimetres or less, the minimum required cover to subgrade is 300 millimetres. For aluminized or polymer laminated corrugated steel pipe of diameter between 2400 millimetres and 3600 millimetres, the minimum required cover is 500 millimetres.

421.04.02 Plastic Pipe Installation

Plastic pipe shall be laid on a bed of 150 millimetres of Select Backfill Material.

Where excavation for foundation is required, the excavation shall be to 150 millimetres below the proposed invert elevations so that Select Backfill Material may be placed to provide a bed for the culvert.

The Select Backfill Material shall be placed and shaped to conform to the underside of the culvert and graded so as to provide a uniformly firm bed throughout the length of the culvert.

The cover shall not be less than the manufacturer's recommended minimum cover.

421.05 PROTECTION FROM TRAFFIC

Prior to allowing the movement of construction equipment or any vehicular traffic over the structure, the depth of cover over the culvert shall be at least equal to that stipulated under Section 421.04. Cover for off highway construction equipment will be in addition to that specified above.

421.06 MEASUREMENT FOR PAYMENT

Measurement for payment for a culvert shall be the length of the culvert within the limits staked by the Owner's Representative, measured in metres, to one decimal place, along the bottom of the new culvert.

Should any part of the culvert extend beyond the limits as staked by the Owner's Representative, then that part beyond the limits shall not be included in measurement for payment.

421.07 BASIS OF PAYMENT

421.07.01 Basis of Payment for Supply and Installation of Pipe Culverts

Payment at the contract price for the type and size of pipe culvert specified shall be compensation in full for all labour, materials and equipment use to: supply the pipe, couplers, nuts and bolts, transport the materials to the project, store the materials at the project, transport the materials to the site, cut the pipe if required, clean the cut end, supply and apply metal conditioner and cold galvanizing compound to all cuts and welds, assemble the culvert, place and compact bedding and backfill as required, supply and place any required strutting, remove the strutting and provide all required unwatering of the culvert site during installation.

Select Backfill for use with plastic pipe shall be paid for in accordance with Section 206, Section 207, or Section 310 as the case may be, but the additional requirements for these

materials as stipulated in this specification shall be considered compensated for in the contract price for supply and installation of pipe culverts.

Backfill for use near aluminized or polymer laminated corrugated steel pipes will be obtained from materials excavated to place the pipes. Should the Owner's Representative determine that the excavated material be unsuitable for backfill, or should additional backfill materials be required, the backfill materials shall be paid for in accordance with Section 206, or Section 207, as the case may be, but the additional requirements for backfilling, as stipulated in this specification shall be considered compensated for in the contract price for supply and installation of pipe culverts.

421.07.02 Basis of Payment for Pipe Restocking

Contractors are advised that should less than the contract estimated quantity of pipe of a particular size and type be required, then the Contractor will be compensated for restocking this excess pipe at the rate of 15% of the Contract Unit Price for the supply and installation of pipe culvert of this size and type. Restocking shall include such things as handling, all transportation and any other expenses associated with removing the excess pipe from the project site and returning it to the supplier or to the Contractor's permanent storage area.

421.07.03 Basis of Payment for Purchase of Pipe

Contractors are advised that should less than the contract estimated quantity of pipe of a particular size and type be required, the Department reserves the right to purchase the excess. Compensation for purchase will be at the invoiced price for that pipe from the pipe supplier plus 10%.