



SECTION 725

METAL PIPE AND PIPE ARCH CULVERTS

725.1 Description. This work shall consist of providing corrugated metal pipe or pipe arch of the diameter or shape designated, laid upon a firm bed and backfilled as specified. Where pipe is referred to, this specification will also apply to pipe-arch, where appropriate.

725.1.1 The contract will specify either the type of pipe or the group of permissible types of pipe. If a group of permissible types is specified, the contractor may use any of the types listed within the specified group as follows:

Group A	Reinforced Concrete Culvert Pipe Vitrified Clay Culvert and Sewer Pipe
Group B	Reinforced Concrete Culvert Pipe Vitrified Clay Culvert and Sewer Pipe Polymer Coated Corrugated Metal Culvert Pipe Corrugated Aluminum Alloy Culvert Pipe Corrugated Polyethylene Culvert Pipe Corrugated PVC Culvert Pipe Corrugated Aluminum-Coated Steel Culvert Pipe
Group C	Reinforced Concrete Culvert Pipe Vitrified Clay Culvert and Sewer Pipe Polymer Coated Corrugated Metal Culvert Pipe Corrugated Aluminum Alloy Culvert Pipe Corrugated Polyethylene Culvert Pipe Corrugated PVC Culvert Pipe Bituminous Coated Corrugated Metal Culvert Pipe Corrugated Aluminum-Coated Steel Culvert Pipe Corrugated Zinc-Coated Steel Culvert Pipe

725.1.2 If the contract specifies corrugated metallic-coated steel pipe culverts of 60-inch (1500 mm) diameter or larger, the contractor may substitute structural plate pipe of like sizes, lengths and thicknesses of steel, constructed in accordance with [Sec 727](#), at the contractor's expense.

725.1.3 If the contract specifies corrugated metallic-coated steel pipe or corrugated aluminum alloy pipe, or if the contract specifies pipe culverts by group and the contractor elects to furnish corrugated metallic-coated steel pipe or corrugated aluminum alloy pipe, the thickness of metal and size of corrugation for the respective pipe size shall be as shown on the plans unless otherwise specified. The overflow height shown on the plans or in the contract shall be used to determine the proper sheet thickness and size of corrugation for the individual pipe culvert. The minimum cover shall be measured as shown on the plans.

725.1.4 If the contract specifies pipe culverts by group and the contractor elects to furnish vitrified clay or reinforced concrete pipe, the culvert shall be constructed in accordance with [Sec 726](#). If the contractor elects to furnish corrugated PVC culvert pipe, the culvert shall be

constructed in accordance with [Sec 728](#). If the contractor elects to furnish corrugated polyethylene pipe, the culvert shall be constructed in accordance with [Sec 730](#).

725.1.5 When Group B and Group C pipe are specified, two pipe diameters will be shown on the plans at those locations. The first dimension will indicate the diameter of pipe that shall be provided if the contractor elects to provide pipe for that location with a corrugated interior wall, and the second dimension provided in parenthesis will indicate the diameter of pipe that shall be provided if the contractor elects to provide pipe for that location with a smooth interior wall. The specified diameters may be the same or different and will be dependent upon the design features for that pipe location. Regardless of which diameter of pipe is selected for a given location, the pipe flow line shall be maintained at the elevations shown on the plans.

725.1.6 Pipe used for storm sewers may be any of the pipe listed under Group B pipe, with the following exceptions. All corrugated metal culvert pipes shall be Type IA or Type IR. Sewer pipe placed beneath the paved portion of roadways with average daily traffic greater than 3500 vehicles per day shall be Group A pipe. No other substitutions will be allowed, regardless of what type or group of pipe is specified for storm sewers outside of the paved portion for these roadways.

725.2 Material. All material shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	Section
Corrugated Metallic-Coated Steel Culvert Pipe, Pipe-Arches and End Sections	1020
Bituminous Coated Corrugated Metal Culvert Pipe, Pipe Arch and End Sections	1021
Corrugated Aluminum Alloy Culvert Pipe	1024
Polymer Coated Corrugated Metal Culvert Pipe and Pipe Arches	1027

725.3 Construction Requirements.

725.3.1 Handling. All pipe shall be handled to avoid damage. Pipe having damaged coating, any localized bends in excess of five percent of the specified pipe diameter, or any dent in excess of 1/2 inch (13 mm) will be rejected, regardless of previous approvals. Rejected damaged pipe may be used if repaired to the satisfaction of the engineer.

725.3.2 Laying Pipe.

725.3.2.1 The pipe shall be carefully laid true to lines and grades shown on the plans. Riveted pipe shall be installed with the outside laps of circumferential joints pointing upstream and with no longitudinal lap placed on the bottom 120 degrees of the pipe on the sides. Any pipe that is not in true alignment or that shows any undue settlement after laying shall be taken up and re-laid at the contractor's expense. If shown on the plans or directed by the engineer, camber shall be built into the pipe structure to compensate for settlement from fill loads.

725.3.2.2 Transverse field joints shall be of such design that the successive connection of pipe sections will form a continuous line free from appreciable irregularities in the flow line. Each successive length of pipe in a field joint shall be adjusted longitudinally or circumferentially when necessary such that coupling bands will properly engage the corrugations in both lengths of pipe.

725.3.3 Bedding And Backfill Material.

725.3.3.1 Backfill material for metal culverts shall consist of crushed stone, gravel, sand or sandy silt.

725.3.3.1.1 Crushed stone, gravel and sand shall consist of a well-graded mixture of stone fragments, gravel and sand, and shall be in accordance with AASHTO M 145, Classification A1 or A3.

725.3.3.1.2 Sandy silt soil shall consist of moderately plastic granular material with silt content higher than that of gravel or sand and shall be in accordance with AASHTO M 145, Classification A2.

725.3.3.2 Bedding material shall have a maximum particle size of 1 1/2 inches (38 mm). Backfill shall be free of organic material or frozen clumps, and shall not contain stones larger than 3 inches (75 mm).

725.3.4 Installation.

725.3.4.1 Installation of Pipe for Non-Embankment Conditions. The construction sequence shall be as follows. The trench shall be excavated to the width, depth and grade shown on the plans or as directed by the engineer. Proper preparation of foundation, placement of foundation material where required and placement of bedding material shall precede the installation of all culvert pipe. Proper preparation shall include necessary leveling of the trench bottom or the top of the foundation material as well as placement and compaction of required bedding material to a uniform grade such that the entire length of pipe will be supported on a uniform base. The material in the haunch and lower side zones shall then be placed and compacted up to the springline of the pipe.

725.3.4.2 Installation of Pipe Prior to Placing Embankment. After the pipe has been laid, the material in the haunch and lower side zones shall be placed to a minimum width of one pipe diameter outside the pipe, except for pipe-arches, where placement of material shall be limited to a maximum of two-thirds the span. The pipe shall be installed and backfilled in accordance with [Sec 725.3.4.1](#). If a subtrench will be required to install the pipe to the specified grade, the width of the trench shall be as shown on the plans. Sufficient clearance shall be provided in order to attain the required compaction in the haunch and outer bedding zones.

725.3.4.3 Installation of Pipe After Placing Embankment. The roadway embankment shall be placed and compacted to the required density to a minimum elevation of one foot (300 mm) above the top of the pipe. A trench shall be excavated through the embankment to a depth sufficient to place the required bedding and to maintain the specified grade of the pipe, in accordance with the section shown on the plans. The pipe shall be installed and backfilled in accordance with [Sec 725.3.4.1](#).

725.3.4.4 Bedding in Unsuitable Material. If rock is encountered, the bedding depth shall be increased as shown on the plans. If soft, spongy or unstable material is encountered, the material shall be removed and replaced with approved fill, compacted to the specified level. Payment for removal of unsuitable material and for backfilling will be made in accordance with [Sec 206.6.3](#), unless the unsuitable material is a result of the contractor's operations, in which case the removal and backfilling will be at the contractor's expense.

725.3.4.5 Backfill. Backfill shall be placed as soon as practical in accordance with [Sec 206](#). Suitable backfill and embankment material, free from large lumps, clods or rocks, shall be compacted in accordance with [Sec 203](#). Care shall be taken to properly compact the backfill under the haunches of pipe-arch. The placement of the remainder of the backfill shall be a

minimum of one foot (300 mm) above the top of the pipe and shall be brought up evenly on both sides of the pipe by working backfill operations from side to side. The side-to-side backfill differential shall not exceed 24 inches (0.6 m) or one-third of the size of the pipe, whichever is less. Additional backfill shall be provided as necessary. After backfilling, the pipe shall have a smooth, uniform concentric shape.

725.3.4.6 Shop Elongation. Round corrugated steel pipe 48 inches (1200 mm) or greater in diameter may be furnished round or shop elongated. The contractor shall maintain elongation during backfilling and embankment construction such that the vertical height of the opening after the embankment has been completed shall be no less than the diameter of the pipe or greater than the pre-elongated height.

725.3.4.7 Construction Loads. Before heavy construction equipment is operated over the pipe, the contractor shall provide adequate depth and width of compacted backfill or other cover to protect the pipe from damage or displacement. Any damage or displacement shall be repaired or corrected at the contractor's expense.

725.3.4.8 Pipe Plugs. The ends of all pipe stubs for future connections at inlet and manhole structures, and all pipe installed as part of future sewers, shall be sealed with approved plugs. The plugs shall be installed in such a manner that infiltration of soil into the pipe is prevented.

725.3.5 Corrugated Metal Drop Inlets. The contractor shall install corrugated metal drop inlets of the proper size and length at the locations shown on the plans. The drop inlet shall be constructed of the same base metal and thickness of corrugated metal used in the culvert pipe and shall be in accordance with [Sec 1020](#) or [Sec 1024](#).

725.3.6 Corrugated Metal Curtain Walls. The contractor shall install metal curtain walls of the proper size and shape at locations shown on the plans. Metal curtain walls shall be constructed of the same base metal used in the culvert pipe, shall be of the thickness of metal shown on the plans and shall be in accordance with [Sec 1020](#) or [Sec 1024](#).

725.4 Inspection. The internal diameter of the barrel shall not be reduced by more than 10 percent of the pipe's nominal inside diameter when measured no less than 30 days following completion of installation. After the roadway has been completed and before final inspection of the project, the engineer will inspect all pipe locations for proper installation. Any section of pipe found to be improperly installed shall be replaced or repaired by the contractor, at the contractor's expense and to the satisfaction of the engineer. Repaired or replaced pipe will be re-inspected by the engineer. The contractor shall provide equipment and assistance deemed necessary by the engineer to perform any testing. Pipe deflections will be determined by the engineer by having the contractor either pushing or pulling a mandrel through the pipe or verifying deflections by other methods approved by the engineer. Mandrels used for deflection testing may have either fixed or adjustable arms, but shall be approved by the engineer prior to use. The following will constitute improper installation:

- (a) If any horizontal or vertical alignment is in excess of 15 percent from plan alignment, will restrict flow or will cause excessive ponding within the pipe.
- (b) Any section of pipe with a diameter deflection greater than 10 percent, based upon the units of measurement used in fabricating the pipe.
- (c) If settlement is greater than one inch (25 mm) at 5 percent or more joints.
- (d) If the pipe shows evidence of being crushed at any location.

- (e) If the pipe shows evidence of joint separation.

Method of Measurement.

725.5.1 Final measurement will not be made except for authorized changes during construction or where appreciable errors are found in the contract quantity. When two different diameters of pipe are shown on the plans for a given location for Group B or Group C pipe, the quantity of pipe installed will be based on the plan quantity for the larger diameter pipe and will not be considered as an appreciable error in the contract quantity if the smaller allowed diameter pipe is used. Where required, measurement of corrugated metal pipe or pipe-arch, complete in place, will be made to the nearest foot (0.5 m) along the geometrical center of the pipe. The revision or correction will be computed and added to or deducted from the contract quantity.

725.5.2 Excavation for placing pipe, pipe-arches, corrugated metal drop inlets and metal curtain walls will not be measured, except when excavation for the installation is shown on the plans.

725.6 Basis of Payment.

725.6.1 The accepted quantities of pipe, complete in place, including all necessary tees, bends, wyes, coupling bands, cutting and joining new pipe to existing pipe or structures, unless otherwise specified, will be paid for at the contract unit price for each of the pay items included in the contract.

725.6.2 The accepted quantities of corrugated metal drop inlets and metal curtain walls, complete in place, including coupling bands, toeplates, nuts and bolts will be paid for at the contract unit price for each of the pay items included in the contract.

725.6.3 Unless specified otherwise, no direct payment will be made for the following:

- (a) Beveling, skewing or additional work required in laying pipe with beveled or skewed ends.
- (b) Work involved in elongating pipe.
- (c) Any required backfilling, except as specified in [Sec 206.6.3](#).
- (d) Construction of bedding or for bedding material.
- (e) Trench excavation and backfilling, except when Class 3 Excavation is shown on the plans for a given pipe location. When shown on the plans, payment for Class 3 Excavation will be made for in accordance with [Sec 206](#).
- (f) Furnishing and installing plugs.
- (g) Work or equipment to perform deflection testing.