

**SECTION 449**  
**PRECAST CONCRETE DRAINAGE PRODUCTS**

**449-1 Description.**

Precast concrete drainage products hereinafter called products, may include but are not limited to, round concrete pipe, elliptical concrete pipe, underdrains, manholes, endwalls, inlets, junction boxes, three-sided precast concrete culverts, and precast concrete box culverts.

Ensure that all precast drainage products are designed and manufactured in accordance with the requirements of the Contract Documents.

Obtain precast concrete pipes, box culverts, and drainage structures from a plant that is currently on the Department's Production Facility Listing. Producers seeking inclusion on the list shall meet the requirements of Section 105.

At the beginning of each project, submit a notarized certification statement to the Engineer from a company designated representative certifying that the plant will manufacture the products in accordance with the requirements set forth in the Contract Documents and Producer Quality Control (QC) Plan. The Quality Control Manager's stamp on each product indicates certification that the product was fabricated in conformance with the Producer QC Plan, the Contract, and this Section. Ensure that each shipment of precast concrete products to the project site is accompanied with a QC signed or stamped delivery ticket providing the description and the list of the products.

When the Producer Quality Control Program is suspended by the Department, accept responsibility of either obtaining products from a plant with an approved Quality Control Program, or await re-approval of the plant. The Engineer will not allow changes in Contract Time or completion dates as a result of the plant's loss of qualification. Accept responsibility for all delay costs or other costs associated with the loss of the plant's qualification.

**449-2 Materials.**

Ensure that the materials used for the construction of the precast drainage products have a certification statement from the source, showing that they meet the applicable requirements of the Specifications with the following modifications:

Reinforcing Bar.....	Section 415
Coarse Aggregate* .....	Section 901
Fine Aggregate* .....	Section 902
Portland Cement and blended cement.....	Section 921
Water.....	Section 923
Admixtures.....	Section 924
Pozzolans and slag .....	Section 929
Gasket Material .....	Section 942
Blended Hydraulic Cements .....	AASHTO M 240
Welded Wire Reinforcement .....	Section 931
Wire for Site Cage Machines .....	Section 931
Liner Repair Systems .....	Section 948

\*For concrete pipes the gradation requirements of concrete aggregates as set forth in Sections 901 and 902 are not applicable.

### 449-3 Construction Requirements.

Unless otherwise stipulated within the Contract Documents, meet the following requirements for concrete mix, product design, fabrication, transportation, and installation:

Three-Sided Precast Culverts.....	Section 407
Precast Concrete Box Culvert.....	Section 410
Pipe Culverts and Storm Sewers.....	Section 430
French Drains.....	Section 443
Inlets, Manholes, and Junction Boxes .....	Section 425 and ASTM C 478
Underdrains.....	Section 440 and ASTM C 444
Steel Reinforced Round Concrete Pipe.....	ASTM C 76
Reinforced Elliptical Concrete Pipe.....	ASTM C 507
Non-reinforced Concrete Pipe .....	ASTM C 985

Meet the special requirements for the applicable pipes as described in 449-4 and 449-5.

### 449-4 Concrete Pipe.

**449-4.1 Special Requirements for Steel Reinforced Concrete Pipe:** Use pipe meeting the requirements of ASTM C76 with the modifications as described in 449-4.2. Use Special Designed pipe meeting the requirements of ASTM C655. Use Class S pipe meeting the requirements of ASTM C655. Ensure all pipes are properly marked.

**449-4.2 Modifications to ASTM C 76 and ASTM C 507:** The following supersedes the provisions of ASTM C76 and ASTM C507:

1. Ensure all materials used in concrete are certified from the source and conform to the requirements of 449-2.
2. Ensure all Joint Reinforcement requirements are in accordance with the Design Standards.
3. When membrane curing compounds are used, ensure that the requirements of 925-2 are met and the membrane curing compounds are applied in accordance with 400-16 immediately after the pipe has been removed from the form.
4. Ensure the manufacturer has a suitable apparatus for testing each product in accordance with ASTM C497 and performs all tests outlined in ASTM C497 when requested by the Engineer.
5. Ensure that the variation of laying lengths of two opposite sides of pipe is not more than 1.04% of the diameter, with a maximum of 1/2 inch in any length of pipe, except where beveled-end pipe for laying on curves is specified.
6. Ensure that the type of wall markings is included on all precast pipes.
7. Ensure all repairs are made in accordance with Section 449-5.4.

**449-4.3 Special Requirements for Non-Reinforced Concrete Pipe:** Ensure the requirements of ASTM C985 are met with the following exception: Modify material requirements set forth in ASTM C985 with the material requirements set forth in 449-2. Ensure all pipes are properly marked.

**449-4.4 Special Requirements for Reinforced Elliptical Concrete Pipe:** Use elliptical concrete pipes conforming to the requirements of ASTM C507, except for the exceptions and modifications as specified in 449-4.2. Ensure the requirements of Table I of ASTM C507 for standard elliptical pipe, the requirements of Class HE-III and Class HE-IV of Table I of ASTM C507 for standard elliptical pipe and special elliptical pipe, respectively are met and the joint design requirements set forth in Article 7 of ASTM C443 are met.

**449-4.5 Concrete Underdrain Pipe:** Use perforated concrete pipe for underdrains meeting the requirements of ASTM C444, with the following modifications:

1. Strength of finished pipe: Underdrain pipe will not be required to be reinforced, and will not be tested for strength of the finished pipe. Approval of the strength of the finished pipe will be based on visual inspection and check.

2. Perforations: The perforations must be molded into the pipe at the time of fabrication, and any undue chips, fractures, incurred thereby, either in the interior of the pipe or on the periphery, which are sufficient to significantly impair the strength or efficiency, will be cause for rejection of the pipe.

Ensure the perforations are circular, and of the diameter called for below, with a tolerance of plus or minus 1/16 inch. Furnish all pipe included in any single order, or for any single installation operation, such diameter is reasonably uniform.

Schedule of Perforations For Concrete Underdrain Pipe				
Internal Diameter of Pipe	Diameter of Perforations *(Design)	Number of Rows	**Approximate distance between Rows	**Spacing within Rows
6 inches	3/8 inch	4	4 inches	5-6 inches
6 inches	1/4 inch	4	4 inches	4-5 inches
8 inches	3/8 inch	4	5 inches	5-6 inches
8 inches	1/4 inch	4	5 inches	4-5 inches

\*1/16 inch fabrication tolerance, over and under.  
 \*\*Perforations to be staggered in alternate rows. The spacing between rows must be uniform.

**449-4.6 Rejection of Concrete Pipe:** Specific causes for rejection of concrete pipe, in addition to any failure to meet the general requirements specified in the Contract Documents, are as follows:

1. Failure to meet the requirements listed in ASTM C76 for permissible variations in dimensions with the modifications outlined in 449-4.1 and 449-4.2.
2. Occurrence of defects listed in ASTM C76.

**449-5 Requirements For Pipe Joints When Rubber Gaskets Are To Be Used.**

**449-5.1 Design of Joint:** Use pipe joint of the bell-and-spigot type or the double spigot and sleeve type, meeting the requirements called for in the Design Standards. Ensure the joint is so proportioned that the spigot, or spigots, will readily enter the bell or sleeve of the pipe.

Ensure the joint ring forms for forming the joint surface are made of either heavy steel, cast iron, or aluminum, and accurately machined to the dimensions of the joint. They must be a true circular form within a tolerance of 1/32 inch. Dimensional checks of joint ring form will indicate for each size pipe a length of spigot, or tongue, not more than 1/8 inch shorter than the bell, or groove, depth. The pipe will be so manufactured that joint surfaces are concentric with the inside of the pipe within a tolerance of 3/32 inch. The shape and dimensions of the joint must be such as to provide compliance with the following requirements:

1. The joint must be so dimensioned that when the gasket is placed on the spigot it will not be stretched more than 20% of its original length, or the maximum stretch length that is recommended by the manufacturer, whichever is lower.

2. The space provided for the gasket must be a groove in the spigot end of the pipe and such space, when the joint is made, it cannot be more than 110% of the volume of the gasket.

3. The joint must be designed so that when the outer surface of the spigot and the inner surface of the bell come into contact at some point on the periphery, the diametric deformation in the gasket at the point of contact cannot be greater than 50% of the normal gasket diameter, and the diametric deformation in the gasket at a point opposite the contact point cannot be less than 20% of the normal gasket diameter.

4. When the pipes are joined, there must be parallel surfaces on both the bell and the spigot, extending from the outside edge of the gasket toward the bell face for a distance of not less than 3/4 inch. These parallel surfaces cannot be farther apart than 1/8 inch, when the spigot is centered in the bell. The tapers on these surfaces cannot exceed three degrees.

5. The inside surface of the bell at the end of the bell must be flared to facilitate joining the pipe sections without damaging or displacing the gasket.

**449-5.2 When Rubber Gaskets are Used:** Ensure that the pipe joints have been tested at the plant hydrostatically and shown to meet the requirements of Section 6.2 of the Materials Manual, which is available at the following URL:

<http://www.fdot.gov/programmanagement/Implemented/URLinSpecs/Section62V2.shtm>.

**449-5.3 When Profile Rubber Gaskets are Used:** Ensure the joint design meets the requirements set forth in Article 7 of ASTM C443.

**449-5.4 Tolerances in Imperfections, and Permissible Repairs for Joint of Concrete Gasketed Pipe:** Ensure that all surfaces of near-contact of the jointed pipes are free from air holes, chipped or spalled concrete, laitance, and other such defects.

Pipes showing minor manufacturing imperfections or handling injuries to the bell or spigot may be acceptable if such defects are acceptably repaired as prescribed below.

Individual air holes (trapped air), or spalled areas with a length of up to one-half the pipe radius, or 12 inches whichever is less, may be repaired by careful use of a hand-placed, stiff, pre-shrunk, 1-to-1 mortar of cement and fine sand, and with no additional preparation other than a thorough washing with water of the defect. Curing will be done either by moisture curing under wet burlap or by application of an approved membrane curing compound. Such repaired pipe which is sound, properly finished and cured, and which otherwise conforms to specification requirements will be acceptable.

Exposed reinforcing and minor spalling in the spigot groove may be accepted if repaired in the following manner: The spalled areas will be chipped back to solid concrete. Exposed reinforcing will be cleaned of all laitance and scale. The entire area is to be coated with an approved epoxy at a thickness of 5 to 10 mils. The coating must be smooth and conform to the shape of the groove. The epoxy must be a Type F-1 as specified in Section 926.