

700 MATERIAL DETAILS

Minimum Requirements for Sampling Materials

Material	Specification Section Number	Quantity Represented by Sample	Size of Sample
Concrete cylinders pavement or base	305,451, 452,499	Each day, each 100 cu. yd. (76m ³) or fraction thereof	2 cylinders
Structures	499 & 511	Over 200-ft.(61m) span, each day, each class, each 100 cu. yd.(76m ³) or less. 20-ft.(6m) span and under, each class, each 50 cu. yd.(38m ³) or less	2 cylinders
Hook bolts	ODOT Std. Dwg. BP-2.1	Each 12,000 units or less	2 units

SECTION 701 - HYDRAULIC CEMENT

Replace the last sentence of the general paragraph with the following:

The procedure for this type of acceptance is set forth as follows:

I. Scope

1. This supplement outlines the requirements for certification of hydraulic cements.

2. Cement certification is the approval by the City of Cincinnati to use cements meeting 701.01, 701.02, 701.03, 701.04, 701.05, and 701.06 specifications to projects without being independently sampled and pretested by the City of Cincinnati prior to shipment.

II. Procedure

1. The Contractor shall initiate a request for Certification by:
 - a. Submitting to the City of Cincinnati and/or its authorized agent a letter of certification stating that each type of cement proposed for certification will meet current ASTM specifications for that type of cement.
 1. Each type of cement must have separate approval for certification.
 2. The Contractor shall warrant the City against costs involved in corrective action required due to inclusion in the work of non-specification cement.
 3. The letter of certification shall be signed by a representative of the manufacturer having legal authority to bind the company.
2. The Contractor in requesting certification agrees to:
 - a. Submit to the City of Cincinnati and/or its authorized agent certified mill test data developed over the last year on the type or types of cement for which certification is sought. The data may be waived where the City has data on record on which to base its decision.
 - b. Submit a monthly summary of mill test data by type for cements under certification
 - c. Have the mill laboratory inspected each inspection tour by the Cement and Concrete Reference Laboratory, U. S. Bureau of Standards. A copy of the report and documentation of corrected discrepancies shall be sent to the City of Cincinnati and/or its authorized agent.
 - d. Maintain records of production control tests for a period of five years.
3. The City of Cincinnati will approve the requesting mill for certification of its products, when an acceptable quality history has been compiled, based on the City's data or the data submitted by the mill.
4. Following approval for certification, the cement plant shall:
 - a. Document each shipment of certified cement with the following information:
 1. Certification as to type
 2. Silo No., Shipping Origin
 3. Quantity (tons)
 4. Consignee and Destination
 5. Invoice Numbers
 6. Date shipped

7. One copy of the documentation to accompany shipment and another sent to the City of Cincinnati and/or its authorized agent.
 - b. The cement plant shall furnish the City of Cincinnati and/or its authorized agent access to those parts of the plant engaged in the testing, storage, and shipment of cement produced for City projects.
 - c. The City of Cincinnati and/or its authorized agent will obtain field samples on a frequency of one sample for each 400 tons, with a minimum of one sample per month from each plant furnishing concrete to a City project.
 - d. If any field samples of a given type fail to meet the requirements of the applicable ASTM specification, that type will be removed from the certification procedure. In addition, the City may take action under 105.12 of the Construction and Material Specifications, Removal of Unacceptable and Unauthorized Work.
 - e. Failure to comply with the aforementioned requirements or failure of meeting test standards will result in removal from certification procedure.
 - f. The City of Cincinnati and/or its authorized agent will maintain a current list which will attest the cements which may be accepted by certification for use on City projects.
 - g. Cement shipped after removal from certification shall be sampled, tested and approved before use.
 - h. Procedure for recertification - see 5d below.
5. Certified Partial Plant Inspection Of Cement
 - a. Silos will be sampled and sealed by the City of Cincinnati and/or its authorized agent representative upon request.
 - b. Upon approval of the silo, shipments will be from these pretested lots and shall maintain the following documentation:
 1. Silo Number
 2. Type of Cement
 3. Quantity of cement (tons)
 4. Location of shipping origin
 5. Consignee and Designation
 6. Invoice No.
 7. Signed statement of certification of accuracy of information
 8. One copy of documentation shall be sent to the City of Cincinnati and/or its authorized agent and one copy to accompany the shipment and to be left at the destination for the City of Cincinnati and/or its authorized agent.

- c. Shipments of material from pretested silos will not exceed the tested quantity by more than ten percent.
- d. The City will field-sample cement from noncertified mills at the rate of one sample per shipment for testing in accordance with ASTM C183. Compliance of 3 consecutive field samples within specification will serve as a basis for return to certification.
- e. City of Cincinnati will assume cost of all testing, except cost of recertification under Item (d) above. The cost of recertification will be by the Contractor.

SECTION 703 - AGGREGATE

703.01 General

703.04 Aggregate

703.05 Aggregate for Coarse Aggregate

703.11 Bank Run Gravel

Method of Test. Change Clay Lumps Test to AASHO T112.

703.04 Aggregate for:

- 1. The coarse aggregate for bituminous aggregate base and the coarse and fine aggregates for aggregate base shall be of 100% crushed carbonate stone, 100% crushed washed gravel or 100% crushed air-cooled slag. The fine aggregate for bituminous aggregate base shall be natural sand or sand manufactured from stone, gravel or air-cooled slag. The aggregate for macadam shall be 100% crushed carbonate stone or 100% crushed air-cooled slag.

703.05 Aggregate for:

Coarse Aggregate

- 1. The coarse aggregate shall be 100% crushed carbonate stone, 100% crushed air-cooled slag, or 100% crushed washed gravel.

703.11 Bank Run Gravel. Bank Run Gravel shall consist of sound durable materials containing not more than five percent clay or silt by weight and free from an excessive amount of deleterious material. It shall be well graded from coarse to fine; 100% shall pass a 3-inch sieve (75mm), at least 90% shall pass a 1" (25mm) sieve, not more than 50% pass a 1/4-inch (6mm) sieve, and not more than 10% pass a No. 50 sieve.

SECTION 704 - MASONRY UNITS

704.01 Clay or Shale Brick

- 704.011 **Vitrified Brick**
- 704.02 **Concrete Brick**
- 704.03 **Concrete Masonry Blocks**

704.01 Clay or Shale Brick. ASTM C-32 with the following exceptions:

Size 3. (a). Brick shall be not less than 2-1/8" x 3-1/2 x 7-1/2" (54mm x 89mm x 191mm) , nor more than 2-1/2" x 4" x 8-1/2" (64mm x 102mm x 216mm) in size. They shall be rectangular in cross section, of uniform dimensions throughout, with straight parallel edges and square corners. The use of cored brick or brick having a depression or recess will not be permitted.

Sampling and Testing 5. (a). Random samples shall be selected at the project site. The brick shall be delivered to the job site at least three days prior to their use in the Work. Upon delivery the Contractor shall notify the Laboratory to make the tests, and the brick shall not be used in the Work until the Engineer has been notified that the brick meet Specifications. All brick failing to meet Specifications shall be immediately removed from the project site.

Brick shall be sampled and tested in accordance with ASTM C-67, except that a sample shall consist of 12 full sized brick.

If the Contractor shall designate, in writing, a source of brick supply which shall be the continual source of supply of this item for any particular project, the City will assume the cost of the original qualifying test for each project and of such additional spot checks as may be deemed necessary. However, the cost of any additional tests ordered because of failure of brick samples from previously approved sources; tests required to qualify additional sources of supply on a particular project; and original and subsequent tests for projects for which a source of supply has not been designated by the Contractor, shall be borne by the Contractor.

704.011 Vitrified Brick. When vitrified brick are specified they shall meet the requirements of ASTM C-32, Grade SA, with the exceptions specified in 704.01.

704.02 Concrete Brick. ASTM C-55, Type II, Grade N 11 and S 11, with the following exceptions and additions:

3. Materials. 3.1.1. and 3.1.2. Cement shall conform to 701 portland Cement. 3.2 Aggregate shall conform to the quality requirements of 703.02.

Size. As specified in 704.01.

Sampling and Testing 7. As specified in 704.01, except that brick shall be tested in accordance with ASTM C-140.

704.03 Concrete Masonry Blocks. ASTM C-139, with the following exceptions:

Materials 2. (a) (1) (2) (3) (4) (5), 2, (b). Cement shall be 701 portland Cement.

Materials 2. (c) Aggregate shall conform to the quality requirements of 703.02.

Dimensions and Permissible Variations 4. (a) Units shall be 4" x 5" x 8" (102mm x 127mm x 203mm). They shall be rectangular in cross section, of uniform dimensions throughout, with straight parallel edges and square corners.

Sampling and Testing 5. As specified in 704.01, except that units shall be tested in accordance with ASTM C-140.

SECTION 706 - CONCRETE AND CLAY PIPE

- 706.02 **Reinforced Concrete Pipe**
- 706.04 **Reinforced Concrete Elliptical Culvert, Storm Drain and Sewer Pipe**
- 706.11 **Resilient and Flexible Gasket**
- 706.12 **Resilient and Flexible Joints**
- 706.152 **Reinforced Concrete Pipe with S Stirrups**

706.02 **Reinforced Concrete Pipe.** ASTM C 76 with the following exceptions and additions:

2.1 Applicable Documents. Replace ASTM C 497 Testing Concrete Pipe or Tile with AASHTO T 33.

4.1 Basis of Acceptance. All materials, processes of manufacture and finished pipe shall be subject to inspection and approval by the Department. The manufacturer when so directed by the Laboratory, shall have holes cut in such sections of the finished pipe as needed for inspection.

5.1 Cement. Cement shall be 701 portland Cement.

5.2 Aggregate. Aggregates shall meet the quality requirements of 703.02.

5.4 Steel Reinforcement. Steel shall be 709.08, 709.10, 709.11 or 709.12.

Tables 2 and 3 shall be modified to include the following additional reinforcement areas when steel conforming to 709.11 or 709.12 is used.

TABLE 2

Internal Diameter of Pipe, in.	Wall Thickness in.	Circular Reinforcement, Inner Cage	Deformed sq. in. Outer Cage
36	4	0.09	0.07
42	4-1/2	0.11	0.08
48	5	0.13	0.09
54	5-1/2	0.16	0.12
60	6	0.19	0.14
66	6-1/2	0.21	0.16
72	7	0.23	0.17
78	7-1/2	0.25	0.19
84	8	0.29	0.21
90	8	0.33	0.24
96	8-1/2	0.37	0.26
102	8-1/2	0.41	0.28

TABLE 3

Internal Diameter of Pipe, in.	Wall Thickness in.	Circular Reinforcement, Inner Cage	Deformed sq. in. Outer Cage
36	4	0.12	0.09
42	4-1/2	0.15	0.11
48	5	0.17	0.12
54	5-1/2	0.21	0.16
60	6	0.26	0.20
66	6-1/2	0.30	0.21
72	7	0.35	0.24
78	7-1/2	0.40	0.27
84	8	0.47	0.30
90	8	0.64	0.35
96	8-1/2	0.80	0.40
102	8-1/2	0.96	0.44
108	9	1.07	0.47

Table 5 shall be modified to include the following additional sizes:

TABLE 5 (Modification)

Internal Diameter of Pipe, in.	Wall Thickness in.	Circular Reinforcement, Inner Cage	Deformed sq. in. Outer Cage
6	1-3/4	0.07	--
8	1-3/4	0.07	--
10	1-3/4	0.07	--
54	5-1/2	0.86	0.62
60	6	0.95	0.68

8.3 Lift Holes. Not more than two holes may be cast, drilled or otherwise neatly made in the shell of each piece of pipe for the purpose of handling or laying. The holes shall be tapered unless drilled, and before backfilling the tapered holes shall be filled with portland Cement mortar, or with precast concrete plugs which shall be secured with portland cement mortar. Drilled holes shall be filled with portland Cement mortar.

9.2 Number and Type of Test Required for Various Delivery Schedules. The specified number of pipe for the purpose of test shall be selected at the plant and at random from the lot to be shipped or at the project site from the pipe delivered and shall be pipe which would not otherwise be rejected under these specifications. Pipe shall be tested in accordance with Basis of Acceptance 4.1.1. except the Laboratory may accept pipe 54 in. and larger in diameter in accordance with 4.1.2 and the following requirements:

When pipe from a plant has been approved by the Laboratory for a specified design and pipe from the same plant has wall and steel area not less than the approved pipe.

When it has been established that two or more plants have complied with the above requirements for the class and size under consideration, and the plant under consideration has established compliance with the above requirement for an adjacent size, and the wall and steel area are not less than the pipe tested at the two plants.

9.3.1 External Load Crushing Strength Requirements. The load to produce a 0.01 in. crack and the ultimate load as determined by AASHTO T 33 three-edge bearing method, shall be not less than shown in Tables 1 through 5. The ultimate strength test may be waived when the test load on the pipe reaches 115% of the required 0.01-inch crack D-load without developing a 0.01-inch or larger crack.

9.4.1 Concrete Test Requirements. Compression tests for satisfying the minimum specified concrete strength requirements shall be made from cores drilled from the wall of the pipe. The diameter of the core shall be such that the capped height to diameter or L/D ratio shall lie between one and two. Cores shall be secured, prepared for testing, and tested by methods prescribed in the appropriate sections of AASHTO T 33. The compressive strength of each core tested shall be equal to or greater than the design strength of the concrete. If a core does not meet the required strength, another core from the same pipe may be tested. If this core does not meet the required strength, that pipe shall be rejected. Additional tests shall be made on other pipe to determine the acceptability of the lot. When the cores cut from a section of pipe successfully meet the strength test requirement, the core holes shall be plugged and sealed by the manufacturer in a manner such that the pipe section will meet all of the test requirements of these specifications.

9.4.2 Absorption Test Requirements of Concrete. The absorption of a sample from the wall of the pipe as determined in AASHTO T 33 shall not exceed 9 percent of the dry weight. When the initial absorption specimen from a pipe fails to conform to these requirements, the absorption test shall be made on another specimen from the same pipe and the results of the retest shall be substituted for the original test results. Should the replacement specimen fail to conform to the specified requirements, the manufacturer will be allowed a retest on two additional pipe for each pipe that failed, and the pipe shall be acceptable only when all retest specimens conform to the specified requirement. Retest specimens may be taken from unbroken pipe.

9.4.3 Retests of Pipe Not Meeting the Concrete Test Requirements. Does not apply.

9.5 Test Equipment. Every manufacturer finishing pipe under these specifications shall furnish all facilities and personnel necessary to carry out the specified tests as described in AASHTO T 33.

13. Inspection. Inspection shall be done at the project site. Random samples shall be obtained from material delivered to the project site, or at other locations designated by the Laboratory.

15. Marking. The following information shall be clearly marked on each section of pipe: (a) the pipe class, (b) type of wall to be designated as A, B, or C, wall thicknesses between standard ASTM wall thicknesses shall be marked with the letters of both the thinner and thicker walls, i.e. A/B for wall thicknesses between A wall and B wall, (c) the date of manufacture, (d) the name or trade-mark of the manufacturer including plant location, (e) pipe with elliptical steel reinforcement and quadrant steel reinforcement shall have the center line of the crown and invert impressed inside or outside the pipe at both ends, except where cast lift holes are centered over the crown of the pipe. The center line of the crown of the pipe without lift holes shall be marked on the inside and outside of the pipe with TB, (f) pipe with quadrant steel shall be marked Q. (g) pipe with elliptical reinforcement shall be marked with the letter E and (h) pipe with deformed reinforcement conforming to modified Tables 2 and 3 shall be marked with the letters DF. Marking shall be legible and indented on the pipe section or painted thereon with waterproof paint.

706.04 Reinforced Concrete Elliptical Culvert, Storm Drain and Sewer Pipe. ASTM C 507 with the following exceptions and additions:

2.1 Applicable Documents. Replace ASTM C 497 Testing of Concrete Pipe or Tile with AASHTO T 33

4.1 Classification. Table 706.04-1 includes additional design requirements.

5.1 Basis of Acceptance. All materials, processes of manufacture and finished pipe shall be subject to inspection and Department. The manufacturer when so directed by the Laboratory, shall have holes cut in sections of the finished pipe as needed for inspection.

6.1 Cement. Cement shall be 701 portland Cement.

6.2 Aggregates. Aggregates shall meet quality requirements of 703.02.

6.4 Steel Reinforcement. Steel shall be 709.08, 709.10, 709.11 or 709.12.

7.2 Design Tables. In addition, horizontal elliptical pipe HE-II and HE-III may be manufactured using the design requirements of Table 706.04-1.

7.4 Placement of Reinforcement. In addition, pipe made in accordance with 706.04-1 shall have 3 lines of reinforcement of elliptical shape. The outer and inner lines shall be so placed that the nominal protective covering of the concrete over the reinforcement in the barrel of the pipe shall be 1 inch subject to the variations permitted in Section 10.5, and the third or middle line shall be in contact with and fastened securely to the inner line at the vertical axis of the pipe both top and bottom and to the outer line at the horizontal axis on both sides. The length of the middle line shall be the average of the length of the inner and outer line. The middle line shall be of elliptical shape and run smoothly between the specified points of contact with the inner and outer lines.

9.3 Lift Holes. Not more than two holes may be cast, drilled, or otherwise neatly made in the shell of each piece of pipe for the purpose of handling or laying. The holes shall be tapered unless drilled, and before backfilling the tapered holes shall be filled with portland Cement mortar, or with precast concrete plugs which shall be secured with portland Cement mortar. Drilled holes shall be filled with portland Cement mortar.

10.2 Number and Type of Test Required for Various Delivery Schedules. The specified number of pipe for the purpose of test shall be selected at the plant and at random from the lot to be shipped or at the project site from the pipe delivered and shall be pipe which would not otherwise be rejected under these specifications. Pipe shall be tested in accordance with Basis of Acceptance 4.1.1 except the Laboratory may accept pipe 54 in. and larger in diameter in accordance with 4.1.2 and the following requirements:

When pipe from a plant has been approved by the Laboratory for a specified design, pipe from the same plant with wall and steel area not less than the approved pipe may be approved by means of tests on cores verifying absorption, strength, wall and steel area.

When it has been established that two or more plants have complied with the above requirements for the class and size under consideration and the plant under consideration has established compliance with the above requirements for an adjacent size, and the wall and steel area are not less than the pipe tested at the two plants.

10.3.1 External Load Crushing Strength Requirements. The load to produce a 0.01-inch crack and the ultimate load as determined by AASHTO T 33 three-edge bearing method, shall be not less than shown in Tables 1, 2 and 706.04-1. The ultimate strength test may be waived when the test load on the pipe reaches 115% of the required 0.01-inch crack D-load without developing a 0.01-inch or larger crack.

10.4.1 Concrete Test Requirements. Compression tests for satisfying the minimum specified concrete strength requirement shall be made from cores drilled from the wall of the pipe. The diameter of the core shall be such that the capped height to diameter or L/D ratio shall lie between one and two. Cores shall be secured, prepared for testing, and tested by methods prescribed in the appropriate sections of AASHTO T 33. The compressive strength of each core tested shall be equal to or greater than the design strength of the concrete. If a core does not meet the required strength, another core from the same pipe may be tested. If this core does not meet the required strength, that pipe shall be rejected. Additional tests shall be made on other pipe to determine the acceptability of the lot. When the cores cut from a section of pipe successfully meet the strength test requirement, the core holes shall be plugged and sealed by the manufacturer in a manner such that the pipe section will meet all of the test requirements of these specifications.

10.4.2 Absorption Test Requirements of Concrete. The absorption of a sample from the wall of the pipe, as determined in AASHTO T 33, shall not exceed 9 percent of the dry weight. When the initial absorption specimen from a pipe fails to conform to these specifications, the absorption test shall be made on another specimen from the same pipe and the results of the retest shall be substituted for the original test results. Should the replacement specimen fail to conform to the requirements, the manufacturer will be allowed a retest on two additional pipe for each pipe that failed, and the pipe will be acceptable only when all retest specimens conform to the specified requirements. Retest specimens may be taken from unbroken pipe.

10.5 Test Equipment. Every manufacturer furnishing pipe under these specifications shall furnish all facilities and personnel necessary to carry out the specified tests as described in AASHTO T 33.

14. Inspection. Inspection shall be done at the project site. Random samples shall be obtained from material delivered to the project site, or at other locations designated by the Laboratory.

16. Marking. In addition, the plant location shall be placed on each pipe, and pipe manufactured to design requirements of 706.04-1 shall have the letter "A" following the pipe class. Markings shall be legible and indented in the pipe section or painted thereon with waterproof paint.

TABLE 706.04-I

Design Requirement for Horizontal Elliptical Pipe

Minimum Reinforcement, Sq. In. per Lineal Foot					
Equivalent Round Size Inches	Rise, In. x Span, In.	Minimum Wall Thickness Inches	HE-II 0.01=1000 Ult.=1500	D-Leads	HE-III 0.01=1350 Ult.=2000
78	63 x 98	8	3 lines totaling 0.87		3 lines totaling 1.23
84	68 x 106	8 1/2	3 lines totaling 0.97		3 lines totaling 1.33
90	72 x 113	9	3 lines totaling 1.03		3 lines totaling 1.43
96	77 x 121	9 1/2	3 lines totaling 1.13		3 lines totaling 1.54
102	82 x 128	9 3/4	3 lines totaling 1.23		3 lines totaling 1.70
108	87 x 136	10	3 lines totaling 1.43		3 lines totaling 1.85

NOTE: The test load in pounds per lineal foot equals D load x nominal inside span in feet.
Concrete strength = 5000 psi

706.11 Resilient and Flexible Gasket. For concrete pipe ASTM C-443, except that only "O"-Ring and "Tylox CR" gaskets are acceptable.

706.12 Resilient and Flexible Joints. For vitrified clay pipe ASTM C-425, Type I or Type III joints.

706.152 Reinforced Concrete Pipe with S Stirrups. ASTM C 76, with the following exceptions:

- 1. **Scope.** This pipe shall be circular with circular reinforcement and S stirrups.
- 3. **Classification.** The pipe shall be Class IV and Class V.

4.1 Basis of Acceptance. All materials, all cages, processes of manufacture and finished pipe shall be subject to inspection and approval by the department. The manufacturer when so directed by the Laboratory, shall have holes cut in such sections of the finished pipe as needed for inspection of the quantity and placement of the reinforcement.

5.1 Cement. Cement shall be 701 portland Cement.

5.2 Aggregate. Aggregates shall meet quality requirements of 703.02.

5.4 Steel Reinforcement. Steel shall be 709.08, 709.10, 709.11 or 709.12. Each line of S stirrups shall have a continuous S shape extending longitudinally from end to end of the pipe. Not more than three lengths of S material may be used in a line and the minimum length of a section of S stirrups shall be 30 inches.

6.3 Placement of Reinforcement. In addition, S stirrups shall pass around and be in contact with each inside circumferential member of the inner cage. Each line of S stirrups shall lie essentially in a plane passing through the longitudinal axis of the pipe.

The requirements for circular reinforcement in Table 706.15-1 and 706.15-2 may be met by the use of quadrant steel reinforcement. The reinforcement shall be the amount required for the size and class of pipe specified.

6.5 Laps, Welds and Spacing. Replace the fifth sentence of paragraph 6.5 ASTM C 76 with: The spacing center to center of adjacent inner rings of circumferential reinforcement in a cage shall be not more than two inches; the spacing center to center of adjacent outer rings of circumferential reinforcement in a cage shall not exceed four inches for pipe up to and including pipe having a four inch wall thickness nor exceed wall thicknesses for larger pipe and shall in no case exceed six inches.

8.3 Lift Holes. Not more than two holes may be cast, drilled, or otherwise neatly made in the shell of each piece of pipe for the purpose of handling or laying. Cast holes shall be centered over one of the auxiliary support centerlines. The holes shall be tapered unless drilled, and before backfilling the tapered holes shall be filled with portland Cement mortar, or with precast concrete plugs which shall be secured with portland Cement mortar. Drilled holes shall be filled with portland Cement mortar.

9.2 Number and Type of Test Required for Various Delivery Schedules. The specified number of pipe for the purpose of test shall be selected at the plant and at random from the lot to be shipped or at the project site from the pipe delivered and shall be pipe which would not otherwise be rejected under these specifications. Pipe shall be tested in accordance with Basis of Acceptance 4.1.1 except the Laboratory may accept pipe 54 inches and larger in diameter in accordance with 4.1.2 and the following requirements:

When pipe from a plant has been approved by the Laboratory for a specified design, and pipe from the same plant has wall and steel area not less than the approved pipe.

When it has been established that two or more plants have complied with the above requirements for the class and size under consideration and the plant under consideration has established compliance with the above requirements for an adjacent size, and the wall and steel area are not less than the pipe tested at the two plants.

9.3.1 External Load Crushing Strength Requirements. The load to produce a 0.01 in. crack and the ultimate load as determined by AASHTO T 33 three-edge bearing method, shall be not less than shown in Tables 706.15-1 and 706.15-2. The ultimate strength test may be waived when the test load on the pipe reaches 115% of the required 0.01-inch crack D-load without developing a 0.01-inch or larger crack.

9.4.1 Concrete Test Requirements. Compression tests for satisfying the minimum specified concrete strength requirement shall be made from cores drilled from the wall of the pipe. The diameter of the core shall be such that the capped height to diameter or L/D ratio shall lie between one and two. Cores shall be secured, prepared for testing, and tested by methods prescribed in the appropriate sections of AASHTO T 33. The compressive strength of each core tested shall be equal to or greater than the design strength of the concrete. If a core does not meet the required strength, another core from the same pipe may be tested. If this core does not meet the required strength, that pipe shall be rejected. Additional tests shall be made on other pipe to determine the acceptability of the lot. When the cores cut from a section of pipe successfully meet the strength test requirement, the core holes shall be plugged and sealed by the manufacturer in a manner such that the pipe section will meet all of the test requirements of these specifications.

determine the acceptability of the lot. When the cores cut from a section of pipe successfully meet the strength test requirement, the core holes shall be plugged and sealed by the manufacturer in a manner such that the pipe section will meet all of the test requirements of these specifications.

9.4.2 Absorption Test Requirement of Concrete. The absorption of a sample from the wall of the pipe, as determined in AASHTO T 33, shall not exceed 9 percent of the dry weight. When the initial absorption specimen from a pipe fails to conform to these specifications, the absorption test shall be made on another specimen from the same pipe and the results of the retest shall be substituted for the original test results. Should the replacement specimen fail to conform to the specified requirements, the manufacturer will be allowed a retest on two additional pipe for each pipe that failed, and the pipe shall be acceptable only when all retest specimens conform to the specified requirement. Retest specimens may be taken from unbroken pipe.

9.4.3 Retests of Pipe Not Meeting the Concrete Test Requirements. Does not apply.

9.5 Test Equipment. Every manufacturer furnishing pipe under these specifications shall furnish all facilities and personnel necessary to carry out the specified tests as described in AASHTO T 33.

10.5.2 Area. This paragraph shall not apply.

13. Inspection. Inspection shall be done at the project site. Random samples shall be obtained from material delivered to the project site, or at the locations designated by the Laboratory.

15. Marking. The following information shall be clearly marked on each section of pipe: (a) the pipe class, (b) type of wall to be designated B for ASTM B walls or A/B for wall thicknesses between standard ASTM A and B wall thicknesses, (c) the following symbol S, (d) the date of manufacture, (e) the name or trade-mark of the manufacturer including plant location, (f) the center lines of the "S" stirrup systems shall be impressed inside the pipe at both ends, except where cast lift holes are centered over one of the "S" stirrup center lines. The center line of the crown of the pipe without lift holes shall be marked on the inside and outside of the pipe with TB and (g) pipe with quadrant steel shall be marked Q.

Marking shall be legible and indented in the pipe section or painted thereon with waterproof paint.

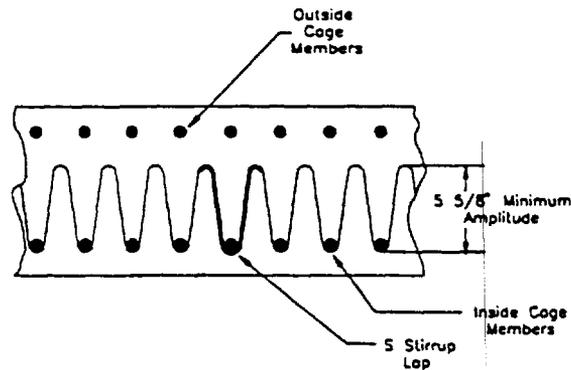
Table 706.15-1 CLASS IV D-load to produce a 0.01 inch crack, 2000 D-load to produce the ultimate load, 3000 Minimum Design Requirements Concrete Strength 5000 psi								
		Circular Reinforcement		S Stirrups				
Internal Diameter of Pipe Inches	Minimum Wall Thickness Inches	Inner Cage Sq. In./Ft. of Pipe	Outer Cage Sq. In./Ft. of Pipe	Minimum Area Per Support Element Sq. In.	Number of Lines *	Longitudinal Spacing Inches	Circum-ferential Spacing on Inner Cage Inches	Minimum Amplitude of Stirrups Inches **
78	7 1/2	0.69	0.52	0.029	11	2	4 1/8	4 5/8
84	8	0.74	0.56	0.029	11	2	4 5/8	5 1/8
90	8	0.85	0.63	0.031	11	2	4 5/8	5 1/8
96	8 1/2	0.91	0.69	0.034	11	2	5 1/8	5 5/8
102	8 1/2	1.02	0.77	0.041	11	2	5 1/8	5 5/8
108	9	1.07	0.80	0.045	11	2	5 5/8	6 1/8

- * Number of lines in the table indicates the number of longitudinal lines required in each top and bottom portion of the pipe. The area of each support element in a pipe is two times the cross-sectional area of the S stirrups wire used. There shall be an equal number of these lines of S stirrups on either side of the mid-point of both the top and bottom of the pipe. See Fig. 1.
- ** Amplitude is the overall width of the line of stirrups.

Table 706.15-2 CLASS V D-load to produce a 0.01 inch crack, 3000 D-load to produce the ultimate load, 3750 Minimum Design Requirements Concrete Strength 5000 psi								
		Circular Reinforcement		S Stirrups				
Internal Diameter of Pipe Inches	Minimum Wall Thickness Inches	Inner Cage Sq. In./Ft. of Pipe	Outer Cage Sq. In./Ft. of Pipe	Minimum Area Per Support Element Sq. In.	Number of Lines *	Longitudinal Spacing Inches	Circum-ferential Spacing on Inner Cage Inches	Minimum Amplitude of Stirrups Inches **
54	5 1/2	0.64	0.48	0.029	15	2	2 1/8	
60	6	0.70	0.53	0.029	14	2	2 5/8	
66	6 1/2	0.79	0.59	0.029	13	2	3 1/8	3 5/8
72	7	0.87	0.66	0.029	12	2	3 5/8	4 1/8
78	7 1/2	0.92	0.69	0.031	11	2	4 1/8	4 5/8
84	8	0.99	0.74	0.034	11	22	4 5/8	5 1/8
90	8	1.13	0.85	0.041	11	2	4 5/8	5 1/8
90	8 1/2	1.20	0.90	0.045	11	2	5 1/8	5 5/8
102	8 1/2	1.34	1.00	0.053	11	2	5 1/8	5 5/8
	9	1.51	1.13	0.063	11		5 5/8	6 1/8

- * Refer to footnote for Table 706.15-1.
- ** Refer to footnote for Table 706.15-1.

FIG. 1-B
ENLARGED SECTION OF PIPE
WALL



NOTE: The "S" stirrups shall extend from the inner cage toward the outer surface of the pipe for a distance not less than the minimum amplitude. Where more than one length of stirrup material is used per line, a lap around one circumferential member of the inner cage shall be made. The ends of "S" shaped stirrups at splices shall include an outer bend.

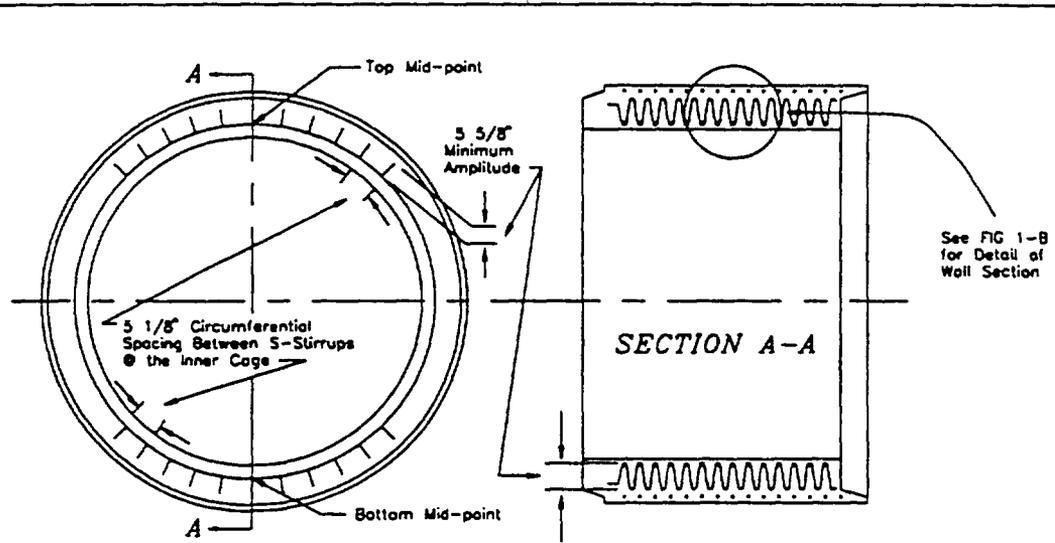


FIG 1

Illustrative Example of S-Stirrup System for Class V, 102" Dia. Pipe
Minimum Area per Support 0.053 Sq. In., 11 Lines spaced @ 5 1/8"
For Other Classes and Sizes See Tables 706.15 - 1 & 2

SECTION 707 - STEEL, ALUMINUM AND PLASTIC PIPE

707.01 Metallic Coated Corrugated Steel Conduits and Underdrains

707.02 Metallic Coated Corrugated Steel Conduits (1-inch Corrugations)

707.171 Plastic Pipe

707.18 Cast Iron Pipe

707.19 Plastic Pipe

707.20 Ductile Iron Pipe

707.01 Metallic Coated Corrugated Steel Conduits and Underdrains. The following sentence shall be added to this section.

When aluminum coated corrugated steel conduits and underdrains are specified, they shall conform to AASHTO M36-801 with addition.

707.02 Metallic Coated Corrugated Steel Conduits (1-inch Corrugations). The following sentence shall be added to this section:

When aluminum coated corrugated steel conduits and underdrains are specified, they shall conform to AASHTO M36-801 with additions.

707.171 Plastic Pipe.

Both PVC and ABS pipe shall have ASTM D-3212 joints flexible elastomeric seals, or solvent welded joints using ASTM D-2855. To be used only if cover is 35' (10m) or less. To be used only if cover is 35' (10m) or less.

Acrylonitrile-Butadiene-Styrene (ABS) sewer pipe and fittings; ASTM D-2751 latest edition.

Type PSM Poly Vinyl Chloride (PVC) sewer pipe and fittings; ASTM D-3034 latest edition.

Minimum requirements of either PVC or ABS shall be Standard Dimension Ratio (SDR) of 35.

707.18 Cast Iron Pipe. Cast iron pipe, fittings and joints for sewers shall conform to AWWA Specifications C-102, C-106, C-108, C-110 and C-111.

707.19 Plastic Pipe. PVC composite piping shall have ASTM D-3212 joints, flexible elastomeric seals or solvent welded joints using ASTM D-2855.

Poly Vinyl Chloride (PVC) composite sewer pipe and fittings; ASTM D-2680 latest edition.

707.20 Ductile Iron Pipe. Ductile iron pipe, fittings and joints for sewers shall conform to AWWA Specification C-151.