

SECTION 706 - CONCRETE, CLAY AND PLASTIC (PVC) PIPE

706.01 (Unassigned)

706.02 Reinforced Concrete Pipe (RCP).

(A) RCP for Drainage System. This pipe shall conform to AASHTO M 170 for the specified diameters and strength class and below.

The acceptance shall be on the:

(1) Plant Load Bearing Test,

(2) Material Test, and

(3) Inspection of Manufactured Pipe for Visual Defects and Imperfections.

The three-edged bearing tests shall be for the load to produce 0.01-inch crack of the pipe or as ordered by the Engineer. Each manufacturer furnishing pipe shall furnish the facilities and personnel to carry out the test described in AASHTO T 33. Besides the required markings, the pipe manufacturer shall also identify the project and inspection lot designation on each section of the pipe.

If specified, the Contractor shall furnish elliptical pipe. Pipe wall design and use of elliptical reinforcement in circular pipe are optional.

Precast reinforced concrete end sections shall conform to the above requirements.

Collars shall be of reinforced concrete. The Contractor shall design the collar so that the collared joint shall be of equal strength as the pipe. Collars shall be at least eight (8) inches wide. The annular space between the outer portion of the pipe and the inner portion of the collar is approximately three-quarters (3/4) inch.

(B) RCP for Sewer System. This pipe shall conform to ASTM C 76 and below:

(1) General.

(a) The Contractor shall furnish the pipes in nominal lengths of eight (8) or twelve (12) feet. The Contractor may require other lengths to meet special conditions. Pipes entering or leaving manholes shall have a maximum length of twenty-four (24) inches.

(b) Concrete shall conform to Subsection 625.02 - Materials for fine aggregate and admixture. Maximum size of coarse aggregate shall be less than half (1/2) the wall thickness and less than half (1/2) of the theoretical clear distance between adjacent coils of circumferential reinforcing steel.

(c) Minimum concrete cover over circular or elliptical reinforcement shall be nominal one (1) inch.

(d) Forms for molding the walls of the pipe shall be circular throughout their full length and rigid to prevent distortion during subsequent operations. Forms may be of seamless or jointed construction designed so that the Contractor may remove the forms without damage to the surface of the pipe. Abutting edges shall be sufficiently tight to prevent leakage.

The Contractor shall form the pipe ends by rigid rings that mold the pipe within the tolerances required. The Contractor may wet, oil, or wax the forms to prevent bonding of the concrete to the form and to aid in the formation of smooth surfaces.

(e) Pipes may be cast vertically or centrifugally.

1. The Contractor shall cast the vertical cast pipes in vertical steel or metallic forms so that the Contractor shall hold the inner and outer forms in a circular and concentric position. The Contractor shall compact the concrete with the aid of high frequency external vibrations. The Contractor shall vibrate the concrete continuously during placing of each batch. The Contractor shall place the concrete so that the consolidated mixture is dense and interior surface even, smooth and hard.

2. The Contractor shall spin the centrifugal cast pipe in horizontally rotating cylindrical metal form. The Contractor shall cast the pipe centrifugally in one (1) operation without cement mortar lining.

The Contractor shall place the concrete in the mold in a continuous and uniform rate. The Contractor shall revolve the pipe form at speeds that shall insure thorough compaction of the concrete. The Contractor shall bring a thin layer of mortar up to form an even, smooth, hard finish on the interior surface of the pipe.

(f) The Contractor shall cure the pipe by steam, water or a combination of steam and water or as ordered. The Contractor shall continue curing for a sufficient length of time until the Contractor gets the specified twenty-eight (28) day strength of the concrete. The Contractor shall provide adequate space and facilities for proper curing.

1. For the centrifugal cast pipe and after spinning, the Contractor shall enclose the mold containing the pipe suitably and subject the mold to the action of saturated steam. The Contractor shall not remove the forms until the Contractor has steam cure the pipe for six (6) hours or water cure the pipe for thirty-two (32) hours.

The Contractor shall then continue curing until a companionate test cylinder reaches the design strength.

2. For the vertical cast pipes and within three (3) hours after the Contractor fills the forms with concrete, the Contractor shall apply steam to the space within the inner form. The Contractor shall not remove the forms until the Contractor has steam cured the pipe for six (6) hours. The Contractor shall continue curing until a companionate test cylinder reaches the design strength. The Contractor may tip and store the pipes horizontally after the concrete has reached a comprehensive strength of two thousand (2,000) pounds per square inch.

(g) Each pipe shall have a minimum of six (6) longitudinal reinforcing bars. The Contractor shall compute the required area of the bars as follows:

1. Each pipe shall have a minimum longitudinal steel reinforcement equivalent in area to half (1/2) inch round bars spaced at thirty (30) inches center to center measured along the circumference of the pipe; or

2. Nominal length pipe of eight (8) feet shall have a minimum of six (6) quarter (1/4) inch round bars or its equivalent steel area; or

3. Nominal length pipe of twelve (12) feet shall have a minimum of six (6) three-eighths (3/8) inch round bars or its equivalent steel area; or

The more stringent steel area requirement of the preceding shall govern. The Contractor shall space the Longitudinal reinforcement approximately uniformly around the circumference.

(h) The pipe bell and the spigot each contain circumferential and longitudinal reinforcement equal to that within the pipe barrel.

(2) Joints. Joints shall be reinforced concrete bell and spigot design using round rubber gaskets for sealing. The Contractor shall enlarge the concrete bell. The spigot shall be of nominal wall thickness. The Engineer will not permit flush bell and spigot joints for pipe sizes smaller than sixty (60) inches in diameter.

The Contractor shall design and make the joint so that when the Contractor lays the pipe, the joint is self-centering and the gaskets do not support the weight of the pipe. When the Contractor completes the joint, the Contractor shall enclose the gaskets on four (4) sides. The Contractor shall keep the joint tight under normal conditions of service including expansion, contraction and normal earth settlement.

The Contractor shall form the spigot surfaces of the pipe and the reinforced concrete bell accurately to provide closely fitting joints. The tolerance between the theoretical diameters and actual diameters of the contact surfaces shall be such that the clearance shall not exceed one-sixteenth (1/16) inch. The Contractor shall ground the inner surface of the reinforced concrete bell.

The Contractor shall contain the rubber gaskets fully. The Contractor shall design and locate and form the joints accurately on each pipe section so that when the Contractor completes the joint, the Contractor restrains the gasket on four (4) sides and effects a water-tight seal.

The Contractor shall seal the joint with a continuous rubber ring gasket of such size and cross section as to completely fill the recess provided for the joint. The rubber gaskets shall conform to ASTM C 361.

The Contractor shall store the rubber in a cool, well ventilated place. The Contractor shall not expose the rubber to the direct rays of the sun.

The Contractor shall submit a certified copy of the laboratory test results for the gasket showing that the gasket conforms to ASTM C 361.

-- If required, the Contractor shall submit test results showing the physical properties of the materials used in the manufacture of the gaskets.

(3) Precast Pipe Fittings

(a) The Contractor shall make fittings from cast concrete pipe sections. The Contractor shall provide a minimum of twelve (12) five-eighths (5/8) inch longitudinal bars, or its equivalent, in pipes cast for fittings. The Contractor shall lap weld the longitudinal bars to a minimum of four (4) inches when spliced.

(b) Bends shall be miter bends. The maximum angle of bevel shall be twenty-two and a half (22-1/2) degrees. The radius as measured to the centerline of the bend shall be four (4) times the diameter of the pipe.

(c) Fittings shall conform to the applicable portions of the pipe specifications.

706.03 (Unassigned)

706.04 (Unassigned)

706.05 (Unassigned)

706.06 (Unassigned)

706.07 (Unassigned)

706.08 **Vitrified Clay Pipe (VCP) and Fittings for Sewer System.**

(A) **General.** VCP and fittings shall be extra strength, first quality, durable, sound, and properly fired throughout its entire thickness.

(B) **Manufacturing Requirements.**

(1) **Identification Marks.** The Contractor shall mark the pipe and fittings clearly with the name or trademark of the manufacturer, the batch number, the location of plant and extra strength designation.

(2) **Shape.** Pipe ends shall be square with the longitudinal axis, and sockets shall be true, circular and concentric with the barrel of the pipe.

The pipe shall be the socket and spigot type.

The Contractor shall form the ends of the pipe so that when the Contractor lays the pipes together and the joints made, the joints shall constitute a continuous and uniform line of pipe and shall have a smooth and regular interior surface.

(3) **Lengths.** The length of straight pipes shall be more than two (2) feet. For special purposes, the Contractor may furnish shorter lengths if accepted by the Engineer.

The Contractor shall make the fittings to such lengths as will accommodate the jointing system provided. The Contractor shall furnish wye fittings with spurs of the size specified, securely and completely fastened to the barrel of the fitting in the process of manufacture. The spur of the wye fittings shall have their axis at angles of approximately sixty (60) degrees or forty-five (45) degrees to the longitudinal axis of the fitting, measured from the socket or bell end of the fitting. The barrel of each spur shall be of sufficient length to permit making a proper joint.

(4) **Dimensions and Tolerances.** The dimensions for VCP shall be as provided in Table 706-I.

TABLE 706-I - DIMENSIONS OF VITRIFIED CLAY PIPE			
Nominal Size, * Inches	Laying Length Limit of Minus Variation Inches/Foot	Difference in Length Two Opposite Sides Maximum, Inches	Limit of Minus Variations from Nominal Size in Average Inside Diameter, Inches
3	1/4	5/16	3/16
4	1/4	5/16	3/16
6	1/4	3/8	1/4
8	1/4	7/16	5/16
10	1/4	7/16	3/8
12	1/4	7/16	7/16
15	1/4	1/2	9/16
18	1/4	1/2	11/16
21	1/4	9/16	13/16
24	3/8	9/16	15/16
27	3/8	5/8	1-1/16
30	3/8	5/8	1-3/16
33	3/8	5/8	1-5/16
36	3/8	11/16	1-7/16
39	3/8	3/4	1-7/16
42	3/8	7/8	1-7/16

* Specifiers should be aware that the pipe sizes are not universally available.

(5) **Imperfection.** Pipes and fittings shall be free from imperfections such as injurious cracks, checks, blisters, or broken extremities. The Engineer will consider and may reject the following imperfections in a pipe or fitting:

(a) No fractures or cracks shall pass through the barrel or socket. The Engineer may permit a single:

1. crack at the spigot end of the pipe not exceeding seventy-five (75) percent of the depth of the socket or

2. fracture in the socket not exceeding three (3) inches around the circumference nor two (2) inches lengthwise.

Chips or fractures on the inner portion of the pipe shall not exceed:

1. two (2) inches in length, *
2. one (1) inch in width, and *
3. quarter (1/4) thickness of the barrel in depth. *

(b) Lumps, blisters, pits, or flakes on the interior surface.

Pipe of nominal sizes from three (3) to eighteen (18) inches shall have no blister with a dimension exceeding three (3) inches. No blister or pimple shall project more than one-eighth (1/8) inch above the surface of the pipe. *

Pipe of nominal sizes over eighteen (18) inches shall have no blister exceeding two (2) inches/foot of internal diameter. No blister or pimple shall project above the surface of the pipe more than one-eighth (1/8) inches/foot of internal diameter. |

Pipe shall have no broken blisters. |

(c) When the spigot or socket of the pipe varies from a true circle more than three (3) percent of its nominal diameter.

(d) When a pipe or fitting, designated to be straight, exhibits a deviation from a straight line of more than one-sixteenth (1/16) inch per linear foot. The Contractor shall measure the deviation from a straightedge on the concave side of the pipe. *

(e) Pieces broken from the socket or spigot end of the pipe or fitting. |

(f) When the dimensions exceed the permissible variations shown in Table 706-I. |

(g) Tramp clays, grog, or other foreign matter that have fused permanently to the exterior or interior surface of the pipe or fittings.

(6) Caps and Branches. The Contractor shall furnish caps with branch pipes and stubs that the Contractor will leave unconnected. Caps shall be polyethylene, polypropylene, polyurethane, polyvinyl chloride, ozone resistant synthetic rubber, clay discs or of other material accepted by the Engineer. *

The manufacturer shall furnish branches with the spurs of the sizes specified, securely and completely fastened to the barrel of the pipe. The Contractor shall use fastening material such as epoxy resin or other accepted material of strength equal to the strength *

of the material of the pipe. Y-branches shall have their axis approximately forty-five (45) degrees from the longitudinal axis of the pipe measured from the socket end. The branches shall terminate in sockets and the barrel of the branch shall be of sufficient length to permit making a proper joint when the Contractor inserts the connecting pipe in the branch socket. *

(7) Hydrostatic Pressure and Loading Test.

(a) General. Before the Contractor uses the pipe, the pipe shall conform to the hydrostatic pressure test and the loading test. An accepted testing laboratory shall make these tests. *

(b) Selection of Test Specimens. The Engineer will select at random and test half (1/2) percent the number of pipes of each size furnished. The laboratory shall test more than two (2) specimens. *

The specimens selected for testing purposes shall be sound pipe having dimensions consistent with the contract.

The Contractor shall furnish the test pipes without charge and bear the costs involved in testing.

(c) Acceptance or Rejection on Results of Tests. If the specimens meet the requirements of the tests, the Engineer will consider the pipes in the lot, shipment or delivery corresponding to the sizes and classes complying with the test. *

If ten (10) percent or less of the specimens fail to meet the tests when the number tested is less than ten (10), then the Contractor may make a second selection of pipe for that test. The number of pipe tested in the second selection of pipe will be five (5) each pipe of the first selection that failed to meet the requirements. *

If ninety (90) percent or more of the pipe including those first tested meet the test, the Engineer will consider the pipes in the lot, shipment, or delivery corresponding to the sizes and classes as complying with that test. *

Otherwise, the Engineer will reject the pipes of these sizes and classes. *

(d) Hydrostatic Test. The Contractor shall apply the hydrostatic pressure test to the pipes in each size and class of pipe. The Contractor shall seal the ends of the pipe by wood, metal, or rubber bulkheads so that no leakage in this area at test pressures occurs. When subjected to an internal hydrostatic pressure of ten (10) pounds per square inch for the

time shown in Table 706-II, the Contractor shall not allow *
leakage on the exterior of the pipe. The Contractor shall not *
consider moisture appearing on the surface of the pipe in the *
form of beads adhering to the surface leakage. The Contractor *
shall construe moisture that starts to run on the pipe as *
leakage regardless of quantity. *

TABLE 706-II - TESTING TIME FOR HYDROSTATIC TEST	
Thickness of Barrel (Inches)	Testing Time (Minutes)
Up to and including 1	7
Over 1, and including 1-1/2	9
Over 1-1/2, and including 2	12
Over 2, and including 2-1/2	15
Over 2-1/2, and including 3	18
Over 3	21

(e) **Loading Tests.** The loading test shall be a "Three-Edge *
Bearing test". The loading test shall conform to ASTM C 301. *
The Contractor shall apply the loading test to the specimens *
selected for testing. *

Pipe shall withstand the loads, each for its respective *
size and class and for the type of test imposed as shown in *
Table 706-III. |

TABLE 706-III - EXTRA STRENGTH PIPE MINIMUM TEST LOADS Pounds per Linear Foot					
Size Inch	3-Edge Bearing Test Strength	Size Inch	3-Edge Bearing Test Strength	Size Inch	3-Edge Bearing Test Strength
6	2000	18	3300	33	3300
8	2200	21	3850	36	3850
10	2400	24	4400	49	4400
12	2600	27	4700	42	4700
15	2900	30	5000		

(C) **Vitrified Clay Sewer Pipe Joints.** The Contractor shall use the mechanical compression joints of the types listed below. *

(1) **Type "B" joints (Polyurethane).** Type "B" joints shall contain two (2) sealing components. One component shall bond to the outer portion of the spigot and the other component shall bond to the inner portion of the bell. The sealing components shall be polyurethane elastomer. The Contractor shall bond the sealing components to pipes and fittings at the pipe factory and cure the sealing components to a uniform hardness and compressibility. The Contractor shall shape, size, bond, and cure the sealing components to form a tight, dense, and homogeneous compression coupling when the Contractor assembles the joint. Imperfection in the sealing components shall be cause for rejection. *

Type "B" joints shall conform to ASTM C 425. |

(2) **Compression Couplings for Plain-End Pipe.** Couplings for plain-end pipes includes a rubber sleeve coupling with shear ring attached to the ends of plain-end pipe and clamped with stainless steel compression bands. Compression couplings for plain-end pipe shall conform to ASTM C 425. |

706.09 PVC Pipe for Sewer System. |

(A) **General.** PVC pipe and fittings shall conform to ASTM D 3034 and below. |

Minimum wall thickness and Standard Dimension Ratio (SDR) shall be thirty-five (35). The Contractor shall use the pipe for agricultural, residential and apartment zoned areas and in sizes from six (6) inches to twelve (12) inches in diameter and only where a soils report shows the soil types met at the site with a Plasticity Index (P.I.) up to twenty-two (22). |

The Contractor shall require special bedding design or installation of vitrified clay pipe under the following conditions: *

(1) In soils with a P.I. greater than twenty-two (22). |

(2) In areas where a planned future facility would require an excavation to the same or greater depth and within two (2) feet of the sewer trench. |

(3) When the depth of cover over the pipe exceeds thirty (30) feet. |

The Contractor shall make the pipe of PVC having a cell classification of 12454-B, 13364-A, or 13364-B according to ASTM D1784. The Contractor shall make the fitting of PVC having a cell classification of 12454-B, 12454-C, or 13343-C. The manufacturer shall prequalify the *

PVC compounds of other cell classifications. Additives and fillers including stabilizers, antioxidants, lubricants, and colorants shall not exceed ten (10) parts by weight per one hundred (100) of PVC resin in the compound.

(B) Manufacturing Requirements.

(1) **Identification Marks.** The Contractor shall mark the pipe, fittings and couplings clearly at an interval not to exceed five (5) feet as follows:

- (a) Manufacturer's name or trademark and code (plant, shift, and date designations).
- (b) Nominal pipe diameter.
- (c) PVC cell classification.
- (d) Type PSM SDR-35.
- (e) ASTM designation - D3034.

The Contractor does not require SDR designation for fittings and couplings.

(2) **Shape.** Pipe ends shall be square with the longitudinal axis. Sockets shall be true, circular and concentric with the barrel of the pipe.

The Contractor shall form the ends of the pipe so that when the Contractor lays the pipes together and the joints made, the joints shall constitute a continuous and uniform line of pipe and shall have a smooth and regular interior surface.

(3) **Length.** The length of straight pipes shall be more than twelve and a half (12-1/2) feet. The Contractor may furnish shorter lengths for special purposes.

(4) Dimensions and Tolerances.

Table 706-IV - PIPE DIMENSION (Inches)				
Nominal Size	Average O. D.	Tolerance on Average	Minimum Wall Thickness	Approx. Wt./Ft. (lbs.)
6	6.275	+0.011	0.180	2.33
8	8.400	+0.012	0.240	4.07
10	10.500	+0.015	0.300	6.37
12	12.500	+0.018	0.360	9.06

(5) **Imperfections.** Pipes and fittings shall be free from imperfections such as injurious cracks, checks, blisters, and broken extremities. The Engineer will consider the following imperfections in a pipe or fitting injurious and cause for rejection:

(a) Cracks in the barrel or bell of the pipe extending through the entire thickness.

(b) Cracks that extends through one-fifth ($1/5$) or more of the barrel or bell thickness and is over three (3) inches long.

(c) Crack that is more than one thirty-secondth ($1/32$) inch wide at its widest point.

(d) Lumps, blisters, pits, or flakes on the interior surface.

(e) When the spigot or bell of the pipe varies from a true circle more than three (3) percent of its nominal diameter.

(f) When a pipe or fitting, designated to be straight, exhibits a deviation from a straight line of more than one-sixteenth ($1/16$) inch per linear foot. The Contractor shall measure the deviation from a straightedge on the concave side of the pipe.

(g) Pieces broken from the socket or bell end of the pipe or fitting.

(h) When the dimensions exceed the permissible variations shown in the table above.

(i) Foreign matter that has fused permanently to the exterior or interior surface of the pipe or fitting.

(6) **Tests.**

(a) **General.** Before using the pipe, the pipe shall meet the test below. An accepted testing laboratory shall make these tests.

(b) **Selection of Test Pipe.** The Engineer shall select one (1) test pipe at random from each one thousand two hundred (1200) linear feet or fraction of each size of pipe delivered to the job site. The Engineer shall select at least one (1) test pipe per lot. The contract defines a lot as pipe having the same identification marking.

The specimens selected for testing shall be sound pipe having dimensions consistent with the contract. The length of specimen for each selected pipe shall be a minimum of eight (8) feet.

The Contractor shall furnish the test pipes without charge. The Contractor shall bear the costs involved in testing.

(c) Acceptance. The basis for acceptance shall be the inspection of pipe, fittings and couplings and the tests specified in the contract. At the time of manufacture, the Contractor shall inspect each lot of pipe and fittings for defects. The Contractor shall test each lot of pipe and fittings for impact, stiffness and flattening according to ASTM D 3034. The Engineer may require certification by the manufacturer stating that the test results comply with contract requirements. When the Contractor delivers the pipe to the job site, the Engineer may require the Contractor to provide additional testing to insure the quality of the pipe at no cost to the State.

The Contractor shall not use pipes that the Contractor does not install within one hundred twenty (120) days of the latest factory test without prior acceptance of the Engineer.

(d) Pipe Flattening. No evidence of splitting, cracking or breaking shall occur when the Contractor tests the pipe as follows:

1. The Contractor shall flatten specimen of pipe until the distance between the plates is forty (40) percent of the outside diameter of the pipe. The pipe shall be equal in length to the nominal outside diameter but not less than six (6) inches long between parallel plates in a suitable press.

2. The rate of loading shall be uniform so that the Contractor completes the compression within two (2) to five (5) minutes.

3. The Contractor shall conduct the test at standard laboratory atmosphere of 73.4 degrees Fahrenheit \pm 3.6 degrees Fahrenheit and fifty (50) \pm five (5) percent relative humidity.

(e) Impact Resistance. The Contractor shall subject the pipe (6 inch long section) to impact from a free falling tup (20 pounds Tup A) according to ASTM D 2444. No shattering or splitting shall be evident when the Contractor impacts the following energy:

Nominal Size (Inches)	Ft. - lb. of Energy
6	210
8	210
10	220
12	220

The Contractor shall conduct the test at standard laboratory atmosphere of 73.4 degrees Fahrenheit \pm 3.6 degrees Fahrenheit and fifty (50) percent \pm five (5) percent relative humidity.

(f) **Pipe Stiffness.** Minimum pipe stiffness (F/AY) at five (5) percent deflection shall be forty-six (46) when calculated according to ASTM D 2412. The Contractor shall conduct the test at standard laboratory atmosphere of 73.4 degrees Fahrenheit \pm 3.6 degrees Fahrenheit and fifty (50) percent \pm five (5) percent relative humidity.

(g) **Joint Tightness.** The Contractor shall join the two (2) sections of pipe together according to the manufacturer's recommendations. Upon subjection to an internal hydrostatic pressure of twenty-five (25) pounds per square inch for one (1) hour, the joint shall show no evidence of leakage.

The Contractor shall conduct the test at standard laboratory atmosphere of 73.4 degrees Fahrenheit \pm 3.6 degrees Fahrenheit and fifty (50) percent \pm five (5) percent relative humidity.

(h) **Acetone Immersion Test.** After two (2) hours immersed in a sealed container of anhydrous (99.5 percent pure) acetone, a one (1) inch long sample ring shall show no visible spalling or cracking when tested according to ASTM D 2152.

(i) **Chemical Resistance.** The pipe manufacturer shall prequalify the PVC compound for cell classifications not identified in Subsection 706.09(A) - General by meeting the chemical resistance tests that follow. The Contractor shall prepare the compound samples and molded test specimens according with ASTM D 543.

The Contractor shall immerse the tensile and Izod impact exposure specimens in the solutions specified in Table 706-V for one hundred twelve (112) days. The Contractor shall

condition the test specimens to constant weight at one hundred ten (110) degrees Fahrenheit before and after submersion. The Contractor shall keep the solutions at a temperature of seventy-seven (77) degrees Fahrenheit \pm five (5) degrees Fahrenheit. At twenty-eight (28) day intervals, The Contractor shall remove, wash, surface dry, and test the selected specimens.

TABLE 706-V - TEST SOLUTIONS Chemical Solution Concentration (percent)	
Sulfuric acid	20*
Sodium hydroxide	5
Ammonium hydroxide	5*
Nitric acid	1*
Ferric chloride	1
Soap	0.1
Detergent (Linear alkyl benzly sulfonate)	0.1
Bacteriological	BOD not less than 700 ppm
*Volumetric percentages of concentrated reagents of C.P grade.	

Weight change specimens shall be two (2) inches in diameter and may be molded discs or discs cut from the pipe wall. The Contractor shall

1. condition the specimens for seven (7) days at forty-three (43) degrees Celsius \pm two (2) degrees Celsius,
2. cool in a desiccator for three (3) hours at twenty-three (23) degrees Celsius \pm two (2) degrees Celsius,
3. weigh the specimen, and
4. then immerse in the solutions.

At four (4) week intervals, the Contractor shall remove, wash, surface dry, and weigh the selected specimens. The Contractor shall recondition these same specimens for seven

(7) days at forty-three (43) degrees Celsius + two (2) degrees Celsius, cool in a desiccator for the three (3) hours at twenty-three (23) degrees Celsius \pm two (2) degrees Celsius and again weigh.

Initial and post exposure specimens shall conform to following requirements when tested at twenty-three (23) degrees Celsius \pm two (2) degrees Celsius:

Property	ASTM Test Method	Cell Class Minimum Values		
		12454	13343	13364
Tensile Strength (Yield), psi	D 638	7000	6000	6000
Impact Strength ft-lbs/in.	D 256 Method A	0.65	1.5	1.5
Weight Change, Percent	D 543	1.5	1.5	1.5

If the specimen fails to meet the requirements during the one hundred twelve (112) day exposure period, the material will be subject to rejection.

(C) Joints. Pipe joints shall be bell and spigot type with an elastomeric gasket. The Contractor shall make the gasketed joints with an integral wall bell and locked-in place rubber ring that will preclude improper installation of the gasket and will insure the gasket remains in place during the joining operation. The pipe shall have a home mark on the spigot end to show proper penetration when the Contractor makes the joint.

(D) Certification. The Contractor shall submit a copy of the manufacturer's test report or a statement by the seller. The Contractor shall also submit a copy of the test results that the Contractor has sample, test, and inspect the material according to the contract. An authorized agent of the seller or manufacturer shall sign each certification.

706.10 (Unassigned)

706.11 (Unassigned)

706.12 Perforated Plastic Pipe. The perforated corrugated polyethylene pipe * shall conform to AASHTO M 252 or AASHTO M 294-911. *

The perforated PVC pipe shall conform to ASTM D 2729. *

The perforated corrugated polyethylene pipe shall be either Type CP * corrugated surface both inside and outside or Type SP corrugated wall outside * and smooth inner liner. *

The Contractor shall submit a certificate of compliance to the Engineer * before the use of the plastic pipes. *

706.13 PVC Pipe and Fittings for Sprinkler System. PVC pipe and fittings for sprinkler system shall conform to the following: |

Schedule 40 or 80, PVC 1120 or PVC 1220 ASTM D 1785 |

SDRPR, PVC 1120 or PVC 1220 ASTM D 2241 or D 2672 |

Sprinkler lines Class 200/SDR 21 |

Rubber ring (slip seal) joint pipe shall have a thickened integral bell as part of the pipe. The Contractor shall use only male adaptors when * connecting to other materials. |

The coupling rubber ring gasket for the rubber ring joints includes synthetic rubber compound that conforms to ASTM D 1869. |

The fittings shall be injected molded PVC of the same material as the pipe. Solvent cemented fittings shall conform to ASTM D 2466 or D 2467. Fittings for rubber ring joints shall be PVC plastic conforming to ASTM D 3139 or D 2466 except of the dimensions and configurations of the barrel portion that receives the rubber ring. The fittings shall withstand the pressure range requirements of the pipe. |

The pipe and fittings shall bear the seal of acceptance or "nsf" trademark of the National Sanitation Foundation Testing Laboratory, Inc., School of Public Health, University of Michigan, Ann Arbor, Michigan. |

Solvent-cement shall be compatible with and of the kind recognized by the industry as proper for use and accepted by the Engineer. |

Plastic pipe (irrigation line) shall be nonrigid PVC hose, cell-type 5360500 or better conforming to ASTM D 2287. The hose shall withstand a sixty (60) minute internal hydrostatic pressure of fifty (50) pounds per square inch at seventy-three (73) degrees Fahrenheit when tested according to ASTM D * 1598. The minimum wall thickness shall be as follows if measured according * to ASTM D 2122: |

706.13

Nominal Size (Inch)	Minimum Wall Thickness (Inch)
1/2	0.090
3/4	0.110
1	0.140

706.14 Polyethylene Pipe. Polyethylene pipe shall conform to ASTM D 2447, Schedule 40 and 80 or ASTM D 2239, SDR-PR.

The polyethylene pipe shall be PE 2305 or PE 2306, Class C, SDR 15.

Fittings for polyethylene pipe shall be PVC plastic conforming to ASTM D 2609.

706.15 (Unassigned)

706.16 (Unassigned)

706.17 Reinforced Concrete Low-Head Pressure Pipe. This pipe shall conform to ASTM C 361, Class C 100.

The Contractor shall make bends from cast concrete pipe sections and shall have a centerline radius of four (4) times the pipe diameter. The maximum deflection per miter joint shall be less than twenty-two and a half (22-1/2) degrees.

706.18 Concrete Cylinder Pipe. This pipe shall conform to Federal Specification: SS-P 00385, Pipe; Pressure, Steel, Cement-Mortar Lining, and Reinforced Cement-Mortar Lining, and shall be designed for Class 100.

The Contractor shall furnish the pipes in nominal lengths of sixteen (16) to thirty-two (32) feet except where the Contractor requires shorter lengths for fittings, curves, closures or special sections.

The Contractor shall make bends from steel cylinders with cement mortar lining and reinforced cement mortar coating. Bends shall have a centerline radius of two and a half (2-1/2) times the pipe diameter. The maximum deflection per miter joint shall be less than twenty-two and a half (22-1/2) degrees.