

**APPENDIX A**

**SUMMARY**

**OF**

**ASTM TESTING METHODS**

**FOR**

**PIPE-JOINT LEAKS**

**TABLE A1. ASTM STANDARDS FOR TESTING OF PIPE JOINTS AND MANHOLES FOR LEAKS**

ASTM STANDARD	TYPE OF PIPE	SIZE	TYPE OF TEST (air/water)	TEST CONDUCTED FOR – INFILTRATION/ EXFILTRATION	TESTING PRESSURE	LEAKAGE CRITERIA	TEST FOR MISALIGNMENT OF JOINTS	TEST FOR SHEAR FORCE ON JOINT	REMARKS		
C14	Concrete	Not Mentioned	Water	Exfiltration (leakage)	10 psi for 10minutes	No visible leakage should occur during the specified time.	NOT CONDUCTED	NOT CONDUCTED	Testing pressure as well as time are specified.		
C361	Concrete	Not Mentioned	Water	Exfiltration (leakage)	In accordance with C497 and said to be 120% of designed pressure for pipe joint.	There should be no leakage in the span of 20 minutes during which test is Conducted.	NOT CONDUCTED	The assembly shall be loaded so as to get maximum joint annular space	Testing pressure and time are both specified. Test conducted for misalignment of sections for maximum allowed deflection..		
C425	Vitrified Clay	Not Mentioned	Water	Exfiltration (leakage)	4.3psi for 1 hour	No visible leakage should occur during the specified time.	The test is to be conducted using the following criteria :	The shear load shall be a force of 150 lb/in (26.3kN/m) of nominal pipe dia. uniformly applied over an arc of not less than 120° (2.1rad) along a longitudinal of 12 in.(305 mm) adjacent to the joint.	Testing pressure, time, angle of deflection for misaligned joints and shear load is specified.		
										Dia. in	Deflection of pipe in/linear ft
										3 to12	½
										15 to 24	3/8
										27 to 36	¼
39 to 42	3/16										
C428	Asbestos Cement	Not mentioned	Water	Exfiltration (leakage)	10 psi for 10 minutes	There should be no leakage in the span of 10 minutes during which test is conducted.	Criteria for test is as follows-	NOT CONDUCTED	Testing pressure as well as time are specified.		
										Angle	Dia.
										5°	12in. &smaller
										3°	14in & larger.
One half of deflection is to be between each pipe and the coupling.											
C443	Concrete	Not mentioned	Water	Exfiltration (leakage)	13 psi for aligned sections & 10 psi for misaligned sections.	There should be no leakage in the span of 10 minutes during which test is conducted.	Test to be conducted at maximum deflected position of joint.	NOT CONDUCTED	Testing pressure as well as time are specified.		
C497-98	Concrete	Not mentioned	Water	Exfiltration (leakage)	Up to required pressure, but pressure not specified.	No visible leakage should occur during the specified time.	NOT CONDUCTED	NOT CONDUCTED	Both testing pressure and time are not specified.		

**TABLE A1. ASTM STANDARDS FOR TESTING OF PIPE JOINTS AND MANHOLES FOR LEAKS (Contd.)**

ASTM STANDARD	TYPE OF PIPE	SIZE	TYPE OF TEST ( air/ water )	TEST CONDUCTED FOR - INFILTRATION/ EXFILTRATION	TESTING PRESSURE	LEAKAGE CRITERIA	TEST FOR MISALIGNMENT OF JOINTS	TEST FOR SHEAR FORCE ON JOINT	REMARKS
C505*	Concrete	Not Mentioned	Water	Exfiltration (leakage)	Testing pressure of (40 psi) for 1min.	No leakage should occur at 1/3 <sup>rd</sup> of this pressure	The joint design shall provide for the deflection of each pipe unit by opening one side of the outside perimeter of the joint , wider than the fully closed position, a distance no less than 1/2in. or 25% of wall thickness, whichever is less, without reducing it's water tightness.	NOT CONDUCTED	Both testing pressure and time are specified.
C700	Vitrified Clay	Not Mentioned	Water	Exfiltration (leakage)	Testing pressure of 10psi with time chosen as per barrel thickness.	No visible leakage should occur during the test.	NOT CONDUCTED	NOT CONDUCTED	Both testing pressure and time (as per barrel thickness are specified)
C828-98	Vitrified clay	3 to 42 inches	Air	Air pressure drop ( Exfiltration )	Joint testing at 3.5 psi.	Pressure drop should be less than 1 psi in specified time.	NOT CONDUCTED	NOT CONDUCTED	Testing time is calculated depending on pipe diameter. This test is also conducted for maximum allowable deflection.
C924-89	Concrete	4 to 24 inches	Air	Air pressure drop ( Exfiltration )	Joint testing at 3.5 psi pressure	Pressure drop should be less than 1 psi in 5 sec.	NOT CONDUCTED	NOT CONDUCTED	Duration and pressure drop are specified in test.
C969	Precast concrete	>24 inches	Water	Infiltration/ Exfiltration	Testing head at least 2 feet above the crown	Allowable leakage limit: 200gal/in. of int. dia/mile of sewer /24hr.	NOT CONDUCTED	NOT CONDUCTED	Minimum testing period of 15 minutes and maximum of 24 hours.
C990	Concrete	Not mentioned	Water	Exfiltration (leakage)	Testing pressure of 10psi	No leakage within specified time	NOT CONDUCTED	NOT CONDUCTED	Testing time of 10minutes is adopted for this test.
C1091-90	Vitrified Clay	4 to 42 inches	Water	Infiltration/ Exfiltration	Testing head atleast 2 feet above the crown.	Allowable leakage limit : 200gal/inches of int. dia/mile of sewer/24hrs	NOT CONDUCTED	NOT CONDUCTED	Minimum testing period of 15 minutes and maximum of 24 hours.
C1103	Precast concrete	> 27 inches	Air as well as Water	Exfiltration (leakage)	Joint testing at 3.5 psi pressure	Pressure drop should be less than 1 psi in 5 sec.	NOT CONDUCTED	NOT CONDUCTED	Duration and pressure drop are specified in test.

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C1208C	Vitrified Clay Pipes	Diameter not mentioned. Barrel thickness: 1in to 3in.	Water	Exfiltration (leakage)	10psi for aligned joints 4.3 psi under shear load.	No leakage within specified time	NOT CONDUCTED	A shear load of 50lb/in is uniformly applied over an arc of 120° along a distance of 12in. adjacent to the joint.	The testing time depends on barrel thickness. Adsorption test is also covered in this specification.	
C1214-94	Concrete	4 to 36 inches	Air	Vacuum drop inside the plugged line . (Infiltration)	Test conducted at 7 inches of mercury ( about 3.5 psi ) under vacuum.	Mercury drop from 7 to 5 inches in specified time i.e. 3.5 to 2.5 psi.	NOT CONDUCTED	NOT CONDUCTED	Testing time is calculated depending on pipe diameter although testing pressure remains same..	
C1244-93	Concrete manholes	750 mm to 1800 mm OR 3 to 7.2 inches.	Air	Vacuum drop inside the plugged line . (Infiltration )	Test conducted at 10inches of mercury (about 5 psi ) under vacuum.	Mercury drop from 10 to 9 inches in specified time. i.e. 5 to 4 psi	NOT APPLICABLE	NOT APPLICABLE	Testing time is calculated depending on pipe diameter although testing pressure remains same.	
D3212 -96 (a)	Plastic	Not mentioned	Air as well as water	For air test- vacuum drop inside plugged line. (Infiltration) For water test - leakage (exfiltration)	For air as well as water test it is 11 psi	Air test: allowable pressure loss of 17 kPa about 2.5 psi in 10 minutes. Water test - There should be no leakage in 10 min.	Test conducted for maximum allowable deflection by manufacturer	Test conducted by placing shear load at d/2 from centerline of gasket OR at the end of bell whichever is greater until load moves down by 5% of pipe outside diameter.	Duration and pressure drop are both specified.	
D4161-96	Fibreglass	8 to 144 inches	Water	Exfiltration (leakage)	29 psi for pipes installed for non-pressure service. Twice this pressure for pipes installed for pressure service	No leakage for 10 minutes	Deflection angle depends on pipe diameter.		The load shall be 100lb/in(17.5kN/m ) in dia. and applied on unsupported spigot end immediately adjacent to the bell. * see brief summary of standard.	Testing pressure, time, angle of deflection for misaligned joints and shear load is specified in detail.
							Angle	Dia.		
							< 20"	3°		
							21"-36"	2°		
							39"-72"	1°		
							> 72"	½ °		
F1365 - 91	Plastic	Not mentioned	Water	Infiltration	Joint testing done at 11 psi.	No leakage should occur up to 15 minutes.	Test conducted for maximum allowable deflection by manufacturer	NOT CONDUCTED	Testing time and pressure specified.	

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F1417	Plastic	Not mentioned	Air	Exfiltration (leakage)	Test conducted at 3.5 psi	Constant pressure method: Air loss should satisfy the specified leakage rate. Time pressure drop method: Time required for pressure drop from 3.5 psi to 2.5 psi should satisfy minimum holding time.	NOT CONDUCTED	NOT CONDUCTED	Testing time and pressure specified.
Remarks	47% of tests for -concrete pipes 14% for - plastic pipes 23% for - vitrified clay pipes 1 for concrete manhole, fiberglass pipe and asbestos pipe.	Tests cover pipe sizes from - 3 to 144 inches.	76% are water tests 33% are air tests	85% are exfiltration tests 23% are infiltration tests	Range of testing pressure is 3.5 to 40psi.*	Leakage criteria vary depending on test.	33% of these test are conducted for joint misalignment.	23% of these tests conduct the shear test.	7 tests out of 15 for misaligned joints testing AND 5 tests for shear load testing on joints.