

**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 to 12  | 1/4                             |
|   |                 |               |                             |   |  |  |  |   |  | 15 to 24 | 3/8                             |
|   |                 |               |                             |   |  |  |  |   |  | 27 to 36 | 1/2                             |
| 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.  |

**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   |  |
|---------------|----------------------|---|----------------------------|--|---|--|---|--|---|--|
| C1208C        | Vitrified Clay Pipes | Diameter not mentioned. Barrel thickness: 1in to 3in. | Water                      | Exfiltration (leakage)   | 10psi for aligned joints<br>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)<br>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.<br>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.<br>* 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.  |  |

**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   |
|---------------|---|--|--|--|---|--|---|--|---|
| F1417         | Plastic   | Not mentioned                                  | Air                                      | Exfiltration (leakage)                                   | Test conducted at 3.5 psi                   | Constant pressure method:<br>Air loss should satisfy the specified leakage rate.<br>Time pressure drop method:<br>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<br>14% for - plastic pipes<br>23% for - vitrified clay pipes<br>1 for concrete manhole, fiberglass pipe and asbestos pipe. | Tests cover pipe sizes from - 3 to 144 inches. | 76% are water tests<br>33% are air tests | 85% are exfiltration tests<br>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. |