



Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill (Metric)¹

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1. Scope

1.1 This test method covers procedures for testing precast concrete manhole sections when using the vacuum test method to demonstrate the integrity of the installed materials and the construction procedures. This test method is used for testing concrete manhole sections utilizing mortar, mastic, or gasketed joints.

1.2 This test method is intended to be used as a preliminary test to enable the installer to demonstrate the condition of the concrete manholes prior to backfill. Users are hereby cautioned that misuse or misapplication of the test criteria contained herein can cause permanent damage to the system being tested.

NOTE 1—Vacuum test criteria presented in this test method are similar to those in general use. The test and criteria have been widely and successfully used in testing manholes.

NOTE 2—It should be understood that no correlation has been found between vacuum (air) and hydrostatic tests.

1.3 This test method is the companion to inch-pound Test Method C1244.

1.4 *This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards*:²

C822 Terminology Relating to Concrete Pipe and Related Products

C924 Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method

C969 Practice for Infiltration and Exfiltration Acceptance

¹ This test method is under the jurisdiction of ASTM Committee C13 on Concrete Pipe and is the direct responsibility of Subcommittee C13.06 on Manholes and Specials.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

Testing of Installed Precast Concrete Pipe Sewer Lines
C1244 Test Method for Concrete Sewer Manholes by the
Negative Air Pressure (Vacuum) Test Prior to Backfill

3. Terminology

3.1 For definitions of terms relating to manholes, see Terminology C822.

4. Summary of Practice

4.1 All lift holes and any pipes entering the manhole are to be plugged. A vacuum will be drawn and the vacuum drop over a specified time period is used to determine the acceptability of the manhole.

5. Significance and Use

5.1 This is not a routine test. The values recorded are applicable only to the manhole being tested and at the time of testing.

6. Preparation of the Manhole

6.1 All lift holes shall be plugged.

6.2 All pipes entering the manhole shall be temporarily plugged, taking care to securely brace the pipes and plugs to prevent them from being drawn into the manhole.

7. Procedure

7.1 The test head shall be placed at the top of the manhole in accordance with the manufacturer's recommendations.

7.2 A vacuum of 33.8 kPa of Hg shall be drawn on the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off. The time shall be measured for the vacuum to drop to 30.4 kPa of Hg.

7.3 The manhole shall pass if the time for the vacuum reading to drop from 33.8 kPa of Hg to 30.4 kPa of Hg meets or exceeds the values indicated in Table 1.

7.4 If the manhole fails the initial test, necessary repairs shall be made by an approved method. The manhole shall then be retested until a satisfactory test is obtained.

7.5 Use or failure of this vacuum test shall not preclude acceptance by appropriate water infiltration or exfiltration testing, (see Practice C969), or other means.

TABLE 1 Minimum Test Times for Various Manhole Diameters (750–3000 mm) in Seconds

Depth, m	Diameter, mm								
	750	825	900	1050	1200	1350	1500	1650	1800
Time, in seconds									
<1.2	6	7	7	9	10	12	13	15	16
1.8	9	10	11	13	15	18	20	22	25
2.4	11	12	14	17	20	23	26	29	33
3.0	14	15	18	21	25	29	33	36	41
3.7	17	18	21	25	30	35	39	43	49
4.3	20	21	25	30	35	41	46	51	57
4.9	22	24	29	34	40	46	52	58	67
5.5	25	27	32	38	45	52	59	65	73
6.1	28	30	35	42	50	53	65	72	81
6.7	31	33	39	46	55	64	72	79	89
7.3	33	36	42	51	59	64	78	87	97
7.9	36	39	46	55	64	75	85	94	105
8.5	39	42	49	59	69	81	91	101	113
9.1	42	45	53	63	74	87	98	108	121

TABLE 1 Minimum Test Times for Various Manhole Diameters (750–3000 mm) in Seconds (continued)

Depth, m	Diameter, mm							
	1950	2100	2250	2400	2550	2700	2850	3000
	Time, in seconds							
<1.2	18	19	21	23	24	25	27	29
1.8	26	29	31	34	36	38	41	43
2.4	35	38	41	45	48	51	54	57
3.0	44	48	52	56	60	63	67	71
3.7	53	57	62	67	71	76	81	85
4.3	62	67	72	78	83	89	94	100
4.9	70	76	83	89	95	101	108	114
5.5	79	86	93	100	107	114	121	128
6.1	88	95	103	111	119	126	135	142
6.7	97	105	114	122	131	139	148	156
7.3	106	114	124	133	143	152	161	170
7.9	114	124	134	144	155	164	175	185
8.5	123	133	145	155	167	177	188	199
9.1	132	143	155	166	178	189	202	213

8. Precision and Bias

8.1 No justifiable statement can be made either on the precision or bias of this procedure, since the test result merely states whether there is conformance to the criteria for the success specified.

9. Keywords

9.1 acceptance criteria; concrete; manhole sections; test method; vacuum test

APPENDIX

(Nonmandatory Information)

X1. Air Testing for a Single Diameter Pipe

X1.1 The standard accepted method of air testing, for a single diameter pipe, Practice C924, allows a drop of 3.4 kPa pressure during the time calculated by the formula:

$$T_{press} = \frac{KD^2L}{Q}$$

where:

- T = time for drop in pressure of 3.4 kPa
- K = 5.3×10^{-8} for SI units
- D = inside pipe diameter, mm
- L = length of line, m
- Q = air loss, m³/min

X1.2 A pressure drop of 3.4 kPa of Hg for the vacuum test compares to a pressure drop of 3.4 kPa of Hg for the air test.

$$1'' \text{ Hg} = 3.376850 \text{ kPa}$$

Therefore, the time relationship is:

$$T_{vac} = 3.4 T_{press}$$

or

$$T_{vac} = \frac{T_{press}}{.294}$$

X1.3 The allowable test times cited in Practice C924, Table 2, for pipe sizes 100 to 600 mm diameter are shown in Table X1.1 and Table X1.2. The allowable test times for sizes above 600 mm were obtained by extrapolation. Therefore, using the appropriate Q , we find that:

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$$\text{for 750 mm } (Q = .20 \text{ m}^3/\text{min}), T_{vac} = 2.6 \times 10^{-7} \frac{D^2}{Q} L = .073 L$$

$$\text{for 1950 mm } (Q = .42 \text{ m}^3/\text{min}), T_{vac} = 2.6 \times 10^{-7} \frac{D^2}{Q} L = .233 L$$

$$\text{for 825 mm } (Q = .22 \text{ m}^3/\text{min}), T_{vac} = 2.6 \times 10^{-7} \frac{D^2}{Q} L = .080 L$$

$$\text{for 2100 mm } (Q = .45 \text{ m}^3/\text{min}), T_{vac} = 2.6 \times 10^{-7} \frac{D^2}{Q} L = .253 L$$

$$\text{for 1050 mm } (Q = .25 \text{ m}^3/\text{min}), T_{vac} = 2.6 \times 10^{-7} \frac{D^2}{Q} L = .115 L$$

$$\text{for 2250 mm } (Q = .48 \text{ m}^3/\text{min}), T_{vac} = 2.6 \times 10^{-7} \frac{D^2}{Q} L = .273 L$$

$$\text{for 1200 mm } (Q = .28 \text{ m}^3/\text{min}), T_{vac} = 2.6 \times 10^{-7} \frac{D^2}{Q} L = .134 L$$

$$\text{for 2400 mm } (Q = .51 \text{ m}^3/\text{min}), T_{vac} = 2.6 \times 10^{-7} \frac{D^2}{Q} L = .294 L$$

$$\text{for 1350 mm } (Q = .31 \text{ m}^3/\text{min}), T_{vac} = 2.6 \times 10^{-7} \frac{D^2}{Q} L = .153 L$$

$$\text{for 2550 mm } (Q = .54 \text{ m}^3/\text{min}), T_{vac} = 2.6 \times 10^{-7} \frac{D^2}{Q} L = .314 L$$

$$\text{for 1500 mm } (Q = .34 \text{ m}^3/\text{min}), T_{vac} = 2.6 \times 10^{-7} \frac{D^2}{Q} L = .172 L$$

$$\text{for 2700 mm } (Q = .57 \text{ m}^3/\text{min}), T_{vac} = 2.6 \times 10^{-7} \frac{D^2}{Q} L = .335 L$$

$$\text{for 1650 mm } (Q = .37 \text{ m}^3/\text{min}), T_{vac} = 2.6 \times 10^{-7} \frac{D^2}{Q} L = .191 L$$

$$\text{for 2850 mm } (Q = .59 \text{ m}^3/\text{min}), T_{vac} = 2.6 \times 10^{-7} \frac{D^2}{Q} L = .355 L$$

$$\text{for 1800 mm } (Q = .40 \text{ m}^3/\text{min}), T_{vac} = 2.6 \times 10^{-7} \frac{D^2}{Q} L = .211 L$$

$$\text{for 3000 mm } (Q = .62 \text{ m}^3/\text{min}), T_{vac} = 2.6 \times 10^{-7} \frac{D^2}{Q} L = .376 L$$

**TABLE X1.1 Minimum Test Times for Various Pipe Diameters
(Practice C924)**

Nominal Pipe Size, mm	Time (T), min/100 m
100	0.9
150	2.0
200	3.5
250	4.7
300	6.0
375	6.8
450	7.7
525	9.7
600	11.0
675	13.0
750	15.0
825	17.0
900	19.0

**TABLE X1.2 Allowable Air Loss for Various Pipe Diameters
(Practice C924)**

Nominal Pipe Size, mm	Air Loss (Q), m ³ /min
100	0.6
150	0.6
200	0.6
250	0.7
300	0.8
375	0.11
450	0.14
525	0.15
600	0.17
750	0.20
825	0.22
1050	0.25
1200	0.28
1350	0.31
1500	0.34
1650	0.37
1800	0.40

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