Designation: C1244/C1244M – 20

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

This standard is issued under the fixed designation C1244/C1244M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

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—The user of this test method is advised that no correlation has been found between vacuum (air) and hydrostatic tests.

1.3 The values stated in inch pound or SI units are to be regarded separately as standard. The SI units are shown in brackets. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.

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

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

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 (Withdrawn 2013)[3]

C924M Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method (Metric) (Withdrawn 2013)[3]

C969 Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines

C969M Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines (Metric)

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.

[1] This test method is under the jurisdiction of ASTM Committee C13 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.

[3] The last approved version of this historical standard is referenced on www.astm.org.

TABLE 1 Minimum Test Times for Various Manhole Diameters 30 – 120 in. [750 – 3000 mm] in Seconds

Depth ft [m]	Diameter, in. [mm]																
	30 [750]	33 [825]	36 [900]	42 [1050]	48 [1200]	54 [1350]	60 [1500]	66 [1650]	72 [1800]	78 [1950]	84 [2100]	90 [2250]	96 [2400]	102 [2550]	108 [2700]	114 [2850]	120 [3000]
	Time, in seconds																
<4 [1.2]	6	7	7	9	10	12	13	15	16	18	19	21	23	24	25	27	29
6 [1.8]	9	10	11	13	15	18	20	22	25	26	29	31	34	36	38	41	43
8 [2.4]	11	12	14	17	20	23	26	29	33	35	38	41	45	48	51	54	57
10 [3.0]	14	15	18	21	25	29	33	36	41	44	48	52	56	60	63	67	71
12 [3.7]	17	18	21	25	30	35	39	43	49	53	57	62	67	71	76	81	85
14 [4.3]	20	21	25	30	35	41	46	51	57	62	67	72	78	83	89	94	100
16 [4.9]	22	24	29	34	40	46	52	58	67	70	76	83	89	95	101	108	114
18 [5.5]	25	27	32	38	45	52	59	65	73	79	86	93	100	107	114	121	128
20 [6.1]	28	30	35	42	50	53	65	72	81	88	95	103	111	119	126	135	142
22 [6.7]	31	33	39	46	55	64	72	79	89	97	105	114	122	131	139	148	156
24 [7.3]	33	36	42	51	59	64	78	87	97	106	114	124	133	143	152	161	170
26 [7.9]	36	39	46	55	64	75	85	94	105	114	124	134	144	155	164	175	185
28 [8.5]	39	42	49	59	69	81	91	101	113	123	133	145	155	167	177	188	199
30 [9.1]	42	45	53	63	74	87	98	108	121	132	143	155	166	178	189	202	213

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 10 in. [254 mm] 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 9 in. [229 mm] Hg.

7.3 The manhole is acceptable if the time for the vacuum reading to drop from 10 in. [254 mm] Hg to 9 in. [229 mm] Hg meets or exceeds the values indicated in Table 1.

7.4 If the manhole fails the initial test, the manhole shall be repaired by an approved method 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 [C969M]), or other means.

8. Precision and Bias

8.1 No justifiable statement is presently capable of being 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 [C924M], allows a drop of 1 psi [6.9 kPa] pressure during the time calculated by the formula:

$$T_{Press.} = \frac{KD^2L}{Q} \quad \text{(X1.1)}$$

where:

T = time for 1 psi [6.9 kPa] drop in pressure, minutes
K = 0.00037 for Imperial units [5.3×10^{-8} for SI units]
D = pipe diameter, in. [mm]
L = length of line, ft [m]
Q = air loss, ft^3/min [m^3/min]

X1.2 A pressure drop of 1 in. [25.4 mm] Hg for the vacuum test compares to a pressure drop of 0.490 psi [3.4 kPa] for the air test.

$$1 \text{ in. Hg} \times \frac{14.696 \text{ lb/in.}^2}{29.02 \text{ 1 Hg}} = 0.490 \text{ psi} \quad \text{(X1.2)}$$

$$\left[25.4 \quad \text{mm Hg} \times \frac{0.133 \text{kPa}}{1 \text{mm Hg}} = 3.4 \text{ kPa}\right]$$

Therefore, the time relationship is:

$$T_{vac} = 0.490\, T_{press} \quad \text{(X1.3)}$$

or

$$T_{vac} = \frac{T_{press}}{2.04} \quad \text{(X1.4)}$$

X1.3 The allowable test times and allowable loss cited in Practice C924 [C924M], Table 1 and Table 2, for pipe sizes 4 in. [100 mm] to 24 in. [600 mm] diameter are provided in Table X1.1 and Table X1.2. The allowable test times for sizes above 24 in. [600 mm] were obtained by extrapolation. Therefore, using the appropriate Q. we find that:

for 30 in. $(Q = 7\ \text{ft}^3/\text{min})$, $T_{vac} = 0.00018\,\frac{D^2}{Q}\,L = 0.023\,L$

$$\left[\text{for}\ \ 750\ \ \text{mm}\ \ (Q = .20\ \text{m}^3/\text{min}),\ \ T_{vac} = 2.6 \times 10^{-8}\ \ \frac{D^2}{Q}\ \ L = 0.073\ \ L\right]$$

for 36 in. $(Q = 8\ \text{ft}^3/\text{min})$, $T_{vac} = 0.00018\,\frac{D^2}{Q}\,L = 0.029\,L$

$$\left[\text{for}\ \ 825\ \ \text{mm}\ \ (Q = .22\ \text{m}^3/\text{min}),\ \ T_{vac} = 2.6 \times 10^{-8}\ \ \frac{D^2}{Q}\ \ L = 0.080\ \ L\right]$$

for 42 in. $(Q = 9\ \text{ft}^3/\text{min})$, $T_{vac} = 0.00018\,\frac{D^2}{Q}\,L = 0.035\,L$

$$\left[\text{for}\ \ 1050\ \ \text{mm}\ \ (Q = .25\ \text{m}^3/\text{min}),\ \ T_{vac} = 2.6 \times 10^{-8}\ \ \frac{D^2}{Q}\ \ L = 0.115\ \ L\right]$$

for 48 in. $(Q = 10\ \text{ft}^3/\text{min})$, $T_{vac} = 0.00018\,\frac{D^2}{Q}\,L = 0.041\,L$

$$\left[\text{for}\ \ 1200\ \ \text{mm}\ \ (Q = .28\ \text{m}^3/\text{min}),\ \ T_{vac} = 2.6 \times 10^{-8}\ \ \frac{D^2}{Q}\ \ L = 0.134\ \ L\right]$$

for 54 in. $(Q = 11\ \text{ft}^3/\text{min})$, $T_{vac} = 0.00018\,\frac{D^2}{Q}\,L = 0.048\,L$

$$\left[\text{for}\ \ 1350\ \ \text{mm}\ \ (Q = .31\ \text{m}^3/\text{min}),\ \ T_{vac} = 2.6 \times 10^{-8}\ \ \frac{D^2}{Q}\ \ L = 0.153\ \ L\right]$$

for 60 in. $(Q = 12\ \text{ft}^3/\text{min})$, $T_{vac} = 0.00018\,\frac{D^2}{Q}\,L = 0.054\,L$

$$\left[\text{for}\ \ 1500\ \ \text{mm}\ \ (Q = .34\ \text{m}^3/\text{min}),\ \ T_{vac} = 2.6 \times 10^{-8}\ \ \frac{D^2}{Q}\ \ L = 0.172\ \ L\right]$$

for 66 in. $(Q = 13\ \ \text{ft}^3\ /\ \text{min})$, $T_{vac} = 0.00018\,\frac{D^2}{Q}\,L = 0.060\,L$

$$\left[\text{for}\ \ 1650\ \ \text{mm}\ \ (Q = .37\ \ \text{m}^3\ /\ \text{min}),\ \ T_{vac} = 2.6 \times 10^{-8}\ \ \frac{D^2}{Q}\ \ L = 0.191\ \ L\right]$$

for 72 in. $(Q = 14\ \text{ft}^3/\text{min})$, $T_{vac} = 0.00018\,\frac{D^2}{Q}\,L = 0.067\,L$

$$\left[\text{for}\ \ 1800\ \ \text{mm}\ \ (Q = .40\ \text{m}^3/\text{min}),\ \ T_{vac} = 2.6 \times 10^{-8}\ \ \frac{D^2}{Q}\ \ L = 0.211\ \ L\right]$$

for 78 in. $(Q = 15\ \text{ft}^3/\text{min})$, $T_{vac} = 0.00018\,\frac{D^2}{Q}\,L = 0.073\,L$

$$\left[\text{for}\ \ 1950\ \ \text{mm}\ \ (Q = .42\ \text{m}^3/\text{min}),\ \ T_{vac} = 2.6 \times 10^{-8}\ \ \frac{D^2}{Q}\ \ L = 0.233\ \ L\right]$$

for 84 in. $(Q = 16\ \text{ft}^3/\text{min})$, $T_{vac} = 0.00018\,\frac{D^2}{Q}\,L = 0.079\,L$

$$\left[\text{for}\ \ 2100\ \ \text{mm}\ \ (Q = .45\ \text{m}^3/\text{min}),\ \ T_{vac} = 2.6 \times 10^{-8}\ \ \frac{D^2}{Q}\ \ L = 0.253\ \ L\right]$$

for 90 in. $(Q = 17\ \text{ft}^3/\text{min})$, $T_{vac} = 0.00018\,\frac{D^2}{Q}\,L = 0.086\,L$

$$\left[\text{for}\ \ 2250\ \ \text{mm}\ \ (Q = .48\ \text{m}^3/\text{min}),\ \ T_{vac} = 2.6 \times 10^{-8}\ \ \frac{D^2}{Q}\ \ L = 0.273\ \ L\right]$$

for 96 in. $(Q = 18\ \text{ft}^3/\text{min})$, $T_{vac} = 0.00018\,\frac{D^2}{Q}\,L = 0.092\,L$

$$\left[\text{for}\ \ 2400\ \ \text{mm}\ \ (Q = .51\ \text{m}^3/\text{min}),\ \ T_{vac} = 2.6 \times 10^{-8}\ \ \frac{D^2}{Q}\ \ L = 0.294\ \ L\right]$$

for 102 in. $(Q = 19\ \text{ft}^3/\text{min})$, $T_{vac} = 0.00018\,\frac{D^2}{Q}\,L = 0.099\,L$

$$\left[\text{for}\ \ 2550\ \ \text{mm}\ \ (Q = .54\ \text{m}^3/\text{min}),\ \ T_{vac} = 2.6 \times 10^{-8}\ \ \frac{D^2}{Q}\ \ L = 0.314\ \ L\right]$$

for 108 in. $(Q = 20\ \text{ft}^3/\text{min})$, $T_{vac} = 0.00018\,\frac{D^2}{Q}\,L = 0.105\,L$

$$\left[\text{for}\ \ 2700\ \ \text{mm}\ \ (Q = .57\ \text{m}^3/\text{min}),\ \ T_{vac} = 2.6 \times 10^{-8}\ \ \frac{D^2}{Q}\ \ L = 0.335\ \ L\right]$$

for 114 in. $(Q = 21\ \text{ft}^3/\text{min})$, $T_{vac} = 0.00018\,\frac{D^2}{Q}\,L = 0.112\,L$

$$\left[\text{for}\ \ 2850\ \ \text{mm}\ \ (Q = .59\ \text{m}^3/\text{min}),\ \ T_{vac} = 2.6 \times 10^{-8}\ \ \frac{D^2}{Q}\ \ L = 0.355\ \ L\right]$$

for 120 in. $(Q = 22\ \text{ft}^3/\text{min})$, $T_{vac} = 0.00018\,\frac{D^2}{Q}\,L = 0.118\,L$

$$\left[\text{for}\ \ 3000\ \ \text{mm}\ \ (Q = .62\ \text{m}^3/\text{min}),\ \ T_{vac} = 2.6 \times 10^{-8}\ \ \frac{D^2}{Q}\ \ L = 0.376\ \ L\right]$$