

FIBERGLASS MANHOLES

PERFORMANCE TESTING IN COMPLIANCE WITH ASTM D 3753, STANDARD SPECIFICATIONS (54" - 120" INTERNAL DIAMETER)

Summary

Separate tests were conducted on 54", 60", 66", 72", 84", 96" and 120" cylinder internal diameter fiberglass manhole. Test samples used were actual pieces of manhole or samples manufactured in a manner consistent in every way with the manhole component construction. While Containment Solutions, Inc. attempts to manufacture fiberglass manholes uniformly, properties of individual manholes may vary somewhat from those measured in these tests, but should always meet or exceed ASTM D 3753 standards.

Results were as follows:

- All workmanship requirements were met without any repair.
- Dimensions of the manholes were as follows:
 - Cylinder internal diameter - $\pm 1/8"$
 - Cylinder length - 3'
- The manhole cylinders met all stiffness requirements of the specification.
- Chemical resistance requirements were exceeded by the constructions used in the cylinder of the manhole.
- Material Properties have been established for the construction of the manhole cylinder.

TESTING REQUIREMENTS

Cylinder Stiffness:

- The cylindrical portion of the manhole is to be tested in accordance with ASTM Method D 2412. The specification stiffness requirements are included in the test table of this report (see Table 1).

Soundness:

- In order to determine soundness, an air or water test is to be applied to the manhole test sample. While holding the pressure between 3-5 psi, the entire manhole must be inspected for leaks (see Table 1).

TABLE 1

Test Results - Stiffness & Soundness								
Depth	ASTM Requirement	54" Diameter	60" Diameter	66" Diameter	72" Diameter	84" Diameter	96" Diameter	120" Diameter
Cylinder Stiffness (psi)								
6'	0.72	4.25	3.58	2.12	5.27	4.84	3.66	6.76
12'	1.26	4.25	3.58	2.12	5.27	4.84	3.66	7.61
20'	2.01	4.25	3.58	2.12	5.27	4.84	3.66	8.42
25'	3.02	4.39	4.28	4.19	8.07	5.60	6.63	9.16
35'	5.24	7.98	7.85	7.75	10.10	8.76	9.37	10.68
Soundness								
Leakage at 5 psi	None	None	None	None	None	None	None	None

Chemical Resistance per ASTM C 581:

- Flexural strength, flexural modulus and barcol hardness are plotted versus time on log-log coordinates. The line defined by these points is extrapolated to 100,000 hours. The minimum extrapolated retention allowed for any of these properties is 50%. Test samples used are actual pieces of manhole or samples manufactured in a manner consistent in every way with the manhole component construction.

Sulfuric acid was used to simulate sewage in this testing because it is the most aggressive material found in sanitary sewers. This sulfuric acid is produced by the action of certain bacteria on hydrogen sulfide in the absence of air. The details of the phenomena have been reported by the EPA and numerous others (see Table 2 and Chart 1).

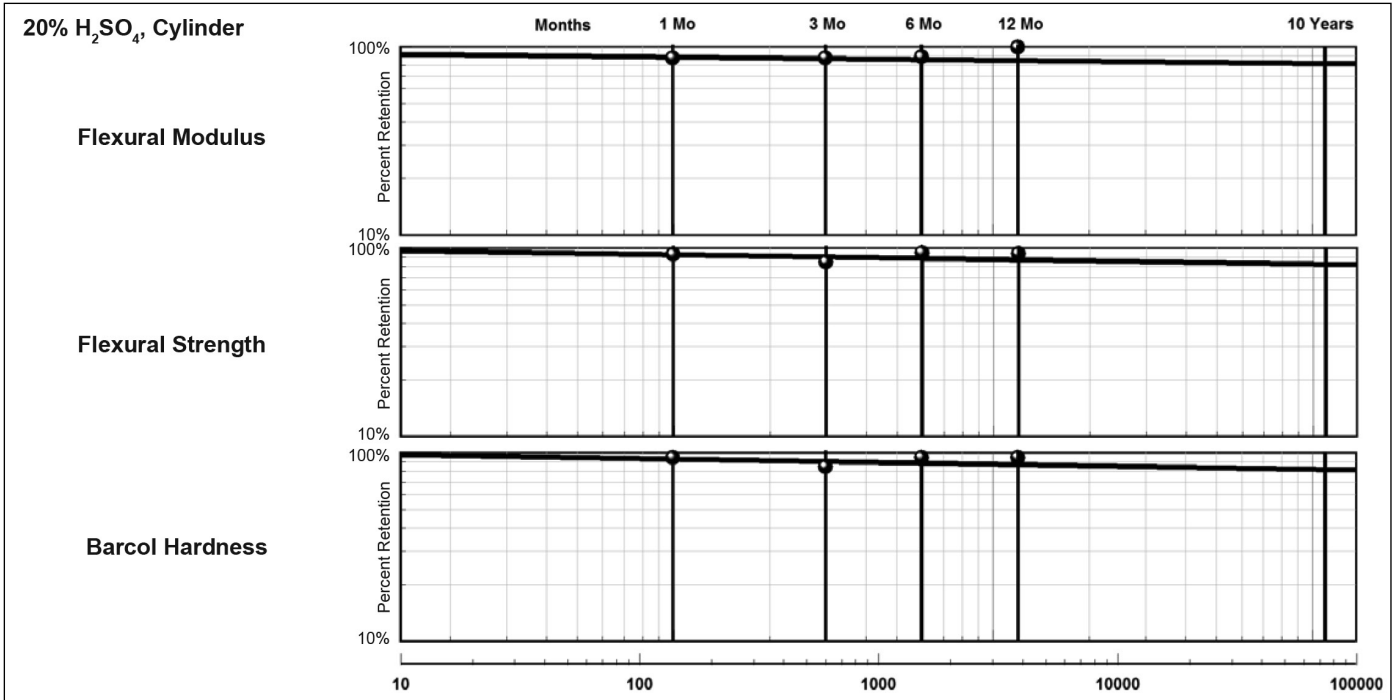
TABLE 2

Test Results - Chemical Resistance

(Extrapolated Values at 100,000 Hours)

	Cone (% Retention)				Cylinder (% Retention)			
	pH4	pH10	Sat'd NaCL	20% H ₂ SO ₄	pH4	pH10	Sat'd NaCL	20% H ₂ SO ₄
Flexural Strength	80	72	94	80	85	100	100	80
Flexural Modulus	96	88	98	92	80	60	82	82
Barcol Hardness	80	92	84	90	80	70	100	82

CHART 1



Material Properties:

Tests are made on actual pieces of manholes or samples manufactured consistent in all respects with the construction of the manholes. Tests are to be as follows: (see Table 3 for results)

- Material composition per ASTM D 2584
- Compressive Strength per ASTM D 695
- Flexural Strength and Modulus per ASTM D 790
- Barcol Hardness per ASTM D 2583
- Thickness

TABLE 3

Test Results - Nominal Material Properties

	Cylinder 52" - 72"	Ribbed Cylinder 72" - 120"		Cylinder 52" - 72"	Ribbed Cylinder 72" - 120"
Material Composition			Flexural Properties		
Resin (wt %)	42	46	Hoop Strength (10 ³ psi)	22.50	8.00
Glass (wt %)	14	19	Hoop Modulus (10 ⁶ psi)	1.05	1.29
Sand (wt %)	44	35	Axial Strength (10 ³ psi)	14.30	13.60
Compressive Properties			Axial Modulus (10 ⁶ psi)	0.96	1.13
Strength (10 ³ psi)	18.90	18.90	Thickness		
Modulus (10 ⁶ psi)	1.40	1.40	Pipe (inches)	0.50	0.25
Barcol Hardness			Rib Height < 120" (inches)		1.25
	35	35	Rib Height = 120" (inches)		2.10

While Containment Solutions has taken every precaution as to the accuracy of content and data presented herein, Containment Solutions cannot be held responsible for the individual interpretation of the data presented, any loss or damage to any property whatsoever, injury or death to any persons whatsoever, or any claims, demands, actions, complaints, proceedings, judgement, losses, damages, compensation, liabilities, costs or charges, however arising from the unauthorized undirected used of this handbook or the data it contains.