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Standard Methods of Testing LAMINATED-WALL BITUMINIZED FIBER PIPE¹

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1. Scope

1.1 These methods cover the physical testing of laminated-wall, bituminized fiber pipe.

1.2 The test methods appear in the following order:

	Sections
Resistance to Flattening	4 to 8
Dry Crushing Strength	9 to 14
Wet Crushing Strength	15 to 20
Axial Compression Crushing Strength	21 to 25
Crushing Strength of Couplings	26 to 29
Beam Strength	30 to 35
Joint Tightness	36 to 38
Longitudinal Permeability	39 to 42
Water Absorption	43 to 48
Boiling Water Resistance	49 to 53
Heat Resistance	54 to 57
Chemical Resistance	58 to 60
Kerosine Resistance	61 to 64

1.3 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of whoever uses this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Purity of Water

2.1 Use distilled, demineralized, or rain water, except in cases where tap water may be used if it is known that such will not affect the results.

3. Conditioning

3.1 Condition specimens for crushing strength (dry and of couplings), beam strength, axial compression strength, and longitudinal permeability, immediately before testing, for not less than 24 h at a temperature of 21 to 24°C (70 to 75°F).

RESISTANCE TO FLATTENING

4. Significance

4.1 This test measures the quality of the fiber preform.

5. Test Specimens

5.1 Accurately and cleanly saw from the pipe two test specimens 76 mm (3 in.) in length and measure the inside diameter. Mark the points at which measurements are taken for identification.

6. Procedure

6.1 Place the specimens in an oven on a common flat base with their axes parallel, and with the measured diameter in a vertical direction (see Fig. 1). Bridge the specimens symmetrically with a flat plate, and symmetrically load the plate with the required load. Maintain the oven at $66 \pm 1^\circ\text{C}$ ($150 \pm 2^\circ\text{F}$) for 48 h. At the end of 48 h, unload the two pieces, remove from the oven, and allow to cool for at least 1 h at 21 to 24°C (70 to 75°F) in air, after which measure the inside diameters again between the original marks.

7. Report

7.1 Report the change in diameter as a percentage of the original diameter.

8. Precision

8.1 Acceptability of results (95 % probability)

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is judged by the following criteria:

8.1.1 *Repeatability*—Duplicate results by the same operator should not be considered suspect unless they differ by more than 0.290 % change in diameter.

8.1.2 *Reproducibility*—Duplicate results by different laboratories should not be considered suspect unless they differ by more than 0.576 % change in diameter.

DRY CRUSHING STRENGTH

9. Significance

9.1 This test is a measure of the rigidity and strength of the pipe in its circumferential dimension and is indicative of the thoroughness of the impregnation and quality of the fiber preform.

10. Apparatus

10.1 *Loading Device*—Any test machine that will apply the load at a uniform head speed of 12.7 mm (0.5 in.)/min may be used in making the test. The testing machine shall be substantial and rigid throughout, so that the distribution of the load will not be affected appreciably by the deformation or yielding of any part.

10.2 *Bearings*—For the three-edge-bearing method (see Fig. 2) the lower bearing consists of a rigid block with a 25.4-mm (1-in.) wide longitudinal groove in the center, the groove having sufficient depth to clear the bottom of the specimen. Round the top corners of the groove to a radius of approximately 12.7 mm (½ in.). Extend the upper and lower bearings the full length of the specimen. For the flat-plate-bearing method, the upper and lower bearings consist of rigid flat platens, accurately parallel. The bearings shall be sufficiently rigid to transmit and receive uniform loads throughout their lengths without deflection, and are so attached to the machine as to transmit and receive the maximum stresses produced by the tests without lost motion, vibration, or sudden shock. Accurately center the bearings and the specimen so as to secure a symmetrical distribution of the loading of the specimen.

11. Test Specimens

11.1 Cleanly saw 300-mm (12-in.) sections (150-mm) (6-in.) sections optional) of sound, undamaged pipe. Condition in accordance with Section 3.

12. Procedure

12.1 Lay the specimens horizontally between the bearings in the testing machine and apply the load with a head speed 12.7 mm (0.5 in.)/min.

13. Report

13.1 Report the load at break in newtons per metre (or pounds-force per linear foot).

14. Precision

14.1 Acceptability of results (95 % probability) is judged by the following criteria:

14.1.1 *Repeatability*—Duplicate results by the same operator should not be considered suspect unless they differ by more than 22 % of the mean test value.

14.1.2 *Reproducibility*—Duplicate results by different laboratories should not be considered suspect unless they differ by more than 24 % of the mean test value.

WET CRUSHING STRENGTH

15. Significance

15.1 This test is a measure of the thoroughness of impregnation, the quality of the impregnant, and the consequent protection of the fiber structure from the effects of water.

16. Loading Device

16.1 See 10.1

17. Test Specimens

17.1 Cleanly saw 300-mm (12-in.) sections (150-mm (6-in.) sections optional) from sound, undamaged pipe.

18. Procedure

18.1 Immerse the specimens in clean water (see 2.1) at 21 to 24°C (70 to 75°F) for 48 h. (Specimens used for the water absorption test may be used for this test.) Within ½ h after removal from the water, lay the specimens horizontally between the bearings in the testing machine and apply the load with a head speed of 12.7 mm (0.5 in.)/min.

19. Report

19.1 Report the load at break in newtons per metre (or pounds-force per linear foot).

20. Precision

20.1 Acceptability of results (95 % probab-

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ity) is judged by the following criteria:

20.1.1 *Repeatability*—Duplicate results by the same operator should not be considered suspect unless they differ by more than 15 % of the mean test value.

20.1.2 *Reproducibility*—Duplicate results by different laboratories should not be considered suspect unless they differ by more than 5 % of the mean test value.

AXIAL COMPRESSION CRUSHING STRENGTH**21. Significance**

21.1 This test is indicative of the overall quality of the pipe.

22. Test Specimens

22.1 Saw 150-mm (6-in.) long specimens with the ends cleanly sawed and accurately parallel, from sound, undamaged sections of pipe.

23. Procedure

23.1 Place the specimens vertically between flat plates covering the entire cross section of the pipe ends. Crush in a testing machine having a head speed of 12.7 mm (0.5 in.)/min. Use a spherical seat to reduce the effects of unequal loading.

24. Report

24.1 Report the maximum load at failure in newtons per metre (or pounds-force per linear foot).

25. Precision

25.1 Acceptability of results (95 % probability) is judged by the following criteria:

25.1.1 *Repeatability*—Duplicate results by the same operator should not be considered suspect unless they differ by more than 10 % of the mean test value.

25.1.2 *Reproducibility*—Duplicate results by different laboratories should not be considered suspect unless they differ by more than 31 % of the mean test value.

CRUSHING STRENGTH OF COUPLINGS**26. Loading Device**

26.1 See 10.1

27. Test Specimens

27.1 Test couplings for dry crushing strength only. Select test specimens from undamaged,

full-length standard couplings.

28. Procedure

28.1 Lay the coupling horizontally between the bearings in the testing machine and apply the load at the rate of 12.7 mm (0.5 in.)/min.

29. Report

29.1 Report the maximum load in newtons per metre (or pounds-force per linear foot).

BEAM STRENGTH**30. Significance**

30.1 This test is indicative of the flexibility of the pipe and its ability to withstand transverse forces without failure.

31. Testing Fixture

31.1 The testing fixture consists of V-blocks and a flexible strap for applying the load (see Fig. 3).

32. Test Specimens

32.1 Saw sound, undamaged sections of pipe of the length and span specified in Table.

33. Procedure

33.1 Place the specimen in the testing fixture as shown in Fig. 3, and apply the load with a head speed of 12.7 mm (0.5 in.)/min.

34. Report

34.1 Report the maximum load reached in breaking the beam specimen in newtons per metre (or pounds-force per linear foot).

35. Precision

35.1 Acceptability of the results (95 % probability) is judged by the following criteria:

35.1.1 *Repeatability*—Duplicate results by the same operator should not be considered suspect unless they differ by more than 8 % of the mean test value.

35.1.2 *Reproducibility*—Duplicate results by different laboratories should not be considered suspect unless they differ by more than 20 % of the mean test value.

JOINT TIGHTNESS**36. Significance**

36.1 This test is a measure of the accuracy of the machined tapers and the ability of the assem-