TABLE 11—CHARACTERISTICS OF ASBESTOS-CEMENT PIPE

Size (in.)	Available lengths (ft)	Approximate weight per foot (lb)* (with coupling attached)						
		Class 1500	Class 2600	Class 3300	Class 4000	Class 5000	Class 6000	Class 7000
		BUILDING AND HOUSE SEWERS						
4	5, 6-1/2, 10, 13	4.6–5.0	5.0–5.6	6.7				
5	5, 6-1/2, 10, 13	6.4–6.7	6.9–7.7	8.9–9.4				
6	5, 6-1/2, 10, 13	7.7–8.7	8.8–9.2	10.3–11.1				
		GRAVITY SEWERS						
6	5, 6-1/2, 10, 13	8.1	8.8	10.4				
8	5, 6-1/2, 10, 13	12.8–13.1	12.8–14.0	14.5–15.8				
10	6-1/2, 13	16.1–17.1	16.1–17.7	17.8–20.5	20.0–22.7	21.9–25.8		
12	6-1/2, 13	22.2–29.9	23.0–24.0	24.9–27.0	26.6–29.6	29.6–33.6		
14	6-1/2, 13	25.9–27.7	25.9–28.9	29.7–34.0	31.1–37.3	34.1–42.0		
15	6-1/2, 13	28.4	28.4	33.1	35.2	39.3		
16	6-1/2, 13	31.5–33.3	31.5–35.3	34.5–41.1	37.1–45.4	40.9–51.0		
18	6-1/2, 13		40.3–42.0	45.6–48.9	50.7–54.2	53.4–60.6		
20	6-1/2, 13		46.3–48.9	52.2–57.1	59.0–63.0	61.7–70.6		
21	6-1/2, 13		50.1	58.7	66.3	72.5		
24	13		56.1–64.3	70.8–74.5	78.9–82.3	81.4–92.2		
27	13			89.3	96.6	110.4		
30	13			104.8	115.9	128.9		
33	13				133.5	148.7		
36	13				152.2	169.8		
39	13					198.0	219.0	238
42	13					216.0	290.0	260

*Weight per foot will vary with pipe length because total weight includes attached coupling. Weight per foot also varies from one manufacturer to another; above ranges are from two manufacturers.

Section 4—Bituminized Fiber Pipe

Laminated-wall, bituminized-fiber drain and sewer pipe is designed to have a resistance to external loads, chemicals, heat, and water. It is manufactured in accordance with Federal Specifications SS-P345a and Commercial Standard CS 226-59. Homogeneous bituminized-fiber pipe is also manufactured in accordance with Commercial Standards CS116-54, but this type of pipe is not covered in this section.

Manufacture

The process of manufacturing laminated-wall bituminized fiber pipe consists of two major steps. The first step is the forming of the pipe as a multiple laminated or spiral fibrous structure of tough uniform fibers bonded with a special water resistant adhesive. The second step is impregnation of the formed pipe, under high pressure, with an especially compounded liquefied pitch. The result is a pipe with a dense wall and smooth interior surface, free from obstructions or rough flaky areas.

Testing

To ensure that the pipe as produced by the manufacturing process meets specifications, samples are tested to determine their strength with respect to crushing, axial-compression crushing, surge pressure, and hydrostatic pressure, and to determine their resistance to flattening pressures, chemicals, kerosene, hot water, and heat. Tests are also made to determine resistance to the absorption of water and to longitudinal permeability seepage. All tests are conducted with standardized equipment and controlled procedures.

MINIMUM TEST CRITERIA

Table 12 lists the minimum acceptable test criteria for physical strength characteristics.

In addition to the criteria in Table 12, laminated-wall, bituminized fiber pipe must have the following characteristics.

Chemical and kerosene resistance. Both pipe and fittings must be highly resistant to corrosive soils, acids, alkalies, salts, and petroleum wastes. After being subjected to the chemicals under test conditions, the crushing strength of the samples must not be less than the values indicated in Table 12. Tests are made by subjecting separate samples, for periods of 10 days at 70 to 80° F, to 0.1 *N* sulfuric acid, 0.1 *N* sodium carbonate, 0.1 *N* sodium sulfate, and kerosene. Then the test specimens are emptied, rinsed, wiped dry, and tested for crushing strength.

Flattening resistance. Both pipe and fittings must resist the combined flattening effects of earth loads and heat.

TABLE 12—MINIMUM REQUIRED PHYSICAL CHARACTERISTICS FOR BITUMINIZED-FIBER PIPE

Federal Specifications SS-P-345a

Pipe size* (in.)	Wall thickness (in.)	Physical strength tests				
		Axial crushing (lb/lin ft)	Beam (lb/lin ft)	Crushing (lb/lin ft)	Hydrostatic pressure (psi)	Surge pressure (psi)
2	0.25	6,000	1,000	1,500	350	600
3	0.28	10,000	1,000	1,500	350	600
4	0.32	13,000	2,200	1,500	350	600
5	0.41	20,000	4,200	1,500	350	600
6	0.46	30,000	4,400	1,500	300	500
8	0.57	39,000	7,000	1,800	300	500
10	0.61	60,000	7,500	1,800	200	350
12	0.61	72,000	8,500	1,800	150	350
15	0.67	98,000	10,000	1,800	150	250
18	0.71	125,000	11,500	1,800	100	250

*Nominal inside pipe diameter.

House sewer connection being set into 12-in. bituminized-fiber sewer pipe.

Tests are made by subjecting two 3-in. lengths to a dead-weight load at a temperature of 150 ± 2° F for 48 hr. The dead-weight loads differ for different pipe diameters, (110 lb per lin ft for pipe 2- to 4-in. diam., 130 lb per lin ft for 5- and 6-in. pipe, and 160 lb per lin ft for pipes of 8- to 18-in. diam.). After cooling to 75° F, the decrease in inside diameter may not be more than 2 percent.

Heat resistance. Specimens selected at random must show a resistance to heat, that is, after being subjected to a temperature of 180° F for 8 hr, while laid on a flat surface, the test specimens must show no appreciable exudation of bituminous material nor any flattening or other distortion.

Hot water resistance. Pipe specimens must be able to withstand the effects of boiling water. There must be no evidence of disintegration or separation into laminations during a 6-hr test. Inspection for such damage is performed after the specimens have been cooled in water at 70° F for 2 hr (or dried overnight at 70° F).

Longitudinal permeability. To test for longitudinal permeability, pipe samples with machined ends joined by a coupling are subjected to water pressure of 5 psi for 1 hr and are examined for movement of water into the pipe longitudinally through the pipe ends. Following the test, no appreciable amount of water should emerge from the ends of the pipe.

Water absorption. Weighed pipe samples, immersed in water at 75° F for 48 hr, then wiped clean and dry, should not increase in weight by more than 2 percent of the dry weight.

Surface characteristics

Laminated-wall, bituminized fiber pipe as produced for commercial use has a smooth bore. According to the manufacturers, calculations of flow capacity may be based on a Kutter or Manning n value of 0.010, but design engineers usually use an n value of 0.012 to 0.015.

Joints

Unless otherwise specified by the design engineer on a project, the ends of bituminized-fiber pipe are tapered to fit within couplings that are also tapered inside. Pipe lengths of more than 10 ft are usually furnished with plain ends. Joints with couplings are watertight. Couplings used for jointing are subjected to rigid testing for strength, etc. In addition to the standard coupling of bituminized fiber, couplings are also made of butyl rubber and neoprene.

TABLE 13—CHARACTERISTICS OF SOME COMMERCIALLY AVAILABLE BITUMINIZED-FIBER PIPE*

Pipe size (in.)	Wall thickness (in.)	Length (ft)	Weight (lb/lin ft)	Crushing strength (lb/lin ft)
2	0.260	10	1.1	
3	0.29	10	1.9	
4	0.34	10	2.7	2100
6	0.29	20	3.7	
6	0.34	20	4.5	
6	0.39	20	5.0	
6	0.48	10	6.8	2900
8	0.34	20	6.0	
8	0.39	20	6.8	
8	0.44	20	7.7	
8	0.57	10	10.8	2650
8	0.57	15	10.8	
10	0.45	20	8.7	2000
12	0.54	20	12.9	1800
12	0.57	15	15.0	
15	0.56	20	16.8	1800
18	0.70	20	24.0	1900

* The data in this table do not necessarily apply to all commercially available pipe.

Commercially available pipe

Table 13 lists the characteristics of typical commercially available pipe. Some commercial products have dimensions and properties that are well above the minimum values specified in Federal Specifications SS-P-345a.

Laminated-wall, bituminized-fiber pipe is also available in sizes between 18 and 48 in. in diameter. All sizes may be obtained as perforated pipe for use in septic tank drain fields (in small sizes) or for land drainage (in large sizes).

SHIPPING

Laminated-wall, bituminized-fiber pipe is crated and shipped by rail (minimum load weight, 36,000 lb), or by truck (minimum load weight, 30,000 lb).

Manufacturers

Laminated-wall, bituminized-fiber pipe may be obtained from the following manufacturers:

Kyova Pipe Co., Ironton, Ohio
Orangeburg Mfg. Co., Div. of Flintkote Co., Orangeburg, N. Y.
Robinson Clay Pipe Co., Akron, Ohio
Sonoco Products Co., Hartsville, S. C.

Section 5—Brick and Clay Blocks

Bricks and vitrified segmented tile blocks are manufactured by firing a clay mixture in a kiln under controlled conditions. The composition and method of manufacture affect the characteristics of the product.

Bricks and tile blocks currently are seldom used in sewer construction because of the high cost of skilled labor required for installation. In some instances, however, liner plates of vitrified clay are used to protect the invert of a concrete sewer against erosion. Brick is sometimes used in the construction of manholes, but in recent years, concrete has largely replaced brick for this application.

Where brick or segmented tile blocks are used, they are usually obtained from the nearest possible point of manufacture.