Designation: C 1081 – 98 (Reapproved 2003)

Standard Specification for Asbestos-Cement Corrugated Fill For Use in Cooling Towers[1]

This standard is issued under the fixed designation C 1081; 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 specification covers splash bar and corrugated sheet type asbestos-cement products used as cooling tower fill.

1.2 Drift eliminators or demisters, louvers, partitioning and casing panels are covered in Specifications C 1080. Asbestos-cement pipes are covered in Specification C 296 and Specifications C 428. Asbestos-cement flat sheet fill (heat exchange surfaces) are specified in Specification C 1082.

1.3 The values stated in the SI system are to be regarded as the standard. The inch-pound units in parentheses are for information only.

1.4 The following precautionary caveat pertains only to the Test Method portion, Section 8, of this Specification: *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 and health practices and determine the applicability of regulatory limitations prior to use.* See 8.1.3 for specific safety hazards.

2. Referenced Documents

2.1 *ASTM Standards:*

C 150 Specification for Portland Cement[2]

C 296 Specification for Asbestos-Cement Pressure Pipe[3]

C 428 Specifications for Asbestos-Cement Nonpressure Sewer Pipe[3]

C 458 Test Method for Organic Fiber Content of Asbestos-Cement Products[3]

C 459 Test Methods of Sampling and Testing Asbestos-Cement Flat Sheets, Roofing and Siding Shingles, and Clapboards[3]

C 500 Test Methods for Asbestos-Cement Pipe[3]

C 1080 Specification for Asbestos-Cement Products Other Than Fill in Cooling Towers[3]

C 1082 Specification for Asbestos-Cement Flat Sheet for Cooling Tower Fill[3]

C 1096 Test Method for Determination of Wood Fiber in Asbestos-Cement[3]

D 2946 Terminology for Asbestos and Asbestos-Cement Products[3]

2.2 *DIN Standard:*

DIN 274 Asbestzement-Weilplatten[4]

3. Terminology

3.1 *Definitions*—The definitions included in Terminology D 2946 are applicable to this specification.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *autoclaved product*—Products that have been treated in a saturated steam atmosphere at between 689 and 1517 kPa (100 and 220 psi) for at least 8 h, and that contain portland cement Type I (Specification C 150) together with fine silica in the ratio of 3:2 that can react to form calcium silicate reaction products.

3.2.2 *pressed products*—Products that are pressed singly or in stacks interlayered with templates, at a minimum pressure of 12 MPa (1740 psi).

3.2.3 *pitch*—The wave length in corrugated products.

4. Classification

4.1 *Splash Bar Classification*:

4.1.1 *Type I*—Splash bars consist of corrugated autoclaved pressed asbestos-cement sheets for the most demanding applications that meet the requirements set forth in Table 1.

4.1.2 *Type II*—Splash bars consist of corrugated pressed asbestos-cement sheets for intermediate service that meet requirements presented in Table 1.

4.1.3 *Type III*—Splash bars are intended for less demanding service that meet the requirements stated in Table 1.

[1] This specification is under the jurisdiction of ASTM Committee C17 on Fiber-Cement Products and is the direct responsibility of Subcommittee C17.03 on Asbestos-Cement Sheet Products and Accessories.

Current edition approved Sept. 10, 1998. Published March 1999. Originally published as C 1081 – 87. Last previous edition C 1081 – 92 (1997).

[2] *Annual Book of ASTM Standards*, Vol 04.01.

[3] *Annual Book of ASTM Standards*, Vol 04.05.

[4] Available from Deutsches Institut für Normunge, Beuth Verlaq GmbH, Auslieferung, Post Fach1107, D-1000 Berlin 30, Germany.

TABLE 1 Manufacturing, Composition and Performance Requirements for Splash Bars

Type No.	I	II	III
Manufacturing requirements:			
Autoclaved	yes	no	no
Pressed	yes	yes	no
Nominal thickness,			
3/16 , mm (in.)	4 (0.17)	4 (0.17)	4 (0.17)
3/8 , mm (in.)	9 (0.35)	9 (0.35)	9 (0.35)
Composition requirements:			
Silica passing through a 149 µm sieve (No. 100)	yes	no	no
Ratio, cement:silica	3:2	...	...
Mineral diluents	no	no	no
Cellulose	no	no	no
Maximum organic content in accordance with Test Method C 458, %	0.01	0.01	0.01
Cement type; per Specification C 150	I	I or V	I, II or V
or ISO type	10	20 or 50	10, 20 or 50
Performance requirements:			
Minimum apparent density, g/cm^3(lb/ft^3)	1.6 (100)	1.6 (100)	1.4 (100)
Maximum water absorption, %	25	25	30
Minimum average bending moment, calculated as in DIN 274 Nm/m (ft-lbf/ft)	556 (125)	556 (125)	556 (125)
Minimum individual specimen bending moment, Nm/m (ft-lbf/ft)	471 (106)	471 (106)	471 (106)
Minimum freeze-thaw resistance, cycles	200	100	50
Minimum Harkort test, cycles	7	5	3
Free lime, in accordance with Test Method C 500, %	1	6	7

4.2 *Corrugated Fill*:

4.2.1 *Type A*—Non-autoclaved, compressed, corrugated sheet, with a nominal thickness of 5 mm (3/16 in.):

Pitch	107 mm (4.2 in.)
Average minimum bending moment	556 Nm/m (125 ft·lbf/ft)
Individual specimen minimum bending moment	471 Nm/m (106 ft·lbf/ft)
Minimum density 1.6 g/cm^3	(100 lb/ft^3)
Maximum water absorption	25 %

NOTE 1—Calculate bending moment in accordance with DIN 274.

5. Ordering Information

5.1 *Splash Bars*:

5.1.1 State the type, dimensions, and quantity required.

5.1.2 State what type of certification, if any, is required.

5.2 *Corrugated Fill*:

5.2.1 State that Type A is required.

5.2.2 State length, width, and quantity of panels required.

5.2.3 State what type of certification, if any, is required.

6. Materials and Manufacture

6.1 *Splash Bars*—Manufacturing and composition requirements are given in Table 1.

6.2 *Corrugated Fill*—Manufacturing requirements are given in 4.2.1.

7. Performance Requirements

7.1 *Splash Bars*—Performance requirements are stated in Table 1.

7.2 *Corrugated Fill*—Performance requirements are stated in 4.2.1.

8. Test Methods

8.1 *Apparent Density*:

8.1.1 *Scope*—This test method covers the determination of the mass per unit volume of asbestos-cement products.

8.1.2 *Significance and Use*:

8.1.2.1 The apparent density gives an indication of relative product robustness and durability. It is used to evaluate the requirements for dedicated support structures.

8.1.3 *Hazards:* **Precaution**—When cutting specimens of asbestos-cement products, avoid creating dust or wear a respiratory protector. Respiration of excessive concentrations of airborne cement, crystalline silica, or asbestos may cause serious bodily harm.

8.1.4 *Procedure*—Calculate the apparent density by dividing the mass of a specimen dried to constant mass at 110 ± 5°C by the volume of the specimen.

8.1.5 *Precision and Bias*:

8.1.5.1 *Precision*—No statement is made on the precision of this test method since conformance to specific criteria is the only measure of success specified.

8.1.5.2 *Bias*—Bias cannot be established on these porous heterogeneous products of variable composition, for lack of a referee test method.

8.2 *Water Absorption*—In accordance with Test Methods C 459.

8.3 *Flexural Strength and Modulus of Rupture*—In accordance with Test Methods C 459.

8.4 *Freeze-Thaw Resistance*:

8.4.1 *Scope*—This test method covers the determination of the freeze-thaw resistance of corrugated asbestos-cement fill for use in cooling towers.

8.4.2 *Significance and Use*—The freeze-thaw resistance is taken as an indication of resistance to low temperature weathering. It is used to estimate product suitability for difficult climates.

8.4.3 *Hazards*—Refer to 8.1.3.

8.4.4 *Procedure*:

8.4.4.1 Each cycle shall consist of saturating the specimen by submerging in water at 30 ± 2°C (86 ± 3°F) during 2 ± 0.2 h followed by rapid drainage and freezing to − 20± 2°C (−4 ±

3°F) during 10 ± 0.2 h. The twice-daily cycle then repeats starting with the 2 h period of thawing and saturation in water at 30°C.

8.4.4.2 The number of freeze-thaw cycles specified must not cause any apparent deterioration. Check for signs of delamination by means of a magnifying glass. Inspect the specimens for the presence of invisible cracks by spraying isopropyl alcohol from a hand spray bottle onto the specimen (hairline cracks are revealed when the alcohol evaporates from the surface).

8.4.5 *Precision and Bias*:

8.4.5.1 *Precision*—No statement is made on the precision of this test method since conformance to specific criteria is the only measure of success specified.

8.4.5.2 *Bias*—Bias cannot be established on porous heterogeneous products of variable composition, for lack of a referee test method.

8.5 *Harkort Test*:

8.5.1 *Scope*—This test method covers the determination of resistance to repeated combined thermal and moisture shocks for corrugated asbestos-cement fill for use in cooling towers.

8.5.2 *Significance and Use*—The Harkort test provides an evaluation of the resistance to thermal and moisture fluctuations. It is used to estimate the durability of products.

8.5.3 *Hazards*—Refer to 8.1.3.

8.5.4 *Procedure*:

8.5.4.1 The specimen is dried in an oven at 100 ± 2°C (212 ± 3°F) for 2 ± 0.2 h before rapidly dunking it in 10 ± 0.1 kg (20 ± 0.2 lb) of water at 20 ± 2°C (68 ± 3°F) for 10 ± 0.2 min. Then the specimen is examined for signs of deterioration. Check and inspect as in 8.4.4.2. If the specimen does not appear deteriorated, return it to the oven for drying during 24 ± 0.2 h at 110 ± 2°C (230 ± 3°F) before dunking again in the same way.

8.5.4.2 Subsequent drying cycles are all of 23 h 45 ± 12 min duration at the following temperatures:

3rd drying	120 ± 2°C (258 ± 3°F)
4th drying	130 ± 2°C (266 ± 3°F)
5th drying	140 ± 2°C (284 ± 3°F)
6th drying	150 ± 2°C (302 ± 3°F)
7th drying	160 ± 2°C (320 ± 3°F)

8.5.4.3 Report the number of cycles sustained without deterioration.

8.5.5 *Precision and Bias*:

8.5.5.1 *Precision*—No statement is made on the precision of this test method since conformance to specific criteria is the only measure of success specified.

8.5.5.2 *Bias*—Bias cannot be established on porous heterogeneous products of variable composition, for lack of a referee test method.

8.6 *Additional Testing Information*—Additional details are presented in Specifications C 296, C 428, C 1080, C 1082, Test Methods C 458 and C 1096 and in DIN 274.

9. Inspection

9.1 Inspection of the material shall be agreed upon by the purchaser and the supplier as part of the purchase contract.

10. Rejection and Rehearing

10.1 Material that fails to conform to the requirements of this specification may be rejected. Rejection shall be reported to the producer or supplier promptly and in writing. In case of dissatisfaction with the results of the tests, the producer or supplier may make claim for a rehearing.

11. Certification

11.1 When specified in the purchase order or contract, a producer's or supplier's certification shall be furnished to the purchaser that the material was manufactured, sampled, tested and inspected in accordance with this specification and has been found to meet the requirements. When specified in the purchase order or contract, a report of the test results shall be furnished.

11.2 Upon request of the purchaser in the contract or order the certification of an independent third party indicating conformance to the requirements of this specification may be accepted instead of the manufacturer's certification.

12. Product Marking

12.1 For Type I and II products it is necessary to print on each piece, in alkali resistant ink, the identification of the type.

13. Keywords

13.1 asbestos; asbestos-cement; cement; cooling tower; corrugated; fill