



Designation: D 5019 – 07

Standard Specification for Reinforced CSM (Chlorosulfonated Polyethylene) Sheet Used in Single-Ply Roof Membrane¹

This standard is issued under the fixed designation D 5019; 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 reinforced non-vulcanized polymeric sheet made from chlorosulfonated polyethylene (CSM)² intended for use as a single-ply roof membrane exposed to the weather. The sheet shall be reinforced with fiber or fabric.

1.1.1 The polymers used in these sheets have thermoplastic characteristics at time of installation. The chlorosulfonated polyethylene will vulcanize in place under ambient conditions.

1.2 The tests and property limits used to characterize these sheets are minimum values.

1.2.1 In-place roof systems design criteria such as fire resistance, field seaming strength, impact/puncture resistance, material compatibility, and uplift resistance, among others, are factors that must be considered, but are beyond the scope of this specification.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.4 The following precautionary caveat pertains to the test methods portion only, 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.*

2. Referenced Documents

2.1 *ASTM Standards:*³

¹ This specification is under the jurisdiction of ASTM Committee D08 on Roofing and Waterproofing and is the direct responsibility of Subcommittee D08.18 on Nonbituminous Organic Roof Coverings.

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² The term CSPE for chlorosulfonated polyethylene is commonly used in the roofing industry.

³ 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.

D 412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension

D 413 Test Methods for Rubber Property—Adhesion to Flexible Substrate

D 471 Test Method for Rubber Property—Effect of Liquids

D 518 Test Method for Rubber Deterioration—Surface Cracking

D 751 Test Methods for Coated Fabrics

D 1004 Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting

D 1149 Test Method for Rubber Deterioration—Surface Ozone Cracking in a Chamber

D 1204 Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature

D 2136 Test Method for Coated Fabrics—Low-Temperature Bend Test

G 151 Practice for Exposing Nonmetallic Materials in Accelerated Test Devices that Use Laboratory Light Sources

G 154 Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials

G 155 Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

3. Classification

3.1 The following type is used to identify the principal polymeric component of the coating portion of the sheet:

3.1.1 *Type 1*—Chlorosulfonated polyethylene (CSM).

3.2 The following grades describe the sheet construction:

3.2.1 *Grade 1*—Backed with fibers, and

3.2.2 *Grade 2*—Internally reinforced with fabric.

3.3 A general description of reinforcing including the type of fiber used and the weight per unit area of the reinforcing or backing material shall be provided, upon request.

4. Materials and Manufacture

4.1 The coating shall be formulated from CSM and other compounding ingredients. The CSM used in the coating shall be a minimum of 90 % in relation to the total polymer present.

4.2 The sheet shall be capable of being bonded to itself to make watertight field splices and repairs. The manufacturer or supplier shall recommend bonding methods and materials.

5. Physical Properties

5.1 **Table 1** contains physical property requirements that shall be met when using the indicated class of reinforcement. (The values shown were obtained from sheets made with coatings having the properties described in **Table 2**.)

5.2 **Table 2** contains property values for the coating portion on the weather side of the sheet. (When requested, the manufacturer shall provide a sample of the coating used on the weathering side of the supplied sheet at the thickness applied during manufacture, for testing purposes.) See **8.2**.

6. Dimensions, Mass, and Permissible Variations

6.1 The width and length of the sheet shall be agreed upon between the purchaser and the supplier.

6.1.1 The width and length tolerance shall be + 3, – 0 %.

6.2 Sheet thickness specified greater than the minimum shall be agreed upon between the purchaser and the supplier as part of the purchase contract.

6.2.1 The thickness tolerance shall be + 15, – 10 % of the specified nominal thickness. In no case shall the total sheet thickness be less than the minimum listed in **Table 1**. The minimum thickness of coating on Grade 1 sheets (backed with fibers) shall not be less than 0.50 mm (0.020 in.). The minimum thickness of coating on the weather side of Grade 2 sheets (internally reinforced with fabric) shall not be less than 0.28 mm (0.011 in.). (See **Annex A1** for method of thickness measurement for coating on weather side of sheet.)

7. Workmanship, Finish, and Appearance

7.1 The sheet, including factory seams if present, shall be watertight and visually free of pinholes, particles of foreign matter, undispersed raw material, or other manufacturing defects that might affect serviceability.

7.2 On Grade 2 sheet, the weather side of the sheet shall be identified as agreed upon between involved parties, and so that it is apparent to the applicator.

7.3 Edges of the sheet shall be straight and flat to permit seaming to one another without fishmouthing.

TABLE 1 Physical Properties of the Backed or Reinforced Sheet

Type (Polymer) Grade (Reinforcement)	I (CSM) 2
Property Thickness, min, mm (in.)	1.02 (0.040)
Breaking strength, strip, min, N (lbf)	935 (210) (fabric)
Elongation, min, %	16.5 (fabric)
Tearing strength, min, N (lbf)	300 (68)
Low temperature bend	pass
Linear dimensional change, max, %	2
Ply adhesion, min, N/m (lbf/in.)	1310 (7.5)
Hydrostatic resistance, min, kPa (psi)	2270 (330)
Ozone resistance, no cracks (7× magnification)	pass
Weather resistance, no cracks or crazing (7× magnification)	pass

TABLE 2 Physical Properties of the Coating Portion on the Weather Side of the Sheet, (No Backing or Internal Reinforcement)

Type	I (CSM)
Property	
Tensile strength, min, MPa (psi)	5.1 (735)
Elongation, min, %	250
Tear resistance, min, kN/m (lbf/in.)	34.0 (195)
Ozone resistance, no cracks	Pass
Water absorption, max, mass, %	10

8. Test Methods

8.1 *Backed or Reinforced Sheet, (See Table 1):*

8.1.1 *Dimensions*—In accordance with Test Methods **D 751**, after unrolling or unfolding and permitting the sheet to relax at 23 ± 2°C (73 ± 4°F) for 1 h minimum.

8.1.2 *Breaking Strength and Elongation*—In accordance with Test Methods **D 751**, grab method.

8.1.3 *Tearing Strength*—In accordance with Test Methods **D 751**, tongue tear method, 200 mm (8 in.) minimum by 200 mm (8 in.) minimum specimen size.

8.1.4 *Low-Temperature Bend*—In accordance with Test Method **D 2136** at –40 ± 2°C (–40 ± 4°F).

8.1.5 *Linear Dimensional Change*—In accordance with Test Method **D 1204**, 1 h minimum at 100 ± 2°C (212 ± 4°F).

8.1.6 *Ply Adhesion*—In accordance with Test Methods **D 413**, machine method, Type A specimens; 0.85 mm/s (2 in./min) jaw speed.

8.1.7 *Hydrostatic Resistance*—In accordance with Test Methods **D 751**, Method A.

8.1.8 *Ozone Resistance*—In accordance with Test Method **D 1149**, Method B (bent loop) exposure of Test Method **D 518**; inspect at 7× magnification after exposure to 50 ± 5 pphm ozone at 40 ± 2°C (104 ± 4°F) for 70 h minimum.

8.1.9 *Weather Resistance*—Accelerated weathering test shall be performed by Practices **G 151** and **G 154** or **G 155**. Choice of type of exposure shall be by mutual agreement among the interested parties. The two different types of exposure may produce different test results. Therefore, they cannot be used interchangeably without supporting data that demonstrates equivalency for the materials tested.

8.1.9.1 *Practice G 154*—2000 h using fluorescent UVA-340 lamps, and test cycle of 20 h UV at 80 ± 2.5°C (uninsulated black panel temperature), followed by 4 h condensation at 50 ± 2.5°C (uninsulated black panel temperature). If irradiance is controlled, it shall be 0.68 ± 0.02 W/(m²·nm) at 340 nm.

8.1.9.2 *Practice G 155*—2000 h xenon arc light exposure using daylight filter, irradiance of 0.35 ± 0.02 W/(m²·nm) at 340 nm; 690 min light exposure at 80 ± 2.5°C uninsulated black panel temperature, followed by 30 min light and deionized water spray; relative humidity 50 ± 5 % during the dry period of exposure to light. For equipment that allows for chamber air temperature control, it shall be 50 ± 2°C.

NOTE 1—The operational fluctuations, that is, the positive and negative deviations from the specified set points for the irradiance, temperature and relative humidity, are allowable deviations from the set points during equilibrium operation of the equipment. They do not imply that the user is allowed to program a set point higher or lower than that specified. Operate the apparatus to maintain the allowable operational fluctuations.