Single-ply standards: how can contractors use them?

New products yield new standards and new tests

by Kathleen Aharoni

After months, if not years, of industry anticipation, the first American Society for Testing and Materials (ASTM) standards for single-ply roofing membranes have been finalized.

Why has it taken so long to establish single-ply standards when the materials have been used in the United States for at least 10 years? The answer is really quite simple; developing standards is a complex procedure. Many materials have to be tested, and a committee of consultants, contractors, manufacturers and association and government representatives must approve both the test methods and results.

The ASTM standard that has just been approved is designated D4434-84. ASTM calls it the Standard Specification for Poly (vinyl chloride) Sheet Roofing. According to the final draft, the specification "covers flexible sheet made from poly (vinyl chloride) resin intended for use in single-ply roofing membranes exposed to the weather. The sheet may be reinforced or contain non-reinforcing or reinforcing fibers, or non-reinforcing or reinforcing fabrics."

The standard does not include criteria for fire resistance, field seam strength, impact/puncture resistance, material compatibility, wind uplift resistance or shrinkage after installation—characteristics that some may believe are important for proper single-ply performance.

According to the Single Ply Roofing Institute's (SPRI) Technical Committee, there are 12 basic material properties that are pertinent to all roofing membranes regardless of their chemical composition.

Evaluating materials

To evaluate material properties a test method must be used that suits the product's chemical composition and construction, according to SPRI. Different types of materials require different test methods.

To understand manufacturers' test results it is important to know what kind of test method was used. It is usually impossible to compare the performance of products that have been tested differently.

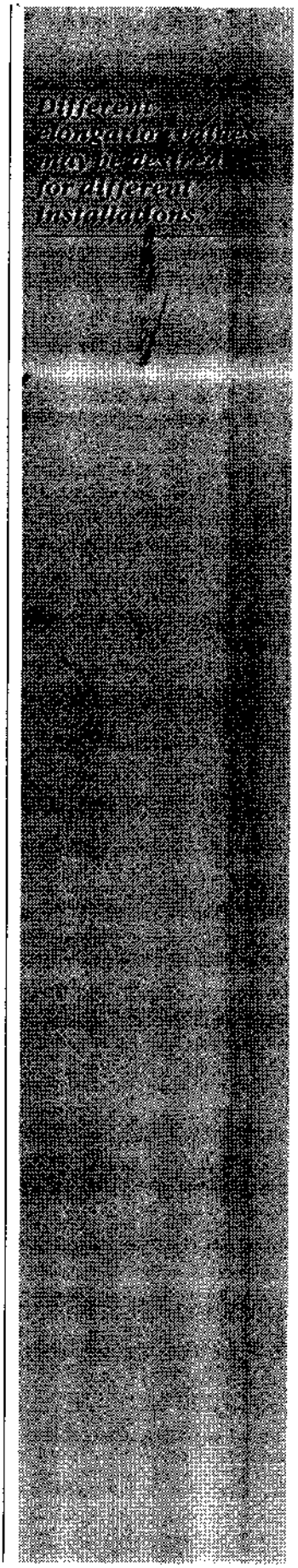
In most cases standard test methods do exist. In the United States they are established by ASTM. SPRI suggests that "if physical property data are to be used to aid in product selection, the test methods should also be considered. Sometimes the difference in test methods accounts for the difference in the particular results reported."

Important properties

To evaluate a single-ply membrane it is essential to know how measurements of each of its properties will affect its overall performance.

Thickness is the distance between a material's surfaces. It is expressed in mils, fractions of an inch or millimeters. Manufacturers must have effective quality control procedures to maintain a uniform product thickness. Thickness properties are usually associated with resistance to mechanical damage, hail, traffic and surface wear.

Tensile strength is the maximum force or stress required to break a membrane sample. Strength for non-reinforced membranes is reported in pounds per square inch (psi) of stress. For reinforced membranes strength is expressed as pounds of force (lbf). Tensile strength relates to the membrane's ability to withstand stress imposed by building movement, wind uplift and thermal loading. The lack of reinforcement or the type of reinforcement used also affects tensile strength.



Ultimate elongation is the amount a membrane sample stretches before it ruptures during tensile testing. Elongation is expressed as a percentage of the test sample's original length. A product's elongation value depends on its chemical composition as well as the presence of reinforcements. Different elongation values may be desired for different installations.

Modulus is the measure of a polymeric membrane's stiffness. It is reported as the psi of tensile stress required to produce a predetermined percentage of elongation. When the modulus for several products is measured using a standard percentage of elongation, it becomes possible to compare the products' relative stiffness.

Tear resistance is the load required to tear a material when stress is concentrated on a prescribed flaw introduced into the sample. Tear resistance is expressed in psi or lbf. This property indicates a membrane's ability to resist tear initiation and/or propagation. Different test methods are used to test the tear resistance of reinforced and non-reinforced membranes.

Water absorption is the measure of how much water a material will absorb when immersed for a prescribed period of time. It is expressed as a percentage of the sample's original weight. This test determines a membrane's water-resistance. The most suitable membranes will not gain or lose weight while immersed. Water absorption can affect a membrane's dimensional stability and membrane thickness as well as lead to internal stresses that can cause cracking.

Dimensional stability is a measure of a material's change in length and/or width after it has been exposed to high temperatures for a long period of time. The measurement is expressed as a percentage of the sample's original dimensions. The most suitable membranes will change little during this test. Dimensional change can build up forces within the roof system and affect a membrane's watertightness.

Low temperature resistance is the lowest temperature at which a material will not fracture or crack under prescribed impact and flexing conditions. Low temperature resistance is important for long membrane life in cold climates, where membranes must be able to withstand a combination of low temperatures and mechanical impact during application, structural movement or rooftop traffic in the winter months.

Accelerated weathering exposes materials to a controlled environment where various phenomena such as heat, water, condensation and light are altered to magnify their effects, creating an accelerated weathering process. The physical properties of the exposed membrane are then measured and compared to those of the original unexposed material. As with heat aging, this test attempts to provide insight into a membrane's long-term performance when exposed to different climatic variables. The relationship between test exposure time and real time, however, is difficult to determine.

More standards on the way

Although the ASTM standard for PVC membranes is the only criteria for single-ply membranes approved for use in the United States at this time, several other standards are being reviewed. The Rubber Manufacturing Association's (RMA) Minimum Requirements for Non-Reinforced Black EPDM Rubber Sheets for Use in Roofing Applications (IPR-1) and Minimum Requirements for Fabric-Reinforced Black Rubber Sheets for Use in Roofing Applications (IPR-2) are expected to be approved shortly.

ASTM is having trouble finalizing a standard criteria for modified bitumen membranes. Presently, the only current North American consensus standard for modified bitumen membranes is the Canadian General Standards Board's CGSB 37-GP-56M, Standard for Membrane, Modified Bituminous, Prefabricated and Reinforced Roofing. This standard is currently being rewritten. Changes in the standard's granular embedment and crack ridging capability criteria are expected to be finalized in the coming months. ASTM's D-8 Committee will be meeting in June to further discuss modified bitumen standards.