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Standard Guide for Use of High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane with Separate Wearing Course[1]

This standard is issued under the fixed designation C898/C898M; 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 guide describes the use of a high solids content, cold liquid-applied elastomeric waterproofing membrane that meets the criteria in Specification C836, in a waterproofing system subject to hydrostatic pressure for building decks over occupied space where the membrane is covered with a separate protective wearing course.

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.3 *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:*[2]

C33 Specification for Concrete Aggregates
C578 Specification for Rigid, Cellular Polystyrene Thermal Insulation
C717 Terminology of Building Seals and Sealants
C836 Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course
C920 Specification for Elastomeric Joint Sealants
C1193 Guide for Use of Joint Sealants
C1299 Guide for Use in Selection of Liquid-Applied Sealants (Withdrawn 2012)[3]
C1471 Guide for the Use of High Solids Content Cold Liquid-Applied Elastomeric Waterproofing Membrane on Vertical Surfaces
C1472 Guide for Calculating Movement and Other Effects When Establishing Sealant Joint Width
D1056 Specification for Flexible Cellular Materials—Sponge or Expanded Rubber
D1751 Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
D1752 Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
D5295 Guide for Preparation of Concrete Surfaces for Adhered (Bonded) Membrane Waterproofing Systems
D5957 Guide for Flood Testing Horizontal Waterproofing Installations
D6134 Specification for Vulcanized Rubber Sheets Used in Waterproofing Systems
D6451 Guide for Application of Asphalt Based Protection Board
D6506 Specification for Asphalt Based Protection Board for Below-Grade Waterproofing
E1907 Guide to Methods of Evaluating Moisture Conditions of Concrete Floors to Receive Resilient Floor Coverings (Withdrawn 2008)[3]

2.2 *American Concrete Institute Standard:*

ACI 301 Specifications for Structural Concrete for Buildings[4]

3. Terminology

3.1 For definitions of terms used in the guide, refer to Terminology C717.

3.2 *Definitions of Terms Specific to This Standard:*

[1] This guide is under the jurisdiction of ASTM Committee D08 on Roofing and Waterproofing and is the direct responsibility of Subcommittee D08.22 on Waterproofing and Dampproofing Systems.

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[2] 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.

[3] The last approved version of this historical standard is referenced on www.astm.org.

[4] Available from ACI International, P.O. Box 9094, Farmington Hills, MI 4833-9094.

3.2.1 *cold-applied*—capable of being applied without heating as contrasted to hot-applied. Cold-applied products are furnished in a liquid state, whereas hot-applied products are furnished as solids that must be heated to liquefy them.

3.2.2 *curing time*—the period between application and the time when the material reaches its design physical properties.

3.2.3 *deflection*—the deviation of a structural element from its original shape or plane due to physical loading, temperature gradients, or rotation of its supports.

3.2.4 *drainage board—see prefabricated drainage composite*, the preferred term.

3.2.5 *drainage course*—see *percolation layer* and Fig. 1.

3.2.6 *flashing*—a generic term describing the transitional area between the waterproofing membrane and surfaces above the wearing surface of the building deck; a terminal closure or barrier to prevent ingress of water into the system.

3.2.7 *freeze-thaw cycle*—the freezing and subsequent thawing of a material.

3.2.8 *percolation layer (drainage course)*—a layer of washed gravel or of a manufactured drainage media that allows water to filter through to the drain (see Fig. 1).

3.2.9 *prefabricated drainage composite*—proprietary devices to facilitate drainage, usually a composite laminate of more than one material including filter fabric.

3.2.10 *structural slab*—a horizontal, supporting, cast-in-place, concrete building deck. See Fig. 1.

3.2.11 *troweled finish*—a concrete finish provided by smoothing the surface with power driven or hand trowels or both, after the float finishing operation. A troweled finish is smoother than the floated finish. For specifications, see ACI 301.

3.2.12 *wearing surface*—a surface exposed to traffic, either pedestrian or vehicular, also described as finish wearing surface.

3.2.13 *wet-film thickness*—the thickness of a liquid coating as it is applied.

3.2.14 *wet-film gage*—a gage for measuring the thickness of a wet film.

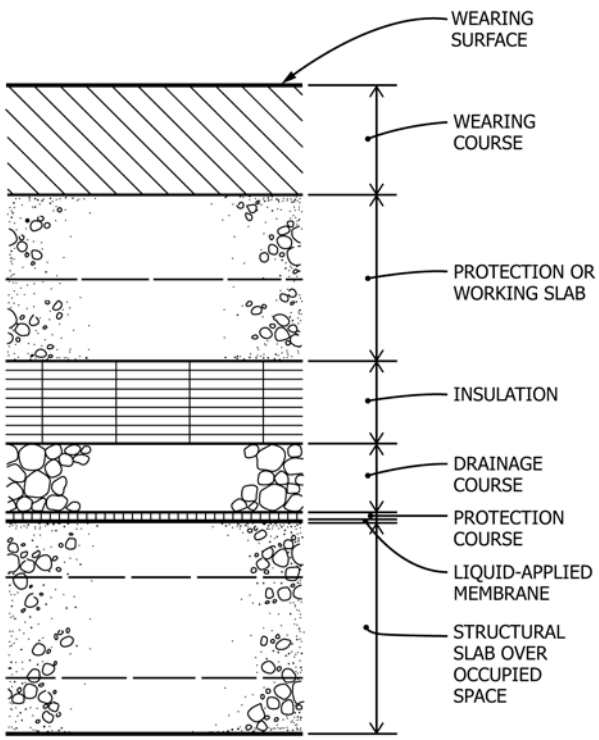

FIG. 1 Basic Components of Cold Liquid-Applied Elastomeric Membrane Waterproofing System with Separate Wearing Course

4. Significance and Use

4.1 Designers and installers of waterproofing systems may consult this guide for a discussion of important elements of the use of cold liquid-applied waterproofing membranes and associated elements of construction. This guide is not intended to serve as a specification for waterproofing installation.

4.2 Long-term performance of waterproofing with a separate wearing course is important because of the substantial difficulty in determining the location of leakage and in removing overlying materials to make repairs.

4.3 Refer to Guide C1471 for application on below grade walls and vertical surfaces.

5. General

5.1 *Major Components, Subsystems, and Features*—The major components to be considered for a building deck waterproofing system are the structural building deck or substrate to be waterproofed, waterproofing membrane, protection of the membrane, drainage, insulation, and wearing course (see Fig. 1). Additional features to be considered are membrane terminal conditions and expansion joints.

5.2 *Compatibility*—It is essential that all components and contiguous elements be compatible and coordinated to form a totally integrated waterproofing system.

6. Substrate

6.1 *General*—The building deck or substrate referred to in this guide is reinforced cast-in-place structural concrete. Precast concrete slabs pose more technical problems than cast-in-place concrete, and the probability of lasting watertightness is greatly diminished and difficult to achieve because of the multitude of joints which have the capability of movement and must be treated accordingly. Moving joints are critical features of waterproofing systems and are more critical when sealed at the membrane level than at a higher level with the use of integral concrete curbs. Such curbs are impractical with precast concrete slabs and necessitate an even more impractical drain in each slab. Other disadvantages of precast concrete slabs are their inflexibility in achieving contoured slope to drains and the difficulty of coordinating the placement of such drains.

6.2 *Strength*—The strength of concrete is a factor to be considered with respect to the liquid-applied membrane insofar as it relates to finish, bond strength, and continuing integrity (absence of cracks and other defects that could affect the integrity of the membrane after installation).

6.3 *Density and Moisture Content*—Density of concrete and moisture content when cured are interrelated and can affect adhesion of the membrane to the substrate with an excessively high moisture content, moisture may condense at the membrane and concrete interface and cause membrane delamination. This is particularly so if the top surface is cooler than the concrete below. Lower moisture contents are achieved with the use of hard, dense, stone aggregate. This type of coarse aggregate will generally provide structural concrete with a moisture content from 3 to 5 % when cured. Lightweight aggregate, such as expanded shale, will generally provide lightweight structural concrete with a moisture content from 5 to 20 % when cured. Lightweight insulating concrete made with a weaker expanded aggregate, such as perlite, has a relatively low compressive strength and can contain over 20 % moisture when cured. The concrete used for the substrate should have a minimum density of 1762 kg/m^3 (110 lb/ft^3) and have a maximum moisture content of 8 % when cured. From this it can be seen that only certain lightweight aggregates can be considered for use and no lightweight insulating aggregates can be used.

6.4 *Admixtures, Additives, and Cement/Concrete Modifiers*—Admixtures, additives, and modifiers serve many functions in mixing, forming, and curing concrete, such as to retard or accelerate the cure rate; reduce the water content required; entrain air; increase strength; create or improve the ability of the concrete to bond to existing, cured concrete; permit thin topping overlayers; and improve workability. Some admixtures and modifiers (particularly polymeric, latex, or other organic chemical based materials) may coat the concrete particles and reduce the ability of the waterproofing membrane to bond to the concrete. The membrane manufacturer should be consulted if the concrete used for the deck will contain any admixtures, additives, or modifiers in order to determine the compatibility of the membrane with the concrete.

6.5 *Underside Liner and Coating*—The underside of the concrete deck should not have an impermeable barrier. A metal liner or coating that forms a vapor barrier on the underside can trap moisture in the concrete and destroy or prevent the adhesive bond of the membrane to the upper surface of the concrete. Uniformly spaced perforations in metal liners may provide a solution to the vapor barrier problem but as yet there are no definitive data on the requirements for the size and spacing of the perforations. It should also be recognized that this method would preclude any painting of the metal liner after the concrete is poured on it.

6.6 *Slope for Drainage*—Drainage at the membrane level is important. When the waterproofing membrane is placed directly on the concrete slab a monolithic concrete substrate slope of a minimum 2 % (¼ in./ft) should be maintained. Slope is best achieved with a monolithic structural slab and not with a separate concrete fill layer. The fill presents the potential of additional cracks and provides a cleavage plane between the fill and structural slab. This cleavage plane complicates the detection of leakage in the event that water should penetrate the membrane at a crack in the fill and travel along the separation until reaching a crack in the structural slab.

6.7 *Finish*—The structural slab should have a finish that facilitates proper application of the liquid-applied membrane. The surface should be of sufficiently rough texture to provide a mechanical bond for the membrane but not so rough as to preclude achieving continuity of the membrane of the specified thickness across the surface. A typical manufacturer's recommendation is a steel-troweled finish, followed by a fine hair broom.

6.7.1 Concrete surfaces shall be free of laitance, loose aggregate, sharp projections, grease, oil, dirt, curing compounds, or other contaminants that could affect the complete bonding of the liquid-applied membrane to the concrete surface. For preparation and acceptance of concrete surfaces, refer to Guide D5295. Application shall not proceed until all protrusions and projections through the structural slab are in place, or sleeves placed through the slab, and provision has been made to secure their watertightness. Concrete surfaces shall be visibly dry and pass any additional dryness tests recommended by the liquid-applied membrane manufacturer prior to application.

6.8 *Curing*—Curing of the structural slab is necessary to provide a sound concrete surface and to obtain the quality of concrete required. The concrete should be cured a minimum of 7 days and aged a minimum of 28 days including curing time, before application of the liquid-applied membrane. Curing is accomplished chemically with moisture and should not be construed as drying.

6.8.1 *Moist Curing*—Moist curing is achieved by keeping the surfaces continuously wet by covering them with burlap saturated with water and kept wet by spraying or hosing. The covering material should be placed to provide complete surface coverage with joints lapped a minimum of 75 mm (3 in.).

6.8.2 *Sheet Curing*—Sheet curing is accomplished with a sheet vapor retarder that reduces the loss of water from the concrete and moistens the surface of concrete by condensation, preventing the surface from drying while curing. Laps of sheets covering the slab should not be less than 50 mm (2 in.) and should be sealed or weighted.

6.8.3 *Chemical Curing*—Liquid or chemical curing compounds should not be used unless approved by the manufacturer of the liquid-applied membrane as the material may interfere with the bond of the membrane to the structural slab.

6.9 *Dryness*—Comply with membrane manufacturer's requirements for substrate dryness. For methods for testing moisture content, refer to Guide E1907.

6.10 *Joints*—Joints in a structural concrete slab in this guide are referred to as reinforced joints, nonreinforced joints, and expansion joints.

6.10.1 *Reinforced Joints*—Reinforced joints consist of hairline cracks, cold joints, construction joints, isolation joints, and control joints held together with steel reinforcing bars or wire fabric. These are considered static joints with little or no anticipated movement because the slab reinforcement is continuous across the joint.

6.10.2 *Nonreinforced Joints*—Nonreinforced joints consist of butted construction joints and isolation joints not held together with steel reinforcing bars or wire fabric. These joints