

LIQUID BOOT® PLUS - Brownfield Membrane and Vent Systems Specifications

Section 07 2623.19 – March 2010 (Supersedes All Previous Versions)

Version 5.0

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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. General and Supplementary Conditions and Division 1- General Requirements applies to this section. Provide gas vapor barrier as indicated, specified and required.

1.02 WORK SUMMARY

- A. Work in this section - principal items include:
1. Gas vapor barrier providing protection from the following gases: Methane, other Hydrocarbon vapors in concentrations up to 20,000ppm, Hydrogen Sulfide, Radon.
 2. Soil vapor extraction piping and low profile venting system beneath the gas vapor membrane.

1.03 RELATED REQUIREMENTS:

- A. Other specification Sections which directly relate to the work of this section include, but are not limited to, the following:
1. Division 03 Section "Cast-In-Place Concrete" for concrete slabs.
 2. Division 07 Section "Self-Adhering Sheet Waterproofing."
 3. Division 07 Section "Cold Fluid-Applied Waterproofing."
 4. Division 07 Section "Crystalline Waterproofing."
 5. Division 26 Section "Conduit and other Electrical Penetrations."
 6. Division 31 Section "Earthwork, Excavation and Fill, Shoring."
 7. Division 33 Section "Geocomposite Foundation Drainage."

1.04 SYSTEM DESCRIPTION

- A. Provide gas/vapor barrier system with prefabricated composite venting system to mitigate the passage of gas or vapor and install without defects, damage or failure. Gas vapor barrier shall be high performance VI-20 with EVOH core technology, Liquid Boot®, UltraShield protection course and applicable accessory products

1.05 SUBMITTALS

- A. General: Prepare and submit specified submittals in accordance with "Conditions of the Contract" and Division 1 Submittals Sections.
- B. Product Data: Submit manufacturer's product data, with complete general and specific installation instructions, recommendations, and limitations.
- C. Product Samples: Submit representative samples of the following for approval:
1. GeoVent – low profile vapor extraction system.
 2. VI-20 – high density polyethylene (HDPE) and ethylene vinyl alcohol (EVOH) composite membrane.
 3. Liquid Boot® Detailing Fabric – ethylene vinyl alcohol (EVOH) and polypropylene composite membrane.
 4. BaseFabric T-40 or T-60 – thermally bonded non woven polypropylene fabric.
 5. Liquid Boot® - asphalt latex spray applied gas vapor barrier membrane.
 6. UltraShield G-1000 – polypropylene needle punched protection course.
- D. Contractor Certificate: At time of bid, submit written certification that installer has current Approved Applicator status with gas vapor membrane manufacturer.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Gas vapor membranes and all accessory products shall be provided by a single manufacturer with a minimum of 25 years experience in the direct production and sales of gas vapor systems. Manufacturer shall be approving an acceptable installer/applicator and recommending appropriate installation methods.

- B. Installer Qualifications: A firm that is trained and approved by the gas vapor barrier system manufacturer for installation of the gas vapor barrier system required for this Project. The installing company should have at least three (3) years experience in work of the type required by this section, who can comply with manufacturer's warranty requirements.
- C. Pre-installation Conference: A pre-installation conference shall be held at the site prior to commencement of field installation to establish procedures to maintain required working conditions and to coordinate this work with related and adjacent work. Verify that final gas vapor barrier components and system details comply with gas vapor barrier manufacturer's current installation requirements and recommendations. Pre-con meeting attendees should include representatives for the owner, architect, inspection firm, general contractor, gas vapor installer/applicator, concrete contractor, excavating/backfill contractor, and mechanical and electrical contractors if work penetrates the gas vapor membrane.
- D. Independent Inspection: Owner shall make all arrangements and payments for an independent inspection service to monitor gas vapor membrane material installation compliance with the project contract documents and manufacturer's published literature and site specific details. Independent Inspection Firm shall be an approved company participating with the gas vapor membrane manufacturer's Certified Inspection Program. Inspection service shall produce reports and digital photographs documenting each inspection. Reports shall be made available to the Contractor, gas vapor membrane installer, gas vapor membrane material manufacturer, and Architect. Inspections should include substrate examination, beginning of gas vapor membrane installation, periodic intervals, and final inspection prior to concrete or backfill placement against the gas vapor barrier.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Handling: Deliver materials in factory sealed and labeled packaging. Sequence deliveries to avoid delays, while minimizing on-site storage. Handle and store following manufacturer's instructions, recommendations and material safety data sheets. Protect from construction operation related damage, as well as, damage from weather, excessive temperatures and prolonged sunlight. Remove damaged material from site and dispose of in accordance with applicable regulations.
- B. Do not allow material to freeze in containers
- C. Remove and replace liquid materials that cannot be applied within their stated shelf life.

1.08 JOB CONDITIONS

- A. Environmental Limitations: Apply gas vapor barrier system within the range of ambient and substrate temperatures recommended by manufacturer. Do not apply gas vapor barrier system to a damp or wet substrate, when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F (3 deg C) above dew point.
- B. Do not apply gas vapor barrier system in snow, rain, fog or mist, or when such weather conditions are imminent during application and curing period.
- C. Maintain adequate ventilation during application and curing of gas vapor barrier system materials.
- D. Ambient temperature shall be within manufacturer's specifications. If winter conditions apply, we recommend the use of space heaters and necessary cover (i.e. visqueen) to bring the ambient temperature to at least +45°F until the protection course and structural slab rebar or a mudslab protection course has been placed.
- E. Surface preparation shall be per manufacturer's specification.

1.09 COORDINATION

- A. Coordinate application of gas vapor barrier with installation of other construction.
 1. Positively secure plumbing, electrical, mechanical, and structural items to be under or passing through the gas vapor barrier in their proper positions and appropriately protected prior to membrane application.
 2. Install gas vapor barrier before placement of reinforcing steel. When not possible, mask all exposed reinforcing steel prior to membrane application.

1.10 PRODUCT WARRANTY

- A. Upon delivery and acceptance by the Owner of material specified by this Section, the materials manufacturer will provide a written one year standard material indicating the material conforms to its product specifications and is free of material defects. Factors affecting the results obtained from using this product including weather, equipment utilized, construction, workmanship and other variables are all beyond the manufacturer's control.

Under this product warranty, manufacturer will provide replacement material, at no charge, for any product proven not to meet the material properties listed in the published product literature This warranty is in lieu of any and all other warranties expressed or implied (including any

implied warranty of merchantability or fitness for a particular use), and manufacturer shall have no further liability of any kind including liability for consequential or incidental damages resulting from any defects or delays caused by replacement or otherwise.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Provide Liquid Boot® Plus membranes, venting system and applicable accessories as manufactured by Colloid Environmental Technologies Company (CETCO), 2870 Forbs Ave, Hoffman Estates, IL 60192,, USA. Phone: (847) 851-1800; Fax: (847) 851-1899; Web-site: <http://www.sedimentremediation.com>.

2.02 QUALIFICATIONS

- A. The gas vapor barrier manufacturer must have produced at least 22 million square feet (2 million square meters) of gas vapor barrier, with at least 22 million square feet (2,000,000 square meters) installed.

2.03 MATERIALS

- A. VI-20® is a seven-layer co-extruded membrane made from ethylene vinyl alcohol (EVOH) and polyethylene to provide strength as well as resistance to VOC vapor transmission. VI-20 membrane is an under-slab barrier when used in conjunction with Liquid Boot® will inhibit volatile organic compound vapor migration through the concrete.

VI-20 geomembrane barrier physical properties:

PROPERTIES	TEST METHOD	VALUE
Thickness, nominal	ASTM D5199	0.51 mm
Weight	ASTM D5261	498 g/m ²
Tensile Strength	ASTM E154	258 N/cm (58 lb/in)
Methane Permeability	ASTM D 1434	< 5 x 10 ⁻¹⁰ m ² /d•atm
Radon Diffusion Coefficient		< 0.25 x 10 ⁻¹² m ² /s

- B. Fluid applied gas vapor barrier system - Liquid Boot®; a single course, high build, polymer modified asphaltic emulsion. Water borne and spray applied at ambient temperatures. A minimum thickness of 60 dry mils, unless specified otherwise as some cities and engineers may require a thicker membrane. Non-toxic and odorless. Liquid Boot® Trowel Grade has similar properties with greater viscosity and is trowel applied. Manufactured by CETCO in Santa Ana, CA and Cartersville, GA (714) 384-0111.

LIQUID BOOT® gas vapor barrier physical properties:

GAS VAPOR MEMBRANE	TEST METHOD	VALUE
Acid Exposure (10% H ₂ SO ₄ for 90 days)	ASTM D543	Less than 1% weight change
Diesel (1000 mg/l), Ethylbenzene (1000 mg/l), Naphthalene (5000 mg/l) and Acetone (500 mg/l) Exposure for 7 days	ASTM D543	Less than 1% weight change, Less than 1% tensile strength change
Radon Permeability	Tested by US Dept. of Energy	Zero permeability to Radon (222Rn)
Bonded Seam Strength Tests	ASTM D6392	Passed*
Micro Organism Resistance (Soil Burial)- average weight change,	ASTM D4068-88	Passed*
Methane Permeability	ASTM 1434-82	Passed*
Oil Resistance Test- average weight change, average tensile strength change, average tensile stress change, average elongation change, bonded seams, methane permeability	ASTM D543-87	Passed*
Heat Aging- average tensile strength change, average tensile stress change, average elongation change, bonded seams	ASTM D4068-88	Passed*
Dead Load Seam Strength	City of Los Angeles	Passed*
Environmental Stress-Cracking	ASTM D1693-78	Passed*
PCE Diffusion Coefficient	Tested at 6,000 mg/m ³	2.74 x 10 ⁻¹⁴ m ² /sec
TCE Diffusion Coefficient	Tested at 20,000 mg/m ³	8.04 x 10 ⁻¹⁴ m ² /sec
Soil Burial	ASTM E154-88	Passed
Water Vapor Permeability	ASTM E96	0.24 perms
Water Vapor Transmission	ASTM E96	0.10 grains/h•ft ²
POTABLE WATER	TEST METHOD	VALUE
Toxicity Test	22 CCR 66696	Passed. CCR Bioassay—Flathead Minnow

Potable Water Containment	ANSI/NSF 61	NSF Certified for tanks >300,000 gal**
Hydrostatic Head Resistance	ASTM D751	Tested to 138 feet or 60 p.s.i
GENERAL INFORMATION	TEST METHOD	VALUE
Freeze-Thaw Resistance (100 Cycles)	ASTM A742	Meets criteria. No spalling or disbondment
Accelerated Weathering & Ultraviolet Exposure	ASTM D822	No adverse effect after 500 hours
Elongation	ASTM D412	1,332% - Ø reinforcement, 90% recovery
Tensile Strength	ASTM D412	58 p.s.i. without reinforcement
Tensile Bond Strength to Concrete	ASTM D413	2,707 lbs/ft ² uplift force

*per City of Los Angeles approval for 100-mil Liquid Boot® gas vapor barrier.

**per NSF approval for 80-mil Liquid Boot® potable water containment membrane

LIQUID BOOT® Agency Approvals:

1. City of Los Angeles Research Report # 24860-Approved for "Liquid Boot® Membrane for Below-Grade Waterproofing and Gas Barrier"
2. United States Navy-Approved for "Liquid Boot® for Use World Wide to Waterproof Earth-Covered Steel Ammunition Storage"
3. NSF International-NSF/61 approved for "Potable Water Tank Liner"
4. Canadian Construction Materials Board-Approved for "Waterproofing and Damp Proofing"
5. County of Los Angeles Department of public works-Approved for "Liquid Boot® Application as a Methane Gas Barrier"

C. ACCESSORY GAS VAPOR BARRIER PRODUCTS: All accessory gas vapor barrier materials shall be provided by the manufacturer or shall have manufacturer's written approval for substitution.

1. GeoVent – low profile vapor extraction system.
 - i. Liquid Boot® GeoVent end outlet.
 - ii. Liquid Boot® GeoVent interior Footing Sleeves.
 - iii. Liquid Boot® GeoVent Fabric Reinforced Tape.
2. Liquid Boot® Detailing Fabric – ethylene vinyl alcohol (EVOH) and polypropylene composite membrane.
3. Optional - vertical applications, Liquid Boot® BaseFabric T-40 or T-60 – thermally bonded nonwoven polypropylene fabric
4. UltraShield – polypropylene needle punched protection mat.
5. Adhesive system for Liquid Boot® UltraShield and Liquid Boot® UltraDrain: Use Liquid Boot® UltraGrip.
6. Hardcast CRT 1602 Tape 3" wide – covering cold joints, cracks form tie holes, etc.

PART 3 - EXECUTION

3.01 EXAMINATION

A. The installer, with the Owner's Independent Inspector present, shall examine conditions of substrates and other conditions under which this section work is to be performed and notify the contractor, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected and are acceptable for compliance with manufacturer requirements. General substrate conditions acceptable for the gas vapor barrier installation are listed below. For conditions not covered in this Section, contact the gas vapor barrier manufacturer for guidance.

B. SOIL SUBSTRATES:

1. Moisture condition and compact sub-grade to a minimum relative compaction of 90 percent or as specified by civil/geotechnical engineer with finished surface smooth, uniform, free of debris and standing water.
2. Stones or dirt clods greater than 1/4 inch to be removed. Aggregate sub-bases shall be rolled flat, free from any protruding sharp edges.
3. Penetrations must be prepared in accordance with manufacturer's specifications. All form stakes that penetrate the membrane shall be of rebar which shall be bent over and left in the slab.
4. Trenches oversize are to be cut to accommodate gas vapor barrier membrane and protection course with perpendicular to sloped sides and maximum obtainable compaction. Finish grade and compact the adjoining grade.
5. Provide excavated walls vertical or sloped back, free of roots and protruding rocks.
6. Soil sterilant applications should at the sterilant manufacturer's recommended rate.

C. WOOD TIMBER SHORING: Wood lagging shoring should extend to the lowest level of the gas vapor membrane installation with any voids or cavities exterior of the lagging timbers filled with compacted soil or cementitious grout. Interior surface of lagging boards should be planar and tight together with gaps less than 1" (25 mm). Gaps in excess of 1" should be filled with cementitious grout, compacted soil, wood, extruded polystyrene (40 psi min.) Do not use plywood or other surface treatment over large lagging gaps that leave the cavity void.

D. CUT ROCK FACE OR AUGER CAST CAISSON SHORING WALLS: Interior surface of cut rock and concrete auger pile retention walls should be planar without irregular surface conditions, voids, and sharp transitions that would leave a void space to the outside of the gas vapor barrier installation. Irregular rock, void pockets, cracks, sharp concave transitions should be completely filled or smoothed with cementitious grout, shotcrete, or other approved solid material

E. MECHANICAL OR OTHER PENETRATIONS: Mechanical, structural, or architectural materials that will pass through the plane of the gas vapor membrane shall be properly installed and secured in their final position prior to installation of the Liquid Boot® Plus system.

- F CONCRETE: Concrete to be gas vapor proof shall be properly placed and consolidated. Reinforced structural slabs should be a minimum of 6" (150 mm) thick when placed on a working mud slab. Reinforced concrete slab(s) on compacted grade shall be a minimum of 4" (100 mm) thick.
1. At cast in place concrete surfaces, provide a light broom finish or smoother, free of any dirt, debris, loose material, release agents or curing compounds. Fill voids more than 1/4 inch deep and 1/4 inch wide.
 2. At masonry joints, cold joints, and form joints, provide a struck smooth surface. Prepare penetrations in accordance with manufacturer's specifications.
 3. Provide a 3/4 inch minimum cant of Liquid Boot®, or other suitable material as approved by manufacturer, at all horizontal to vertical transitions and other inside corners of 120 degrees or less. Allow to cure overnight before the application of Liquid Boot®.
 4. Completely grout all cracks or cold joints greater than 1/16 inch with non-shrink grout. Install Hardcast reinforcing tape over all cold joints, cracks and form tie holes (after holes and cracks are grouted).

3.02 SURFACE PREPARATION-

- A. Provide 24 inch minimum clearance out from surfaces to receive the gas vapor barrier. The application surface shall be prepared and provided to the applicator in accordance with manufacturer's specifications listed below:
- B. Remove dirt, debris, oil, grease, cement laitance, or other foreign matter which will impair or negatively affect the performance of the gas vapor barrier and venting system.
- C. Protect adjacent work areas and finish surfaces from damage or Liquid Boot® over spraying during product applications.

3.03 INSTALLATION OF GAS COLLECTION/VENT SYSTEM

- A. Roll out Liquid Boot® GeoVent per approved layout
- B. Provide prefabricated Liquid Boot® GeoVent Sleeves or GeoVent End Outlets where venting penetrates interior footing
- C. At points of intersections, cut away geotextile to produce rectangular flaps. Interlock exposed dimple board in a Lego-like fashion. Fold flaps of geotextile in a manner so that the dimple board is covered completely. Secure geotextile folds with Liquid Boot® Fiber Reinforced Tape so that the geotextile is completely impermeable to sand fill
- D. Use Liquid Boot® GeoVent End Outlet to attach to a solid (non-perforated 2" (inches) diameter PVC pipe at penetration through building foundation. Seal/grout piping at penetrations through foundation using approved methods.

3.04 INSTALLATION ON CONCRETE/SHOTCRETE/MASONRY

- A. Seal around penetrations in accordance with manufacturer instructions.
- B. Provide a ¾ inch minimum cant of LIQUID BOOT®, or other suitable material as approved by manufacturer, at all horizontal to vertical transitions and other inside corners of 120° or less. Allow to cure overnight before the application of Liquid Boot®.
- C. Delineate a test area on site with a minimum dimension of 10 feet by 10 feet (3m by 3m). Apply Liquid Boot® to a thickness of 60 mils and let it cure for 24 hours. Observe for blisters. If minor or no blistering occurs, proceed to the next step. If significant blistering does occur, apply a thin (10 mil) tack coat of LIQUID BOOT® "A" side without catalyst to the entire concrete surface and allow to cure before proceeding.
- D. Spray apply Liquid Boot® to a 60 mil minimum dry thickness. Increase thickness to 100 dry mils if shotcrete is to be applied directly to membrane. If a second coat is required, remove any standing water from the membrane before proceeding with the second application.
- E. Non-horizontal surfaces: Spray on non-horizontal surfaces should begin at the bottom and work towards the top. This method allows the product to adhere to the surface before hitting catalyst runoff.

- F. Do not penetrate membrane. Keep membrane free of dirt and debris and traffic until a protective cover is in place. It is the responsibility of the General Contractor to insure that the membrane and the protection system are not penetrated.
- G. After membrane has cured and checked for proper thickness and flaws, install protection material pursuant to manufacturer's instructions.
 1. Perform all testing or inspection prior to placing protection course.

NOTE: Due to the nature of concrete as a substrate, it is normal for some blistering to occur. This is caused by either concrete's tendency to off-gas or water that is temporarily trapped between the concrete and the membrane. With time and the applied pressure of backfill or over-slab, blisters will absorb into the concrete without detriment to the membrane. A small number of blister heads should be sampled and checked for proper membrane thickness. If the samples have the minimum required membrane thickness, then the remaining blisters should not be punctured or cut. If the samples have less than the minimum required membrane thickness, then the area can either be re-sprayed to obtain the proper thickness, or the blisters can be cut out and the area re-sprayed or patched with Liquid Boot® Trowel Grade.

3.05 INSTALLATION ON DIRT SURFACES AND MUDSLABS

- A. Roll out VI-20 geomembrane on sub-grade and overlap seams a minimum of 6 inches. Lay geomembrane tight at all inside corners. Apply a thin 20 mil Liquid Boot® spray applied within the seam overlap. Line trenches with geomembrane extending at least six inches (6") onto adjoining sub-grade if slab and footings are to be sprayed separately.
- B. Minimize the use of nails to secure the geomembrane to the dirt subgrade. Remove all nails before spraying membrane, if possible. Nails that cannot be removed from the dirt subgrade are to be patched with Liquid Boot® Detailing Fabric or Hardcast reinforcing tape overlapping the nail head by a minimum of two inches (2"). Apply a 20 mil Liquid Boot® under the geomembrane patch, when patching with geomembrane.
- C. Sealing around penetrations.
- D. Spray apply Liquid Boot® onto VI-20 geomembrane to a 60 mil minimum dry thickness. Increase thickness to 100 dry mils if shotcrete is to be applied directly to membrane. If a second coat is required, remove any standing water from the membrane before proceeding with the second application.
- E. Do not penetrate membrane. Keep membrane free of dirt, debris and traffic until a protective cover is in place. It is the responsibility of the General Contractor to insure that the membrane and the protection system are not penetrated.
- F. After membrane has cured and checked for proper thickness and flaws, install protection material pursuant to manufacturer's instructions.
 - 1. Perform all testing or inspection to be performed prior to placing protection course.

3.06 SEALING AROUND PENETRATIONS

3.06.10 OPTION 1

- A. Clean all penetrations. Sand metal penetrations clean with emery cloth.
- B. For applications requiring VI-20, roll out geomembrane on sub-grade, overlapping seams a minimum of six inches (6"). Cut the geomembrane around penetrations so that it lays flat on the sub-grade. Lay geotextile tight at all inside corners. Apply a thin (20 mil) LIQUID BOOT® within the seam overlap then lap Liquid Boot® Detailing Fabric around penetrations extending 3 inches around the base of penetration.
- C. At the base of penetration Install a minimum ¾ inch thick membrane cant of Liquid Boot®, or other suitable material as approved by manufacturer. Extend the membrane at a 60 mil thickness three inches (3") around the base of penetration and up the penetration a minimum of three inches (3"). Allow to cure overnight before the application of Liquid Boot® membrane. (See manufacturer's standard detail.)
- D. Spray apply LIQUID BOOT® to an 60 mils minimum dry thickness around the penetration, completely encapsulating the collar assembly and to a height of one and one half inches (1 1/2") minimum above the membrane. Spray-apply Liquid Boot® to surrounding areas as specified for the particular application. (SEE MANUFACTURER'S STANDARD DETAIL)
- E. Allow LIQUID BOOT® to cure completely before proceeding to step "F".
- F. Wrap penetration with polypropylene cable tie at a point 2 inches above the base of the penetration. Tighten the cable tie firmly so as to squeeze, but not cut, the cured membrane collar.

3.06.20 OPTION 2

- A. Clean all penetrations. Sand metal penetrations clean with emery cloth.
- B. For applications requiring VI-20, roll out geomembrane on sub-grade overlapping seams a minimum of six inches (6"). Cut the geomembrane around penetrations so that it lays flat on the sub-grade. Lay geomembrane tight at all inside corners. Apply a thin (20 mil) of Liquid Boot® within the seam overlap then lap Liquid Boot® Detailing Fabric around penetrations extending 3 inches around the base of penetrations.
- C. Spray-apply LIQUID BOOT® to surrounding areas as specified for the particular application to a 60 mil minimum dry thickness. At the base of penetration Install a minimum 3/4 inch thick membrane cant of LIQUID BOOT®, or other suitable material as approved by manufacturer. Extend the membrane at 60 mil thickness up the penetration a minimum of three inches (3"). Allow to cure overnight before proceeding to D (SEE MANUFACTURER'S STANDARD DETAIL)
- D. Spray apply Liquid Boot® the membrane at an 60 mil thickness three inches (3") around the base of penetration and up the penetration, completely encapsulating the collar assembly, to a height of one and one half inches (1 1/2") minimum above the membrane. (SEE MANUFACTURER'S STANDARD DETAIL)
- E. Allow Liquid Boot® to cure completely before proceeding to step "F".
- F. Wrap penetration with polypropylene cable tie at a point two inches (2") above the base of the penetration. Tighten the cable tie firmly so as to

squeeze, but not cut, the cured membrane collar.

3.07 FIELD QUALITY CONTROL

- A. The membrane must be cured at least overnight before inspecting for dry-thickness, holes, shadow shrinkage, and any other membrane damage. When thickness or integrity is in question the membrane should be tested in the proper manner as described below. However, over-sampling defeats the intent of inspections. Inspectors should always use visual and tactile measurement to guide them. Areas suspected of being too thin to the touch should be measured with the gauges to determine the exact thickness. With practice and by comparing tactile measurements with those of the gauges, fingers become very accurate tools.
- B. **ON CONCRETE/SHOTCRETE/MASONRY & OTHER HARD SURFACES**
1. Membrane may be checked for proper thickness with a blunt-nose depth gauge, taking one reading every 500 square feet. Record the readings. Mark the test area for repair, if necessary.
 2. If necessary, test areas are to be patched over with Liquid Boot® to a 60 mils minimum dry thickness, extending a minimum of 1 inch beyond the test perimeter.
- C. **ON DIRT AND OTHER SOFT SUBSTRATES**
1. Samples may be cut from the membrane and geomembrane sandwich to a maximum area of 2 square inches. Measure the thickness with a mil-reading caliper, per 500 sq. feet. Deduct the geomembrane thickness of 20 mils to determine the thickness of LIQUID BOOT® membrane. Mark the test area for repair.
 2. Patch voids left by sampling with Detailing Fabric underlay beneath the existing membrane with HDPE side up and a minimum of 2 inches overlap. Apply a thin tack coat of Liquid Boot® under the geomembrane patch. Then spray or trowel-apply Liquid Boot® to a 60 mils minimum dry thickness, extending at least three inches (3") beyond geotextile patch.
- D. **SMOKE TESTING FOR HOLES**
1. Smoke test the membrane for holes and other breaches in accordance with the manufacturer's written instructions.

END OF SECTION