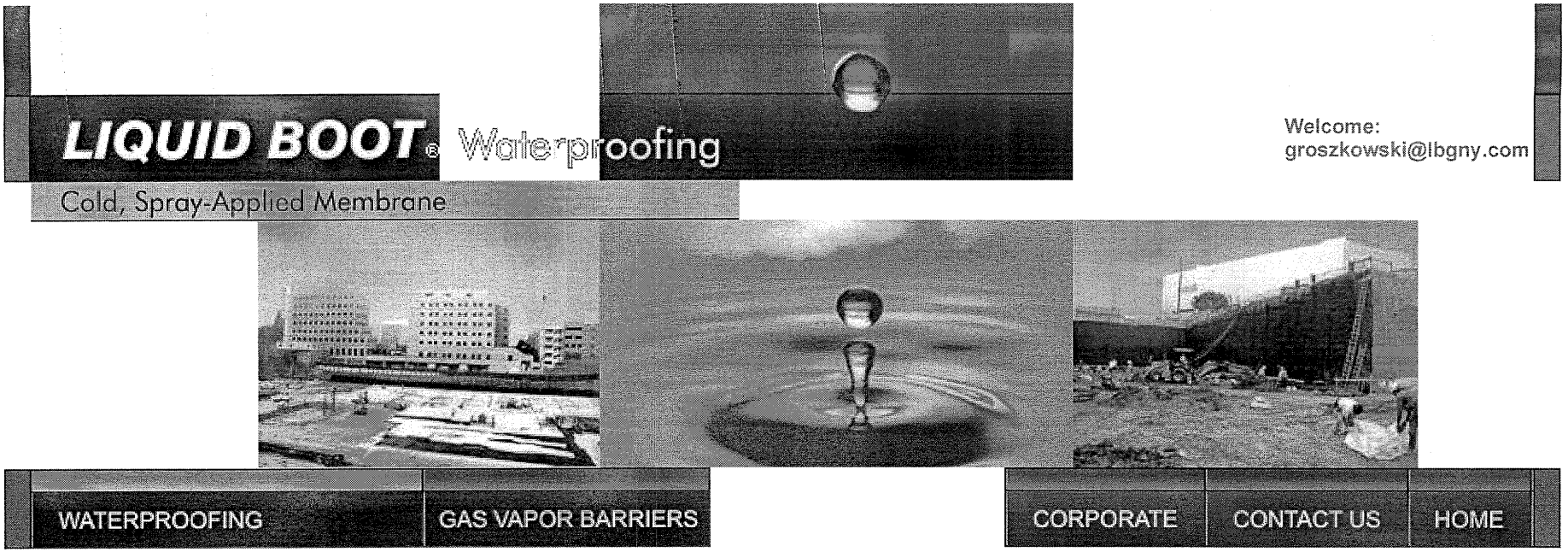
APPENDIX II



BLINDSIDE BELOW GRADE
POSITIVE SIDE BELOW GRADE
BETWEEN SLAB DECKS
UNDERSLAB BELOW GRADE
SLAB ON GRADE
RESERVOIRS & TANKS
DRAINAGE & PROTECTION
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LIQUID BOOT® Fluid-Applied Waterproofing

SECTION 07100
Version 2.6

These specifications may have changed. Go to www.liquidboot.com or call LBI Technologies, Inc. at 714.384.0111 for the most recent version.

PART 1 - GENERAL

1.01 DESCRIPTION

General and Supplementary Conditions and Division 1 - General Requirements applies to this section. Provide fluid applied waterproofing as indicated, specified and required

A. Work in this section - principal items include:

1. Fluid applied waterproofing on buildings, planter and site retaining walls.
2. Between slab waterproof membrane

B. Related work not in this section:

1. Excavation and backfilling.
2. Parge coat on masonry to receive waterproof membrane.
3. Mortar beds or concrete toppings over waterproof membranes.
4. Latex waterproofing.

5. Damp-proofing.
6. Flashing and sheet metal.
7. Joint sealers.
8. Soil sterilant.
9. Drainage

1.02 QUALITY ASSURANCE

Waterproofing contractor/applicator shall be trained and approved by waterproof membrane manufacturer, LBI Technologies, Inc. A pre-installation conference shall be held prior to application of waterproof membrane to assure proper substrate and installation conditions, to include contractor, applicator, architect/engineer and special inspector.

1.03 SUBMITTALS (Refer to section 01300 for procedures)

A. Project Data - Submit manufacturer's product data and installation instructions for specific application.

B. Samples - Submit representative samples of the following for approval:

1. Waterproof membrane material.
2. Protection Board and/or Protection Mat.
3. Prefabricated Drainage Mat.
4. Geotextiles.

1.04 DELIVERY, STORAGE AND HANDLING

Deliver materials to site in original unbroken packages bearing manufacturer's label showing brand, weight, volume and batch number. Store materials at site in strict compliance with manufacturer's instructions. Do not allow materials to freeze in containers.

1.05 JOB CONDITIONS

A. Protect all adjacent areas not to be waterproofed. Where necessary, apply masking to prevent staining of surfaces to remain exposed wherever membrane abuts to other finish surfaces.

B. Perform work only when existing and forecasted weather conditions are within manufacturer's recommendations for the material and product used.

C. Minimum clearance of required for application of product:

- 90° spray wand- 2 feet
- Conventional spray wand- 4 feet.

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 +45ºF until the protection course and structural slab rebar or a mudslab protection course has been placed.

E. All plumbing, electrical, mechanical and structural items to be under or passing through the waterproof membrane shall be positively secured in their proper positions and appropriately protected prior to membrane application.

F. Waterproof membrane shall be installed before placement of reinforcing steel. When not possible, all exposed reinforcing steel shall be masked by General Contractor prior to membrane application.

G. Expansion joints must be filled with a conventional waterproof expansion joint material.

H. Surface preparation shall be per manufacturer's specification.

1.06 PRODUCT WARRANTY

LBI Technologies, Inc. (LBI) warrants its products to be free of defects. This warranty only applies when the LIQUID BOOT® is applied by LBI Approved Applicators and that the required respective products (such as LIQUID BOOT® UltraDrain, LIQUID BOOT® UltraShield, LIQUID BOOT® BaseFabric and LIQUID BOOT® GeoVent) are used. As factors which affect the result obtained from this product, including weather, equipment utilized, construction, workmanship and other variables -are all beyond the manufacturer's control, LBI warrants only that the material conforms to its product specifications. Under this warranty LBI will replace at no charge any product not meeting these specifications within 12 months of manufacture, provided it has been applied in accordance with LBI written directions for use recommended as suitable for this product. Warranties are available for a longer period upon request and mutual written consent. 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 LBI 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 MATERIALS

A. Fluid applied waterproofing system - LIQUID BOOT®; a single course, high build, polymer modified asphaltic emulsion. Water borne and spray applied at ambient temperatures. A minimum thickness of 80 dry mils, unless specified otherwise. Non-toxic and odorless. LIQUID BOOT® Trowel Grade has similar properties with greater viscosity and is trowel applied. Manufactured by LBI Technologies, Inc., Santa Ana, CA (714) 384-0111.

B. Fluid applied waterproofing physical properties:

WATERPROOFING	TEST METHOD	VALUE
Soil Burial	ASTM E154-88	Passed
Water Penetration Rate	ASTM D2434	<7.75 x 10-9 cm/sec
Water Vapor Permeability	ASTM E96	0.24 perms
Water Vapor Transmission	ASTM E96	0.10 grains/h-ft2
GAS VAPOR MEMBRANE	**TEST METHOD**	**VALUE**
Hydrogen Sulfide Gas Permeability	ASTM D1343	None Detected
Benzene, Toulene, Ethylene, Xylene, Gasoline, Hexane, Perchloroethylene	ASTM D543, D412, D1434 (tested at 20,000 ppm)	Passed-gas permeability & weight change
Sodium Sulfate (2% water solution)	ASTM D543, D412, D143	Passed-gas permeability & weight change
Acid Exposure (10% H2SO4 for 90 days)	ASTM D543	Less than 1% weight 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, average tensile strength change, average tensile stress change, average elongation change, bonded seams, methane permeability	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/m3	2.74 x 10-14 m2/sec
TCE Diffusion Coefficient	Tested at 20,000	8.04 x 10-14 m2/sec

	mg/m3	
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
GENERAL INFORMATION	**TEST METHOD**	**VALUE**
Coefficient of Friction-with geotextile both sides	ASTM D5321	0.72
Cold Bend Test	ASTM D146	Passed. No cracking at -25°F
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
Hydrostatic Head Resistance	ASTM D751	Tested to 138 feet or 60 p.s.i
Elongation	ASTM D412	1,332% Ø reinforcement, 90% recovery
Elongation- with 8oz. non-woven geotextile both sides	ASTM D751	100% (same as geotextile tested separately)
Tensile Strength	ASTM D412	58 p.s.i. Ø reinforcement
Tensile Strength-8oz. non-woven geotextile both sides	ASTM D751	196 psi (same as geotextile tested separately)
Tensile Bond Strength to Concrete	ASTM D413	2,556 lbs/ft2 uplift force
Puncture Resistance-8oz. non-woven geotextile both sides	ASTM D4833	286 lbs. (travel of probe = 0.756 inches) (same as geotextile tested separately)
Flame Spread	ASTM E108	Class A with top coat (comparable to UL790)
Electric Volume Resistivity	ASTM D257	1.91 x 1010 ohms-cm

C. Agency Approvals

- City of Los Angeles Research Report – RR 24860 – Approved for "LIQUID BOOT® Spray Applied Membrane for Below-Grade Waterproofing"
- United States Navy – Approved for "LIQUID BOOT® for use World Wide to Waterproof Earth-Covered Steel Ammunition Storage"
- County of Kern Environmental Health Services Department – Approved for "LIQUID BOOT® as a Methane Barrier"
- NSF International – NSF/61 approved for "Potable Water Tank Liner"
- Canadian Construction Materials Board – Approved for "Waterproofing and Dampproofing"

- County of Los Angeles Department of Public Works – Approved for "LIQUID BOOT® Application as a Methane Gas Barrier"

D. **LIQUID BOOT® 500 (Contact LBI before specifying/bidding LB 500 to insure it is appropriate for the project)**

LIQUID BOOT® 500 may be used in lieu of LIQUID BOOT® (described in section 2.01 B. above) where the membrane is not exposed to hydrostatic head pressure. The Agency Approvals in section 2.01 C above do not apply to LIQUID BOOT® 500. The physical properties for LIQUID BOOT® 500 are as follows:

Note: LIQUID BOOT® 500 may tend to sag on vertical surfaces at higher ambient temperatures. When this condition occurs, use LIQUID BOOT® at these locations.

WATERPROOFING	TEST METHOD	VALUE
Elongation	ASTM D412	800%
Bond Seam Strength Tests	ASTM D6392	Passed
Methane Permeability	ASTM D1434	None detected
Water Vapor Permeability	ASTM E96	0.18 perms

- Agency Approval- City of Los Angeles Research Report-RR 25549-Approved for "LIQUID BOOT® 500 Spray Applied Membrane for Below-Grade Waterproofing and Gas Barrier"

E. Protection - On vertical surfaces, use: LIQUID BOOTâ UltraShield P-100 or other protections as approved by the manu-facturer, project architect or engineer.

On horizontal surfaces, use: LIQUID BOOT® UltraShield G-1000 or other protections as approved by the manufacturer, project architect or engineer.

Due to the diverse jobsite conditions, all protection materials must be approved by the membrane manufacturer, including the use of the LIQUID BOOT® UltraShield products.

F. Prefabricated Drain Mat - Vertical surfaces, use LIQUID BOOT® UltraDrain 6200 - Horizontal surfaces, use LIQUID BOOT® UltraDrain 9000

G. Adhesive system for LIQUID BOOT® UltraShield and LIQUID BOOT® UltraDrain : Use LIQUID BOOT® UltraGrip.

H. Base Geotextile – LIQUID BOOT® BaseFabric T-40 non-woven geotextile, unless otherwise specified and approved by membrane manufacturer. The heat-rolled side shall be used as the application surface. Some projects may require a heavier geotextile (LIQUID BOOT® BaseFarbic T-60.)

I. Cold Joints, Cracks, and Form Tie Holes: Covered with Hardcast CRT 1602 Tape 3" wide.

PART 3 - Execution

3.01 EXAMINATION

All surfaces to be waterproofed shall be inspected and approved by the applicator at least one day prior to commencing work.

3.02 SURFACE PREPARATION

Provide 24 inch minimum clearance out from surfaces to receive the waterproof membrane. The application surface shall be prepared and provided to the applicator in accordance with manufacturer's specifications listed below:

A. **Concrete/Shotcrete/Masonry**

Concrete surfaces shall be light broom finish or smoother, free of any dirt, debris, loose material, release agents or curing compounds. Fill all voids more than 1/4 inch deep and 1/4 inch wide. Masonry joints, cold joints, and form joints shall be struck smooth. All penetrations shall be prepared in accordance with manufacturer's specifications. 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° or less. Allow to cure overnight before the application of LIQUID BOOT®. All form ties holes must be completely grouted from the inside to outside of wall with non-shrink grout as approved by engineer. All cracks or cold joints greater than 1/16 inch must be completely grouted with non-shrink grout as approved by engineer. Install Hardcast reinforcing tape over all cold joints, cracks and form tie holes (after holes and cracks are grouted).

B. **Dirt & Gravel**

The sub-grade shall be moisture conditioned and compacted to a minimum relative compaction of 90 percent or as specified by civil/geotechnical engineer. The finished surface shall be smooth, uniform, free of debris and standing water. Remove all stones or dirt clods greater than 1/4 inch. (NOTE: Aggregate sub-base surfaces shall be rolled flat, free from any protruding sharp edges). Final sub-grade preparation shall not precede the membrane application by more than 72 hours. All penetrations shall 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. Trenches shall be cut oversize to accommodate waterproof membrane and protection course with perpendicular to sloped sides and maximum obtainable compaction. Adjoining grade shall be finish graded and compacted. Excavated walls shall be vertical or sloped back, free of roots and protruding rocks. Specific sub-grade preparation shall be designed by a qualified civil or geotechnical engineer. If organic materials with potential for growth (ie: seeds or grasses) exist within the subbase, spray apply soil sterilant at the sterilant manufacturer's recommended rate.

C. **Lagging**

Lagging shall be held securely in place. All sharp edges and nails shall be removed or protected so as not to penetrate the membrane.

3.03 INSTALLATION

3.03.10 INSTALLATION ON CONCRETE/SHOTCRETE/MASONRY (Follow the procedures below carefully)

A. Refer to section 3.03.30, "Sealing Around Penetrations", for procedures to seal around penetrations.

B. Provide a ¾" 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. (See note regarding blisters). 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. (See also information regarding blister repair).

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. 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.**

F. After membrane has cured and checked for proper thickness and flaws, install protection material pursuant to manufacturer's instructions.

NOTE: If water testing or inspection is to be performed, conduct before placing protection course.

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.

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 required membrane thickness (80 mils minimum), then the remaining blisters should not be punctured or cut. If the samples have less than the minimum 80 mils, 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.

3.03.20 INSTALLATION ON DIRT SURFACES AND MUDSLABS

A. Roll out LIQUID BOOT® BaseFabric geotextile on sub-grade with the heat-rolled side facing up. Overlap seams a minimum of six inches (6"). Lay geotextile tight at all inside corners. Spray LIQUID BOOT® within the seam overlap to a thickness of 80 mils minimum. Line trenches with geotextile extending at least six inches (6") onto adjoining sub-grade if slab and footings are to be sprayed separately. Overlap seams a minimum of six inches (6"). Lay geotextile tight at all inside corners. Spray LIQUID BOOT® within the seam overlap to a thickness of 80 mils minimum.

B. Refer to section 3.03.40, "Sealing Around Penetrations", for procedures to seal around penetrations.

C. Spray apply LIQUID BOOT® onto geotextile to an 80 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.

D. 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.**

E. After membrane has cured and checked for proper thickness and flaws, install protection material pursuant to manufacturer's instructions.

NOTE: If water testing or inspection is to be performed, conduct before placing protection course.

3.03.30 INSTALLATION ON LAGGING

A. Attach subsurface LIQUID BOOT® UltraDrain 6200 or, securely nail LIQUID BOOT® UltraShield G-800 over lagging and soldier piles keeping geotextile tight to lagging wall. Overlap seams a minimum of six inches (6").

B. Roll out LIQUID BOOT® BaseFabric T-60 geotextile vertically with the heat-rolled side facing out and staple to lagging using 3/8 long staples 12" on center. Overlap seams a minimum of six inches (6"). Spray LIQUID BOOT® within the seam overlap to a

thickness of 80 mils minimum. Do not staple top layer of geotextile at overlap.

C. Refer to section 3.03.40, "Sealing Around Penetrations", for procedures to seal around penetrations.

D. 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° or less. **Allow to cure overnight before the application of LIQUID BOOT® membrane.**

E. Spray apply LIQUID BOOT® to a minimum thickness of 80 mils (100 mils if installing shotcrete walls). Remove any standing water.

F. **Do not penetrate membrane.** Keep membrane free of dirt and debris until concrete is in place. **It is the responsibility of the General Contractor to insure that the membrane and the protection system are not penetrated.**

3.03.40 SEALING AROUND PENETRATIONS

A. Clean all penetrations. All metal penetrations shall be sanded clean with emery cloth.

B. For applications requiring LIQUID BOOT® BaseFabric geotextile, roll out geotextile on sub-grade with the heat-rolled side facing up, overlapping seams a minimum of six inches (6"). Cut the geotextile around penetrations so that it lays flat on the sub-grade. Lay geotextile tight at all inside corners. Spray LIQUID BOOT® within the seam overlap to a thickness of 80 mils minimum.

C. 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 an 80 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 80 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 as described in 3.03.40 C above. 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 "G".

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 the cured membrane collar.

3.04 FIELD QUALITY CONTROL

Field Quality Control is a very important part of all LIQUID BOOT® applications. Applicators should check their own work for coverage,

thickness, and all around good workmanship before calling for inspections.

Applicators and Inspectors should check membrane for holes, shadow shrinkage, and any other membrane damage when reviewing the membrane.

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.

3.04.10 ON CONCRETE/SHOTCRETE/MASONRY & OTHER HARD SURFACES

A. Membrane may be checked for proper thickness with a blunt-nose depth gauge. Record the minimum reading. Mark the test area for repair, if necessary.

B. If necessary, test areas are to be patched over with LIQUID BOOT® to an 80 mils minimum dry thickness, extending a minimum of one inch (1") beyond the test perimeter.

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 by water 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 required membrane thickness (80 mils minimum), then the remaining blisters should not be punctured or cut. If the samples have less than the minimum 80 mils, then the area can either be resprayed to obtain the proper thickness, or the blisters can be cut out and the area resprayed or patched with LIQUID BOOT® Trowel Grade.

3.04.20 ON DIRT AND OTHER SOFT SUBSTRATES

A. Samples may be cut from the membrane and geotextile sandwich to a maximum area of 2 square inches. Measure the thickness with a mil-reading caliper. Deduct the plain geotextile thickness to determine the thickness of LIQUID BOOT® membrane. Mark the test area for repair.

B. Voids left by sampling are to be patched with geotextile overlapping the void by a minimum of two inches (2"). Apply a thin tack coat of LIQUID BOOT® under the geotextile patch. Then spray or trowel apply LIQUID BOOT® to an 80 mils minimum dry thickness, extending at least three inches (3") beyond geotextile patch.

LIQUID BOOT® Gas Vapor Barriers

The Leader in Brownfield & Methane Gas Membrane Technology

LIQUID BOOT® Brownfield Membrane/Liner

SECTION 2
Version 3.9

These Specifications may have changed. Go to www.liquidboot.com or call LBI Technologies, Inc. at 714.384.0111 for the most recent version.

NOTE: If the membrane is to also perform as a waterproofing membrane, do not use this specification, use standard LIQUID BOOT® FLUID APPLIED WATERPROOFING specification

PART 1 - GENERAL

1.01 DESCRIPTION

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

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. Gas vapor barrier under single family homes.

B. Related work not in this section:

1. Excavation and backfilling.
2. Parge coat on masonry to receive gas vapor barrier membrane.
3. Mortar beds or concrete toppings over gas vapor barrier membranes.
4. Latex waterproofing.
5. Damp-proofing.
6. Flashing and sheet metal.
7. Joint sealers.
8. Soil sterilant.
9. Gas collection systems.
10. Gas monitoring.
11. Drainage

1.02 QUALITY ASSURANCE

Gas vapor barrier contractor/applicator shall be trained and approved by gas vapor barrier manufacturer, LBI Technologies, Inc. A pre-installation conference shall be held prior to application of gas vapor barrier to assure proper substrate and installation conditions, to include contractor, applicator, architect/engineer and special inspector.

1.03 SUBMITTALS (Refer to section 01300 for procedures)

A. Project Data - Submit manufacturer's product data and installation instructions for specific application.

B. Samples - Submit representative samples of the following for approval:

1. Gas vapor barrier membrane material.
2. Protection Board and/or Protection Mat.
3. Prefabricated Drainage Mat.
4. Geotextiles.

1.04 DELIVERY, STORAGE AND HANDLING

Deliver materials to site in original unbroken packages bearing manufacturer's label showing brand, weight, volume, and batch number. Store materials at site in strict compliance with manufacturer's instructions. Do not allow materials to freeze in containers.

1.05 JOB CONDITIONS

A. Protect all adjacent areas not to receive gas vapor barrier. Where necessary, apply masking to prevent staining of surfaces to remain exposed wherever membrane abuts to other finish surfaces.

B. Perform work only when existing and forecasted weather conditions are within manufacturer's recommendations for the material and product used.

C. Minimum clearance of required for application of product:

- 90° spray wand- 2 feet
- Conventional spray wand- 4 feet.

D. Ambient temperature shall be within manufacturer's specifications. If winter conditions apply, we recommend the use space of 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. All plumbing, electrical, mechanical and structural items to be under or passing through the gas vapor barrier shall be positively secured in their proper positions and appropriately protected prior to membrane application.

F. Gas vapor barrier shall be installed before placement of reinforcing steel. When not possible, all exposed reinforcing steel shall be masked by General Contractor prior to membrane application.

G. Expansion joints must be filled with a conventional waterproof expansion joint material.

H. Surface preparation shall be per manufacturer's specification.

1.06 PRODUCT WARRANTY

LBI Technologies, Inc. (LBI) warrants its products to be free of defects. This warranty only applies when the LIQUID BOOT® is applied by LBI Approved Applicators and that the required respective LBI products (such as LIQUID BOOT® UltraDrain. LIQUID BOOT® UltraShield, LIQUID BOOT® BaseFabric and LIQUID BOOT® GeoVent) are used. As factors which affect the result obtained from this product -including weather, equipment utilized, construction, workmanship and other variables- are all beyond the manufacturer's control, LBI warrants only that the material conforms to its product specifications. Under this warranty LBI will replace at no charge any product not meeting these specifications within 12 months of manufacture, provided it has been applied in accordance with LBI written directions for use recommended as suitable for this product. Warranties are available for a longer period upon request and mutual written consent. 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 LBI 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 MATERIALS

A. 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 LBI Technologies, Inc., Santa Ana, CA (714) 384-0111.

B. Gas vapor barrier physical properties:

GAS VAPOR MEMBRANE	TEST METHOD	VALUE
Hydrogen Sulfide Gas Permeability	ASTM D1343	None Detected
Benzene, Toulene, Ethylene, Xylene, Gasoline, Hexane, Perchloroethylene	ASTM D543, D412, D1434 (tested at 20,000 ppm)	Passed in gas permeability and weight change
Acid Exposure (10% H 2SO 4 for 90 days)	ASTM D543	Less than 1% weight 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, average tensile strength change, average tensile stress change, average elong-ation change, bonded seams, methane permeability	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 elong-ation 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
WATERPROOFING	**TEST METHOD**	**VALUE**
Soil Burial	ASTM E154-88	Passed
Water Penetration Rate	ASTM D2434	<7.75 x 10 -9 cm/sec

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
GENERAL INFORMATION	**TEST METHOD**	**VALUE**
Coefficient of Friction- geotextile both sides	ASTM D5321	0.72
Cold Bend Test	ASTM D146	Passed. No cracking at -25°F
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
Hydrostatic Head Resistance	ASTM D751	Tested to 138 feet or 60 p.s.i
Elongation	ASTM D412	1,332% - Ø reinforcement, 90% recovery
Elongation- 8oz. non-woven geotextile both sides	ASTM D751	100% (same as geotextile tested separately)
Tensile Strength	ASTM D412	58 p.s.i. without reinforcement
Tensile Strength- 8oz. non-woven geotextile both sides	ASTM D751	196 p.s.i. (same as geotextile tested separately)
Tensile Bond Strength to Concrete	ASTM D413	2,556 lbs/ft 2 uplift force
Puncture Resistance- 8oz. non-woven geotextile both sides	ASTM D4833	286 lbs. (travel of probe = 0.756 inches) (same as geotextile tested separately)
Flame Spread	ASTM E108	Class A with top coat (comparable to UL790)
Electric Volume Resistivity	ASTM D257	1.91 x 10 10 ohms-cm

C. Agency Approvals

- City of Los Angeles Research Report-RR 24860-Approved for "LIQUID BOOT® Spray Applied Membrane for Below-Grade Waterproofing and Gas Barrier"
- United States Navy-Approved for "LIQUID BOOT® for Use World Wide to Waterproof Earth-Covered Steel Ammunition Storage"
- NSF International-NSF/61 approved for "Potable Water Tank Liner"
- Canadian Construction Materials Board-Approved for "Waterproofing and Damp proofing"

- County of Los Angeles Department of public works-Approved for "LIQUID BOOT® Application as a Methane Gas Barrier"

D. **LIQUID BOOT® 500 (Contact LBI before specifying or bidding LB 500 to insure LB 500 is appropriate for the project)**

LIQUID BOOT® 500 may be used in lieu of LIQUID BOOT® (described in section 2.01 B. above) where the membrane is not exposed to hydrostatic head pressure. The Agency Approvals in section 2.01 C above do not apply to LIQUID BOOT® 500. The physical properties for LIQUID BOOT® 500 are as follows:

Note: LIQUID BOOT® 500 may tend to sag on vertical surfaces at higher ambient temperatures. When this condition occurs, use LIQUID BOOT® at these locations.

WATERPROOFING	TEST METHOD	VALUE
Elongation	ASTM D412	800%
Bond Seam Strength Tests	ASTM D6392	Passed
Methane Permeability	ASTM D1434	None detected
Water Vapor Permeability	ASTM E96	0.18 perms

- Agency Approval- City of Los Angeles Research Report-RR 25549-Approved for "LIQUID BOOT® 500 Spray Applied Membrane for Below-Grade Waterproofing and Gas Barrier"

E. Protection- On vertical surfaces, use: LIQUID BOOT® UltraShield P-100 or other protections as approved by the manu-facturer, project architect or engineer.

On horizontal surfaces, use: LIQUID BOOT® UltraShield G-1000 or other protections as approved by the manufacturer, project architect or engineer.

Due to the diverse jobsite conditions, all protection materials must be approved by the membrane manufacturer, including the use of the LIQUID BOOT® UltraShield products.

F. Prefabricated Drain Mat - Vertical surfaces, use LIQUID BOOT® UltraDrain 6200 - Horizontal surfaces, use LIQUID BOOT® UltraDrain 9000

G. Adhesive system for LIQUID BOOT® UltraShield and LIQUID BOOT® UltraDrain : Use LIQUID BOOT® UltraGrip.

H. Gas vapor vent piping – LIQUID BOOT® GeoVent system

I. Base Geotextile- LIQUID BOOT® BaseFabric T-40 non-woven geotextile, unless otherwise specified and approved by membrane manufacturer. The heat-rolled side shall be used as the application surface. Some projects may require a heavier geotextile (LIQUID BOOT® BaseFarbic T-60 .)

J. Cold Joints, Cracks, Form Tie Holes: Covered with Hardcast CRT 1602 Tape 3" wide.

PART 3 - Execution

3.01 EXAMINATION

All surfaces to receive gas vapor barrier shall be inspected and approved by the applicator at least one day prior to commencing work.

3.02 SURFACE PREPARATION

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:

A. **Concrete/Shotcrete/Masonry**

Concrete surfaces shall be light broom finish or smoother, free of any dirt, debris, loose material, release agents or curing compounds. Fill all voids more than 1/4 inch deep and 1/4 inch wide. Masonry joints, cold joints, and form joints shall be struck smooth. All penetrations shall be prepared in accordance with manufacturer's specifications. 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 ° or less. Allow to cure overnight before the application of LIQUID BOOT®. All cracks or cold joints greater than 1/16 inch must be completely grouted with non-shrink grout as approved by engineer. Install Hardcast reinforcing tape over all cold joints, cracks and form tie holes (after holes and cracks are grouted).

B. **Dirt & Gravel**

The sub-grade shall be moisture conditioned and compacted to a minimum relative compaction of 90 percent or as specified by civil/geotechnical engineer. The finished surface shall be smooth, uniform, free of debris and standing water. Remove all stones or dirt clods greater than 1/4 inch. (NOTE: Aggregate sub-bases shall be rolled flat, free from any protruding sharp edges). Penetrations shall 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. Trenches shall be cut oversize to accommodate gas vapor barrier membrane and protection course with perpendicular to sloped sides and maximum obtainable compaction. Adjoining grade shall be finish graded and compacted. Excavated walls shall be vertical or sloped back, free of roots and protruding rocks. Specific sub-grade preparation shall be designed by a qualified civil or geotechnical engineer. If organic materials with potential for growth (ie: seeds or grasses) exist within the sub-base, spray apply soil sterilant at the sterilant manufacturer's recommended rate.

3.03 INSTALLATION

3.03.10 INSTALLATION ON CONCRETE/SHOTCRETE/MASONRY (Follow the procedures below carefully)

A. Refer to section 3.03.30, "Sealing Around Penetrations", for procedures to seal around penetrations.

B. P rovide a ¾" 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. (See note regarding blisters). 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. (See also information regarding blister repair).

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. 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.

F. After membrane has cured and checked for proper thickness and flaws, install protection material pursuant to manufacturer's instructions.

NOTE: All testing or inspection to be performed prior to placing protection course.

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.

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.

3.03.20 INSTALLATION ON DIRT SURFACES AND MUDSLABS

A. Roll out LIQUID BOOT® BaseFabric geotextile on sub-grade with the heat-rolled side facing up. Overlap seams a minimum of six inches (6"). Lay geotextile tight at all inside

corners. Apply a thin (10 mil) tack coat of LIQUID BOOT® "A" side without catalyst within the seam overlap.

Line trenches with geotextile extending at least six inches (6") onto adjoining sub-grade if slab and footings are to be sprayed separately. Overlap seams a minimum of six inches (6"). Lay geotextile tight at all inside corners. Apply a thin (10 mil) tack coat of LIQUID BOOT® "A" side without catalyst within the seam overlap.

B. Minimize the use of nails to secure the geotextile 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 geotextile or Hardcast reinforcing tape overlapping the nail head by a minimum of two inches (2"). Apply a thin tack coat of LIQUID BOOT® under the geotextile patch, when patching with geotextile.

C. Refer to section 3.03.30, "Sealing Around Penetrations", for procedures to seal around penetrations.

D. Spray apply LIQUID BOOT® onto geotextile to an 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 mem-brane 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 manu-facturer's instructions.

NOTE: All testing or inspection to be performed prior to placing protection course.

3.03.30 SEALING AROUND PENETRATIONS

3.03.31 OPTION 1

A. Clean all penetrations. All metal penetrations shall be sanded clean with emery cloth.

B. For applications requiring LIQUID BOOT® BaseFabric geotextile, roll out geotextile on sub-grade with the heat-rolled side facing up, overlapping seams a minimum of six inches (6"). Cut the geotextile around penetrations so that it lays flat on the sub-grade. Lay geotextile tight at all inside corners. Apply a thin (10 mil) tack coat of LIQUID BOOT® "A" side without catalyst within the seam overlap.

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 ATTACHED 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 as described in 3.03.31 C above. 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 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.

3.03.32 OPTION 2 (For Gas Vapor Membrane Only)

A. Clean all penetrations. All metal penetrations shall be sanded clean with emery cloth.

B. For applications requiring LIQUID BOOT® BaseFabric geotextile, roll out geotextile on sub-grade with the heat-rolled side facing up, overlapping seams a minimum of six inches (6"). Cut the geotextile around penetrations so that it lays flat on the sub-grade. Lay geotextile tight at all inside corners. Apply a thin (10 mil) tack coat of LIQUID BOOT® "A" side without catalyst within the seam overlap.

C. Spray-apply LIQUID BOOT® to surrounding areas as specified for the particular application to an 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 as described in 3.03.32 C above. **(SEE ATTACHED 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.

3.04 FIELD QUALITY CONTROL

Field Quality Control is a very important part of all LIQUID BOOT® applications. Applicators should check their own work for coverage, thickness, and all around good workmanship before calling for inspections.

The membrane must be cured at least overnight before inspecting for dry-thickness, holes, shadow shrinkage, and any other membrane damage. If water testing is to be performed, allow the membrane to cure at least 72 hours prior to the water test.

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.

3.03.10 ON CONCRETE/SHOTCRETE/MASONRY & OTHER HARD SURFACES

A. 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.

B. If necessary, test areas are to be patched over with LIQUID BOOT® to a 60 mils minimum dry thickness, extending a minimum of one inch (1") beyond the test perimeter.

3.03.20 ON DIRT AND OTHER SOFT SUBSTRATES

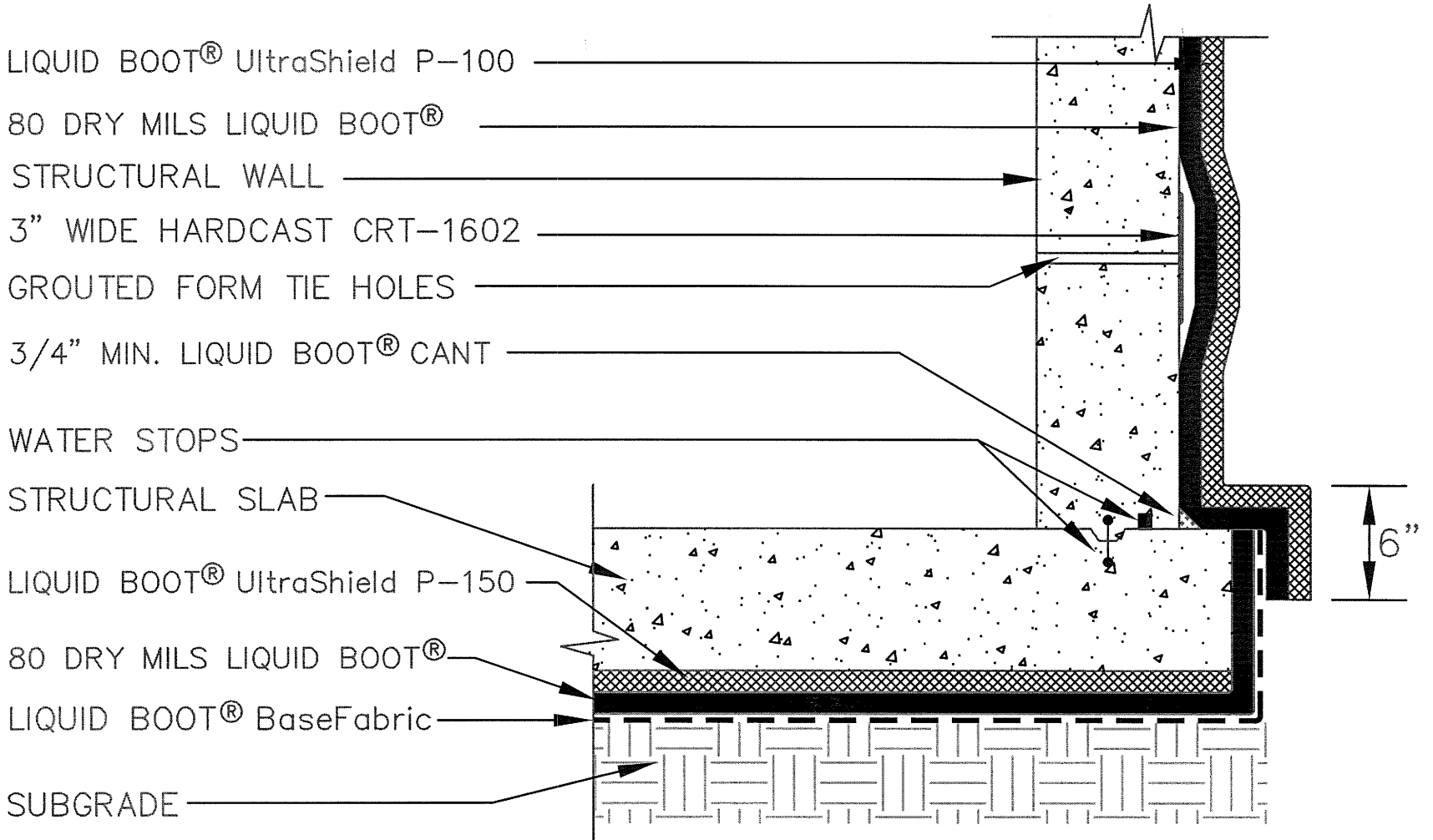
A. Samples may be cut from the membrane and geotextile sandwich to a maximum area of 2 square inches. Measure the thickness with a mil-reading caliper, per 500 square feet. Deduct the plain geotextile thickness to determine the thickness of LIQUID BOOT® membrane. Mark the test area for repair.

B. Voids left by sampling are to be patched with geotextile overlapping the void by a minimum of two inches (2"). Apply a thin tack coat of LIQUID BOOT® under the geotextile patch. Then spray or trowel apply LIQUID BOOT® to an 60 mils minimum dry thickness, extending at least three inches (3") beyond geotextile patch.

3.04.30 SMOKE TESTING FOR HOLES (Optional)

Holes or other breaches in the membrane can be detected by conducting a smoke test. This involves pumping smoke under the membrane for a specified period of time, under a specified pressure, which varies from project to project. Contact LBI Technologies for information about this test.

LBI Technologies, Inc., 1001 S. Linwood Avenue, Santa Ana, CA 92705 • Phone: 714-384-0111 • Fax: 714-384-0112
Designed by: 1EZ Consulting Services, Inc.



WATERPROOFING
UNDER SLAB & WALLS

NOT TO SCALE

W2.1
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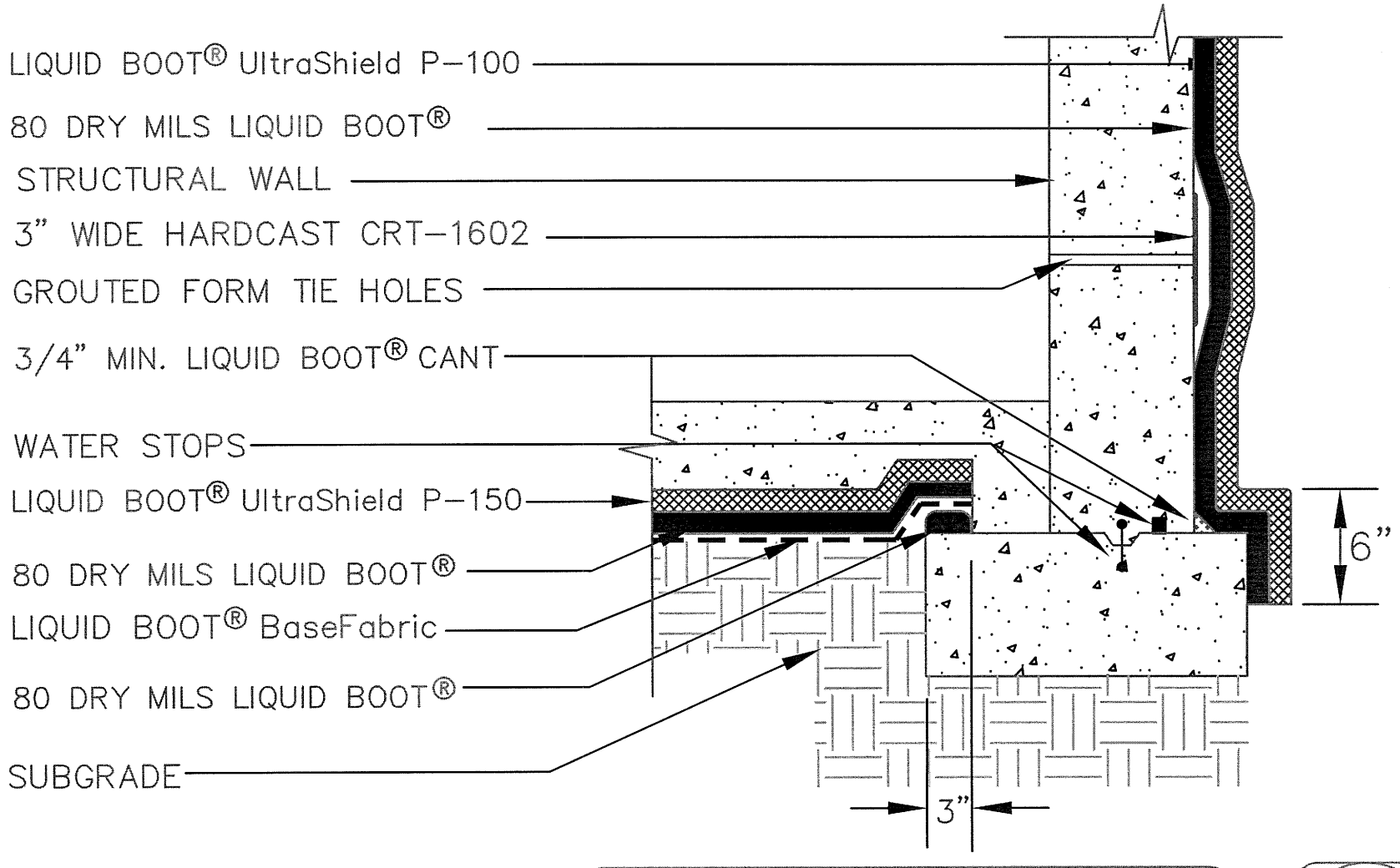
NOTE:
TERMINATE MEMBRANE 1" ABOVE FINISH GRADE



NOTE:
TERMINATE MEMBRANE 1" ABOVE FINISH GRADE

WATERPROOFING
UNDERSLAB & WALLS

NOT TO SCALE

W2.2
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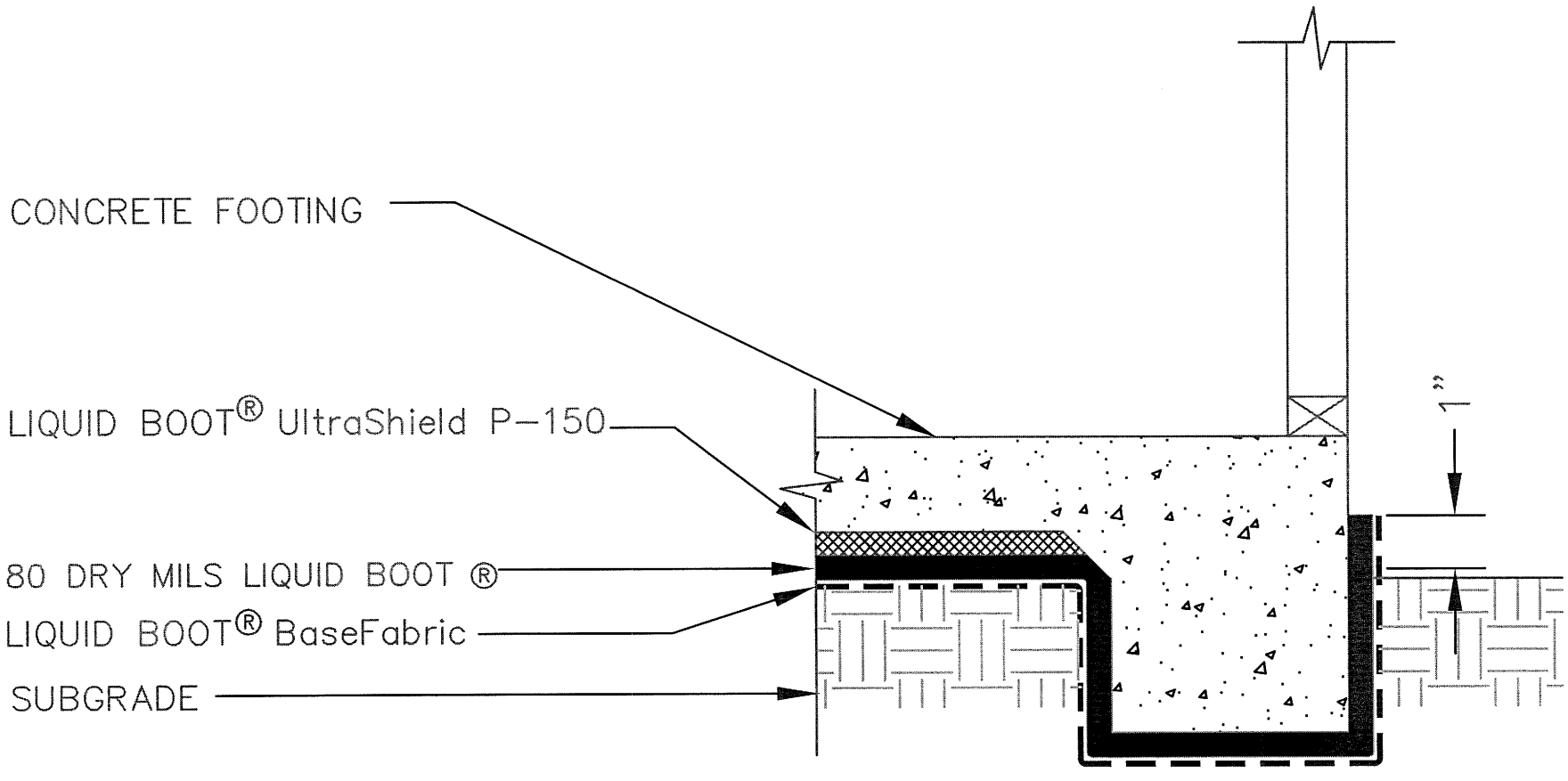

NOTE:
TERMINATE MEMBRANE 1" ABOVE FINISH GRADE

WATERPROOFING
FOOTINGS AND GRADE BEAMS

NOT TO SCALE

W2.3
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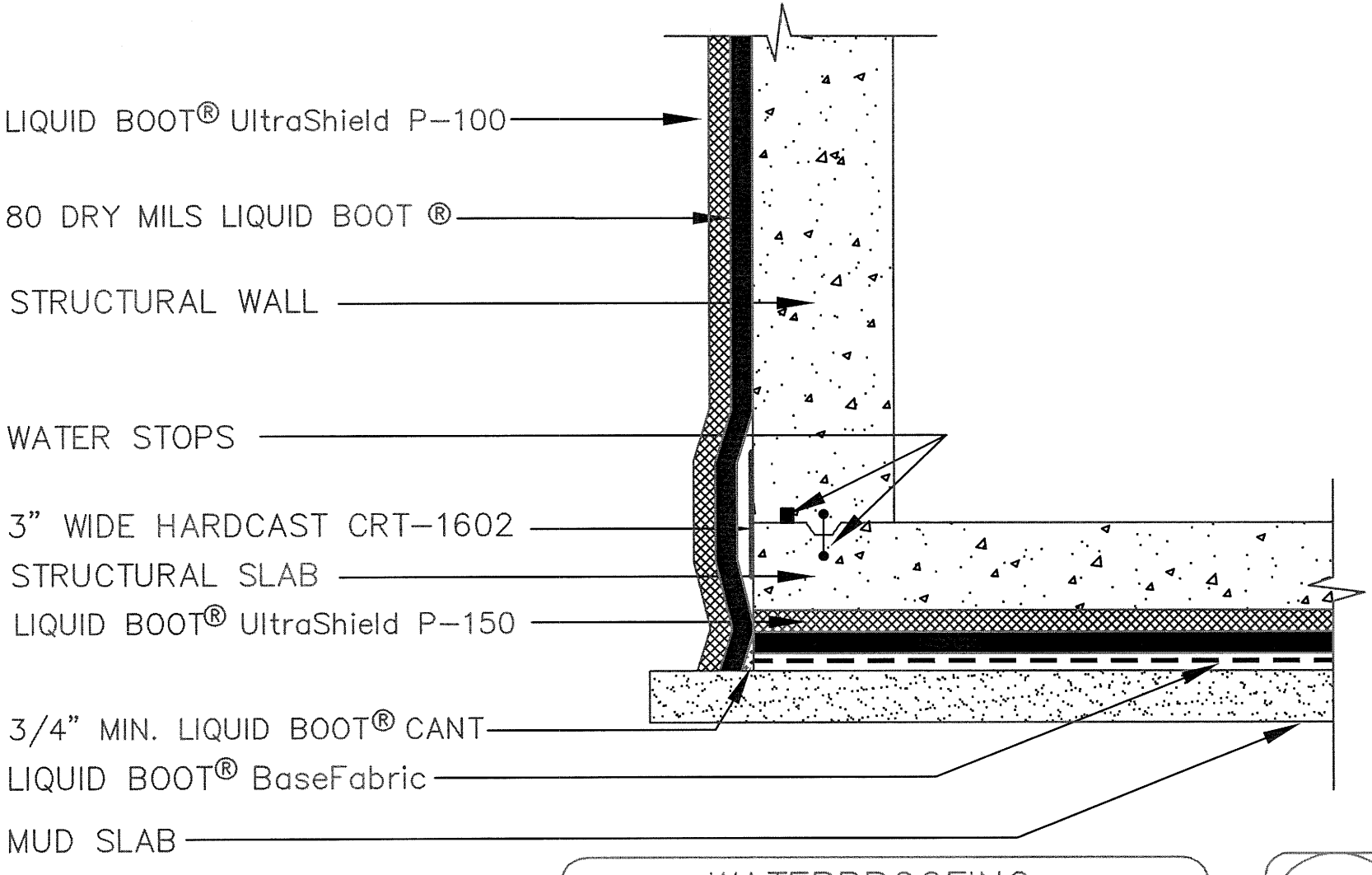
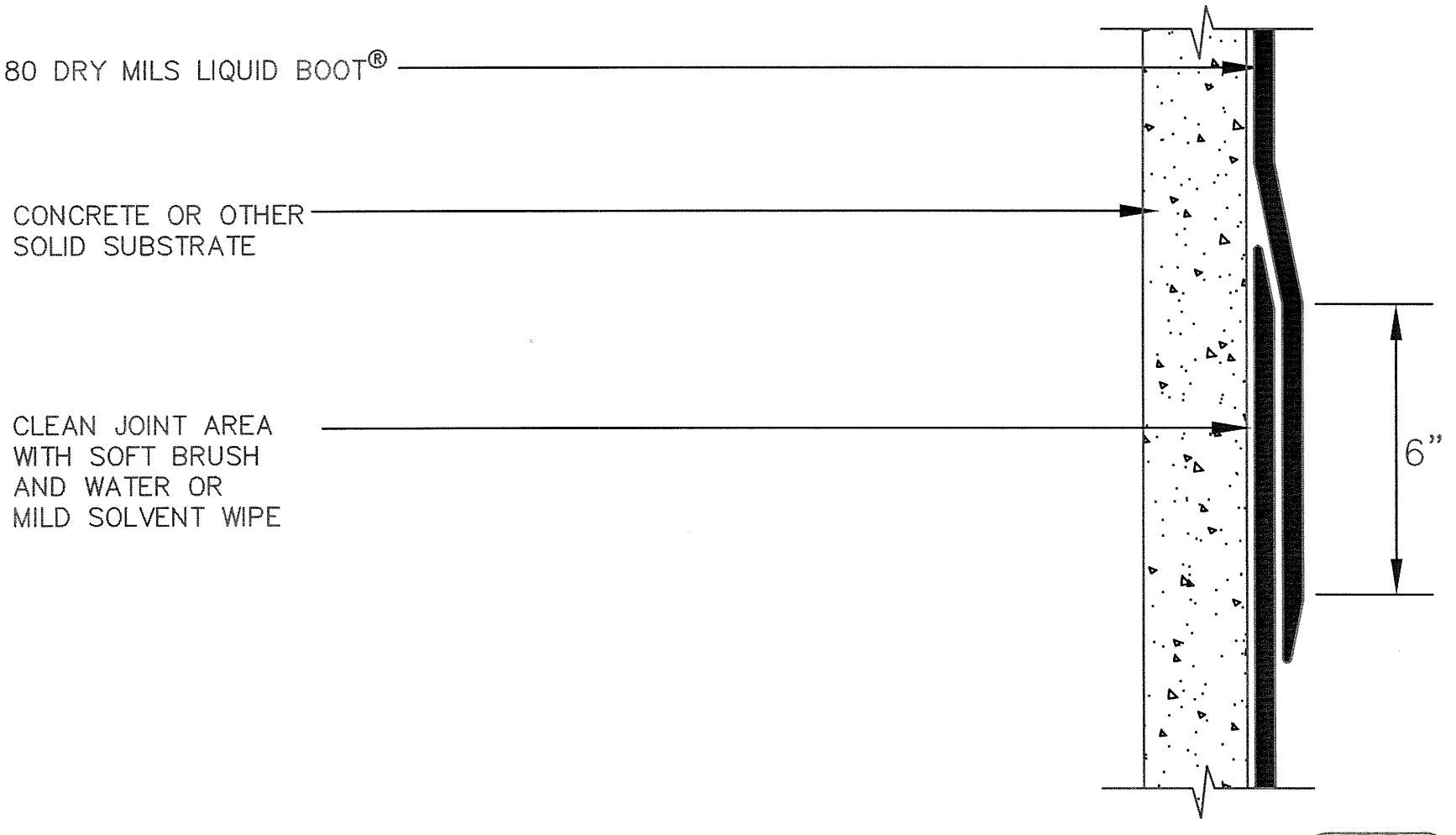


NOTE:
TERMINATE MEMBRANE 1" ABOVE FINISH GRADE

WATERPROOFING
ON MUDSLABS

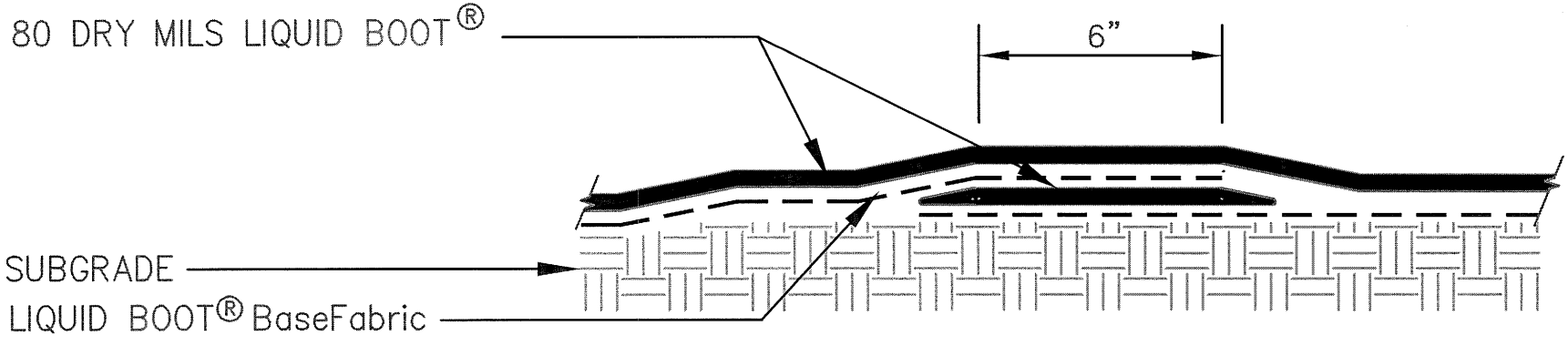
NOT TO SCALE

W2.4
—



WATERPROOFING
MEMBRANE LAP JOINTS
ON SOLID SUBSTRATE
NOT TO SCALE

W2.5
—



WATERPROOFING
MEMBRANE LAP JOINTS
ON GEOTEXTILE
NOT TO SCALE

W2.6
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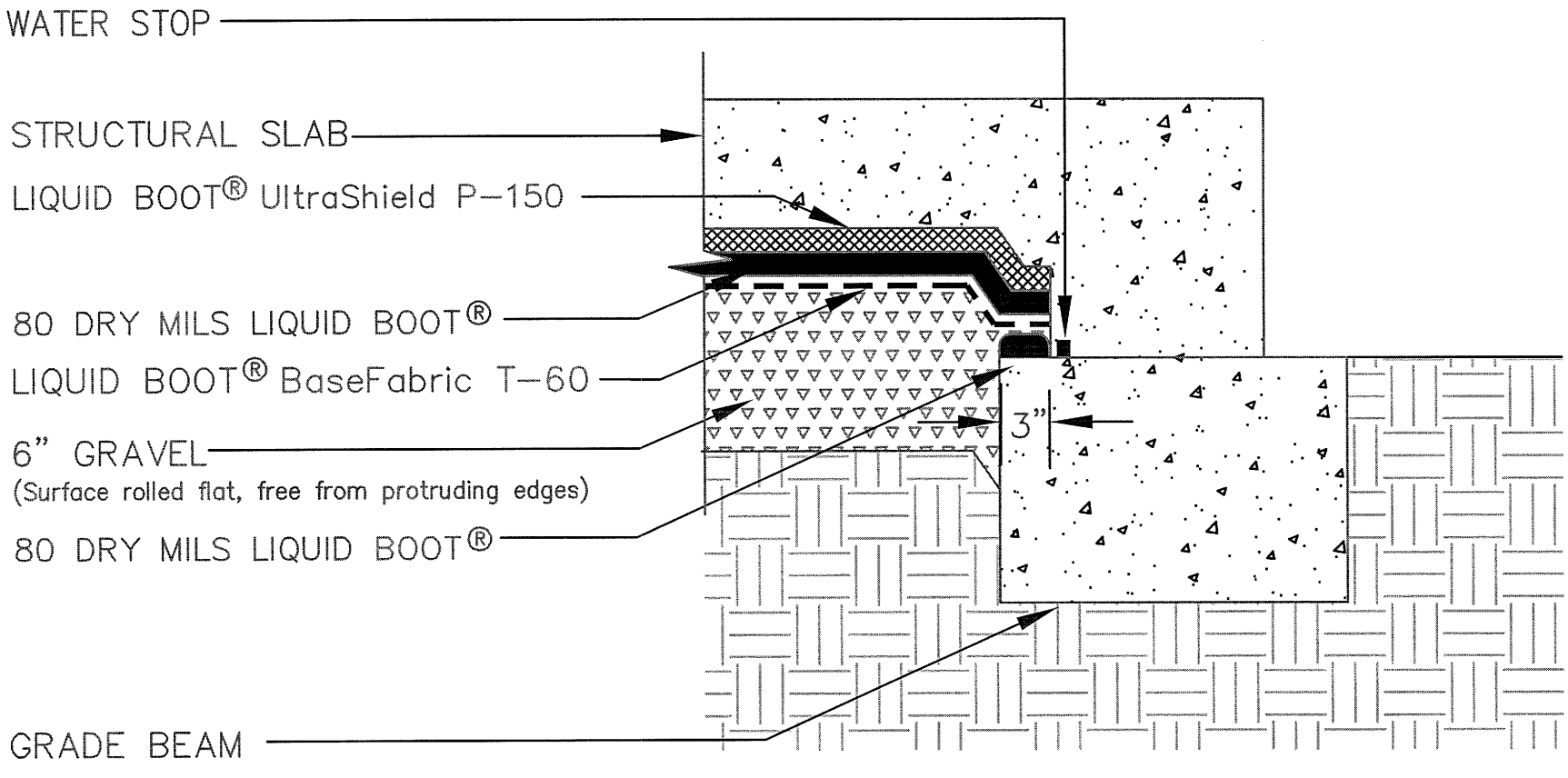
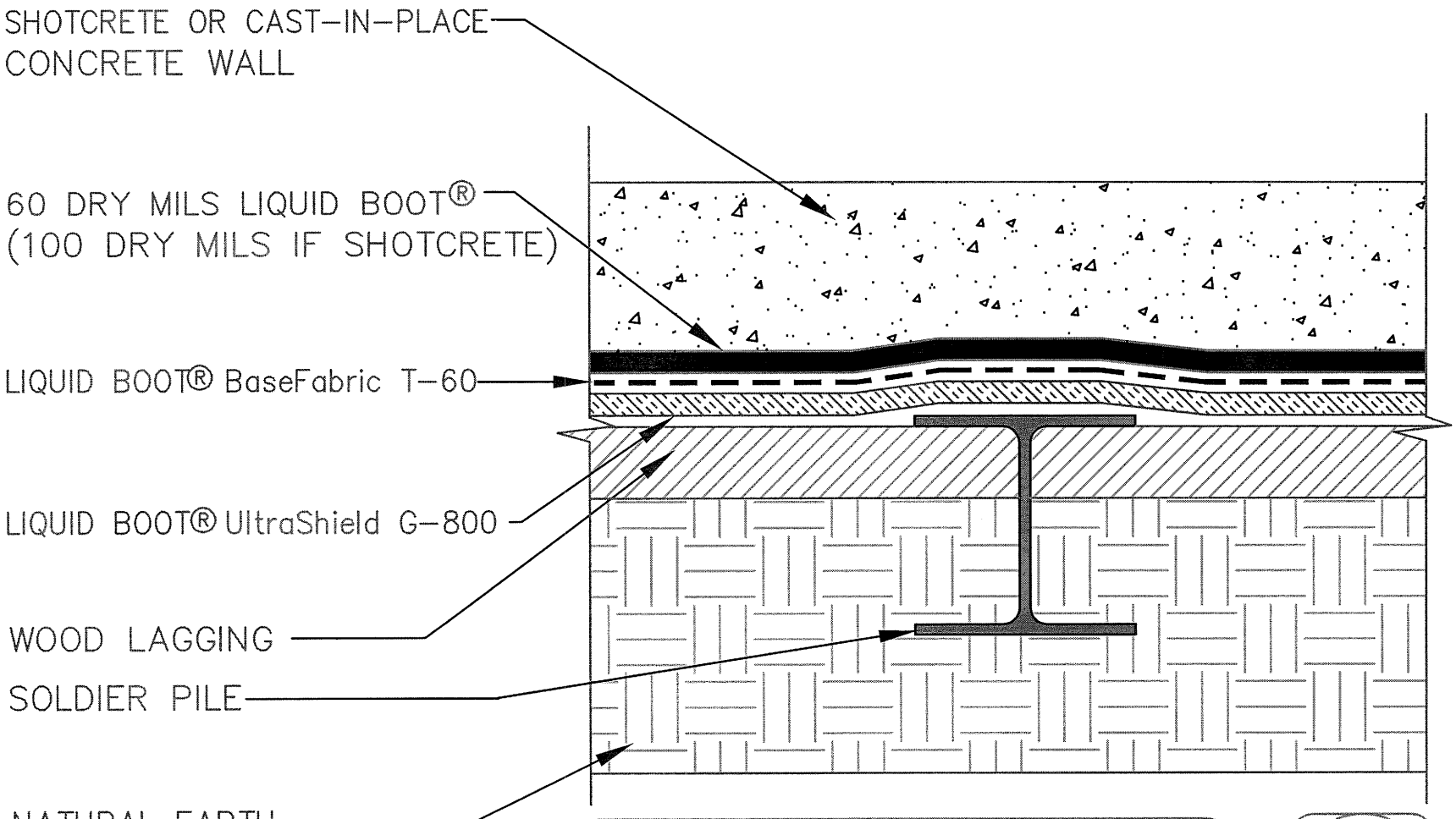


WATERPROOFING OVER FOOTINGS & GRADE BEAMS

NOT TO SCALE

W2.8

-

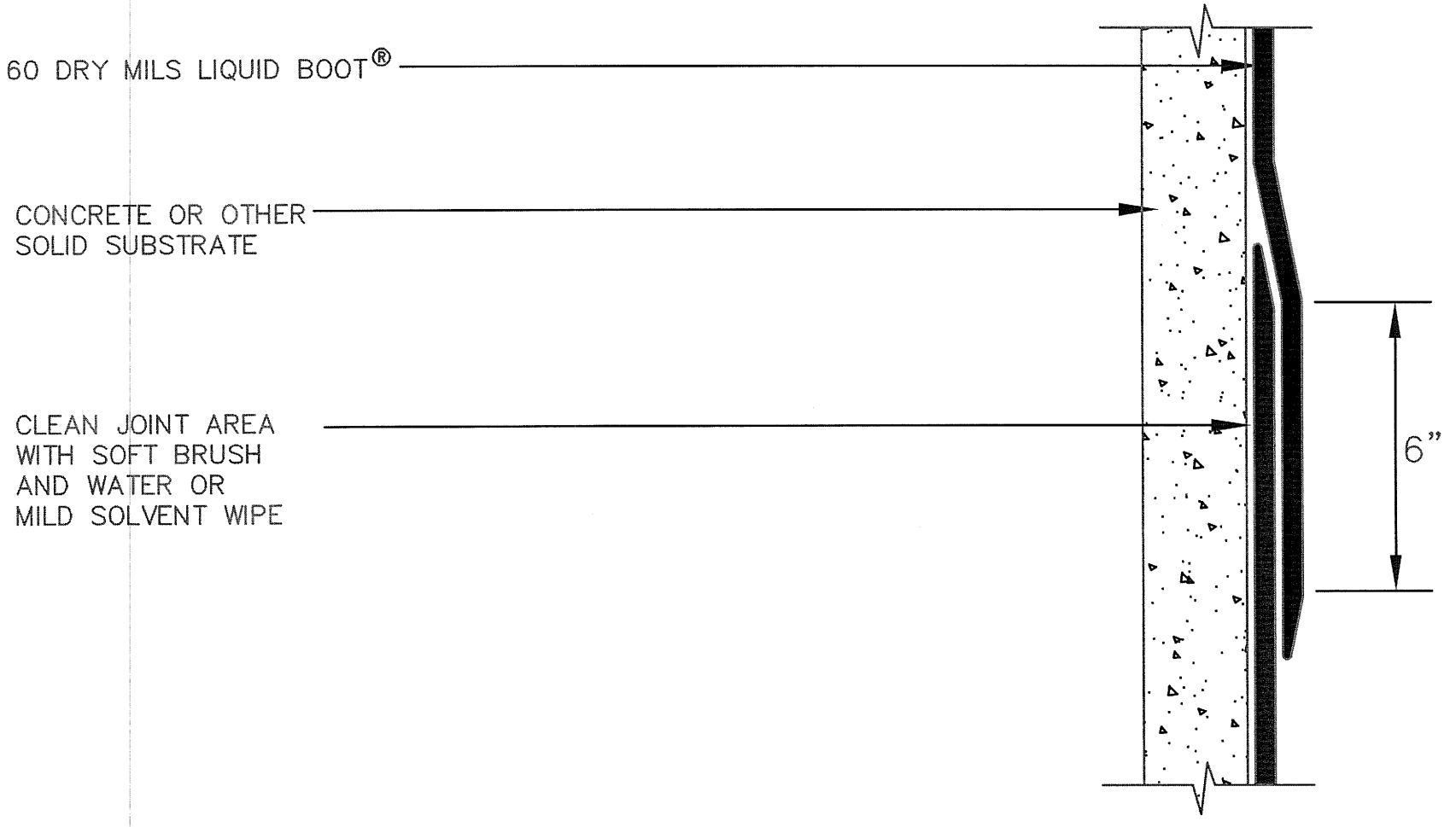


GAS VAPOR BARRIER
ZERO LOT LINE WITH LAGGING

NOT TO SCALE

G1.1

—



GAS VAPOR BARRIER
MEMBRANE LAP JOINTS
ON SOLID SUBSTRATE
NOT TO SCALE

G1.2
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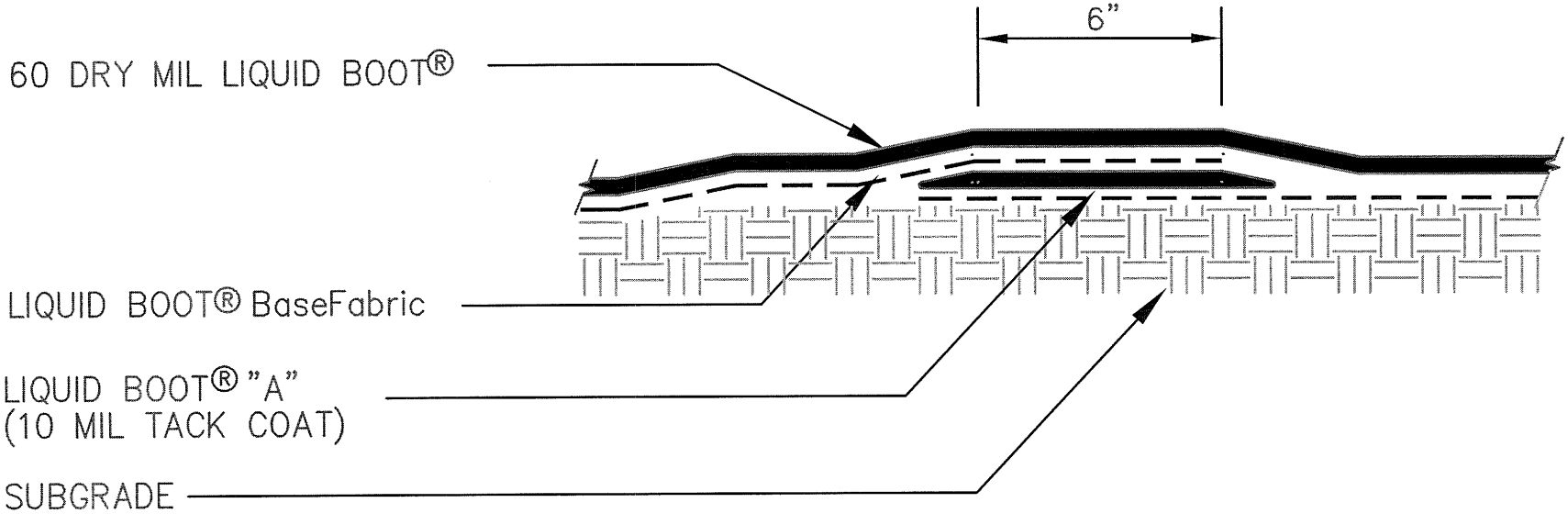

GAS VAPOR BARRIER
MEMBRANE LAP JOINTS
ON GEOTEXTILE
NOT TO SCALE

G1.3
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