



Applications: Slab On Grade Gas Containment Vapor Intrusion Barrier With Spray Applied Seams
Spec Version: EproGSEV80.VB.v1.08.20gs
Date issued: September 22, 2020
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**SECTION 02 56 16
GAS CONTAINMENT
SECTION 02 56 19.13
FLUID APPLIED GAS BARRIER**

**Geo-Seal EV40S EVOH
Vapor Intrusion Barrier
Guide Specification**

Slab On Grade

Geo-Seal EV40s is comprised of an EVOH membrane combined with a robust geotextile layer to provide a sheet membrane that is highly chemically resistant, easy to install, while also providing better protection during the installation process. Geo-Seal EV40s utilizes Geo-Seal CORE spray membrane to seal seams, detail penetrations, and terminate the membrane to concrete surfaces. This guide specification has been prepared according to the principles established in the Manual of Practice published by the Construction Specification Institute.

Note: If areas will be subjected to water and/or hydrostatic conditions, contact EPRO for appropriate system recommendations.

For additional questions, your local EPRO technical representative can be contacted through: EPRO Services, Inc., Wichita KS; 1.800.882.1896; www.eproinc.com.

GEO-SEAL EV40S SLAB ON GRADE EVOH VAPOR INTRUSION BARRIER WITH SPRAY APPLIED SEAMS SPECIFICATION VERSION 1.0

**SECTION 02 56 16 – GAS CONTAINMENT
SECTION 02 56 19.13 – FLUID-APPLIED GAS BARRIER**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including general and supplementary conditions, and Division 1 specification section, apply to this section.

1.2 SECTION INCLUDES

- A. The installation of materials designed to provide vapor intrusion protection when installed per project specification, this section covers the methane mitigation and vapor intrusion membrane, along with the following:
 - 1. Surface preparation and substrate treatment
 - 2. Auxiliary materials
 - 3. Prefabricated drainage mat (if applicable)
 - 4. Foundation drain (if applicable)

1.3 RELATED SECTIONS

- A. Section 02 24 00: Environmental Assessment
- B. Section 02 32 00: Geotechnical Investigation
- C. Section 03 15 00: Concrete Accessories
- D. Section 03 30 00: Cast-in-Place Concrete
- E. Section 03 40 00: Precast Concrete
- F. Section 07 90 00: Joint Protection
- G. Section 31 30 00: Earthwork Methods
- H. Section 33 41 00: Subdrainage

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide a vapor mitigation system that prevents the passage of methane gas, contaminant vapors including chlorinated solvents and petroleum hydrocarbons, and complies with the physical requirements as demonstrated by testing performed by an independent testing agency.

1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's printed technical data, tested physical and performance properties, instructions for evaluating, preparing, and treating substrates, and installation instructions.
- B. Shop Drawings: Project specific drawings showing locations and extent of vapor intrusion barrier system, details for overlaps, penetrations, transitions, and termination conditions.
- C. Samples: Submit two standard size samples of the each of the following:
 - 1. Individual components of the specified vapor intrusion barrier system.
- D. Applicator Certification: Submit written confirmation at the time of bid that applicator is currently approved by the membrane manufacturer.

1.6 QUALITY ASSURANCE

- A. Applicator Qualifications: System applicator shall be an EPRO Authorized Applicator who is trained to perform work that in accordance with EPRO standards and policies.
- B. Manufacturer Qualification: Obtain vapor intrusion barrier materials and system components from a single manufacturer source, EPRO. Manufacturer must have 20 years of experience in the manufacture of vapor intrusion barrier systems.
- C. Third Party Inspection: Independent inspection of the system installation may be required based on project conditions and desired warranty coverage, or as required based on local building code/government agency jurisdiction. Inspection reports shall be submitted directly to the vapor intrusion barrier manufacturer and made available to other parties per the owner's direction.
- D. Pre-Construction Meeting: A meeting shall be held prior to application of the barrier system to assure proper substrate preparation, confirm installation conditions, and any additional project specific requirements. Attendees of the meeting shall include, but are not limited to the following:
 - 1. EPRO authorized applicator
 - 2. Third party inspector
 - 3. General contractor
 - 4. Owner's representative
 - 5. Architect and Engineer
 - 6. Concrete/Shotcrete contractor
 - 7. Rebar contractor
 - 8. All appropriate related trades
- E. Field Sample: Apply vapor intrusion barrier system field sample to 100 ft² (9.3 m²) of each assembly to demonstrate proper application techniques and standard of workmanship.

1. Notify membrane system manufacturer's representative, architect, certified inspector, and other appropriate parties one week in advance of the dates and times when field sample will be prepared.
2. If architect and certified inspector determines that field sample does not meet requirements; reapply membrane system until field sample is approved.
3. Retain and maintain approved field sample during construction in an undisturbed condition as a standard for judging the completed membrane system. An undamaged field sample may become part of the completed work.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Delivery: Deliver materials to site labeled with manufacturer's name, product brand name, material type, and date of manufacture. Upon the arrival of materials to the jobsite, inspect materials to confirm material has not been damaged during transit.
- B. Storage: Proper storage of onsite materials is the responsibility of the certified applicator. Consult product data sheets to confirm storage requirements. Storage area shall be clean, dry, and protected from the elements. If ambient air temperatures are expected to fall below 40°F, precautions will need to be taken to protect any emulsion product from near freezing temperatures. Protect stored materials from direct sunlight.
- C. Disposal: Remove and replace any material that cannot be properly applied in accordance with local regulations and specification section 01 74 19.

1.8 PROJECT CONDITIONS

- A. Substrate Review: Substrates shall be reviewed and accepted by the certified applicator and independent inspector prior to application.
- B. Penetrations: **All plumbing, electrical, mechanical, and structural items to be passing through the membrane system shall be properly spaced, positively secured in their proper positions, and appropriately protected prior to system application and throughout the construction phase.** Braided grounding rods are not allowed to pass through the vapor intrusion barrier.
- C. Reinforcement Steel and Concrete Forms: Vapor intrusion barrier shall be installed before placement of reinforcing steel. When penetrations post system installation occurs, it is the responsibility of the general contractor to notify the vapor intrusion barrier applicator to immediately make repairs prior to the placement of overburden, this includes the use of solid plastic "VaporStakes" used to secure concrete forms.
- D. Clearance: Minimum clearance of 24 inches is required for application of spray applied polymer modified asphalt, **Geo-Seal CORE**. For areas with less than 24-inch clearance, the product may be applied by hand using **Geo-Seal CORE Detail**.
- E. Overspray: Protect all adjacent areas not receiving the barrier application. Masking is necessary to prevent unwanted overspray from adhering to, or staining, areas not receiving the membrane. Once **Geo-Seal CORE** adheres to a surface it is extremely difficult to remove.
- F. Weather Limitations: Perform work only when existing and forecast weather conditions are within manufacturer's recommendations.

1. Spray Applied Polymer Modified Asphalt Membrane: Minimum ambient temperature should be 40°F (7°C) and rising. For applications temperatures below 38°F, but greater than +19°F/-7°C, special equipment and material handling is required. Substrate shall be clean and free from standing moisture.
2. EPRO applicators reserve the right not to install product when application conditions might be within manufactures acceptance, but ambient conditions may limit a successful application.

1.9 WARRANTY

- A. Special Warranty: Submit a written warranty signed by vapor intrusion barrier manufacturer agreeing to replace system materials that do not conform to manufacturer’s published specifications or are deemed to be defective. Warranty does not include failure of vapor intrusion barrier due to failure of soil substrate prepared and treated according to requirements or formation of new joints and cracks in the concrete that exceed 1/8 inch (3.175 mm) in width.
 1. Warranty Period: 1 years after date of substantial completion. Longer warranty periods are available upon request.
 2. Coverage: Manufacturer will guarantee that the material provided is free of defects for the warranty period.
- B. Additional Warranty Options: Upgraded warranties are available by contacting the manufacturer. These warranties may have additional requirements and approval must be granted in accordance to the manufacturer’s warranty requirements. Additional warranty options include:
 1. Waterproofing Warranties: For below grade projects that require vapor intrusion barriers and below grade waterproofing for foundation walls, single source warranties are available from EPRO.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: EPRO Services, Inc. (EPRO), P.O. Box 347; Derby, KS 67037; Tel: (800) 882-1896; www.eproinc.com
- B. Basis of Design: Geo-Seal EV40s (41 mils) – **Geo-Seal EV40**, **Geo-Seal CORE** (for detailing seams, terminations and penetrations)

2.2 VAPOR INTRUSION BARRIER MATERIALS

- A. EVOH Geocomposite Sheet Membrane
 1. **Geo-Seal EV40: Geo-Seal EV40** is an extremely durable, high strength base course made from the lamination of EVOH film and nonwoven polypropylene geotextile fabric.

PROPERTIES	TEST METHOD	VALUE
Film Material		Polyethylene & EVOH
Film Color		White/Blue
Fabric Material		Non-woven Polypropylene
Fabric Color		White
Thickness		41 Mil
Weight		618 g/m ²
Classification	ASTM E1745	Class A, B & C

Water Vapor Transmission	ASTM E96	0.033 perms
Water Permeance	ASTM E96	0.0098 perms (US)
Tensile Strength	ASTM D882	61 lbf
Puncture Resistance	ASTM D1709	2600 grams
Life Expectancy	ASTM E 154	Infinite
Low Temperature Impact	ASTM D 1790	Resistant to 105 °C
Methane Gas Permeance	ASTM D1434	3.68 x 10 ⁻¹² m/s
Benzene Vapor Permeance	Queens University	1.13 x 10 ⁻¹⁰ m ² /s
TCE Vapor Permeance	Queens University	7.66 x 10 ⁻¹¹ m ² /s
PCE Vapor Permeance	Queens University	7.22 x 10 ⁻¹¹ m ² /s
Weight: 165 pounds		
Dimensions: 12" x 100'		

B. Polymer Modified Asphalt

1. **Geo-Seal CORE:** *Geo-Seal CORE* is a non-hazardous, low-viscosity, water-based, anionic asphalt emulsion modified with a blend of synthetic polymerized rubbers and proprietary additives. *Geo-Seal CORE* is highly stable during transit and when properly stored but becomes highly reactive during the spray application to form a rapidly cured membrane with exceptional bonding, elongation, and hydrophobic characteristics.

PROPERTIES	TEST METHOD	VALUE
Color		Brown to Black
Solvent Content		No Solvents
Shelf Life		6 months
Tensile Strength	ASTM 412	32 psi
Elongation	ASTM 412	4140%
Resistance to Decay	ASTM E 154 Section 13	4% Perm Los
Accelerated Aging	ASTM G 23	No Effect
Moisture Vapor Transmission	ASTM E 96	0.026 g./sq. ft./hr.
Hydrostatic Water Pressure	ASTM D 751	26 psi
Perm Rating	ASTM E 96 (US Perms)	0.21
Methane Transmission Rate	ASTM D 1434	0
Adhesion to Concrete & Masonry	ASTM C 836 & C 704	20 lbf./inch
Adhesion to HDPE	ASTM C 836	28.363 lbf./inch
Adhesion to Polypropylene Fabric	ASTM C 836	31.19 lbf./inch
Hardness	ASTM C 836	80
Crack Bridging	ASTM C 836-00	No Cracking
Low Temp. Flexibility		No Cracking at -20° C
Packaging: 55 gallon drum, 275 gallon tote, 330 gallon tote		

2. **Geo-Seal CORE Detail:** *Geo-Seal CORE Detail* is single component, medium viscosity, water-based, polymer-modified anionic asphalt emulsion, which exhibits exceptional bonding, elongation and hydrophobic characteristics.

PROPERTIES	TEST METHOD	VALUE
Color		Brown to Black
Solvent Content		No Solvents
Shelf Life		6 months
Tensile Strength	ASTM 412	32 psi
Elongation	ASTM 412	3860%
Resistance to Decay	ASTM E 154 SECTION 13	9% Perm Loss
Accelerated Aging	ASTM G 23	No Effect

Moisture Vapor Transmission	ASTM E 96	0.071 g/sq. ft./hr.
Hydrostatic Water Pressure	ASTM D 751	28 psi
Perm Rating	ASTM E 96 (US Perms)	0.17
Methane Transmission Rate	ASTM D 14334	0
Adhesion to Concrete & Masonry	ASTM C 836	1 lbf/inch
Hardness	ASTM C 836	85
Crack Bridging	ASTM C 836	No Cracking
Low Temp. Flexibility	ASTM C 836-00	No Cracking at -20° C
Packaging: 5 gallon bucket		

2.3 AUXILIARY MATERIALS

- A. General: All accessory products shall be provided by the specified vapor intrusion barrier manufacturer. Auxiliary products used in lieu of, or in addition to, the manufacturer's products must be approved in writing by EPRO prior to installation.
- B. Reinforcement Fabric: Manufacturer's polyester fabric, **Geo-Seal Reinforcement Fabric** is available in 6 inch, 12 inch, and 40 inch widths.
- C. Detailing Material: **Geo-Seal CORE Detail**, a roller applied, water based, high viscosity, polymer modified asphaltic material.
- D. Backer Rod: Closed cell polyethylene foam
- E. Termination Bar: **e.term hd**, or approved alternate.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Comply with project documents, manufacturer's product information, including product application and installation guidelines, pre-job punch list, as well as, manufacturer's shipping and storage recommendations.

3.1.2 SURFACE PREPARATION

- A. The general contractor shall engage the certified vapor intrusion barrier contractor and certified inspector to ensure surfaces are prepared in accordance with manufacturer's instructions. Unless, explicitly stated in the contract documents, the vapor intrusion barrier contractor is not responsible for surface preparation.
- B. Examine all substrates, areas, and conditions under which the membrane system will be installed, applicator and inspector must be present. Do not proceed with installation until unsatisfactory conditions have been corrected and surface preparation requirements have been met. If conditions exist that are not addressed in this section, notify inspector and contact EPRO for additional clarification.
- C. Soil and Sand Substrates: Native soil and sand substrates shall be uniformly compacted to meet structural and building code requirements. All surfaces shall be free from protrusions and debris that may compromise the membrane system. Free standing water must be removed prior to application.

- D. Aggregate Substrates: Aggregate substrates shall be compacted to meet structural and building code requirements and then rolled flat to provide a uniform substrate. $\frac{3}{4}$ inch minus aggregate with no more than one fractured face is recommended, but other aggregates substrates may be approved by the manufacturer provided they do not create sharp angular protrusions that may compromise the vapor intrusion system.
- E. Working Slab: Mud slab, rat slab, or other concrete working slab shall have a uniform plane with a light broom or light trowel finish.
- F. Concrete Surfaces: Clean and prepare concrete surface to manufacturer's recommendations. In general, only apply the **Geo-Seal CORE** material to dry, clean and uniform concrete substrates with a light trowel, light broom, or equivalent finish.
- G. Cast-in-Place or Shotcrete Walls: Application to green concrete is acceptable provided the substrate is prepared in accordance with manufacturers specifications and published instructions.
 - 1. Provide clean, dust-free, and dry substrate for vapor intrusion barrier application.
 - 2. Surfaces shall be power washed to remove grease, oil, form release agents, or any other penetrating contaminants from the concrete.
 - 3. Remove all fins, ridges, and other protrusions.
 - 4. Fill honeycomb, aggregate pockets, tie holes, and other voids with hydraulic cement, or rapid-set grout.

3.2 VAPOR INTRUSION BARRIER INSTALLATION

- A. General: The underslab vapor intrusion system shall be installed under strict accordance with the manufacturer's guidelines and project specifications.

3.2.2 EVOH GEOCOMPOSITE SHEET MEMBRANE – GEO-SEAL EV40

- A. Whenever possible roll out **Geo-Seal EV40** in the same direction over the substrate with geotextile side facing down, away from the installer. When multiple pours will occur, extend the **Geo-Seal EV40** a minimum of 2 feet past the pour joint.
- B. Overlap **Geo-Seal EV40** a minimum of 6 inches.
- C. At the seam overlap, peel back the top layer of **Geo-Seal EV40** and apply 60 mils into the overlapping seam, making certain to apply **Geo-Seal CORE** to both the top of the bottom sheet and the bottom of the top sheet. Embed the top sheet into the bottom sheet.
- D. Visually verify there are no gaps/fish-mouths in seams.

3.2.3 POLYMER MODIFIED ASPHALT MEMBRANE – GEO-SEAL CORE

- A. Mask off adjoining surfaces where unwanted **Geo-Seal CORE** polymer modified asphalt membrane may be exposed on finished surfaces or impact other construction trades.
- B. Commence application of **Geo-Seal CORE** polymer modified asphalt when ambient air temperatures are within manufacturer recommendations.
- C. Surfaces that will receive the membrane must be clean and free from standing moisture.
- D. Start installing **Geo-Seal CORE** in presence of approved 3rd party inspector or required city inspector.

- E. Apply one application of **Geo-Seal CORE** membrane in accordance to manufacturer's instructions in order to obtain a seamless membrane with a minimum dry film thickness of 60 mils (1.5 mm).
- F. Apply **Geo-Seal CORE/Geo-Seal CORE Detail** in and around penetrations and cavities to ensure the formation of monolithic seal around all penetrations.
- G. Apply **Geo-Seal CORE/Geo-Seal CORE Detail** to prepared wall terminations and vertical surfaces to heights indicated according to manufacturer's recommendations and details. (if applicable)

3.2.4 TERMINATION SEQUENCE

- A. System Termination: The termination process is appropriate for terminating the membrane onto exterior footings, pile caps, interior footings and grade beams. When terminating the membrane to stem walls or vertical surfaces the same process should be used.
 1. Concrete surfaces that are not a light trowel, light broom or equivalent finish, will need to be repaired.
 2. Terminations on horizontal and vertical surfaces should extend 6" onto the termination surface. Job specific conditions may prevent a 6" termination.
 3. Apply 60 mils of **Geo-Seal CORE** to the terminating surface and then embed the **Geo-Seal EV40** layer by pressing it firmly into the **Geo-Seal CORE** layer.
 4. Apply 30 mils of **Geo-Seal CORE** over the edge of termination. For further clarification, refer to the termination detail provided by the manufacturer.

3.2.5 SEALING OF PENETRATIONS

- A. Sealing of Standard Pipe Penetrations: Prepare membrane penetrations so they are free of any material that will inhibit a direct bond to the penetration surface: foam, insulation, protective coatings, etc.
 1. Trim **Geo-Seal EV40** to within 1/8 inch of the penetration.
 2. Apply **Geo-Seal CORE Detail** 3 inches horizontally and 3 inches vertically around the base of the penetration.
 3. Embed **Geo-Seal Reinforcement Fabric** reinforcement fabric 3 inches horizontally and 3 inches vertically around the base of the penetration.
 4. Apply a second layer of **Geo-Seal CORE Detail** to reinforcement fabric until the reinforcement fabric is fully saturated. Secure **Geo-Seal Reinforcement Fabric** reinforcement fabric to penetration with a cable tie. For further clarification, refer to the termination detail provided by manufacturer.

3.3 FIELD QUALITY CONTROL

- A. Smoke Test: Conduct smoke test on all underslab areas upon installation of the **Geo-Seal EV40** sheet, the sealing of all penetrations, **terminations, and sheet membrane overlaps**. All deficient areas shall be noted, marked for repair, and repairs verified. Refer to manufactures smoke testing protocol for additional guidance.
- B. Field Inspection: Contact EPRO for independent certification process.

- C. Take care to prevent contamination and damage during application stages and curing. Machinery, additional trades, or general construction shall NOT take place over the membrane until inspection is complete and concrete has been placed. The membrane shall always be properly protected when equipment is operated near the membrane.
- D. Prevent damage during the placement of reinforcement steel and overburden.
- E. Damage Observation: Prior to the placement of concrete a visual inspection to confirm no damage has occurred from construction traffic or during the placement of reinforcement steel is recommended.

3.4 REPAIRS

- A. Underslab:
 - 1. Inspect damaged area to determine which system components have been damaged.
 - 2. If the **Geo-Seal EV40** sheet has not been compromised, patch only the areas that have been damaged by re-installing the damaged materials. The patch should extend 6 inches beyond the damaged area in all directions.
 - 3. If the **Geo-Seal EV40** sheet has been breached but no additional system components have been installed, install a patch below and above the base sheet that extends 6 inches beyond the damaged area. Area shall be sealed using the specified method for sealing the base sheet.
 - 4. Refer to manufacturer's detail for further repair clarification.

End of Section