

R A V E N

Installation Guidelines for Interim Landfill Covers

Dura♦Skrim® R8BV, R12BV and R20BDV

INSTALL GUIDELINES

INSTALLATION GUIDELINES FOR INTERIM LANDFILL COVERS DURA♦SKRIM® R8BV, R12BV AND R20BDV

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Part 1 – General

1.01 Guideline Scope

This document is an installation guideline for factory fabricated Dura♦Skrim® R8BV, R12BV and R20BDV reinforced interim landfill covers. This guideline is designed to provide a minimum set of standards for site installation. However, depending on the complexity and project specific requirements, a qualified design engineering firm may be required for design and installation specifications of the geomembrane. All work shall be in accordance with the project drawings, specifications and QC requirements.

Applications

Typical applications for Dura♦Skrim® R8BV, R12BV and R20BDV include but are not limited to:

- Daily Landfill Covers
- Interim Landfill Covers
- Temporary Rainshed Covers
- Remediation Covers or Liners
- Temporary Erosion Control

Dura♦Skrim® R8BV, R12BV and R20BDV are used in more demanding applications requiring high tear resistance. They are designed to withstand longer term outdoor applications requiring up to 5 years of exposure or more depending upon geographical location. When Dura♦Skrim® R12BV and R20BDV are covered with the Wind Defender ballast system, a 10 year limited warranty may be available depending upon the final application.

Dura♦Skrim® R8BV, R12BV and R20BDV are designed to meet the requirements of the Geosynthetics Research Institute; GRI-GM22 Standard Specification, categories 2 & 3.

1.02 References

American Society for Testing and Materials (ASTM)

1. ASTM Standards D751, "Standard Test Methods for Coated Fabrics". ASTM International, West Conshohocken, PA.
2. ASTM Standards D7003, "Standard Test Method for Strip Tensile Properties of Reinforced Geomembranes". ASTM International, West Conshohocken, PA.
3. ASTM Standards D7004, "Standard Test Method for Grab Tensile Properties of Reinforced Geomembranes". ASTM International, West Conshohocken, PA.
4. ASTM Standards D5884, "Standard Test Method for Determining Tearing Strength of Internally Reinforced Geomembranes". ASTM International, West Conshohocken, PA.
5. ASTM Standards D6241, "Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile Related Products Using a 50-mm Probe. ASTM International, West Conshohocken, PA.

Other References

1. Geosynthetic Research Institute (2012). "Test Methods, Required Properties and Testing Frequencies for Scrim Reinforced Polyethylene Barriers Used in Exposed Temporary Applications". GRI GM22. Geosynthetic Institute, Folsom, PA.

1.03 Submittals

Documents to be included in a submittal to the owner / engineer:

1. Example of the material warranty and geomembrane installation warranty.
2. Sample of the geomembrane to be installed including the technical data sheet.
3. Product Certification shall be prepared and submitted to the Owners Representative.
4. Shop drawings / panel layout for geomembranes with panel numbers, field seam locations, corresponding to shipping labels.
5. Submit resumes or qualifications of the installation supervisor.
6. The documentation to be submitted by the fabricator varies depending on the Owner's requirements. These may include copy of tested seams, certifications, or any other document related to the quality of the geomembranes and their installation.
7. Fabricator and Installer QC Manuals.

Part 2 – Products

2.01 Geomembrane Materials

Geomembranes included:

This document is an installation guideline for factory fabricated Dura♦Skrim® R8BV, R12BV and R20BDV reinforced polyethylene geomembranes. The top and bottom lamination layer of the geomembranes included in this guideline will be comprised of a linear low density polyethylene (LLDPE).

Geomembranes that are included in this Guideline are the following:

- Scrim Reinforced Geomembranes: These geomembranes have a scrim reinforcement with an open grid of greater than one-quarter (1/4" or 8 mm) between fibers. The finished Dura♦Skrim® R8BV, R12BV and R20BDV sheet shall be capable of being sewn in the field.

2.02 Quality Control

a. Manufacturer Qualifications

The manufacturer of the specified geomembrane or similar product shall have at least five years of continuous experience in the manufacture of the geomembrane. Additionally, the Manufacturer shall have produced a minimum of 2,000,000 m² (21,527,820 ft²) of the specified type or similar geomembranes.

b. Fabricator Qualifications

The fabricator of the geomembrane shall have fabricated a minimum of 250,000 m²/year (2,691,000 ft²/year) of the specified type or similar geomembranes.

c. Installer Qualifications

The Geomembrane Installer shall be the Fabricator, approved Fabricator's Installer, or an installer/contractor approved by the Owner's Representative. The installer shall have a minimum experience level of 50,000 m² (538,200 ft²) using the specified geomembrane.

It is the responsibility of any of the aforementioned parties to select a Geomembrane Installer with the appropriate degree of experience, personnel, and equipment to accomplish the required quality standards.

2.03 Geomembrane Arrival at Project Site**a. Geomembrane Unloading**

Inspect fabricated geomembrane panels prior to unloading from vehicle at project site (e.g. type of material, conditions, etc.). Make any claims for damage directly with the carrier prior to unloading or shortly after geomembrane unloading. Document any damage with photos if possible.

Materials delivered to site should be off-loaded (using forklift or similar equipment) in a location where minimum handling steps will be required.

While unloading or transferring the fabricated panels from one location to another, prevent damage to the wrapping and the fabricated panel itself.

Any damage during offloading and transferring should be documented by the contractor unloading the material and the installer.

b. Geomembrane Storage

Leave the panels packaged in UV protected wrap until the day that the panels are to be installed. If extremely hot or cold temperatures are present, keep the panels inside at a moderate temperature. This reduces the force required to unfold the panels.

Fabricated panels, when possible, should be stored on pallets off the ground. The storage area should be dry, level, and with a firm base to facilitate lifting; so the panels are not damaged, do not become dirty, and remain dry externally and internally.

Part 3 – Execution

3.01 Installation**a. Subgrade Preparation**

A pre-installation inspection shall be requested by the geomembrane installer and ALL interested parties before moving panels from the storage location to the placement area. If the subgrade is deemed to be inappropriate for any reason, it should be remediated prior to geomembrane movement and placement.

Subgrade surfaces should be free of loose rock fragments (>10 mm or 0.4 inches), sticks, sharp objects, or debris of any kind. The surface should provide a smooth, flat, firm, un-yielding foundation for the geomembrane with no sudden, sharp or abrupt changes or breaks in the grade that can tear or damage the geomembrane.

No standing water, mud, vegetation, snow, frozen subgrade, or excessive moisture is allowed before geomembrane placement. All pipes, drains, fittings, etc., which are to be installed beneath the geomembrane, should be in place, backfilled, and ready to be covered with the geomembrane before panel deployment.

An anchor trench in the shape of a "U" or "V" can be used as a perimeter termination point for the geomembrane. Installation of the geomembrane shall be started from the anchor trench.

b. Unfolding and Deploying Prefabricated Panels

The geomembrane shall be supplied as a continuous panel with factory seams in the panel to reduce the amount of field seaming and testing.

All large panels are accordion folded into a stack and rolled onto a heavy-duty 6" I.D. core then packaged in two separate outer wrap materials. When the panels are unloaded on site, they should be positioned per the deployment instructions. Each panel should contain a deployment instruction sheet detailing how to roll out the panel to length and pull from the accordion folded stack to cover the width of the area. Confirm that the area to be covered is free of any materials that could damage the cover.

While unrolling and/or unfolding the geomembrane, inspect the fabricated panel for proper material type and thickness, damage, and/or defects. Repair any damage found.

Check weather conditions prior to starting installation and do not try to deploy covers in windy conditions. Site personnel should be spaced the length of the cover about every 15' to 30' depending on the weight or thickness of the material being deployed. The site supervisor should coordinate the deployment of the cover material making sure the entire crew is pulling the cover material in equal proportions evenly across the entire length of the cover. Depending on the wind conditions, the crew should be able to take advantage of a slight breeze by pumping a layer of air under the cover material to help float the material while deploying. If at any time the air underneath becomes excessive, the deployment crew should pull the material closer to ground level to help push out some of the air. If a large wind gust comes up during deployment the crew should hold the material down to the ground temporarily until the wind gust passes.

Only material that is to be immediately joined with sewn seams, i.e., during that work-day, should be deployed.

The deployment crew should ballast the leading edge at any point they stop to prevent wind damage. The material should be loosely laid out and never pulled tight or tensioned. Wrinkles or folds in the cover material should be worked throughout the overall area to prevent any stress points in the cover. Laying the material out loosely will allow for the expansion and contraction properties that are inherent to polyethylene.

Normally, about 3% slack is recommended in each direction. Upon completion of the deployment process, the entire area should be inspected to insure that the 3% slack is evenly dispersed.

Once the cover has been completely inspected, the perimeter of the cover should be temporarily secured either with ballast or in an anchor trench. In most installations the cover is deployed and left out overnight, with weather conditions permitting, to assure the cover will not be shrinking any further due to cool weather after anchoring the perimeter. Once the cover has been determined to have sufficient slack, the cover can be anchored permanently. Attach to structure or placed into the trench and secure with backfill or other ballast materials.

Typically sandbags are used as ballast and should be placed as required in the specifications per the actual site layout. However, new and cost effective ballast systems such as knitted reinforced geotextiles like Wind Defender®, have been proven to be an effective longer term solution compared to ropes and sand bags.

If sandbags are chosen for ballast, they are normally spaced approximately 10' on center across the width direction and 5' on center the length direction. If used on perimeter, place bags end to end. When placing sandbags on slopes, it may be advantageous to run a rope up the slope anchoring each sandbag accordingly. When material must be deployed on windy days it is suggested to pull out short sections and immediately place ballast on the material prior to moving on to the next sections.

When installing multiple panels, the additional panels should be deployed following the same procedures as listed above. The additional panels should be deployed and positioned to achieve the necessary overlap for sewn seams.

Once the geomembrane is properly placed, the material should be seamed as soon as practical.

c. Field Seaming

An advantage of factory fabricated geomembranes is mill rolls of material can be fabricated into large panels in the factory before shipment to the project site. This minimizes the amount of field seaming and maximizes the amount of factory seaming which results in higher quality seams. The individual widths of the manufactured geomembrane rolls shall be assembled into large panels that are custom-designed for the specific project and correspond to the panel layout diagram. If factory seaming is maximized, field seaming can be reduced by 80 to 95 %. In other words, only 5 to 20% of all seams need to be made in the field depending on the unit weight of the geomembrane material. This reduction in field seaming improves seam quality, accelerates construction eliminates destructive field seam tests, reduces

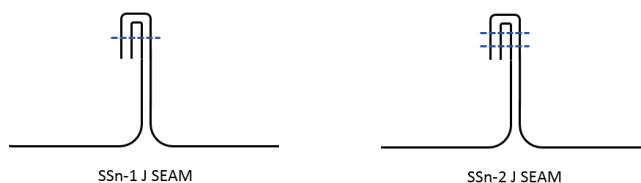
Due to the thickness and construction of Dura♦Skrim® R8BV, R12BV and R20BDV, hot wedge or hot air welding are not a requirement for field seaming. The preferred method is a sewn "J-style" prayer seam which requires stitching through four layers of material.

Sewing is a simple procedure and can be accomplished with minimal instruction. Please keep in mind that this seaming process will not be totally watertight due to the stitching involved. Always review project drawings, specifications and QC requirements. Raven recommends using a 2 thread (401 stitch type), single needle machine (a Union Special 2200 series portable hand held or equal), using F or FF thread with 3 stitches per inch and no more than 5 stitches per inch. Polyester or polyester/cotton tread with the expected longevity of the interim cover should be used.

Seam Preparation

After the panels are initially placed in the proper position, remove as many wrinkles as practical. If possible, allow the panels to “relax” by allowing the panel to warm in the sun. The edges to be sewn need to be smooth and free of wrinkles to ensure good field seams and no “fish mouths.”

Sewn field seams cannot be overlapped during the sewing process and require positioning the panel edges in a J-folded prayer configuration slightly above the surface. An SSn-1 or SSn-2 “J” seam type configuration is recommended for maximum seam strength as noted below:



Once the panels are joined, pull the seamed area flat to the ground, allowing for 3% slack. For most projects, field seams should be run perpendicular to the slope to shed water and minimize stress.

Unless rechargeable battery operated sewing machines are used, properly functioning portable electric generators must be available within close proximity of the sewing region and with adequate extension cords to complete the entire seam. The generator must have rubber tires, or be placed on a smooth plate such that it is completely stable and it does not damage the geomembrane. Fuel (gasoline or diesel) for the generator must be stored away from the geomembrane, and if accidentally spilled on the geomembrane it must be removed immediately. The areas should be inspected for damage to the geomembrane and repaired if necessary.

d. Field Seaming Inspection

Inspection should be performed as the sewing / seaming progresses, not at the completion of all field seaming, unless agreed to in advance by the Owner’s Representative. All defects found should be repaired and remarked to indicate acceptable completion of repair.

Identification of Defects

Seams shall be visually inspected by the geomembrane installer and the owner’s representative before, during, and after field seaming to assure a continuous sewn seam.

Evaluation of Defects

- i. Each suspect location marked, numbered, measured, and posted on the daily installation drawings and subsequently repaired.

- ii. Defective seams shall be repaired by cutting out the defective seam and re-seaming. If stitches are missing in seam areas, repairs can be made by sewing a section 24" before and after the defect. Single seams in excess of 20% of their total length requiring repair should be entirely removed and re-sewn.

e. Field Acceptance

The Geomembrane will be accepted by the Owner's Representative when all of the following have been completed:

1. The entire installation is finished or on agreed upon subsections of the installation are finished.
2. All Installer's QC documentation is complete and submitted to the Owner.
3. Verification of the adequacy of all field seams and repairs are complete.

f. Site Clean Up and Demobilization

On completion of installation, the geomembrane installer shall dispose of all waste and scrap material in a location provided and approved by the owner. The installer should also remove all equipment used in connection with the work herein, and shall leave the premises in a neat and acceptable manner. No scrap material shall be left on the completed surface of the geomembrane nor in the anchor trenches.

Note: These installation guidelines do not take precedence over the original Project Specifications. Please make reference to the original Project Specifications prior to installation of the interim cover. The information contained in this document is to be used as a guide only. RAVEN INDUSTRIES MAKES NO WARRANTIES OR GUARANTEES OF SATISFACTORY RESULTS FROM RELIANCE UPON CONTAINED INFORMATION OR RECOMMENDATIONS AND DISCLAIMS ALL LIABILITY FOR RESULTING LOSS OR DAMAGE. Limited Warranty available at www.ravenefd.com

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