



PVC INSTALLATION MANUAL

AccuGeo Liner is not an installer of geosynthetics and does not represent as such. This manual has been developed only as a guideline and not meant as an authority of exactitude. AccuGeo Liner will not be held liable for the installation of others.

AccuGeo Liner, Inc.
321 Industrial St.
Bakersfield, CA 93307
Phone: 661-321-0447 • Fax: 661-321-0449
Toll Free: 800-955-4637 • www.AccuGeo.com

TABLE OF CONTENTS

SECTION I: General Sequence of Events

SECTION II: Installer Furnished Materials For Installation

SECTION III: Installer Make-Ready List

SECTION IV: Fabricator Packaging

SECTION V: Contractor Storage

SECTION VI: Unfolding and Deploying Prefabricated Panels

SECTION VII: Field Seaming Procedures Using Solvent Adhesive

SECTION VIII: Patching Instructions For PVC Liners

SECTION IX: Field Seam Testing For Solvent Adhesive Welds

SECTION X: Field Seaming Procedures Using Wedge Welders

SECTION XI: Installing Pipe Boots

SECTION XII: Tool List For Field Seaming Crews

SECTION XIII: Covering PVC Liner

SECTION I: GENERAL SEQUENCE OF EVENTS

1. See attached “Check-Off List of Materials” and prepare materials necessary for lining installation.
2. Only unfold the panels that are to be anchored or seamed together in one day. See Section VI, “Unfolding and Deploying Prefabricated Panels”.
3. After the panels are initially placed, remove as many wrinkles as practical. If possible, allow the panels to “relax” by warming in the sun. The edges to be bonded need to be smooth and free of wrinkles to ensure good field seams.
4. When panels are in position, commence field seaming operations. See Section VIII: Field Seaming Procedures Using Solvent Adhesive and Section X: Field Seaming Procedures Using Wedge Welders.
5. All unseamed edges should be anchored with sandbags at the end of each day. If winds are expected, place boards along the edges of the liner panels with sandbags on top. A “wind row” of backfill material placed three-feet back from leading edge can also anchor the liner. Other ballast materials, such as rolls of geotextile may be used at the determination of the installer.
6. Bury the liner edges in the anchor trench after field seaming is completed around the given area. Do not bury the liner edge in the anchor trench within 30 feet of an incomplete field seam. This is to allow the seam area to be re-tensioned to remove wrinkles along the seam.
7. To begin the field seaming, always start in the middle and work toward an open end. This will minimize large wrinkles becoming trapped, which requires cutting and patching.

SECTION II: INSTALLER FURNISHED MATERIALS FOR INSTALLATION

Installer should supply the listed materials for installation of prefabricated panels of AccuGeo Liner PVC Liners.

1. All field installation labor and official supervision, i.e., crew chief or foreman.
2. The means to move packaged, folded panels of liner to specific locations on site. Panels may weigh up to 6,000 pounds.
3. Stakes and string or chalk lines (not lime) to define panel location and initial unfolding guidelines.
4. Canvas, burlap or polyethylene bags filled with sand or soft dirt to hold the unseamed edges in place. Quantity depends on wind present during installation. Estimate 1 bag per 10 feet of unanchored panel perimeter. Note that continuous ballast must be provided along an unsecured edge for strong wind conditions.
5. Minimum of 2 hand rakes or large paving rakes and 2 shovels.
6. 1 or more compacting rollers for smoothing out or compacting rough or badly gouged earth at the pit site.
7. Box or barrel of clean cotton rags.
8. Surveyor's tape measure.
9. Can of surveyor's spray paint.
10. All proper safety equipment and supplies. The installer is responsible for all safety aspects of the installation.
11. All persons at the site should have smooth, protrusion-free shoe soles (no heels).
12. All workmen should wear gloves so the hot liner will not blister the back of their knuckles while spreading the panels. This is particularly true during the summer months.
13. Each crew member should have a 1 foot x 2 inch grade stake with the pointed end cut off or a dowel. These will be used to prevent damage to the panel when deploying and to protect the crew members' hands. The folded edge of the panel should be rolled around the stake in preparation for deploying the panel.
14. If field seaming will be performed, all required equipment listed in Section XII: Tool List For Field Seaming Crews should be provided.

SECTION III: INSTALLER MAKE-READY LIST

Preparations to be made the afternoon or evening before commencement of the lining operations.

1. All equipment, tools and supplies are to be at the pond site and properly stored.
2. Soil sterilant should be applied when control of vegetation is needed.
3. The first day's panels are to be in position. Leave the panels packaged. 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.
4. Dig an anchor trench, around the entire parameter of the pond, if required. The soil should be spread out (raked flat, away from anchor trench) so panels can be unfolded on the top of the berm.
5. Stakes installed and/or lines measured and drawn indicating panel locations, reference lines, etc.
6. All pond dimensions checked to verify actual dimensions are not greater than shown on the drawing.
7. Pond preparations for the deployment of the liner:
 - A. Pond subgrade raked smooth, rolled if necessary. Subgrade should be free of all large, sharp rocks or other sharp objects and free of all vegetation and/or stubble.
 - B. Cover or wrap all penetrations (pipes, etc.) to protect liner from being cut, abraded or punctured during installation.
 - C. Where bonding of liner to concrete is required, the surface should be smooth, clean and dry.
 - D. All pipes, drains, fitting, etc., which are to be installed beneath the liner, should be in place and ready to be covered with the liner.
8. Distribute sandbags (about 1 every 10 feet) along the perimeters of the area to be lined the next day. DO NOT put them in the area where the panels will be unfolded, but immediately adjacent.

SECTION IV: FABRICATOR PACKAGING

The PVC lining is accordion folded in both directions to fit on the pallet. Liner panels are wrapped with a protective cover of 10 mil PVC liner and adequately packed and loaded for shipment to prevent damage during transit. Wooden pallets shall be free from mechanical obstructions such as nails, screws, or other fasteners that may damage lining.

Any lining that is damaged during shipment, storage or installation must be repaired by the Contractor before placement of the protective cover materials or backfill.

SECTION V: CONTRACTOR STORAGE

The PVC lining material should be stored at the job site in its original unopened packaging to protect the material against damage. When possible, PVC liner material should be stored in dry areas offering protection from direct heat of the sun or freezing temperatures, especially if the storage period is long. Space should be allowed between each liner pallet for ease of identification and abrasion prevention. Pallets of liner shall never be stacked.

SECTION VI: UNFOLDING AND DEPLOYING PREFABRICATED PANELS

1. The Liner panel is marked on the outside covering indicating the panel identification letter or number. The panel markings are also on the material inside the packaging.
2. When ready to unfold the panels, remove the packaging carefully. **DO NOT USE A KNIFE AS DAMAGE TO LINER MAY OCCUR.** Carefully inspect for protrusions before unfolding panels from the pallet. Remove any protrusions that may cause damage.
3. Positioning the panel and unfolding it from the pallet is best handled with a front-end loader or forklift. Liner panels may weigh as much as 6,000 pounds. The equipment operator should slowly drive backwards while workers on each side of the pallet unfold the liner onto the ground.
4. After the panel is unfolded, it is straightened out to the layout guidelines.
5. The panel is then spread into position. Men are positioned at the edge of the panel as indicated by the Crew Chief. The men are positioned approximately 15 feet apart, depending on the size of the panel and the terrain to be covered. Men are positioned at the uphill end of the panel to keep it from sliding down the slope as it is spread. If the edge to be gripped is subsequently to be bonded, then the panel edge is folded back about 2 or 3 feet, creating a fold. The fold is gripped using the 1 foot x 2 inch grade stake or dowel rather than the edge itself. This is to avoid stretching the edge where it is to be bonded.
6. As the panel is pulled out, it is necessary to maintain air under the liner to reduce friction. This can be accomplished in several ways. One is to simply hold the edge and advance at a rate fast enough to create air under the liner as it is unfolded. Another is to “fan” air under the liner. This is done by raising and lowering the edge of the panel to create a wave-like action across the liner as it is being spread. This fanning action should be directed by the Crew Chief.
7. Caution should be observed when spreading the panel under windy conditions. The panel should always be pulled into the wind to facilitate proper air flotation. Extreme care must be taken to prevent the liner from getting out of control and blowing away.
8. A slight lateral tension on the leading edge of the panel being spread should be maintained. This lateral tension facilitates the spreading operations.

NOTES:

- During unfolding-spreading operations it is necessary that the crew wear gloves, as these operations can chafe the knuckles.
- During unfolding-spreading operations it is necessary that the crew work as a team.
- If a gust of wind begins to pull the liner away from the crew and they are about to lose their footing, they should:
 1. Apply lateral tension in the leading edge and lower it to the ground.
 2. Attempt to restrain it further by placing one knee on the leading edge.

If these efforts fail to restrain it, LET IT GO. DO NOT HOLD ONTO THE LINER. DON'T BE PULLED ALONG WITH THE WIND.

- Extreme caution should be exercised when walking on the PVC liner material when wet. The sheeting becomes slippery when wet. It may be necessary to use a rope as an aid for going in or out of ponds.

SECTION VII: FIELD SEAMING PROCEDURES USING SOLVENT ADHESIVE

1. Temperatures for seaming must be as follows:
 - Minimum ambient temperature: 50° F
 - Minimum liner temperature: 60° F
 - Minimum solvent adhesive temperature: 60° F
2. Before adhesive is applied, surfaces to be seamed must be free of dirt and foreign materials. The presence of a few particles of sand or dirt is permissible in situations where it is unavoidable. The particles must be totally encapsulated in the adhesive/seam so they do not connect to form a path for a leak.
3. Adhesion of one liner panel to another is accomplished by lapping the edges of panels a minimum of 3 inches (6 inches is more desirable). The contact surfaces of the panels should be wiped clean to remove all dirt, dust or other foreign materials. A clean cloth, foxtail or grout brush may be used. If adverse conditions exist, such as mud, caked mud, or clay, remove by washing with clean water. Dry the liner before attempting to continue with seaming. A plywood seaming board should be placed under the liner portion to be immediately seamed. Adhesive can be applied with squeeze bottles or cans with brushes. Cans and brushes must be used cautiously with a lid slit barely large enough to accept the brush; otherwise the solvent in the adhesive can evaporate prematurely. Always keep the dispensing vessel sealed when not in immediate use. The actual bonded area must be continuous, extend to the exposed edge of the seam be a nominal 2 to 3 inches wide and have a minimum width of 1/2 inch. Using too much PVC bonding solvent in a wide area could result in a poor quality seam. With a typical 2-inch wood or plastic wallpaper seam roller, burnish the freshly joined areas by rolling perpendicular to the seam squeezing out excess adhesive and air pockets.
4. “Fishmouths” can be folded over and bonded closed or slit, bonded down and patched. Patches over “fishmouths” or other seam flaws should extend at least 2 inches past the flaw in question. The rule on patching should be “When in doubt, patch it!”

SECTION VIII: PATCHING INSTRUCTIONS FOR PVC LINERS

1. Before making repairs, the contact surfaces of the lining shall be thoroughly cleaned to remove all dirt, dust, moisture and other foreign materials.
2. When making repairs, a hot-air gun or other approved heating device shall be used to warm the lining when the ambient air temperature is below 50° F. No lining repairs shall be made when the ambient air temperature is below 35° F.
3. A solvent adhesive supplied or approved by AccGeo Liner, Inc. shall be used in the repair work.
4. All lining repairs shall be made using patches of parent material (same gauge or thicker PVC) with rounded corners.
5. All patches shall have a minimum of 3 inches overlap outside of the damaged area for bonding.
6. The patch is to be applied with the same adhesive as used for liner seaming and must be rolled and/or burnished to ensure a complete seal.
7. Any area repaired shall be inspected and approved by quality control personnel before placement of any cover.

SECTION IX: FIELD SEAM TESTING FOR SOLVENT ADHESIVE WELDS

All field seams made to join liner panels or penetration details (such as pipe boots) shall be 100% visually inspected for integrity and 100% air lance tested using a pressure of 40 PSI. Quality control personnel shall identify all inadequate seams and determine the appropriate measures to correct the condition. Any problematic areas found shall be visibly identified with a bright marker that will not interfere with repair process itself. After repairs are made, every identified area must be re-inspected and approved by quality control personnel before backfilling operations over the affected area.

Non-destructive coupon samples shall be taken at least twice each day for each seaming technician at the beginning and end of field seaming operations. Non-destructive coupon samples shall have minimum measurements of 12 inches x 24 inches (lengthwise being parallel to the seam direction) and shall be identified as to the time of day, adhesive used and the name of the seaming technician. Coupon seams shall be cured for a minimum of 20 hours including at least 6 hours of direct sunlight exposure and the balance being at room temperature. Testing shall be in the shear and peel directions.

SECTION X: FIELD SEAMING PROCEDURES USING WEDGE WELDERS

PVC liners equal or greater than 30 mils thick can typically be welded with a wedge welder. Thinner PVC liners will experience more burnouts when a wedge welder is used to make the seams. Refer to the instruction manual provided by the wedge welder manufacturer for details on wedge welding PVC.

SECTION XI: INSTALLING PIPE BOOTS

Whenever possible, avoid slitting liner panels for piping details until boot itself is ready for immediate installation. Generally, it is best to let the lining material straddle a relatively small protrusion (for later detail work) provided that a rag or towel is taped over the pipe to avoid damage to the liner.

Prematurely cutting the liner panel for a pipe penetration could lead to problems with wind and/or precipitation. Cuts made in liner for clearance over protrusions should always be made as small as possible to minimize patch work. Factory prepared pipe boots should fit snugly but not require excessive force to pull over a pipe. If a boot feels overly snug but workable, try applying either talc powder or using compressed air with a nozzle to float the boot sleeve over the pipe. Boots should never be used if the force required to install them stresses or weakens the boot.

When properly installed, the pipe boot will lay flat against grade surrounding pipe without leaving pockets that may become stressed during or after placement of backfill. Pipe boot aprons should be seamed to the parent liner using the same techniques as described in Section VII. In any instance where the apron does not cover an open area, that area shall be patched in accordance to repair procedures mentioned in Section VIII. Proper leakproof sealing of pipe boots should be verified by air lance or pick technique yielding no loose or curled edges.

The pipe boot sleeve should be attached to the pipe using butyl tape and a stainless steel band clamp.

SECTION XII: TOOL LIST FOR FIELD SEAMING CREWS

- One (1) set size 10 cloth gloves.
- Two (2) set knee pads. (If desired)
- Roll of tape to hold on knee pads.
- Ten (10) cotton rags per hour (24# box normally is adequate).
- Gallon can with handle for adhesive. Plastic applicator bottles can be ordered from AccuGeo Liner.
- One (1) whisk broom (or fox tail brush).
- One (1) 1" X 10" X 1'-16' long Douglas fir clear board, rounded off on both ends as well as all edges, with a rope tied to one end to be used as a seaming board.
- One (1) Stanley Knife.
- One (1) red or yellow crayon for marking liner surface.
- One (1) pair of scissors with rounded-off points.
- Safety glasses for each man on seaming crew for protection from solvent splash.
- One (1) 2" plastic or wood wallpaper seam roller per each field seaming crew.

SECTION XIII: COVERING PVC LINER

1. Care must be taken by equipment operators to avoid damaging the PVC liner.
2. Heavy equipment should operate on a minimum 3-foot roadway where the "haul road" is established in and out of the pond.
3. Always operate equipment on a minimum of 12 inches of covering. Avoid sharp turns with equipment that could pinch and rupture the liner.
4. When covering the side slopes always push cover material up the slope from the bottom of the pond. This will avoid stressing the liner.
5. If damaged does occur, DO NOT COVER IT UP. Advise the foreman so repair can be made.