



P.O. Box 20825  
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## **INSTALLATION PROCEDURES**

### PPL CONTAINMENT MEMBRANES LONG TERM STORAGE/CONTAINMENT MEMBRANE CONTAINMENT MEMBRANE QA/QC & INSTALLATION PROCEDURES

#### **1. SCOPE OF WORK:**

Furnish and install a flexible membrane lining as shown on engineering or contractor supplied drawings. All work shall be done in strict accordance with the drawings and related specifications and the membrane lining manufacturer's recommendations.

It is the intent of these specifications to insure a quality finished product as described on the plans and specifications and shall be the responsibility of the contractor to take whatever measures shall be deemed necessary to insure that this requirement shall have been met.

All interested governmental agencies shall provide inspection services throughout the installation procedure or provide written acceptance of the installation after final inspection.

#### **2. PRODUCT:**

The material supplied under these specifications shall be first quality goods specifically formulated and tested for the containment of the material(s) as set forth in the accompanying specifications.

The material used for the lining shall be a high density polyolefin reinforced low density polyethylene membrane and shall have been satisfactorily demonstrated by prior use and testing to be suitable, appropriate and durable for the purpose of this work.

The membrane shall be manufactured by the application of Low Density coating over High Density scrims and shall be uniform in color, thickness, size and surface texture. The finished lining shall be a sunlight (UV) and weather resistant (Cold temperature), plant and fish safe membrane that is a flexible, durable, liquid tight product free from pinholes, blisters, contaminates or other off specification defects.



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The membrane shall be manufactured from a composition of high quality ingredients, specifically compounded for use in hydraulic structures. Only domestic resins and additives shall be used. Reprocessed materials will not be acceptable other than clean rework materials of the same virgin ingredients generated from the manufacturer's own production.

The finished membrane liner shall consist of 2/2.5 mils of LD polyethylene coating over 2 HD scrims followed by 2/2.5mils of LD coating creating a 5 layer impermeable membrane with tremendous strength and resistance to hydrocarbons. The finished thickness shall be plus or minus 10% based on the material type i.e. PPL20,PPL24, PPL36 etc.

### **3. ROLL SAMPLING:**

Each roll upon delivery shall be visually inspected. Each roll shall be wrapped individually and each roll shall be clearly labeled with a roll number and lot number. Each load will be accompanied by a box of samples 6" x 12', for each roll delivered, for archiving and sampling.

Prior to placing the roll into production, the roll number and lot number will be recorded on the inside of the core with permanent marker. A 6" wide sample taken from the entire width of the roll will be removed and cut into 2 pieces 6" x 6'. long and welded together for sampling and material integrity testing. Peel testing of the sample shall be done to insure weldability and careful inspection at weld separation shall be checked for delamination. If delamination failure is present, retest as described above, after removing 15 feet from the roll. If failure is still apparent the roll shall be labeled as rejected and removed from the production area. These procedures apply to all new rolls and roll splice joints.

All roll tests are to be recorded in the test log.



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#### **4. FABRICATION:**

The individual widths of the PPL fabric shall be assembled into large sheets custom-designed for the specific project so as to minimize field seaming. All factory seams shall provide a bond between the sheet goods sufficiently strong to meet the test requirements of these specifications.

All machines used in the seaming process shall be tested daily, prior to any fabrication, by welding a 6' long test sample of the material and manually peel testing along the entire length. Each test must show film tear bonding along the length of the seam to be considered a "pass". All results shall be recorded in the test report log and must include Date, time, machine #, operator, temp and speed as well as pass/fail indication. If the sample fails the testing, make appropriate corrections to the equipment and retest as stated above.

Machines will be further requalified after the following: change of material, unexpected power loss, change of operator, or shutdowns of 45 minutes or longer.

The factory seaming shall be performed on thermal welding equipment with pressure wheels and shall consist of seams of 2" minimum width in the case of wedge welding, 1.5" width in the case of hot air welding, which will provide a film-tearing bond of 80% of the fabric tensile strength. All seams shall be visually inspected along their entire length, and destructively tested at an interval not to exceed 500 lineal feet of factory seam per machine.

#### **5. PANEL PACKAGING AND HANDLING:**

Factory fabricated panels shall be accordion folded during production to width of approximately 6' wide. Upon completion each bundle shall be folded or rolled by hand or machine based on the total square footage of the panel. Panels 10,000 sq.ft. or larger are rolled by machine and include a core and continuous unroll strap. Each roll shall be secured to a pallet or export container designed to be moved by a forklift or similar piece of equipment. Each factory-fabricated panel shall be prominently and permanently marked with the panel size and installation location as per factory drawings. Each panel will



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then be wrapped with its own protective wrap and marked again as to size and installation location. Packaged factory liner sections, which are delivered to a project site, shall be stored in their original shipping wrappers and stored in a dry area and protected from harsh weather elements when at all possible. The liner sections shall not be stacked.

#### **6. INSTALLER:**

The installer of the lining fabric shall be experienced in the installation of flexible membrane linings and shall be approved in writing by the fabricator and the manufacturer of the material.

#### **7. LINING BASE MATERIAL:**

A base shall be prepared on the bottom and slopes of the area to be lined. This base shall be free of all sharp objects, roots, grass and vegetation. Unsuitable material found during the pre-installation inspection by the installer shall be removed prior to the installation of the liner.

The base (subgrade) material shall be native materials or materials obtained from a borrow source compacted to a minimum 95% compaction or an approved construction fabric of at least 100 mils thickness, weighing 8 ozs. per square yard with a grab tensile strength of at least 275 lbs. per square inch and a Mullen burst strength of at least 450 pounds per square inch, which will provide a finished sub grade suitable for the flexible membrane lining.

Foreign materials, vegetation, protrusions, voids, cracks and other penetrating or raised sources shall be removed from the sloping areas as well as the base. Loose rocks, rubble and other foreign matter shall be collected and deposited in the appropriate site out of the area to be lined. The excavated and filled areas shall be trimmed to elevations and contours shown on the drawings and shall be smooth, uniform and free of all foreign matter, vegetation and sudden changes in grade.

A pre-installation inspection shall be called for and ALL interested parties, including governmental agencies, shall be present for this inspection. Any parties not participating in this inspection shall be construed as accepting the site preparation and will acknowledge this



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defacto acceptance in writing at the appropriate time

#### **8. FINAL SUBGRADE PREPARATION:**

The sub grade shall be prepared immediately prior to the placing of the liner. The surface on which the liner is to be placed is to be firm, clean, dry and smooth. Anchor trench excavation and any structure seal preparation should be completed before the lining installation begins.

#### **9. LINING INSTALLATION:**

A continuous sheet of liner shall be installed throughout the installation site as according to the drawings. The lining shall be placed over the prepared surfaces to be lined in such a manner as to assure a minimum of handling. The sheets shall be of prescribed lengths and widths and shall be placed in such a manner as to minimize field seams. Only those pieces of fabric that can be installed and anchored in place during the workday shall be unpacked and placed in position.

Sandbags and or other suitable weights may be used as required to hold the lining in position during the installation. The weights shall not have any sharp edges, which may snag or otherwise penetrate the liner fabric. Care should be taken to keep the seam areas as clean as possible. It may be necessary to wipe down the edges prior to heat-sealing the panels together.

No materials or equipment shall be dragged across the face of the liner nor shall the workmen while installing the liner subject the liner to abuse. All installation party members shall wear soft-soled shoes or boots while working on the surface of the liner.

Lining sheets shall be closely fit around all penetrations through the liner. Lining to concrete seals shall be affected with mechanical anchors as shown on drawings. All piping, structures and irregular projections shall be sealed and flashed with the fabricated boots or other approved sealing methods.

A meeting of all interested parties shall prescribe the method of



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backfilling of the site with the appropriate materials. The lining installation manager prior to commencement of the backfilling program shall approve all actions undertaken to place the top cover material.

#### **10. FIELD SEAMS:**

All seaming shall be done with thermal heat-sealing equipment, Heat-sealing with automatic wedge welding is the preferred method of field seaming whenever possible.

Wedge welders for field seams shall be qualified prior to beginning field seaming. A 6' section of material, at current ambient temperature, shall be welded and manually torn apart to insure proper welding adhesion.

Lap joints require a minimum of 2.5" overlap of the factory fabricated panels. The contact surfaces of the panels must be cleaned and all moisture and other foreign material must be removed prior to heat sealing.

If the sub-surface area is not capable of 95% compaction it may require the placement of a back board or rub sheet under the liner to give a firm, dry and clean welding surface.

Extreme caution should be taken throughout the installation to avoid wrinkling the edge of the liner. These "fish mouths" must be slit back sufficiently to remove them and the liner sealed to assure total integrity.

Any portion of the liner damaged or hurt for any reason shall be repaired or replaced by the installation crew before it departs. Normally the ends of the panels can be used for a patching source.

#### **11. PATCHING:**

Any repairs resulting from damage during installation shall be repaired with like fabric and heat sealing to ensure a secure lining. It is recommended that at least 2"-4" of overlap be used on any



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penetrations. It is suggested that any major scuffing be replaced with undamaged liner.

**12. INSPECTION:**

A thorough inspection of the completed liner installation shall be undertaken by a representative of the installer and a representative of the owner or the engineer in charge of the project. All government agencies involved in the project should also have an inspector or designated representative on site during the installation and after completion of same so as to register any complaints at that time. Any and all discrepancies to the permit process or license shall be attended to at this time.

**13. FIELD TESTING:**

All field seams shall be visually inspected along their entire length for integrity. If required by contract seams and repairs may additionally require non destructive testing using the Air Lance method (ASTM D4437) as outlined:

- A Installer will supply a compressor and air wand with a fixed nozzle tip with an opening approx. 3/4" wide x 1/8" high.
- B Compressor shall be equipped with an output gauge and the ability to continuously supply 30 psi of air pressure.
- C The non destructive test involves running the nozzle of air 1/4" to 1/2" away from the outside edge of the field seam for its entire length. If air penetrates the seam area the audible noise or visual puffing of the seam indicates an area of concern and should be marked and repaired accordingly.

**14. SOIL COVER:**

PPL geomembranes may be covered by soil if desired. In areas of high traffic or areas with a high water table covering the entire liner is often recommended.

Care should be taken when covering the liner to prevent any damage to the geomembrane or geosynthetics. At no time will construction equipment be allowed to drive directly on the liner. Access roads for soil cover should be maintained to provide 6" minimum, 12" preferable, between the excavation equipment and liner at all times.



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Damage to the liner, shall be repaired prior to proceeding with cover. Costs associated with repairs are the contractor's responsibility.

\*\*Cover material shall be 1/2" minus particles, clean rounded soils or gravels, free of sharp edges, sticks, rubbish and debris or foreign materials. The cover material shall be placed as soon as practical, upon completion of the liner installation, or in conjunction with, as the installation progresses to minimize traffic.

Cover soils should be dumped and leveled over the liner and not pushed from one end to the other to minimize rolling of the geomembrane beneath the soils. Cover soil should always be placed from the base up on slopes never pushed from the top of the slope downwards. Equipment should be turned in long sweeping turns and not spun quickly to eliminate the chance of digging down to the liner thru the cover soil.

When covering or initially filling a liner it is important not to lock the liner into the perimeter anchor trench prior to covering. This can cause undue stress and tension on the liner slopes during the covering process. The anchor trench or perimeter shelf area should be the last area covered to complete the cover process.

\*\* Site specific materials or sizes may be acceptable. It is recommended that the contractor receive prior written approval for acceptance of the cover materials, from BTL representative, before covering the liner.





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## **OVERSIZE BUNDLE INSTRUCTIONS**

It is always recommended to physically receive the liner prior to scheduling site installation.

Liners in excess of 10,000 sq.ft. will require a piece of equipment to offload the pallet from the delivering carrier. Typically the PPL liners weigh between 90 to 100 pounds per 1000 sq.ft. of area and come on oversized pallets 4'-6'wide x 8' long. It is the customers sole responsibility to provide suitable equipment to remove the liner from the delivering carriers enclosed truck.

All shipped liners come wrapped in a protective fabric and are securely fastened to the pallet. In some instances it may be easier to remove the wrapping while in the truck and simply pick the bundle only off the pallet to remove.

Please inspect the liner package carefully prior to accepting it from the carrier. If the packaging looks damaged please contact PM. Please note any damage to the package on the delivering carrier's paperwork prior to acceptance.

## **HOT-AIR WELDER INSTRUCTIONS**

Material to be welded should be as clean and dry as possible, and on a relatively smooth hard surface. Plug in welder (110 volt), turn on welder fan using black toggle switch on back end of welder, and turn red dial to "8" (small numbers can be found around the dial).

Let welder warm up for about 3 minutes before beginning welding. The weld will be approximately one and one-half inches wide (width of roller head). If operator is right-handed, hold the welder in left hand and position welder at a very low angle, with rear end of welder barely off surface and slotted nozzle just in between layers of material being joined together.

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Operator should be able to visually see just the outside corner of nozzle during welding process. The roller will be held in the right hand. When ready to begin welding, quickly insert welder nozzle between the two pieces of material, with roller head positioned immediately to right of welder nozzle and on top of both layers of material. Immediately begin moving welder from right to left along the seam at a slow, steady speed while following along with the roller head, using a "rocking and rolling" motion (moving roller forward and backward in rapid 1" to 2" motions).

The speed of welder travel should be just fast enough to keep from burning material. The goal is to get the materials as hot as possible (for a good weld) yet not so hot as to obviously burn them.

Check the weld periodically (after about 1 to 2 minute cooling time) to see if the coatings of the material are being removed uniformly. If not, you are welding too fast or erratically.

In order to make the heat elements last as long as possible, turn off heat (red dial) when finished welding and allow the air to cool the welder for several minutes prior to turning off completely.

## **WEDGE WELDER INSTRUCTIONS**

The welder you have received has been preset to run PPL. Prior to starting a field seam, the welder requires testing to insure that no damage or problems arose in transit.

This testing procedure will help familiarize you with the actual welding process.

Please refer to Step 2 prior to beginning the welding process.

The following items are required to run and test the welder:

Generator or power source 110v 20-amp minimum. 5kw or equivalent  
100' extension cord type 12/3 minimum (200' may be used if 10/3 or above wire gauge.)

Under no circumstance should more than 200' of cord be used, the controller in the machine requires a constant load, and drops in line voltage can cause damage.



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Rags  
Grease pencils  
Scissors

For testing 2 - 12" wide samples of the liner 15' long

The wedge welder you are using is an inseam or fixed overlap welder, the welded seam is produced by the 2 edges of the liner going thru the machine (1 piece over the wedge and 1 piece under the wedge) at a fixed rate of speed over a hot wedge which melts the sheets and continues on until they are clamped together by the rear pressure/drive wheels.

The liner sections require a fixed overlap of 3" to 4", this may require trimming of the top sheet to ensure that the 4" overlap is continuous along the length of the seam to be welded.

Step1 check that the pressure release for the roller wheels at the back of the machine (figure 3) is disengaged (down). Figure 3 shows the lever in the locked (up) position. Figure 8 shows it down and unlocked.

Step 2 Plug the machine in, and turn on drive switch 2 (figure 6) this will engage the drive wheels.

Step3 Now that the drive wheels are turning, it is time to load the material into the machine. The machine travels forward with the drive wheels being at the rear of the machine (figure 8). The material is loaded with a top sheet and a bottom sheet, looking from the rear or behind the machine the top sheet is the sheet that will be on the left hand side, the bottom sheet will load on the right.

Practice loading the machine a few times with the heat turned off and the drive wheels running.

Slide the bottom (right) sheet over the lower drive wheel and under the wedge, the front right rubber wheel of the welder will be on top of the liner. Once lined up, ensure that the material is pushed as far to the left within the machine as possible.



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Slide the upper (left) sheet thru the machine above the plate and wedge and under the upper drive wheel. Once lined up ensure that the material is pushed as far to the right within the machine as possible.

SWITCH 1

SWITCH 2

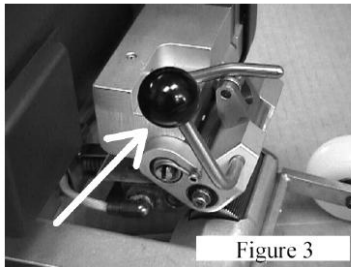


Figure 3



Figure 6

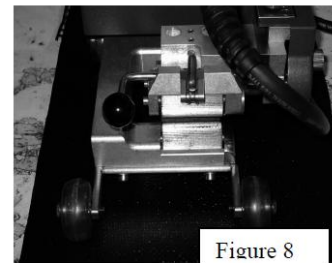


Figure 8

Once the material pieces are approx 2" beyond the back of the machine, engage the drive wheels by locking the pressure release handle in the up position (figure 3). This should cause the welder to begin traveling along the material. Once you reach the end of the seam or material, disengage the drive wheels by moving the pressure release handle down. Caution: allowing the drive wheels to run while locked in place and no material in the machine can cause damage to the wedge assembly.

Step 4 At this time turn on switch 1 (figure 6) which is on the left rear side of the machine, this will start the warm-up process.

The welder needs to run a self-test and heat up to the preset temp. (750 – 800 deg) the warm-up process takes about 5 minutes. The indicator should read between 750-800 constantly once the machine is warmed up.

Once the machine is warmed up it is time to try welding, please repeat step 3 to begin. Please note: With the wedge being hot, beginning immediately upon loading the material is critical as the material may start melting prior to engaging of the drive.

Note: Setting for temperature is generally between 750-800 deg.

Speed setting is generally between 50-60

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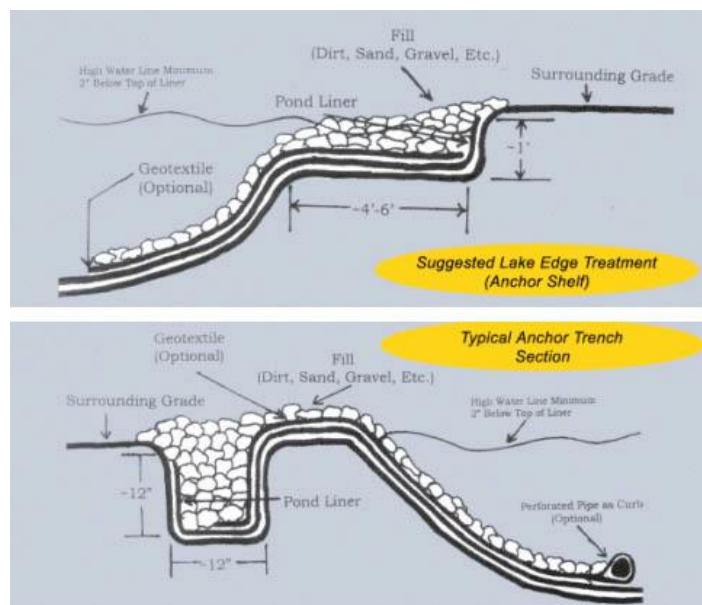
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Warmer weather will cause you to slightly adjust the speed upward, colder weather slow the machine down.

Temperature of the machine usually will not require adjustment.

The machine will require slight adjustments as you weld on the seams.

## SUGGESTED LAKE EDGE TREATMENT



## TYPICAL PIPE PENETRATION PROCEDURE

CORRUGATED PIPE DISCLAIMER: ALS, INC REQUIRES ONLY SMOOTH WALL PIPE BE USED TO PENETRATE THE LINER.

THIS DISCLAIMER IS TO SERVE NOTICE THAT THE CUSTOMER HAS BEEN

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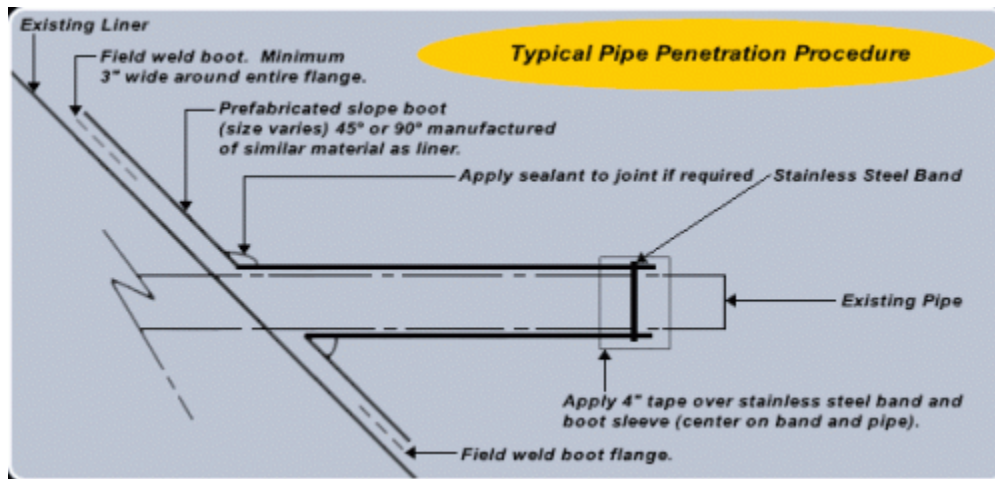
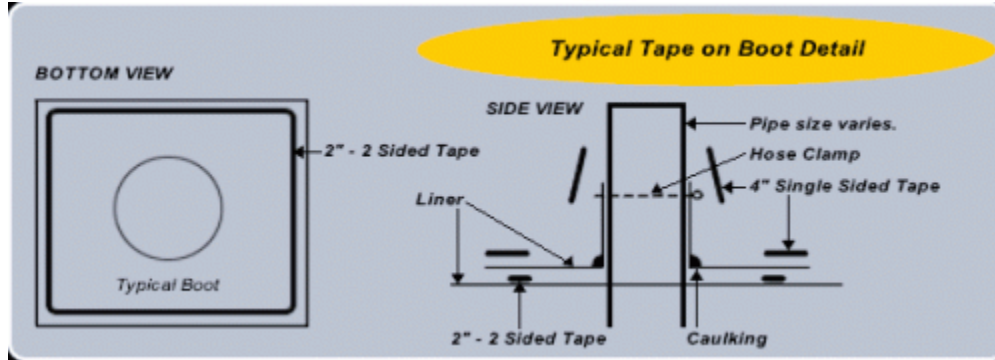
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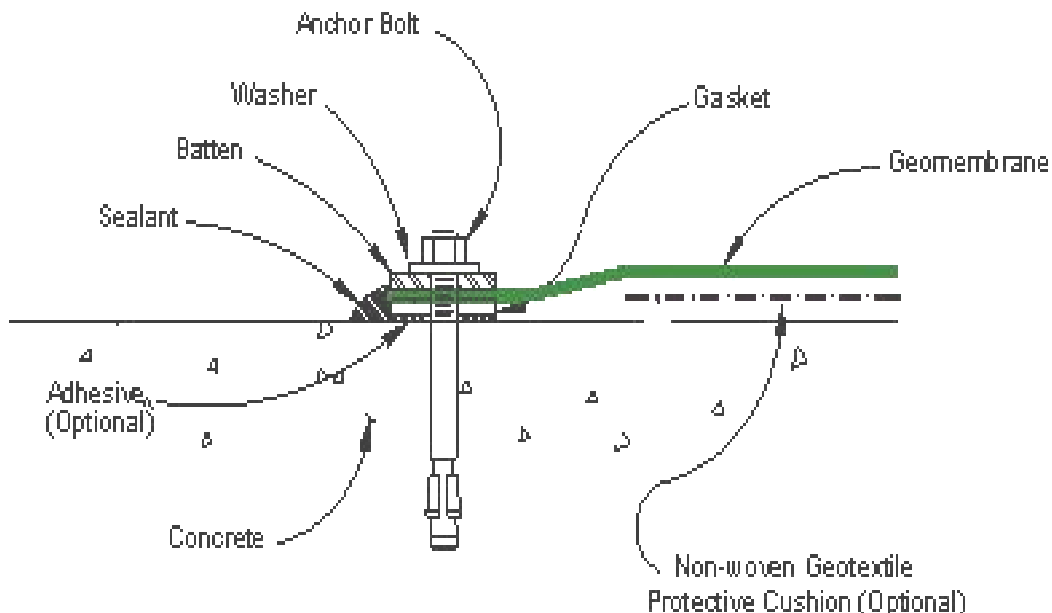
INFORMED THAT ALS, INC. NEITHER REPRESENTS NOR OFFERS A WARRANTY RELATED TO THE USE OF CORRUGATED PIPES THROUGH THE LINER SYSTEM. ALTHOUGH ALL EFFORTS WILL BE MADE TO SEAL THE LINER IN AN APPROPRIATE MANNER THE CUSTOMER ACKNOWLEDGES THAT ANY AND ALL REPAIRS (IF REQUIRED) TO PIPE BOOTS ASSOCIATED WITH CORRUGATED PIPE WILL BE FOR THE CUSTOMER'S ACCOUNT AND AT ALS, INC. 'S PUBLISHED DAILY RATES.

### Installation of Pipe Boot with Tape

1. After installation of pond liner, carefully cut hole to allow pipe to slide through liner. Allow liner to fit flat on ground.
2. Slide boot over pipe and push down to pond floor/wall, etc...
3. Carefully cut boot flange base so that it exceeds the cut in the liner by 4 to 6 inches in all directions. Make the flange square.
4. Clean liner and flange. Use water, MEK, Xylene, etc... Do not use soap.
5. Mark a line around flange and remove boot.
6. Please note some versions of our tape on boots now come with fully adhesive coated base plates identified by a white peel off layer on the entire bottom of the boot. If applicable please skip step #7 below and proceed to step #8
7. Place 2" wide double sided tape on liner (bottom view drawing). Be sure to overlap at corners by 14". Leave film layer on the top of tape. Use a rag to firmly press down the tape and work out any wrinkles.
8. Replace boot remove protective covering and press down on the tape and work out wrinkles.
9. Place 4" single sided tape completely over edge of boot, centering on the seam.
10. Place band clamp on boot riser approximately 1" from top of boot. Tighten and cover with 4" single sided tape.



## TYPICAL CONCRETE INSTALLATION PROCEDURE



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