GeoCHEM INCORPORATED

HDPE - ALLOY LINER SYSTEM

FIELD INSTALLATION RECOMMENDATIONS

This document provides information related to the installation of liner systems. Included in this document is information to assist the customer in accessing the site, provide guidance on site preparation, estimating staffing and support necessary for the installation and finally, information on installing the liner.

This document does not attempt to address all aspects of an installation for all applications. The information presented is general information presented in order to familiarize the individual with the overall scope of project. Specific site criteria should be addressed prior to start of the project to insure a successful installation.

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SECTION I

DETERMINING LINER SIZE REQUIREMENTS

To ensure that the panel (or panels) of liner ordered will sufficiently cover the area requiring a liner and that the liner will perform as required, a thorough site review is required. Items to be considered are substrate, fill and drain lines, utilities that may travel over, under or through the area, debris that may accumulate in the lined area and access to the pond area by personnel or animals. All of these items should be considered to insure the liner installation proceeds smoothly and the liner will perform as required after installation.

The site should be measured to determine sizes required. As built dimensions can vary significantly from blueprints or designed dimensions. Allowances should be made for anchor trenches or other anchoring system required. Measurements should be generous instead of conservative to allow for slack in the liner once installed. An oversized liner can always be cut to fit, an undersized liner has to be field patched or enlarged and is more difficult and may not perform as desired.

The pond area should be measured in both directions and for a large pond area several measurements in both directions will provide more accurate information. The tape should be placed at the approximate location of the anchor trench and allowed to follow the contours of the slopes and bottom of the cell. Additional length or width should be added to this measurement to account for the anchor trench. Normally 4'-6' per anchor trench is sufficient.

Pipe intrusions such as drain lines, fill lines, overflow lines should be located and identified. At least 1'-2' of pipe needs to be exposed to allow for pipeboot installation. To secure the liner to the pipe intrusion, pipeboots will be required to be fabricated and sealed to the liner in the field. Each pipe outside diameter should be measured and recorded. Also the slope where the pipe is located should be recorded (i.e. 3:1 side slope for a fill line) Notations should also be made if valves are installed on the pipes. Information on pipe intrusions must be provided to GeoCHEM, Inc. that pipe boots can be fabricated and provided as an accessory to the liner for field installation.

SECTION II

SITE EVALUATION AND PREPARATION

One of the most important steps in protecting a liner is correct site preparation. Insufficient effort in this area will most likely cause short term and long term problems with the liner's performance.

Subgrade preparation is the most important portion of the site work. The surface the liner will come in contact with needs to be smooth and free of rocks, debris and old vegetation. Ideally, the liner should be placed on a 4"-6" sand base, but if not practicable work can be performed on existing subgrades. In some cases, compacting existing subgrade materials and correction of any erosion damage which may exist will provide an adequate surface. Chunks of clay or dirt should be leveled or removed. A liner draped over a chunk of soil will be required to "formfit" around the dirt chunk risking the chance of damage to the liner. Also, material such as crushed rock is not an acceptable surface for the liner since foot traffic on top of the liner may cause punctures due to the sharp subgrade materials.

Vegetation removal is also important. Dry weed stalks or brush become brittle and when broken can act as ideal sources for punctures. Tree roots or stumps should be completely removed or covered with a 6" layer of fill dirt.

Underground utilities in the area should be marked to prevent damage during installation of the anchor trench. Utilities which may be present are telephone, gas, electrical, cable TV, or storm drains. Line locations should be marked prior to start of any dirtwork.

All water should be drained from the pond prior to liner installation and the site allowed to dry. Liners cannot be pulled across a muddy surface since the mud will act as a vacuum and make installation extremely difficult. Installation of a liner on a muddy surface is not recommended. The pond should be allowed to dry out for at least 30 days prior to liner installation.

Areas around pipe intrusions such as drain lines, fill lines, overflow lines should be prepared. The surfaces should be smoothed around the pipes. Rip-rap located around storm drains should be removed or covered. Backfill or other materials may have to be added to provide a smooth gradient with the remainder of the liner area. At least 1 '-2' of pipe needs to be exposed to allow for pipeboot installation.

An anchor trench is normally used to secure the perimeter edge of the liner. The anchor trench can be mechanically or manually dug and is normally 5"-.8" wide and 12"-16" deep. The trench should be located far enough back from the filled elevation of the pond to prevent the trench from being washed out. Dirt should be placed to the outside of the trench for easy backfilling.

The anchor trench can be dug just prior to placement of the liner or during installation of the liner. Anchor trenches dug too early may fill up with dirt requiring the trench to be cleaned out during the liner installation.

SECTION Ill

ESTIMATING MANPOWER AND EQUIPMENT FOR INSTALLATION

Determining what materials, equipment and personnel will be required to install a liner is not an exact science. Each project presents its own unique challenges and complicates what appeared to be a straight forward task. The information presented here is based on previous installation experience and aids in insuring the project progresses as smoothly as possible.

A 100' x 100' cut flat sheet of HDPE-Alloy weighs approximately 750 lbs and may be packaged in a wooden crate approximately 4' x 4' x 4'. Total package weight: about 1000 lbs. A 200' X 200' cut flat sheet of HDPE-Alloy weighs approximately 3000 lbs. A crate large enough to handle this liner weighs about 500-600lbs. The crate would also be approximately 6' x 6' x 12' long.

The two package sizes are provided to give you a relative idea of the size of the liner you are ordering. The liners are normally shipped via common carrier, therefore arrangements must be made to receive your liner and unload it from the enclosed trailer. The crate is built sturdy enough for shipment, but care should be taken to prevent forks or other items from puncturing the container during handling.

In addition to heavy equipment which is necessary to move the crates, slings, chain or rope should also be available for pulling or lifting the crate/liner. Smaller rope is used to secure the liner in the event of wind.

Sandbags are used to secure the cover/liner during and after installation. Normally sandbags are installed on the cover/liner on a 15' x 15' grid and along the perimeter on 4' - 6' increments. On a 10,000 square foot cover/liner approx. 150 sandbags would be required. If high winds are expected more sandbags should be used. The sandbags do not need to be filled completely. Bags that are too heavy slow down placement or removal of the bags.

Hand tools normally required are hammers and pry bars for opening the crates, shovels and rakes for performing last minute preparation of the site and filling sandbags. Gloves should be available for personnel who will be pulling on the liner.

The number of personnel required is dependent on the size and quantities of liners/covers to be installed. For a 10,000 square foot liner, 3-5 people would be sufficient. For a 40,000 square foot liner, a minimum of 8 people are required and 10 are strongly recommended. Prior to the liner being placed, personnel may be used for last minute site work, assisting with crate placement and opening and for filling sandbags.

Other items may be required depending on location and conditions. Where access is difficult or the unloading point for the common carrier is at a far point from the final location for the liner, a flatbed trailer may be required to transport the liner.

SECTION IV

UNCRATING AND POSITIONING OF LINER SYSTEMS

These instructions are meant to be used as general guidelines for the installation of liners. Other conditions may apply depending on the size of the liner. These instructions should be used in conjunction with any additional installation instructions provided.

A deployment area must be designated for each site and sufficient access for crate positioning and an area along the side of the pond area for the liner. Normally roadways are used if sufficiently prepared to prevent liner damage. A recommended width for the deployment area is 20-30 feet.

HDPE- ALLOY liners are shipped in either large cardboard boxes or wooden crates depending on the size of the liner. Smaller liners will be accordion folded, then rolled and placed into cardboard boxes. Larger panels are accordion folded and then accordion folded into wooden crates. Instructions will be attached to the shipping container on how your liner has been folded, Information should also be provided on how to remove and install your liner. The information is similar to what is being presented here.

ROLLED TARPS IN CARDBOARD BOXES

Smaller liners or tarps are packaged to allow them to be unrolled at the pond site. As a general rule, cut flat sheets 15,000 square feet and below are accordion folded and then rolled (See drawing #2). Sheet sizes larger than 15,000 are accordion folded in both directions. Rolled liners are packaged and shipped in cardboard boxes. The roll of material is tipped on its end to fit into the cardboard box; therefore the rolled liner must be turned and positioned correctly at the site for deployment. Package size is approx. 4’ x 4’ x 5’-S’ high weighing about 1100-1200 lbs.

The liner package should be positioned at one corner of the deployment area. To determine how the package should be positioned and in which direction to turn the liner, the top should be removed. Once these factors have been determined and the crate positioned, the sides of the box should be opened. The cardboard sides can remain in placed to protect the liner from any sharp edges on the crate. The liner should be rotated and oriented so that the end of the liner faces the deployment end of the pond (See Drawing 4.) The liner can then be unrolled along the side of the pond. Section V addresses the actual placement of the liner material.

ACCORDION FOLDED LINERS IN CRATES.

Large liners are required to be shipped in wooden crates to protect the liner during shipment and also provide a workable package for moving the liner around the work site and to the final pond site. The crates are built of standard construction lumber, i.e. plywood, 2x4’s and 4x4’s. The crates can be stored outdoors prior to use, but a secure location should be selected for storage to protect against damage.

A liner is accordion folded and then accordion folded into the crate at the fabrication facility (See Drawing #1.) Normally, the base, sides and the rear of the crate are constructed first and the liner is folded into the container. Once the liner is secured in the crate, the remaining end and top are installed, and shipping labels and other information is attached. One end of the crate will be marked as “OPEN THIS END”. This end is the same one that was missing when the liner was placed in the crate and is therefore the best point from which to deploy the liner.

Removal of the liner from the crate can be accomplished in one of two ways. The method chosen, determines the starting location for the crate. The first method for removal requires the crate to be positioned at one corner of the site from which the accordion folded liner is pulled from the crate parallel to the long side of the pond (See drawing #6.) The liner can be pulled from the crate by either personnel or a piece of construction equipment. The second method again positions the crate at a corner of the pond, the leading edge of the liner is pulled from the crate and the crate is pulled backwards allowing the liner to be deployed as the crate is moved (See Drawing #5.) The second method is preferable over the first for several reasons. They are:

a. The liner is positioned along the edge of the site in its correct orientation as it is removed from the crate. This reduces the potential for damage which can occur if it were positioned using the first method. For example if a liner is 200’ long, and method one was utilized, the leading edge would have to be slid along the ground 200’ to be positioned correctly. With the second method, no sliding or dragging of the liner is required to remove the liner from the crate.

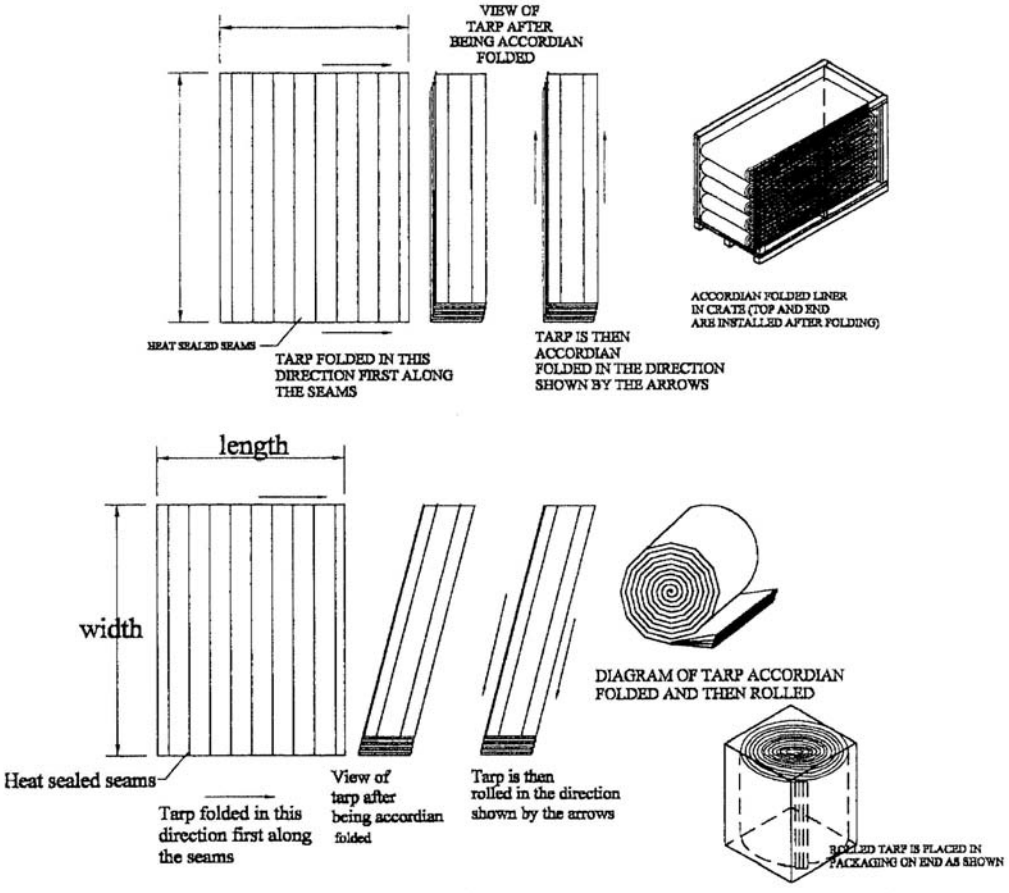
b. Heavy equipment is used to move the crate/unfold the liner which reduces the initial manpower requirements. It is usually more efficient to allow a front end loader to move a 3500-4000 LB crate/liner instead of having 8-10 or more personnel drag a 3000 LB liner from the crate. Equipment may be available for pulling the liner out of the crate and should be used if possible.

Once a decision has been made as to how the liner will be removed from the crate, the crate should be positioned correctly at the site with the end of crate marked “OPEN THIS END” in the correct orientation (See Drawing # 3.) The top and marked end should be removed from the crate. Pry bars and hammers are sufficient to open the crate. Caution should be used while removing the wooden panels to insure that nails or wood splinters do not damage the liner. All exposed edges should be inspected to insure all nails, wood splinters or other sharp objects have been removed. All wooden debris should be removed and placed safety out of the path of equipment and personnel. The liner is now accessible and ready for removal.

The leading edge of the liner should be pulled from the crate. On some occasions the leading edge has been folded under the top fold or flap. To expose the leading edge, the top flap should be folded forward starting at the rear of the crate. Several personnel may be required to perform this task. NOTE: Only personnel wearing soft soled shoes should be allowed to work on the liner to protect against damage. Approximately 20’ of material should be removed from the crate. If the liner will be pulled along the long side of the pond with a piece of equipment a nylon sling should be wrapped around the liner bundle about 10’ from the end and attached to the equipment.

Chain or cable should not be used on the liner for pulling. The liner can then be slowly pulled from the crate. Personnel should continually watch the deployment area for sharp rocks or other debris which may damage the liner as it is being deployed. Once the liner is totally removed from the crate the sling can be removed.

If the second method is selected, the leading edge of the liner is removed from the crate and secured. The crate is then pulled backwards. One method that may utilized is to support the rear of the crate with the bucket of a front end loader. A chain can be tied from the top of the bucket around the lower edge of the front of the crate and then back to the top of the bucket. The chain should be snug to insure the crate does not slip off the bucket during liner deployment. Again with this method, personnel should watch the area where the liner is being placed to insure no rocks are being exposed by the equipment or the crate. Once the liner is fully removed, the crate can be removed from the site. Normally the liner will appear to be too short or will have excessive slack. Utilizing a sling, secure the end of the liner and pull the slack out of the folded liner.



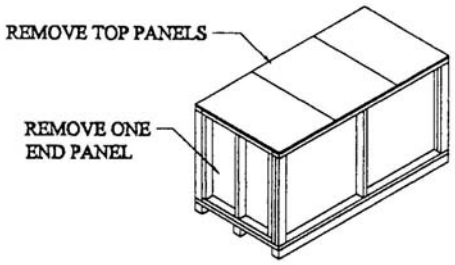


FIGURE 1

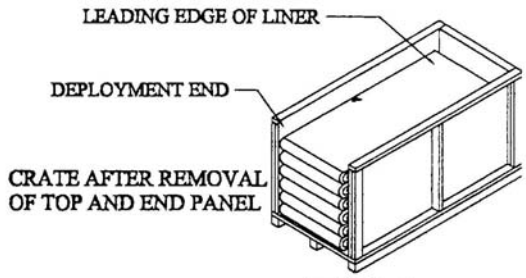
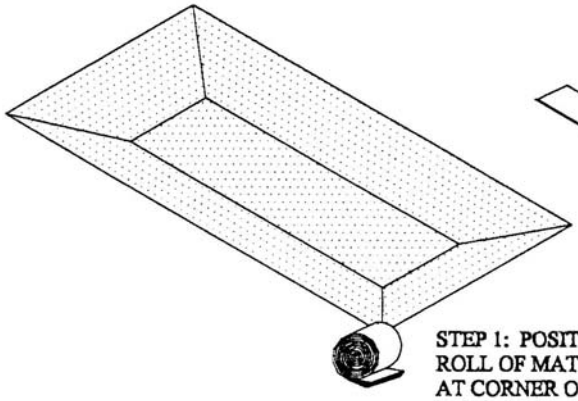
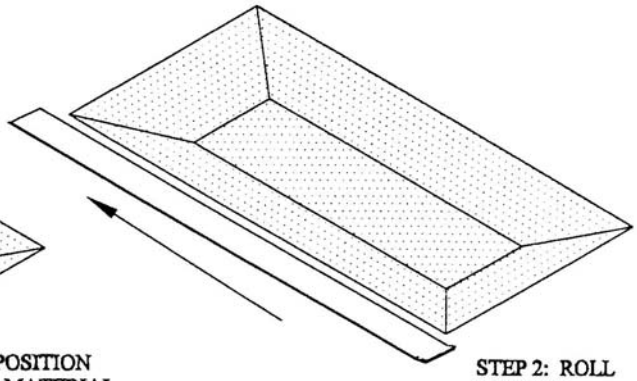


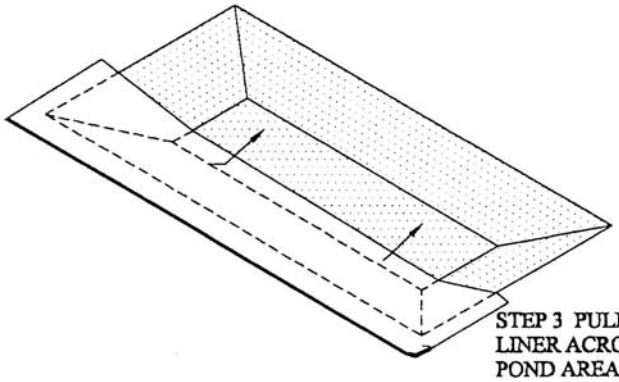
FIGURE 2



STEP 1: POSITION ROLL OF MATERIAL AT CORNER OF POND AREA.



STEP 2: ROLL LINER TO OTHER END OF POND AREA



STEP 3 PULL LINER ACROSS POND AREA

Placement of the HDPE - Alloy Liner System

Once the crate materials, toots and other construction items have been removed from the immediate area, the liner is ready for deployment across the pond. The pond area should be inspected to insure no materials or other items will be covered by the liner once installed. This is also a good time to inspect the pond area to insure it has been properly prepared i.e. all rocks, wood debris, etc. are removed and that the site is smooth and that no ruts or deep cuts exist in the liner area. Five minutes spent now doing a review of the site is a good investment. Materials should also be on site to secure the liner after deployment. These materials must be placed on the liner as soon as the liner has been placed. Sandbags are commonly used, along with backfill dirt.

At this point, wind conditions are critical. Liners should not be installed during windy or strong breeze conditions. If excessive wind is allowed under the liner during deployment, the liner will act as a sail and personnel will not be able to control or retain the liner. If the wind is too strong to allow deployment, sandbags or other ballast should be used to secure the liner. Another recommendation is to take short lengths of rope and cinch the liner on about a 20'- 40' spacing along the entire length. If the wind picks up and catches the liner edge, this method of securing the liner limits the amount of exposed surface area.

Light breezes blowing across the pond towards the deployment side are actually an aid since a small amount of air under the liner will allow the cover to float on a cushion of air during the deployment stage. Also wind conditions can increase during the deployment stage, therefore deployment should be scheduled to insure the wind does not jeopardize this stage of the project.

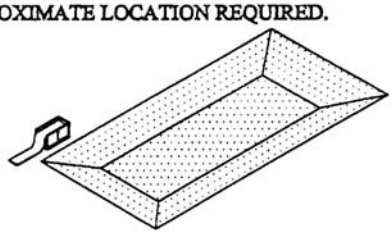
Personnel should be spread evenly along the deployment edge. The optimum spacing for personnel is about 20'-30' apart, so on a 200' long liner 9-11 personnel would be required. The leading edge should be held firmly and the liner pulled across the pond evenly. A site supervisor should coordinate movement across the pond to insure the liner is pulled in unison. As mentioned early, a small amount of air trapped under the cover aids in deployment. If the wind increases in intensity or it appears too much air is traveling under the cover, the leading edge of the cover should be held closer to the ground or held down temporarily until the wind gust dissipates.

If the liner cannot be pulled across the entire width in one pull, the leading edge should be secured, and personnel moved back to the remaining accordion folded section of the liner. Personnel should then pull the extra material across the pond. Utilizing this method, the liner can be "indexed" into position.

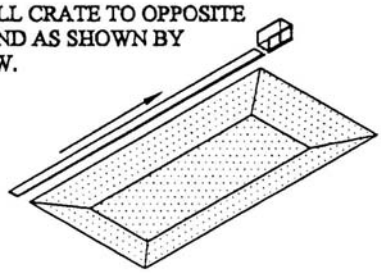
The liner should not be pulled too tight. Wrinkles or folds will not affect the performance of the liner. The liner will stretch in warm or hot weather and

contract in cool or cold weather. The lined area should be walked after deployment to insure that the liner is lying flat in all areas. Sandbags should be spread out across the exposed area to protect against wind damage. At this point, the perimeter of the liner should be temporarily secured. If the liner is allowed to contract overnight or if water is placed in the pond, these activities will help seat the liner. The edge of the liner can now be anchored or secured in the anchor trench or totally secured with backfill or other ballast materials.

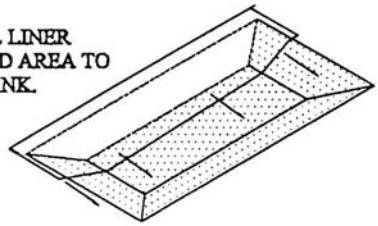
STEP 1: POSITION CRATE AS SHOWN BESIDE AREA TO BE LINED.
STEP 2. REMOVE LEADING EDGE OF LINER AND POSITION IN APPROXIMATE LOCATION REQUIRED.



STEP 3: PULL CRATE TO OPPOSITE END OF POND AS SHOWN BY THE ARROW.



STEP 4: PULL LINER ACROSS POND AREA TO OPPOSITE BANK.



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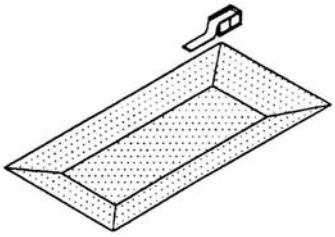
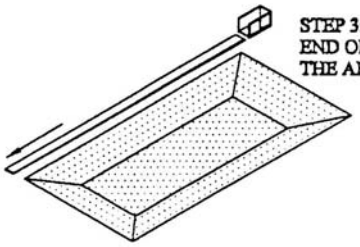


FIGURE 3

STEP 3: PULL LINER TO OPPOSITE END OF POND AS SHOWN BY THE ARROW.



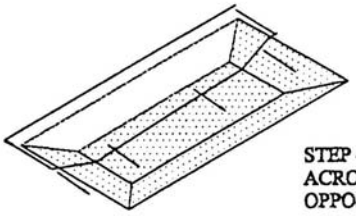


FIGURE 4

STEP 4: PULL LINER ACROSS POND AREA TO OPPOSITE BANK.

FIGURE 5

SECTION VI

FIELD EXTRUSON WELDING

HDPE-Alloy material used for liner applications is fabricated in the largest panels practical to reduce or eliminate field seams. For those projects where it is impractical to make the cover in a single sheet, multiple panels are used which require field seams.

One method of joining adjacent panels of HDPE-Alloy liner material is through the use of field extrusion welding equipment. The process involves applying a hot bead or extruded over the overlapped panel sections. The extruded provides a permanent bond between the two panels and consists of materials similar to those used in manufacturing the liner material. The weld has the same chemical, UV, and moisture resistance as the base liner material. If properly performed, this seaming method produces a watertight seam which frequently is stronger than the sheets the seam is joining.

Subgrade: General considerations for subgrades are given in Section II. Considerations for subgrade condition that are of primary importance for a liner that is to be field seamed include: 1) Degree of compaction, 2) Smoothness, and 3) Dryness. Soft subgrades will allow the extrusion welder to bog down, thus making seaming difficult and inconsistent. Rough or irregular subgrades cause irregular seams due to difficulties in maintaining the correct contact angle between welder and liner. Wet subgrades cause two problems: 1) Water softens the subgrade, and 2) Water acts as a heat sink, drawing heat out of the seam and causing a weak seam.

Preparation: The surfaces to be welded must be clean. The molten plastic from the welder cannot penetrate into the liner if there is a foreign substance. Due to the configuration of the welder, a small amount of dust, sand, and/or moisture can be tolerated. The welder has a hot air blower that precedes the welding head. The blower will dry off a small amount of moisture and will blow small, loose debris out of the way. Additionally, the sheet should be as clean as possible to facilitate “taping” the seams prior to welding. After overlapping the sheets approximately **6”** the seams are “taped” used a double sided adhesive tape to attach the sheets approximately **~** back from the top sheet’s overlapped edge. This prevents the sheets from diverging as the weld progresses along the seam.

Welding: Extrusion welding is an art. It does not take long to be taught the basics; however, it does take some time to develop a “touch” and an instinct for appropriate operating parameters. Prior to production welding, the technician must qualify the extrusion welder to ensure that good seams are being made. To qualify a welder, trial seams are made on scrap material. The seams are then tested, and the welder operating parameters adjusted accordingly until a consistent quality seam is achieved. Adjustable welder parameters are extruded (plastic melt) temperature and preheat (hot air blower) temperature. The extruded melt temperature controls the viscosity and heat energy of the extruded. The preheat temperature is used to lessen the temperature gradient between the extruded arid the liner. On a hot afternoon, sheet surface temperatures can vary by 100°F (overcast or sunny). Other main parameters that are controlled solely by

the operators handling of the equipment include welding speed (ft min) and welding head contact angle. All of these factors must be adjusted to compensate for wind, humidity, temperature, sun or overcast (compensates for variations in terrain to produce a consistent bead). Rain, extreme cold or high winds are cause to suspend welding operations. As can be seen, there are many considerations to field seam extrusion welding, most controlled by the operator handling the welder.

Testing: Two tests typically are performed. They are seam shear and seam peel. (Copy of 180°F T-Peel available upon request). Pulling the 1” wide strips by hand in a slow, controlled manner is usually acceptable; however, portable tensile testers are available. Stretching and failure in the main body panels of liner will generally precede failure of the weld. Typically, too low temperature and/or high welding speeds will cause poor penetration and weak seams. Conversely, too high temperatures and/or low welding speeds will cause overheated “burned” seams and possibly “brittle” seams that will fail after a year or two (typified by a tear along the side of seam).

SECTION VII

SEAMING AND REPAIR OF LINERS With FABRICATION TAPE

HDPE-Alloy material used for liner applications is fabricated in as large of panels as practical to reduce or eliminate field seams. For those projects where it is impractical to make the cover in a single sheet, multiple panels are used which require field seams. If extrusion welding seams is not feasible or not required, another approach to field seaming is the use of Fabrication Tape and Pressure Sensitive tape. Taped seams cannot provide the same level of performance as those obtained by factory or welded seams. Therefore the performance requirements of the taped liner should be considered verses other seaming methods. Fabrication Tape is a double sided bituminous tape which is applied between the overlapping panels. The Pressure Sensitive tape secures the exposed top edge of the top panel to the second panel. See Drawing #8 for positioning of both types of tape.

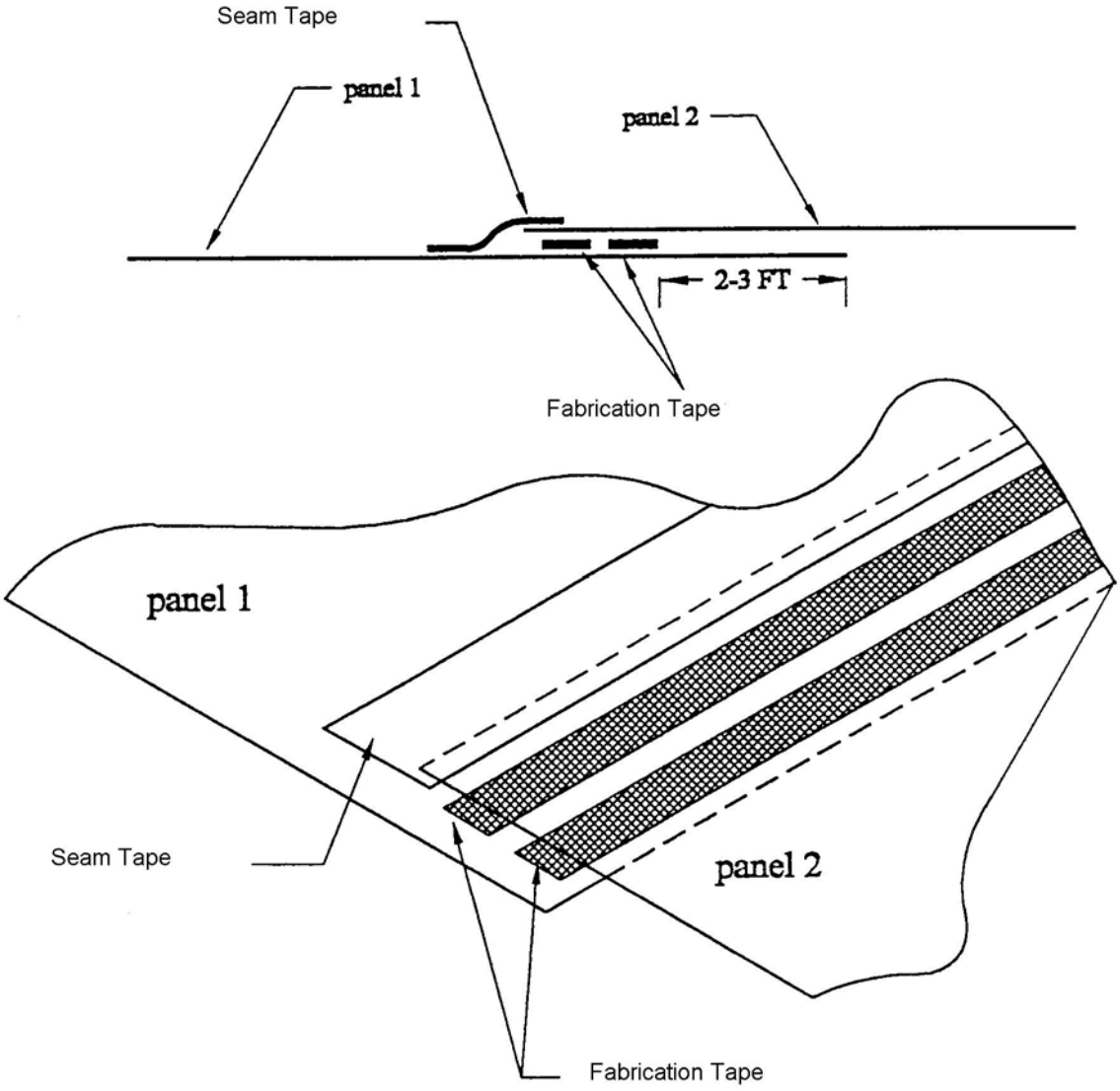
The surfaces which will receive the tape should be clean and dry. The tape will not adhere or give the level of performance required if the surfaces are not properly prepared. Dirty or wet surfaces should be completely cleaned with water, paper towels, dry rags or other materials which will prepare the surface for the tape. Accumulations of dust should also be removed to insure a secure sealed seam.

Both of the products used obtain their optimum adhesion when the surfaces to be bonded are warm. The surfaces should be at least 60°F to insure an acceptable bond. In order to obtain a bond at lower temperatures, external heat may be required. The use of an industrial style hot air blower is one recommended method. Extra care should be taken when attempting to place Fabrication tape at temperatures below 32°F.

To install Fabrication tape, the overlapping top panel edge should be pulled back approximately one foot. A row of Fabrication tape should be placed about 2'-3' away from the edge of the bottom panel. The tape should be applied as straight and as uniformly as possible. The tape should be allowed to follow the contours of the panel and should not be stretched tight. If fold-overs exist in the material, they should be smoothed prior to placement of the tape. Applying firm pressure ensures that the tape is sealed to the material. Once the first row of tape is installed, place a second row of tape approximately 2" away from the first row following the same steps as for the first row.

After the second row of Fabrication tape has been installed, the release paper should be removed from both rows of tape and the top panel secured to the bottom. Again, do not pull the material tight during the securing process since excess tension will eventually result in numerous wrinkles which are difficult to seal. All voids or wrinkles, if they exist, should be sealed with Fabrication tape. The exposed edge of the panel can now be secured to the bottom sheet with a layer of pressure sensitive tape. Again, the material should be clean and dry. Apply the tape so that half of the tape is on one panel and half on the second panel. Press into place and insure that the tape is secure.

After completion of the seams, the seams should be inspected to insure that sufficient adhesion as been obtained in all areas. If the tape has not adhered, the tape should be resealed and/or replaced if the tape has become contaminated from dirt or other foreign substances. The liner should then be positioned as necessary to insure that during operation the liner/liner seam will not be under tension.



SECTION VIII

FIELD REPAIR EXISTING LINERS

Repairs can be made to HDPE-Alloy material after installation. Repairs consist of patching over cuts or punctures, additions to existing liners or projects where sections of liner need to be removed and new sections added. The condition of the existing liner must be carefully evaluated to determine if a patch or repair is possible.

The success of the patch or repair depends on the liner's environment during use, the type of exposure to which the liner has been subjected, (weather or chemical) and the location. Seaming should be performed on sections of the liner which have retained their integrity. A liner that has degraded due to long term exposure may not be repairable and may need to be replaced.

Once the state or condition of the liner has been determined, the area where the repairs or seaming will occur should be evaluated. For liners, the subgrade must be reviewed. Welding needs to be accomplished on a smooth firm substrate. If muddy or a non-compactable subgrade is present, the subgrade will need stabilization. If repairs are required on floating covers, the cover may need to be removed.

The following steps should be followed when preparing an area for welding:

1. The area where the welding is to occur should be clean. All dirt or residue must be totally removed from the weld area. After removal of these deposits, the surface can be cleaned with isopropyl alcohol.
2. Seaming surfaces must be free from moisture. If the weld area is wet or damp all moisture must be removed. Additionally, field seaming cannot be performed during rain or drizzle or snow conditions.
3. The ambient temperature should be greater than 45 degrees Fahrenheit. Lower temperatures produce greater difficulties in achieving an effective weld. If welding is required below this temperature seam integrity should be closely monitored. 4. The liner and patch material should be as positioned as required minimizing the amount of wrinkles or folds in the weld area. Care should be taken to insure that sufficient material is positioned as necessary to insure the liner will not be placed under tension during use. Thermal contraction during cold weather should also be considered.
5. Test welding should be conducted in an area of the liner where the function of the liner is not affected. If the weld is acceptable on the patch material and not on the existing liner, the surface of the existing liner may need to be butted or sanded. The surface can be buffed with 150-200 grit sandpaper. The extent of preparation will be dependent on the condition of the liner and the type of seam required. Once an effective field seam is obtained, repairs or patching should be performed utilizing similar conditions.
6. Non destructive evaluation of field seams be performed utilizing ASTM D.4377 "Standard Practice for Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Sheet Geomembranes"

FIELD PERSONNEL HANDOUT

INTRODUCTION

This handout should be provided to all field personnel who will be handling the HDPE- Alloy liner material. Information in this appendix is provided to Insure personnel who handle the material are aware of their responsibilities in protecting the liner. Instructions for the overall scope of the project are addressed in the HDPE- Alloy Liner System manual

Most personnel may not have experience with the placement of HDPE-Alloy liner materials. Many personnel have some and maybe extensive experience in construction type activities involving heavy equipment, dirt work, concrete, setting up forms or building erection. Most of the activities associated with liner placement are straight forward using a common sense approach to the project Personnel assisting with the liner placement will be required to finalize site work, place the crate or package, remove the liner from the crate or packaging, pull the liner into position, assist in securing the material and may be required to assist during the field welding operation.

The following information should familiarize you with the liner installation process.

SAFETY - The information provided in this handout does not replace or supersede any standard or required safety procedures or information. The activities associated with the liner placement may be a new experience for many or all of the personnel. Remember to work in a method which will not place yourself or others working with you in danger. If you see someone who may be placing themselves in a hazardous or dangerous position, please inform your supervisor or warn the person immediately of the potential danger.

PERSONNEL CLOTHING - Personnel designated to assist should be wearing clothing suitable for heavy physical labor based on the local climate. In hot climates appropriate attire is required.

Soft soled shoes should be worn to protect the liner from damage when walking on the liner. Cowboy boots or other hard soled shoes SHOULD NOT BE allowed.

Gloves are also recommended. The liner is pulled into place by hand and gloves will protect the hands during this portion of the operation as well as protect the hands from the material during hot weather. (The liner temperature can reach 140-160 degrees Fahrenheit). Personnel should also be aware that if exposed skin may be burned if it comes in direct contact with the heated material.

WEATHER - Liner installation must be coordinated with the weather. If rain or snow is predicted and the liner cannot be installed prior to the start of the inclement weather, installation should be postponed. Once moisture has accumulated on the liner, the pond water must be removed before the liner can be moved or shifted. Additionally, wet surroundings create a muddy environment from which mud and rocks can be more easily tracked onto the liner. Mud or dirt will not affect the performance of the liner, however in areas where field seams or welding is required the quality of the seaming can be adversely affected by their presence..

The most unpredictable component is wind. Light breezes are not a major factor in liner installation, however, when winds approach or exceed 10 mph, placement and anchoring the liner becomes a serious issue. At this point, wind conditions are critical. Liners should not be installed during windy or strong breeze conditions. If excessive wind is allowed under the liner during deployment, the liner will act as a sail and personnel will not be able to control or retain the liner. If the wind is too strong to allow deployment, sandbags or other ballast should be used to secure the liner.

FINAL SITE REVIEW- Personnel working in the area where the liner is to be placed should be aware of any potential items which could damage the liner. Examples are rocks, rough surfaces, large clumps of dried mud, steel debris, wire, brick, wood, etc. All items should be removed prior to placement of the liner. If during the installation of the liner, these items are discovered in the area where the liner is to be placed, they should be removed and/or brought to the attention of the supervisor. It is much easier to move an item before the liner is placed instead of after. Holes or rough surfaces should be filled or smoothed over.

TOOLS- A variety of tools are used during the installation process such as hammers, pry bars, rakes, shovels, etc. A central point for these items should be maintained which allow personnel to keep track of their location to insure they are not covered with the liner. If you have been provided with pull grips, keep track of its location so that it is available the next time it is required. Also, none of these items should be dropped on the liner or thrown next to the liner. They may bounce onto the liner and cause damage.

OPENING THE CRATE- Most liners are shipped in wooden crates which protect the liner during shipment and at the job site. Portions of the crate must be removed prior to placement of the liner. In most cases, the top and one end is removed. Since all sections of the crate have been nailed together, lumber removed from the crate will contain nails. All sections removed should be stored or positioned in such a fashion that does not create a hazard for other personnel. Nails should be removed or boards should be stacked with the nails pointing down. NOTE: DO NOT THROW LUMBER OR OTHER MATERIALS ONTO ANY PORTION OF THE LINER. Nails may remain in areas where lumber is removed. All nails In these areas should be removed before any portion of the liner is removed from the crate.

REMOVING THE LINER FROM THE CRATE- Liners are accordion folded and then accordion folded again into the box. To remove and place the liner, the operation needs to be reversed. The last fold into the box must be the first fold out. The original packing and shipping will have compressed the liner into the crate which means that normally as personnel are pulling the liner out of the crate, one or more personnel is needed in the crate to assist with the deployment. The liner material can be stiff and heavy therefore sufficient personnel should be available. All personnel should pull uniformly and steadily. Teamwork provides the best results.

If a liner has been removed from the crate and wind conditions make deployment impractical, short lengths of rope should be used to cinch the liner on about a 20'-30' spacing along the entire length. If the wind picks up and catches the liner edge, this method of securing the liner limits the amount of exposed surface area. Additionally ballast material may also be necessary to protect the liner from wind damage.

HOLES OR LINER DAMAGE - The liners and/or covers provided with this order have been inspected prior to shipment to insure that the material does not contain defects. If during the course of the liner placement, you discover a hole or the material is damaged during installation, please notify your supervisor or on-site representative from the liner company. Do not feel you will be held responsible for the damage that you discover. The objective is to provide an intact product holes or damage can be more easily repaired prior to utilizing the liners instead of afterwards.

LINER PLACEMENT- Once the liner is removed from the crate, the liner is ready to be pulled into position. Depending on the size of the panel and the number of personnel available, the entire panel may be pulled at one time or it may require several incremental pulls. Grips or pullers (Vise-Grips with handles) may be provided to assist with the deployment The tool has small pieces of angle iron welded into the jaw of the vise grip and also has a U-shaped handle. The liner is pinched between the pieces of angle and the handle is used for pulling. These tools can be used instead of pulling by hand and allow the person to pull utilizing more force. The pullers should be firmly secured to the liner with the vise grip pointing in the same direction as the direction you will be pulling. Do not twist the grip or install the grips at an angle. Utilizing the tool correctly will protect the liner from damage.

Personnel should be spread evenly along the deployment edge. The optimum spacing for personnel is about 20'- 40' apart. Example: On a 200' long liner, 9 -11 personnel would be required. The leading edge should be held firmly and the liner pulled across the pond evenly. Personnel working with the liner should hold the liner close to the ground (2'- 3') to prevent large amounts of air from becoming trapped under the liner. A site supervisor should coordinate movement across the pond to insure the liner is pulled in unison. A small amount of air trapped under the cover aids in deployment If the wind increases in intensity or it appears too much air is traveling under the cover, the leading edge of the cover should be held closer to the ground or held down temporarily until the wind gust dissipates.

If insufficient personnel are available to pull the entire liner at one time, one section should be pulled as far as reasonable and then secured. Workers then can move over to the remaining accordion folded section of the liner. Personnel should then pull the extra material across the pond. Utilizing this method, the liner can be "indexed" into position.

Once the liner has been roughly positioned where necessary, final positioning is required. Excess slack will need to be removed, but the liner should not be pulled too tight Wrinkles or folds will not affect the performance of the liner and some excess material will be allowed to remain to allow the liner to expand and contract as necessary. The lined area should be walked after deployment to insure that the liner is lying flat in all areas and also to inspect for damage. Sandbags should be spread out across the exposed area to protect against wind damage. At this point, the perimeter of the liner should be temporarily secured. If the liner is allowed to contract overnight or if water is placed in the pond, these activities will

help seat the liner. The edge of the liner can now be anchored or secured in the anchor trench or totally secured with backfill or other ballast materials.

SECURING THE LINER- After the liner has been aligned as necessary and no further shifting is required, the liner can be permanently secured. Sandbags or other ballast may be required to remain on the cover until other fill materials are placed on the liner. Spacing of this ballast is determined on a job-by job basis. Along the perimeter the liner needs to be adequately secured in the anchor trench. A standard anchor trench is approximately 12”-18” deep and approximately 6’-12” in width. The edge of the liner should be placed into the trench and extend along the bottom of the trench. Backfill materials should be used to secure the liner but should not contain any items (rock, wood, scrap metal) which may damage the liner. If excess liner is present, the excess liner can be placed in the anchor trench or trimmed off.