

Putting Factory and Field Seams to the Test

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Advantages of Using Fabricated Geomembranes

In general, there are two major types of geomembranes. One is considered to be a true flexible membrane liner (FML), where large panels can be prefabricated before delivery to the job site. The other type of geomembrane is more rigid and has to be shipped to the job site in roll form, where all seams are joined in the field. In a typical liner application, a rigid geomembrane will normally have up to ten times more field seams than a flexible geomembrane.

As a result, a rigid geomembrane is more labor intensive to install and requires more CQA (Construction Quality Assurance) testing, which will increase the cost of the total geomembrane liner system. This paper discusses the benefits of fabricated geomembranes for all types of liner and/or cover applications.

Factory Seams Compared to Field Seams

Most geomembranes today are thermoplastic in nature and can be joined together via various types of equipment – hot wedge welders, hot air welders/tools, extrusion welders and RF (radio frequency/dielectric) welders. Some geomembranes such as EPDM can be joined with tape or glues, but would not be recommended in critical containment applications holding liquids such as wastewater or hydrocarbons. Thermoplastic welding equipment technology has improved dramatically over the past decade with faster speeds and consistent weld temperatures from beginning to end for a typical weld seam.

A geomembrane liner is only as good as the quality of the installation and the seams of a geomembrane are often considered to be the “weakest link”. That being said, field seams will always have more challenges and issues as compared to factory seams. Rain, wind, dirt, welding equipment performance, temperature swings and crew changes can all affect the integrity of field seams. In comparison, a factory seam is normally made on a clean table or smooth concrete floor. This provides faster and more consistent welding, in addition to normally higher peel adhesion and bonded seam shear values. More factory seams will allow for a lower rate of destructive testing in the field, with fewer patches in the finished liner system and lower CQA costs.

For irregular shaped containments, prefabricated geomembrane panels can be “stepped” to better fit the area and reduce wasted material from a typical rectangular panel. For some projects, a fabricated liner is big enough to line the entire area and therefore no field seams will be required. All of the seams can be put together in a controlled and clean facility with no patches needed for destructive testing of field seams. These “drop in” or one-piece systems work well for tank liners, small ponds, oilfield pit liners and secondary containment tank bottoms for aboveground storage tanks.

For other projects that are medium in size (1 to 2 acres), the fieldwork required for a fabricated geomembrane is normally completed in one day. These projects usually require only 3 to 4 field seams and can therefore be inspected and certified on the same day. The prefabricated panels can be custom fit for the area to be lined, which will result in less detail work required on site. Additional savings can be found from a smaller crew size, lower mobilization costs and less welding equipment. In comparison, a field-assembled geomembrane will normally require a second day for inspection, testing and certification. Below is a typical 40,000 SF dike liner application for a tank that compares the field seams required for fabricated geomembrane panels versus rigid HDPE that comes in 22.5' wide rolls.

Testing Frequency of Factory and Field Seams

Due to the consistent quality of factory seams, normally a lower testing frequency is specified as compared to field seams. For example, current guidelines for field seams recommends a destructive seam sample be taken at a minimum of one per every 500 lineal feet (152.5 meters).



Prefabricated geomembrane panel being unfolded

The Fabricated Geomembrane Institute (FGI) has developed a guideline for the testing frequency of factory seams and specifies requirements for qualification and production factory seams as follows:

- Pre- and Post-Qualification Seam Testing
Trial seams shall be at least 6 feet long using the same equipment, operator, and conditions anticipated during production welding. Trial seams will be tested in both shear and peel strength.
- Production Seam Testing
During production the testing frequency is once every shift change or every 4 hours of production, whichever is more frequent. Trial seams shall be at least 6 feet long using the same equipment, operator, and conditions anticipated during product welding. Trial seams will be tested in both shear and peel strength.

As expected, this guideline does not recommend any destructive samples to be taken from the middle of a production panel. Factory seams have proven to be more consistent than field seams because of the controlled environment, dry and clean area for welding, plus



Prefabricated geomembrane panel (over 1/3 acre) being deployed over a geotextile fabric

consistent welding conditions in a factory. As a result, the welding equipment and settings can be verified both at the beginning and end of a typical shift instead of during the actual welding of panels together. This is due to factory conditions basically staying the same as opposed outdoor weather conditions, which can change quickly (i.e., temperature, humidity, rain, snow, etc.). If both pre and post production weld seams are of consistent quality and meet the design criteria, this would eliminate the need to make a destructive test in the middle of a factory fabricated panel.

Summary

Using prefabricated geomembranes in a typical project can speed up installation time dramatically due to the lower amount of field seams required. Some common applications include baffle curtains, canal liners, landfill caps, water/wastewater lagoons, floating covers, tank liners and secondary containment dikes. In addition, less field seams allow for less destructive testing in the field as compared to rigid liners that need welding every 22.5 feet.

Lower installation costs in addition to less CQA/CQC testing can be expected on projects with prefabricated geomembrane panels due to the reduced man-hours from inspectors, field personnel and contractors. Prefabricated geomembranes also have more consistent welded seams as compared to geomembranes where all of the welds are done in the field. This is due to most of the welded seams being made in a factory environment with clean and dry conditions, in addition to a humidity controlled area. Less field seams in a typical geomembrane application allows for fewer destructive tests with less patches and an overall better looking installation.

References

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