POLYEHTYLENE INSTALLATION GUIDELINES

Field Seaming

In general, all seams must be oriented parallel to the slope, not across. Tie-in seams (perpendicular to the slope) should not be located within five feet (1.5 meter) from the toe of the slope. The Quality Control Inspector shall document all seaming procedures using the Seaming Procedures form. The field documentation of the seaming procedures includes the seam number, date and time of seaming, welding technician, seam length and a reference to the corresponding test seam (calibration).

The welding technician must ensure that the seam area is free of dirt, moisture and any other object that could effect the seam quality. All panel intersections ("T" seams) shall be extrusion welded to ensure a proper seal. As often as possible, the QC Inspector will cut a one-inch (25rnrn) wide specimen at the end of seams and test them for peel adhesion. If the specimen fails, welding with the designated equipment shall be stopped immediately. The defective area will be delimited by the QC Inspector and repaired accordingly. A new trial seam will be required for the welding technician to resume welding.

1. Seaming Procedures

The primary seaming method used should be **the hot wedge welder**. This automated equipment allows for greater welding speed as well as a much more consistent welding method. The geomembrane panels are overlapped five (l25mrn) to six inches (150mrn), allowing adequate double fusion welding and leaving enough material to perform peel and shear tests on seam samples taken in place. These welds include an air channel allowing for air-pressure testing of the seam (see figure 1). In restricted areas such as comers and close patches where the wedge welder cannot be adequately used, a manual **extrusion fillet welder** is employed (see figure 2). Prior to any fillet extrusion welding, the geomembrane shall be ground to insure proper adhesion of the extruded material.

Wedge Weld

Extrusion Welding

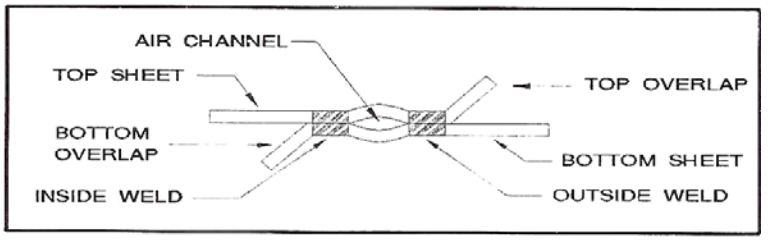


Figure 1 – Double-Track Fusion Seam

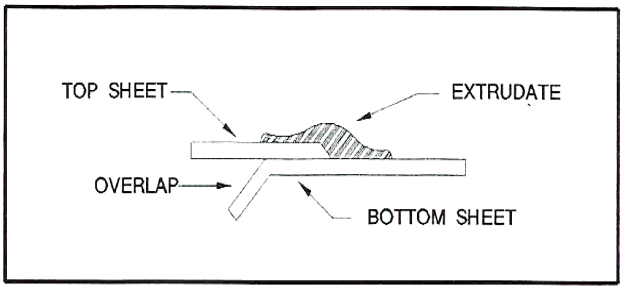


Figure 2 – Extrusion Seam

2. Trial Seams

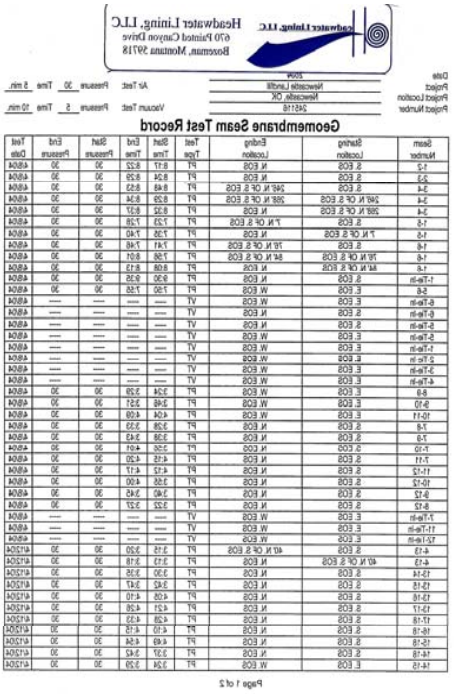
Trial seams are conducted prior to every shift and at intervals of no greater than four to five hours. The test seams shall reproduce the same conditions as those found when welding the geomembrane panels: type of material, ambient temperature, etc. The QC Inspector can also request trial seams when weather conditions vary considerably.

For each trial seam, the QC Inspector cuts four one-inch (25rnm) wide specimens using a die-cutter. The specimens are then tested for peel adhesion and shear strength using a field tensiometer. All four specimens must meet or exceed the project requirements for peel and shear testing, and exhibit a Film Tear Bond (FTB) type of break (refer to NSF-54 for the types of break).

Trial seams are tested and approved by the QC Inspector. The QC Inspector shall document every trial seam with the following information: trial seam number, welding parameters (speed and temperature), welding technician's name, equipment number, date and time, peel and shear testing results, etc. as it appears on Fusion Trial Testing form and Extrusion Trial Testing form. .

3. Documentation

For each seam, the welding technician shall mark on the liner his initials, equipment number and the time he started welding. The QC Inspector will record this information on the Seaming Procedures form.


Geomembrane Seam Test Record

4. Non-Destructive Testing

The continuity of all seams (100%) shall be inspected with a non-destructive testing method. These methods include the air-pressure test and the vacuum-box test (most cornmon methods for polyethylene geomembranes). Any seam that fails one of these tests is rebuilt or repaired until a satisfactory result is obtained. All non-destructive test results are recorded on the proper form.


Vacuum Box Test

4.1 Air Pressure Testing

Air pressure testing is employed as much as it is possible since it is less observer dependent, and it represents a supplementary mechanical resistance test for the seam (see figure 3). This test consists of injecting air in the center channel of double-track fusion seams at a predetermined pressure of approximately 30 psi (207 kPa). After a three to five minute monitoring time, the QC Inspector will record the pressure drop and ensure that it is within the limits of the project requirements.

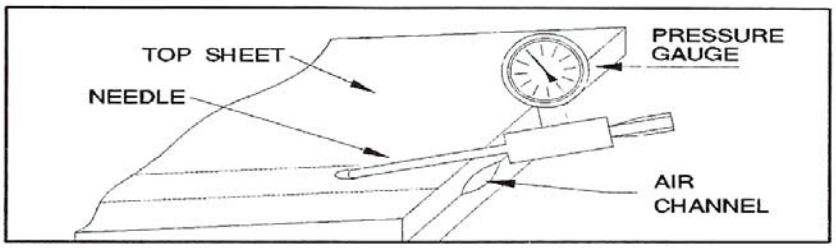


Figure 3 – Air-Pressure Testing

When pressure testing of a seam is completed, the end of the seam opposite to the pressure gauge shall be cut to ensure that the air pressure flows freely along the entire seam. If the air pressure is not relieved from the opposite end of the seam, the blockage of the air channel must be located. If the blockage cannot be located visually, the seam shall be cut halfway and re-tested on both sides of the cut. The same operation should be repeated until the channel blockage is located.

Air Channel Testing

If the seam does not hold the air pressure, verify that both ends are sealed tight and re-test. If the seam still does not hold the pressure and the leak cannot be visually located, the seam overlap shall be cut and the seam tested using the vacuum box method. The seam shall be considered satisfactory only when one of the non-destructive testing methods gives a satisfactory result.

4.2 Vacuum Testing

Vacuum Testing

Wherever the air pressure test method cannot be used if a leak must be located, the vacuum box test method is employed. This test consists of sprinkling soapy water over the area to be tested and applying a negative pressure over that same area so that if there is a puncture or pinhole within the area, bubbles will appear and be detected by the operator (see figure 4).

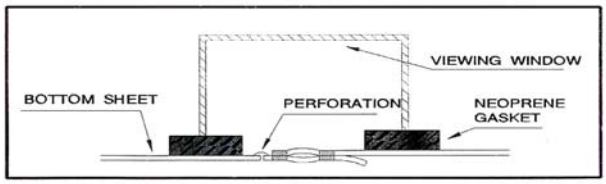


Figure 4 – Vacuum-Box Testing

A box fitted with a transparent upper cover and a neoprene lower rim (gasket) is used to apply the negative pressure over the area to be tested (see figure 5). The negative pressure of approximately -5 psi (-34 kPa) is obtained within the box by using a compressor or an industrial all-purpose vacuum. In order to obtain a good seal around the neoprene gasket and to accurately locate a leak, the seam overlap must be trimmed prior to vacuum box testing. Therefore, if destructive testing is required, it shall be done prior to the removal of the seam overlap and vacuum box testing.

4.3 Destructive Testing

In order to evaluate field seaming, destructive samples shall be tested in the field for both peel adhesion (see figure 6) and shear strength (see figure 7). In most cases, samples will also be sent to an independent laboratory by the Quality Assurance Representative. The destructive samples are usually marked at a frequency of one per 500 feet (150 meters) of seam length, unless otherwise specified. This frequency represents an average frequency for the entire project.

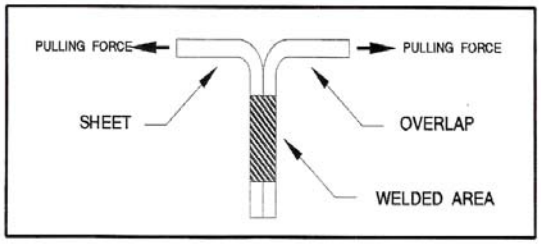


Figure 6 – Peel Adhesion Testing

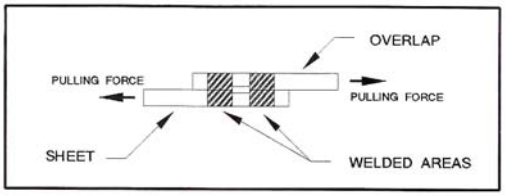


Figure 7 – Shear Strength Testing

The location of the samples shall be indicated by either the QA Representative or QC Inspector. Whenever possible, destructive samples shall be taken such that repair procedures will be minimized or unnecessary (ex. in the anchor trench). Care shall be taken so that all destructive samples cut from the geomembrane are patched or covered the same day to avoid possible damage to the sub grade by overnight rain or heavy wind. The QC Inspector should verify destructive testing with the foreman and advise him of all testing locations so that they are patched later on that same day.

Sample for Destructive Testing

The QC Inspector must test four one inch-wide (25mm) specimens for peel and shear strength. For double-track fusion seams, both sides of the seam shall be tested for peel adhesion. When all four specimens meet the project specifications, the seam is considered to pass field-testing and the remainder of the sample can be sent to the laboratory for further testing. For laboratory testing purposes, four out of five passing specimens are usually found acceptable. At the end of the project, every field seam should be bound by two passing destructive tests, as it appears on Destructive Testing form.

The QC Inspector shall document the destructive testing with the following information: date and time, destructive test number, seam number, location, peel and shear strength results and type of break for each specimen.

4. 4 Destructive Test Failure

If a destructive test does not meet the project requirements, additional samples shall be taken on both sides of the initial sample in order to determine the defective seam length. When passing samples are found (on both sides) the defective seam length shall be repaired according to the prescribed procedures. When tracking down a defective seam, care shall be taken to evaluate seams that were produced by the same wedge welder (if more than one are used).