XR-5 8130 Floating Covers

Contents

PART 1 GENERAL

1.1 SCOPE

This section includes the reinforced-XR-5 8130 geomembrane floating cover and its related appurtenances.

1.2 REFERENCES

The publications and standards referenced herein form a part of this specification. Where a date is given for referenced standards, that edition shall be used. Where no date is given for referenced standards, the latest edition available on the date of the Notice Inviting Bids shall be used.

1.3 SUBMITTALS

Submittals shall be made in accordance with the requirements of the SUBMITTALS SECTION and the following special provisions provided herein. The Bidder shall include, as a part of his bid, his proposed:

- XR-5 8130 manufacturer's name(s) and qualifications
- Fabricator's name(s) and qualifications
- Installer's name and qualifications

1.3.1 Shop Drawings

The Installer shall submit, for the Engineer's approval, shop drawings showing the floating cover panel layout with proposed size, number, position, weight, and sequence of placing all factory fabricated panels, and indicating the location and overlap of all field joints and the direction of all factory joints on each panel.

If the Installer proposes alternate design details, methods of construction or seaming procedures which are different than that shown on the drawings and stated in the specifications, complete descriptions and or shop drawings, showing the proposed details, methods of construction and procedures, shall be submitted for the Engineer's approval. Such proposed alternates shall not be used unless approved in writing by the Engineer prior to the Installer starting that portion of work. Approval of any alternate design, method, or procedure proposed by the Installer may be granted only if, in the Engineer's sole opinion, such proposal will produce an end result equal to or better than the design, method, or procedure shown in the contract documents.

1.3.2 Samples

Prior to ordering XR-5 8130 materials, four 8 inch by 10 inch samples shall be submitted to the Engineer for approval.

If the material specified is not a standard product, then samples prepared in the laboratory or samples of the manufacturer's standard product most closely approximating the material specified shall be submitted to the Engineer for approval. Additionally, four 8-inch by 10-inch samples of the specified material shall be submitted to the Engineer for approval within 7 days from the time of the first production of the specified material.

1.3.3 Manufacturer's Quality Assurance Plan

The Contractor shall submit the geomembrane manufacturer's quality assurance plan for the Engineer's review and approval. Prior to the Contractor's submittal to the Engineer, the Installer shall have reviewed and approved the manufacturer's quality assurance plan. The manufacturer's quality assurance plan shall be approved in writing by the Engineer prior to manufacturing any materials.

1.3.4 Fabricator's Quality Assurance Plan

The Contractor shall submit the geomembrane fabricator's quality assurance plan for the Engineer's review and approval. Prior to the Contractor's submittal to the Engineer, the Installer shall have reviewed and approved the fabricator's quality assurance plan. The fabricator's quality assurance plan shall be approved in writing by the Engineer prior to fabricating the material into panels.

1.3.5 Installer's Quality Assurance Plan

Prior to installing XR-5 8130 materials, the Contractor shall submit the Installer's job-specific quality assurance plan covering installation for the Engineer's review and written approval.

1.3.6 Qualifications of Installer

The Installer shall be an experienced contractor in the realm of installation of geomembrane floating covers and shall submit with its bid a written statement of its qualifications. This statement shall demonstrate the Installer's compliance with the qualification requirements stated in this specification section, and shall include, as a minimum, the following items:

- Project names, which are the basis of qualification
- Project site locations
- Brief description of each project (size, type of project, type of geomembrane material, completion date, etc.)
- The current name, mailing address, and phone number of the owner for each project
- Current contact person's name or owner's representative most knowledgeable of each project

The Owner and/or Engineer intend to verify all references given.

1.3.7 Qualifications of the Site Superintendent and Quality Assurance Manager

The Contractor shall submit with his bid a written statement of qualifications for the Installer's proposed Site Superintendent and Quality Assurance Manager. This statement shall demonstrate compliance with the qualification requirements stated in this specification section, and shall include, as a minimum, the following items:

- Individual's name
- Project names and specific position/title held and duties performed by the individual on each project
- Project site locations
- Brief description of each project
- The current name, mailing address, and phone number of the owner for each project
- Current contact person's name or owner's representative most knowledgeable of each project

The Owner and/or Engineer intend to verify all references given. Before substituting another Site Superintendent, the Contractor shall furnish to the Engineer for approval a written statement of the qualifications of the Installer's proposed substitute.

1.4 REGULATORY REQUIREMENTS

All materials in contact with the reservoir water shall be designed and manufactured specifically for reservoirs containing treated (potable) water, shall have been satisfactorily demonstrated by prior use to

be suitable for such use, and shall, where possible, be in accordance with the requirements of NSF 61. Where certification to NSF standards for a type of material specified is not available, when requested by the Engineer the Installer shall submit documentation that the given material is acceptable for use in potable water.

All XR-5 8130 materials in contact with potable water shall be designed and manufactured specifically for reservoirs containing treated (potable) water, shall have been satisfactorily demonstrated by prior use to be suitable for such use, and shall be approved by NSF International (NSF) and other regulatory agencies having jurisdiction for such use. In lieu of NSF approval, the manufacturer shall provide written certification, from a product certification organization accredited for this purpose by the American National Standards Institute (ANSI) and regularly engaged in testing such products, that the XR-5 8130 products to be used meet the requirements of NSF 61 for use in potable water.

1.5 QUALIFICATIONS

1.5.1 Installer

The work shall be performed by an Installer who is a specialty contractor and who shall have been regularly engaged in the installation of flexible geomembrane floating covers for a minimum period of 5 years immediately prior to the bid opening date and shall have installed not less than 10 million square feet of flexible geomembrane material.

1.6 QUALITY ASSURANCE

1.6.1 Quality Assurance Plan

The Quality Assurance Plan shall be project-specific. The Installer shall thoroughly review and comprehend the project drawings and specifications prior to the development of the Quality Assurance Plan. The Installer's Quality Assurance Plan shall be in accordance with the project specifications. Any deviations or conflicts with the project specifications shall be clearly marked, immediately brought to the Engineer's attention, and shall not be used without the Engineer's prior written consent. The Installer's Quality Assurance Plan shall state how the following items shall be accomplished and shall include sample forms to be used to document each quality assurance activity. The major heading and subheadings list those tasks, as a minimum, which shall be included in the Quality Assurance Plan. The Installer shall include any additional pertinent information and topics that it sees fit.

1.6.2 Materials

Monitor and document the unloading, handling, and on-site storage of fabricated panels and other materials. Monitor material, process, and equipment certifications required by the specifications to ensure their adequacy and timely submittal. The Engineer shall be notified of any deviations.

1.6.3 Deployment/Installation

Evaluate and document the suitability of weather conditions to insure proper installation. Monitor and document placement and condition of all panels while being placed. Monitor and document the proper installation of panels in accordance with approved shop drawings. Perform overall visual observations of entire geomembrane surface to locate and document all damage and defects. Monitor and record the repair of all damage, defects, and all destructive testing.

1.6.4 Seaming

Monitor and document trial seaming procedure and test results to evaluate seaming personnel and equipment. Monitor and document seaming procedure. Photograph or develop details of procedure if necessary. Devise seam identification numbering system unique to each seam such that the seam location, seaming crew, equipment used, date, time, and weather conditions are properly documented.

Develop a list of all equipment, with pertinent technical information, to be used for seaming. Ensure that all heat seaming welders shall be equipped with gages which monitor speed and temperature. Describe in complete detail each seaming procedure the Installer proposes to use in executing the work. Provide

drawings or photos if necessary. Before using, each seaming procedure shall be approved by the Engineer. The seaming procedures shall include cleaning of material to be seamed, seaming temperatures, seaming rate, and dwell (factory only). Describe seaming methods to be used at special locations such as “T” joints where a factory or field seam is bonded to another layer. Indicate adverse weather or other conditions which could limit or halt seaming operations. Describe measures to account for and compensate for temperature changes in ambient air or material which may affect seam quality. Describe equipment calibration frequency and procedure. Include material manufacturer’s recommendations for heat seaming, where available or applicable.

1.6.5 Seam Testing Samples

- Monitor and document nondestructive testing of seams
- Select locations for destructive seam samples, when selection is not made by the Engineer. No destruct sample to be taken that could impact the integrity of the floating cover.
- Monitor and document the cutting of seam test samples and patching of test sample holes, if required.
- Utilizing the test seam identification numbering system, document the location, seaming crew, equipment used, date, time and weather conditions for each test sample.
- Interpret all laboratory test results on material and seam compliance with specifications.
- Distribute five copies of the certified laboratory test results with interpretation to the Engineer.
- Monitor and document the repair of all rejected seams.
- Monitor and document destructive and nondestructive testing of repaired seams.

1.6.6 Execution of the Quality Assurance Plan

Upon the Engineer's written approval of Installer’s Quality Assurance Plan, the Installer shall implement and continuously monitor the Quality Assurance Plan, as described above, through an active and ongoing Quality Assurance Program. The Engineer will continuously monitor the Installer’s approved Quality Assurance Program for compliance. The Quality Assurance Program shall include, but not necessarily be limited to, the following items:

a. Review of all contract drawings and specifications for clarity and completeness, and to acquire a thorough knowledge of project materials and construction procedure requirements.

b. Review, revise as deemed necessary, and approve the geomembrane material manufacturer's quality assurance plan.

c. Review, revise as deemed necessary, and approve the geomembrane fabricator's quality assurance plan.

d. Continuous review and revision, as necessary, of the Quality Assurance Plan for thoroughness, adequacy, and feasibility.

e. Develop and/or use special job and task specific forms or logs for monitoring all activities involved with the Quality Assurance Plan.

f. Maintain logs summarizing all daily activities.

g. Interpret all laboratory test results on materials and seams for compliance with specifications.

h. Distribute five (5) copies of certified laboratory test results with interpretation to the Engineer.

1.6.7 Field Heat Seaming Demonstration

Following the submittal of the Quality Assurance Plan and prior to the Engineer's approval, the Installer shall conduct a field demonstration for the Engineer, demonstrating the seaming procedures, equipment usage, calibration procedures, and all other aspects of the proposed heat seaming method. At least 2 seams, having at total of not less than 2 "T" joints and a total length of 10 feet, shall be made. Samples will be taken from the demonstration seams and field-tested by the Installer in the presence of the Engineer. Approval of the Quality Assurance Plan will be contingent upon the results of the demonstration test samples.

1.6.8 Quality Assurance Final Report

At the completion of the installation and final acceptance of all work by the Engineer, a final quality assurance report shall be submitted to the Engineer. The Engineer shall have the opportunity to review and comment on a draft report at the 80% and 100% completion prior to the issuance of the final report. The Installer shall positively address all of the Engineer's comments prior to the issuance of the final report. The Quality Assurance Final Report shall include, but not necessarily be limited to, the following items:

a. A brief description of the project, including the project name, type of facility, location, material supplier(s), shop fabricator(s),subcontractors and the Installer's superintendent.

b. Detailed description of cover system, including area and type of geomembrane materials installed.

c. Copy of floating cover drawings and specifications with as-built mark ups.

d. Record of daily activities, including all special problems and associated resolutions encountered during the project.

e. Copies of all field and laboratory destructive and nondestructive test results, with Interpretations, not previously submitted to the Engineer.

f. Copies of all standard forms and logs completed as part of the Quality Assurance Plan.

g. Copies of final approved shop drawings.

h. Copy of quality assurance record drawings indicating panel code numbers, seam code numbers, seaming dates, location of defects type of defect, repairs, repair dates, and location of all samples.

i. Statement from the Installer indicating cover has been installed in accordance with project drawings and specifications.

j. The Installer's, fabricator's, and manufacturer's approved quality assurance plans.

1.7 DELIVERY, STORAGE, AND HANDLING

Delivery, storage, and handling shall be in accordance with the following requirements and provisions:

Packing and Shipping	Each factory-fabricated XR-5 8130 panel shall be individually packaged. Each folded/rolled panel shall be strapped to a pallet and enclosed in an opaque, light reflective water resistant plastic bag to protect and prevent damage during shipment and storage. Each roll enclosure shall be prominently marked in the same fashion as the panel within.
Storage and Protection	Packaged factory-fabricated XR-5 8130 panel rolls shall be stored in their original unopened condition, on a flat and clean surface, in a dry area, and protected from the direct rays of the sun under an opaque, light colored heat-reflective cover.

Sand for sand-filled tubes shall be stored on a clean, paved area or tarpaulin to prevent contamination, and shall be covered with a tarpaulin and maintained in a dry condition until used.

1.8 WARRANTIES AND GUARANTEES

Prior to the deployment of any XR-5 8130 material, a written material warranty from the manufacturer of the XR-5 8130 material shall be submitted to the Engineer for review and approval of the warranty content and terms. The material shall be warranted in writing by the manufacturer against manufacturing defects and against deterioration due to ozone, ultraviolet rays, and other-than-normal weather aging.

The Contractor and Installer shall warrant and guarantee that the floating covers constructed under the Contract, including materials and equipment furnished and/or installed by them, fully meet the requirements of the Contract and that such work shall be free of deficiencies and defects for a period of one year after the date of final acceptance of the work by the Engineer. They shall further warrant and guarantee to make or have made at their expense repairs or other corrective work necessary to restore the factory/field work which during the guarantee period is found to be deficient.

PART 2 PRODUCTS

2.1 MANUFACTURERS

XR-5 8130 shall be manufactured by an experienced firm regularly engaged in manufacturing reinforced-XR-5 8130 sheeting for a minimum period of 5 years immediately prior to the award of the contract and which has produced a minimum of 5,000,000 square feet of XR-5 8130 membrane materials within that 5-year period.

Manufacturer of XR-5 8130 material shall be Seaman Corporation.

2.2 MATERIALS

2.2.1 Composition

The XR-5 8130 compound shall be manufactured from a composition of high quality ingredients. The Owner may, at its discretion, have a representative at the manufacturing facility to verify the XR-5 8130 production for the project.

The Contractor shall notify the Engineer no less than two weeks in advance of manufacturing so that shop inspection(s) may be arranged. The finished color of the sheet shall be black-on-black. The color shall not vary between sheets. Certification from the manufacturer that the XR-5 8130 has the appropriate property values shall be submitted to the Engineer by the Contractor

The material shall be certified in writing by the manufacturer to have the following property values:

Table 2-1: XR-5 8130 Mechanical Properties

XR-5 8130 Reinforced	Test Method	Specification
Base Fabric Type	ASTM D3776	Polyester
Base Fabric Weight (nominal)	ASTM D3776	6.5 oz/yd^2
Thickness	ASTM D751	30.0 mils (min.)
Weight	ASTM D751	30.0 $\pm$ 2 oz/yd^2
Tear Strength	ASTM D4533, Trapezoid Tear	35/35 lbf (min.)
Breaking Strength	ASTM D751, Grab Tensile	550/550 lbf (min.)

Table 2-1: XR-5 8130 Mechanical Properties Continued

XR-5 8130 Reinforced	Test Method	Specification
Low Temperature	ASTM D2136, 4hr – 1/8" mandrel	Pass @ -30°F
Dimensional Stability	ASTM D1204, 212°F / 100°C – 1 hr	1.5% max. each direction
Adhesion – Heat Sealed Seam	ASTM D751, Dielectric Weld	35 lbf/2 in (min.)
Dead Load – Seam Shear Strength	ASTM D751	2 in seam, 4 hr, 1 in strip 210 lbf @ 70°F 105 lbf @ 160°F
Bursting Strength	ASTM D751 Ball Tip	650 lbf (min.) 800 lbf (typical)
Hydrostatic Resistance	ASTM D751, Method A	800 psi (min.)
Blocking Resistance	ASTM D751 (180°F / 82°C)	#2 Rating (max.)
Adhesion – Ply	ASTM D413	15 lbf/in (min.) or Film Tearing Bond
Bonded Seam Strength	ASTM D751 as modified by NSF 54	550 lbf (min.)
Abrasion Resistance	ASTM D3389 (H-18 Wheel, 1000 g load)	2,000 cycles (min.) before fabric exposure 50 mg/ 100 cycles max weight loss
Weathering Resistance	ASTM G23 (Carbon-Arc)	8,000 hrs (min.) – No appreciable changes or stiffening or cracking of coating
Water Absorption	ASTM D471, Section 12, 7 days	0.025 kg/m^2 (max.) @ 70 °F / 21°C 0.14 kg/m^2 (max.) @ 212 °F / 100°C
Wicking	Shelter-Rite® Procedure	1/8 in (max.)
Puncture Resistance	ASTM D4833	250 lbf (min.)
Coefficient of Thermal Expansion / Contraction	ASTM D696	8 x 10^{-6} in/in/°F (max.)

2.2.2 Use of XR-5 8130

Unless otherwise indicated, all XR-5 8130 material used in the cover appurtenances shall be the same type of XR-5 8130 as that used for the floating cover membrane.

2.2.3 Float

Floats shall be rigid, closed-cell, polyethylene foam planks weighing 2.2 pounds per cubic foot ±10 percent. Individual float dimensions from the factory can be 4-inch non-laminated or built up to 4-inch by lamination. Polyethylene foam floats shall be fully encased in the same XR-5 8130 as that used for the floating cover membrane. Floats at rainwater collection troughs shall be one-piece.

2.2.4 Access Hatches

Access hatch frames and covers shall be fabricated in accordance with the drawings.

2.2.5 Vents / Sampling Ports

Vents/Sampling Ports shall be fabricated from stainless steel in accordance with ASTM A167, Type 304, unless otherwise shown on the drawings.

2.2.6 Sand-Filled Tubes

Sand-filled tubes shall be fabricated from the same XR-5 8130 as that used for the floating cover membrane. Sand-filled tubes shall be of sufficient length and lay-flat width to produce the finished length and diameter shown on the drawings. The overall tube length shall include extra material required to seal the ends of the tube. Sand-filled tubes shall be filled to 95% of their capacity with dry, even-graded sand with 100 percent passing a No. 12 sieve and 98 percent retained on a No. 16 sieve,. Inadequately filled sand tubes will be rejected.

2.2.7 Attachment

Round brass grommets shall be installed in the XR-5 8130 membrane material attachment tabs as shown on the drawings. Holes in the XR-5 8130 membrane material attachment tabs shall be punched. The grommets shall be seated so that the entire rim is firmly gripping the XR-5 8130 material all the way around the grommet. No loose or sharp edges around the grommet shall be permitted.

2.2.8 Rigid / Flexible Pipe

Rigid or Flexible pipe shall be used in rain collection troughs and cover water removal to top of slopes or berm of pond as required. Drilled holes in the pipe as shown on the drawings are in addition to the manufacturer's perforations. All drilled holes shall be de-burred, filings removed, and sharp edges softened. The interior of the pipe shall be cleaned of all cuttings. All exposed piping shall be UV stable.

2.2.9 Rainwater Removal Sumps

Sumps shall be black polyethylene tanks. Location and size of holes in perforated sumps shall be as shown on the drawings. Membrane wrapped floats shall be attached to each sump as shown on the drawing. Other methods and means may be used if approved by Engineer.

2.2.10 Rope

Rope shall be polypropylene. Rope size shall be as shown on the drawings.

2.2.11 Miscellaneous Metal

Unless otherwise noted, all metal utilized in the installation of the floating cover shall be 304 stainless steel.

2.2.12 Sandbags

Sandbags used for temporary ballasting of the membrane shall contain a minimum of 40 pounds of sand/soil.

2.3 FABRICATION

Individual sheets of XR-5 8130 shall be factory-fabricated into large panels by an experienced fabricator regularly engaged in fabricating geomembrane for a minimum period of 5 years. Immediately prior to award of the contract, such fabricator shall be approved by the geomembrane manufacturer. Fabricators shall be Lange Containment Systems, Inc or approved equal.

Other experience relevant to fabrication which does not meet the above requirements may be considered. The Engineer's opinion as to the acceptability of all experience shall be final and conclusive.

Factory seams shall develop a minimum of 90 percent of the tensile strength of the parent material, when tested in accordance ASTM D751. Factory seams shall be fully bonded on the top side so that no loose edge is present on the top side of the fabricated sheet. All seams shall provide a bond between sheets sufficiently strong that failure of the seam will not occur in the plane of the bonded surface.

Factory-fabricated sections or panels shall be given prominent, unique indelible identifying markings in accordance with the approved panel layout drawing and shall indicate the proper direction for unrolling to facilitate their layout and positioning in the field.

Horizontal field-made seams will not be permitted on the reservoir wall or slope, except for factory rollstock splices, which shall be offset by at least 5 feet from such splices in adjacent rollstock in the same panel.

Rollstock splices are not permitted on rollstock on the edge of a panel.

All factory seams shall be staggered as required to ensure that no more than 3 layers of membrane meet at a joint.

Fish-mouths, pleats, folds, and similar defects will not be permitted in any seams.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Protection

Under no circumstances shall the floating cover be subjected to rough treatment or have sandbags, equipment, or other material dragged across or thrown upon its surface. Workers or others shall not slide down slopes on top of the floating cover. Scuffed surfaces resulting from abuse or inadvertent damage of any kind by the Installer's employees, or inadvertent damage caused by the Owner’s or Engineer's personnel overseeing the work, shall be repaired in accordance with the specifications.

All persons walking on the floating cover material shall wear smooth, rubber-soled shoes. Shoes with patterns in relief (like those popularly known as "sneakers") that could pick up rocks and debris will not be permitted.

No wheeled vehicles will be permitted on the floating cover material. Scissors and utility knives used in the work shall have blades with rounded points. Marking pens or pencils used for identifying areas requiring work shall not contain oil or grease.

Tarpaulins of reinforced polyethylene or XR-5 8130, about 10 feet by 10 feet in size, shall be spread out on the XR-5 8130 floating cover material as a work area for storing soiled rags, tools, gasoline-driven equipment, or aggressive chemicals. Under no circumstances shall gasoline-driven engines, cans of gasoline, solvents, paints, or any liquids be placed directly on the floating cover material, reservoir floor, or be stored within the reservoir overnight.

3.1.2 Cleaning of the Reservoir

Prior to placement of XR-5 8130 panels or material on the reservoir concrete lining, loose particles shall be removed from the lining by blowing with compressed air. Blowing shall be performed with an air compressor and suitable lengths of air hose. Accumulations of loose particles shall be broomed and vacuumed up. Cleaning of large areas far in advance of panel placement is not acceptable. The Installer shall comply with all requirements of the ODEQAQD concerning fugitive dusts from the site and shall conduct his work so as to minimize the movement of fugitive dusts from the site boundaries by using suitable Reasonably Available Control Measures (RACM).

3.2 INSTALLATION

3.2.1 Panels

The Installer shall identify and repair any damage or defects to panels occurring during shipping, unloading, storage, and installation.

Panels of floating cover material shall be carefully placed on the bottom and slopes of the reservoir in accordance with approved shop drawings, and in such a manner as to assure minimum handling. During installation of the floating cover, the Engineer shall have complete authority to order an immediate stoppage of the work because of inclement weather, the use of improper installation procedures, or any other reason which may result in a defective floating cover.

Seaming shall keep pace with the placement and spreading of panels such that panels will not be laid out unless they can be seamed the same day.

Prior to punching holes in an individual floating cover panel to attach it to the anchor studs and prior to seaming it to previously installed adjacent floating cover panels, the Installer shall straighten and pull taut, in both directions, the panel being installed, in order to remove wrinkles as much as possible. If seaming equipment lifts the material off the substrate and leaves slack material along the seam, wherever possible the wrinkle so formed shall also be pulled out before the material is punched for anchor studs or seamed to adjacent panels. The Installer shall make every effort to remove most wrinkles in the floating cover on a continuing basis.

3.2.2 Sandbags

Sandbags shall be used as necessary to hold the floating cover material in position during installation in order to protect it from damage or displacement due to wind.

During any discontinuity of the work exceeding 8 hours in length, the leading (un-seamed) edges of all panels shall be ballasted with sandbags at not more than 3 feet on center. The Installer shall be responsible for ballasting and maintaining closer sandbag spacing as necessary to protect the work during all weather conditions.

Sandbags placed on slope shall be tied off at the top of slope to prevent their shifting or sliding down the slope. Bags that are split, torn, or otherwise losing their contents shall immediately be removed from the reservoir area, and any spillage shall immediately be cleaned up.

3.2.3 Heat Seaming

Machine-made heat seams shall be made using hot air or hot wedge welding equipment. All machine heat seaming equipment shall be equipped with gauges which monitor speed and temperature. Hand-held heat seaming equipment may be used where machine-made heat seams are not practical and for miscellaneous seaming.

Heat seaming shall comply with these specifications and the Installer's Quality Assurance Plan.

Contact surfaces to be seamed shall be cleaned with a dry cloth until all foreign matter, dust, dirt, and water has been removed. A solvent-wipe shall be used as conditions warrant. Only clean, colorfast, lint-free, cotton cloths shall be used in the work. Cleaning of the surface shall not be completed more than 10 minutes ahead of seaming. When conditions are adverse to proper workmanship such as high winds, or other conditions increase the probability of dirt or other foreign material being deposited on the contact surfaces, the time between cleaning and seaming shall be reduced as necessary to produce acceptable seams.

3.2.4 Joinings

Panels to be joined in the field shall be lapped as shown on the drawings. After the initial seal of the lap joint has been made, all exposed free edges of the floating cover shall be sealed or trimmed, using hand-held equipment, to eliminate all loose edges. The top edge of all seams shall be fully bonded.

All seams, field and factory, shall be staggered a minimum of 12 inches to ensure that no more than 3 layers of material meet-at a joint.

Where three layers of material occur at a "T" joint (field seams, factory seams, and rollstock splices), care shall be taken to seal the small leak path that would otherwise occur along the edge of the middle layer. The upper layer shall be heated and rolled to conform or "step-down" and seal the leak path. In addition, a 4-inch diameter patch shall be applied over the "T" joint. The center of the patch shall be placed at the intersection of the top and middle layers of the membrane.

Seam preparation shall be in accordance with the requirements stated herein. Where transverse joints are encountered at the ends of panels, the free edge on the bottom of the overlapping panel shall be sealed for a minimum of 6 inches from the end of the overlapping sheet prior to making the transverse seam.

Care shall be taken to avoid fish-mouths, pleats, folds, and tucks in seams. Any such defects shall be prevented by tugging on the seam just completed in the general direction of the seam, while seaming is in progressing. The Installer's seaming crew shall give continuous attention to the elimination of all such defects to prevent their occurrence. Regardless of the location or cause of such defects, they shall be slit out far enough from the seam to dissipate the defect. The slit edges shall then be lapped and field seamed. Wherever the lap width is less than 2-inches, the defect shall be repaired with a 5 inch wide joint cover strip made from the same XR-5 8130 material as the floating cover.

3.2.5 Small Air Vents

The Installer shall furnish and install small air vents as specified and as shown on the drawings. The Owner will operate the completed floating cover for a period up to 120 calendar days following final acceptance of the work. The Installer will be notified by the Owner between 4 and 8 months from final acceptance of the work as to how many small air vents are required and to proceed with installation of said vents. The Installer shall have 30 working days following said notification to complete the installation of the vents. The installation of small air vents shall be performed while the reservoir is in service. Small air vents shall be located as directed by the Owner. Payment will be made at the unit price stated in the Proposal Bid Schedule.

3.2.6 Top-Of-Slope Air Vents

Top-of-slope air vents shall be constructed and installed as shown on the drawings.

3.2.7 Sand-Filled Tubes

After installation the sand-filled tubes on the reservoir bottom shall be punctured on both sides at 12" on center with an awl to create "dimensionless" holes to allow complete saturation of the sand when submerged in rainwater. Sand tubes on slope or on the wall shall be punctured at 6 inches on center. The use of a blade such as a knife for this purpose is not permitted. This work shall be witnessed by the Engineer.

3.2.8 Anchorage and Fastenings

Floating cover material shall be anchored at the concrete perimeter wall and other structures as shown on the drawings. Anchor stud holes in the XR-5 8130 material shall be neatly installed on the studs with a pipe having an ID approximately 1/16 inch larger than the stud OD to uniformly force the geomembrane over the anchor studs, thus ensuring a snug fit. Oversized or irregular-shaped holes will not be permitted. All holes for studs to be set as adhesive concrete anchors shall be drilled normal to the concrete surface and shall be accurately spaced to accommodate the existing batten bars.

Studs that "lean" as a result of holes that were not drilled normal to the concrete surface shall not be bent straight or tapped with a hammer to reposition them. Studs that were initially set correctly and which were subsequently bent may be repositioned. Leaning studs and studs that were improperly spaced, so as not to accommodate the anchor bar, shall be removed and replaced.

Anchor studs shall be 304SS studs above water and below water, set with epoxy adhesive or wedge-style, with potable-grade anti-seizing compound and the aforementioned nuts applied, and the nuts torqued to 10 foot-pounds.

3.2.9 Rope

The rope shall be installed in the hem at the top-of-wall cover attachment, as shown on the drawings, such that the rope hem is installed snug to the attachment bar.

3.2.10 Repair Float

The Installer shall provide 2ft x 2ft x 4in repair float. The repair float shall be built up from rigid, closed-cell polyethylene foam and fully encased in the same XR-5 8130 as the floating cover. After the cover installation is complete the repair float shall be installed beneath the cover at the locations indicated on the drawings or as instructed by the Engineer.

3.3 REPAIRS

Punctures, cuts, tears, abrasions, and similar damage to the XR-5 8130 material shall be repaired to the satisfaction of the Engineer.

All repairs shall be considered either structural or non-structural. Non-structural repairs shall be defined as pinholes and abrasions where the scrim is intact. Structural repairs shall be defined as all other defects.

Non-structural repairs shall be performed using patches. Patches shall be cut from flat unwrinkled material. Patches shall be of sufficient size to extend a minimum of 2 1/2 inches beyond the limits of any puncture, pinhole, or abrasion. Patches shall be neat in appearance with corners rounded to a minimum of 1-inch radius.

Patches for structural repairs shall be cut from flat, unwrinkled parent material like that being patched, and shall be free of defects, field seams, and factory seams. Patches shall be of sufficient size to extend a minimum of 2½ -inches in all directions beyond the limits of any puncture, cut, tear, or abrasion. Patches shall be neat in appearance with corners rounded to a minimum 1 inch radius.

Patches shall be applied as specified previously for heat seaming and joining. The parent material shall be pulled and held flat in the area to be patched as to provide an acceptable surface to receive the patch. Patches shall be fully bonded across their entire width.

3.4 FIELD QUALITY CONTROL

The Installer's Quality Assurance / Quality Control testing shall keep pace with the deployment and seaming operations to identify all problems at the earliest possible point in time.

3.4.1 Seam Testing

The Installer shall have tests performed, at his own expense, to ensure that the XR-5 8130 parent material and field seams meet the following requirements.

Peel Strength Test	Field seam test samples shall be tested for peel strength in accordance with the requirements of ASTM D751. A minimum of three test specimens shall be tested from each test sample.
Strength Test	Tensile Strength Test Specimens from any given factory or field seam test sample shall be 4 inches wide, with a length equal to the specified seam width plus 9 inches. Factory and field test samples shall be tested in accordance with the requirements of ASTM D751 (modified method). A minimum of three test specimens shall be shall be tested from each test sample.

Test results not meeting these requirements shall be cause for readjusting/setup of seaming equipment and retesting until passing values are attained.

3.4.2 Test Samples

Samples of factory and field seams shall measure not less than 14 inches wide by 36 inches long with the seam parallel to the 36-inch side, and down the middle of the sample.

A minimum of three test specimens for each of the above tests (peel strength and tensile strength) shall be taken from each test sample.

Field and factory seam samples shall be numbered, dated, and identified as to the personnel making the seam from which the sample is taken, the seaming method being used, and the temperature and weather conditions at the time of seaming. Each test sample shall be keyed to its general location on the seam

from which it is taken by appropriate notes or markings on a drawing, furnished by the Installer/Fabricator, for future reference.

3.4.3 Testing of Factory Seams during Fabrication

The Fabricator will provide results from the factory test seams taken from the same rollstock as the fabricated panels. One test sample per 5,000 feet of rollstock-to-rollstock shop seam shall be tested for the above tests (peel strength and tensile strength). The certified test results of specimens from each sample shall be submitted to the Engineer, if requested, for review prior to installation of panels represented by that sample.

3.4.4 Testing of Field Seams during Field Installation

The Installer shall test field seam samples of scrap material from edges of fabricated panels. One test sample per 500 feet of panel-to-panel field seam shall be tested for the above tests (peel strength, tensile strength and effective seam width). Tests shall be conducted on site by the Installer's Quality Assurance personnel using equipment furnished by the Installer. If any test results are not satisfactory, the Engineer, at his discretion, may require that additional sampling and testing be done at the Installer's expense.

In addition to all sampling and testing described above, the Engineer may, at his discretion, require the Installer, at the Installer's expense, to provide the Engineer with additional samples of any field seam, for testing by the Engineer, at the Owner's expense.

The fabricator and the Installer shall certify all test results of their respective tests. Five copies of the certification and test results shall be submitted to the Engineer within 5 days of the tests.

3.4.5 Air-Lance Testing

Prior to performing air lance testing, the Installer shall visually check the seams and patches may utilize a probe (such as a wire 1/16 inch maximum diameter with the point slightly rounded).

Except for the top-of-wall hem, all field seams, joint cover strips, and patches shall be air-lance tested. Air-lance tests shall be performed in the field by the Installer in the presence of the Engineer during daylight hours. Leak paths or suspect areas revealed by these inspections shall be marked and repaired.

As per ASTM 4437-08 the air-lance shall have a 3/16 inch diameter orifice. Pressure shall be 50 psi. The jet of air shall be directed at the edge of seams and patches to effect the lifting of un-bonded edges. The air-lance testing shall be done in a manner so as to allow the Installer's Quality Assurance/Quality Control personnel sufficient time to observe and document any leaks or suspect areas. All defects found during probing shall not be repaired until the defect is tested by air-lancing.

3.5 CLEANUP

Cleanup within and around the reservoir shall be an ongoing responsibility of the Installer throughout the course of the work. Particular care shall be taken to ensure that no dirt, scrap material, trash, tools, or other unwanted materials are trapped beneath the floating cover.

- END OF SPECIFICATION -