

Flambeau Mining Company

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**Kennecott
Minerals**

September 25, 1995

Mr. Tom Bauman
Industrial Wastewater Section
Wisconsin Department of Natural Resources
101 S. Webster Street, Box 7921
Madison, WI 53707

RE: Settling Pond Lining
Flambeau Mining Company

Dear Mr. Bauman:

Flambeau Mining Company (Flambeau) is submitting for the Department's review the enclosed Technical Specifications for Settling Pond Liner (September 1995). The currently unlined settling ponds are part of the treatment system for storm water runoff from the Type I Stockpile area (wasterock with less than one percent sulfur). Surface and subsurface water control relate to continued stability of the open pit walls. Flambeau has chosen to take a proactive approach to enhance the maintenance of pit wall stability. During a September 14 site inspection, Ken Markart (WDNR) reviewed several of Flambeau's proposed action related to the pit walls. One of the measures to be taken will be to minimize potential groundwater seepage toward the north wall of the open pit. Pondered areas north of the pit contribute subsurface water seepage to the north wall. The pondered areas include the Type I stockpile perimeter ditches. Flambeau intends to move any water from the perimeter ditch as soon as it is collected and transfer the water to the settling ponds. The unlined settling ponds may be then serving as a source of subsurface seepage towards the pit. As a result, Flambeau intends to line the settling ponds with a PVC membrane during the first two weeks of October 1995. The timing of the scheduled pond lining is critical since upcoming cold weather could impede installation. Installation this fall will also allow improved water management during the 1996 spring snowmelt runoff season.

Flambeau's Mine Permit, Part 2, Condition 2. requires that "all operations shall be accomplished in substantial conformance with the approved Mining Plan. Flambeau shall not construct or operate any facilities not described in the Mining Plan, increase the dimensions, design capacity or annual production rates by greater than 10% of any facilities or activities or change major facility design features for those facilities and activities not regulated under another authority without obtaining Department approval." During a September 21, 1995 mine site inspection Mr. Larry Lynch, WDNR

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Mine Reclamation Unit, agreed that the lining of the settling ponds will not require a modification to the approved Mining Plan since there would not be a substantial change in the ponds dimensions or design capacity. The settling ponds will be operated in the same manner and capacity as their original unlined design. Therefore, the lining of the settling ponds will be considered a minor deviation "as a result of final engineering refinements". A documentation report will be submitted to the Department within Flambeau's 1995 Annual Report.

Flambeau contends that the lining of the settling ponds does not constitute a "reviewable project" under NR 108.03. The reason being that the lining of the settling ponds will not affect the quality or quantity of the discharge as compared to the projected quality or quantity of discharge. In fact, the discharge quality may improve since the treated Type I runoff water will not be exposed to erodible materials within the ponds. This submittal serves to inform the Department of Flambeau's continued attempt to improve safe operating conditions with minimal impact to the environment.

The original design of the settling ponds design did not include lining since "the dissolved metals concentration in the influent water for projected worst case conditions (is) lower than primary drinking water standards. Therefore, exfiltration from the settling ponds (will) not exceed primary standards" (Section 6.3.1, Flambeau Project Final Engineering Report for Wastewater Treatment Facilities, December 1989). Under NR 213.06 the volunteer lining of the settling ponds can be excluded from ch. NR 213 requirements since it will result in a design which is more stringent than necessary to comply with groundwater standards. Also, it can be concluded from NR 213.02(2)(b) that the Flambeau settling ponds can be excluded from requirements under ch. NR 213 since the ponds were constructed in association with runoff water from a facility licensed under NR 182.

The concerns that you raised, Mr. Bauman, on September 22 regarding the lining of the settling ponds are briefly addressed below. Your concerns are in italics and Flambeau's response follows.

- 1) *Sludge remaining within settling ponds should be removed prior to construction.*

As you are aware, there has been very low quantities of water within the settling ponds up to this point of the project. The minimal amount of sludge, which consists of silts and fine sands, within the first settling pond is only one to two inches thick. During the subgrade preparation, this material will be removed and placed in the Type I stockpile.

- 2) *Minimize flow velocity as Type I water enters the ponds to prevent resuspension of solids.*

This item should be easily addressed due to the large volume and surface area of each pond. The entry point of the Type I water is at the opposite end of the pond as compared to the outlet structures to either Outfall 002 or the overflow to the second pond for final polishing. If Flambeau should determine that flow velocity is affecting the settleability of the solids, a means of reducing flow velocity will be established.

3) *Protection against freeze/thaw.*

Past experience over the last three years has shown that freeze/thaw conditions within the Surge and Runoff Ponds has not been of substantial concern. Flambeau will also effectively manage the settling ponds to prevent damage to the liner by ice. However, note that any potential damage to the liner is not an environmental issue, but, rather, a mining operations issue.

4) *Consider the necessity of venting the liner.*

The venting of the liner system will be unnecessary. Flambeau will be removing existing vegetation. An application of an herbicide will prevent vegetation from reestablishing under the liner. Gas formation should be minimized.

5) *Consider the separation from groundwater.*

Again, the installation of the liner is for mining operation purposes. The unlined ponds had been previously approved due to the quality of the untreated water and minimal potential impact upon groundwater. However, groundwater monitoring wells located in the vicinity of the settling ponds show the depth to groundwater to be greater than five feet below the base of the ponds.

6) *Maintain effective erosion control.*

Flambeau will take the necessary precautions to prevent erosion in quantities which would impede the operation of the settling ponds. Erosion control may include seeding, mulching, culverts, riprap, etc.

7) *Sludge management plans should be considered.*

The accumulated sludge will be removed as necessary. Methods used to remove sludge will minimize impacts to the liner's integrity, however, any resultant damage is not an environmental concern, but rather a mine operations concern. The sludge will be placed in the Type I Stockpile in accordance with Flambeau's permits.

8) *Seam testing should be included in construction.*

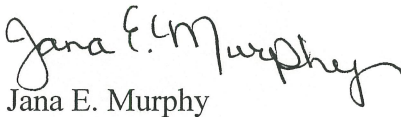
Representative seam testing will be performed to verify the integrity of the seams. Seam integrity is not an environmental concern, but is a mine operations concern. A report documenting the installation of the liner will include seam testing. This documentation will be included in Flambeau's 1995 Annual Report.

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Flambeau intends to generally comply with the enclosed "Technical Specifications" during the installation of the liner within the settling ponds. Refinements of specifications will be made as the project progresses and as field conditions warrant. The Department will be advised of any substantial changes to the specifications.

The liner installation is scheduled to initiate during the first week of October 1995 or soon thereafter. Flambeau would prefer to address the Department's questions as soon as possible so that this schedule may be maintained. We appreciate any efforts to expedite the Department's review of this submittal. If you should have any questions, please contact me at 715-532-6690 Ext. 717.

Sincerely,


Jana E. Murphy

Enclosures

cc: John Barnes, Flambeau
Von Shanks, Flambeau
Larry Lynch, WDNR
Ken Markart, WDNR
Bob Grefe, WDNR
Jim Hansen, WDNR
Bernice Dukerschein, Rusk Co.
Al Christianson, City of Ladysmith
Tom Riegel, Town of Grant
Melvin Spencer, Rusk Co. Zoning
Paul Kent, DeWitt, Ross & Stevens
Jim Hutchison, Foth & Van Dyke (w/o enclosure)

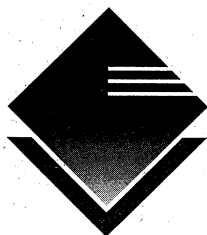
Report

**Technical Specifications for
Settling Pond Liner**

Flambeau Mining Company

Scope ID: 95F004

September 1995



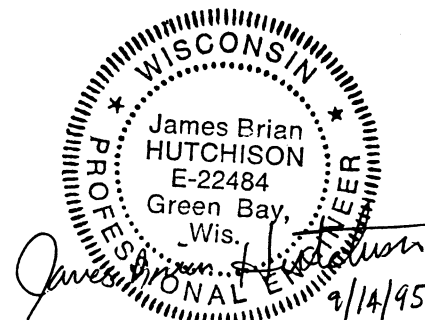
Foth & Van Dyke
engineers · architects · scientists

**Technical Specifications
for
Settling Pond Liner**

Scope I.D.: 95F004

Prepared for
Flambeau Mining Company
Ladysmith, Wisconsin

September 1995



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SECTION 02275

PVC MEMBRANE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work in this section shall include, but not be limited to the following:
1. Furnish and install 30 mil PVC membrane.
 2. Furnish required sealing around objects penetrating the membrane.
 3. Furnish quality control testing of PVC membrane as specified in this section.
 4. Furnish adequate personnel, materials, and equipment so that mechanical breakdowns do not affect the progress of work.

1.2 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM):

1. ASTM D413 Test Methods for Rubber Property - Adhesion to Flexible Substrate. Annex A
2. ASTM D751 Method of Testing Coated Fabrics. Method A
3. ASTM D792 Tests for Specific Gravity and Density of Plastics by Displacement. Method A
4. ASTM D882 Tests for Tensile Properties of Thin Plastic Sheeting.
5. ASTM D1004 Tests for Initial Tear Resistance of Plastic Film and Sheeting. Die C
6. ASTM D1203 Tests for Loss of Plasticizer from Plastics (Activated Carbon Methods). Method A
7. ASTM D1204 Test for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature.
8. ASTM D1593 Specification for Nonrigid Vinyl Chloride Plastic & Sheeting.
9. ASTM D1790 Test for Brittleness Temperature of Plastic Film by Impact.
10. ASTM D1922 Test for Propagation Tear Resistance of Plastic Film and Thin Sheeting by Pendulum Method.
11. ASTM D3083 Specification for Flexible Polyvinyl Chloride Plastic Sheeting for Pond, Canal, and Reservoir Lining. Annex A
12. ASTM D5321 Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method

B. National Sanitation Foundation (NSF):

1. NSF Standard 54 - Flexible Membrane Liners

1.3 SUBMITTALS

- A. Submit following with bid to Flambeau Mining with copy to Foth & Van Dyke:
1. Quality Control Program
 2. Type of seams and seaming equipment to be used.

- B. Prior to construction submit to Flambeau Mining with copy to Foth & Van Dyke:
 - 1. Shop drawings including:
 - a. Product data.
 - b. Panel layout.
 - c. Installation procedures.
 - d. Membrane anchor details.
 - e. Membrane penetration details.
 - f. Membrane repair procedures.
 - g. Resume of installation foreman.
 - 2. Samples of:
 - a. Membrane material (one 24"x24" sample).
 - b. Welded seams, shop and field (one sample of each).
 - 3. Certification that membrane material conforms with specifications.
 - a. QC data shall be provided with each PVC material package. Data shall include at a minimum: roll number, thickness test results, tensile strength and tear resistance.
 - b. Test data on factory seams if any factory seams are used.
- C. During construction submit test reports of all required tests as results become available.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Delivery shall be by a transporter who is aware of the consequences of damage to PVC membrane and familiar with handling requirements of the manufacturer.
- B. All materials shall be suitably prepared and packaged to prevent damage or deterioration such as excessive aging or puncturing during shipment.
- C. All material packaging shall identify the roll number, thickness, length, width and manufacturer's mark.
- D. All material shall be dry upon arrival on site (i.e., free of water, snow, etc.).
- E. Store the shipping pallets upright in a dry area. When possible, store the material indoors or in a shed on the job site. If such storage is not available on the job site, the panels on their pallets should be stored together and shall be covered with a suitable waterproof membrane.
- F. Store material where it is protected from vandalism, vehicular traffic and damage from construction activities.
- G. The material shall be stored in accordance with the manufacturer's recommendations.

1.5 WARRANTY

- A. In addition to the requirements of the General Conditions, a written warranty shall be provided by the manufacturer/fabricator and installer in the Owner's name guaranteeing the quality of the material and workmanship for a period of three years after the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE SUPPLIERS/INSTALLERS

- A. Watersaver Company, Inc.
- B. Occidental Chemicals Corp.
- C. Huls American, Inc.
- D. EPI
- E. GSI
- F. An approved equal.

2.2 PVC MATERIAL

- A. Provide a PVC material meeting the following requirements:

Table 02275-1
30 mil PVC Material Properties

Property	Test Method	30 mil PVC Value	Manufacturer Test Frequency
Thickness, mils	ASTM 1593 Para. 8.1.3	28.5 min.	50,000 ft ²
Specific Gravity	ASTM D 792	1.20 min.	50,000 ft ²
Volatile Loss	ASTM D 1203 Method A	0.5% max.	50,000 ft ²
Minimum Tensile Properties (each direction)	ASTM D 882 Method A or B		
1. Breaking factor (pounds/ inch width)		69 min.	50,000 ft ²
2. Elongation at Break (percent)		325 min.	50,000 ft ²
3. Modulus at 100% Elongation (pounds/inch width)		30 min.	50,000 ft ²
Tear Resistance (pounds)	ASTM D 1004 Die C	8 min.	50,000 ft ²
Low Temperature impact, °C maximum allowable failure temperature	ASTM D 1790	-29	1 per product

Property	Test Method	30 mil PVC Value	Manufacturer Test Frequency
Water Extraction (percent loss)	ASTM 03083 (as modified in Annex A)	-0.25 max.	1 per product
Resistance to Soil Burial (percent change max. in original value)	ASTM 03083 (as modified in Annex A)		
1. Breaking Factor		5%	1 per product
2. Elongation @ Break		20%	1 per product
3. Modulus @ 100% Elongation		20%	1 per product
Dimensional Stability (each direction percent change maximum)	ASTM D 1204 212° F, 15 min.	5	1 per product
Friction Resistance between PVC and Drainage Soil ³	ASTM D5321	27.7° min.	1 per product
Hydrostatic Resistance (psi, min.)	ASTM D 751 Method A	82 min.	1 per product

Factory and Field Seam Requirements

Property	Test Method	30 mil PVC Value	Manufacturer Test Frequency	Third-Party Conformance Test Frequency
Bonded Seam Strength (ppi width)	ASTM D 3083 (as modified in Annex A)	55.2 min.	1 per fabricated panel	1 per 500 lineal feet of field seam
Peel Adhesion (lb/in minimum)	ASTM D 413 (as modified in Annex A)	10 min ²³	1 per fabricated panel	1 per 500 lineal feet of field seam

Notes:

- 1 - Unsaturated condition.
- 1 - Failure must be a Film Tearing Bond (FTB).
- 2 - No more than 10% of the seam width may separate.

B. PVC materials shall be manufactured from virgin polyvinyl chloride with plasticizers and other modifiers, formed into uniform flexible sheets, complying with ASTM D3083. Reprocessed material shall not be used. Certification test results showing that the sheeting meets the specifications shall be supplied prior to or at delivery.

C. Factory Fabrication

1. Fabricate membrane in large panels with factory-sealed seams, consistent with limitations of weight and installation procedures.
2. Provide factory fabricated PVC boots at penetrations through the membrane.
3. After fabrication, the membrane may be accordion folded in both directions and packaged for minimum handling in the field. Shipping boxes shall be substantial enough to prevent damage to contents.

2.3 PVC - WELDING PRODUCTS

- A. Seaming method and materials shall be as recommended by the membrane manufacturer. Both chemical welding and double-fusion welding shall be acceptable field seaming methods.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. Contractor shall be responsible for preparing the underlying soil prior to PVC membrane placement. The subgrade must be free of sharp stones, sticks, roots, sharp objects and debris of any type which may damage the membrane. The soil surface shall be rolled, compacted, or hand-worked so as to be free of irregularities, protrusions, loose soil and abrupt changes in grade. The installer shall certify in writing that the surface on which the PVC membrane will be installed is acceptable.

3.2 INSTALLATION SUPERVISION

- A. The installer shall provide a full-time superintendent experienced in the installation of PVC membrane to both supervise and provide technical expertise at all times during installation.

3.3 INSTALLATION OBSERVATION

- A. The Owner shall provide an experienced and qualified observation team.
 - 1. The observation team will be on-site at all times during the PVC membrane installation to observe installation and quality control procedures of the installer, coordinate quality assurance tests, and collect data for documentation.
- B. Observation of Installation
 - 1. The team will observe and record the following with handwritten notes and photographs:
 - a. PVC membrane packaging identification slips.
 - b. Subgrade conditions prior to PVC membrane installation.
 - c. Handling of PVC material.
 - d. Deployment of each PVC panel.
 - e. Temporary and permanent anchoring of PVC membrane.
 - f. Confirm that required overlap distances are met.
 - g. Preparation and cleaning of PVC prior to seaming.
 - h. Seaming products for PVC for proper products, equipment and techniques.
 - i. Visual observation of the PVC membrane to ensure it is free from pores, pinholes and other detrimental defects.
 - j. Visual observation of seams. Mark all breaks or holes for repairs.
 - k. Observation of non-destructive test on seams.
 - l. Observation of sampling destructive test samples.

3.4 PVC MEMBRANE INSTALLATION

A. Climatic Conditions

1. Temperature: Installation shall take place when temperatures are 15°C minimum for chemical welding and between 0° and 35°C minimum for fusion welding.
2. Wind: Do not attempt installation when wind velocity and/or dusty conditions interfere with liner placement, alignment of seams or cleanliness of seam area.
3. Precipitation: Do not attempt installation when precipitation interferes with having a dry seaming surface (i.e., rain, sleet, snow or heavy dew).
4. Should the installer wish to perform the installation in climatic conditions outside these guidelines, then written approval from the Manufacturer shall be obtained.

B. Layout

1. Overlap a minimum of 4 inches for fusion welding and chemical welding.
2. Prepare areas for welding in accordance with the manufacturer's/installer's requirements including cleaning.
3. Place temporary anchoring such as sand bags on 2 foot centers on membrane immediately after layout.
4. Provide sufficient personnel to properly place the PVC membrane.

C. Welding

1. Fusion Welding

- a. Factory fabricated panels may be welded together by hot wedge (double-fusion) welding according to manufacturer's instructions.
- b. Welding equipment shall be capable of continuously monitoring and controlling the temperature in the zone of contact.
- c. If field seams are parallel to the toe of the slopes they shall be typically located 10 to 15 feet from the toe but in no case less than 5 feet.
- d. Installer shall mark any burnouts or defects found along seam while welding.
- e. A sufficient number of hot shoe welders shall be on-site at all times such that the progress of work is not hampered due to lack of equipment and personnel.

2. Chemical Welding

- a. Factory fabricated panels may be welded by chemical welding according to manufacturer's recommendations.
- b. Wipe contact surface of membrane clean and free of dirt, dust, moisture, and other foreign materials. Use solvent cleaning methods when recommended by membrane manufacturer.
- c. Apply bonding adhesive to both contact surfaces in joint area and press together immediately. Perform seaming according to manufacturer's recommendations.
- d. Smooth out any wrinkles.
- e. Inspect seams and reseal voids.

D. Repair

1. Repair and patch all areas of membrane which show damage, scuffing, puncture or distress according to manufacturer's recommendations.
2. Repair and patch all defective welds.
3. Repairing and patching shall be completed in accordance with the manufacturer's recommendations.
4. All repairs are to be completed within 24 hours of initial discovery, weather permitting.

- E. Anchoring
 - 1. Excavation of anchor trench is the responsibility of the membrane installer.
 - 2. Anchor in accordance with the anchoring details shown on the drawings. Excavate the trench only for such lengths as will be used for anchoring on any particular day. Anchor trench shall have no sharp edges. Use temporary anchor until the panels are welded and are ready for permanent anchoring.
 - 3. Backfill anchor trenches the same day the membrane welding has been tested and approved.
 - 4. Backfill anchor trench with excavated soil and compact to 90% Modified Proctor Maximum Dry Density (ASTM 1557).

- F. Membrane Penetrations

- 1. Attach membrane to objects penetrating the membrane in accordance with approved shop drawings.
 - 2. Provide fabricated boots for pipes where applicable. Install boots in accordance with approved shop drawings.

3.5 FIELD QUALITY CONTROL

- A. The membrane installer shall provide all membrane samples for quality control testing specified in this section.
- B. Trial Seams
 - 1. Conduct trial seams at the beginning of each seaming period and a minimum of once each 4 hours for each seaming apparatus used.
 - 2. Make trial seams at locations selected by Owner's representative near the area of the seaming and in contact with the subgrade.
 - 3. Trial seam samples shall be 3 feet long for hot shoe welding and chemical welding and the seam will be centered lengthwise.
 - 4. Specimens one inch wide shall be cut from each opposite end of the trial seam and tested for shear and peel with a tensiometer to be provided by the installer.
 - 5. If trial seam fails test, the seaming apparatus cannot be used until deficiencies are corrected and two consecutive successful tests are achieved.
- C. Non-destructive Seam Testing
 - 1. Non-destructively test all field seams over their full length.
 - 2. Testing equipment shall be provided by the installer.
- D. Non-destructively test double fusion seams with enclosed space with air pressure testing equipment which consists of air pump equipped with pressure gauge and manometer with air feeding device. Proceed with air pressure testing as follows:
 - 1. Seal both ends of the seam to be tested.
 - 2. Attach air feed device to enclosed air space.
 - 3. Pressurize air space to 10 psi and maintain.
 - 4. Test for a period of 10 minutes, if there is a pressure loss which exceeds 2 psi, locate leak, repair and retest.
- E. Non-destructively test chemical welds by directing compressed air (45 to 50 psi) at the leading edge of the seam through a 3/16" diameter nozzle and observing any unsealed areas (air lance testing). Repair and retest any failed areas.

F. Destructive Seam Testing

1. Destructive test samples shall be taken at locations designated by the QA observer. The locations should average one for every 500 feet of the total seaming length for the installation. The following should be considered by the QA observers in selecting the sample locations.
 - a. All areas identified as suspect during non-destructive testing/observation.
 - b. A minimum of two samples for each seamer.
 - c. A minimum of two samples for each seaming condition.
 - d. A minimum of two samples for each representative working conditions (i.e., weather conditions).
 - e. Seams that appear suspect to the observer.
2. Installer shall cut samples as seaming progresses and immediately repair holes resulting from sampling and vacuum test the seams.
3. At each sampling location, two types of samples shall be taken by the installer. First, two (2) one-inch test strips for field testing should be taken. Each of these strips shall be cut one-inch wide with the seam centered parallel to the width. The distance between these two strips shall be 48 in. If both strips pass the field test a sample for laboratory testing shall be cut.

The sample for laboratory testing shall be located between the one inch strips and shall be 12 in. wide by 48 in. long with the seam centered lengthwise. The sample shall be cut into three parts and distributed as follows:

- a. One 12 in. x 12 in. portion to the installer for field and optional laboratory testing.
 - b. One 12 in. x 24 in. portion for independent laboratory (approved by Owner) testing.
 - c. One 12 in. x 12 in. portion to the Owner for archive storage.
4. The two one-inch wide strips shall be tested in the field using a tensiometer for peel adhesion. The tensiometer shall be capable of maintaining a constant jaw separation rate of two inches per minute. If the test passes, the sample qualifies for testing in the laboratory. If it fails, the seam should be repaired. Final judgement regarding seam acceptability, based on the failure criteria, rests with the QA observer.

The QA observer shall witness all field tests and mark all samples with identifying sample numbers. The QA observer shall also log the date and time, ambient temperature, location and seam number, pass or fail description, and reason for taking sample attached to each sample.

For seams to be considered acceptable, four out of five strips per sample must pass field and laboratory tests.

5. Destructive test samples shall be packaged and shipped as soon as possible to expedite laboratory testing.

The independent laboratory shall provide verbal test results no more than 24 hours after they receive the samples. The QA observer shall review laboratory test results as soon as they become available, and make appropriate recommendations to the Owner.

- G. Procedure for failed destructive tests:
 - 1. Installer can elect to cut additional destructive test samples a minimum of 10 feet on both sides of failed destructive test to further isolate the length of failed seam or repair the whole seam.
 - 2. Repair failed seam with one of the following methods:
 - a. Cut out failed seam, reposition panel and reseam.
 - b. Install a cap strip.
 - 3. Test repaired seams by destructive test method if repair length exceeds 100 feet.
 - 4. All repaired seams must be bounded by passing destructive tests.

- H. Defects and repairs of non-seam areas:
 - 1. A visual inspection shall be made and the following shall be repaired:
 - a. Holes.
 - b. Blisters.
 - c. Membrane with undispersed raw material.
 - d. Contaminated membrane material.
 - 2. Installer shall keep membrane clean for this inspection and repair.
 - 3. Repairs shall be non-destructively tested.

- I. Report of Quality Control Testing and Inspection
 - 1. Installer shall provide written quality control reports for all testing and observations made.
 - a. Provide reports to the Owner at the end of each day.
 - b. Provide copies of all field laboratory test results within 24 hours of completion of tests.

- END OF SECTION -