

DETAILED SYSTEM SPECIFICATION

5.1 General

This section covers the watertight lining of ponds and other underground/ underwater structures by use of **KRUBBER® Composite Pond Lining Geomembrane**. It shall be installed continuously under ponds etc. with proper anchoring to prevent any uplift.

The pond lining shall be such that the entire pond and other allied underground / underwater structures provided with lining systems are watertight.

5.2 Description

The purpose of the pond lining is to permanently hold the liquid within a pond and also to prevent ingress of groundwater and deleterious chemical influences into the pond. Pond lining shall be installed on the base of a pond and on to its sides along with anchoring trenches, sump pits, chambers etc. The pond lining membrane shall be minimum 2.0mm thick and shall be made up of a composite of elastomeric terpolymer geomembrane and geotextile fleece. Elastomeric terpolymer watertight geomembrane shall always be fused with geotextile fleece on both the sides at factory level, thus permanently integrated and protected by geotextile fleece.

Installation at inlets and outlets shall be properly detailed and lined to avoid any leaks from the ponds.

Suitable rip rap or other protective courses shall be laid over the pond lining system for further protection and counterweight on the geomembrane.

5.3 Quality Assurance

Supply and install suitable products designed and manufactured specifically for application in pond lining geomembrane works having acceptable performances as mentioned in material specification.

Execute all installation and testing under the direct supervision of an individual with recent continuous, acceptable experience in the installation of pond lining systems.

Provide all personnel involved in pond lining system installation and testing with adequate training prior to beginning work.

Installation records are to be submitted to the engineer for approval with all relevant data for all checks etc. These records shall form a part of the submission to obtain approval to proceed with the installation subsequent layers over pond lining protective layers.

5.4 Materials

5.4.1 KRUBBER® Composite Pond Lining geomembrane

Pond liner geomembrane shall be minimum 2.0 mm thick composite geomembrane which is made of elastomeric terpolymer, designed and installed to hold water or a liquid effectively. Pond liner geomembrane shall have a minimum 1.52 mm thick central elastomeric terpolymer core sandwiched and factory fused between two layers of minimum 150 GSM geotextile fleece on both the sides. The composite elastomeric terpolymer pond liner shall comply and meet to following technical properties and characteristics mentioned in Table 5 here below:

Table 5: Pond liner geomembrane Characteristics

Sr.No.	Parameter	Test Method	Performance Spec per ASTM Standard
1	Thickness of Composite elastomeric terpolymer with 150 GSM Geotextile on both the sides (mm)	ASTM D-412	2.0 (+15% / -10%)
	Properties of elastomeric terpolymer core herebelow:		
2	Thicknesses of elastomeric terpolymer Core (mm)	ASTM D-412	1.52 (+15% / -10%)
3	Specific Gravity of elastomeric terpolymer Core (g/cm ³)	ASTM D-297	1.23 (+/- 10%)
4	Tensile Strength (MPa)	ASTM D-412	9 (Min)
5	Elongation ultimate (%)	ASTM D-412	300 (Min)
6	Tensile Set (%)	ASTM D-412	10 (Max)
7	Tear Resistance (kN/m)	ASTM D-624	26.27 (Min)
8	Brittleness Point (°C)	ASTM D-2137	(-45) Max
9	Ozone Resistance No Cracks	ASTM D-1149	Pass
10	<u>Heat Aging</u>	ASTM D-573	
	Tensile Strength (MPa)	ASTM D-412	8.30 (Min)
	Elongation Ultimate (%)	ASTM D-412	200 (Min)
	Tear Resistance (kN/m)	ASTM D-624	21.9 (Min)
	Liner Dimension Change Max (%)	ASTM D-1204	±1
11	Water Absorption (Mass %)	ASTM D-471	+8, -2
12	Weather Resistance	ASTM G -155 ASTM G-151	
	Visual Inspection No Cracks or Cracking	ASTM D-518	Pass
13	Puncture Resistance (Kgs)	ASTM D-5602	32
14	Hardness (Shore A)	ASTM D-2240	60 (+/- 10)

The above-mentioned material specification shall comply with the properties in ASTM D 7465 Standard spec for geomembrane applications & ASTM D 6134.

5.4.2 Accessories

Fixing and sealing adhesive material, overlap seams sealing, flashing, sealing flanges and preparation of corners and intersections etc. shall be made as recommended by the manufacturer of the pond liner geomembrane.

5.5 Installation

5.5.1 General Guidelines

Designated areas shall be marked and barricaded for pond lining works and no other trades shall be permitted within that area before handing over the pond lining work.

The substrate soil shall be well compacted to minimum 95% standard proctor compaction density.

All trenches for anchoring shall be excavated and dressed prior to installation of pond liner.

5.5.2 Laying pond liner Geomembrane.

The Geomembrane pond liner roll shall be unrolled from the top peripheral trench towards the embankment slope. It shall be positioned as per the slope and dimensions of the pond.

On aligning, the geomembrane shall be temporarily fixed or ballasted at the top into the trenches to avoid it from sliding down.

The geomembrane must be installed with some slack to allow for some shrinkage and dimensional variations due to temperature changes and prevent overstretching in case of differential settlement. All the geomembrane rolls shall be unrolled, unfolded and positioned over the pond substrate without excessive stretching.

The Geomembrane sheets can be moved sideways over the substrate by floating and allowing air underneath. Prior to any attachment, cutting or splicing, each sheet shall be allowed to relax a minimum of 45 minutes.

5.5.3 Pond liner geomembrane Overlap Seams

Place the geomembrane rolls as close as possible to its final alignment to achieve side and end overlaps as minimum 75mm. Fold the first membrane back, evenly onto itself so as to expose the underside and the substrate. The sheet fold should lay smooth so as to minimize the formation of wrinkles and fish-mouths during and after installation. Before applying adhesive at overlap seams, remove excess of dust or other foreign loose particles. Air blowing is required at all areas that have excess amounts of dust, adhesives and any foreign particles.

Apply the adhesive parallel to the seam along the length of the splicing area and allow time for the same to marginally flash off. To test for the same, use the touch-push test at the back of the splice area by pushing straight down onto the surface with a clean, dry finger. Push forward on the adhesive at an angle. The adhesive should feel tacky and stringy to the finger.

Clean the edge of the overlap seam where the Lap Sealant is to be applied and apply a 3 mm bead of Krubber Lapseal, liquid sealant, centred above the edge of the seam. Feather the Lap Sealant over the edge using the tool provided or install the Lap Sealant directly using a gun or spatula.

5.5.4 Testing of Membrane

The installed membrane shall be tested by **Seam Test with probe tester and Holiday detection test** and records of these tests shall be submitted by the Contractor to the Engineer. The purpose of the test is to detect any fish mouths during and after installation of pond liner geomembrane before laying any subsequent layers.

a) Seam Test with probe tester

For seams between adjacent sheets of waterproofing membrane the testing for bonding and fish mouths shall be carried out by means of sharp probe tester. The probe tester shall be dragged at seam joint longitudinally and if any breach in seam is observed shall be sealed with Krubber Lapseal liquid waterproofing sealant.

b) Holiday Detection Test

Glide Holiday detection tool on to the membrane by passing minimum 50V current. The machine will beep in case of any breaches or pin holes in the membrane. Further it shall be patched with Krubber membrane or sealing by Krubber Lapseal liquid waterproofing sealant.

5.5.5 Protective Measures

All anchoring trenches shall be backfilled with gravels/soil/PCC/RCC and the geomembrane may be covered with RipRap stones or PCC or as directed in project specifications.

In case of empty ponds lined with geomembranes with anticipated rise in groundwater table, sufficient counterweight shall be designed and specified by the engineering consultant.

Every care shall be taken not to damage the pond lining geomembrane during or after installation. Any damages occurred shall be reported to the Engineer, repaired and tested before the casting of concrete placements or backfilling.

5.6 Measurement and Payment

The quantities of the pond lining geomembrane to be paid for shall be measured by the unit of square metres installed. The finished installed areas i.e. horizontal, vertical, slanted, anchored etc. in ponds, trenches, sump pits, chambers etc. shall be measured after the fixing and finishing of the work and shall not be paid separately for overlaps, and any wastage etc.

Payment shall be for the installed area as shown on the design drawings in square metres at the unit rates shown in the bill of quantities and shall not include overlaps and any wastage etc. The payment shall include all materials and work required to carry out the work in accordance to specifications and shown on the drawings or as instructed by the Engineer.

5.7 Warranty

Pond lining system shall be warranted for good performance for the period of 15 years for product and installation. In case, any third-party damage is observed during the warranty period, it should be recorded and informed to the pond lining system provider for corrective actions.
