

GeoTough™ EPDM

Geosynthetic Membrane

Water Containment and Lining System

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June 2015

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GeoTough™ EPDM

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Water Containment and Lining System

June 2015

This specification outlines Carlisle's GeoTough Water Containment and Lining System requirements and is intended for use as a guideline by developers, engineers and other design professionals when specifying a lining material for water containment or tanks. While the specification contains specific installation details pertaining to various methods of membrane termination, contractors may reference other Carlisle technical publications for in-depth application procedures.

PART I GENERAL

1.01 DESCRIPTION

This GeoTough EPDM Water Containment System utilizes the GeoTough EPDM membrane as liners for reservoirs, ponds, canals and other irrigation and water management systems. The membrane (depending on type and thickness) can also be utilized for floating covers associated with such water containment systems.

The GeoTough EPDM Water Containment and Lining System is recommended for use in reservoirs, decorative ponds, fire protection and water storage system, irrigation canals, etc.

CAUTION: This Water Containment and Lining System shall not be utilized for containment of hazardous waste (poisonous, toxic, corrosive, flammable, etc.).

A. Water Containment Systems (Reservoirs, Ponds, Canals and Irrigation Systems)

The **GeoTough Water Containment System** incorporates 1.1 mm (.045 inch) or 1.5 mm (.060 inch) thick GeoTough, black, non-reinforced or reinforced EPDM membrane **loose-laid** directly over compacted soil **or** over a geotextile separator sheet (339 g/m² -10 oz/square yard) placed over structural concrete or mud slabs. Adjoining sheets of EPDM membrane are spliced together using a variety of options. (Factory-Applied Splice Tape, Field-Applied Splice Tape or Pressure-Sensitive Cover Strip in conjunction with a Primer). All membrane splices shall be a minimum of 150 mm (6 inches) wide.

Notes: For reservoirs with side slopes exceeding 30 degrees or those with floating covers, a **reinforced** 1.1 mm (.045 inch) or 1.5 mm (.060 inch) thick EPDM membrane shall be used.

The GeoTough EPDM Water Containment Lining Systems is not intended for use as a liner for fishponds. Contact Carlisle for special membranes available.

B. Construction details pertaining to the installation of this system have been designated as follows:

EPDM Water Containment System designated with "L" for lining of systems (i.e. ponds, canals, reservoirs, etc.).

1.02 QUALITY ASSURANCE

A. The GeoTough EPDM membrane meets the **Institut Pasteur de Lille** test **Afnor XP-P 41250-1** approval as a liner in potable water systems (**Reference: MAT 97-003 – July 97**).

B. GeoTough Reinforced and un-reinforced EPDM Membranes have passed the **NSF-WRc Water Regulations Advisory Scheme BS6920 Test on Effect of Water Quality**.

C. This GeoTough EPDM Water Containment and Lining System must be installed by an Authorized Applicator and in compliance with Carlisle's installation details and project specification as approved by Carlisle.

Deviations from Carlisle's details or approved specification shall be secured in writing prior to commencement of work.

- D. There must be no deviations made from Carlisle's specification or Carlisle's approved shop drawings without the **PRIOR WRITTEN APPROVAL** of Carlisle.
- E. Comply with applicable regulatory requirements and applicable codes, ordinances, regulations and laws.
- F. On-site technical assistance is available for a charge. Projects where technical assistance is required must have a manufacturer's approved drawing.

1.03 SUBMITTALS

- A. To ensure compliance with the applicable design criteria, project drawings, specification and pertinent details may be submitted for Carlisle's review.
- B. Requests for certification and/or formal drawing approval must be accompanied by a copy of the project specification and details.
- C. Substitution of a non-Carlisle supplied product is permitted upon review and approval. Samples of the product along with technical literature may be forwarded to Carlisle for consideration.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- 1. Deliver materials to the job site in the original, unopened containers labeled with the manufacturer's name, brand name and installation instructions.
- 2. Job site storage temperatures in excess of 32°C (90°F) may affect shelf life of curable materials (i.e., sealants and cleaners).
- 3. When sealants or cleaners are exposed to lower temperatures, restore to minimum 16°C (60°F) before use.

1.05 JOB CONDITIONS

- A. The GeoTough EPDM membrane resists a wide variety of chemicals. Depending upon level of concentration and temperature, the membrane performance will vary. Carlisle may be contacted to determine of compatibility of either membrane with a specific chemical.
- B. Comply with applicable codes and regulations pertaining to the operation and storage of heavy equipment.
- C. Coordination between various trades is essential to avoid unnecessary traffic over sections of already installed membrane to prevent damage to the membrane.
- D. Do not allow waste products (i.e., petroleum, grease, oil, solvents, vegetable or mineral oil, animal fat) or direct steam venting to come in contact with the membrane.
- E. Do not expose **EPDM** membrane and accessories to constant temperatures in excess of **82°C (180°F)**.
- F. Prior to the use of any product, consult the Material Safety Data Sheet and Technical Data Bulletin for cautions and warnings. Store adhesives, sealants and cleaners away from all sources of heat, flame or sparks. Do not use in confined or unventilated areas.
- G. Cold temperatures will not restrict installation of the GeoTough EPDM Water Containment and Lining System. Follow specified precautions for storage of materials.
- H. Splicing surfaces should be dry and clean.
- I. Substrate shall be free of ponded water, ice or snow.

J. Coordinate work with other trades.

K. Maintain work area neat and orderly condition, removing empty containers, rags and debris daily from the site.

1.06 WARRANTY

A Material Warranty is available for a charge. The warranty covers normal deterioration due to weathering and is pro-rated. Contact Carlisle for warranty samples and applicable terms.

PART II PRODUCTS

2.01 GENERAL

The components of this EPDM Water Containment and Lining System are to be products of Carlisle or accepted by Carlisle as compatible. The installation, performance or integrity of products by others, **when selected by the specifier and accepted as compatible by Carlisle**, is not the responsibility of Carlisle.

2.02 MEMBRANE

A. **GeoTough EPDM (black) 1.14 mm (.045") and 1.5 mm (.060") thick non-reinforced EPDM** (Ethylene, Propylene, Diene Terpolymer) membrane available in maximum 15 m (50') wide, maximum 45 m (150') long which meets ASTM D7465-08. Used for lining of water containment systems (i.e., reservoirs, ponds, canals, irrigation trenches, etc.). Not for use for fishponds, floating covers and ponds with side slopes greater than 30°.

GeoTough EPDM			
Essential Characteristics	Test Standard	Performance	Harmonized Technical Specification
Tensile Strength @ Break (MPa)	ISO R 527 parts 1 & 3		EN 13361 : 2004
No Aging – (L,T)		≥ 8,0	
Oxidation – 90 days @ 85°C	Pr EN 14575	Δ ≤ 25%	
Weathering – 3000 hours UV	EN 12224	Δ ≤ 25%	
Static Puncture (kN)	EN ISO 12236	≥ 0,5	
Water Permeability (m³/m²/d)	pr EN 14150	0	
Durability – Environmental Stress Cracking (hours)	ASTM D 5397-99 Appendix	≥ 200	
Local turbulence with water velocity exceeding 4 ft/sec (1.2 m/sec) (integral agitator or canals)	-	Protection with designed cover system or ballast	-

GeoTough EPDM

Physical Property	Test Method	ASTM SPEC. (Pass)	Typical	
			1.14 mm (45-mil)	1.5 mm (60-mil)
Tolerance on Nominal Thickness, %	ASTM D 412	±10	±10	±10
Weight, kg/m ² (lb/ft ²)			1.3 (0.26)	1.7 (0.35)
Tensile Strength, min, MPa (psi)	ASTM D 412	9 (1305)	11 (1600)	11 (1600)
Elongation, Ultimate, min, %	ASTM D 412	300	480	465
Tear Resistance, min, kN/m (lbf/in)	ASTM D 624 (Die C)	26.3 (150)	35.0 (200)	35.0 (200)
Factory Seam Strength, min.	Modified ASTM D 816	Membrane Rupture	Membrane Rupture	Membrane Rupture
Resistance to Heat Aging* Properties after 4 weeks @ 240°F (116°C)	ASTM D 573			
Tensile Strength, min, MPa (psi)	ASTM D 412	8.3 (1205)	10.3 (1500)	10.0 (1450)
Elongation, Ultimate, min, %	ASTM D 412	200	225	280
Tear Resistance, min, kN/m (lbf/in)	ASTM D 624	21.9 (125)	37.6 (215)	37.6 (215)
Linear Dimensional Change, max, %	ASTM D 1204	±1.0	-0.4	-0.5
Ozone Resistance* Condition after exposure to 100 pphm Ozone in air for 168 hours @ 40°C (104°F) Specimen is at 50% strain	ASTM D 1149	No Cracks	No Cracks	No Cracks
Brittleness Temp., max, deg. C (deg. F)*	ASTM D 746	-45 (-49)	-45 (-49)	-45 (-49)
Resistance to Water Absorption* After 7 days immersion @ 70°C (158°F) Change in mass, max, %	ASTM D 471	-2.0,+8.0	[+2]	[+2]
Water Vapor Permeance* max, perm	ASTM E 96 (Proc. B or BW)	0.1	0.03 (Typ.) 0.045 (Max.)	0.03 (Typ.) 0.045 (Max.)
Resistance to Outdoor (Ultraviolet) Weathering* Xenon-Arc, total radiant exposure at .70 W/m ² irradiance, 80° C (176°F) black panel temp.	ASTM D 4637 Conditions	No Cracks No Cracking @ 7560 kJ/m ²	No Cracks No Cracking @ 41580 kJ/m ²	No Cracks No Cracking @ 41580 kJ/m ²

* Not a Quality Control Test due to the time required for the test or the complexity of the test. However, all tests are run on a statistical basis to ensure overall long-term performance of the sheeting.

B. **Sure-Tough (black) 1.14 mm (.045") and 1.5 mm (.060") thick reinforced EPDM** (Ethylene, Propylene, Diene Terpolymer) **membrane**; maximum 3.3 m (10') wide, maximum 30 m (100') long which meets ASTM D6134-97. The membrane is reinforced with polyester fabric which meets ASTM D4637 and ANSI/RMA 600236- GeoTough Water Containment and Lining-6/2015

IPR-2. Used for lining of water containment systems (i.e., reservoirs, ponds, canals, irrigation trenches, including ponds with side slopes greater than 30°, as well as floating covers.). The use of this Sure-Tough EPDM membrane is not intended for lining of fishponds.

SURE-TOUGH REINFORCED EPDM MEMBRANES				
Physical Property	Test Method	ASTM SPEC. (Pass)	Typical	
			1.14 mm (45-mil)	1.5 mm (60-mil)
Tolerance on Nominal Thickness, %	ASTM D 751	±10	±10	±10
Weight, kg/m ² (lb/ft ²)			1.3 (0.27)	1.9 (0.39)
Thickness Over Scrim, min. mm (in.)	ASTM D 4637 Annex	.381 (0.015)	.406 (0.016)	.508 (0.020)
Breaking Strength, min, N (lbf)	ASTM D 751 Grab Method	400 (90)	623 (140)	623 (140)
Elongation, Ultimate, min, %	ASTM D 751 Grab Method	250 **	480**	480**
Tear Strength, min, N (lbf)	ASTM D 751 B Tongue Tear	45 (10)	311 (70)	311 (70)
Brittleness Temp., max. deg. C (deg. F)*	ASTM D 2137	-45 [-49]	-45 [-49]	-45 [-49]
Resistance to Heat Aging* Properties after 4 weeks @ 240°F	ASTM D 573			
Breaking Strength, min, N (lbf)	ASTM D 751	355 (80)	823 (182)	823 (182)
Elongation, Ultimate, min, %	ASTM D 751	200**	250**	250**
Linear Dimensional Change, max, %	ASTM D 1204	±1.0	-1.0	-1.0
Ozone Resistance* Condition after exposure to 100 ppm Ozone in air for 168 hours @ 104°F (40°C) Specimen wrapped around 3" mandrel	ASTM D 1149	No Cracks	No Cracks	No Cracks
Resistance to Water Absorption* After 7 days immersion @ 70°C (158°F) Change in mass, max, %	ASTM D 471	-2.0,+8.0	[+5.5**]	[+5.5**]
Factory Seam Strength, min.	Modified ASTM D 816	Membrane Rupture	Membrane Rupture	Membrane Rupture
Resistance to Outdoor (Ultraviolet) Weathering* Xenon-Arc, total radiant exposure at .70 W/m ² irradiance, 80° C (176°F) black panel temp.	ASTM D 4637 Conditions	No Cracks No Cracking @ 7560 kJ/m ²	No Cracks No Cracking @ 35320 kJ/m ²	No Cracks No Cracking @ 35320 kJ/m ²
* Not a Quality Control Test due to the time required for the test or the complexity of the test. However, all tests are run on a statistical basis to ensure overall long-term performance of the sheeting.				
** Specimens to be prepared from coating rubber compound, vulcanized in a similar method to the reinforced product.				

2.03 FLASHING

A. **GeoTough Pressure-Sensitive Cured Cover Strip:** A 6" or 9" wide and 100' long and 12" wide by 50' long

GeoTough 60-mil cured EPDM membrane laminated to a nominal 28-mil cured Factory-Applied TAPE. The Cured Cover Strip is ideal for flashing and repairs, as well as a seam splice option.

- B. **GeoTough Pressure-Sensitive Overlayment Strip:** A nominal 40-mil black, **semi-cured** EPDM membrane laminated to a nominal 28-mil cured, Factory-Applied TAPE. Available in 6" and 9" widths and 100' long and 12" width and 50' long rolls used to flash inlet or outlet pipes, overflow drains in conjunction with EPDM water containment systems.
- C. **GeoTough Uncured EPDM Elastoform Flashing®:** an easily formed, 1.5 mm (.060") thick uncured EPDM membrane available in widths of 15, 23, 30, 50, and 60 cm (6, 9, 12, 18 and 24 inches) and lengths of 30 m (100 feet). Used for flashing of inlet/outlet pipes and overflow drains.

2.04 CLEANERS PRIMERS, ADHESIVES AND SEALANTS

- A. **Weathered Membrane Cleaner:** Used to prepare GeoTough EPDM membranes that have been exposed to the elements for approximately 7 days to remove surface oxidation and general construction dirt prior to primer application and splicing of the GeoTough EPDM membrane. The Weathered Membrane Cleaner is applied at an approximate coverage rate of 37 m² (400 square feet) per gallon (one surface).

Note: If the Weathered Membrane Cleaner is used in conjunction with the GeoTough EPDM membrane, GeoTough Splice Cleaner is not required prior to application of Splicing Cement. When SecurTAPE is used for splicing, HP-250 Primer must be applied after cleaning the membrane with the Weathered Membrane Cleaner.

- B. **90-8-30A Bonding Adhesive:** A high-strength, yellow colored, synthetic rubber adhesive used for bonding GeoTough EPDM membrane to various surfaces. Applied at a coverage rate of approximately 5.6 square meters (60 square feet) per 3.78 liters (1 gallon) per finished surface (includes coverage on both surfaces).
- C. **Sure-Seal Lap Sealant:** A heavy-bodied material (trowel or gun-consistency) used to seal the exposed edges of a GeoTough EPDM membrane splice.
- D. **Sure-Seal SecurTAPE™:** A 15 cm (6 inch) wide by 30 m (100 feet) long splice tape used for splicing adjoining sections of GeoTough EPDM membrane. The tape is also available in 7.5 cm (3 inches) wide by 30 m (100 feet) long for use in conjunction with Geomembrane as terminations around pipes and overflow drains.
- E. **Carlisle EPDM Primer:** A solvent-based primer used to prepare the surface of GeoTough EPDM membrane for application of Splice Tape. This Primer can also be used in conjunction with EP-95 Splicing Cement in lieu of Splice Cleaner and in tank lining applications to prime concrete surfaces to which a compression termination utilizing Pressure-Sensitive Flashing is utilized.
- F. **Water Cut-Off Mastic:** A one-component, low viscosity, self wetting, Butyl blend mastic used as a sealing agent between the EPDM membrane or Elastoform Flashing and applicable substrates.

2.05 FASTENING COMPONENTS

- A. **HP CD-10 Concrete Spike:** A hammer-driven, non-threaded, black epoxy electro-deposition coated (E-Coat) fastener for use with structural concrete rated 211 kg/cm² (3,000 psi) or greater.
- B. **HD 14-10 Concrete Fastener:** A #14 threaded fastener used for minimum 211 kg/cm² (3,000 psi) structural concrete.

2.06 OTHER PRODUCTS

- A. **Stainless Steel Termination Bar (by others):** A 50 mm (2 inch) wide and 6 mm (1/4 inch) thick bar pre-punched 150 mm (6 inches) on center to be used in conjunction with stainless steel fasteners as a membrane termination against structural concrete surfaces around edges of ponds.
- B. **Protection Fabric:** A non-woven 339 g/m² (10 oz/square yard), polypropylene, geotextile fabric that is used as a protection layer to separate between a loose-laid membrane and the structural concrete substrate.

Protection Fabric		
Physical Properties	Test Method	Performance
Unit Weight	ASTM D 5261	339 g/m ²
Grab Tensile Strength	ASTM D 4632	1.11 kN
Grab Tensile Elongation	ASTM D 4632	50%
Mullen Burst	ASTM D 3786	3584 kPa
Puncture	ASTM D 4833	0.730 kN
Trapezoid Tear	ASTM D 4533	0.445 kN
UV Resistance ²	ASTM D 4355	70% @ 500 hrs.
Roll Width	-	4.57 m
Roll Length	-	54.8 or 182.8 m

PART III EXECUTION

3.01 GENERAL

- A. Refer to the applicable Material Safety Data Sheets and Technical Data Bulletins for cautions and warnings.
- B. Comply with the manufacturer's published instructions for the installation of the GeoTough EPDM Water Containment and Lining System including proper substrate preparation, jobsite considerations and weather restrictions.

3.02 SUBSTRATE PREPARATION

A. Earth-Dug Reservoirs

1. Excavate to the designated water depth in addition to a minimum of 60 cm (2 feet) of free board (distance between the top of the reservoir and the anticipated water level typically determined by the designer) to prevent possible water overflow.
2. During excavation, boulders, cobbles and gravel shall be removed. A relatively smooth substrate shall be achieved by compacting a mixture of medium (.4 to 2 mm) and coarse (2 to 5 mm) sand (mixture 65% to 35% respectively). Finer grades of sand, silt or clay can be used if available. Compact mixture to 95% Modified Proctor in accordance with ASTM D 1557.
3. Soil condition should be evaluated and slopes shall be provided in the base to preclude gas entrapment. If necessary, a relief mechanism through or beneath the liner shall be incorporated by the designer.
4. Surrounding the earth dug reservoir, excavate a continuous trench 30 cm x 30 cm (12" x 12") minimum approximately 60 cm (2 feet) from the top edge of the reservoir.

B. Structural Concrete Reservoirs

1. For structural concrete reservoirs, new structural concrete shall be relatively even and water cured, with a smooth broom finish and in place for a minimum of 72 hours.
2. Sweep all loose debris from the structural concrete substrate prior to application of the membrane.
3. Remove splatters, fins, ridges or other projections to provide a level vertical or horizontal surface. Fill holes, honeycombs, rock pockets, spalls or other voids and indentations with approved concrete patching compound.

4. Grind or fill surface at cold joints where each concrete pour is at a different plane to provide a smooth and level surface.
5. All surfaces shall be structurally sound, dry and free of dust, dirt and frost.

3.03 GEOTOUGH EPDM MEMBRANE APPLICATION

A. General

1. Reinforced GeoTough EPDM membrane shall be used for lining of ponds with side slopes exceeding 30° and assembling of floating covers. Ponds with side slopes less than 30° may incorporate the use of a non-reinforced membrane.
2. Prior to liner installation, complete all excavation work inside and around the perimeter of the pond or reservoir.
3. Ensure the substrate is clean, smooth, dry and free of projections (i.e., fins, sharp edges), contaminants, foreign material, oil and grease.
4. Where applicable over structural concrete substrates, install 339 g/m² (10 oz/square yard) geotextile fabric loose-laid with adjoining sheets overlapped approximate 30 cm (12 inches). Extend fabric up the sides of pond as shown in the applicable Carlisle Detail.
5. Unroll EPDM membrane without stretching and allow to relax approximately 1/2 hour. Overlap adjoining membrane sheets approximately 17 - 20 cm (7 - 8 inches) in order to achieve a 15 cm (6 inch) wide minimum splice.
6. Assemble splices using either field applied 15 cm (6 inch) wide SecurTAPE and EPDM Primer or Factory Applied (FAT) 15 cm (6 inch) wide SecurTAPE and EPDM Primer.

B. Reservoirs, Ponds, etc.

1. For earth-dug or reservoirs with structural concrete substrates, comply with specifier's requirements concerning the appropriate GeoTough EPDM type and thickness.
2. Position GeoTough EPDM loose-laid directly over the properly prepared substrate or in conjunction with geotextile fabric.
3. Adjoining sheets of geotextile fabric, if used, must be overlapped approximately 30 cm (12 inches).

C. Terminations and Floating Covers

Terminate membrane into an earth-dug trench surrounding the perimeter of the reservoir or pond. Reservoirs with a structural concrete substrate, may be terminated using a mechanical bar termination consisting of 6 mm x 50 mm (1/4 inch x 2 inch) stainless steel or aluminum bar fastened with an appropriate fastener to maintain constant compression on the Water Cut-Off Mastic.

1. Flash all penetrations according to the applicable detail using either Sure-Seal Uncured Elastoform Flashing or Sure-Seal Uncured Pressure-Sensitive.
2. For ponds and reservoirs with floating covers, the floating covers must assembled using 1.1 (.045") or 1.5 (.060") thick reinforce GeoTough EPDM.
3. The floating covers must be terminated into a burial trench around the perimeter of the pond or reservoir and sized according to prevent stretching when water levels drop.
4. Drains connected to outlet pipes should also be incorporated at each corner to prevent accumulation of rainwater that may promote insect infestation.

D. GeoTough EPDM Membrane Splicing Options

1. **1.1 mm (.045 inch) or 1.5 mm (60-mil) EPDM Membrane:** Tape splices must be a minimum of 6 cm (2-1/2") wide using 7 cm (3") **Factory-Applied Tape (FAT)** OR a minimum of 14 cm (5-1/2") wide using 15 cm (6") **field applied SecurTAPE**.

Note: A single layer of 15 cm x 15 cm (6"x6") uncured pressure sensitive Elastoform flashing must be used at all splice intersections. The use of continuous Overlayment strip is optional and can be used in lieu of 'T'-Joint Overlayment.

2. **2.2 mm (90-mil) EPDM Membrane:** Tape splices may be a minimum of 6 cm (2-1/2") wide using 7 cm (3") wide **Factory-Applied Tape (FAT)**. In addition the entire field splice must be overlaid with a continuous 15 cm (6") wide Pressure Sensitive Overlayment Strip.
3. **1.1 mm (.045 inch) or 1.5 mm (60-mil) EPDM Membrane:** Splices may be made using a minimum of 15 cm (6") wide **GeoTough Pressure-Sensitive Cured Cover Strip** in conjunction with EPDM Primer.

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GeoTough™ EPDM Geosynthetic Membrane

Water Containment and Lining System

Details

Table of Contents

June 2015

LINERS (RESERVOIRS, PONDS, etc.)

General

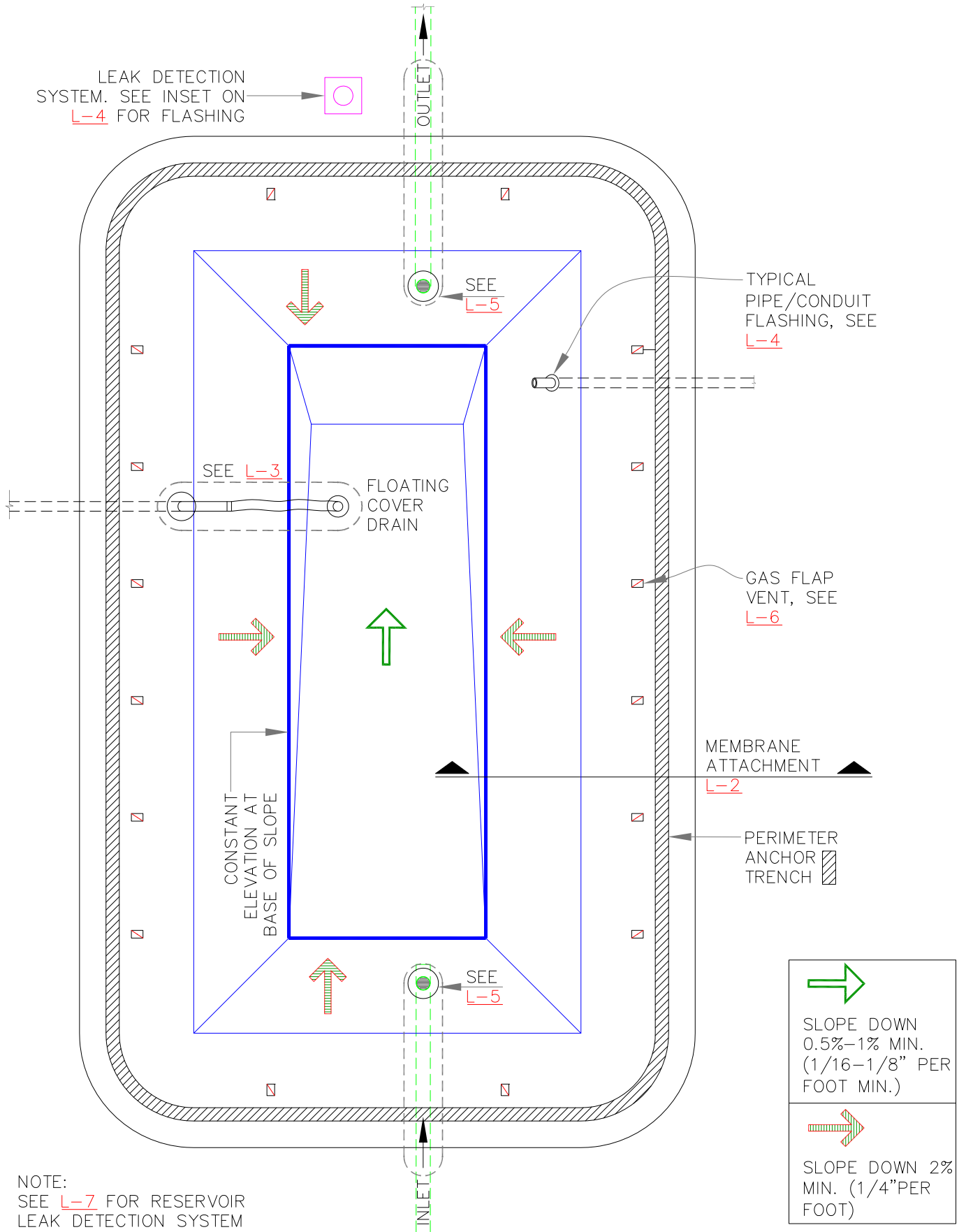
- L-1 Generic Plan View
- L-2 Membrane Application
- L-3 Floating Cover Drain
- L-4 Pipe Penetration Through Liner
- L-5 Inlet or Outlet Through Liner
- L-6 Gas Vent Detail
- L-7 Reservoir Leak Detection System

Membrane Splices

- L-8A Membrane Seam Options
- L-8B Membrane Seam Options
- L-8C Membrane Seam Options

Inside/Outside Corners

- L-9 Inside Corner with Continuous EPDM Wall Flashing



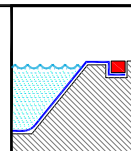
NOTE:
SEE **L-7** FOR RESERVOIR LEAK DETECTION SYSTEM

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GeoTough™ EPDM
Geosynthetic Membrane

GENERIC PLAN VIEW

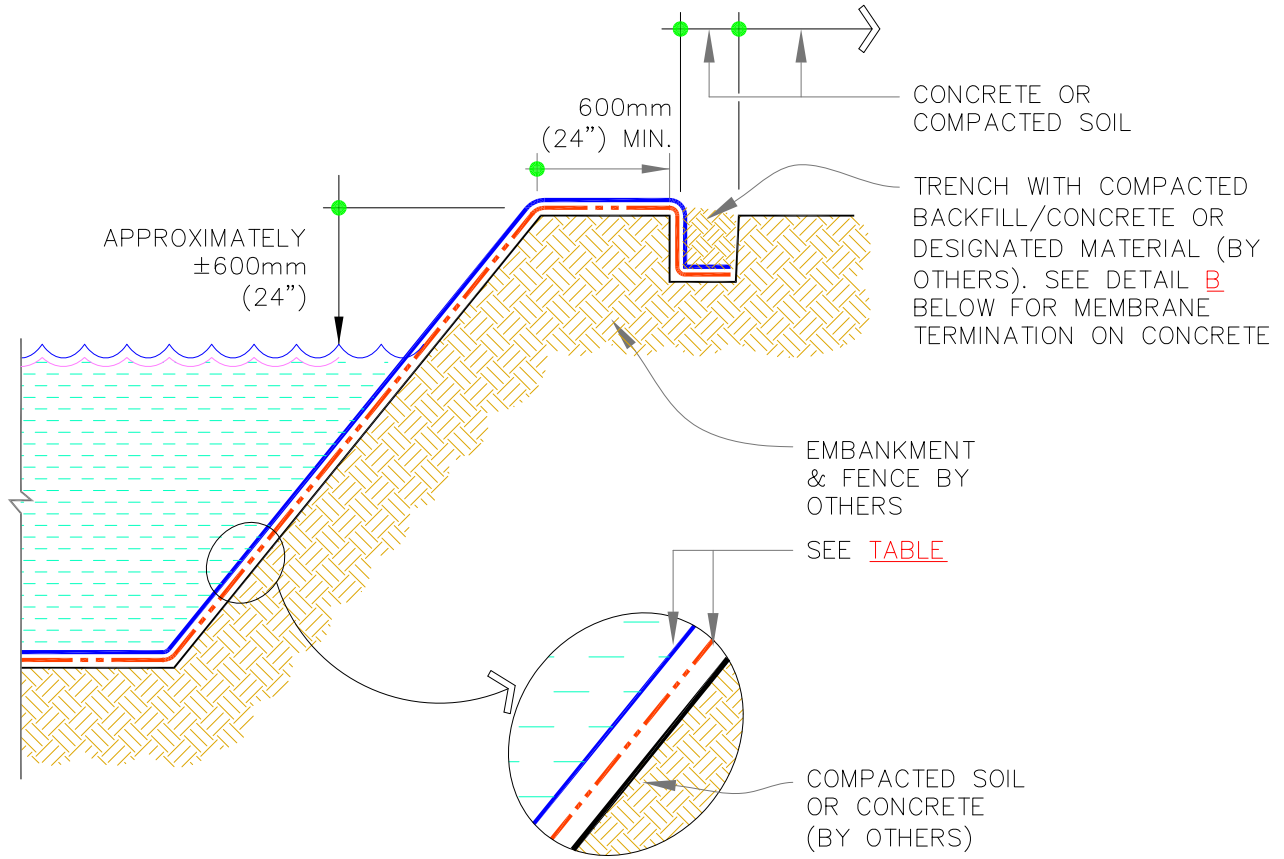
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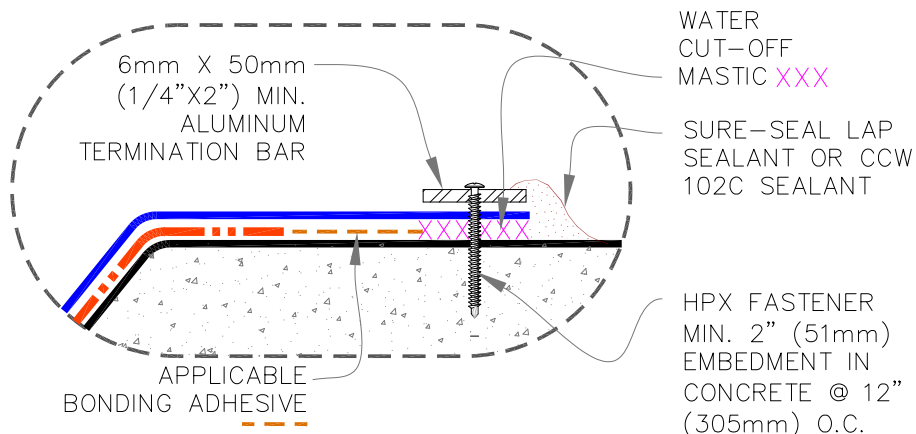
SHEET NO.

L-1

• L (LINER) • TL (TANK LINER)



A **MEMBRANE APPLICATION EARTHEN BASE**



B **MEMBRANE ANCHORED WITH TERMINATION BAR**

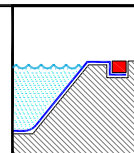
TABLE

MATERIAL TYPES	THICKNESS	
	INCH	mm
GEOTOUGH EPDM	0.045	1.14
	0.060	1.52
CARLISLE CCW 300HV PROTECTION FABRIC		

GeoTough™ EPDM
Geosynthetic Membrane

1 SEE NOTE(S)

MEMBRANE APPLICATION



SHEET NO.
L-2

• L (LINER) • TL (TANK LINER)

POND LINER

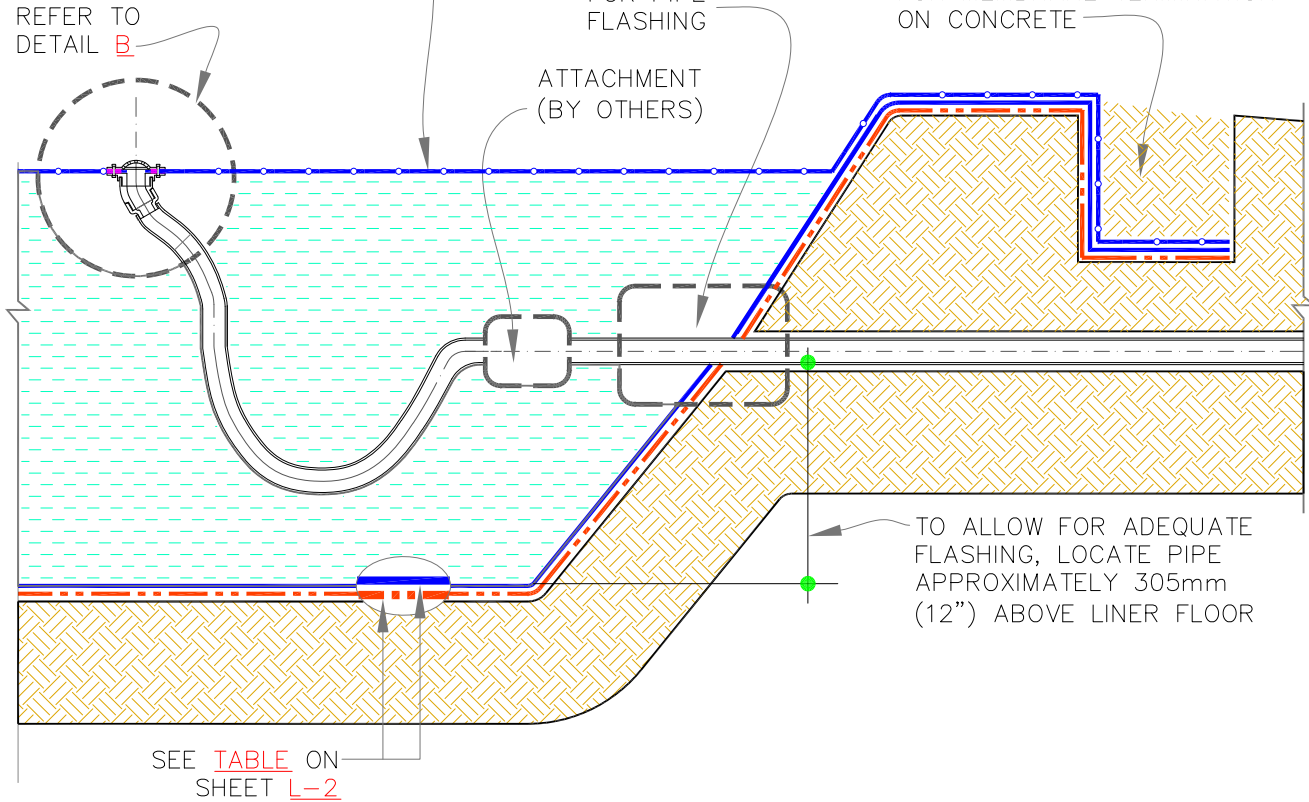
GEOTOUGH EPDM 1.14mm (45 MIL) OR 1.52mm (60 MIL) REINFORCED/UN-REINFORCED MEMBRANE

TRENCH WITH COMPACTED BACKFILL/CONCRETE OR DESIGNATED MATERIAL (BY OTHERS). SEE DETAIL B/L-2 FOR MEMBRANE TERMINATION ON CONCRETE

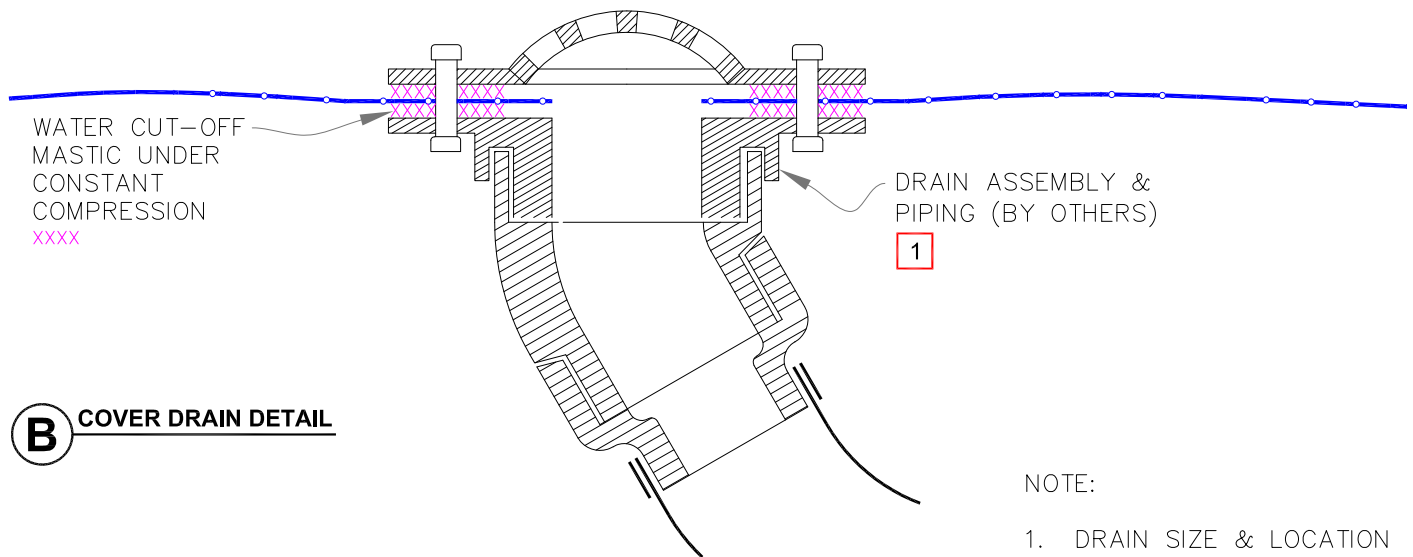
REFER TO DETAIL B

REFER TO L-4 FOR PIPE FLASHING

ATTACHMENT (BY OTHERS)



A FLOATING COVER DRAIN

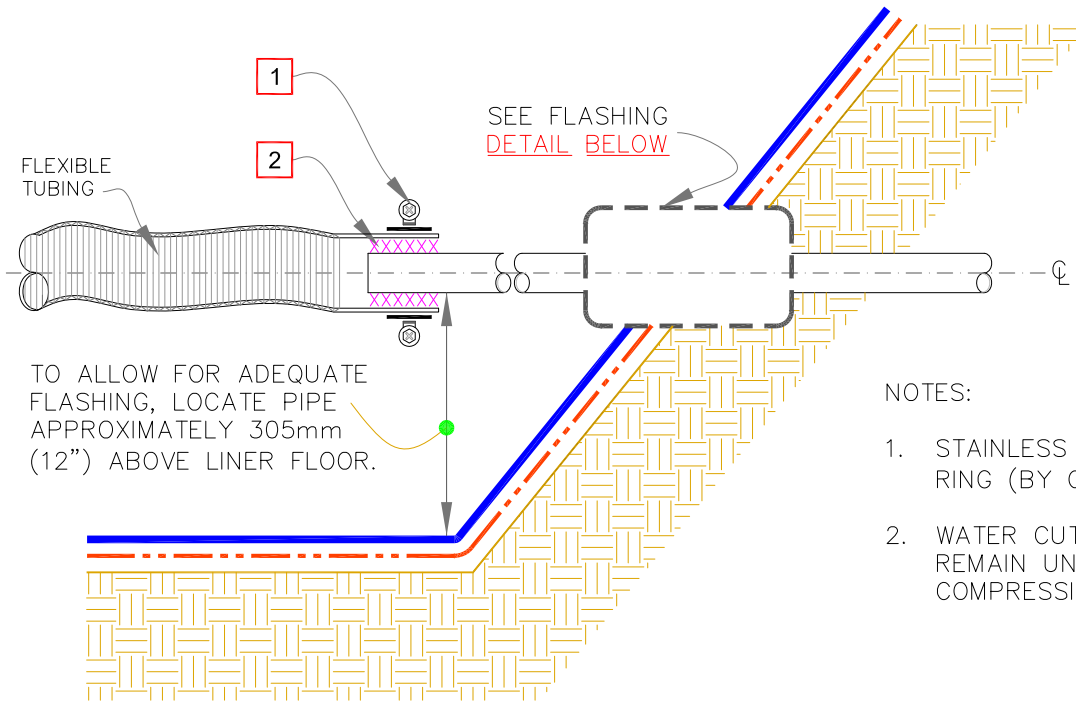


B COVER DRAIN DETAIL

NOTE:

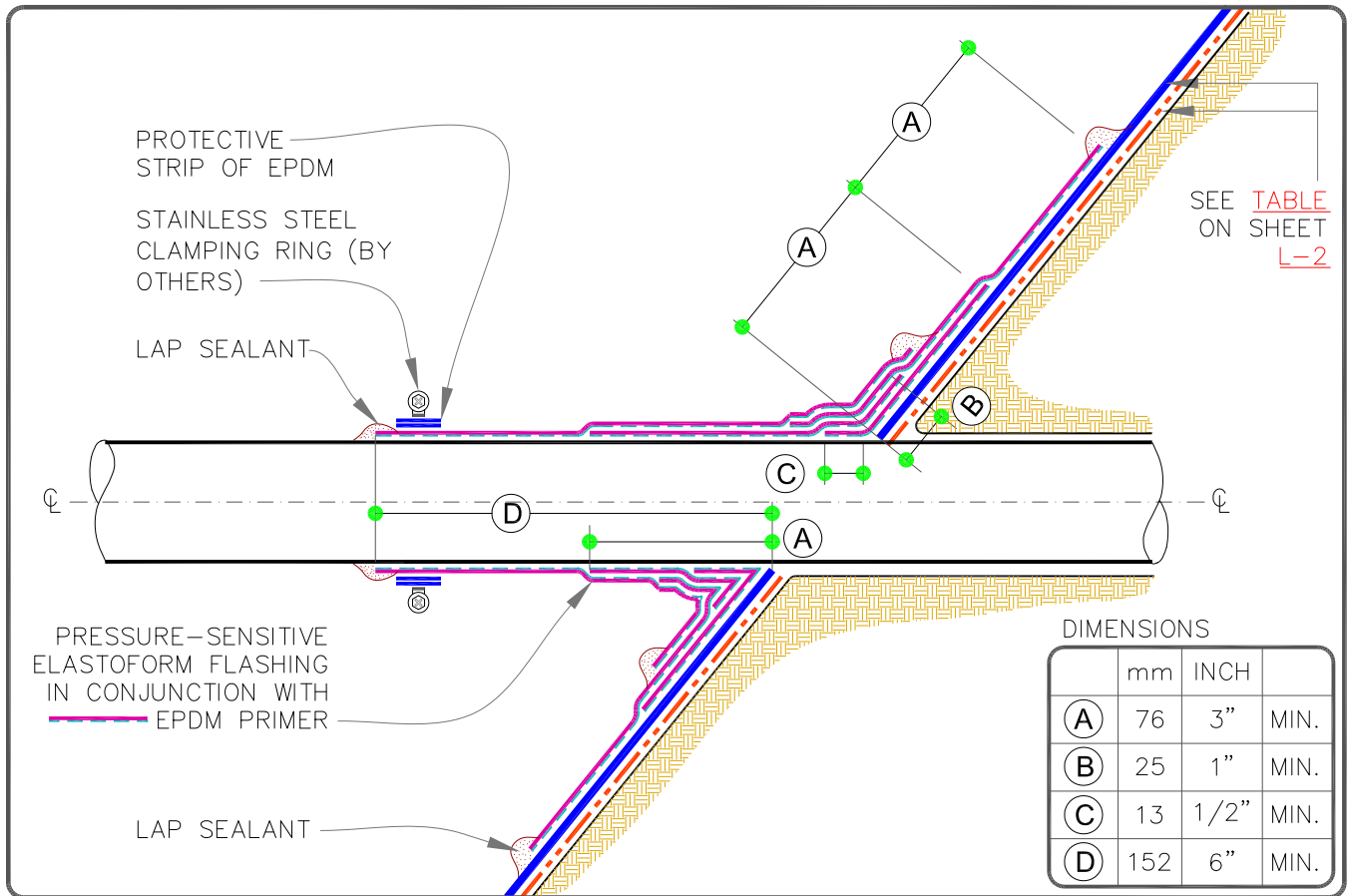
1. DRAIN SIZE & LOCATION TO BE DETERMINED BY THE SPECIFIER.

GeoTough™ EPDM Geosynthetic Membrane	FLOATING COVER DRAIN		SHEET NO.
			L-3
1 SEE NOTE(S)		• L (LINER) • TL (TANK LINER)	



NOTES:

1. STAINLESS STEEL CLAMPING RING (BY OTHERS)
2. WATER CUT-OFF MASTIC TO REMAIN UNDER CONSTANT COMPRESSION



GeoTough™ EPDM
Geosynthetic Membrane

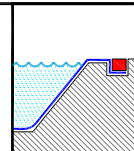
PIPE PENETRATION THROUGH LINER

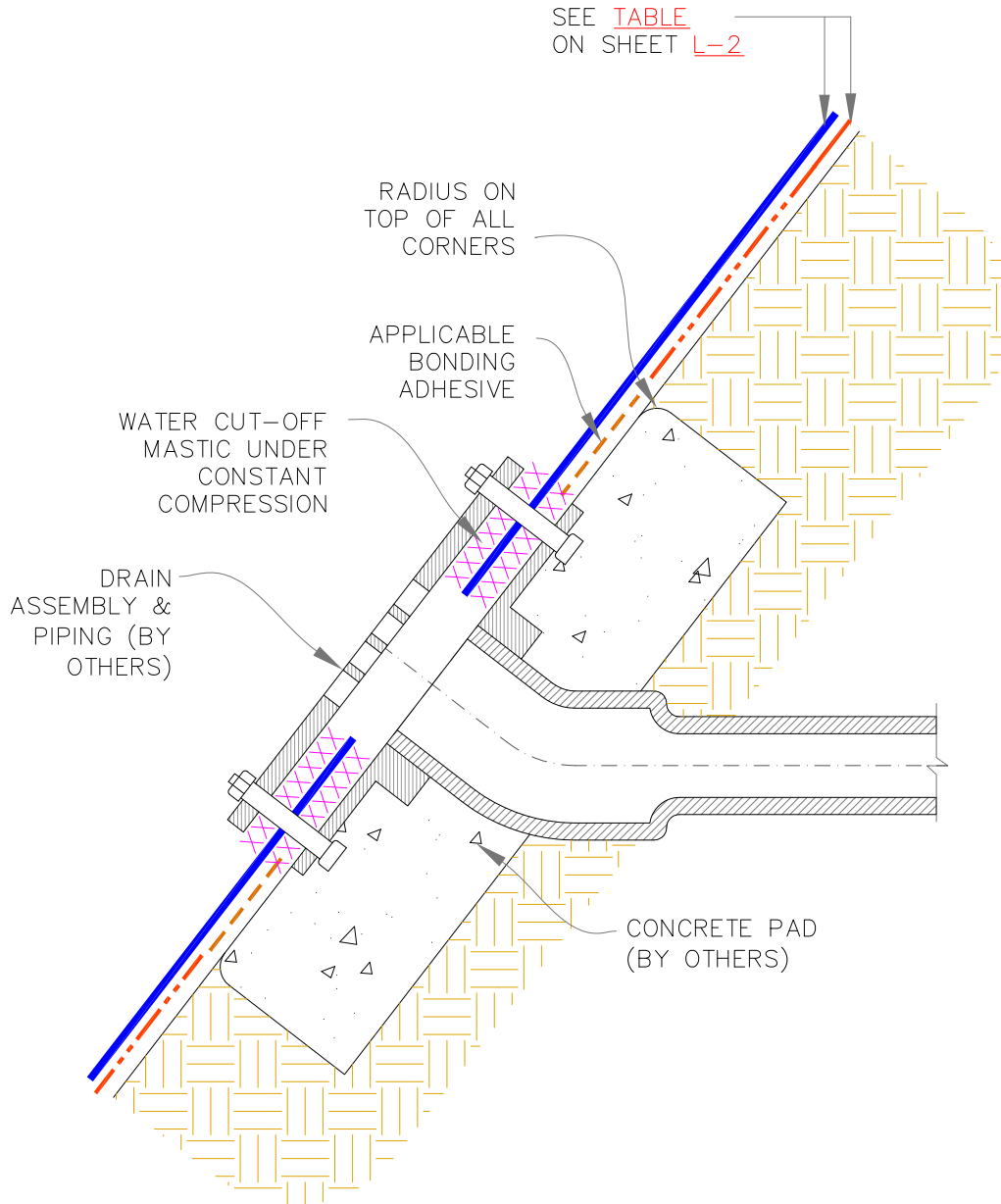
SHEET NO.

L-4

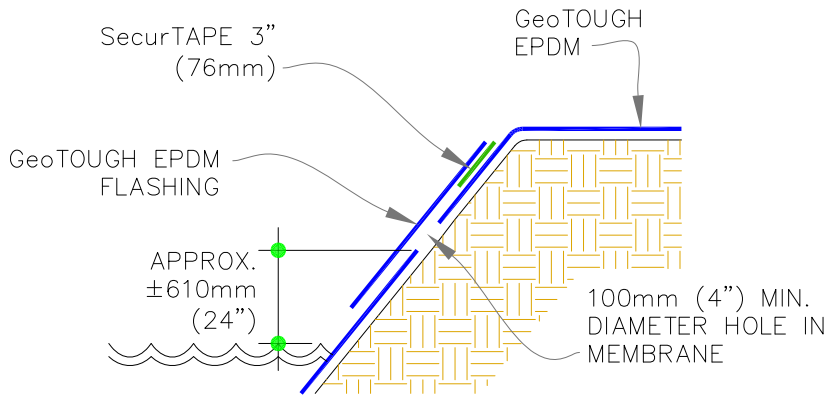
• L (LINER) • TL (TANK LINER)

1 SEE NOTE(S)





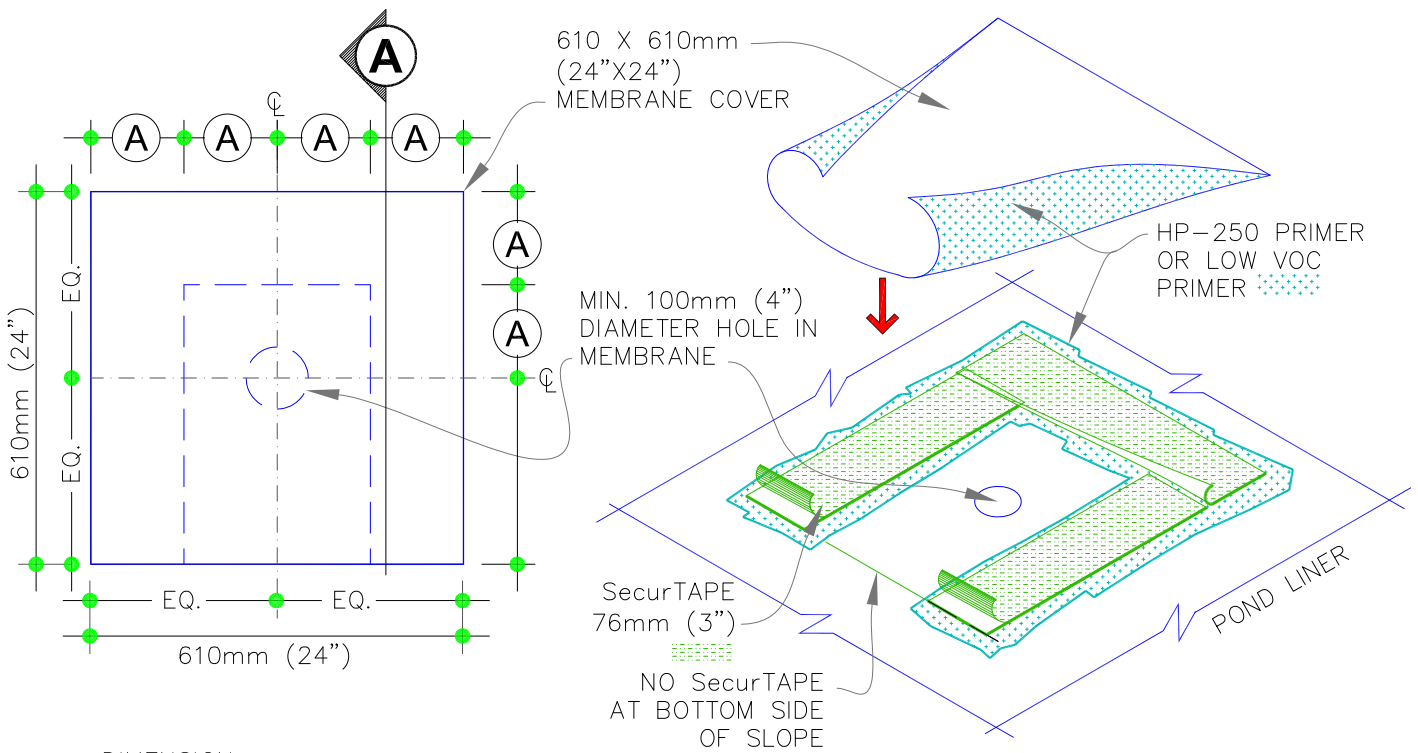
	INLET OR OUTLET THROUGH LINER		SHEET NO.
			L-5
1 SEE NOTE(S)			• L (LINER) • TL (TANK LINER)



NOTES:

1. GAS VENT MUST BE ABOVE MAXIMUM WATER LEVEL.
2. DETAIL NOT FOR USE IN PONDS WITH FLOATING COVERS.

A CROSS-SECTION AT GAS VENT



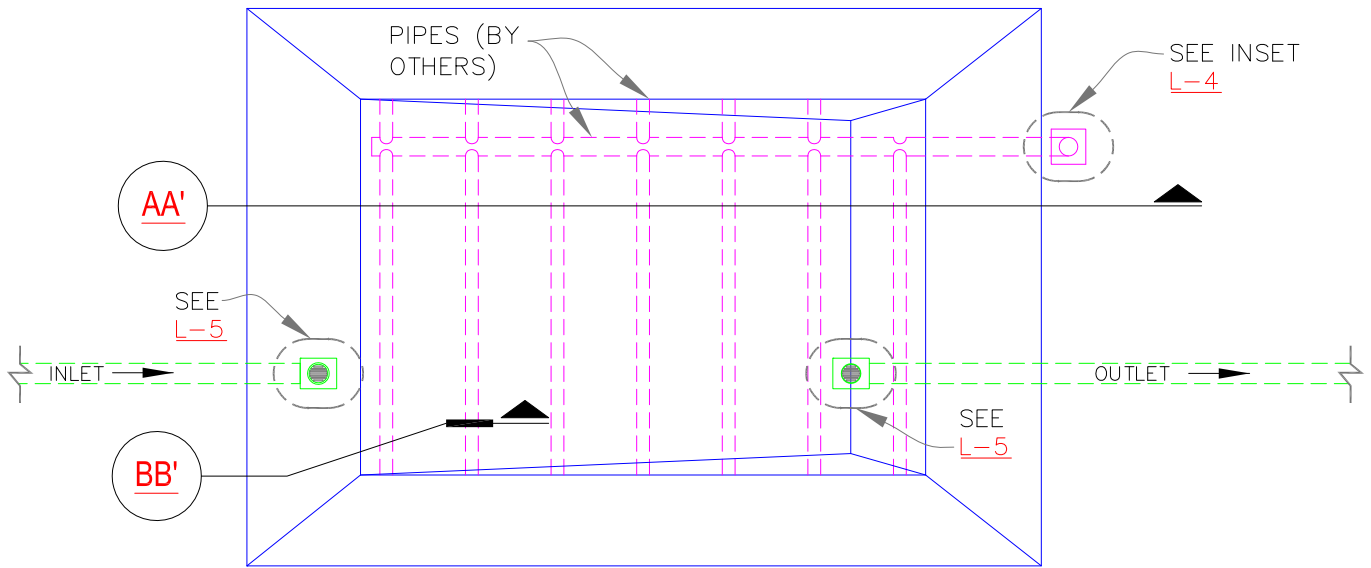
DIMENSION

	mm	INCH	
A	152	6"	MIN.

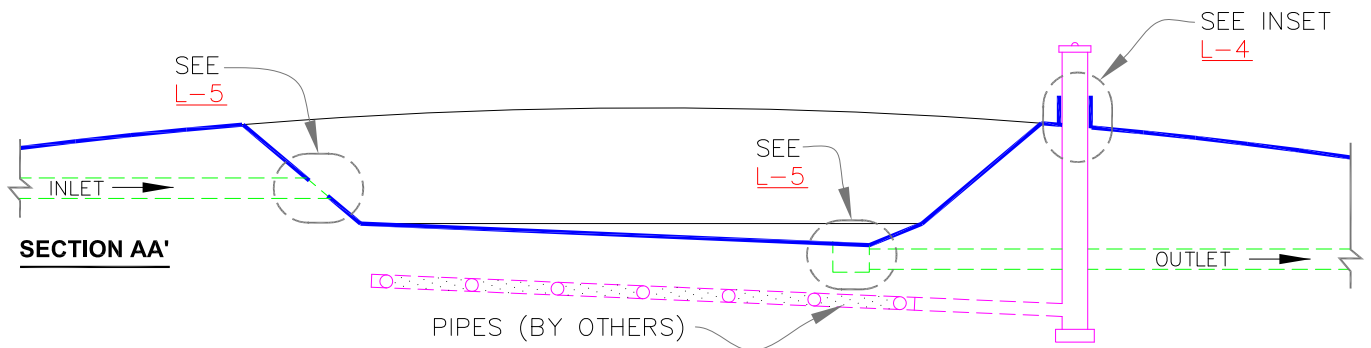
B PLAN VIEW OF VENTING FLAP

C ISOMETRIC VIEW MEMBRANE COVER

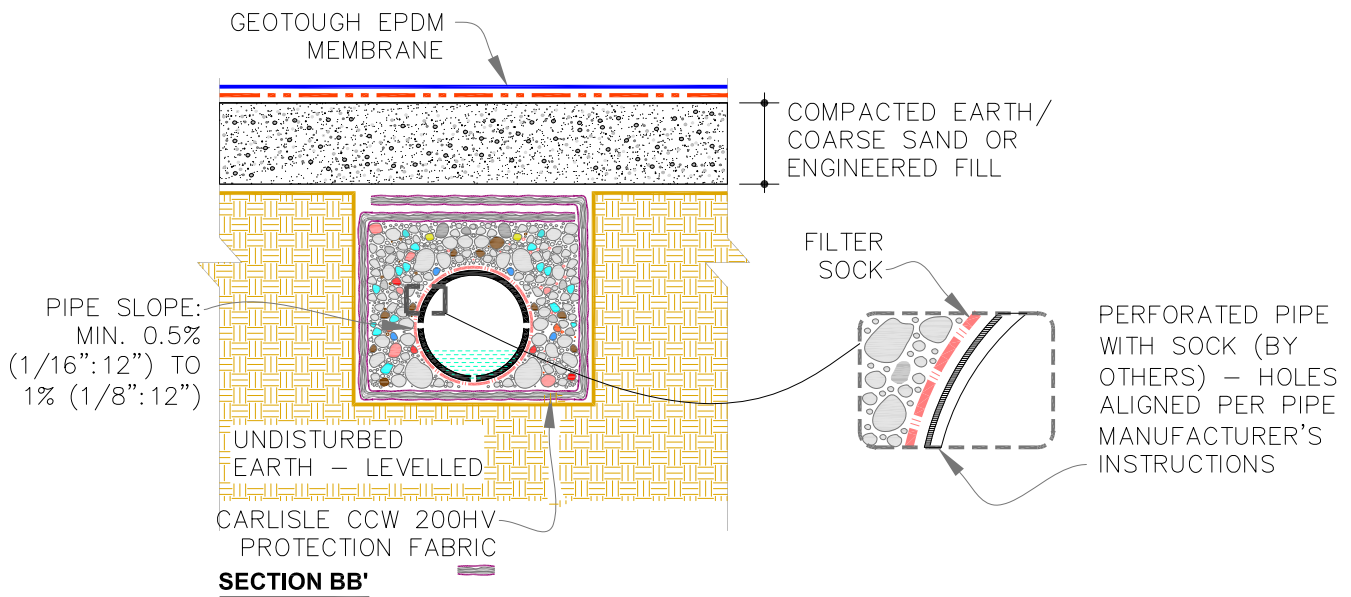
	<p>GAS VENT DETAIL</p>		SHEET NO.
			L-6
<p>1 SEE NOTE(S)</p>			<p>• L (LINER) • TL (TANK LINER)</p>



PLAN W/ GENERIC SUBSTRATE PIPING LAYOUT



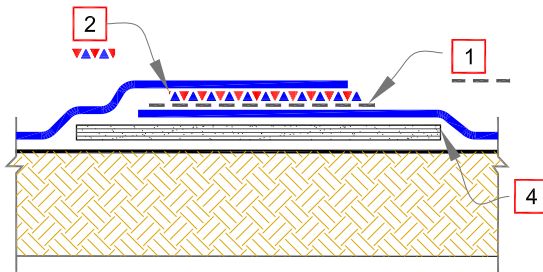
SECTION AA'



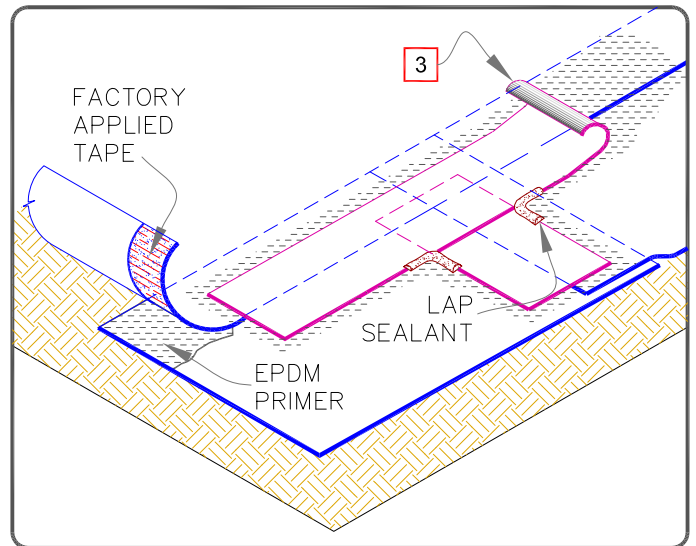
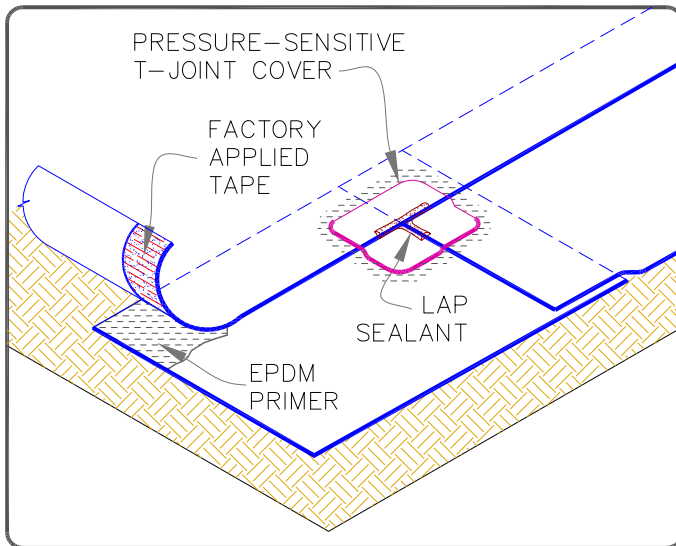
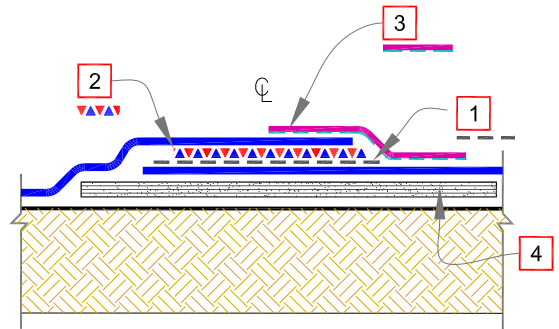
SECTION BB'

	<p>RESERVOIR LEAK DETECTION SYSTEM</p>		SHEET NO.
			<p>L-7</p>
<p>1 SEE NOTE(S)</p>			<p>• L (LINER) • TL (TANK LINER)</p>

SEAM - OPTION A



SEAM - OPTION B

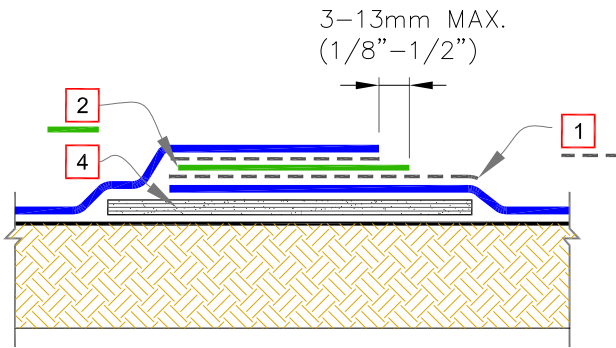


NOTES:

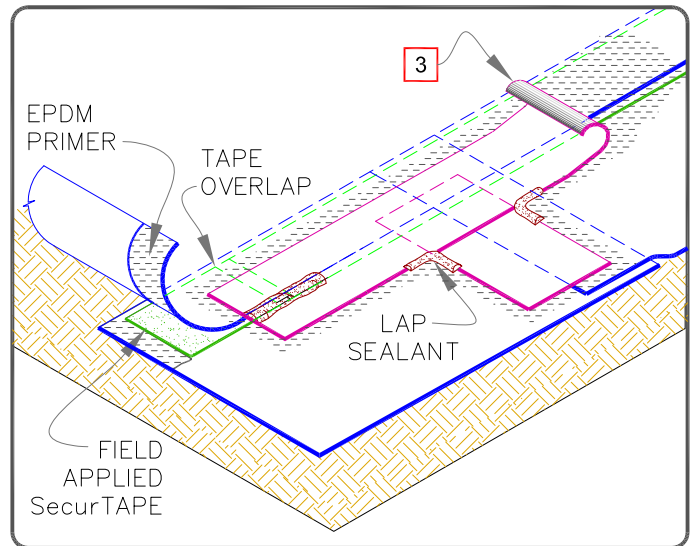
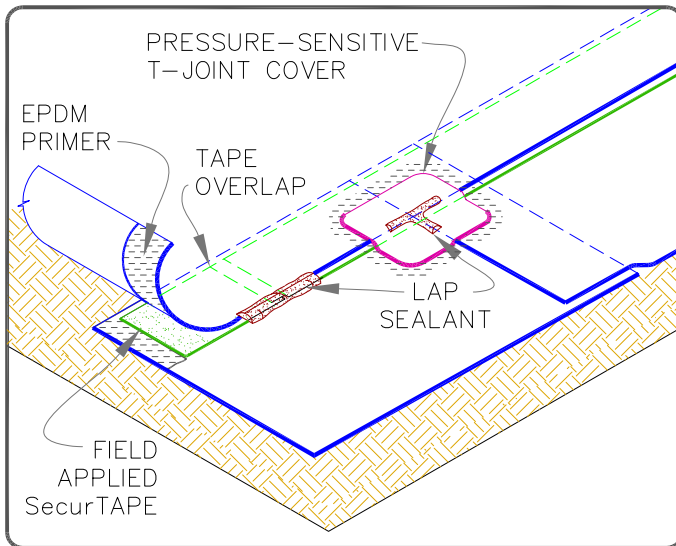
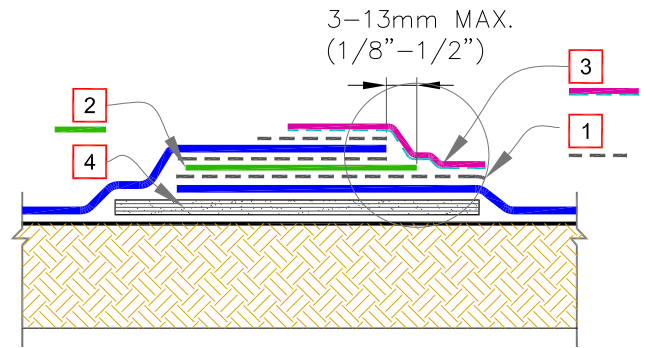
1. SURE-SEAL EPDM PRIMER.
2. 76mm (3") OR 152mm (6") WIDE F.A.T. (FACTORY-APPLIED TAPE).
3. 152mm (6") WIDE PRESSURE-SENSITIVE OVERLAYMENT STRIP CENTRALLY ALIGNED.
4. SUPPORT SEAMING AREA UNDERNEATH THE MEMBRANE WITH TEMPORARY SECUROCK/PLYWOOD STRIP, WIDE ENOUGH TO SUPPORT THE SEAMING AREAS AND TO PERFORM PROPER SEAMING. KEEP IT CENTRALLY ALIGNED WITH THE CENTER OF SEAM. SLIDE BOARD WITH THE SEAM PROGRESSION. ENSURE T-JOINTS OR OVERLAYMENT STRIPS ARE ROLLED IN, PRIOR TO DISPLACEMENT OF BOARD.
5. APPLY LAP SEALANT AT ALL INTERSECTIONS BETWEEN PRESSURE-SENSITIVE OVERLAYMENT STRIP.

	<p>MEMBRANE SEAM OPTIONS</p>		SHEET NO.
			L-8A
<p>1 SEE NOTE(S)</p>			<p>• L (LINER) • TL (TANK LINER)</p>

SEAM - OPTION C



SEAM - OPTION D

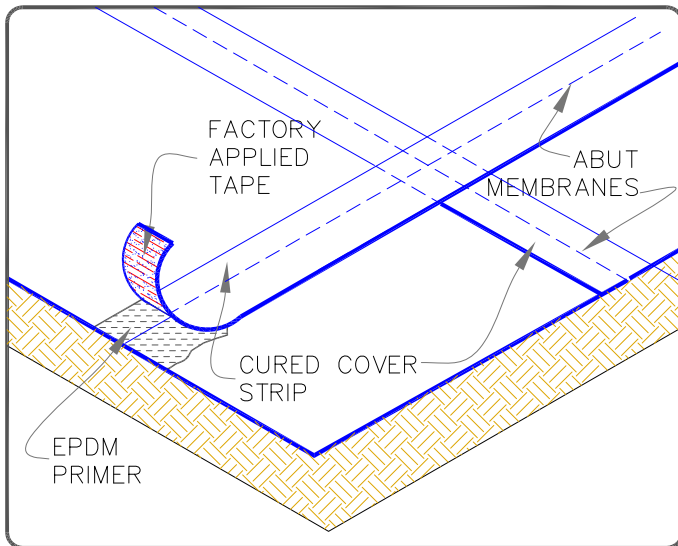
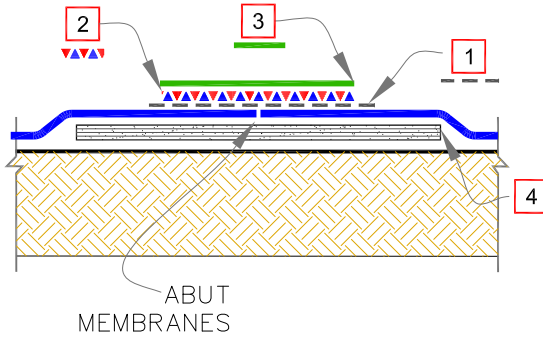


NOTES:

1. SURE-SEAL EPDM PRIMER.
2. 76mm (3") OR 152mm (6") WIDE SecurTAPE.
3. 152mm (6") WIDE PRESSURE-SENSITIVE OVERLAYMENT STRIP CENTRALLY ALIGNED.
4. SUPPORT SEAMING AREA UNDERNEATH THE MEMBRANE WITH TEMPORARY SECUROCK/PLYWOOD STRIP, WIDE ENOUGH TO SUPPORT THE SEAMING AREAS AND TO PERFORM PROPER SEAMING. KEEP IT CENTRALLY ALIGNED WITH THE CENTER OF SEAM. SLIDE BOARD WITH THE SEAM PROGRESSION. ENSURE T-JOINTS OR OVERLAYMENT STRIPS ARE ROLLED IN, PRIOR TO DISPLACEMENT OF BOARD.
5. APPLY LAP SEALANT AT ALL INTERSECTIONS BETWEEN PRESSURE-SENSITIVE OVERLAYMENT STRIP.

<p>GeoTough™ EPDM Geosynthetic Membrane</p>	<p>MEMBRANE SEAM OPTIONS</p>		<p>SHEET NO. L-8B</p> <p>• L (LINER) • TL (TANK LINER)</p>
<p>1 SEE NOTE(S)</p>			

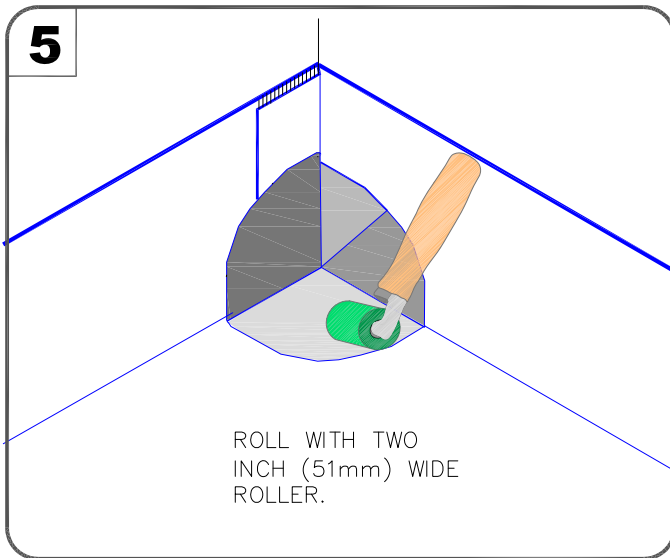
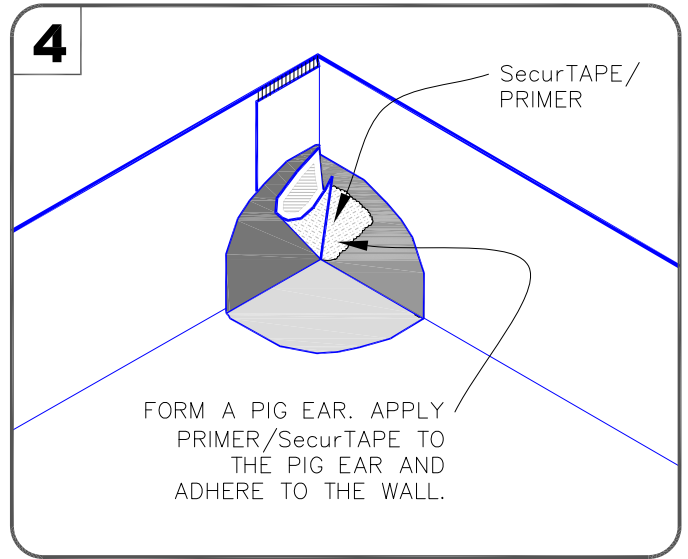
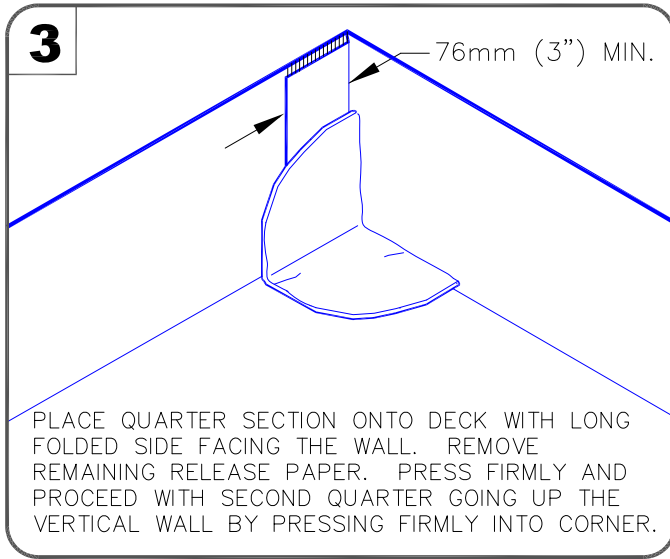
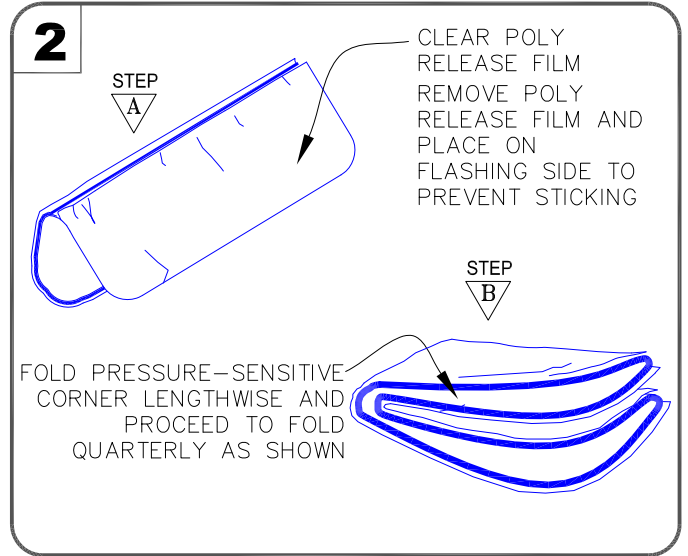
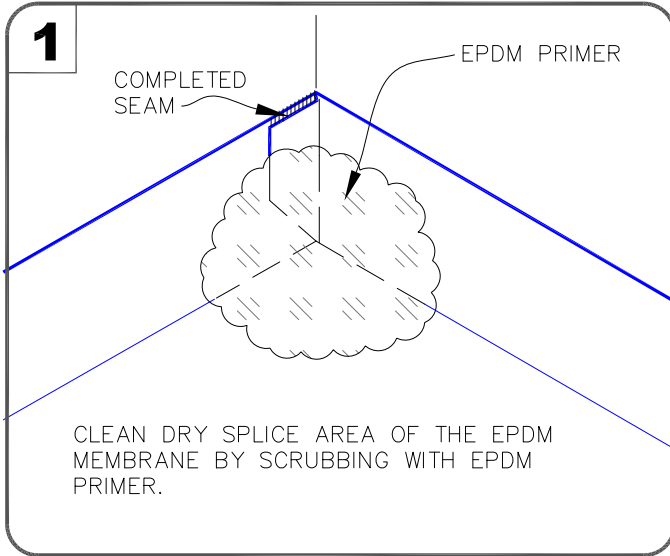
SEAM - OPTION E



NOTES:

1. SURE-SEAL EPDM PRIMER.
2. 152mm (6") WIDE F.A.T. (FACTORY-APPLIED TAPE).
3. 152mm (6") WIDE PRESSURE-SENSITIVE CURED COVER STRIP – CENTRALLY ALIGNED.
4. SUPPORT SEAMING AREA UNDERNEATH THE MEMBRANE WITH TEMPORARY SECUROCK/PLYWOOD STRIP, WIDE ENOUGH TO SUPPORT THE SEAMING AREAS AND TO PERFORM PROPER SEAMING. KEEP IT CENTRALLY ALIGNED WITH THE CENTER OF SEAM. SLIDE BOARD WITH THE SEAM PROGRESSION. ENSURE T-JOINTS OR OVERLAYMENT STRIPS ARE ROLLED IN, PRIOR TO DISPLACEMENT OF BOARD.
5. APPLY LAP SEALANT AT ALL INTERSECTIONS BETWEEN PRESSURE-SENSITIVE OVERLAYMENT STRIP.

<p>GeoTough™ EPDM Geosynthetic Membrane</p>	<p>MEMBRANE SEAM OPTIONS</p>		<p>SHEET NO. L-8C</p>
<p>1 SEE NOTE(S)</p>			<p>• L (LINER) • TL (TANK LINER)</p>



<p>GeoTough™ EPDM Geosynthetic Membrane</p>	<p>INSIDE CORNER WITH CONTINUOUS EPDM WALL FLASHING</p>		SHEET NO.
			L-9
<p>1 SEE NOTE(S)</p>			• L (LINER) • TL (TANK LINER)