

Attachment 1

The Firestone Lining Systems uses a complete range of materials including the Firestone EPDM Geomembrane, adhesives, tape, sealants, cleaning products and prefabricated accessories in order to guarantee the homogeneity of the system.

Membrane

- **Firestone Geomembrane** : the main component of the system consists of the Firestone EPDM Geomembrane. The Geomembrane is manufactured by calendaring and vulcanising. The sheet has a thickness of 1,02 - 1,14 or 1,52 mm. The 1,02 mm thick sheet is specially designed for application in decorative and landscape ponds.
- **FormFlash** : self-vulcanising rubber strips which can be shaped and adapted in a flexible way to irregular shapes such as corners, pipes, etc.

Adhesives and pressure sensitive tape

- **Splice Adhesive** : butyl based contact adhesive, used for field splicing of Firestone Geomembrane and FormFlash.
- **Bonding Adhesive** : neoprene based contact adhesive used for bonding Geomembrane sheets or FormFlash to non Geomembrane surfaces (wood, metal, concrete and others).
- **QuickSeam Splice Tape** : double sided butyl based adhesive tape for splicing Firestone Geomembrane panels.

Cleaning products

- **Splice Wash** : cleaning product used during the preparation of a Firestone Geomembrane sheet, before applying the Splice Adhesive. This product may not be used for the application of QuickSeam Splice Tape.
- **QuickPrime Plus** : product for treating the Firestone Geomembrane sheet prior to applying the QuickSeam Splice Tape.

Sealants

- **Lap Sealant** : rubber based sealant for sealing splice edges, when Splice Adhesive is used.
- **Water Block Seal** : butyl based sealant, for making a waterproof seal when executing waterproofing details

Accessories

- **Termination Bar** : aluminium profile for terminating the Firestone Geomembrane sheet at the top against an upright wall .

Materials from other manufacturers, including fasteners, drain insert pieces, metal profiles, etc. , which are not described in these technical guidelines, can be used when approved by Firestone.

Technical Data Sheets

- Firestone Geomembrane
- FormFlash
- QuickSeam FormFlash
- Splice Adhesive
- Bonding Adhesive
- QuickSeam Splice Tape
- Splice Wash
- QuickPrime Plus
- Lap Sealant HS
- Water Block Seal
- Termination Bar

Firestone Geomembrane

1. Description

The Firestone Geomembrane is a cured single-ply synthetic rubber membrane made of ethylene-propylene-diene terpolymer (EPDM). It is available in a variety of thicknesses and panel sizes. Depending on the dimensions of the liner, the waterproofing surface may be seamless. In other situations, seams can be made using a self-adhesive tape.

The 1,02 mm thick Firestone EPDM Geomembrane is specifically designed for decorative pond applications. It is commercialized under the trade name “**Firestone Pond Liner™**”. Because of its specific formulation and production process, **only the Firestone Pond Liner™ membrane is guaranteed to be compatible with aquatic life** in accordance with testing reports published by the Water Research Centre in the UK.

2. Preparation

Product : Allow the membrane to relax for approximately 30 minutes before splicing.

Substrate : The substrate needs to be smooth, dry and free of sharp objects, oil, grease and other materials that may damage the Geomembrane.

3. Application

Install the Firestone Geomembrane in accordance with current specifications and details.

4. Coverage

The dimensions of the Geomembrane are calculated to cover the base of the reservoir, slopes and anchor trenches, including seam overlaps.

5. Characteristics

The Firestone Geomembrane is a rubber material with the following properties :

Physical	<ul style="list-style-type: none">• Elastomeric membrane with a good combination of high elasticity and tensile strength• Water-resistant• Temperature stable from -45°C to 130°C• Retains its elasticity at low temperature and resists to temperature shocks up to 250°C.• Excellent resistance to alkali rains, less resistant to oil products. Contact with some kind of oils, petroleum products, hot bitumen and grease must be avoided• Excellent resistance to U.V. radiation and ozone concentration
Technical	<ul style="list-style-type: none">• Base rubber• Colour black• Solvents none• Solids (%) 100• State cured• Storage Store the membrane in a dry place until use

6. Technical Specifications

1. Physical Properties	Method	Result	Unit
• Specific weight	direct measurement	1150	kg/m ³
• Shore A durometer	ASTM-D-2240	65 ± 10	-
• Tensile strength	UEAtc		
- unaged		≥ 8,0	N/mm ²
- heat aged *		≥ 8,0	N/mm ²
• Elongation	UEAtc		
- unaged		≥ 300	%
- heat aged *		≥ 300	%
• Tear resistance	UEAtc	11,7	N/mm
• Dimensional stability** (free)	UEAtc	≤ 0,5	%
• Low temperature flexibility	DIN 53361	crack free at -30	°C
• Ozone resistance	DIN 7864	crack free	-
• U.V. resistance	ASTM G 53-84	crack free	-
• Static indentation	UEAtc		
- concrete		L ₄	
• Peel resistance	UEAtc		
- concrete		27,8	N

* 84 days at 80° C. - ** 24 hours at 100° C.

2. Packaging				
Thickness (in)	Thickness (mm)	Width (m)	Length (m)	Weight (kg/m ²)
.040"	1,02	6,10-7,62-9,15-12,20-15,25	30,50-45,75-61	1,25
.045"	1,14	3,05-6,10-7,62-9,15-12,20-15,25	30,50-45,75-61	1,41
.060"	1,52	3,05-6,10	30,50	1,95

Note: Special panel sizes are available upon request.

7. Precautions

Take care when moving, transporting or handling to avoid sources of punctures and physical damage. Isolate waste products, such as petroleum products, greases, oils (mineral and vegetable) and animal fats from the Geomembrane.

FormFlash

1. Description

Firestone FormFlash is a self-curing rubber strip, adaptable to irregular shapes and designed to flash the system details in accordance with Firestone specifications.

2. Preparation

Product : During cold weather (< 15°C) the FormFlash may be installed using a heat gun to improve its workability.

Substrate : Must be clean, dry, smooth, free of sharp edges, loose or foreign materials, oil, grease and chemical products that could affect the material.

3. Application

Refer to Firestone installation instructions for flashing. The FormFlash material is to be adhered using Splice Adhesive. The edge of each splice has to be protected with Lap Sealant.

4. Characteristics

Physical	<ul style="list-style-type: none">easily adaptable to irregular shapes and surfacessuperior weathering characteristicsself-curing rubber material, with similar characteristics as the Firestone Geomembrane after 12 months												
Technical	<ul style="list-style-type: none">Base rubberColour blackSolvents noneSolids (%) 100State uncuredThickness (mm) 1,40Packaging <table><thead><tr><th>Width (cm)</th><th>Length (m)</th><th>Packaged</th><th>Weight (kg)</th></tr></thead><tbody><tr><td>15 - 30</td><td>30,5</td><td>2 rolls/ctn</td><td>± 8-16</td></tr><tr><td>45 - 60</td><td>30,5</td><td>1 roll/ctn</td><td>± 24-32</td></tr></tbody></table> <ul style="list-style-type: none">Storage/Shelf Life 12 months, if stored in original unopened carton at temperatures between 15°C and 25°C	Width (cm)	Length (m)	Packaged	Weight (kg)	15 - 30	30,5	2 rolls/ctn	± 8-16	45 - 60	30,5	1 roll/ctn	± 24-32
Width (cm)	Length (m)	Packaged	Weight (kg)										
15 - 30	30,5	2 rolls/ctn	± 8-16										
45 - 60	30,5	1 roll/ctn	± 24-32										

5. Precautions

Keep away from heat sources during storage and installation. Do not expose to the sunlight when stored.

QuickSeam FormFlash

1. Description

QuickSeam FormFlash consists of a 229 mm (9") or 305 mm (12") uncured FormFlash factory laminated to QuickSeam Tape. The strip is designed to flash inside and outside corners, pipes, penetrations and other applications as specified in the Firestone specifications as an alternative to details with FormFlash. Please contact Firestone Technical Department for further information about the use of this product.

2. Preparation

The Geomembrane surfaces and/or mating surfaces must be prepared with QuickPrime Plus, using a QuickScrubber tool. Use of other products is not allowed. Restore the product to room temperature prior to use if exposed to temperatures below 15°C for prolonged periods.

3. Application

On cloudy days with ambient temperature below 15°C, the use of a heat gun is recommended to warm the QuickSeam FormFlash and to ensure good formability. On sunny days, pre-heating of the product is usually not necessary. QuickSeam FormFlash is to be applied as per the Firestone specifications and details.

4. Coverage

In accordance with length of detail.

5. Characteristics

<i>Technical</i>	<i>EPDM Flashing</i>	<i>QuickSeam Tape</i>
<ul style="list-style-type: none">• Base• Colour• Solvents• Solids (%)• State• Thickness (mm)• Width (mm)• Packaging	<p>EPDM Black None 100 Uncured 1,6 229 - 305 15.2 m (50') rolls 2 rolls per carton (9") - 1 roll per carton (12")</p>	<p>Rubber polymers Black None 100 Cured 0,6 235 - 311</p>
	<p><i>Note: QuickScrubber pads and handles are included in each carton. Quantities vary depending on the QuickSeam product.</i></p>	
<ul style="list-style-type: none">• Storage• Shelf life	<p>Store in original unopened carton at temperatures between 15°C and 25°C. Keep the material out of direct sunlight until ready for application. 12 months, when stored in above-mentioned conditions. Verify production date on each roll. Shelf life will be reduced if exposed to higher temperatures.</p>	

Splice Adhesive (SA-1065)

1. Description

Firestone Splice Adhesive is a butyl based contact adhesive designed for field splicing of Firestone Geomembrane panels and FormFlash to Firestone Geomembrane.

2. Preparation

Product : Stir the adhesive before and during use. Restore the adhesive to room temperature prior to use, if exposed to temperatures lower than 15°C.

Substrate : The adhered surfaces must be cleaned with Splice Wash using cotton cloths.

3. Application

Apply in a thick, even, smooth coat on both surfaces with a 75 to 100 mm wide solvent resistant paint brush. Do not use circular motions for applying Splice Adhesive (no paint rollers) and allow the adhesive to flash off prior to mating the surfaces. In cold weather, moisture contamination of the adhesive can occur when condensation/frost forms on the adhesive while the solvents flash off. For further instructions refer to the splicing section.

4. Coverage

A uniform application is required to avoid mixed results. Thinning of the adhesive is not allowed. A coverage rate of 15 lin.m/gal, for a 300 mm wide splice area, on both sides, is recommended.

5. Characteristics

Physical

- excellent moisture resistance
- excellent resistance to heat and cold
- excellent green tack

Technical

- Base synthetic polymers
- Colour black
- Solvents hexane, toluene, xylene
- Solids (%) 26 (min)
- Viscosity (cp) 2.900-3.700
- Weight/gallon (kg) 3,33
- Specific gravity 0,876
- Flash Point (°C) -17,7
- Packaging 1 gallon (3,78 l)
- Storage/Shelf life 9 months if stored in original sealed container at temperatures between 15°C and 25°C.
Once opened, use the adhesive within 48 hours

6. Precautions

Flammable. Keep away from sources of ignition. Do not smoke when using. Store and use the material in well ventilated areas. May cause sensitivity by inhalation. Avoid contact with skin and eyes.

Bonding Adhesive (BA-2004)

1. Description

Firestone Bonding Adhesive is a neoprene-based adhesive designed for bonding Firestone Geomembrane to wood, metal, masonry and other acceptable non rubber substrates.

2. Preparation

Product : Stir the adhesive. Restore the adhesive to room temperature prior to use if exposed to cold temperatures (< 15°C.).

Substrate : Surfaces to which Bonding Adhesive is to be applied must be clean, smooth, dry and free of sharp edges, loose materials, oil, grease and other contaminants. The mating surface of the Geomembrane shall be cleaned with a brush or clean rag.

3. Application

Apply the adhesive in an even, smooth coat on both surfaces with a solvent-resistant paint roller and avoid globs and puddles. Allow adhesive to flash off until tacky (15 to 45 minutes). Test the adhesive for its dryness, using the push-touch test procedure. If the adhesive is ready, mate both surfaces and press with a brush.

4. Coverage

The adhesive must be applied at a uniform rate to both the back of the Geomembrane and the substrate. If the applicator can place a finger or hand directly on the adhesive without feeling some degree of tackiness, the application is too thin and the adhesive should be re-applied. Thinning of the adhesive is not allowed. The normal coverage rate is 5 tot 6 m² both sides, per gallon.

5. Characteristics

Physical

- excellent resistance to ageing
- excellent adhesive strength to different applications
- good resistance to heat, cold and water

Technical

- Base polychloroprene
- Colour amber
- Solvents toluene, acetone, hexane
- Solids (%) 23 (min)
- Viscosity (cp) 2.300-3.000
- Weight/Gallon (kg) 3,2
- Specific gravity 0,84
- Flash Point (°C) < -17,7
- Packaging 5 gallon pail
- Storage/Shelf life 12 months if stored in original sealed container at temperatures between 15° and 25°C.
Once opened, use the adhesive within 48 hours.

6. Precautions

Flammable. Keep away from sources of ignition. Do not smoke when using. Store and use the material in well ventilated areas. May cause sensitivity by inhalation. Avoid contact with skin and eyes.

QuickSeam 3" (76 mm) Splice Tape

1. Description

Firestone QuickSeam Splice Tape is designed for field splicing of Firestone Geomembrane panels.

2. Preparation

Product : Restore the tape to room temperature prior to use if exposed to temperatures below 15°C for prolonged periods.

Substrates : The Geomembrane surfaces must be prepared with QuickPrime using the QuickScrubber tool.

3. Application

Refer to splicing section for specific installation instructions. Use of Firestone QuickPrime and Quick-Scrubber is required.

4. Characteristics

Physical	<ul style="list-style-type: none">• excellent moisture resistance• excellent resistance to heat and cold• excellent green tack
Technical	<ul style="list-style-type: none">• Base rubber polymers• Colour black• Solvents none• Solid (%) 100• Specific gravity 0,98 ± 0,02• Cure state cured• Thickness 0,76 mm +/- 0,127 mm• Packaging Length : 30,48 m per roll - 6 rolls/per box Width : 76 mm• Storage/Shelf life 12 months when stored at temperatures between 15 °C and 25 °C in original unopened carton Storage period is shortened at high temperatures Keep in box on site and out of the sun

Splice Wash (SW-100)

1. Description

Firestone Splice Wash is designed to clean and prepare the Firestone Geomembrane in areas to receive Splice Adhesive. It is not designed to prepare the Geomembrane prior to the installation of QuickSeam Splice Tape.

2. Preparation

Substrate : Remove excess accumulations of dirt with a brush (and water) prior to application.

3. Application

Apply Splice Wash to the splicing area using clean cotton rags in a scrubbing motion until the splicing surface is dull black in colour. Take extra care at factory seams and allow the cleaned surfaces to dry.

4. Coverage

Coverage rate for 300 mm one side, is 60 lin.m. per gallon.

5. Characteristics

Physical	<ul style="list-style-type: none">• Flammable liquid
Technical	<ul style="list-style-type: none">• Colour Clear• Solvents Aliphatic Hydrocarbon• Viscosity Very thin, free flowing• Weight/gallon (kg) 2,676• Specific gravity 0,75• Flash Point (°C) 12,8• Boiling Point (°C) 119• Packaging 5 gallon (13,4 kg)• Storage/Shelf life 12 months if stored in original unopened container at temperatures between 15° and 25°C Keep the material out of direct sunlight until ready for immediate use

6. Precautions

Flammable. Keep away from sources of ignition. Do not smoke when using. Store and use the material in a well ventilated place. Do not empty into drains.

QuickPrime Plus

1. Description

Firestone QuickPrime Plus is designed to clean and prime the Geomembrane in seaming areas, before application of the QuickSeam Splice Tape. The Primer activates the Geomembrane surface and ameliorates the seam quality.

Firestone QuickPrime Plus must be applied with a QuickScrubber. It may also be used to clean the Firestone Geomembrane prior to the application of the Firestone Splice Adhesive.

2. Preparation

Product : Stir thoroughly before and during use.

Substrate : Surfaces to be primed must be clean, dry, free of foreign materials, talc and dirt. Clean with broom if required.

3. Application

Apply QuickPrime Plus to the Firestone Geomembrane surfaces with the QuickScrubber tool using long back and forth strokes with moderate to heavy pressure along the length of the area until surfaces become dark grey in colour with no streaking or puddling. Allow the primed surfaces to dry completely (usually less than 10 minutes) before applying QuickSeam Splice Tape or Splice Adhesive.

4. Coverage

Coverage rate of $\pm 10 \text{ m}^2$, both sides, or $\pm 60 \text{ lin.m.}$ of standard 3" seam per gallon. Thinning is not allowed.

5. Characteristics

Physical

- excellent resistance to ageing
- excellent resistance to heat and cold
- translucent when dry which allows guide marks to show through after application.

Technical

- Base synthetic rubber polymers
- Colour Translucent grey
- Solvents Heptane, toluene , methyl alcohol
- Solids (%) 16-18
- Viscosity Very thin, free flowing
- Weight/gallon (kg) 3
- Specific gravity 0,793
- Flash Point (°C) -17,77
- Packaging 1 gallon (3,8 l) and 3 gallon (11,4 l) pails
- Storage/Shelf life 12 months if stored in original unopened container at temperatures between 15 °C and 25 °C

6. Precautions

Flammable. Keep away from sources of ignition. Do not smoke when using. Store and use the product in well ventilated areas. Avoid contact with skin and eyes. Do not empty into drains.

Lap Sealant HS

1. Description

Firestone Lap Sealant is designed to seal and mechanically protect the exposed edge of all field fabricated seams made with Splice Adhesive.

2. Preparation

Product : Restore to room temperature prior to use if exposed to temperatures < 15 °C for a prolonged period.

Substrate : Surfaces on which Lap Sealant is to be applied must be clean, dry, free from loose and foreign materials, oil and grease and primed with Splice Adhesive. Wait minimum 4 hours between splicing and application of Lap Sealant. Under bad weather conditions Lap Sealant must be applied before end of the working day.

3. Application

Apply with a mastic gun a bead of Lap Sealant along the properly cleaned, exposed Geomembrane lap edge. A preformed tool shall be used to feather the bead of sealant. Feathering must take place immediately after the Lap Sealant is applied.

4. Coverage

7 lin.m. per cartridge. Thinning is not allowed.

5. Characteristics

Physical

- excellent resistance to ozone, ultra violet and general weathering
- excellent resistance to heat, cold and water
- good adhesion to Firestone Geomembrane sheet, metals, wood and concrete
- good slump resistance

Technical

- Base rubber polymers
- Colour black
- Solvents light aliphatic solvent
- Solids (%) min. 80
- Weight/gallon (kg) 4,24
- Specific gravity 1,34-1,46
- Flash Point (°C) 11
- Packaging 25 tubes/carton
- Storage/Shelf life 12 months when stored in original sealed containers at temperatures between 15° and 25°C.

6. Precautions

Flammable. Keep away from sources of ignition. Do not smoke when using. Use in a well ventilated place.

Water Block Seal (S-20)

1. Description

Firestone Water Block Seal is designed to provide a watertight seal as indicated in the details.

2. Preparation

Product : Restore to room temperature prior to use if exposed to temperatures < 15 °C for a prolonged period.

Substrate : Surfaces onto which Water Block Seal is to be applied shall be free from loose parts of concrete, stone, mortar, foreign materials, and other contaminants.

3. Application

Apply a bead onto the substrate surface. Roll or press the flashing membrane firmly against the seal and substrate avoiding wrinkles to assure a complete seal. Install the appropriate Firestone detail as per Firestone's current specification.

4. Coverage

3 lin.m. per tube or 4 drains per tube

5. Characteristics

Physical

- excellent resistance to ageing
- good resistance to heat, cold and water
- non drying, adheres well to Firestone Geomembrane sheets, metals, wood and concrete
- good slump resistance

Technical

- Base butyl rubber
- Colour grey
- Solvents heptane
- Solids 86 %
- Viscosity (27°C) (cp) 1.600.000 ± 300.000
- Weight/Gallon (kg) 5,0
- Specific Gravity 1,33
- Flash Point (°C) -10,0
- Packaging 25 tubes/carton
- Storage/Shelf life 12 months if stored in original sealed container at temperatures between 15° and 25 °C

6. Precautions

Flammable. Keep away from sources of ignition. Do not smoke when using. Use in well ventilated place and do not breathe fumes.

Termination Bar

1. Description

Firestone Termination Bar is designed for attaching and sealing flashing terminations as per Firestone's current specifications.

2. Preparation

Product : When field cutting is necessary, remove any burrs from the bar and clean up shavings that may result from cutting.

Substrate : Must be free from dust, dirt, oil, water and other contaminants prior to installation and needs to provide the required pull-out resistance.

3. Application

Install Water Block Seal behind flashing. Anchor the bar through pre-punched holes at a rate to maintain a tight compression to the wall against Water Block Seal. Remove excess flashing material above and install Lap Sealant into the upper channel. Keep each piece (3.05 m) of Termination Bar separated from adjoining bar by 6 mm and cut the bar at inside and outside corners.

4. Characteristics

• Material	Corrosion-resistant aluminium
• Length (m)	3,05
• Width (mm)	27,4
• Thickness (mm)	2,2
• Holes (mm)	7,1 x 9,9 slotted holes - 100 mm on centre
• Packaging	50 pieces of 3,05 lin.m. per carton (152,4 m)
• Storage	in a dry place