

Flexamat Plus FR Specification

1. DESCRIPTION

A Tied Concrete Block Mat with Triple Layered Underlayment and manufactured with a flame retardant stabilized interlocking geogrid. This work shall consist of furnishing and placing the system in accordance with this specification and conforming with the lines, grades, design, and dimensions shown on the plans.

2. MATERIALS

Flexamat Plus FR is manufactured from individual concrete blocks tied together with high strength flame retardant bi-axial geogrid. Each block is tapered, beveled and interlocked and includes connections that prevent lateral displacement of the blocks within the mats when they are lifted for placement.

Tied Concrete Block Mat with Triple Underlayment FR shall be Flexamat Plus FR, manufactured by Motz Enterprises, Inc.

2.1. **Blocks.** Furnish blocks manufactured with concrete conforming to the cement requirements of ASTM C150 and to the aggregate requirements of ASTM C33. Blocks shall have a minimum weight of 3 lbs. per block and placed no further than 2 in. apart. Material shall have a weight per square foot not exceeding 10 lbs. Blocks shall have a 2.25" profile, a flat-top pyramid shape, and a coarse finish without protrusions. Concrete shall have a minimum compressive strength requirement of Table1, certified by a third party.

Table 1
Concrete Compressive Strength Requirements

Age	Required Compressive Strength psi
28 - Day	5000 psi

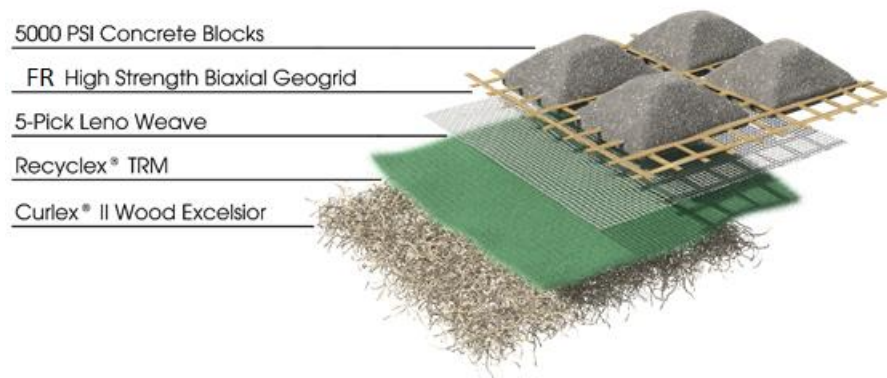
2.2. **Bi-Axial Geogrid.** The interlocking geogrid shall be composed of polyester yarns crafted into a stable interlocked pattern. The multifilament yarns are knitted and coated in tension and designed to resist degradation in environments with exposure to water and low pH (<4 pH) and high pH (>9 pH). The geogrid shall then be subsequently coated with a flame-resistant synthetic coating with a yellow color (for identification). When combined with the revetment mat, this will yield a durable, high tenacity, low elongating, and continuous filament polyester fibers that is securely cast into and embedded within the base of the concrete blocks and obtains connection strength greater than that of the geogrid. Ensure the geogrid meets physical requirements of Table 2.

Table 2 - FR Geogrid Requirements

Property	Test	Requirement
Mass/Unit Area	ASTM D5261	10 oz/yd ²
Geogrid Raw Material		PET
Flame Retardant Coating		Polymer
Aperture Size	Measured	2.17 x 2.17 inch
Open Area of Grid	CWO 22125	90%
Ultimate Tensile Strength Machine Direction (MD)	ASTM D-6637	2398 lb/ft
Ultimate Tensile Strength Cross Machine Direction (CMD)	ASTM D-6637	2398 lb/ft
Wide Width Tensile Strength @ 5% Strain Machine Direction (MD)	ASTM D-6637	1,165 lb/ft
Wide Width Tensile Strength @ 5% Strain Cross Machine Direction (CMD)	ASTM D-6637	1,165 lb/ft
Elongation at Ultimate Tensile Strength (MD x CMD)	ASTM D6637	≥11%
Flame Test - MSHA	ASTP 5011	
Color	Visual	Yellow
Complies with Standardized Small Scale Flame Test Procedure for the Acceptance of Geogrid Material from Mine Safety and Health Administration, Version ASTP5011 2010-02-12		

2.3. **Triple Underlayment material included within rolls** – System underlayment material are required to be packaged within the tied concrete block mat rolls to ensure proper installation.

Flexamat Plus FR – A four-layered system must include, in order from top to bottom, 1) Concrete block mat 2) 5-Pick Leno Weave 3) Recyclax TRM-V and 4) Curlx® II. The underlayment materials shall be packaged within the roll of the Flexamat Plus FR.



Leno Weave Five-Pick Weave:

This is a woven, white polypropylene netting that provide added strength and support to the underlayments.

<u>Index Property</u>	<u>Units</u>	<u>Value</u>
GSM	g/m ²	118 (-3 ~ +3)
Density	Picks/10cm	62 x 24 (+/- 2)
Warp Strength	N/5cm	≥ 350
Warp Elongation	%	20 - 50
Weft Strength	N/5cm	≥ 280
Weft Elongation	%	20 - 50
Warp Shrinkage	%	≤ 7
Weft Shrinkage	%	≤ 9

Recyclex® TRM:

Recyclex TRM – V is a permanent non-degradable Turf Reinforcement Mat (TRM), consists of 100% post-consumer recycled polyester (green or brown bottles) with 80% five-inch fibers or greater fiber length. It is of consistent thickness with fibers evenly distributed throughout the entire area of the TRM. The top and bottom of each TRM is covered with heavy duty polypropylene net. Fibers are tightly crimped and curled to allow fiber interlock, and to retain 95% memory of the original shape after loading by hydraulic events. **Fibers are required to have a specific gravity greater than 1.0; ensuring the blanket will not float during hydraulic events.** Recyclex TRM – V meets Federal Government Executive Order initiatives for use of products made from, or incorporating, recycled materials. Recyclex TRM – V shall be manufactured in the U.S.A. and the fibers shall be made from 100a% recycled post-consumer goods.

<u>Index Property</u>	<u>Test Method</u>	<u>Value</u>
Thickness	ASTM D 6525	0.294 in (7.47 mm)
Light Penetration	ASTM D 6567	57%
Resiliency	ASTM D 6524	86%
Mass per Unit Area	ASTM D 6566	0.50 lb/yd ² (271 g/m ²)
MD-Tensile Strength Max.	ASTM D 6818	295.2 lb/ft (4.32 kN/m)
TD-Tensile Strength Max.	ASTM D 6818	194.4 lb/ft (2.85 kN/m)
MD-Elongation	ASTM D 6818	32.2%
TD-Elongation	ASTM D 6818	40.8%
Swell	ECTC Procedure	8%
Water Absorption	ASTM D 1117/ECTC	33.8%
Specific Gravity	ASTM D 792	1.21
UV Stability	ASTM D 4355 (1,000 hr)	80% minimum
Porosity	Calculated	97.5%
Bench-Scale Rain Splash	ECTC Method 2	SLR = 5.86 @ 2 in/hr ^{1,2}
Bench-Scale Rain Splash	ECTC Method 2	SLR = 5.00 @ 4 in/hr ^{1,2}
Bench-Scale Rain Splash	ECTC Method 2	SLR = 6.33 @ 6 in/hr ^{1,2}
Bench-Scale Shear	ECTC Method 3	2.41lb/ft ² @ 0.5 in soilloss ²
Germination Improvement	ECTC Method 4	432%

¹ SLR is the Soil Loss Ratio, as reported by NTPEP/AASHTO. ² Bench-scale index values should not be used for design purposes

Curlex® II:

Curlex II erosion control blanket (ECB) consists of a specific cut of naturally seed free Great Lakes Aspen curled wood excelsior with 80% six-inch fibers or greater fiber length. It is of consistent thickness with fibers evenly distributed throughout the entire area of the blanket. The top and bottom of each blanket is covered with degradable polypropylene netting.

<u>Index Property</u>	<u>Test Method</u>	<u>Value</u>
Thickness	ASTM D 6525	0.418 in (10.62 mm)
Light Penetration	ASTM D 6567	34.6%
Resiliency	ASTM D 6524	64%
Mass per Unit Area	ASTM D 6475	0.57 lb/yd ² (309 g/m ²)
MD-Tensile Strength Max.	ASTM D 6818	127.0 lb/ft (1.9 kN/m)

TD-Tensile Strength Max.	ASTM D 6818	50.9 lb/ft (0.7 kN/m)
MD-Elongation	ASTM D 6818	28.64%
TD-Elongation	ASTM D 6818	29.84%
Swell	ECTC Procedure	89%
Water Absorption	ASTM D 1117/ECTC	199%
Bench-Scale Rain Splash	ECTC Method 2	SLR = 6.84 @ 2 in/hr ^{2,3}
Bench-Scale Rain Splash	ECTC Method 2	SLR = 7.19 @ 4 in/hr ^{2,3}
Bench-Scale Rain Splash	ECTC Method 2	SLR = 7.56 @ 6 in/hr ^{2,3}
Bench-Scale Shear	ECTC Method 3	2.6lb/ft ² @ .5 in soil loss ³
Germination Improvement	ECTC Method 4	645%

¹ Weight is based on a dry fiber weight basis at time of manufacture. Baseline moisture content of Great Lakes Aspen excelsior is 22%.

² SLR is the Soil Loss Ratio, as reported by NTPEP/AASHTO. ³ Bench-scale index values should not be used for design purposes.

2.4. Cover the Flexamat Plus FR or otherwise protect it during long periods of storage to protect against degradation of the backing material as recommended by the manufacturer.

2.5. Mats will be rolled for shipment and packaged with lifting straps. Upon delivery, rolls may be left exposed for up to 30 days. If exposure will exceed 30 days, cover or tarp the rolls to minimize exposure.

All mats to be inspected upon delivery. Assure that all units are sound and free of defects that would interfere with the proper placing of the unit or impair the strength or permanence of the construction.

Chipping or missing concrete resulting in a weight loss exceeding 15% of the average weight of a concrete unit is grounds for rejection by the engineer. Replace, repair or patch the damaged areas per the manufacturer's recommendations.

3. PERFORMANCE

Full-Scale laboratory testing performed by an independent 3rd party testing facility with associated engineered calculations certifying the hydraulic capacity of the proposed TCBM meets the following requirements:

Test	Tested Value	Bed Slope	Soil Classification	Limiting Value
ASTM 6460	Shear Stress	30%	Sandy Loam (USDA)	24lb./ft ²
ASTM 6460	Velocity	20%	Loam (USDA)	30 ft./sec

4. ALTERNATIVE PRODUCTS

Such products must be pre-approved in writing by the Engineer prior to bid date. Alternative product packages must be submitted to the Engineer a minimum of fifteen (15) days prior to bid date. Submittal packages for alternate products must include, as a minimum, the following:

4.1.1. Alternative Product Properties – Product must be comprised of materials as detailed in Section 2, including both in composition, underlayment layers and performance requirements.

4.1.2. Full-Scale laboratory testing performed by an independent 3rd party testing facility with associated engineered calculations certifying the hydraulic capacity of the proposed Tied-Concrete Block Erosion Control Mat meets the performance requirements listed in Section 3 of this specification.

- 4.2. A list of 5 comparable projects in terms of project size, application and utilizing the type of Flame Retardant interlocking bi-axial geogrid in the United States, where the results of the specific alternative material's use can be verified and reviewed for system integrity and sustained after a minimum of 5 years of service life.

5. EQUIPMENT

Provide the proper equipment to place the mat that will not damage the mat material or disturb the soil subgrade and seed bed.

6. CONSTRUCTION

Prior to installing Flexamat Plus FR, prepare the subgrade as detailed in the plans. All subgrade surfaces to be smooth and free of rocks, roots, debris, or other protrusions that would prevent intimate contact between the block and the subgrade. When seeding is shown on the plans, provide subgrade material that can sustain growth.

Ensure the prepared subgrade provides a smooth, firm, and unyielding foundation for the mats. The subgrade shall be graded into a parabolic or trapezoidal shape to concentrate flow to middle of mat or mats.

Distribute seed on the prepared topsoil subgrade before installation of the tied concrete block mats in accordance with the specifications.

Install mats to the line and grade shown on the plans and per the specification. The manufacturer or authorized representative will provide technical assistance during preparation and installation of the concrete block mats as needed.

Provide a minimum 18 in. deep concrete mat embedment toe trench at all edges exposed to concentrated flows. Recess exterior edges subject to sheet flow a minimum of 6 in.

Areas that require mat seams parallel to concentrated flows are required to install mats with an interlocking geogrid and underlayment extension on the long edge for overlapping and anchoring the adjacent mat. Extensions shall be comprised of the mat's interlocking geogrid and all three layers of the Plus underlayment system.

Provide fastening or anchoring as recommended by the manufacturer or engineer for the site conditions.

7. MEASUREMENT

This Item will be measured by the square footage used, complete in place.

8. PAYMENT

The work performed, and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for Flexamat Plus FR. This price is full compensation for loading and transporting, placing concrete block mats; excavation and disposal; furnishing topsoil and bedding; and equipment, labor, materials, tools, and incidentals.