

ENGINEERING BULLETIN



EB601 MANUFACTURING QUALITY CONTROL (MQC) PROGRAM FOR GEOSYNTHETIC PRODUCTS

GENERAL INFORMATION

Propex is the leading erosion control and geotextile company in the world. With test lab certification from the Geosynthetic Accreditation Institute Laboratory Accreditation Program (GAILAP) and a quality system that is designed to be compliant with ISO manufacturing standards, we're committed to developing and manufacturing the highest-quality, most technologically advanced products available.

RESPONSIBILITIES & AUTHORITY

The Geosynthetic Manufacturing Quality Control (MQC) Program is administered jointly by the Engineering Services Group within the Geotextile Systems Business Unit and by the Quality Assurance function within Manufacturing. It shall be the responsibility of the Quality Assurance (QA) Leaders and their testing labs at each of the individual plants to adhere to this document.

The Site Quality Assurance Leaders, Product Engineers and Engineering Services at Propex share the responsibility for the quality of the Geosynthetic products produced both internally and externally.

RESIN

Each lot of resin is shipped by truck or rail car to our manufacturing facilities. Each lot is certified by the resin manufacturer to meet the stringent acceptance requirements set forth by Propex. An in-house laboratory randomly tests resin for melt ow, pellet sizing, and other acceptance criteria.

MANUFACTURING PROCESS

Quality Assurance (QA) works closely with Engineering Services to insure only first quality geosynthetic products are produced at Propex. Defect prevention and continuous improvement are emphasized during all stages of the manufacturing process.

It is the responsibility of Manufacturing and QA to establish and utilize statistical process control programs when necessary. Manufacturing provides process condition sheets for each production run. All process changes are carefully recorded and monitored by both Process Engineering and Manufacturing personnel. All changes to products and processes are qualified, approved and communicated through the Propex Engineering Change Notification (ECN)

Process; records of all changes to product and process are maintained.

Manufacturing teammates continually monitor production lines for visual defects in geosynthetic products. All process conditions are monitored to insure lot to lot consistency. All manufacturing jobs and processes are carried out in accordance with written job descriptions and standard work procedures.

Product property conformance is constantly monitored by manufacturing personnel and Quality Assurance. Should a nonconforming product be noted, the QA group initiates containment and corrective action procedures immediately. Both departments work together in solving the problem. The control of nonconforming products is done in accordance with written procedures to insure that proper labeling, segregation, and dispositioning takes place.

QUALITY CONTROL TESTING

Propex will meet or exceed the sampling frequency requirements for physical properties outlined in ASTM D-4354. All samples are taken and tested in accordance with written procedures. Products are sent to independent third-party laboratories as needed to insure test method reliability. Non conformities located during quality control tests are controlled in accordance with written procedures to insure that proper labeling, segregation, and dispositioning takes place.

GEOTEX® NONWOVEN GEOTEXTILES

Quality Manager/Laboratory Leader is responsible for the QA program at the Ringgold, Georgia manufacturing plants. Under their direction, the staff lab teammates test the following physical properties of nonwoven geotextiles produced as follows:

(continued)

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	Property	Units	Test Method	Minimum Frequency			
				< 200 g/m ² (<6 oz/yd ²)	>200g/m ² (>6oz/yd ²)		
Index	Mass per Unit Area	g/m ² (oz/yd ²)	ASTM D-5261	15,000 m ² (162,000 ft ²)	8,360 m ² (90,000 ft ²)		
	Grab Tensile	N (lbs)	ASTM D-4632				
	Elongation	%	ASTM D-4632				
	Trapezoidal Tear	N (lbs)	ASTM D-4533				
Design	CBR Puncture	N (lbs)	ASTM D-6241	93,000 m ² (1,000,000 ft ²)	47,000 m ² (500,000 ft ²)		
	Permeability	cm/sec	ASTM D-4491				
	Water Flow Rate	l/min/m ² (gal/min/ft ²)	ASTM D-4491				
	Permittivity	sec ⁻¹	ASTM D-4491				
	AOS	mm (US sieve size)	ASTM D-4751				
	Thickness	mm (mils)	ASTM D-5199				
	Puncture	N (lbs)	ASTM D-4833			465,000 m ² (5,000,000 ft ²)	235,000 m ² (2,500,000 ft ²)
	Mullen Burst	kPa (psi)	ASTM D-3786				
	Wide Width Tensile	kN/m (lbs/in)	ASTM D-4595				
	Xenon Arc (UV)	% Tensile Retained	ASTM D-4355			Once per year on 401, 801, and 1601 products	

	Property	Units	Test Method	Minimum Frequency	
					Index
	Elongation	%	ASTM D-4632*		
	Trapezoidal Tear	N (lbs)	ASTM D-4533*		
Design	Mullen Burst	kPa (psi)	ASTM D-3786	See Attachment	
	CBR Puncture	N (lbs)	ASTM D-6241		
	AOS	mm (US sieve size)	ASTM D-4751		
	Water Flow Rate	l/min/m ² (gal/min/ft ²)	ASTM D-4491		
	Permittivity	sec ⁻¹	ASTM D-4491		
	Permeability	cm/sec	ASTM D-4491		
	Wide Width Tensile	kN/m (lb/in)	ASTM D-4595*		
	Wide Width Elongation	%	ASTM D-4595*		
	Puncture	N (lbs)	ASTM D-4833		
	Thickness	mm (mils)	ASTM D-5199		
	Mass per Unit Area	g/m ² (oz/yd ²)	ASTM D-5261		
	Xenon Arc (UV)	% Tensile Retained	ASTM D-4355		Once per year
	Count	Ends/in. Picks/in.	ASTM D-3775		Once per style change

Propex takes systematic action to prevent needles or any other metallic items from being shipped in our nonwoven products to customers. This is carried out through the use of in-line detection and removal devices.

Testing shall be completed and recorded within a timely manner after material receipt in the testing laboratory.

GEOTEX® ENVIRONMENTAL NONWOVEN GEOTEXTILES

Quality Manager/Laboratory Leader is responsible for the QA program at the Ringgold, Georgia manufacturing plants. Under their direction, the staff lab teammates test the following physical properties of nonwoven environmental geotextiles produced as follows:

	Property	Units	Test Method	Minimum Frequency
				>200g/m ² (>6oz/yd ²)
Index	Mass per Unit Area	g/m ² (oz/yd ²)	ASTM D-5261	8,360 m ² (90,000 ft ²)
	Grab Tensile	N (lbs)	ASTM D-4632	
	Elongation	%	ASTM D-4632	
	Trapezoidal Tear	N (lbs)	ASTM D-4533	
	Puncture	N (lbs)	ASTM D-4833	
	Mullen Burst	kPa (psi)	ASTM D-3786	
Design	CBR Puncture	N (lbs)	ASTM D-6241	47,000 m ² (500,000 ft ²)
	Permeability	cm/sec	ASTM D-4491	
	Water Flow Rate	l/min/m ² (gal/min/ft ²)	ASTM D-4491	
	Permittivity	sec ⁻¹	ASTM D-4491	
	AOS	mm (US sieve size)	ASTM D-4751	
	Thickness	mm (mils)	ASTM D-5199	
	Wide Width Tensile	kN/m (lbs/in)	ASTM D-4595	
Xenon Arc (UV)	% Tensile Retained	ASTM D-4355	Once per year on 401, 801, and 1601 products	

Propex takes systematic action to prevent needles or any other metallic items from being shipped in our nonwoven products to customers. This is carried out through the use of in-line detection and removal devices.

Testing shall be completed and recorded within a timely manner after material receipt in the testing laboratory.

GEOTEX® WOVEN SLIT TAPE GEOTEXTILES

Quality Manager/Laboratory Leader is responsible for the QA program at the Nashville, Georgia manufacturing plant. Under their direction, the laboratory teammates test the following physical properties of the woven slit tape geotextiles produced as follows:

*Both machine and cross-machine directions tested.

**With the exception of Xenon arc, one sample per lot shall be tested, at minimum, for runs of material less than listed frequencies.

Testing shall be completed and recorded within a timely manner after material receipt in the testing laboratory.

GEOTEX® WOVEN MONOFILAMENT GEOTEXTILES

Quality Manager/Laboratory Leader is responsible for the QA program at the Ringgold, Georgia manufacturing plant. Under their direction, the staff lab teammates test the following physical properties of woven mono filament geotextiles produced as follows:

	Property	Units	Test Method	Minimum Frequency	
					Index
	Elongation	%	ASTM D-4632*		
	Trapezoidal Tear	N (lbs)	ASTM D-4533*		
	AOS	mm (US sieve size)	ASTM D-4751		
	Permittivity	sec ⁻¹	ASTM D-4491		
	Water Flow Rate	l/min/m ² (gal/min/ft ²)	ASTM D-4491		
	Permeability	cm/sec	ASTM D-4491		
	Puncture	N (lbs)	ASTM D-4833		
	CBR Puncture	N (lbs)	ASTM D-6241		
	Mass per Unit Area	g/m ² (oz/yd ²)	ASTM D-5261		
Design	Mullen Burst	kPa (psi)	ASTM D-3786	See Attachment	
	Thickness	mm (mils)	ASTM D-5199		
	% Open Area	%	Light Projection Method		
	Wide Width Tensile	kN/m (lb/in)	ASTM D-4595*	See Attachment	
	Wide Width Elongation	%	ASTM D-4595*		
Xenon Arc (UV)	% Tensile Retained	ASTM D-4355	Once per year		

*Both machine and cross-machine directions tested.

**With the exception of Xenon arc, one sample per lot shall be tested, at minimum, for runs of material less than listed frequencies.

Testing shall be completed and recorded within a timely manner after material receipt in the testing laboratory.

GEOTEX® MEDIUM AND HIGH STRENGTH WOVEN GEOTEXTILES

Quality Manager/Laboratory Leader is responsible for the QA program at the Ringgold, Georgia manufacturing plant. Under their direction, the staff lab teammates test the following
(continued)

physical properties of medium and high strength woven geotextiles produced as follows:

Property		Units	Test Method	Minimum Frequency
Prop	Aperture Dimensions**	mm (in)	Measured	Per Lot
	Minimum Rib Thickness**	mm (in)	Measured	
	Tensile Strength @ 2% Strain	kN/m (lb/in)	ASTM D-6637	
	Tensile Strength @ 5% Strain	kN/m (lb/in)	ASTM D-6637	
	Ultimate Tensile Strength	kN/m (lb/in)	ASTM D-6637	
Structural Integrity	Junction Strength	kN/m (lb/in)	GRI-GG2-05	Per Lot
	Resistance to Installation Damage Resistance to Long-term Degradation Resistance to UV Degradation	%SC/%SW/%GP %	ASTM D-5818 & ASTM D-6637 EPA 9090 ASTM D-4355	

1. Resistance to in-plane rotational movement measured by applying a 20 kg-cm (2 m-N) moment to the central junction of a 9 inch x 9 inch specimen restrained at its perimeter in accordance with U.S. Army Corps of Engineers Methodology for measurement of Torsional Rigidity.

*For BXP geogrids both machine and cross-machine directions are tested. For UXP geogrids only machine direction is tested. **Aperture Dimensions & Minimum Rib Thickness will be measured by Propex's QA/QC Department in Ringgold once per lot.

GEOTEX® WOVEN SILT FENCE GEOTEXTILES

Quality Manager/Laboratory Leader is responsible for the QA program at the Hazelhurst, Georgia manufacturing plant. Under their direction, the staff lab teammates test the following physical properties of woven slit tape geotextiles produced as follows:

Property		Units	Test Method	Minimum Frequency
Index	Grab Tensile	N (lbs)	ASTM D-4632*	See Attachment
	Elongation	%	ASTM D-4632*	
	Trapezoidal Tear	N (lbs)	ASTM D-4533*	
	Mullen Burst	kPa (psi)	ASTM D-3786	
Design	Puncture	N (lbs)	ASTM D-4833	See Attachment
	Permittivity	sec ⁻¹	ASTM D-4491	
	Permeability	cm/sec	ASTM D-4491	
	AOS	mm (US sieve size)	ASTM D-4751	
	Water Flow Rate	l/min/m ² (gal/min/ft ²)	ASTM D-4491	
	Mass per Unit Area	g/m ² (oz/yd ²)	ASTM D-5261	
Xenon Arc (UV)	% Tensile Retained	ASTM D-4355	Once per year	

*Both machine and cross-machine directions tested.

**With the exception of Xenon arc, one sample per lot shall be tested, at minimum, for runs of material less than frequencies listed above.

LANDLOK® EROSION CONTROL BLANKETS

The Corporate Quality Department will be responsible for the QA program for Erosion Control Blankets. Under their direction, the laboratory tests the following physical properties of the erosion control blankets as follows:

Property	Units	Test Method	Frequency
Roll Weight	kg (lbs)	Measured	Every Roll
Mass per Unit Area	g/m ² (oz/yd ²)	ASTM D-6475	Every Lot
Ultimate Tensile Strength	kN/m (lbs/ft)	ASTM D-6818	
Ultimate Elongation	%	ASTM D-6818	
Light Penetration	%	ASTM D-6567	As Requested
Thickness	mm (in)	ASTM D-6525	

LANDLOK® TURF REINFORCEMENT MATS

Quality Manager/Laboratory Leader is responsible for the QA program at the Ringgold, Georgia manufacturing plant. Under their direction, the staff lab teammates test the following physical properties of the turf reinforcement mats produced as follows:

Property	Units	Test Method	Minimum Frequency
Roll Weight	kg (lbs)	-	Every Role
Thickness	mm (mils)	ASTM D-5199	16,722 m ² (180,000 ft ²)
Mass per Unit Area	g/m ² (oz/yd ²)	ASTM D-5261	
Light Penetration	%	ASTM D-6567	
Ultimate Tensile	kN/m (lbs/ft)	ASTM D-6818	16,722 m ² (180,000 ft ²)
Ultimate Elongation	%	ASTM D-6818	
Resiliency	%	ASTM D-6524	93,000 m ² (1,000,000 ft ²)
Flexibility	mg-cm (in-lb)	ASTM D-6575 - ECTC Guidelines	
UV Resistance	%	ASTM D-4355	Annually
Seedlings Emergence	-	Draft Method 4	Every three years per NTPEP
Shear Stress (Large Scale)	Lb/ft ²		As required
Mannings "N"	Calculated		As required

PYRAMAT® & LANDLOK® 300 WOVEN TURF REINFORCEMENT MATS

Quality Manager/Laboratory Leader is responsible for the QA program at the Ringgold, Georgia manufacturing plant. Under their direction, the staff lab teammates test the following physical properties of the turf reinforcement mats produced as follows:

Property		Units	Test Method	Minimum Frequency
Index	Roll Weight	Kg (lbs)	-	Every Roll
	Mass per Unit Area	g/m ² (oz/yd ²)	ASTM D-5261	See Attachment
	Thickness	mm	ASTM D-6525	
	Light Penetration	%	ASTM D-6567	
	Ultimate Tensile	kN/m (lbs.ft)	ASTM D-6818	
Ultimate Elongation	%	ASTM D-6818		
Design	Resiliency	%	ASTM D-6524	See Attachment
	Flexibility	mg-cm	ASTM D-6575 ECTC Guidelines	
	UV Resistance	%	ASTM D-4355	
Moisture Absorption	%	ASTM D-570	Annually	

PETROMAT NONWOVEN PAVING FABRICS

Quality Manager/Laboratory Leader is responsible for the QA program at the Ringgold, Georgia manufacturing plant. Under their direction, the staff lab teammates test the following physical properties of the nonwoven geotextiles produced as follows:

Property	Units	Test Method	Minimum Frequency
Mass per Unit Area	g/m ² (oz/yd ²)	ASTM D-5261	15,000 m ² (162,000 ft ²)
Grab Tensile	N (lbs)	ASTM D-4632	
Elongation	%	ASTM D-4632	
Mullen Burst	kPa (psi)	ASTM D-3786	
Asphalt Retention	l/m ² (gal/yd ²)	ASTM D-6140	Annually

Propex takes systematic action to prevent needles or any other metallic items from being shipped in our nonwoven products to customers. This is carried out through the use of in-line detection and removal devices.

Testing shall be completed and recorded within a timely manner after material receipt in the testing laboratory.

PETROTAC PAVING PRODUCT

Quality Manager/Laboratory Leader is responsible for the QA program at the Ringgold, Georgia manufacturing plant. Actual testing may be performed by an independent third party such as Texas Research Institute or equivalent. Under their direction, outside lab teammates test the following physical properties of the nonwoven geotextiles as follows:

Property	Units	Test Method	Minimum Frequency
Strip Tensile	N/m (lbs/in)	ASTM D-882 (modified)	Twice Annually
Puncture Resistance	N (lbs)	ASTM E-154	
Permeance - Perms	-	ASTM E-96 Method B	
Pliability	# of Cracks	ASTM D-146	
Thickness	mm (mils)	ASTM D-5199	

CUSTOM GEOTEXTILES

Respective Quality Manager/Laboratory Leader is responsible for the QA program at the manufacturing plant. Test properties of the product are determined by the customer.

RECORD KEEPING AND DOCUMENT CONTROL

Quality assurance data is maintained in computer databases, making historical information easily accessible. Data acquisition programs ensure minimal data entry error. Procedures are maintained for the identification, collection, indexing, filing, storage, maintenance, and disposition of all records. Records are maintained for an appropriate period of time, as defined in documented procedures.

Procedures have been established and are maintained to control all documentation relating to the requirements of our quality management system. Documents are reviewed and approved only by authorized personnel.

PACKAGING

All rolls are wrapped with a UV resistant stretch wrap or bag. This allows for protection from the elements should a roll have to be temporarily stored on site. Each shipping unit (i.e. bales, rolls, pallets, gaylords) has a label applied to it with appropriate information in order to facilitate product identification.

For all materials a label shows the Handling Unit Number (eg. roll number) and Material Variant Number (ie SKU number) which provides traceability to the time the material was produced.

Handling unit is Propex terminology for roll number and production order is synonymous with lot number. Our enterprise resource planning system generates sequential handling unit and production order designation independent of the manufacturing facility producing the materials. Therefore, handling unit numbers may not be in sequential order within a production order.

All packaging processes are done in accordance with the written procedures and /or packaging specifications. All packaging meets the requirements set forth in ASTM D-4873, Section 5.1.

HANDLING, STORAGE, AND DELIVERY

Handling, storage, and delivery procedures are maintained to designate methods and means of handling our products in order to prevent damage or deterioration.

Proper storage facilities are utilized for the holding products, and procedures are maintained for the receipt and dispatch of products to and from the storage location. The condition of products is assessed at regular intervals in accordance with documented procedures.

CERTIFICATION

Propex Operating Company can provide certification letters for finished and delivered geosynthetics as requested by the customer. The standard certification includes a letter of certification covering the product shipped on a particular bill of lading. Actual test data can be provided at the time of shipment, when requested. Per above testing frequencies, not all rolls are tested but test data can be provided which is representative of the rolls in a particular shipment in addition to test data for the rolls in the shipment which were tested.

ATTACHMENTS

a. Woven Geotextiles: B, C, D, E, H

Style	Width	MQC Frequency sq. yd	
		Sort term	Long term
315ST	150	32500	162500
	180	39000	195000
	210	45500	227500
270ST	150	32500	162500
	180	39000	195000
	210	45500	227500
250ST	150	32500	162500
	210	45500	227500
200ST	150	49479	197917
	180	59375	237500
	210	69271	277083
135ST	150	48611	291667
	180	58333	350000
	210	68056	408333
350ST	150	17000	85000
	180	20400	102000
61TXL	180	61250	367500
82TXL	180	58333	350000
2x2HF	180	29167	175000
2130	108	44000	132000
	126	51333	154000
PYR	102	10625	42500
	126	13125	52500
LLK	102	7438	29750
LLK3000	102	10625	42500
	180	18750	75000

References

1. ASTM, 2013, "ASTM D-4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles," American Society for Testing and Materials, West Conshohocken, PA.
2. ASTM, 2011, "ASTM D-4595, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method," American Society for Testing and Materials, West Conshohocken, PA.
3. ASTM, 2011, "ASTM D-4595, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method," American Society for Testing and Materials, West Conshohocken, PA.
4. ASTM, 2009, "ASTM D-6992, Standard Test Method for Accelerated Tensile Creep and Creep-Rupture of Geosynthetic Materials Based on Time-Temperature Superposition Using the Stepped Isothermal Method," American Society for Testing and Materials, West Conshohocken, PA.

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