

# **GRI-GM30 Specification**

## **Coated Tape Polymeric Barriers**

- spec covers smooth cPE
- thicknesses 0.61, 76 & 1.02 mm (24, 30 & 40 mils)
- silent on production method
- lists properties, test methods, test values and test frequencies
- covers ten (10) properties
- this is a MQC generic specification

# Preliminary Comments

- definition of formulation

“A formulation is defined as the exact percentages and types of resin(s), additives and carbon black used to make geosynthetic products”
- regarding quantities referred to in the spec

90,000 kg = 200,000 lb  $\simeq$  1 railcar  
20,000 kg = 45,000 lb  $\simeq$  25 rolls of 1.5 mm (60 mil)  
9,000 kg = 20,000 lb  $\simeq$  10 rolls of 1.5 mm(60 mil)
- formulated density  $\geq 0.926$  g/cc
- no more than 25% rework of same formulation
- no post consumer resin at all!

## **Physical Properties**

1. thickness
2. Weight

## **Mechanical Properties**

3. Strip tensile
4. Trouser tear
5. CBR puncture
6. Index puncture
7. Hydrostatic Resistance
8. Dimensional Stability

## **Endurance Properties**

9. Water Vapor Transmission
10. UV resistance

# 1. Thickness

- follows ASTM D751
- dead weight micrometer with flat tip
- 9.5 mm (0.375 in.) diameter pressure foot
- 1.7 N (6 oz.) mass applied to specimen
- one specimen measured in five places across roll width
- required for each roll
- average must equal nominal



Mitutoyo

ABSOLUTE

in / mm

0.0336 in

ZERO / ABS

ON / OFF

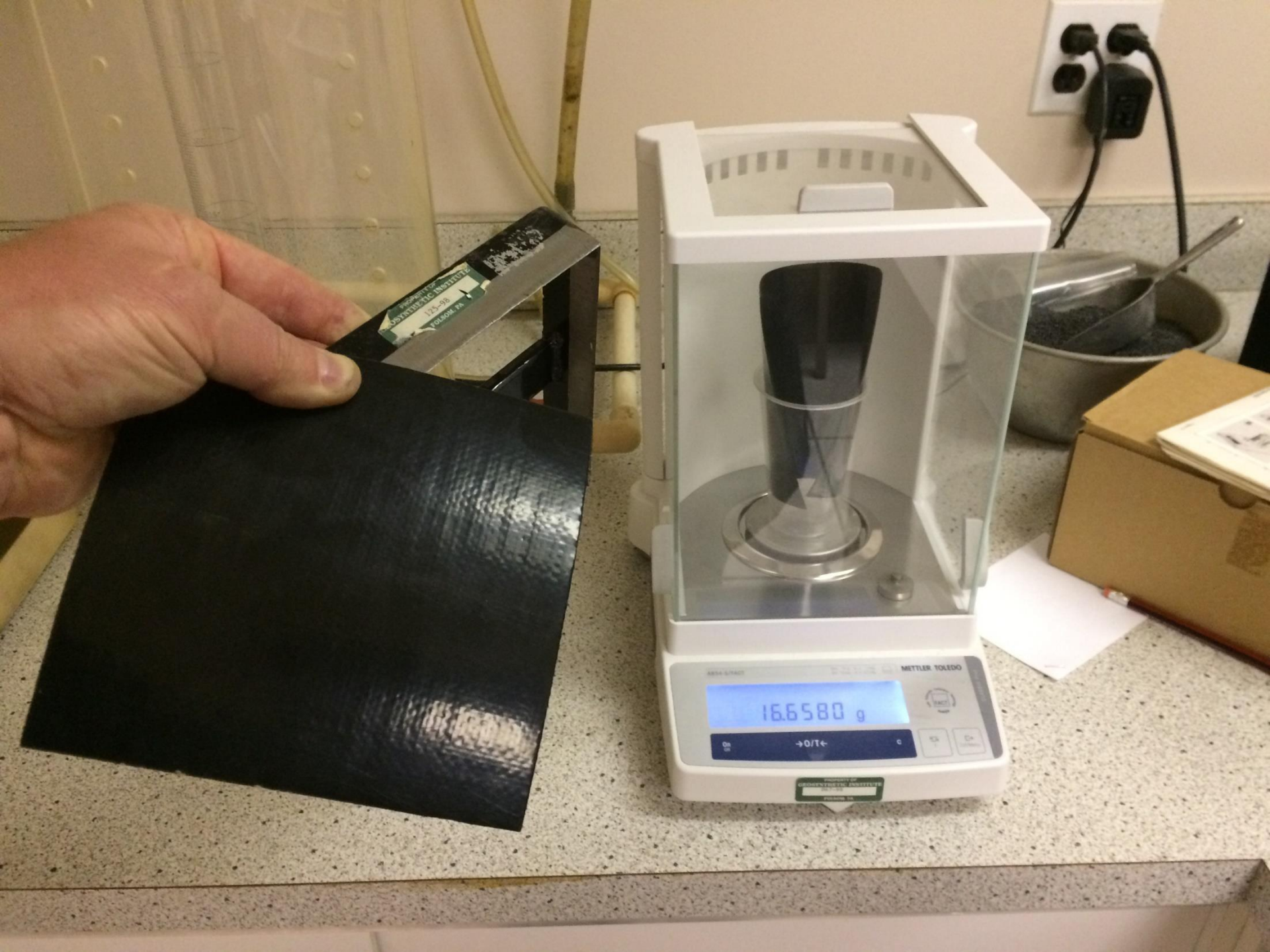
PRESET

TOL

## 2. Weight

- uses ASTM D751 gravimetric
- each railcar: 9,000 kg or 20,000 lb
- specimen at least 129 cm<sup>2</sup> (20 in<sup>2</sup>)
- no specimen near selvage
- die cut
- weigh to nearest 2.8 g (0.1 oz.)





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ANALYTICAL METTLER TOLEDO

16.6580 g

→0/T←

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# 3. Tensile Properties

- uses ASTM D7003
- min. ave. of 5 MD and 5 XMD
- 25 mm (1 in.) wide
- gage length 75 mm (3 in.)
- speed 300 mm/min (12 in./min)
- every 9000 kg (20,000 lb)  $\simeq$  10 rolls





## 4. Tongue Tear

- uses ASTM D5884
- min. ave. of 5 MD and 5 XMD
- result of all thicknesses  $\geq 220$  N (50 lb)
- 200 mm (8 in.) kg 200 mm (8 in.) wide specimen with 75 mm ( 3 in. cut)
- gage length 75 mm (3 in.)
- speed 300 mm/min. (12 in./min)
- every 10,000 kg (20,000 lb)  $\simeq$  12 rolls





# 5. CBR Puncture Resistance

- follows ASTM D6241
- called “CBR” puncture
- min. ave. of 10-tests
- 50 mm (2 in.) diameter probe
- 150 mm (6 in.) diameter hole/opening
- speed 50 mm/min (2 in./min)
- good clamping key to reduce slippage

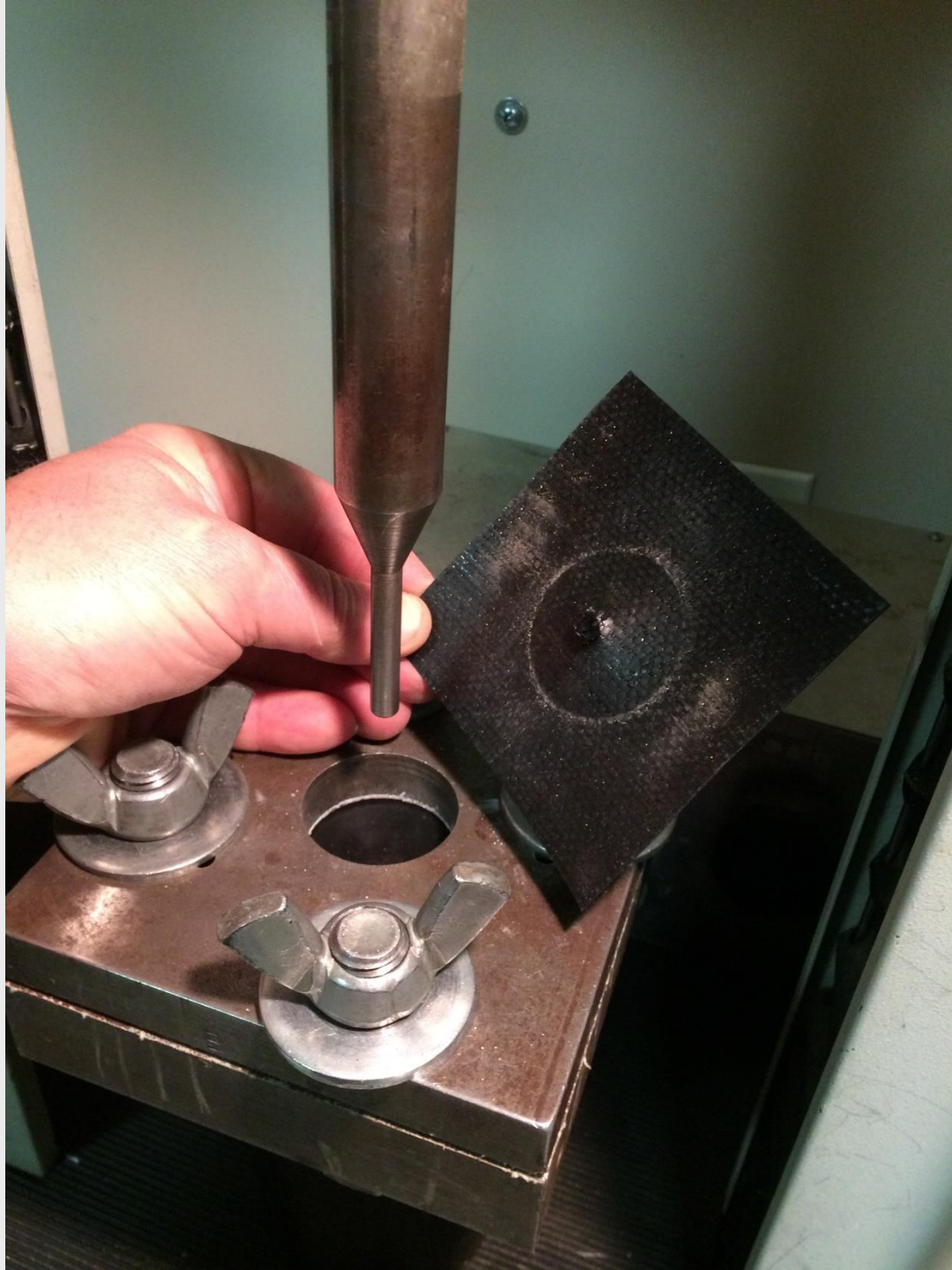


INSTRON

## 6. Index/Pin Puncture Resistance

- follows ASTM D4833
- called index or pin puncture
- min. ave. of 15-tests
- 8 mm (0.32 in.) diameter probe
- 45 mm gage opening-hole
- speed 300 mm/min

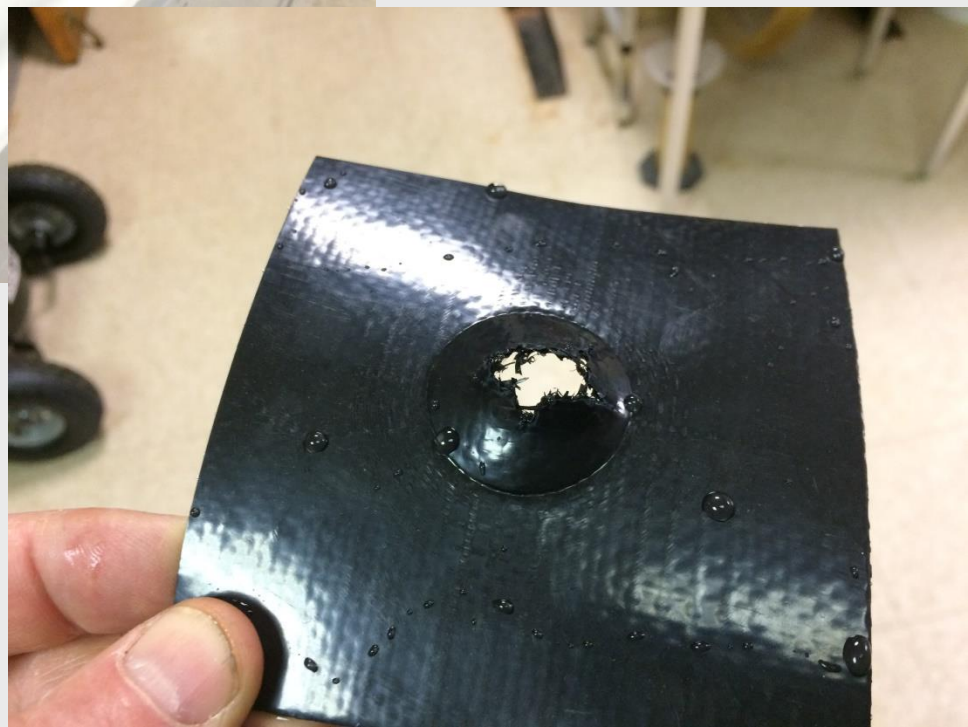






# 7. Hydrostatic Resistance

- follows ASTM D751 (called Mullen burst)
- min. ave. of 5-tests
- every 20,000 kg (40,000 lb)  $\simeq$  25 rolls
- 32 mm (1.24 in.) diameter aperture
- barrier is pressurized from below with water at a rate of 1.4 cm<sup>3</sup>/sec (5.2 in<sup>3</sup>/min)



## 8. Dimensional Stability

- follows ASTM D1204
- ave. of two tests 250 mm (10 in.) by 250 mm (10 in.) specimens
- every 9000 kg (20,000 lb)  $\simeq$  10 rolls
- measure a-b or x-y center dimension with ruler or caliper accurate to 0.25 mm (0.01 in.)
- specimen exposed to 100°C for 1 hour in faced air oven



# 9. Water Vapor Transmission

- follows ASTM E96
- measures Fickian diffusion or hydraulic conductivity
- looking for dimension change over time
- 3 specimens plus blank
- test condition 32°C (90°F); 50% RH
- run cups with DPP water inverted
- every 20,000 kg (45,000 lb)  $\approx$  25 rolls





# 10. Ultraviolet Resistance

- ASTM D7238 & G154
- assessment of UV stability of the AOs and CB (there should be synergy)
- uses commercial laboratory weatherometer
- called “ultraviolet fluorescent device” (UVA bulbs, 340 nm)
- 20 hr. UV cycle at 75°C, then 4 hr. condensation at 60°C
- tensile before and after exposure using ASTM D7003; > 50% retained
- frequency is per formulation
- response to bending GRI-GM16; no cracking



Warning - Ultraviolet

- Do not look into the sample chamber
- Do not touch the sample chamber or the sample
- Do not touch the sample chamber or the sample
- Do not touch the sample chamber or the sample

LLDPE  
@ 65°C  
2/10/17

HDPE  
@ 65°C  
2/10/17

EPDM  
@ 65°C  
2/10/17

PVC  
@ 65°C  
2/10/17

PP  
@ 65°C  
2/10/17

PPR  
@ 65°C  
2/10/17

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@ 65°C  
2/10/17

# Regarding the Warranty

- based on GRI Report #16, i.e., if AOs are present lifetime  $\simeq$  200 yrs.
- GM30 was crafted to be sure the AOs are present and of proper type, i.e., OIT and oven aging verification
- also, for geomembrane used in exposed conditions a UV exposure is included
- recommended material warranty using GM13 spec is for 5-years (it promises to be 100's)
- GM30 is silent on any type of installation warranty (this is the major concern)

# Concluding Comments

- specification was essential due to NSF dropping its Std. 54 in 1997
- mfgs. want spec for both covered and exposed GM installations
- this is MQC specification i.e., the manufacturers required tests, minimum values and frequencies
- if MQA project specific spec is more restrictive, manufacturer may ask for additional compensation

# The Basic Tables Follow

Note: The most recent version of this specification (text and tables) is available on the GSI Web Site <[geosynthetic-institute.org](http://geosynthetic-institute.org)>.

## Table 1 – Specification Values for Coated Tape Polyethylene Barriers

Property and Units <sup>(1)</sup>	ASTM or GRI Test Methods	Category 1 – Severe <sup>(2)</sup> (40 mil – nominal)	Category 2 – Moderate <sup>(2)</sup> (30 mil – nominal)	Category 3 – Light <sup>(2)</sup> (24 mil – nominal)	Testing Frequency
Thickness (mils) (min. ave.)	ASTM D751	36	27	22	per roll
Weight, (oz/yd <sup>2</sup> ) (min. ave.)	ASTM D751	18	15	10	20,000 lb
Strip Tensile Strength <sup>(3)</sup> (lb) (min. ave.)	ASTM D7003	250	225	200	20,000 lb
Strip Tensile Elongation <sup>(3)</sup> (%) (min. ave.)	ASTM D7003	20	20	20	20,000 lb
Trouser Tear <sup>(3)</sup> (lb) (min. ave.)	ASTM D5884	50	50	50	20,000 lb
CBR Puncture (lb) (min. ave.)	ASTM D6241	1000	700	400	
Index Pin Puncture-Resistance (lb) (min. ave.)	ASTM D4833	220	180	160	45,000 lb
Hydrostatic Resistance (psi) (min. ave.)	ASTM D751	700	500	300	45,000 lb
Dimensional Stability (% change) (Max)	ASTM D1204	3	3	3	
Water Vapor Transmission (WVT) (g/m <sup>2</sup> -day) <sup>(4)</sup> (max. ave.)	ASTM E96	0.3	0.4	0.5	per each formulation
UV Resistance (fluorescent light method) (a) Strength and Elongation retained after 10,000 light hours (b) Response to bending	ASTM D7238 ASTM D7003  GRI GM16	> 50% retained  no cracking	> 50% retained  no cracking	> 50% retained  no cracking	per each  formulation

**Notes**

- (1) All values are minimum, or minimum average, except dimensionally stability and WVT which are maximum values.
- (2) The categories refer to the type of subgrade, manner of installation, anchorage/tie downs, and site-specific conditions, see Table 3.
- (3) If the tape reinforcement is aligned in any direction other than the machine and transverse directions, specimen shall be cut such that reinforcing yarns are oriented parallel to the central axis of the tension testing machine.
- (4) Performed at 23° ± 0.5°C temperature and 50% ± 5% relative humidity.

Table 2 – Specification Values for Coated Tape Polyethylene Barriers

Property and Units <sup>(1)</sup>	ASTM or GRI Test Methods	Category 1 – Severe <sup>(2)</sup> (1 mm – nominal)	Category 2 – Moderate <sup>(2)</sup> (0.75 mm – nominal)	Category 3 – Light <sup>(2)</sup> (0.61 mm – nominal)	Testing Frequency
Thickness (mm) (min. ave.)	ASTM D751	0.91	0.69	0.56	per roll
Weight, (g/m <sup>2</sup> ) (min. ave.)	ASTM D751	610	520	340	9,000 kg
Strip Tensile Strength <sup>(3)</sup> (N) (min. ave.)	ASTM D7003	1100	1000	900	9,000 kg
Strip Tensile Elongation <sup>(3)</sup> (%) (min. ave.)	ASTM D7003	20	20	20	9,000 kg
Trouser Tear <sup>(3)</sup> (N) (min. ave.)	ASTM D5884	220	220	220	9,000 kg
CBR Puncture (N) (min. ave.)	ASTM D6241	4400	3100	1800	
Index Pin Puncture-Resistance (N) (min. ave.)	ASTM D4833	980	800	700	20,000 kg
Hydrostatic Resistance (kPa) (min. ave.)	ASTM D751	4800	3400	2000	20,000 kg
Dimensional Stability (% change) (Max)	ASTM D1204	3	3	3	
Water Vapor Transmission (WVT) (g/m <sup>2</sup> -day) <sup>(4)</sup> (max. ave.)	ASTM E96	0.3	0.4	0.5	per each formulation
UV Resistance (fluorescent light method) (a) Strength and Elongation retained after 10,000 light hours	ASTM D7238 ASTM D7003	> 50% retained	> 50% retained	> 50% retained	per each formulation
(b) Response to bending	GRI GM16	no cracking	no cracking	no cracking	formulation

(1) All values are minimum, or minimum average, except dimensionally stability and WVT which are maximum values.

(2) The categories refer to the type of subgrade, manner of installation, anchorage, downs, and site-specific conditions.

(3) If the tape reinforcement is aligned in any direction other than the machine and transverse directions, specimen shall be cut such that reinforcing yarns are oriented parallel to the central axis of the tension testing machine.

(4) Performed at 23° ± 0.5°C temperature and 50% ± 5% relative humidity.