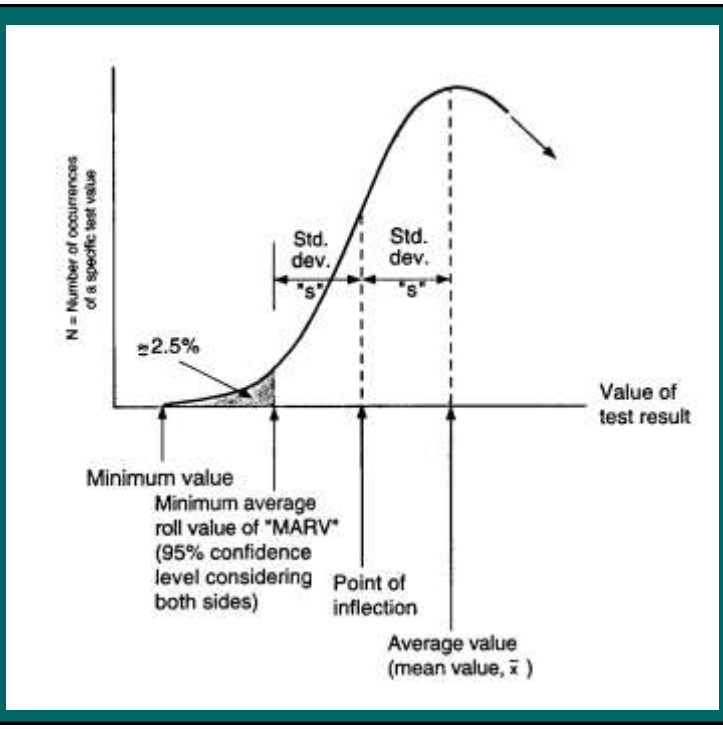
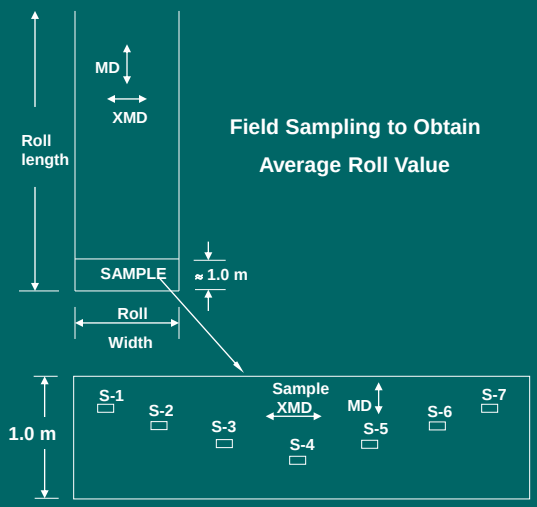
GRI-GT12 Specification
Nonwoven Geotextiles for Geomembrane Protection

- also called geomembrane "cushions"
- weights 340-2000 g/m^2 (10-60 oz/yd^2)
- silent on type of polymer
- silent on virgin, rework or recycle
- provides different puncture options
- all values are MARV, except UV

Regarding MARV

- minimum average roll value
- accommodates variation in GT properties
- statistically it's the "μ-2σ" value
- procedure shown in next screens





Field Sampling to Obtain Average Roll Value

Take Specimens from above Sample and Test as Required

Test Number	Roll Number					
	1	2	3	4	5	6
1	643N	627N	637N	642N	652N	637N
2	627	615	643	646	641	624
3	652	621	628	658	639	631
4	629	616	662	641	657	620
5	632	619	646	635	642	618
6	641	621	633	642	651	633
7	662	622	619	658	641	641
Average =	641	620	638	646	646	629

This is MARV Value!

Listed Properties

1. mass per unit area
2. grab tensile strength and elongation
3. trapezoidal tear
4. various puncture strengths
5. ultraviolet resistance

1. Mass per Unit Weight

- generally referred to as “weight”
- follows ASTM D5261
- 5 specimens across roll width
- average value is determined
- develop MARV to compare to spec
- 6-categories from 340-2000 g/m^2 (10-60 oz/yd^2)

2. Grab Tensile Response

- follows ASTM D4632
- 10 specimens MD & XMD across width
- 100 mm wide; gripped in center 25 mm
- must avoid slippage or grip failure
- record maximum strength in kN (lb)
- record elongation at max. strength
- (δ/L) 100 = % elongation
- develop MARV for strength and elongation and compare to spec

D4632 - Grab Tensile Test
(Evaluates Strength and Elongation at Failure)

3. Trapezoidal Tear Strength

- follows ASTM D4533
- tear propagates from an initial cut
- maximum value is recorded
- 10 specimens in MD and XMD across roll width
- take average value of lowest
- develop MARV and compare to specification value

D4533 - Trapezoidal Tear Strength
(Evaluates the Maximum Value)

4(a) Puncture (Pin) Strength

- follows ASTM D4833
- uses a 8 mm (5/16 in.) probe
- 15 specimens across roll width
- take average value
- develop MARV and compare to specification value

D4833 - Puncture (Pin) Strength
(Evaluates Strength at Rupture)

4(b) Puncture (Pyramid) Strength

- follows ASTM D5494, Method “B”
- uses a pyramid shape pointed probe on GT on metal substrate
- contact made with underlying substrate registering electric signal
- 10 specimens across roll width
- take average value
- develop MARV and compare to spec

D5494 - Puncture (Pyramid) Strength
(Evaluates Strength at Metal Base Plate Contact)

4(c) CBR Puncture Strength

- California Bearing Ratio (CBR) is a soil strength test adopted for geosynthetics
- follows ASTM D6241 using the same device
- probe is 50 mm (2.0 in.) diameter
- container is 150 mm (6.0 in.) diameter
- 10 specimens across roll width
- strength and deformation monitored
- take average value of each
- develop MARV and compare to spec

D6241 - Puncture (CBR) Strength
(Evaluates Strength at Rupture and Accompanying Deformation)

CBR Relationships

(a) for wide width strength

$$T_f = F_p / 2\pi r$$

where

T_f = tensile force per unit width of fabric (kN/m),
F_p = puncture breaking force (kN), and
r = radius of the puncturing rod (m).

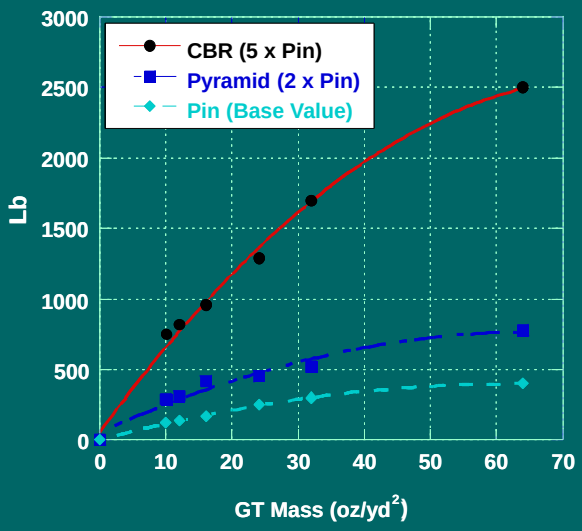
(b) for strain at failure

$$\varepsilon_f = \frac{(x - a)}{a} \times 100$$

where

x = diagonal elongation of the geosynthetic at failure (m)
a = horizontal distance between the outer edge of the plunger and the inner edge of the mold (m).

Puncture Interrelationships



5 Ultraviolet Resistance

- follows ASTM D7238 (UV fluorescent tube method)
- 500 lt. hrs. exposure
- cycled at 20 hrs. light; 4 hrs. dark with condensation
- 50 mm strip tensile per D5035
- 5 MD and 8 XMD and values averaged
- 70% strength retained from original

ASTM D7238 Ultraviolet Fluorescent Weatherometer

USA Units

Table 1(a) – Required Properties, Test Methods and Values for Geotextiles Used as Geomembrane Protection (or Cushioning) Materials

Property[1]	Test Method ASTM	Unit	Mass/Unit Area (oz/yd²)					
Mass per unit area	D5261	oz/yd²	10	12	16	24	32	60
Grab tensile strength	D4632	lb	230	300	370	450	500	630
Grab tensile elongation	D4632	%	50	50	50	50	50	50
Trap. tear strength	D4533	lb	95	115	145	200	215	290
Puncture (pin) strength	D4833	lb	120	140	170	250	300	390
UV resistance[2]	D7238	%	70	70	70	70	70	70

Notes:
(1) All values are MARV except UV resistance; it is a minimum value.
(2) Evaluation to be on 2.0 inch strip tensile specimens after 500 ltr. hrs. exposure.

Table 2(a) – Alternative Puncture Test Methods to be Considered in Place of Pin Puncture, ASTM D4833, in Table 1(a)

Property[1]	Test Method ASTM	Unit	Mass/Unit Area (oz/yd²)					
Mass per unit area	D5261	oz/yd²	10	12	16	24	32	60
Puncture (pyramid) strength	D5494	lb	300	320	410	440	510	760
Puncture (CBR) strength	D6241	lb	700	800	900	1100	1700	2400
Puncture (CBR) elongation	D6241	in	1.5	1.5	1.5	1.5	1.5	1.5

(1) All values are MARV

S.I. (Metric) Units

Table 1(b) – Required Properties, Test Methods and Values for Geotextiles Used as Geomembrane Protection (or Cushioning) Materials

Property[3]	Test Method ASTM	Unit	Mass/Unit Area (g/m²)					
Mass per unit area	D5261	g/m²	340	406	542	812	1080	2000
Grab tensile strength	D4632	kN	1.02	1.33	1.64	2.00	2.25	2.80
Grab tensile elongation	D4632	%	50	50	50	50	50	50
Trap. tear strength	D4533	kN	0.42	0.51	0.64	0.89	0.96	1.27
Puncture (pin) strength	D4833	kN	0.53	0.62	0.75	1.11	1.33	1.71
UV resistance[4]	D7238	%	70	70	70	70	70	70

Notes:
(3) All values are MARV except UV resistance; it is a minimum value.
(4) Evaluation to be on 50 mm strip tensile specimens after 500 ltr. hrs. exposure.

Table 2(b) – Alternative Puncture Test Methods to be Considered in Place of Pin Puncture, ASTM D4833, in Table 1(b)

Property[3]	Test Method ASTM	Unit	Mass/Unit Area (g/m²)					
Mass per unit area	D5261	g/m²	340	406	542	812	1080	2000
Puncture (pyramid) strength	D5494	kN	1.33	1.42	1.82	1.96	2.27	3.37
Puncture (CBR) strength	D6241	kN	3.11	3.56	4.00	4.90	7.56	10.60
Puncture (CBR) elongation	D6241	mm	38	38	38	38	38	38

(1) All values are MARV

Required Properties GT12 ISO Conversion*

Property	Test Method	Units	CLASS					
Mass per unit area	ISO 09864	g/m²	340	406	542	812	1080	2160
Tensile Properties • strength • elongation	ISO 10319	 kN/m %	 16 50	 21 50	 26 50	 32 50	 36 50	 46 50
Trapezoidal Tear Strength	ISO 13434	kN	0.42	0.51	0.64	0.89	0.96	1.33
CBR Puncture • force • elongation	ISO 12236	 kN mm	 3.1 3.8	 3.6 38	 4.0 38	 4.9 38	 7.6 38	 11.1 38
UV strength ret.	ISO 12959	%	70	70	70	70	70	70

*Common European tests not included:

1. Cone Drop Test per EN 918
2. Protection Efficiency per PrEN 13719
3. Chemical Resistance per EN 1403
4. Oxidation Resistance per EN 13438