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Standard Practice for Manufacturing Quality Control of Geotextiles[1]

This standard is issued under the fixed designation D8102; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers the manufacturing quality control of geotextiles, describing types of tests, the proper test methods, minimum testing frequencies, and best practices for sampling.

1.2 This practice does not address manufacturing quality assurance, product acceptance testing, or conformance testing. These are independent activities taken by organizations other than the geotextiles manufacturer.

1.3 This practice is intended to aid manufacturers, suppliers, purchasers, installers, and end users of geotextiles in establishing a minimum level of effort for maintaining quality control.

1.4 This practice covers procedures for sampling geotextiles for the purpose of manufacturing quality control (MQC). These procedures are designed to ensure that the correct number of representative samples are obtained and properly reported by the manufacturer.

1.5 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D123 Terminology Relating to Textiles

D4354 Practice for Sampling of Geosynthetics and Rolled Erosion Control Products (RECPs) for Testing

D4355 Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus

D4491 Test Methods for Water Permeability of Geotextiles by Permittivity

D4533 Test Method for Trapezoid Tearing Strength of Geotextiles

D4595 Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method

D4632 Test Method for Grab Breaking Load and Elongation of Geotextiles

D4751 Test Methods for Determining Apparent Opening Size of a Geotextile

D5261 Test Method for Measuring Mass per Unit Area of Geotextiles

D6241 Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe

2.2 *American National Standard:*[3]

ANSI/ASQ Z1.9-2008 Sampling Procedures and Tables for Inspection by Variables for Percent Nonconforming

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of other textile terms used in this standard, refer to Terminology D123.

3.2 *Organizational Definitions:*

3.2.1 *installer, n*—party who installs, or facilitates installation of, any materials purchased from manufacturers or suppliers.

3.2.2 *manufacturer, n*—group, corporation, partnership, or individual that manufactures a product.

3.2.3 *purchaser, n*—person, company, or organization that purchases any materials or work to be performed.

3.2.4 *supplier, n*—party who supplies materials or services.

3.3 *Sampling Definitions:*

3.3.1 *lot (geotextile lot), n*—the amount of geotextile produced per style type under the same standard operating conditions during a specific period of time not to exceed twelve consecutive months.

3.3.2 *lot summary, n*—a lot-specific report that shows all sequential sample roll test results and the associated lot

[1] This practice is under the jurisdiction of ASTM Committee D35 on Geosynthetics and is the direct responsibility of Subcommittee D35.01 on Mechanical Properties.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from American Society for Quality (ASQ), 600 N. Plankinton Ave., Milwaukee, WI 53203, http://www.asq.org.

statistics, including the following information: typical value (mean) minimum, maximum, standard deviation, and MARV for each test property.

3.3.3 *MARV, n*—the minimum average roll value (MARV) for the geosynthetic, defined as the average value minus two (2) standard deviations from documented quality control test results for a defined lot of production, sampled in accordance with Table 1 of Practice D4354.

3.3.4 *maximum test value, n*—the maximum test value for the geosynthetic, defined as the highest average roll value from documented quality control test results for a defined lot of production, sampled in accordance with Table 1 of Practice D4354.

3.3.5 *sublot, n*—a smaller portion or subset of a lot produced under same standard operating conditions per style. Combined consecutive sublots become the lot.

4. Significance and Use

4.1 Geotextiles are to be properly manufactured in a manner consistent with a minimum level of quality control as determined by in-house testing of the final product. This practice sets forth the types of tests, the methods of the testing, and the minimum testing frequencies appropriate for geotextile manufacturing quality control.

4.2 It should be clearly recognized that manufacturers may perform additional tests or at a greater frequency than set forth in this practice, or both. In this case the manufacturer's quality control plan will take precedence over this practice.

4.3 It should also be recognized that purchasers and installers of geotextiles may require additional tests or at a greater frequency than called for in this practice, or both. The organization(s) producing such project-specific specification or quality assurance plan should recognize that such requirements are beyond the current state of this practice. If such a request is made by the purchasers or installers, they should clearly communicate the requirements to the manufacturer or supplier during the contract decisions in order that disputes do not arise at a subsequent time.

4.4 This practice provides guidance for sampling and testing as well as proper management of test data and certifications.

5. Sampling Procedure for Manufacturer's Quality Control (MQC) Testing

5.1 *Divisions into Lots*—Consider as a lot any portion of production that represents the planned production quantity not to exceed twelve consecutive months that differs from other portions in the specifications, style, or physical characteristics. If portions that are billed or designated as separate lots are shipped from different production plants, treat each separate portion as a separate lot.

5.2 *Determination of Lot Sample Size:*

5.2.1 Determine the lot sample size for quality control testing in accordance with Table 1 of Practice D4354.

5.2.2 Time-intensive tests, such as ultraviolet degradation (Test Method D4355), are not used for quality control but are rather indicators of performance, thus the frequency of testing is determined by the purchaser.

5.2.3 If a sample is required during manufacture, select the units for the lot sample at uniformly spaced or predetermined time intervals throughout the production period.

6. Procedure for Recommended Quality Control Tests and Requirements

6.1 The recommended quality control tests for the manufacture of geotextiles are included in Table 1. It is recommended that testing be done on the finished product.

6.2 Other manufacturing quality assurance or conformance tests may be requested by the purchaser or installer. These tests should be contracted separately and all parties involved should agree to the method to be used, as well as to the frequency of testing.

6.3 *Quality Control Sampling of Each Lot:*

6.3.1 Material produced during a start-up phase is not considered part of the produced lot for the purposes of calculating MARV. A limited number of tests may be done on these samples to verify that the line is within standard operating conditions and producing first-quality material. These start-up test results are not considered part of the statistical evaluation, but are to be maintained in the database or on record at such time sampling for the purpose of MQC is initiated. The frequency of sampling and comprehensive testing for a given lot is not to be less than that required by Table 1 of Practice D4354.

TABLE 1 Recommended Tests and Requirements for MQC of Geotextiles

NOTE 1—Different tests and test requirements other than what is stated within this table may be required on a project basis.

Test Designation	ASTM Standard	Reported Value	Test Frequency
Mass Per Unit Area	Test Method D5261	Typical[A]	Practice D4354, Table 1
Grab Tensile Strength	Test Method D4632	MARV	Practice D4354, Table 1
Trapezoid Tearing Strength	Test Method D4533	MARV	Practice D4354, Table 1
Static Puncture Strength	Test Method D6241	MARV	Practice D4354, Table 1
Permittivity	Test Methods D4491	Minimum Test Value[B]	Practice D4354, Table 1
Apparent Opening Size	Test Methods D4751	Maximum Test Value[B]	Practice D4354, Table 1
Wide Width[C]	Test Method D4595	MARV	Practice D4354, Table 1

[A] MARV certification may be required on a project basis.
[B] The precision data stated in these methods for repeatability (CV % *r*, CV % *Sr*) and reproducibility (CV % *SR*, CV % *R*) suggest that test method variability and material variability cannot be reliably differentiated; therefore statistical use of the data for calculating MARV is not appropriate.
[C] For geotextiles used in reinforcement applications.

6.4 *Quality Control Testing of Each Sample:*

6.4.1 Each quality control sample is sent to the quality control lab immediately upon production. Full identification of the sampled roll is to be provided with the sample.

6.4.2 The results for each roll sampled and tested are given as average roll values. The average roll value, which is also called the sampling average, is the average of all the specimens tested in the same orientation (that is, machine direction or cross-machine direction, also referred to as MD or CD) from a sample using a specific test method. Regardless of the individual specimen results, it is the average of all specimens—the average roll value—which characterizes the sample.

6.5 *Quality Control Test Results:*

6.5.1 All quality control test results are maintained with the corresponding roll identification.

6.5.2 Lot testing summaries are to be available upon request detailing the test results and typical value (aggregate mean), minimum, maximum, standard deviations, and MARV of each test property required for the lot under consideration.

6.6 *Failing Test Results:*

6.6.1 Test results falling below published values do not always define failing production. Duplicate tests should be run on material from the same sample roll to determine if the problem is in the application of the test procedure.

6.6.2 If the retest shows failing results, then an additional sample from subsequent production (rolls) is required.

6.6.3 If this additional testing shows similarly failing results, then further subsequent rolls are to be sampled and tested until acceptable test results are achieved. All material from all failing rolls and associated rolls (if not tested and between failed tested rolls) will be removed from first-quality production.

6.6.4 If the testing of additional rolls produces satisfactory test results, then the additional test results are to become data within the lot summary. If the test results fall below published limits, then all material from all associated rolls are to be removed from first quality. Material may be downgraded.

6.6.5 If no assignable cause is determined for the failing production, then the test values associated with the failing rolls are to be maintained in the database to characterize future production within that lot. If the cause is not identified and documented, then the material is to be considered characteristic of the general production lot and the corresponding data kept in the MARV calculation within the lot summary.

6.6.6 If an assignable cause is identified for the failing production, it is to be documented along with a corrective action. If this is accomplished and all associated rolls are removed from first-quality status for the style being produced, then all record of failed production may be removed from the lot summary but is to be maintained in the database or on record within files.

6.7 *Minimum Average Roll Values (MARVs) and Release of Lots:*

6.7.1 MARV is to be calculated for each lot for each test property required. MARV can then be calculated using Eq 1:

$$\text{MARV} = \bar{x} - 2(s) \quad (1)$$

where:

$\bar{x}$ = typical (mean), and
s = standard deviation (roll data).

NOTE 1—Two (2) is a reasonable *t*-value for use in the above equation. Other *t*-values may be used based on sample size.

6.7.2 A lot may consist of consecutive runs or sublots, where all sublots are characterized by production of the same product style manufactured under the same standard operating conditions and using raw materials meeting the same specifications.

6.7.3 It is important when using this statistical evaluation to use a large enough body of data, including data from rejected rolls without an identifiable cause, to confirm that a reasonably normal distribution of data exists.

6.7.4 Consecutive sublots may be combined to calculate MARV as long as the shipped rolls are within these sublots. These sublots will be produced within twelve consecutive months. See example in Appendix X1.

6.7.5 A sublot(s) may be shipped once the sublot data has been added to the MARV calculation for the lot.

6.8 *Certifications:*

6.8.1 All certifications are to be fully supported by available test data.

6.8.2 Lot summary statistics (typical value, standard deviation, minimum value, maximum value, calculated MARV) will be provided upon request.

6.8.3 No order should be confirmed until quality control requirements are met indicating that shipment rolls from acceptable lots are available.

7. Report

7.1 All activities on product acceptance should be recorded on a suitable datasheet or in a database.

7.1.1 Manufacturer's letter of certification or MQC data, or both;

7.1.2 Description or title of product acceptance activity, or both;

7.1.3 Location, date, and time of acceptance activity;

7.1.4 Procedure used for acceptance activity;

7.1.5 Roll and lot numbers, brand names, and other product-specific information;

7.1.6 Results of acceptance activity;

7.1.7 Company of involved personnel;

7.1.8 Name of acceptance inspector;

7.1.9 Summarized test results of acceptance activities;

7.1.10 Roll number of rejected rolls.

8. Keywords

8.1 geotextiles; MQC; sampling; testing

APPENDIX

(Nonmandatory Information)

X1. EXAMPLES OF CERTIFICATIONS

X1.1 See Figs. X1.1-X1.3.

Characteristic Properties of _____ Products

Property	Unit	Test Method	Reported Value	Product A (MARV)	Product B (MARV)	Product C (MARV)
*Mass per Unit Area	g/m^2	ASTM D5261	Typical			
Grab Tensile	N	ASTM D4632	MARV			
Grab Elong.	%	ASTM D4632	MARV			
Wide Width Str.	N/m	ASTM D4595	MARV			
Static Puncture	N	ASTM D6241	MARV			
Trapezoid Tear	N	ASTM D4533	MARV			
A.O.S.	mm	ASTM D4751	Max			
Permittivity	sec^{-1}	ASTM D4491	Min			

NOTE 1—MARVs are calculated for each lot or sublot and cannot be determined prior to production of the material. Please contact the manufacturer for MARVs of currently available material.

NOTE 2—Typical: These values represent the aggregate mean value determined from QC testing on all first-quality lots produced. Minimum/Maximum: These values represent absolute minimum/maximum test values determined from QC testing on all first quality lots produced.

FIG. X1.1 Example of Published Characteristic Properties

CERTIFICATION OF COMPLIANCE

TEST RESULTS

Style:_____; Lot:_____
# of Rolls Produced per Lot_____

Roll No.	Date	Area Wt.	MD Tens	MD Elong.	CD Tens	CD Elong.	MD Trap Tear.	CD Trap Tear	Punc	Perm	AOS
		g/m^2	N	%	N	%	N	N	N	s^{-1}	mm
Lot Summary											
average											
_Std. Dev.											
Min.											
Max.											
MARV											
Spec.											

FIG. X1.2 Example of Supporting Test Data for Certification

lot		GRAB MD	EL MD	GRAB CD	EL CD	TT MD	TT CD	CBR
sublot 1		446	25	210	11	197	86	850
		476	28	217	11	203	92	798
		446	26	232	12	212	101	826
		483	27	224	12	191	95	843
		482	28	218	11	211	92	725
		470	27	221	12	192	89	875
	count	6	6	6	6	6	6	6
	min	446	25	210	11	191	86	725
	max	483	28	232	12	212	101	875
	avg	467	27	220	12	201	93	820
	std	17.17	1.17	7.41	0.55	9.15	5.18	52.92
	calc MAR V	433	24	206	10	183	82	714
	target MAR V	365	24	200	10	115	75	675
sublot 2		390	28	220	13	218	114	772
		421	28	225	10	207	95	725
		375	32	201	15	176	110	825
	count	3	3	3	3	3	3	3
	min	375	28	201	10	176	95	725
	max	421	32	225	15	218	114	825
	avg	395	29	215	13	200	106	774
	std	23.46	2.31	12.70	2.52	21.70	9.79	50.03
	calc MAR V	348	25	190	8	157	86	674
	target MAR V	365	24	200	10	115	75	675
sublot 3		457	27	212	11	230	106	776
		476	30	207	11	200	87	821
		440	26	211	12	175	101	792
		450	28	208	11	225	86	767
		448	25	219	11	203	95	778
		457	26	214	12	187	92	725
		444	27	206	12	176	97	803
	count	7	7	7	7	7	7	7
	min	440	25	206	11	175	86	725
	max	476	30	219	12	230	106	821
	avg	453	27	211	11	199	95	780
	std	11.68	1.63	4.51	0.53	22.00	7.21	30.46
	calc MAR V	430	24	202	10	155	80	719
	target MAR V	365	24	200	10	115	75	675
sublot 4		455	26	217	12	176	83	892
		457	28	223	11	193	98	776
		434	25	211	11	206	86	823
		444	27	206	12	176	97	773
		475	28	223	12	167	112	752
		451	27	224	12	176	118	794
		448	31	239	10	182	122	786
		449	27	216	12	167	115	743
		456	28	231	11	172	111	909
		456	27	215	11	159	93	832
		455	28	226	12	150	110	802
		449	29	225	12	165	94	795
	count	12	12	12	12	12	12	12
	min	434	25	206	10	150	83	743
	max	475	31	239	12	206	122	909
	avg	452	28	221	11	174	103	806
	std	9.57	1.51	9.00	0.66	14.85	12.94	50.91
	calc MAR V	433	25	203	10	144	77	705
	target MAR V	365	24	200	10	115	75	675
sublots 1-4	count	28	28	28	28	28	28	28
	min	375	25	201	10	150	83	725
	max	483	32	239	15	230	122	909
	avg	450	27	218	12	189	99	799
	std	23.78	1.64	8.91	0.95	20.51	10.90	47.38
	calc MAR V	402	24	200	10	148	77	704
	target MAR V	365	24	200	10	115	75	675

NOTE 1—Data is for example purposes only.

FIG. X1.3 Example of Lot Summary Table

RELATED MATERIAL

ASTM Guide D4873 for Identification, Storage, and Handling of Geosynthetic Rolls and Samples