



Standard Specification for Paper Towels for Industrial and Institutional Use¹

This standard is issued under the fixed designation D 4431; 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 specification covers two classes, five types, and four styles of paper hand towels for purchasers, such as governmental agencies, school boards, and industry.

1.2 This specification covers virgin, recycled, and recycled content paper products (see X1.2).

1.3 The values stated in either inch-pound or SI units are to be regarded separately as the standard. The values given in parentheses are for information only.

NOTE 1—As appropriate, reference the following test methods: Test Method D 828; and TAPPI T 404, T 410, T 432, T 456, and T 494.

1.4 The following safety hazards caveat pertains only to the test method portion, Section 9, of this specification. *This standard does not purport to address all of the safety problems, 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:

D 685 Practice for Conditioning Paper and Paper Products for Testing²

D 828 Test Method for Tensile Properties of Paper and Paperboard Using Constant-Rate-of-Elongation Apparatus²

D 1968 Terminology Relating to Paper and Paper Products²

2.2 TAPPI Standards:

T 402 Standard conditioning and testing atmospheres for paper, board, pulp handsheets, and related products³

T 404 Tensile breaking strength and elongation of paper and paperboard (using pendulum-type tester)³

T 410 Grammage of paper and paperboard (weight per unit area)³

T 432 Water absorption of bibulous papers³

T 452 Brightness of pulp, paper, and paperboard (directional reflectance at 457 nm)³

T 456 Wet tensile breaking strength of paper and paperboard³

T 494 Tensile breaking properties of paper and paperboard (using constant rate of elongation apparatus)³

3. Terminology

3.1 Definitions:

3.1.1 Definitions shall be in accordance with Terminology D 1968 and the *Dictionary of Paper*.⁴

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *narrowfold*—2¾ in. (70 mm) or less in folded depth.

3.2.2 *widefold*—more than 2¾ in. (70 mm) in folded depth.

4. Classification

4.1 The paper towels shall be of the following classes, types, and styles (see Figs. 1-4):

4.1.1 Classes:

4.1.1.1 *Class A*—Bleached or Semibleached (one-ply) and

4.1.1.2 *Class B*—Natural

4.1.2 Types:

4.1.2.1 *Type 1*—One-ply,

4.1.2.2 *Type 2*—One-ply,

4.1.2.3 *Type 3*—One-ply,

4.1.2.4 *Type 4*—Two-ply,

4.1.2.5 *Type 5*—Two-ply, double delivery.

4.1.3 Styles:

4.1.3.1 *Style I*—Singlefold,

4.1.3.2 *Style II*—Multifold (wide and narrowfold),

4.1.3.3 *Style III*—C-fold,

4.1.3.4 *Style IV*—Roll (perforated or unperforated).

NOTE 2—See Table 1 and Table 2 for further clarification.

5. Ordering Information

5.1 Orders for towels based on this specification shall specify the class, type, style, and type of dispenser.

6. Chemical Composition

6.1 Fiber content, or recycled fiber content, or both, of towels supplied in accordance with this specification is to be agreed upon between the buyer and the seller.

7. Physical Properties

7.1 The average value of each characteristic shall meet the

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² *Annual Book of ASTM Standards*, Vol 15.09.

³ Available from the Technical Association of the Pulp and Paper Industry, P.O. Box 105113, Atlanta, GA 30348.

⁴ Available from American Paper Institute, 260 Madison Avenue, New York, NY 10016.

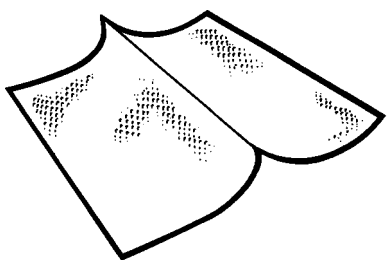


FIG. 1 Style I—Singlefold

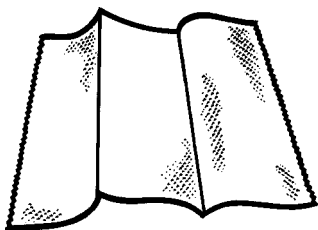


FIG. 2 Style II—Multifold

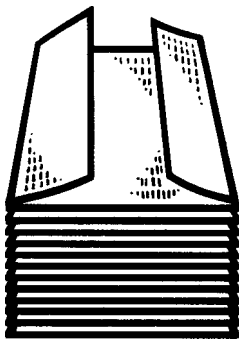


FIG. 3 Style III—C-fold

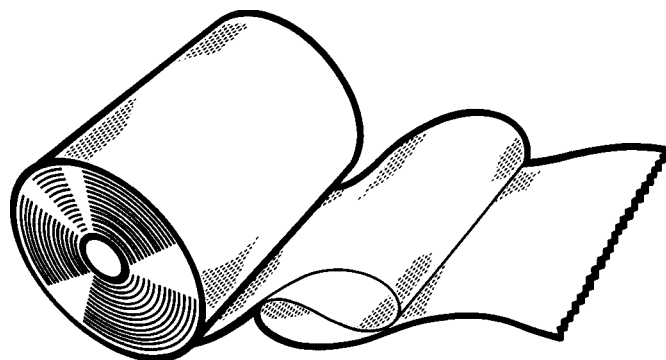


FIG. 4 Style IV—Roll

8.3 *Dispensability*—Towels shall dispense properly from the correct cabinet when loaded in accordance with the manufacturer's directions.

requirements specified in Table 1.

7.2 *Workmanship*—Towels shall be made as agreed in 8.1 with respect to holes, tears, wrinkles, cleanliness, and foreign materials. Edges shall be cleanly cut and not ragged. Towels shall be folded or rolled as specified.

7.3 *Dimensions*—Average dimensions and permissible variations shall be in accordance with Table 2.

7.4 *Brightness*—When required, the brightness level shall be agreed upon between the buyer and the seller.

8. Other Requirements

8.1 Precise defect levels and acceptable quality levels will be agreed upon between the buyer and the seller.

8.2 *Odor*—Towels shall have no disagreeable odor, either wet or dry.

TABLE 1 Physical Requirements

	Style I-Singlefold ^A					Style II-Multi-fold ^B Widefold				Narrowfold				Style III-C-fold ^C				Style IV-Roll ^D				
	Types					Types					Types				Types				Types			
	1	2	3	4 (bonded) ^E	(double delivery) ^E	1	2	3	4 (bonded) ^E	2	3	1	2	3	4 (bonded) ^E	1	2	3	4 (bonded) ^E			
Class A-Bleached or Semibleached	32	28	24	27	...	32	28	24	27	28	24	32	28	24	27	32	28	24	27			
Basis weight, 24 × 36–500, lb, ± 5 % (g/m ² ± 5 %)	(52.1)	(45.6)	(39.1)	(43.9)	...	(52.1)	(45.6)	(39.1)	(43.9)	(45.6)	(39.1)	(52.1)	(45.6)	(39.1)	(43.9)	(52.1)	(45.6)	(39.1)	(43.9)			
Tensile strength, dry, avg, both directions, min oz/in. ^G	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...			
N/m	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	36	36	36	36			
Tensile strength, wet, avg, both directions, min oz/in. ^G	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	392	392	392	392			
N/m	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	392	392	392	392			
Tensile strength, dry, avg, both directions, min oz/in. ^G	9	9	9	6	...	9	9	9	6	9	9	9	9	9	6	9	9	9	6			
N/m	98	98	98	65	...	98	98	98	65	98	98	98	98	98	65	98	98	98	65			
Absorption time (0.1 mL, water) max, s	60	80	80	5	...	60	80	80	5	80	80	60	80	80	5	60	80	80	5			
Class B-Natural	28	24	24	...	56	30	28	24	...	24	24	28	26	24	...	28	26	24	...			
Basis weight, 24 × 36–500, lb, ± 5 %	45.6	39.1	39.1	...	91.2	48.9	45.6	39.1	...	39.1	39.1	45.6	42.3	39.1	...	45.6	42.3	39.1	...			
Grammage g/m ² ± 5 %	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	F	F	F	F			
Tensile strength, dry, avg, both directions, min, oz/in. ^G	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	36	36	36	...			
N/m	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	392	392	392	...			
Tensile strength, wet, avg, both directions, min, oz/in. ^G	9	9	9	...	24	9	9	9	...	9	9	9	9	9	...	9	9	9	...			
N/m	98	98	98	...	262	98	98	98	...	98	98	98	98	98	...	98	98	98	...			
Absorption time (0.1 mL water), max, s	100	100	100	...	5	100	100	100	...	100	100	100	100	100	...	100	100	100	...			

^ASee Fig. 1.

^BSee Fig. 2.

^CSee Fig. 3.

^DSee Fig. 4.

^EAll tests are to be run on two-ply bonded or double delivery.

^FSpecification is applicable for hand pull dispenser, but not applicable for automated or mechanical dispenser.

^GTo obtain this value (1) determine the average for all the machine direction tensiles in the test sample (2) determine the average for all the cross direction tensiles in the test sample (3) add those two averages together and divide by 2. Instrument from either TAPPI T-404 or T-494 may be used.