



## Standard Specification for Wool Felt<sup>1</sup>

This standard is issued under the fixed designation D 2475; 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 all standard types of wool and part-wool felt in the form of rolls and sheets that are suitable for mechanical use. Certain special-purpose felts are also covered.

1.2 This specification is not applicable to felt-like products that utilize weaving, knitting, stitching, or bonding such as papermaker's felt.

1.3 Trade practice in the felt industry deals in pounds, yards, and inches, therefore the values stated in inch-pound units are to be regarded as standard. The values in SI units are provided as information only.

1.3.1 The specification referenced in 2.2 uses only inch-pound units.

### 2. Referenced Documents

#### 2.1 ASTM Standards:

D 123 Terminology Relating to Textiles<sup>2</sup>

D 461 Test Methods for Felt<sup>2</sup>

#### 2.2 Federal Standard:

C-F-206, Felt Sheet: Cloth Felt, Wool, Pressed<sup>3</sup>

#### 2.3 Felt Manufacturers Council:

FS14-68/71 Wool Felt Standard Specifications<sup>4</sup>

#### 2.4 SAE Standard:

J314b Felts-Wool and Part Wool<sup>5</sup>

### 3. Terminology

#### 3.1 Definitions:

3.1.1 *black felt, n*—those classifications of felt manufactured to various shades of the color black.

3.1.2 *felt, n*—a textile structure characterized by interlocking and consolidation of its constituent fibers achieved by the interaction of a suitable combination of mechanical energy, chemical action, moisture, and heat but without the use of weaving, knitting, stitching, thermal bonding, or adhesives.

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee D-13 on Textiles and is the direct responsibility of Subcommittee D13.13 on Wool and Wool Felt.

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 07.01.

<sup>3</sup> Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

<sup>4</sup> Available from the Northern Textile Association, 230 Congress Street, Boston, MA 02110.

<sup>5</sup> Available from the Society of Automotive Engineers, 2 Pennsylvania Plaza, New York, NY 10001.

3.1.2.1 *Discussion*—In practice, light needling or tacking may be used to supplement the ability of the fibers to interlock and consolidate.

3.1.3 *gray felt, n*—a blend of white fibers with naturally colored or dyed fibers or both and that has an overall gray appearance.

3.1.4 *needled felt, n*—a textile structure composed entirely of fibers physically interlocked and reoriented through the action of felting needles.

3.1.5 *orthopedic and surgical felt, n*—a white, soft, low density, highly resilient felt.

3.1.5.1 *Discussion*—Such felts are commonly used in splint pads, abdominal supports, orthopedic devices, and fracture cast linings as well as other medical applications.

3.1.6 *papermaker's felt, n*—a fabric, made from wool or man-made fibers or mixtures of both, fabricated as an endless belt for use on a paper making machine. (See also *felt* and *needled felt*.)

3.1.6.1 *Discussion*—Papermaker's felt received its name because it replaced the sheets of felt used in squeezing the water from newly formed, manually made sheets of paper. Some finished papermaker's felts have matted surfaces similar to wool felts.

3.1.7 *part wool felt, n*—a felt composed of any one of or a combination of new and recycled wool fibers mixed with one or more man-made fibers, vegetable fibers, or animal fibers other than wool.

3.1.8 *recycled wool, n*— as defined in the *Wool Products Labeling Act of 1939 as amended in 1980*,<sup>6</sup> "the resulting fiber when wool has been woven or felted into a wool product which, without ever having been utilized in any way by the ultimate consumer, subsequently has been made into a fibrous state, or the resulting fiber when wool or reprocessed wool has been spun, woven, knitted or felted into a wool product which, after having been used in any way by the ultimate consumer, subsequently has been made into a fibrous state."

3.1.8.1 *Discussion*—In the amended Act of 1980, the term "recycled wool" replaced the terms "reprocessed wool" and "reused wool."

3.1.9 *specialty felt, n*—one of a number of special purpose felt structures available for, but not limited to, a specific end-use application.

<sup>6</sup> Act of Congress, "Wool Products Labeling Act of 1939," 76th Congress, Third Session, approved October 14, 1939, the amended Act of 1980.

3.1.9.1 *Discussion*—Orthopedic and surgical felts are examples of specialty felts. Additional information on these types is available in NTA Specifications FS14-68/71.

3.1.10 *specific gravity, n—of felt*, the relative mass per unit volume of felt expressed as a percentage of the mass per unit volume of water.

3.1.11 *supported needled felt, n*—a needled felt that is composed entirely of fibers physically interlocked and reoriented in combination with interlay, scrim, or foundation of knitted, stitched, bonded, or extruded structure.

3.1.12 *unsupported needled felt, n*—a needled felt that is composed entirely of fibers physically interlocked and reoriented with, and of themselves without an interlay, scrim, or foundation of knitted, stitched, bonded, or extruded structure.

3.1.13 *white wool, n*—wool having shade variations from true white to creamy white but free of pigmented, dyed, or otherwise colored wools.

3.1.13.1 *Discussion*—The shade variations in white wool can be caused by range conditions including forage, soil, rain, or lack thereof as well as the health of the animal.

3.1.14 *wool, n*—the fibrous covering of the sheep, *Ovis* species.

3.1.15 *wool, n—as defined in the Wool Products Labeling Act of 1939*, "the fiber from the fleece of sheep or lamb, or hair of the Angora goat or Cashmere goat (and may include the so called specialty fibers from the hair of the camel, alpaca, llama, and vicuna) which has never been reclaimed from any woven or felted wool product."

3.1.15.1 *Discussion*—For the purpose of this standard, the term "wool" includes both wool as defined in the Wool Products Labeling Act of 1939 as well as recycled wool as defined in the amended Act of 1980.

3.1.16 *wool content, n*—the quantity of new and recycled wool, as defined in the Wool Products Labeling Act, which is determined by chemical analysis.

3.1.16.1 *Discussion*—Felt 34R1, as an example, which theoretically is made from 100 % wool fiber, may contain incidental amounts of other natural or man-made fibers, residual wool fats and oils, and processing soaps which may reduce the actual wool content on the chemical analysis basis to 95 %.

3.1.17 *wool felt, n*—a felt composed wholly of any one of or a combination of new or recycled wool fibers.

3.1.18 For definitions of other textile terms, refer to Terminology D 123.

## 4. Types of Felts

### 4.1 ASTM Classification:

4.1.1 The ASTM Classification number in Tables 1-3 is the percent specific gravity of that class. It may be computed from the mass (weight), thickness, and area values in these tables. This number is followed by the letter R or S, which designates the method of manufacture as roll or sheet form, respectively. The last digit is the overall quality index in decreasing order of quality from one to four (see Note 1).

**TABLE 1 Wool Roll and Sheet Felt Corresponding Classifications—Properties and General Description**

ASTM (NTA) Classification <sup>A</sup>	Corresponding Classifications		Compo- sition	Chemical Requirements				Physical Requirements				Color	General Description			
	SAE J314b	Fed. Spec. C-F-206	Wool Content Chemical Basis, min %	1,1,1-Trichloroethane Extract, max %	Water Extract max %	1,1,1-Trichloroethane and Water Extract, max %	Ash, max %	Min. Tensile Strength,		Min. Split Resistance			Normal Width		Thickness: Available Range	
								psi	kPa	lbf/2 in. width	N/50 mm width		in.	cm	in.	mm
14R1	...	...	40	2.5	2.5	3.0	2.5	...	...	...	...	white	72	183	0.125–0.500	3.17–12.7
17R1	...	...	45	2.5	2.5	3.0	2.5	...	...	...	...	white	72	183	0.125–1.000	3.17–25.4
17R2	F26	8R5	45	8.0	6.0	14.0	5.0	...	...	...	...	gray	72	183	0.125–1.000	3.17–25.4
18R1	F10	9R1	95	2.5	2.5	3.0	2.5	225	1551	8	35	white	72	183	0.063–1.000	1.60–25.4
18R2	F11	9R2	87	3.0	2.5	4.5	3.0	200	1379	6	26	gray	72	183	0.063–1.000	1.60–25.4
18R3	F12	9R3	85	4.0	2.5	6.5	3.5	100	690	3	13	gray	72	183	0.063–1.000	1.60–25.4
18R4	F13	9R4	75	4.0	4.0	8.0	3.5	75	517	2	9	gray	72	183	0.063–1.000	1.60–25.4
18R5	F15	9R5	55	4.0	5.0	9.0	4.0	75	517	2	9	gray	72	183	0.063–1.000	1.60–25.4
26R1	F5	12R1	95	2.5	2.5	3.0	2.0	400	2758	18	79	white	60	152	0.063–1.000	1.60–25.4
26R2	F6	12R2	87	2.5	2.5	4.5	2.5	275	1896	16	71	gray	60 or 72	152 or 183	0.063–1.000	1.60–25.4
26R3	F7	12R3	80	3.0	4.0	7.0	3.0	250	1724	12	53	gray	72	183	0.063–1.000	1.60–25.4
26R3X	F55	12R3X	75	4.0	4.0	8.0	3.0	200	1379	...	...	gray	60 or 72	152 or 183	0.063–0.094	1.60–2.39
34R1	F1	16R1	95	2.5	2.5	3.0	1.5	500	3448	33	147	white	60	152	0.125–1.000	3.17–25.4
34R1X	F50	16R1X	95	2.5	2.5	3.0	1.5	500	3448	...	...	white	60	152	0.047–0.092	1.19–2.39
34R2	F2	16R2	90	2.5	2.5	4.0	2.0	500	3448	28	124	not blk or gray	60	152	0.047–1.000	1.19–25.4
34R3	F3	16R3	85	2.5	3.0	4.5	2.5	400	2758	22	97	gray	60	152	0.125–1.000	3.17–25.4
34R3X	F51	16R3X	92	2.5	2.5	4.5	2.5	300	2069	...	...	gray	60 or 72	152 or 183	0.047–0.094	1.19–2.39
38R1	...	18R1	95	2.5	2.5	3.0	1.5	600	4137	35	154	white	60	152	0.125–0.500	3.17–12.7
38R2	...	...	95	2.5	2.5	3.0	2.5	550	3792	30	132	gray	60	152	0.125–0.500	3.17–12.7
26S1	...	12S1	95	2.0	2.0	3.0	1.5	400	2758	18	79	white	36	91	0.125–3.000	3.17–76.2
26S4	...	...	95	2.5	2.5	4.0	2.0	300	2069	16	71	gray	36	91	0.125–3.000	3.17–76.2
34S1	...	16S1	95	2.0	2.0	3.0	1.5	500	3448	32	141	white	36	91	0.125–3.000	3.17–76.2
34S2	...	16S3	95	2.5	2.5	3.5	2.0	400	2758	28	124	white	36	91	0.125–3.000	3.17–76.2
34S3	...	16S4	95	2.5	2.5	4.0	2.5	300	2069	20	89	white	36	91	0.125–3.000	3.17–76.2
34S4	...	...	95	2.5	2.5	3.5	2.0	400	2758	22	97	gray	36	91	0.125–3.000	3.17–76.2
43S1	...	20S1	95	2.0	2.0	3.0	1.5	500	3448	44	196	white	36	91	0.125–3.000	3.17–76.2
43S2	...	20S3	95	2.5	2.5	3.5	2.0	400	2758	40	178	white	36	91	0.125–3.000	3.17–76.2
43S3	...	20S4	95	2.5	2.5	4.0	2.5	300	2069	32	142	white	36	91	0.125–3.000	3.17–76.2
43S4	...	...	95	2.5	2.5	3.5	2.0	400	2758	36	160	gray	36	91	0.125–3.000	3.17–76.2
56S1	...	26S1	95	2.0	2.0	3.0	1.5	600	4137	48	212	white	36	91	0.125–3.000	3.17–76.2
56S2	...	26S3	95	2.5	2.5	3.5	2.0	500	3448	46	205	white	36	91	0.125–3.000	3.17–76.2
56S3	...	26S4	95	2.5	2.5	4.0	2.5	400	2758	36	160	white	36	91	0.125–3.000	3.17–76.2
56S4	...	...	95	2.5	2.5	3.5	2.0	400	2758	40	178	gray	36	91	0.125–3.000	3.17–76.2
68S1	...	32S1	95	2.0	2.0	3.0	1.5	600	4137	50	222	white	36	91	0.125–2.500	3.17–63.5
68S2	...	32S3	95	2.5	2.5	3.5	2.0	500	3448	48	212	natural	36	91	0.125–3.000	3.17–76.2
68S3	...	32S4	95	2.5	2.5	4.0	2.5	400	2758	40	178	natural	36	91	0.125–3.000	3.17–76.2
68S4	...	...	95	2.5	2.5	3.5	2.0	400	2758	46	205	gray	36	91	0.125–2.500	3.17–63.5

<sup>A</sup> NTA refers to Northern Textile Association.

**TABLE 2 Wool Roll Felt Thicknesses and Weights**

NOTE 1—The F-50, F-51, and F-55 classifications are available in limited thickness ranges. See Table 1.

ASTM (NTA) Classifi- cation	SAE J314b	Fed. Spec. C-F-206	Color	Trade Designa- tion	Thickness Tolerances						Mass (Weight) Per Unit Area			
					Nominal	Inches		Nominal	Millimetres		Nominal Tolerances			
						Roll	Cutparts		Roll	Cutparts	lb/yd <sup>2</sup>	kg/m <sup>2</sup>		
14R1	...	...	White	Soft Pad	0.125	± 0.040	± 0.048	3.18	± 1.02	± 1.22	0.83	± 0.10	0.45	± 0.05
					0.250	0.056	0.064	6.35	1.42	1.63	1.65	0.20	0.90	0.11
					0.375	0.072	0.082	9.53	1.83	2.08	2.48	0.30	1.35	0.16
					0.500	0.088	0.098	12.70	2.24	2.49	3.30	0.40	1.79	0.22
17R1	...	...	White	Soft Pad	0.125	0.040	0.044	3.18	1.02	1.12	0.9	0.09	0.49	0.05
17R2	F-26	8R5	Gray		0.250	0.056	0.062	6.35	1.42	1.58	1.8	0.18	0.98	0.10
					0.375	0.072	0.079	9.53	1.83	2.01	2.7	0.27	1.47	0.15
					0.500	0.088	0.098	12.70	2.24	2.49	3.6	0.36	1.95	0.20
					0.750	0.120	0.135	19.05	3.05	3.43	5.4	0.54	2.93	0.29
					1.000	0.152	0.170	25.40	3.86	4.32	7.2	0.72	3.91	0.39
18R1	F-10	9R1	White	Firm Pad	0.125	0.020	0.023	3.18	0.51	0.58	1.06	0.08	0.58	0.04
18R2	F-11	9R2	Gray	Firm Pad	0.188	0.023	0.026	4.78	0.58	0.66	1.59	0.12	0.86	0.07
18R3	F-12	9R3	Gray	Firm Pad	0.250	0.026	0.031	6.35	0.66	0.79	2.12	0.16	1.15	0.09
18R4	F-13	9R4	Gray	Firm Pad	0.313	0.029	0.033	7.95	0.74	0.84	2.65	0.20	1.44	0.11
18R5	F-15	9R5	Gray	Firm Pad	0.375	0.032	0.036	9.53	0.81	0.91	3.18	0.24	1.73	0.13
					0.500	0.038	0.044	12.70	0.97	1.12	4.24	0.32	2.31	0.18
					0.625	0.044	0.050	15.88	1.12	1.27	5.30	0.40	2.89	0.22
					0.750	0.050	0.060	19.05	1.27	1.52	6.36	0.48	3.46	0.26
					0.875	0.056	0.065	22.23	1.42	1.65	7.42	0.56	4.03	0.30
					1.000	0.062	0.070	25.40	1.58	1.78	8.48	0.64	4.62	0.35
26R1	F-5	12R1	White	Ex Firm Pad	0.063	0.007	0.012	1.60	0.18	0.31	0.75	0.04	0.41	0.02
26R2	F-6	12R2	Gray	Ex Firm Pad	0.094	0.007	0.012	2.39	0.18	0.31	1.12	0.05	0.61	0.03
26R3	F-7	12R3	Gray	Ex Firm Pad & Gray or Black Lining	0.125	0.014	0.016	3.18	0.36	0.41	1.53	0.08	0.83	0.04
					0.188	0.016	0.018	4.78	0.41	0.46	2.29	0.12	1.24	0.07
26R3X	F-55	12R3X	...		0.250	0.018	0.020	6.35	0.46	0.51	3.06	0.16	1.66	0.09
					0.313	0.020	0.022	7.95	0.51	0.56	3.82	0.20	2.07	0.11
					0.375	0.022	0.025	9.53	0.56	0.64	4.59	0.24	2.49	0.13
					0.500	0.026	0.029	12.70	0.66	0.74	6.12	0.32	3.32	0.18
					0.625	0.030	0.033	15.88	0.76	0.84	7.65	0.40	4.15	0.22
					0.750	0.034	0.038	19.05	0.86	0.97	9.18	0.48	4.98	0.26
					0.875	0.038	0.042	22.23	0.97	1.07	10.71	0.56	5.82	0.30
					1.000	0.042	0.046	25.40	1.07	1.17	12.24	0.64	6.65	0.35
34R1	F-1	16R1	White	Backcheck & Ball Bearing	0.047	0.007	0.010	1.19	0.18	0.25	0.75	0.04	0.41	0.02
34R1X	F-50	16R1X	White		0.063	0.007	0.010	1.60	0.18	0.25	0.98	0.04	0.53	0.02
34R2	F-2	16R2	Not Black or Gray	Backcheck	0.078	0.007	0.010	1.98	0.18	0.25	1.20	0.04	0.65	0.02
					0.094	0.007	0.011	2.39	0.18	0.28	1.43	0.04	0.78	0.02
34R3	F-3	16R3	Gray	Backcheck & Ball Bearing	0.125	0.012	0.015	3.18	0.31	0.38	2.00	0.10	1.09	0.05
34R3X	F-51	16R3X	Gray		0.188	0.013	0.017	4.78	0.33	0.43	3.00	0.15	1.63	0.08
					0.250	0.014	0.020	6.35	0.36	0.51	4.00	0.20	2.17	0.11
					0.313	0.015	0.021	7.95	0.38	0.53	5.00	0.25	2.72	0.14
					0.375	0.016	0.023	9.53	0.41	0.58	6.00	0.30	3.26	0.16
					0.500	0.019	0.025	12.70	0.48	0.64	8.00	0.40	4.34	0.22
					0.625	0.022	0.027	15.88	0.56	0.69	10.00	0.50	5.43	0.27
					0.750	0.025	0.030	19.05	0.64	0.76	12.00	0.60	6.52	0.33
					0.875	0.028	0.035	22.23	0.71	0.89	14.00	0.70	7.60	0.38
					1.000	0.031	0.040	25.40	0.79	1.02	16.00	0.80	8.69	0.43
38R1	...	18R1	White	Laundry	0.125	0.012	0.015	3.18	0.31	0.38	2.25	0.10	1.22	0.05
38R2	...	...	Gray		0.188	0.013	0.017	4.78	0.33	0.43	3.38	0.15	1.84	0.08
					0.250	0.014	0.020	6.35	0.36	0.51	4.50	0.20	2.44	0.11
					0.313	0.015	0.021	7.95	0.38	0.53	5.63	0.25	3.06	0.14
					0.375	0.016	0.023	9.53	0.41	0.58	6.75	0.30	3.67	0.16
					0.500	0.019	0.025	12.70	0.48	0.64	9.00	0.40	4.89	0.22

**TABLE 3 Wool Sheet Felt: Thickness and Mass (Weight)**

ASTM (NTA) Class	Color	Thickness, in.			Thickness, mm			Mass (Weight) lb/yd <sup>2</sup>		Mass (Weight) kg/m <sup>2</sup>	
		Nominal	Tolerances		Nominal	Tolerances		Nominal	Tolerances	Nominal	Tolerances
			Sheets	Cut Parts		Sheets	Cut Parts				
26S1	White	0.125	± 0.014	± 0.016	3.17	± 0.35	± 0.41	1.50	± 0.10	0.81	± 0.05
26S4	Gray	0.188	0.016	0.018	4.78	0.41	0.46	2.25	0.15	1.22	0.08
		0.250	0.020	0.022	6.35	0.51	0.56	3.00	0.20	1.63	0.11
		0.313	0.022	0.024	7.95	0.56	0.61	3.75	0.25	2.04	0.14
		0.375	0.024	0.026	9.52	0.61	0.66	4.50	0.30	2.44	0.16
		0.500	0.030	0.032	12.70	0.76	0.81	6.00	0.40	3.26	0.22

**TABLE 3** *Continued*

ASTM (NTA) Class	Color	Thickness, in.			Thickness, mm			Mass (Weight) lb/yd <sup>2</sup>		Mass (Weight) kg/m <sup>2</sup>	
		Nominal	Tolerances		Nominal	Tolerances		Nominal	Tolerances	Nominal	Tolerances
			Sheets	Cut Parts		Sheets	Cut Parts				
		0.625	0.035	0.037	15.88	0.89	0.94	7.50	0.45	4.07	0.24
		0.750	0.040	0.042	19.05	1.02	1.07	9.00	0.50	4.89	0.27
		0.875	0.046	0.048	22.23	1.17	1.22	10.50	0.55	5.70	0.30
		1.000	0.051	0.053	25.40	1.30	1.35	12.00	0.60	6.52	0.33
		1.250	0.062	0.065	31.75	1.57	1.65	15.00	0.70	8.15	0.38
		1.500	0.072	0.075	38.10	1.83	1.91	18.00	0.80	9.77	0.43
		1.750	0.083	0.085	44.45	2.11	2.16	21.00	0.90	11.40	0.49
		2.000	0.094	0.098	50.80	2.39	2.49	24.00	1.00	13.03	0.54
		2.500	0.115	0.119	63.50	2.92	3.02	30.00	1.05	16.29	0.57
		3.000	0.136	0.141	76.20	3.45	3.58	36.00	1.10	19.55	0.60
34S1	White	0.125	0.012	0.014	3.17	0.30	0.36	2.00	0.10	1.09	0.05
34S2	White	0.188	0.012	0.014	4.78	0.30	0.36	3.00	0.15	1.63	0.08
34S3	White	0.250	0.016	0.018	6.35	0.41	0.46	4.00	0.30	2.17	0.16
34S4	Gray	0.313	0.017	0.019	7.95	0.43	0.48	5.00	0.35	2.71	0.19
		0.375	0.019	0.021	9.52	0.48	0.53	6.00	0.40	3.26	0.22
		0.500	0.022	0.024	12.70	0.56	0.61	8.00	0.50	4.34	0.27
		0.625	0.026	0.028	15.88	0.66	0.71	10.00	0.60	5.43	0.33
		0.750	0.029	0.031	19.05	0.74	0.79	12.00	0.70	6.52	0.38
		0.875	0.032	0.034	22.23	0.87	0.86	14.00	0.75	7.60	0.41
		1.000	0.036	0.038	25.40	0.91	0.97	16.00	0.80	8.69	0.43
		1.250	0.042	0.045	31.25	1.07	1.14	20.00	0.90	10.86	0.49
		1.500	0.049	0.052	38.10	1.24	1.32	24.00	1.00	13.03	0.54
		1.750	0.056	0.059	44.45	1.42	1.50	28.00	1.10	15.20	0.60
		2.000	0.063	0.067	50.80	1.60	1.70	32.00	1.20	17.38	0.65
		2.500	0.076	0.080	63.50	1.93	2.03	40.00	1.25	21.72	0.68
		3.000	0.090	0.095	76.20	2.29	2.41	48.00	1.30	26.06	0.71
43S1	White	0.125	0.012	0.014	3.17	0.30	0.36	2.50	0.30	1.36	0.16
43S2	White	0.188	0.012	0.014	4.78	0.30	0.36	3.75	0.35	2.04	0.19
43S3	White	0.250	0.014	0.016	6.35	0.36	0.41	5.00	0.40	2.71	0.22
43S4	Gray	0.375	0.016	0.019	9.52	0.41	0.48	7.50	0.50	4.07	0.27
		0.500	0.019	0.022	12.70	0.48	0.56	10.00	0.60	5.43	0.33
		0.625	0.022	0.025	15.88	0.56	0.64	12.50	0.70	6.79	0.38
		0.750	0.025	0.028	19.05	0.63	0.71	15.00	0.80	8.15	0.43
		0.875	0.027	0.030	22.23	0.69	0.76	17.50	0.90	9.50	0.49
		1.000	0.030	0.033	25.40	0.76	0.84	20.00	1.00	10.86	0.54
		1.250	0.036	0.040	31.15	0.91	1.02	25.00	1.10	13.56	0.60
		1.500	0.041	0.045	38.10	1.04	1.14	30.00	1.20	16.29	0.65
		1.750	0.047	0.051	44.45	1.19	1.30	35.00	1.30	19.00	0.71
		2.000	0.053	0.058	50.80	1.35	1.47	40.00	1.40	21.72	0.76
		2.500	0.064	0.070	63.50	1.63	1.78	50.00	1.45	27.15	0.78
		3.000	0.075	0.082	76.20	1.90	2.08	60.00	1.50	32.58	0.81
56S1	White	0.125	0.010	0.014	3.17	0.25	0.36	3.25	0.40	1.76	0.22
56S2	White	0.188	0.010	0.014	4.78	0.25	0.36	4.90	0.50	2.66	0.27
56S3	White	0.250	0.011	0.016	6.35	0.28	0.41	6.50	0.60	3.53	0.33
S654	Gray	0.375	0.013	0.018	9.52	0.33	0.46	9.75	0.80	5.29	0.43
		0.500	0.016	0.022	12.70	0.41	0.56	13.00	1.00	7.06	0.54
		0.625	0.018	0.024	15.88	0.46	0.61	16.25	1.10	8.82	0.60
		0.750	0.020	0.026	19.05	0.51	0.66	19.50	1.20	10.59	0.65
		0.875	0.022	0.028	22.23	0.56	0.71	22.75	1.30	12.35	0.70
		1.000	0.025	0.031	25.40	0.63	0.79	26.00	1.40	14.12	0.76
		1.250	0.029	0.036	31.75	0.74	0.91	32.50	1.50	17.65	0.81
		1.500	0.033	0.040	38.10	0.84	1.02	39.00	1.60	21.18	0.87
		1.750	0.038	0.046	44.45	0.97	1.17	45.50	1.70	24.71	0.92
		2.000	0.042	0.051	50.80	1.07	1.30	52.00	1.80	28.24	0.98
		2.500	0.050	0.061	63.50	1.27	1.55	65.00	1.85	35.29	1.00
		3.000	0.058	0.070	76.20	1.47	1.78	78.00	1.90	42.35	1.03
68S1	White	0.125	0.007	0.013	3.17	0.18	0.33	4.00	0.50	2.17	0.27
68S2	White	0.188	0.007	0.014	4.78	0.18	0.36	6.00	0.75	3.26	0.41
68S3	White	0.250	0.007	0.015	6.35	0.18	0.38	8.00	1.00	4.34	0.54
68S4	Gray	0.375	0.009	0.018	9.52	0.23	0.46	12.00	1.10	6.52	0.60
		0.500	0.011	0.020	12.70	0.28	0.51	16.00	1.20	8.69	0.65
		0.625	0.013	0.022	15.88	0.33	0.56	20.00	1.30	10.86	0.71
		0.750	0.015	0.024	19.05	0.38	0.61	24.00	1.40	13.03	0.76
		0.875	0.017	0.026	22.23	0.43	0.66	28.00	1.50	15.20	0.81
		1.000	±0.019	±0.028	25.40	±0.48	±0.71	32.00	±1.60	17.38	±0.87
		1.250	0.022	0.032	31.75	0.56	0.81	40.00	1.70	21.72	0.92
		1.500	0.026	0.036	38.10	0.66	0.91	48.00	1.80	26.06	0.98
		1.750	0.029	0.041	44.45	0.74	1.04	56.00	1.90	30.41	1.03
		2.000	0.032	0.046	50.80	0.81	1.17	64.00	2.00	34.75	1.09
		2.500	0.038	0.055	63.50	0.97	1.40	80.00	2.05	43.44	1.11



the roll equal to the width of the roll. Mark the pieces to indicate the lengthwise direction of the original roll or sheet.

6.3 *Test Specimens*—Except for testing length or width for which the specimens are the rolls or sheets in the lot sample, take specimens as follows:

6.3.1 From each laboratory sampling unit, cut three specimens at least 5 by 8 in. (13 by 20 cm). Take one specimen from each edge and from the center of the width of the laboratory sampling unit with no specimens being taken less than 6 in. (150 mm) from the edge of the laboratory sampling unit. Identify the specimens as “Edge 1, Lab. Sampling Unit \_\_\_,” “Center Lab. Sampling Unit \_\_\_,” and “Edge 2 Lab. Sampling Unit \_\_\_.”

NOTE 3—A specimen 5 by 9 in. (13 by 23 cm) is commonly used.

NOTE 4—In some cases, the same specimens may be used for more than one test. For example, the specimens for thickness may also be used for mass, air permeability, wool content, or ash test.

## REQUIREMENTS

### 7. Chemical Composition

7.1 The chemical properties of roll and sheet felt shall conform to the specifications in Table 1.

7.2 The chemical properties of specialty felts shall conform to the specifications in Table 4.

7.3 Unspecified chemical properties of felt such as pH, acid content, and others deemed critical for end use shall be as agreed upon by the supplier and the purchaser.

### 8. Physical Requirements

8.1 The physical properties of roll and sheet felt such as width, thickness, and mass (weight) per unit area, shall conform to the requirements in Tables 1-3. The length of roll and sheet felt shall conform to the requirements agreed upon by the supplier and the purchaser.

8.2 The physical properties of specialty felts, such as width, thickness, and mass (weight) per unit area, shall conform to the requirements in Table 3. The length of specialty felts shall conform to the requirements agreed upon by the supplier and the purchaser.

### 9. Fiber Composition

9.1 The wool content of roll and sheet felts shall conform to the specifications in Table 1.

9.2 The wool content in specialty felts shall conform to the specifications in Table 4.

### 10. Fiber Composition of Sheet Felt

10.1 *Type S1*—Composed predominantly of natural white wools, U.S. 62’s (540 mtex) or finer. The wool or felt shall be free of vegetable matter, paint, and other foreign material.

10.2 *Type S2*—Composed predominantly of natural white wools, U.S. 56’s (783 mtex) or finer. Color may be less of a clear white than Type S1 and foreign matter may be detectable.

10.3 *Type S3*—Composed predominantly of natural white wools, U.S. 50’s (968 mtex). Color may be less clear white than Types S1 or S2 and foreign matter may be readily observable.

10.4 *Type S4*—Same as Type 2, but composed of gray wool.

## TEST METHODS

### 11. Properties Except Color

11.1 For all properties except color, determine the property as directed in Test Methods D 461.

### 12. Color

12.1 *Scope*—This procedure is applicable only to determine the color of roll or sheet felt.

12.2 *Uses and Significance:*

12.2.1 The procedure in Specification D 2475 for the determination of the color of rolls and sheets of wool felt is considered satisfactory for acceptance testing of commercial shipments of wool felt because it is used in the trade for that purpose. Comparative tests as directed in 12.2.2 may be advisable.

12.2.2 In case of a dispute arising from differences in reported tests results when using the procedure in Specification D 2475 for the acceptance testing of commercial shipments, the purchaser and the supplier should conduct comparative tests to determine if there is a statistical bias between their laboratories. Competent statistical assistance is recommended for the investigation of bias. As a minimum, the two parties should take a group of test specimens that are as homogeneous as possible and that are from a lot of material of the type in question. The test specimens should then be randomly assigned in equal numbers to each laboratory for testing and graded as acceptable or not acceptable. The average results from the two laboratories should be compared. If a bias is found, either its cause must be found and corrected or the purchaser and the supplier must agree to interpret future test results in the light of the known bias.

12.2.3 Color is important in rolls or sheet felt for esthetic and functional purposes. Minor differences in color are not important.

12.2.4 The highest grades of roll and sheet felt are made of white fibers without the presence of naturally colored or dyed fibers. The majority of felts for mechanical applications are gray. Other colors are manufactured for special end uses upon request.

12.3 *Apparatus and Standard Materials:*

12.3.1 *Viewing Equipment*, acceptable to the purchaser and the supplier, such as daylight through a north window or standardized artificial light sources.

12.3.2 *Standard Samples*, acceptable to the purchaser and the supplier. Tolerances around a standard sample shall be to a commercial match as agreed between purchaser and supplier.

12.4 *Procedure*—Compare the specimens to the standards and determine if the color is acceptable.

12.5 *Report:*

12.5.1 Report that the specimens were tested as directed in the color procedure in ASTM Specification D 2475. Describe the material sampled and the method of sampling used.

12.5.2 Report whether the specimens had acceptable color.

12.6 *Precision and Bias*—No statement is made about either the precision or bias of the procedure in Specification D 2475 for measuring the color of rolls or sheets of felt since the result merely states whether there is conformance to the criteria specified in the procedure.

## CONFORMANCE

### 13. Conformance

13.1 The purchaser and seller may agree on a procedure to establish conformance, including control charts furnished by the seller, a sequential-sampling plan, or the double sampling plan outlined in 13.2.

13.2 In the absence of a control-chart or sequential-sampling plan, proceed as directed in 13.2.1-13.2.3.

13.2.1 If the test results for the lot conform to the requirements for all characteristics specified consider the lot a valid delivery.

13.2.2 If the test results for one or more characteristics do not conform to the specifications, take a new laboratory sample

from either the original lot sample or a new lot sample. Test the new sample for the characteristic(s) that did not conform to the specifications in the first test, and average the results of the first and second samples as if all results were from one test. If the new average(s) conform(s) to the specifications, consider the lot a valid delivery.

13.2.3 If the test results obtained as directed in 13.2.2 do not conform to the specifications, consider the lot a nonvalid delivery.

### 14. Keywords

14.1 ash; color; content; mass per unit area; solubility relationships; specific gravity; splitting; tension (tensile) properties/tests; thickness; width; wool felt

## APPENDIX

### (Nonmandatory Information)

#### X1. DESIGN DATA FOR FELT PRODUCTS

X1.1 Although not part of the specification, the typical design data in Table X1.1 shows representative characteristics that will assist the equipment designer in the use of felt. These typical design characteristics should not be used for specification purposes unless mutual agreement is established.

**TABLE X1.1 Typical Design Data**

ASTM (NTA) Classification	Compressional Resistance, %	Compressional Recovery, %
14R1	35	80
17R1	45	85
17R2	40	80
18R1	50	85
18R2	50	85
18R3	50	80
18R4	50	80
18R5	50	80
26R1	65	97
26R2	65	95
26R3	65	95
34R1	75	98
34R2	75	97
34R3	75	95
38R1	80	98
38R2	80	98
26S1	65	97
26S4	65	95
34S1	80	95
34S2	80	93
34S3	80	93
34S4	80	93
43S1	85	98
43S2	85	98
43S3	85	98
43S4	85	98
56S1	90	98
56S2	90	98
56S3	90	98
56S4	90	98
68S1	92	99
68S2	92	99
68S3	92	98
68S4	92	98

X1.2 *Test Method for Percent Compression Resistance (NTA):*

X1.2.1 Average compressional resistance is defined as the percent decrease in the initial thickness ( $T_1$ ) of approximately 1/2 in. (13 mm) measured after 1 min at a compressive stress of 0.625 psi (4.3 kPa). ( $T_2$ ) is measured 1 min after loading with a compressive stress of 100 psi (689 kPa). Using Eq X1.1, compute percent compressional resistance as follows:

$$\% \text{ Compressional Resistance} = 100 T_2/T_1 \quad (\text{X1.1})$$

where:

$T_1$  = initial thickness (1/2 in.) (approximately 13 mm), and

$T_2$  = compressed thickness at 100 psi (689 kPa).

This property is a measure of the felt's ability to resist loading.

X1.3 *Test Method of Percent Compressional Recovery (NTA):*

X1.3.1 Average compressional recovery is the percentage difference between the original measured thickness ( $T_1$ ) of approximately 1/2 in. (13 mm) and a measured thickness as determined after a compressive stress of 100 psi (689 kPa) has been exerted for a 1-min duration and thereafter released for 1 min before measuring thickness ( $T_3$ ). Both initial and final thickness are measured at a compressive stress of 0.625 psi (4.3 kPa). Using Eq X1.2, compute percent compressional recovery as follows:

$$\% \text{ Compressional Recovery} = 100 T_3/T_1 \quad (\text{X1.2})$$

where:

$T_1$  = initial thickness (1/2 in.) (approximately 13 mm), and

$T_3$  = final thickness measured 1 min after unloading.

Compressional recovery is a measure of the felt's ability to recover after loading. It is sometimes referred to as compression set.



X1.3.2 Specific data on other typical design properties are available.

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