Designation: A 947M – 95 (Reapproved 2004)

METRIC

Standard Specification for Textured Stainless Steel Sheet [Metric][1]

This standard is issued under the fixed designation A 947M; 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 stainless steel, textured sheets, especially for use in electronic packaging applications, for example, cabinet, rack, enclosure, and shelf constructions for telecommunication, computer, and data-processing equipment.

1.2 This specification applies to all finished flat-rolled stainless products specified by standards organizations such as International Standards Organization (ISO), American Society for Testing and Materials (ASTM), European Committee for Standardization (CEN), German Institute for Standardization (DIN), and others participating in a global standards harmonization effort.

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

2. Referenced Documents

2.1 *ASTM Standards:* [2]

A 176 Specification for Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products

A 480/A 480M Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip

A 700 Practices for Packaging, Marking, and Loading Methods for Steel Products for Domestic Shipment

A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products

B 117 Practice for Operating Salt Spray (Fog) Apparatus

B 193 Test Method for Resistivity of Electrical Conductor Materials

D 257 Test Methods for DC Resistance or Conductance of Insulating Materials

D 523 Test Method for Specular Gloss

2.2 *ISO Standards:*[3]

ISO 1462 Accelerated Corrosion Tests and Evaluation of Results

ISO 6892 Metallic Materials Tensile Testing

2.3 *IEC Standard:*[4]

IEC 68 Environmental Testing

2.4 *CEN Standard:*[5]

EN 10002/1 Metallic Materials Tensile Testing

2.5 *DIN Standards:*[6]

DIN 17441 Stainless Steel Technical Delivery Conditions for Stainless Cold Rolled Steel

DIN 50021-SS Spray Test with Different Sodium Chloride Solutions

DIN 50980 Evaluation of Corrosion Tests

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *textured*—a three-dimensional design pattern, regardless of the specific production-process approach.

4. Ordering Information

4.1 It is the responsibility of the purchaser to specify all requirements that are necessary for material ordered under this specification. Such requirements may include, but are not limited to the following:

4.1.1 *Quantity*—Number of sheets or weight.

4.1.2 Dimensions of sheet (thickness (texture included), width, and length). See Tables 1-5 and Section 9 for preferred sizes and tolerances.

4.1.3 ASTM designation and date of issue.

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[1] This specification is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel, and Related Alloys and is the direct responsibility of Subcommittee A01.17 on Flat-Rolled and Wrought Stainless Steel.

Current edition approved Sept. 1, 2004. Published September 2004. Originally approved in 1995. Last previous edition approved in 2000 as A 947M - 95 (2000).

[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 International Organization for Standardization (ISO), 1 rue de Varembé, Case postale 56, CH-1211, Geneva 20, Switzerland.

[4] Available from International Electrotechnical Commission (IEC), 3 rue de Varembé, Case postale 131, CH-1211, Geneva 20, Switzerland.

[5] Available from European Committee for Standardization (CEN), Rue Bredérode 2, B 1000 Bruxelles.

[6] Available from German Institute for Standardization (DIN), Burggrafenstrasse 6, 1000 Berlin 30.

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TABLE 1 Permissible Deviations in Thickness[A]

Preferred Nominal Thickness	Applicable Thickness		Permissible Thickness Variations for Nominal Sheet Widths ≥10 ≤1600
	≥	≤	
0.40	0.4	0.5	0.04
0.50; 0.60	0.5	0.7	0.05
0.70; 0.80; 0.90; 1.00	0.7	1.1	0.06
1.20	1.1	1.5	0.08
1.50; 2.00	1.5	2.5	0.1
2.50; 3.00	2.5	3.5	0.12
3.50; 4.00	3.5	4.5	0.14
4.50; 5.00; 6.00	4.5	6.0	0.15

[A] In reference to preferred sheet thicknesses. Dimensions stated are in millimetres.

TABLE 2 Permissible Deviations for Nominal Widths[A]

Nominal Thickness		Permmissible Deviation at Nominal Width			
≥	≤	≤100	≥100 to ≤300	≥300 to ≤700	≥700 to ≤1600
0.40	1.00	0.5	0.8	1.0	1.5
1.00	1.75	0.7	1.0	1.5	1.5
1.75	3.00	1.0	1.5	1.5	2.0
3.00	6.00	. . .	. . .	2.0	2.0

[A] Dimensions stated are in millimetres.

TABLE 3 Permissible Deviations for Nominal Length[A]

Nominal "L"	Permissible Deviation for Nominal Length
≤2000	5
> 2000	0.0025 × Length

[A] Dimensions stated are in millimetres.

TABLE 4 Permissible Deviations on Flatness[A]

Nominal Thickness		Total Deviation, %	
		Relating to Length D/L	Relating to Width D/W
0.40	2.00	0.4	0.5
2.00	4.00	0.3	0.4
4.00	6.00	0.1	0.4

[A] Dimensions stated are in millimetres.

4.1.4 Name and type of material.

4.1.5 Surface condition of the nontextured surface. See Specification A 480/A 480M or DIN 17441 Table 8.

4.1.6 Textured identification reference number. See Table 6.

4.1.7 Type and thickness of protective liner, if required by the purchaser.

4.1.8 Marking requirements. Reference: Practices A 700.

NOTE 1—A typical ordering description is as follows: 500 sheets, 1.00 by 1200 by 2500 mm; Specification A 176, Type 430; Surface Finish Texture ID: S-F-O, 6-1, 3-6-170-3; 100 sheet maximum/skid, textured side up. Each skid marked with purchase order number, applicable ASTM standard, and date of shipment.

5. Materials and Manufacture

5.1 The textured side or sides of the sheet shall be produced in such a manner that guarantees repeatability of the pattern over time. See 6.2.

TABLE 5 Permissible Deviations on Squareness[A]

Nominal Length		Squareness Tolerances at Nominal Width Ratio of AA/BB Dimension	
≥	≤	≤1000	≥1000 to ≤1600
. . .	2000	6	7
2000	3000	7	7
3000	3500	7	8
3500	5000	8	10
5000	6000	12	12

[A] Dimensions stated are in millimetres.

TABLE 6 Textured Reference Identification

Pattern orientation		Note 1
Pattern appearance		Note 2
Height of pattern		Note 3
Size of pattern		Note 4
Type of pattern		Note 5
Pattern repetition configuration		Note 6
Pattern effect on far side of sheet		Note 7
Example of typical ordering description:		
	S-F-O,6-1,3-6-170-3	
Note 1: S (Straight)	Pattern oriented with flow line of rolling process.	
A (Angular)	Pattern oriented 45° to flow line of rolling process.	
O (Other)	Optional pattern orientation.	
Note 2: F (Fine)	If the number of pattern repetitions under Note 6 exceeds 100.	
C (Coarse)	If the number of pattern repetitions under Note 6 is less than 100.	
Note 3:	Height of pattern in millimetres.	
Note 4:	Size of individual pattern. (Largest individual pattern dimension in millimetres; length, width, diagonal, and so forth.)	
Note 5:	Type of pattern:	
No. 0 round	No. 7 trapezoidal	No. 14 arrow
No. 1 square	No. 8 lines	No. 15 snowflake
No. 2 rectangular	No. 9 points	No. 16 teardrop
No. 3 triangular	No. 10 letters	No. 17 combination
No. 4 hex	No. 11 numbers	No. 18 shapeless
No. 5 octal	No. 12 bricks	No. 19 irregular shape
No. 6 oblong	No. 13 star	No. 20 others not defined
Note 6:	Number of largest individual pattern repetitions within a 20-mm · 20-mm area of the stainless steel sheet. (Partial pattern repetition included.)	
Note 7:	A two-sided pattern under this specification displays the same pattern on both sides of the sheet. This pattern is usually reserved for material thicknesses of 2.5 mm and thicker.	
	No. 1 Two-sided pattern.	
	No. 2 One-sided pattern. No visible marks from an one-sided pattern, when viewed with the unaided eye from a distance of 1 m.	
	No. 3 One-sided pattern. Shadings and reflections as a result from the pattern process on the opposite side of the sheet shall be acceptable.	
	No. 4 One-sided pattern. Measurable deformation, caused by the pattern on the opposite side of the sheet shall be acceptable.	

5.2 Manufacture process of textured material under this specification shall follow industry practices.

6. Texture of Sheet

6.1 The texture of any sheet delivered under this specification shall meet the provisions outlined in Table 6 and Section 13.

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6.2 The customer shall either provide a control-sample (300 mm by 400 mm) or designate a control-sample from a chosen textured material to ensure accurate repetition in appearance of like products. See Section 13.

7. Chemical Composition

7.1 The heat chemical composition shall be reported to the purchaser, or his representative, and shall conform to the requirements specified in the applicable ASTM standard of the steel type selected for texturing.

7.2 Methods and practices relating to chemical analysis required by this specification shall be in accordance with Test Methods, Practices, and Terminology A 751.

8. Other Requirements

8.1 If requested by the purchaser, physical (electrical and optical) and mechanical (tensile, yield, and elongation) property requirements shall be reported to the purchaser based on a lot size as specified in 8.2.

8.2 A lot shall consist of all sheets of the same thickness made from the same coil. In case the material cannot be identified by coil, a lot shall consist of no more than 5000 kg (approximately 5 tons) of sheets of the same thickness.

8.3 *Electrical Requirements*:

8.3.1 The specific resistivity of the material measured at 20°C to be reported in ohms·mm^2/m (μΩ·cm).

8.3.2 The surface resistivity of the material measured at 20°C to be reported in milliohms. Refer to Test Methods D 257.

8.4 *Optical Requirements*—The textured surface of the material selected under this specification shall meet the inspection requirements (see 13.2) based on a visual sample comparison or a 6:1 art master pattern comparison, or both.

8.5 *Mechanical Requirements*—The mechanical properties, tensile strength, yield strength, and elongation of the material selected for texturing shall be reported in values specified in 12.5 of this specification.

9. Dimensions, Mass, and Permissible Variations

9.1 Unless noted in the purchase order, the stated tolerance conditions in Tables 1-5 are deemed to be acceptable.

9.2 Table 1 lists the tolerance for sheet thickness relevant to the preferred thickness sizes of textured sheets in this specification.

9.3 Table 2 lists the tolerance for sheet widths relevant to the preferred width sizes of textured sheets in this specification.

9.4 Table 3 lists the tolerance for sheet lengths relevant to the preferred length sizes in this specification.

9.5 Table 4 lists the permissible tolerance for sheet flatness relevant to the preferred flatness tolerances in this specification as a ratio of: deviation "*D*" to length "*L*" and width "*W*" of textured sheet. (See 10.5.)

9.6 Table 5 lists the maximum permissible difference between the diagonal dimensions "*AA*" and "*BB*" of the textured sheet. (See 10.6 and Fig. 1.)

9.7 The maximum permissible deviation of the edge camber "*D*" for textured sheets is 0.2 % of the nominal length of the sheet. (See 10.6)

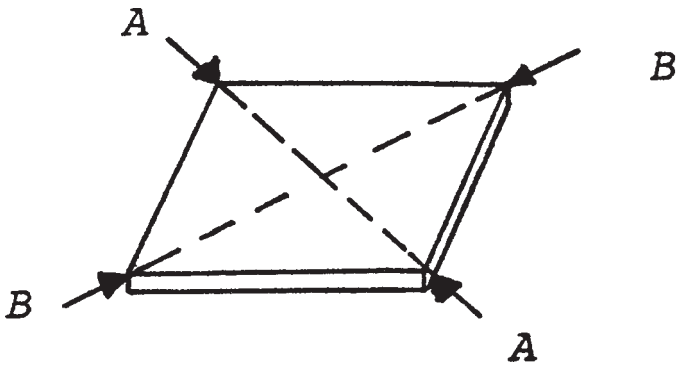

FIG. 1 Squareness

10. Measurement

10.1 Unless otherwise stated, the measurement of the geometrical requirements shall be based on the definition outlined in Section 10.

10.2 *Thickness*—The thickness (texture included) may be measured at any point located more than 20 mm from the edges.

10.3 *Width*—The width is measured perpendicularly to the longitudinal axis of the product.

10.4 *Length*—The length is measured along one of the sides of the sheet or cut length.

10.5 *Flatness*—The measurement of the flatness deviation (pockets) is made according to the pictorial representation "*A*" and "*B*", see Fig. 2. The sheet is lying on a flat surface with the concave side upward.

10.6 *Edge Camber*—The edge camber is the greatest deviation of a side edge from a straight line, the measurement being taken on the concave side with a straight edge (see Fig. 3).

11. Workmanship

11.1 Textured sheets shall be uniform in quality and condition and free of injurious defects, that due to their nature or severity, may detrimentally affect the suitability for the service intended.

12. General Requirements for Delivery

12.1 Unless otherwise specified in the purchase order, the materials furnished under this specification shall conform to applicable requirements of the current edition of Specification A 480/A 480M or, if applicable, to DIN 17441.

12.2 If requested by the purchaser, material shall be delivered with a protective liner of either polyvinyl (PVC) or polyethylene (PE) on the textured side of the sheet. However, if a protective liner is being specified it must not be detrimentally affected by ultraviolet (UV) or temperature exposure, or both, up to 70°C. Its removal from the sheet stock must be guaranteed not to leave any residue on the textured sheet up to a storage time of 18 months.

12.3 If requested by the purchaser, material shall be delivered with a certification of electrical properties such as:

12.3.1 *Specific Resistivity*, measured in ohms·mm^2/m (μΩ·cm) in accordance with Test Method B 193.

12.3.2 *Surface Resistivity*, measured in milliohms in accordance with Test Methods D 257.

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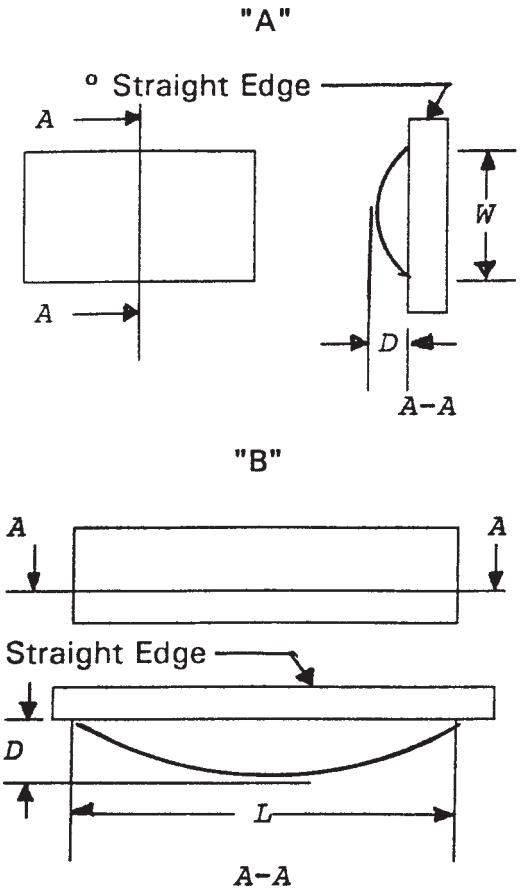

FIG. 2 Flatness Deviation (Pockets)

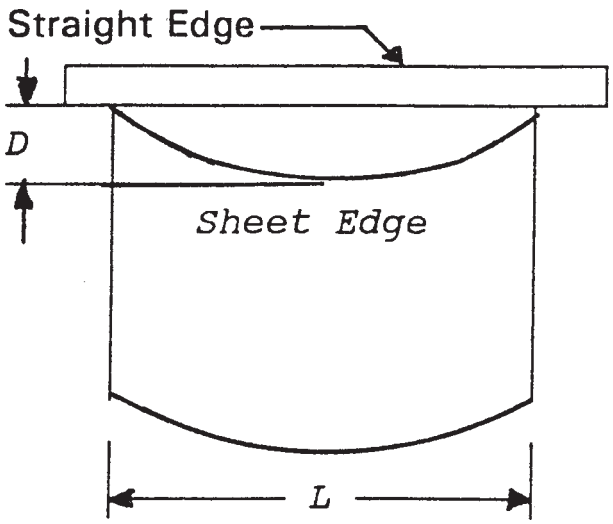

FIG. 3 Edge Camber

12.4 If requested by the purchaser, material shall be delivered with a certification of thermal conductivity measured in W/(m·K) at 20°C.

12.5 If requested by the purchaser, material shall be delivered with a certification of mechanical properties such as:

12.5.1 Yield strength maximum in N/mm^2.

12.5.2 Tensile strength maximum in N/mm^2.

12.5.3 Elongation in 50 mm (2 in.) minimum %.

13. Inspection

13.1 Unless otherwise specified in the purchase order, the seller agrees to perform all the tests and inspections as outlined in Section 11, demonstrating conformity to the applicable relevant conditions or standards in a test report at the time of the initial purchase order.

13.2 *Appearance*—The textured and untextured surfaces shall match the appearance of the purchasers control sample or that of a designated control sample agreed upon between both parties, when viewed with the unaided eye from a distance of 1 m by daylight.

13.2.1 If there is a substantial disagreement between the seller and the purchaser on the appearance, the following inspection shall become the tie breaker.

13.2.1.1 The precision of the texture, as defined in Table 6, shall be established by comparing an art-master (100 mm by 100 mm) magnified 6:1 (600 mm by 600 mm), provided by the purchaser, with a photographic enlargement, 6:1, of the product, provided by the seller. See Fig. 4 for example. (Not to scale.)

13.2.1.2 The precision of the gloss shall be established by comparing the measured values of gloss of the control sample with the production sample. The measurement shall be performed in accordance with Test Method D 523.

13.3 *Tensile Strength*—A tensile test shall be carried out in accordance with Test Methods A 370 or ISO 6892 or EN 10002/1.

13.4 *Corrosion: Indoor Environment*—(Dry/damp heat cycle test) In accordance with IEC 68.

13.4.1 *Specifics*:

13.4.1.1 Stabilizing in a climate of 23°C at 50 % RH according to IEC 68.1.

13.4.1.2 Duration: 8 h and immediately thereafter exposure to climate of 40°C at 93 % RH according to IEC 68.2.3.

13.4.1.3 Duration: 16 h.

13.4.1.4 Total cycle time to be 10.

13.5 *Corrosion: Indoor Environment*—(Corrosive atmospheric test) In accordance with IEC 68.2.60: Method No. 4.

13.5.1 *Specific Type and Concentration of Polluting Gases*:

H_2S (10^{-9} vol/vol)	10 ± 5
NO_2(10^{-9} vol/vol)	200 ± 20
Cl_2(10^{-9} vol/vol)	10 ± 5
SO_2(10^{-9} vol/vol)	200 ± 20
Temperature: 25 ± 1°C	
RH: 75 ± 3 %	
Volume change/h: 3 to 10	
Duration: 10 days	

13.6 *Corrosion: Outdoor Environment*—In accordance with Practice B 117 or DIN 50021-SS.

13.7 *Corrosion: Evaluation of Test Results*—In accordance with Practice ISO 1462 or DIN 50980.

13.7.1 For 13.4 and 13.5: Use No. 6.

13.7.2 For 13.6: Use No. 4.

14. Rejection and Rehearing

14.1 Material that fails to conform to the appearance specification set by this specification, see 13.2, may be rejected. Rejection should be reported to the producer or supplier promptly and in writing. In case of dissatisfaction with the

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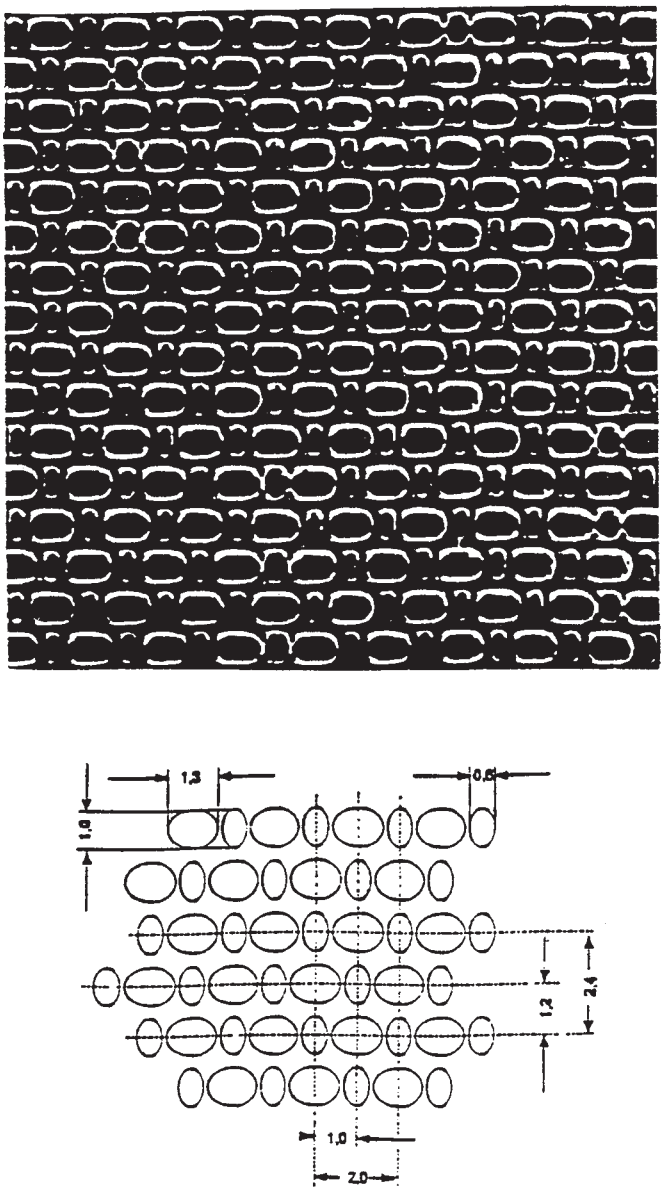

FIG. 4 Typical Sample of a Texture Pattern Defined by This Specification

result of the test, see 13.2, the producer or the supplier may make claim for a rehearing.

15. Packaging, Marking, and Loading

15.1 Unless otherwise specified, packaging, marking, and loading shall be in accordance with those procedures recommended by Practices A 700.

16. Keywords

16.1 appearance; certification; corrosion indoor environment; corrosion outdoor environment; data processing equipment; electrical requirements; enclosures; mechanical requirements; optical requirements; pattern; permissible variations; specific resistivity; stainless steel sheets; surface resistivity; telecommunication equipment; terminology; textured; thermal conductivity

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