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## Standard Specification for Metal, Expanded, Steel<sup>1</sup>

This standard is issued under the fixed designation F1267; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the U.S. Department of Defense.*

### 1. Scope\*

1.1 This specification covers expanded metal.

1.1.1 Expanded metal covered by this specification is intended for a variety of applications.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only and may be approximate.

1.3 The following precautionary caveat pertains only to the test methods portion, Section 11, of this specification. *This standard does not purport to address all of the safety problems 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*:<sup>2</sup>

**A123/A123M** Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

**A167** Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip (Withdrawn 2014)<sup>3</sup>

**A176** Specification for Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip

**A240/A240M** Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

**A666** Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

**A700** Practices for Packaging, Marking, and Loading Methods for Steel Products for Shipment (Withdrawn 2014)<sup>3</sup>

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee A01.19 on Steel Sheet and Strip.

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

<sup>3</sup> The last approved version of this historical standard is referenced on [www.astm.org](http://www.astm.org).

**A1008/A1008M** Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

**A1011/A1011M** Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

2.2 *SAE Standard*:<sup>4</sup>

**SAE J 1086** Metals and Alloys in the Unified Numbering System

2.3 *Military Standards*:<sup>5</sup>

**MIL-C-16173** Corrosion Preventive Compound, Solvent Cutback, Cold-Application

**MIL-STD-105** Sampling Procedures and Tables for Inspection by Attributes

### 3. Terminology

3.1 *Expanded Metal Terminology*:

3.1.1 *bond, n*—the solid intersection of two strands.

3.1.2 *camber, n*—the bow of a side or edge from end to end from a straight line.

3.1.3 *diamonds, n*—open area of metal after expanding. Most expanded metal open area or patterns are uniform diamond shaped, but may also be hexagonal, louvered, asymmetric, square, or other shapes, or combinations thereof.

3.1.4 *edge configuration, n*—refers to the edge condition of a sheet may they be closed diamonds, or open diamonds produced by shearing.

3.1.5 *expanded metal, n*—a rigid sheet of metal that is simultaneously been slit and stretched creating an open diamond pattern.

3.1.6 *flattened, v (F)*—expanded metal that has been cold-rolled after expansion.

3.1.7 *flattening, adv*—the process of producing flattened expanded metal.

<sup>4</sup> Available from Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001, <http://www.sae.org>.

<sup>5</sup> Available from Manufacturers Standardization Society of the Valve and Fittings Industry (MSS), 127 Park St., NE, Vienna, VA 22180-4602, <http://www.mss-hq.com>.

\*A Summary of Changes section appears at the end of this standard

3.1.8 *grating, n*—expanded metal that is produced from heavier sheet.

3.1.9 *levelness, n*—(flatness of sheet), sheets shall be free from waves or buckets that are in excess of 1-1/2 in. from a plane surface.

3.1.10 *LWD, n*—nominal dimension, Long Way of the Diamond.

3.1.11 *LWO, n*—Long Way of the Opening.

3.1.12 *regular-raised-standard, n*—(R) expanded metal as it comes from the press. The strands and bonds are set at a uniform angle to the plane of the sheet.

3.1.13 *SWD, n*—nominal dimension, Short Way of the Diamond.

3.1.14 *SWO, n*—Short Way of the Opening.

3.1.15 *shearing, n*—cutting the sheet to a specific size or tolerance.

3.1.16 *squareness, n*—the dimensional variance a side and edge are out of square.

3.1.17 *strand thickness, n*—thickness of the base metal

3.1.18 *strand thickness, n, and strand width, n*—can be varied to create different expanded metal products for different applications.

3.1.19 *strand width, n*—amount of material fed through top and bottom dies to produce one strand.

3.1.20 *taper, n*—edges of a sheet that deviates from parallel.

**4. Classification**

4.1 Expanded metal shall be of the following types, classes, and grades as specified (see 5.1.2).

4.2 *Type:*

4.2.1 *Type I*—Expanded (see Fig. 1).

4.2.2 *Type II*—Expanded and flattened (see Fig. 2).

4.3 *Class:*

4.3.1 *Class 1*—Uncoated.

4.3.2 *Class 2*—Hot-dip zinc-coated (galvanized).

4.3.3 *Class 3*—Corrosion-resisting steel.

4.4 *Grade:*

4.4.1 *Grade A*—0.0025 in. (0.06 mm) minimum coating thickness.

4.4.2 *Grade B*—0.0012 in. (0.03 mm) minimum coating thickness.

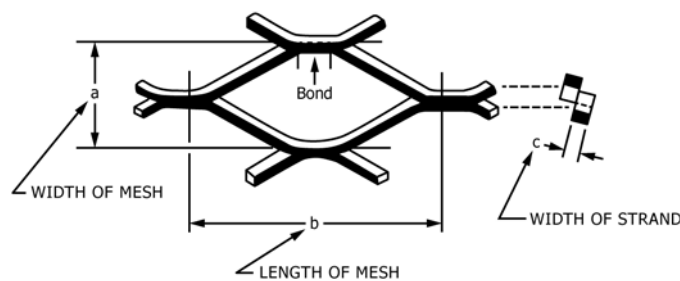


FIG. 1 Type I, Expanded

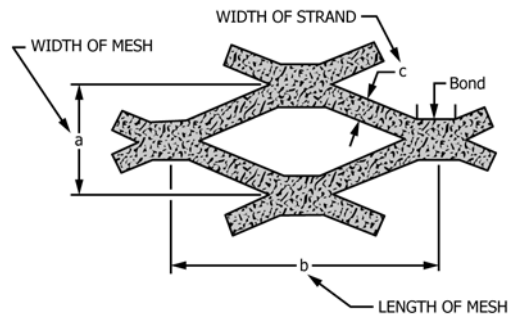


FIG. 2 Type II, Expanded and Flattened

**5. Ordering Information**

5.1 Orders for material under this specification shall include the following information, as required, to describe the material adequately:

5.1.1 ASTM designation,

5.1.2 Type, class, and grade of steel required (see 4.1),

5.1.3 Material required (see 6.1),

5.1.4 Direction of shear, if not as specified (see 6.2.1),

5.1.5 Length, width, and thickness of uncoated mesh, and weight per square ft. uncoated (see Tables 1-6),

5.1.6 Size of sheet required, if other than sizes specified in 7.1,

5.1.7 Whether or not sheets from which samples have been selected for coating thickness test may be included as part of material shipped (see 10.1.2), and

5.1.8 Optional requirements, if any (see Supplementary Requirements S1 through S3).

**6. Materials and Manufacture**

6.1 Expanded metal shall be made from Commercial Steel (CS Type B) carbon steel sheets as specified in Specifications A1008/A1008M or A1011/A1011M or from stainless steel sheets as specified in Specifications A167, A176, A240/A240M or A666.

6.2 Expanded metal shall be manufactured from sheet steel in thicknesses corresponding to Tables 1-6 as specified (see 5.1.5).

6.2.1 Each opening shall be integral with adjoining openings by means of unsheared bonds (see Fig. 1 and Fig. 2) of the original sheet.

**7. Dimensions, Mass, and Permissible Variations**

7.1 Unless otherwise specified (see 5.1.6), Type I expanded metal shall be furnished in sheets 4 ft (1.2 m) wide by 8 ft (2.4 m) long, and Type II, flattened, expanded metal shall be furnished in sheets 4 ft (1.2 m) wide by 8 ft (2.4 m) long.

7.2 Types I and II expanded metal shall be furnished in accordance with the weights and dimensions as specified in Tables 1-6, respectively.

7.3 *Tolerances for Type I (raised expanded metal) sheets:*

7.3.1 Strand width shall not vary in excess of ±10 % of the nominal width.

7.3.2 Sheet width shall not exceed 1/4 in. per ft. of SWD dimension. (Example: factory run stock sheet 48 in. could be 49 in. wide.)

**TABLE 1 Carbon Steel Dimensions, Strand Sizes, and Weight for Type I (Raised), Class 1 Metal<sup>A</sup>**

Style	Minimum <sup>B</sup> Thickness	Nominal Weight per CSF <sup>C</sup>	Design Size <sup>D</sup>		Opening Size <sup>D</sup>		Strand Size		Overall Thickness	Diamond per ft.		Percent Open Area
			SWD	LWD	SWO	LWO	Width	Thickness		SWD	LWD	
¼ 20	0.032	86	0.250	1.000	0.125	0.718	0.072	0.036	0.135	48	12	45 %
¼ 18	0.042	114	0.250	1.000	0.110	0.718	0.072	0.048	0.147	48	12	43 %
½ 20	0.032	43	0.500	1.200	0.438	0.938	0.072	0.036	0.140	24	10	80 %
½ 18	0.042	70	0.500	1.200	0.438	0.938	0.088	0.048	0.172	24	10	72 %
½ 16	0.053	86	0.500	1.200	0.375	0.938	0.087	0.060	0.175	24	10	65 %
½ 13	0.083	147	0.500	1.200	0.312	0.938	0.096	0.092	0.204	24	10	57 %
¾ 16	0.053	54	0.923	2.000	0.813	1.750	0.101	0.060	0.210	13	6	78 %
¾ 13	0.083	80	0.923	2.000	0.750	1.688	0.096	0.092	0.205	13	6	76 %
¾ 10	0.083	120	0.923	2.000	0.750	1.625	0.144	0.092	0.290	13	6	72 %
¾ 9	0.127	180	0.923	2.000	0.688	1.562	0.150	0.134	0.312	13	6	68 %
1 16	0.053	44	1.000	2.400	0.938	2.062	0.078	0.060	0.192	12	5	82 %
1½ 18	0.042	20	1.330	3.000	1.313	2.625	0.068	0.048	0.140	9	4	90 %
1½ 16	0.053	40	1.330	3.000	1.250	2.625	0.108	0.060	0.230	9	4	85 %
1½ 13	0.083	60	1.330	3.000	1.188	2.500	0.105	0.092	0.242	9	4	85 %
1½ 10	0.083	79	1.330	3.000	1.188	2.500	0.138	0.092	0.284	9	4	80 %
1½ 9	0.127	120	1.330	3.000	1.125	2.375	0.144	0.134	0.312	9	4	76 %
1½ 6	0.184	250	1.330	3.000	1.110	2.313	0.203	0.198	0.433	9	4	69 %
2 10	0.083	68	1.850	4.000	1.625	3.438	0.164	0.092	0.327	6.5	3	82 %
2 9	0.127	90	1.850	4.000	1.563	3.375	0.149	0.134	0.312	6.5	3	84 %

<sup>A</sup> 1 in. = 25.4 mm; 1 lb = 0.454 kg.

<sup>B</sup> The minimum thickness is absolute, not subject to minus variation.

<sup>C</sup> A variation in weight per square ft. of ±10 % is permissible, based on the weight of any sheet or bundle.

<sup>D</sup> A tolerance of ±10 % is permitted in dimensions, center to center.

**TABLE 2 Grating—Carbon Steel Dimensions, Strand Sizes, and Weight for Type I (Raised), Class 1 Metal<sup>A</sup>**

Style	Nominal Weight per CSF <sup>B</sup>	Design Size in. <sup>C</sup>		Opening Size in. <sup>C</sup>		Strand Size in.		Overall Thickness	Diamond per ft		Percent Open Area
		SWD	LWD	SWO	LWO	Width	Thickness		SWD	LWD	
2.0 lb	2.00	1.33	5.33	1.000	3.60	0.235	0.135	0.460	9.0	2.25	77 %
3.0 lb	3.00	1.33	5.33	0.940	3.44	0.264	0.183	0.540	9.0	2.25	60 %
3.14 lb	3.14	2.00	6.00	1.625	4.88	0.412	0.250	0.656	6.0	2.00	69 %
4.0 lb	4.00	1.33	5.33	0.940	3.44	0.300	0.215	0.618	9.0	2.25	55 %
4.27 lb	4.27	1.41	4.00	1.000	2.88	0.300	0.250	0.625	8.5	3.00	58 %
5.0 lb	5.00	1.33	5.33	0.813	3.38	0.331	0.250	0.655	9.0	2.25	50 %
6.25 lb	6.25	1.41	5.33	0.813	3.38	0.350	0.312	0.715	8.5	2.25	50 %
7.0 lb	7.00	1.41	5.33	0.813	3.38	0.391	0.318	0.740	8.5	2.25	45 %

<sup>A</sup> 1 in. = 25.4 mm; 1 lb = 0.454 kg.

<sup>B</sup> A variation in weight per square ft. of ±5 % is permissible, based on the weight of any sheet or bundle.

<sup>C</sup> A tolerance of ±5 % is permitted in dimensions, center to center.

**TABLE 3 Grating—Stainless Steel Dimensions, Strand Sizes, and Weights for Type 1 (Raised), Class 1 Metal<sup>A</sup>**

Style	Nominal Weight per CSF <sup>B</sup>	Design Size, in. <sup>C</sup>		Opening Size, in. <sup>C</sup>		Strand Size, in.		Overall Thickness	Diamond per ft. per ft.		Percent Open Area
		SWD	LWD	SWO	LWO	Width	Thickness		SWD	LWD	
3.3 lb.	3.32	2.00	6.0	1.625	4.880	0.312	0.250	0.656	6	2	69 %
4.5 lb.	4.25	1.41	4.0	1.000	2.880	0.300	0.250	0.625	8.5	3	58 %

<sup>A</sup> 1 in. = 25.4 mm; 1 lb = 0.454 kg.

<sup>B</sup> A variation in weight per square ft. of ±5 % is permissible, based on the weight of any sheet or bundle.

<sup>C</sup> A tolerance of ±10 % to ±5 % is permitted in dimensions, center to center.

7.3.3 Sheet length shall not exceed 1/4 in. per ft. of LWD dimension. (Example: factory run stock sheet 96 in. could be 98 in. long.)

7.3.4 Camber shall not exceed 3/32 in. per ft. of dimension.

7.3.5 Taper shall not exceed 1/16 in. per ft. of dimension, or 1/4 in. overall, whichever is greater.

7.3.6 Squareness of ends of sheets shall not exceed 1/8 in. per ft. out of square or 1/2 in. of overall length.

7.3.7 Levelness of sheets shall be free from waves or buckles that are in excess of 1-1/2 in. from a plane surface.

7.3.8 Each sheet shall have closed diamond openings on all sides of the sheet unless ordered differently.

**TABLE 4 Carbon Steel Dimensions, Strand Sizes, and Weight for Type II (Flattened), Class 1 Metal<sup>A</sup>**

Style	Minimum Thickness <sup>B</sup>	Nominal Weight per CSF <sup>C</sup>	Design Size <sup>D</sup>		Opening Size <sup>D</sup>		Strand Size		Overall Thickness	Diamond per ft.		Percent Open Area
			SWD	LWD	SWO	LWO	Width	Thickness		SWD	LWD	
¼ 20	0.029	82	0.250	1.050	0.084	0.715	0.079	0.030	0.030	48	11.6	35 %
¼ 18	0.039	108	0.250	1.050	0.075	0.715	0.080	0.040	0.040	48	11.6	35 %
½ 20	0.029	40	500	1.250	0.375	1.000	0.079	0.029	0.029	24	9.5	65 %
½ 18	0.039	66	500	1.250	0.312	1.000	0.097	0.039	0.039	24	9.5	60 %
½ 16	0.048	82	500	1.250	0.312	1.000	0.096	0.050	0.050	24	9.5	63 %
½ 13	0.068	140	500	1.250	0.265	1.000	0.107	0.070	0.070	24	9.5	52 %
¾ 16	0.048	51	0.923	2.100	0.750	1.750	0.111	0.048	0.048	13	5.7	75 %
¾ 14	0.060	63	0.923	2.100	0.688	1.813	0.105	0.061	0.061	13	5.7	74 %
¾ 13	0.068	75	0.923	2.100	0.688	1.781	0.106	0.070	0.070	13	5.7	73 %
¾ 10	0.068	114	0.923	2.100	0.637	1.755	0.160	0.070	0.070	13	5.7	68 %
¾ 9	0.108	171	0.928	2.100	0.563	1.688	0.165	0.120	0.120	13	5.7	63 %
1 16	0.048	41	1.000	2.500	0.813	2.250	0.098	0.050	0.050	12	4.68	78 %
1½ 16	0.048	38	1.330	3.200	1.062	2.750	0.119	0.048	0.048	9	3.75	83 %
1½ 14	0.060	46	1.330	3.200	1.062	2.750	0.116	0.060	0.060	9	3.75	80 %
1½ 13	0.068	57	1.330	3.200	1.062	2.750	0.116	0.070	0.070	9	3.75	80 %
1½ 9	0.108	114	1.330	3.200	1.000	2.653	0.158	0.110	0.110	9	3.75	75 %

<sup>A</sup> 1 in. = 25.4 mm; 1 lb = 0.454 kg.

<sup>B</sup> The minimum thickness is absolute, not subject to minus variation.

<sup>C</sup> A variation in weight per square ft. of ±10 % is permissible, based on the weight of any sheer or bundle.

<sup>D</sup> A tolerance of ±10 % is permitted in dimensions, center to center.

**TABLE 5 Stainless Steel Styles, Weights, Dimensions, and Sheet Sizes for Type I (Raised), Class 3 Metal<sup>A</sup>**

Style	Nominal Weight per CSF <sup>B</sup>	Design Size <sup>C</sup>		Opening Size <sup>C</sup>		Strand Size <sup>C</sup>		Overall Thickness	Diamond per ft.		Percent Open Area
		SWD	LWD	SWO	LWO	Width	Thickness		SWD	LWD	
½ 18	73	0.500	1.200	0.437	0.937	0.087	0.050	0.164	24	10	68 %
½ 16	91	0.500	1.200	0.437	0.937	0.087	0.062	0.164	24	10	60 %
½ 13	187	0.500	1.200	0.325	0.875	0.119	0.093	0.225	24	10	56 %
¾ 18	48	0.923	2.000	0.812	1.750	0.106	0.050	0.202	13	6	85 %
¾ 16	60	0.923	2.000	0.812	1.750	0.106	0.062	0.202	13	6	83 %
¾ 13	91	0.923	2.000	0.750	1.687	0.107	0.093	0.202	13	6	80 %
¾ 9	205	0.923	2.000	0.687	1.582	0.160	0.140	0.300	13	6	67 %
1½ 16	45	1.330	3.000	1.250	2.750	0.115	0.062	0.222	9	4	85 %
1½ 13	68	1.330	3.000	1.250	2.750	0.115	0.093	0.222	9	4	83 %
1½ 9	137	1.330	3.000	1.125	2.500	0.155	0.140	0.280	9	4	77 %

<sup>A</sup> 1 lb = 0.454 kg; 1 in. = 25.4 mm.

<sup>B</sup> A variation in weight per square ft. of ±10 % is permissible, based on the weight of any sheet or bundle.

<sup>C</sup> A tolerance of ±10 % is permitted in dimensions.

**TABLE 6 Stainless Steel Styles, Weights, Dimensions, and Sheet Sizes for Type II (Flattened), Class 3 Metal<sup>A</sup>**

Style	Nominal Weight per CSF <sup>B</sup>	Design Size <sup>C</sup>		Opening Size <sup>C</sup>		Strand Size		Overall Thickness	Diamond per ft.		Percent Open Area
		SWD	LWD	SWO	LWO	Width	Thickness		SWD	LWD	
½ 18	69	0.500	1.260	0.312	1.000	0.098	0.040	0.040	24	9.5	60 %
½ 16	86	0.500	1.260	0.312	1.000	0.099	0.050	0.050	24	9.5	60 %
½ 13	178	0.500	1.260	0.240	0.915	0.132	0.080	0.080	24	9.5	57 %
¾ 18	46	0.923	2.100	0.750	1.812	0.118	0.040	0.040	13	5.7	77 %
¾ 16	57	0.923	2.100	0.750	1.812	0.118	0.050	0.050	13	5.7	75 %
¾ 13	86	0.923	2.100	0.625	1.750	0.120	0.070	0.070	13	5.7	74 %
¾ 9	195	0.923	2.100	0.562	1.687	0.165	0.119	0.119	13	5.7	61 %
1½ 16	43	1.330	3.150	1.062	2.750	0.128	0.050	0.050	9	3.8	80 %
1½ 13	65	1.330	3.150	1.000	2.625	0.130	0.079	0.079	9	3.8	80 %
1½ 9	131	1.330	3.150	0.037	2.625	0.165	0.119	0.119	9	3.8	75 %

<sup>A</sup> 1 lb = 0.454 kg; 1 in. = 25.4 mm.

<sup>B</sup> A variation in weight per square ft. of ±10 % is permissible, based on the weight of any sheet or bundle.

<sup>C</sup> A tolerance of ±10 % is permitted in dimensions.

7.3.8.1 Generally, all stock or machine run sheets will have closed diamonds on all four sides.

7.4 Tolerances for Type II (expanded and flattened metal) sheets: