

MIL-S-4174B
9 FEBRUARY 1968

Superseding
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MILITARY SPECIFICATION

STEEL SHEET AND STRIP, FLAT, ALUMINUM COATED
LOW CARBON

This specification is mandatory for use by all
Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope.- This specification covers the requirements for cold rolled low carbon steel sheet and strip coated on both sides with a layer of aluminum using a hot-dipped coating process.

1.2 Classification.- The aluminum coatings shall be of the following types and grades, as specified:

- Type I - Aluminum-silicon coating
 - Grade A - Regular (0.40 oz. per sq. ft., min.)
 - Grade B - Wiped (0.25 oz. per sq. ft., min.)
- Type II - Commercially pure aluminum coating
(0.75 oz. per sq. ft., min.)

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

STANDARDS

Federal

FED. STD. NO. 183	Continuous Identification Marking of Iron and Steel Products
FED. TEST METHOD STD. NO. 151	Metals; Test Methods

Military

MIL-STD-129	Marking for Shipment and Storage
MIL-STD-163	Steel Mill Products, Preparation for Shipment and Storage

FSC 9515

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(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 Material.-

3.1.1 The steel (base metal) shall be made by the open hearth, basic oxygen, or electric furnace process. Sufficient discard shall be taken from each ingot to insure freedom from injurious piping and undue segregations.

3.1.2 The base metal shall be coated on each side with a layer of aluminum using a hot-dipped coating process. The coating for type I shall be aluminum-silicon alloy; for type II, commercially pure aluminum.

3.2 Chemical composition.-

3.2.1 Base metal.- Chemical composition and check analysis tolerances shall comply with the requirements of table I.

TABLE I. Chemical composition of steel

Element	Analysis (percent)	Check analysis tolerance <u>1</u> / (percent)
Carbon	0.10 max.	+0.03
Manganese	0.20 - 0.50	+0.03
Phosphorus	0.040 max.	+0.008
Sulfur	0.050 max.	+0.008

1/ Individual determinations may vary to the extent shown in the "tolerance" column, except that the several determinations of a single element in any one heat shall not vary both above and below the specified range.

3.2.2 Coating.- Compositions for the aluminum coating bath are given in 6.3.

3.3 Coating weight.- The minimum weight of the aluminum coating as determined by the triple spot check shall be as follows:

- (a) Type I, grade A - 0.40 ounce per square foot
- (b) Type I, grade B - 0.25 ounce per square foot
- (c) Type II - 0.75 ounce per square foot

3.4 Bending requirements.-

3.4.1 The material shall withstand, without cracking of the basis steel, bending at room temperature flat on itself, with axis of bend parallel to the direction of rolling.

3.4.2 The coated material shall withstand, without flaking or peeling of the coating, bending at room temperature through an angle of 180 degrees around a diameter equal to twice the nominal thickness of the material, with axis of bend parallel to the direction of rolling.

3.5 Tolerances.-

3.5.1 Sheet and strip.-

3.5.1.1 Thickness.- The acceptable limits of variation in thickness shall be as indicated in table II.

3.5.1.2 Width.- The acceptable limits for variation in width shall be as indicated in table III.

3.5.1.3 Length, cut.- The acceptable limits of variation of sheet and strip ordered cut-to-length shall be +1/8, -0 inch.

3.6 Marking.- Sheet and strip shall be legibly marked in accordance with Fed. Std. No. 183. The following marking items shall be included:

- (a) Specification number
- (b) Manufacturer's name or trademark
- (c) Commercial designation (optional)
- (d) Nominal thickness (optional)

If the nominal thickness is not included in the continuous marking, it shall be indicated on diagonally opposite corners of each sheet or strip.

3.7 Workmanship.- The sheet and strip shall be uniform in quality and temper, straight, flat, clean, sound, smooth, and free from buckles, seams, cracks, laminations, blisters or any other evidence of poor workmanship that is such that the sheets or strips are unsuitable for the purpose intended.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection.- Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

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TABLE II. Permissible variations in thickness of sheet and strip
(All dimensions in inches)

Specified thickness	Permissible variations in thickness for widths given	
	Sheet	
	48 and under	Over 48 to 60, incl.
	Plus and minus $\frac{1}{2}$	Plus and minus $\frac{1}{2}$
0.018 to 0.025 incl.	0.002	0.003
Over 0.025 to 0.034 incl.	.003	.004
Over .034 to .043 incl.	.004	.005
Over .043 to .056 incl.	.004	.005
Over .056 to .070 incl.	.005	.006
Over .070 to .078 incl.	.006	.007
Over .078 to .093 incl.	.007	.008
Over .093 to .109 incl.	.007	.009
Over .109 to .125 incl.	.008	.010
Over .125 to .140 incl.	.008	.010
Over .140 to .171 incl.	.009	.012
Over .171 to .187 incl.	.010	.013
Over .187 to .218 incl.	.011	.015
Over .218 to .234 incl.	.012	.016
Over .234 to .250 incl.	.013	.018
	Strip	
	Widths - 14 and less	
	Plus and minus $\frac{1}{2}$	
Under 0.006	0.0005	
0.006 to 0.009 incl.	.0008	
Over 0.009 to 0.050 incl.	.0015	
Over .050 to .093 incl.	.0025	
Over .093 to .125 incl.	.004	
Over .125 to .156 incl.	$\frac{2}{2}$.0045
Over .156 to .250 incl.	$\frac{2}{2}$.0055

$\frac{1}{2}$ Measured $\frac{3}{8}$ inch or more from any edge except for strip under 1 inch in width which is measured at any place.

$\frac{2}{2}$ For widths over 8 inches the permissible variations for cold rolled sheet are applicable.

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TABLE III. Permissible variations in width of sheet and strip

Specified thickness (inches)	Specified width (inches)	Permissible variations in specified width (inches)	
		Plus	Minus
Sheet			
Up to 0.109, incl.	Up to 14, incl.	0.062	0
Over 0.109	Up to 14, incl.	.125	0
All thicknesses	Over 14	.125	0
Strip			
<u>Slit edge</u>			
0.009 and under	8 and under	0.005	0.005
Over 0.009 to 0.024, incl.	8 and under	.007	.007
Over 0.024 to 0.75, incl.	14 and under	.007	.007
Over 0.075 to 0.100, incl.	14 and under	.009	.009
Over 0.100 to 0.125, incl.	14 and under	.012	.012
Over 0.125 to <u>1/</u> 0.250, incl.	8 and under	.015	.015

1/ Available in straight lengths only.

4.2 General.- All the tests required herein for the testing of steel are classified as quality conformance tests, for which necessary sampling techniques and methods of testing are specified in this section.

4.3 Lot.- A lot shall consist of sheet, strip or coils produced under the same processing conditions from the same heat, of the same condition and the same thickness, essentially uniform in all respects, and submitted for acceptance at one time.

4.3.1 Chemical samples.- Samples for chemical analysis of the base material shall be taken, as described in Method 111 of Fed. Test Method Std. No. 151, to represent each melt in the shipment. A sample shall consist of not less than 2 ounces after removal of the aluminum coating (see 4.4.1).

4.3.1.1 Samples for check chemical analysis may be waived provided that all of the material under inspection can be identified as being made from a melt previously analyzed and found to be in conformance with the chemical composition specified herein.

4.3.2 Unless otherwise specified, one sample for coating thickness, one transverse bend test specimen, and one bend test specimen for the determination of the ductility of coating shall be selected from each 200 sheets or less comprising the lot.

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4.3.3 The method of selecting the samples specified in 4.3.2 is based on the assumption that the material is produced from ingots from the same melt at one time and is essentially uniform in all respects. If the material is taken from stock and is not identifiable as to melt and method of manufacture, or if the identify of any portion of the shipment is obscure in any respect, the necessary additional samples shall be selected to determine conformance of all portions of the shipment to this specification.

4.4 Preparation of specimens.-

4.4.1 Chemical samples.- The aluminum coating shall be removed from both sides of the sample by use of a caustic solution or other suitable means.

4.4.1.1 Coating weight specimens.- Three specimens shall be cut from the sample sheet. One of these specimens shall be taken from the center and the other two from diagonally opposite corners. The corner specimens shall be at least $\frac{1}{4}$ inches from the end and 2 inches from the side of the sheet. Each specimen shall be $2\frac{1}{4}$ inches square.

4.4.1.2 When material is in the form of coils, a sample piece approximately 12 inches long by the width of the coil shall be taken for the weight of coating test. Three specimens, $2\frac{1}{4}$ inches square shall be cut from this sample, one from the middle of the width, and one from each side not closer than 2 inches from the side edge.

4.4.2 Bend test specimens.- The bend test specimens shall be in accordance with Fed. Test Method Std. No. 151.

4.5 Test methods.-

4.5.1 Examination of product.- Sufficient spot checks shall be made to assure compliance with surface conditions, identification, dimensional, and workmanship requirements.

4.5.2 Chemical analysis.- A analysis for composition of steel shall conform to Method 111 or 112 of Fed. Test Method Std. No. 151. In the event of dispute, analysis shall be by Method 111, except for carbon, which shall be by the combination method.

4.5.3 Coating weight.- Each specimen shall be cleaned by washing in petroleum ether or other suitable solvent, dried thoroughly and weighed to the nearest 0.005 gram. The specimen shall be immersed in hot (approximately 150° F.) 20 percent sodium hydroxide solution until evolution of gas ceases. It shall then be removed, scrubbed under running water, blotted with a towel to remove all of the water, immersed for 2 to 3 seconds in cold concentrated hydrochloric acid, again scrubbed under running water and reimmersed in the hot sodium hydroxide. This cycle shall be repeated until no visible evolution of gas occurs on the immersion in the sodium hydroxide. The specimen is then scrubbed, dried, and reweighed. The loss in weight in grams is equal to the weight of coating in ounces per square foot of sheet surface. The weight of coating of the sample carrying the lightest weight of coating shall be taken as the minimum weight of coating. In the above procedure it is important that the water be removed from the surface of the samples before immersion in the hydrochloric acid since diluted hydrochloric acid will attack the base metal to a greater extent than the concentrated acid.

4.5.4 Bend tests.- The specimens and the procedures used for the bend test shall be in accordance with Method 231 of Fed. Test Method Std. No. 151. The specimens shall be bent at room temperature either by pressure or by blows. In the event of dispute, bending shall be by pressure.

4.6 Rejection and retest.- Materials failing to meet all the requirements of this specification shall be rejected. Retests shall be permitted in accordance with the requirements of Fed. Test Method Std. No. 151.

4.7 Examination of preparation for delivery.- Preparation for delivery shall be inspected for conformance to section 5:

5. PREPARATION FOR DELIVERY

5.1 Preservation and packaging.-

5.1.1 Level A.- The material shall be properly separated by type, grade, condition, and size when prepared for delivery. The sheets and strip shall be preserved and packaged in accordance with MIL-STD-163.

5.1.2 Level C.- The material shall be preserved and packaged in accordance with the manufacturer's commercial practice.

5.2 Packing.-

5.2.1 Level A.- The material shall be packed in accordance with MIL-STD-163.

5.2.2 Level C.- The material shall be prepared for shipment in accordance with commercial practice to insure carrier acceptance and safe transportation at the lowest rate to the point of delivery and shall meet, as a minimum, the requirements of carrier rules and regulations applicable to the mode of transportation.

5.3 Marking.- In addition to any special marking required by the contract or order, shipping containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use.-

6.1.1 Type I.- Type I is intended for use in applications where resistance to heat scaling and destruction is of primary importance.

6.1.1.1 Grade A.- Grade A is intended for normal fabrication application.

6.1.1.2 Grade B.- Grade B is intended for use where a thinner, more tightly adherent coating and an extra smooth finish for more severe forming applications are required.

6.1.2 Type II.- Type II is intended for use in applications where resistance to atmospheric and some chemical corrosion is of primary importance.

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6.2 Ordering data.- Procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Type, grade, size, and thickness.
- (c) Applicable levels of preservation, packaging, and packing.

6.3 Coating baths of the following chemical compositions have been used successfully to produce material conforming to this specification:

	Type I	Type II
	Percent (max.)	
Silicon	11.0	--
Iron	4.5	3.0
Other alloying elements and impurities	0.5	0.5
Aluminum	Remainder	Remainder

Custodians:

Army - MR
Navy - AS
Air Force - 11

Preparing activity:

Air Force - 11

Reviewer activities:

Army - MR
Navy - AS
Air Force -11

Project No. 9515-0099

SPECIFICATION ANALYSIS SHEET

Form Approved Budget
Bureau No. 119-RO04

INSTRUCTIONS

This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity.

SPECIFICATION

MIL-S-4174B Steel Sheet and Strip, Flat, Aluminum Coated, Low Carbon

ORGANIZATION

CITY AND STATE

CONTRACT NO.

QUANTITY OF ITEMS PROCURED

DOLLAR AMOUNT

\$

MATERIAL PROCURED UNDER A

 Direct Government Contract Subcontract

1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?

A. GIVE PARAGRAPH NUMBER AND WORDING.

B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES.

2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID.

3. IS THE SPECIFICATION RESTRICTIVE?

 YES NO

IF "YES", IN WHAT WAY?

4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity.)

SUBMITTED BY (Printed or typed name and activity)

DATE