

MIL-B-20148D
 30 March 1987
 SUPERSEDING
 MIL-B-20148C
 15 April 1970

MILITARY SPECIFICATION

BRAZING SHEET, ALUMINUM ALLOY

This specification is approved for use by all Departments and Agencies of the Department of Defense;

1. SCOPE

1.1 Scope. This specification covers aluminum alloy brazing sheet for use in brazed aluminum joints.

1.2 Classification. Aluminum brazing sheet shall be supplied in the following alloys and tempers (see 6.3 for cross reference information):

Alloy	Tempers
#11 Brazing sheet (3003 Core, 4343 Cladding)	O, H12, H14
#12 Brazing sheet (3003 Core, 4343 Cladding)	O, H12, H14
#23 Brazing sheet (6951 Core, 4045 Cladding)	O, F
#24 Brazing sheet (6951 Core, 4045 Cladding)	O, F

Odd numbered sheet is supplied with cladding on one side and even numbered sheet is supplied with cladding on both sides (see Table III).

1.2.1 Form. Brazing sheet is available in either coil or sheet form.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. Unless otherwise specified, the following specifications and standards of the Issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Systems Engineering and Standardization Department (Code 9321), Naval Air Engineering Center, Lakehurst, NJ 08733-5100, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 3439

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STANDARDS

FEDERAL

FED-STD-151 Metals; Test Methods

MILITARY

MIL-STD-129 Marking for Shipment and Storage

MIL-STD-649 Aluminum and Magnesium Products; Preparation for Shipment and Storage

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

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. The issue of the document which is indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI H35.2 American National Standard Dimensional Tolerances for Aluminum Mill Products

(Application for copies should be addressed to the American National Standards Institute, 1430 Broadway, New York, NY 10018.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B557 Tension Testing Wrought and Cast Aluminum and Magnesium Alloy Products

(Applications for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia PA 19103.)

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8 Specification for Brazing Filler Metal

(Application for copies should be addressed to the American Welding Society, P.O. Box 351040, Miami FL 33135.)

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal Agencies.)

2.3 Order of precedence. In the event of a conflict between the contents of this specification and the references cited herein, the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

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3. REQUIREMENTS

3.1 Chemical composition. Material shall conform to the chemical composition detailed in Table I.

3.2 Mechanical properties. Mechanical properties shall conform with those detailed in Table II for the alloy and temper specified. There are no mechanical tests required for the "F" temper.

3.3 Cladding thickness. The cladding bonded to the aluminum core shall have a thickness that meets the requirements of Table III.

3.4 Dimensional tolerances. Sheet shall not vary from specified dimensions by an amount greater than those tolerances specified in ANSI H35.2 for flatness, thickness, width, length and lateral bow for aluminum alloys.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor 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.

4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.2 Sampling.

4.2.1 Lot. A lot shall consist of an identifiable quantity of sheet of the same alloy, temper and nominal thickness submitted for inspection at one time.

4.2.2 Sampling for chemical analysis.

4.2.2.1 Ingot analysis. At least one sample shall be taken from each group of ingots of the same alloy, poured simultaneously from the same source of molten metal by the producer and analyzed to determine conformance with 3.1. Ingots not conforming to the requirements of 3.1 shall be rejected. Complete ingot analysis shall be maintained at the producer's facility and shall be available to the procuring activity for review upon request.

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TABLE I. Chemical composition.^{1/} ^{2/}

Elements	#11 and #12 Brazing Sheet		#23 and #24 Brazing Sheet	
	Core (3003)	Cladding (4343)	Core (6951)	Cladding (4045)
Silicon	0.6	6.8 - 8.2	0.2 - 0.5	9.0 - 11.0
Iron	0.7	0.8	0.8	0.8
Copper	0.05 - 0.2	0.25	0.15 - 0.4	0.3
Manganese	1.0 - 1.5	0.1	0.1	0.05
Magnesium	----	----	0.4 - 0.8	0.05
Zinc	0.1	0.2	0.2	0.1
Other elements				
Each	0.05	0.05	0.05	0.05 ^{3/}
Total ^{4/}	0.15	0.15	0.15	0.15
Aluminum	Remainder	Remainder	Remainder	Remainder

1/ Analysis shall routinely be made only for the elements specifically mentioned in Table I. If, however, the presence of other elements is indicated or suspected in the amounts greater than the specified limits, further analysis shall be made to determine that these elements are not present in excess of specified limits.

2/ Composition is maximum weight percent unless shown as a range.

3/ Also 0.20 percent maximum titanium.

4/ The sum of those "Other elements" 0.010 percent or more each, expressed to the second decimal before determining the sum.

TABLE II. Mechanical properties.

Class	Temper	Thickness (inches)	Tensile strength		Elongation In 2 Inches ^{1/} Minimum (percent)
			Minimum (lbf/in ²)	Maximum (lbf/in ²)	
#11 and #12	0	0.006-0.007	---	20000	12
		0.008-0.012	---	20000	15
		0.013-0.031	---	20000	18
		0.032-0.050	---	20000	20
		0.051-0.249	---	20000	23
	H12	0.019-0.050	17000	23000	4
		0.051-0.249	17000	23000	6
	H14	0.019-0.050	20000	26000	3
		0.051-0.249	20000	26000	5
	#23 and #24	0	0.020-0.031	---	21000
0.032-0.050			---	21000	20
0.051-0.249			---	21000	23

1/ Not required for material 1/2 inch or less in width.

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4.2.2.2 Finished product analysis. Specimens of products shall be analyzed when the compliance of an inspection lot with 3.1 is doubtful. The sampling procedure applied shall comply with the most applicable procedure from among the following:

4.2.2.2.1 Ingot identities known. When ingot identities of units comprising an inspection lot are known, one specimen from a unit from the products representing the ingot shall be analyzed in accordance with 4.4.1.

4.2.2.2.2 Ingot identities indeterminable. When ingot identities of units comprising an inspection lot can not be determined, the number of specimens taken for analysis in accordance with 4.4.1 shall comply with the following:

- a. From a lot of flat sheet, one specimen from each 2000 pounds or fraction thereof constituting the lot;
- b. From a lot of coils, one specimen from each coil.

Not more than one specimen shall be taken from the same unit when more than one unit is available,

4.2.3 Sampling for mechanical tests. One tension test specimen shall be taken for each 2000 pounds or less of sheet comprising the lot, except that not more than one specimen shall be taken from the same sheet.

4.2.4 Sampling for visual and dimensional examination. Each sheet shall be examined to determine conformance to this specification with respect to workmanship and markings. Examinations for dimensions shall be made at specified intervals to ensure conformance to the tolerances specified. When approved by the procuring activity, the producer may use a system of statistical quality control for dimensional, marking and workmanship examinations.

4.3 Examination.

4.3.1 Visual and dimensional examination. Each sample sheet selected in accordance with 4.2.4 shall be examined visually and dimensionally to verify conformance to this specification.

4.3.2 Preservation, packaging, packing and marking for shipment. The preservation, packaging, packing and marking for shipment shall be examined to determine compliance with the requirements of Section 5.

4.4 Test procedures.

4.4.1 Chemical analysis. Chemical analysis shall be made by the wet chemical method in accordance with Method III of FED-STD-151, by spectrographic or other analytical method approved by the procuring activity.

4.4.2 Mechanical properties.

4.4.2.1 Test specimens. Tension test specimens shall conform to ASTM B557. Sheet less than 3/4 inch in width shall be tested in full section. Test specimens shall be taken parallel to the direction of finish rolling for #H and #12 brazing sheet and perpendicular to the direction of finish rolling for #23 and #24 brazing sheet.

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4.4.2.2 Tension test. Tension tests shall conform with the requirements of ASTM B557.

4.5 Cladding thickness. If a question arises concerning the uniformity of cladding on the finished product, not fewer than three transverse samples, approximately 3/4 inch in length, shall be mounted to expose an edge perpendicular to the plane of the sample and polished for microscopic examination. After etching with Keller's etch or other suitable etch to differentiate between core and cladding, each specimen shall be examined at a magnification of 100X. The maximum and minimum cladding thickness shall be measured in each of 5 fields approximately 1/10 inch apart along each clad side of the exposed edge of each mounted specimen. The mean of the 10 thickness measurements on each side of the exposed edge of each mounted specimen is the mean cladding thickness for that side.

4.6 Rejection and retest. Unless otherwise specified, failure of a specimen to meet a test requirement shall be cause for rejection of the lot. A retest consisting of two specimens from the original sample to replace each failed specimen may be performed. If one of the retest specimens fails, the lot shall be rejected with no further testing permitted.

5. PACKAGING

5.1 Preservation, packaging, packing and marking. All sheets shall be preserved, packaged, packed and marked in accordance with the requirements of MIL-STD-649. Unless otherwise specified, material shall be preserved, packaged, packed and marked in accordance with Level C.

5.2 Marking. In addition to any special or other identification marking required by the contract (see 6.1), each sheet shall be marked in accordance with MIL-STD-129.

5.3 Packaging inspection. All packaging requirements shall be inspected in accordance with 4.3.2 to ensure compliance.

6. NOTES

6.1 Ordering data. Procurement documents shall specify the following:

- a. Title, number and date of this specification.
- b. Alloy, temper and form required (see 1.2).
- c. Length, width and thickness required (see 3.4).
- d. Levels of preservation, packaging, packing and marking, if other than Level C (see 5.1).

6.2 General notes.

6.2.1 Numbers 11 and 12 brazing sheet, after heating to brazing temperatures, will be fully annealed regardless of the condition in which it was originally supplied. The tensile strength may be expected to vary between 14500 to 20000 pounds per square inch. For this reason, brazing sheet should not be ordered in any temper other than annealed unless very little or no forming is necessary and the higher tensile strength of the alloy is of some particular advantage in the use of the material subsequent to brazing.

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6.2.2 Numbers 23 and 24 brazing sheet have an alloy core that responds to heat treatment. On cooling in still air from the brazing temperature, tensile strengths of approximately 23000 pounds per square inch may be expected. A more rapid cooling rate, as in as air blast, may produce tensile strengths of approximately 27000 pounds per square inch. Somewhat higher values are realized for more rapid quenching rates, and aging for 8 hours at 350°F may be expected to produce further increases in tensile strength to approximately 35000 pounds per square inch.

6.2.3 Aluminum brazing sheet clad on one side only should be ordered whenever practicable. Brazing sheet clad on both sides should only be used where the joint or part necessitates the flowing of the brazing material into the joint from both side, or when there are joints on both faces of a plate. It should also be noted that aluminum clad materials conforming to QQ-A-250/3, QQ-A-250/5, QQ-A-250/13, QQ-A-250/15 and QQ-A-250/18 are not intended for nor are suitable as "brazing sheet".

6.3 Cross reference Information.

MIL-B-20148C	Class 1	Class 2	Class 5	Class 6
MIL-B-20148D	#11	#12	#23	#24

6.3.1 Classes 3 and 4 of MIL-B-20148C have been deleted from this revision due to the absence of any domestic producers of these particular alloys. However, upon verification that there are domestic producers manufacturing these materials, they will be reinserted in the next revision or amendment to this specification.

6.3.2 Classes 7 and 8 of MIL-B-20148C have been deleted from this revision. AWS A5.8 Classes BA1Si-2 and BA1Si-4 may be used in lieu of Class 7 and 8, respectively.

6.4 Subject term (keyword) listing.

Aluminum
Brazing
Sheet, aluminum
Sheet, brazing

6.5 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodians:
Army - MR
Navy - AS
Air Force - 20

Preparing Activity:
Navy - AS
(Project No. 3439-0628)

Review activities:
Army - AR, AV, EA, ME

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TABLE III. Cladding thickness.

Class	Total Thickness of Composite Product (inches) ^{1/}	Number of Sides of Clad	Thickness of Each Cladding Plate, nominal (Percent of Total Thickness)	Minimum Mean Thickness of cladding on finished sheets (Percent of Total Thickness)	Maximum Mean Thickness of cladding on finished sheets (Percent of Total Thickness)
#11	$T < 0.063$	One	10	8	12
	$T \geq 0.064$	One	5	4	8
#12	$T < 0.063$	Both	10	8	12
	$T \geq 0.064$	Both	5	4	8
#23	$T < 0.090$	One	10	8	12
	$T \geq 0.091$	One	5	4	8
#24	$T < 0.090$	Both	10	8	12
	$T \geq 0.091$	Both	5	4	8

^{1/} T = Total Thickness of Composite Material.

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NOTE: This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER NIL-B-20148D		2. DOCUMENT TITLE BRAZING SHEET, ALUMINUM ALLOY	
3a. NAME OF SUBMITTING ORGANIZATION		4. TYPE OF ORGANIZATION <i>(Mark one)</i>	
b. ADDRESS <i>(Street, City, State, ZIP Code)</i>		<input type="checkbox"/> VENDOR	
		<input type="checkbox"/> USER	
		<input type="checkbox"/> MANUFACTURER	
		<input type="checkbox"/> OTHER <i>(Specify):</i> _____	
5. PROBLEM AREAS			
a. Paragraph Number and Wording:			
b. Recommended Wording:			
c. Reason/Rationale for Recommendation:			
6. REMARKS			
7a. NAME OF SUBMITTER <i>(Last, First, MI) - Optional</i>		b. WORK TELEPHONE NUMBER <i>(Include Area Code) - Optional</i>	
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