

MIL-P-25995B(USAF)

2 March 1982

SUPERSEDING

MIL-P-25995A(USAF)

2 Oct 1968

## MILITARY SPECIFICATION

## PIPE, ALUMINUM ALLOY, DRAWN OR EXTRUDED

This specification is approved for use by HQ AFLC CASO/LODS, Federal Center, Battle Creek MI 49016 Department of the Air Force, and is available for use by all Departments and Agencies of the Department of Defense.

## 1. SCOPE

1.1 Scope. This specification covers requirements for drawn or extruded aluminum alloy pipe in dimensions and weights covered by United States of America Standards Institute schedule 5, 10, or 40 (standard), or 80 (extra heavy). (See Table III and 6.2.)

1.2 Classification.

\*1.2.1 Types. Pipe shall be of the following types, as specified (see 6.2):

Type Designator	
A	Type I - Structural pipe for nonpressure applications
B	Type II - Seamless pipe for pressure applications

1.2.1.1 At the discretion of the supplier, seamless pipe may be substituted for structural pipe.

\*1.2.2 Alloys and tempers. Pipe shall be of the following alloys and tempers, as specified (see 6.2):

Designator Code	
1	3003-H18
2	3003-H112
3	6061-T6
4	6063-T6

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: HQ AFLC CASO/LODS, Federal Center, Battle Creek MI 49016 by using the self addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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\*1.3 Part Number. Specification part numbers for items described in this document will be formulated as shown in section 6.4.

## 2. APPLICABLE DOCUMENTS

## \*2.1 Government Documents.

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

## SPECIFICATIONS

## Military

MIL-H-6088	Heat Treatment of Aluminum Alloys
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## STANDARDS

## Federal

FED-STD-151	Metal, Test Methods
FED-STD-184	Identification Marking of Aluminum, Magnesium, and Titanium
FED-STD-245	Tolerance For Aluminum Alloy and Magnesium Alloy Wrought Products

## Military

MIL-STD-105	Sampling Procedures and Tables For Inspection by Attributes
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-414	Sampling Procedure and Table For Inspection by Variables for Percent Defective
MIL-STD-649	Aluminum and Magnesium Products Preparation For Shipment and Storage

(Copies of specifications, standards, 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 issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

## UNITED STATES OF AMERICA STANDARDS INSTITUTE

(Application for copies should be addressed to the United States of America Standards Institute, NE 45th Street, New York NY 10017.)

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## OFFICIAL CLASSIFICATION COMMITTEE

## Uniform Freight Classification Rules

(Application for copies should be addressed to the Official Classification Committee, Room 202, Union Station, 516 West Jackson Boulevard, Chicago IL 60606.)

\*2.3 Order of Precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

## 3. REQUIREMENTS

3.1 Chemical composition. The chemical composition shall conform to the requirements specified in Table I.

Table I. Chemical Requirements 1/

Element	Percent					
	Alloy 3003		Alloy 6061		Alloy 6063	
	Min	Max	Min	Max	Min	Max
Silicon	-	0.6	0.40	0.8	0.20	0.6
Iron	-	0.7	-	0.7	-	0.35
Copper	0.05	0.20	0.15	0.40	-	0.10
Manganese	1.0	1.5	-	0.15	-	0.10
Magnesium	-	-	0.8	1.2	0.45	0.9
Chromium	-	-	0.04	0.35	-	0.10
Zinc	-	0.10	-	0.25	-	0.10
Titanium	-	-	-	0.15	-	0.10
Other elements each <u>1/</u>	-	0.05	-	0.05	-	0.05
Other elements total <u>1/</u>	-	0.15	-	0.15	-	0.15
Aluminum	Remainder		Remainder		Remainder	

1/ Analysis shall regularly be made only for the elements specifically mentioned in Table I. If, however, the presence of other elements is indicated in the course of routine analysis, further analysis shall be made to determine conformance to the limits specified for other elements.

3.2 Mechanical properties. The mechanical properties in the direction of working shall conform to the requirements specified in Table II.

Table II. Mechanical Properties

Alloy and temper	Pipe size	Tensile strength	Yield strength	Elongation
		minimum	minimum	in 2 in. or 4 times dia. minimum
	Inches	PSI	PSI	Percent
3003-H18	Under 1	27,000	- - -	- - -
3003-H112	1 and over	14,000	- - -	- - -
6061-T6	Under 1	42,000	35,000	12
	1 and over <u>1/</u>	38,000	35,000	10
6063-T6	All	30,000	25,000	8

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- 1/ For Wall thickness up through 0.249 inch, the elongation is 8 percent ~~minimum~~.

3.3 Tolerances. The tolerances for outside diameter, wall thickness and weight shall not exceed this specification. Straightness and pipe length shall be governed by FED-STD-245. Nominal dimensions and weights shall be as specified in Table III.

3.4 Marking for identification. Unless otherwise specified, pipe shall be marked in accordance with FED-STD-184. In addition, seamless pipe shall be marked with the word "seamless."

3.5 Heat treatment. Alloy 6063-T6 pipe shall be heat treated in accordance with the best recommended commercial practice. Alloy 6061-T6 shall either be furnace heat treated in accordance with MIL-H-6088 or shall comply with the requirements of 3.5.1.

3.5.1 Alternate procedure. For 6061-T6 pipe, the producer may use an alternate heat treating procedure in lieu of furnace heat treatment in accordance with MIL-H-6088 providing the material conforms to all other requirements of this specification when sampled and tested in accordance with 4.2.4.1.2. The alternate heat treatment shall be performed on the whole of a piece, never on a part only, and shall be performed in a manner that will produce the utmost uniformity.

3.6 Workmanship. The pipe shall be uniform in quality and temper. The exterior and interior surfaces shall be clean, smooth, and free from slivers, laminations, folds, grooves, cracks, and other injurious defects within the limits consistent with best commercial practice. Discoloration due to thermal treatment will not be cause for rejection.

\*3.7 Recovered Materials. Unless otherwise specified herein, all equipment, material and articles incorporated in the products covered by this specification shall be new and shall be fabricated using materials produced from recovered materials to the maximum extent practicable without jeopardizing the intended use. The term "recovered materials" means materials which have been collected or recovered from solid waste and reprocessed to become a source of raw materials, as opposed to virgin raw materials. None of the above shall be interpreted to mean that the use of used or rebuilt products is allowed under this specification unless otherwise specifically approved.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the contractor may use his/her 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 III. Nominal Dimensions and Weights of Aluminum-Alloy Pipe

SIZE GRATOR	*NOMINAL PIPE SIZE Inches Col. 1	*SCHEDULE DESIGNATOR(1) Col. 2	OUTSIDE DIAMETER Inches				INSIDE Diameter Inches				WALL THICKNESS Inches				WEIGHT PER FOOT	
			Min(2)(4) Col. 3		Max(2)(4) Col. 5		Nom Col. 6		Nom Col. 7		Min(2) Col. 8		Max(2) Col. 9		Nom(3) Col. 10	Max(2)(3) Col. 11
			Col. 3	Col. 4	Col. 4	Col. 5	Col. 6	Col. 6	Col. 7	Col. 7	Col. 8	Col. 8	Col. 9	Col. 9	Col. 10	Col. 11
A	.125	C	0.405	0.374	0.420	0.269	0.068	0.060	0.085	0.091	0.085	0.091	0.085	0.091	0.085	0.091
			0.405	0.374	0.420	0.215	0.095	0.083	0.109	0.109	0.117	0.109	0.117	0.109	0.117	
			0.540	0.509	0.555	0.364	0.088	0.077	0.147	0.147	0.159	0.147	0.159	0.147	0.159	
			0.540	0.509	0.555	0.302	0.119	0.104	0.185	0.185	0.200	0.185	0.200	0.185	0.200	
B	.25	D	0.675	0.644	0.690	0.493	0.091	0.080	0.196	0.212	0.196	0.212	0.196	0.212		
			0.675	0.644	0.690	0.423	0.126	0.110	0.256	0.276	0.256	0.276	0.256	0.276		
			0.840	0.809	0.855	0.710	0.065	0.053	0.186	---	0.186	---	0.186	---		
			0.840	0.809	0.855	0.674	0.083	0.071	0.232	---	0.232	---	0.232	---		
C	.375	C	0.840	0.809	0.855	0.622	0.109	0.095	0.294	0.317	0.294	0.317	0.294	0.317		
			0.840	0.809	0.855	0.622	0.109	0.095	0.294	0.317	0.294	0.317	0.294	0.317		
			0.840	0.809	0.855	0.546	0.147	0.129	0.376	0.406	0.376	0.406	0.376	0.406		
			1.050	1.019	1.065	0.920	0.065	0.053	0.237	---	0.237	---	0.237	---		
D	.5	A	1.050	1.019	1.065	0.884	0.083	0.071	0.297	---	0.297	---	0.297	---		
			1.050	1.019	1.065	0.824	0.113	0.099	0.391	0.422	0.391	0.422	0.391	0.422		
			1.050	1.019	1.065	0.742	0.154	0.135	0.510	0.550	0.510	0.550	0.510	0.550		
			1.315	1.284	1.330	1.185	0.065	0.053	0.300	---	0.300	---	0.300	---		
E	.75	B	1.315	1.284	1.330	1.097	0.109	0.095	0.486	---	0.486	---	0.486	---		
			1.315	1.284	1.330	1.049	0.133	0.116	0.581	0.627	0.581	0.627	0.581	0.627		
			1.315	1.284	1.330	0.957	0.179	0.157	0.751	0.811	0.751	0.811	0.751	0.811		
			1.660	1.629	1.675	1.530	0.065	0.053	0.383	---	0.383	---	0.383	---		
F	1	A	1.660	1.629	1.675	1.442	0.109	0.095	0.625	---	0.625	---	0.625	---		
			1.660	1.629	1.675	1.380	0.140	0.122	0.786	0.849	0.786	0.849	0.786	0.849		
			1.660	1.629	1.675	1.278	0.191	0.167	1.037	1.120	1.037	1.120	1.037	1.120		
			1.900	1.869	1.915	1.770	0.065	0.053	0.441	---	0.441	---	0.441	---		
G	1.25	B	1.900	1.869	1.915	1.682	0.109	0.095	0.721	---	0.721	---	0.721	---		
			1.900	1.869	1.915	1.610	0.145	0.127	0.940	1.015	0.940	1.015	0.940	1.015		
			1.900	1.869	1.915	1.500	0.200	0.175	1.256	1.356	1.256	1.356	1.256	1.356		
			1.900	1.869	1.915	1.500	0.200	0.175	1.256	1.356	1.256	1.356	1.256	1.356		
H	1.5	C	1.900	1.869	1.915	1.500	0.200	0.175	1.256	1.356	1.256	1.356	1.256	1.356		
			1.900	1.869	1.915	1.500	0.200	0.175	1.256	1.356	1.256	1.356	1.256	1.356		
			1.900	1.869	1.915	1.500	0.200	0.175	1.256	1.356	1.256	1.356	1.256	1.356		
			1.900	1.869	1.915	1.500	0.200	0.175	1.256	1.356	1.256	1.356	1.256	1.356		



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Table III. (Cont'd)

SIZE IGNATOR	*NOMINAL PIPE SIZE Inches Col. 1	*SCHEDULE DESIGNATOR(1) Col. 2	OUTSIDE DIAMETER				INSIDE Diameter Inches		WALL THICKNESS Inches				WEIGHT PER FOOT	
			Min(2)(4)		Max(2)(4)		Nom	Min(2)	Max(2)	Nom(3)		Max(2)(3)		
			Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 10	Col. 11		
S	10	A B C D	10.750	10.719	10.843	10.482	0.134	0.117	0.151	5.256	---	---		
			10.750	10.719	10.843	10.420	0.165	0.144	0.186	6.453	---	---		
			10.750	10.662	10.858	10.020	0.365	0.319	---	14.00	---	15.12		
			10.750	10.642	10.858	9.564	0.593	0.519	---	22.25	---	24.03		
T	12	A B C D	12.750	12.719	12.843	12.438	0.156	0.136	0.176	7.268	---	---		
			12.750	12.719	12.843	12.390	0.180	0.158	0.202	8.359	---	---		
			12.750	12.622	12.878	11.938	0.406	0.355	---	18.52	---	20.000		
			12.750	12.622	12.878	11.376	0.687	0.601	---	30.62	---	33.07		

\*(1) Schedule Designation.

SCHEDULE DESIGNATOR	SCHEDULE NUMBER
A	5
B	10
C	40
D	80

(2) Based on standard tolerances for pipe as specified in FED-STD-245.

(3) Based on nominal dimensions, plain ends, and a density of 0.098 pound per cubic inch, the density of 6061 and 6063 alloys. For alloy 3003 multiply by 1.01.

(4) For schedules 5 and 10 these values apply to mean outside diameters.

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4.2 Sampling.

4.2.1 Lot. An inspection lot shall consist of an identifiable quantity of pipe of the same type, alloy, temper, and size subjected to 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 this specification shall be cause for rejection. Complete ingot analysis records shall be available at the producer's plant to the Government.

4.2.2.2 Finish product analysis. When compliance with 4.2.2.1 cannot be established, samples shall be selected as follows: From material having a nominal weight of less than one pound per lineal foot, one sample shall be selected from each lot weighing 1000 pounds or less; from lots weighing more than 1000 pounds, one additional sample shall be taken for each 1000 pounds or fraction thereof in excess of the first 1000 pounds. From material having a nominal weight of one pound or more per lineal foot, one sample shall be taken from each lot consisting of 1000 feet or less; from lots consisting of more than 1000 feet, one additional sample shall be taken from each 1000 feet or fraction thereof in excess of the first 1000 feet. Only one test specimen shall be taken from any one piece when more than one piece is available. Not more than one analysis shall be required per piece.

4.2.3 Samples for mechanical property tests.4.2.3.1 Samples for tensile tests.

4.2.3.1.1 Number of test samples in temper supplied. From material having a nominal weight of less than one pound per lineal foot, one tension test sample weighing more than 1000 pounds, one additional sample shall be taken for each 1000 pounds or fraction thereof in excess of the first 1000 pounds. From materials having a nominal weight of one pound or more per lineal foot, one tension test sample shall be taken from each lot consisting of 1000 feet or less; from lots consisting of more than 1000 feet, one additional sample shall be taken for each 1000 feet or fraction thereof in excess of the first 1000 feet. Only one tension test sample shall be taken from any one piece when more than one piece is available.

4.2.3.1.2 Additional sampling and testing. When 6061-T6 pipe has not been heat treated in accordance with MIL-H-6088, in addition to the requirements of 4.2.3.1.1, hardness tests shall be performed either on each extruded charge in the lot or on samples selected in accordance with a 1 1/2 percent Acceptable Quality Level (AQL) sampling plan from MIL-STD-105 or MIL-STD-414. The minimum hardness control value shall be in accordance with Table IV for the type of hardness tester used. The specific type of hardness tester used shall be left to the discretion of the producer. The hardness shall be checked at the portion of the piece which is determined to have received the least drastic quench. Lots rejected by the statistical sampling plan may be retested by hardness testing each extruded charge and all charges or finished lengths meeting the applicable requirements of Table IV are acceptable.

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Individual extrusion charges which fail to conform to the requirements of Table IV may be accepted provided the two pieces in the lot having the two lowest hardness readings are tensile tested and found to conform to the requirements of Table II.

Table IV-Hardness Values

Thickness	Hardness	Number	Minimum
	Webster	Barcol	Rockwell E
0.050 - 0.075	15	72	89
0.076 - 0.499	15	72	90
0.500 - 0.749	--	72	--

4.2.4 Sampling for visual and dimensional examination. Each pipe shall be examined to determine conformance to this specification with respect to workmanship and identification marking. Examinations for dimensions shall be made at planned intervals to insure conformance with the tolerances specified. On approval of the procuring activity, the contractor may use a system of statistical quality control for these examination requirements.

#### 4.3 Examination.

4.3.1 Visual and dimensional examination. Each sample pipe selected in accordance with 4.2.4 shall be visually examined and measured to verify conformance with 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 herein.

#### 4.4 Test methods.

4.4.1 Chemical analysis. Chemical analysis shall be made by the wet chemical method in accordance with Method 111 of FED-STD-151 or by the spectrochemical method in accordance with Method 112 of FED-STD-151.

#### 4.4.2 Mechanical properties.

4.4.2.1 Types of specimens. Specimens for tensile testing shall conform to the requirements of Method 211 of FED-STD-151. When practicable, the material should be tested in full section. For pipe less than 0.500 inch in wall thickness, which is not tested in full section, the standard T1 type specimen shall be used. For pipe having a wall thickness of 0.500 inch or more, a test specimen of type R1, R2, or R3 shall be used.

4.4.2.2 Location of test specimens. Tension test specimens shall be taken from the pipe in the longitudinal direction. From pipe in wall thicknesses 0.5 inch to 1.5 inches, inclusive, tension test specimens shall be taken with the axis midway between the inside and outside diameter surfaces.

#### 4.4.2.3 Tensile tests.

4.4.2.3.1 Tensile strength. Tensile strength shall be determined in accordance with Method 211 of FED-STD-151.

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4.4.2.3.2 Yield strength. The yield strength shall be determined either by the offset method or the extension-under-load method in accordance with method of 211 FED-STD-151. In case of dispute, the offset method shall govern.

4.5 Rejection and retest. If any specimen fails to conform to the requirements of this specification, it shall be cause for rejection of the material represented by the specimen subject to the retest provisions of FED-STD-151.

4.6 Inspection of the preservation, packaging, packing and marking for shipment and storage. Sample items or packs and the inspection of the preservation, packaging, packing and marking for shipment and storage shall be in accordance with the requirements of Section 5, or the documents specified therein.

## \*5 PACKAGING

5.1 Preservation and packaging. Preservation and packaging shall be Level A or C as specified (see 6.2) and in accordance with MIL-STD-649.

5.2 Packing. Packing shall be Level A, B or C as specified (see 6.2) and in accordance with MIL-STD-649.

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. Structural pipe is for use in structural application, and seamless pipe is utilized in pressure applications. Where structural applications are required, the procuring activity should specify structural pipe. The pipe's mechanical properties, composition, dimensions, etcetera, are the same, but because of lower production cost, it can generally be procured at a lower price.

6.2 Ordering data. Procurement documents should specify the following:

- a. Title, number, date of this specification.
- b. Type (see 1.2.1).
- c. Alloy and temper (see 1.2.2).
- d. Nominal pipe size and schedule number (see Table III).
- e. Length desired (specify only when mill lengths cannot be used, see 3.3).
- f. Level of preservation and packaging (see 5.1).
- g. Level of packing (see 5.2).

\*6.4 Definitive Specification Part Number. The Specification Part Number is a definitive part number which will be formulated to identify each item covered by this document. The part number will be formulated by selecting from the requirements options available in this specification as follows:

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## Definitive Specification Part Number

	<u>M25995</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>XXX</u>
Military Specification	_____	_____	_____	_____	_____	_____
Type (see 1.2.1)	_____	_____	_____	_____	_____	_____
Alloy/Temper (see 1.2.2)	_____	_____	_____	_____	_____	_____
Pipe Size (see Table III)	_____	_____	_____	_____	_____	_____
Schedule Size (see Table III)	_____	_____	_____	_____	_____	_____
Length In Feet	_____	_____	_____	_____	_____	_____

6.5 The margins of this specification are marked with an asterisk to indicate where changes (additions, modifications, corrections, deletions) from the previous issue are made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

## Custodian:

Air Force - 99

## Preparing Activity:

Air Force - 99

## Review Activity:

Army - EA  
 Navy - YD  
 DSC - CS

Project No. 4710-F569

## User Activity:

Army - ME

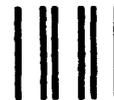
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**NOTE:** This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to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

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DEPARTMENT OF THE AIR FORCE



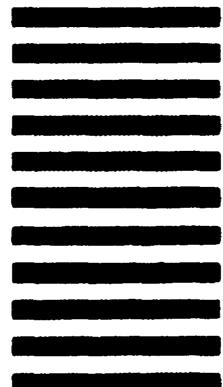
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**STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL***(See Instructions – Reverse Side)*

1. DOCUMENT NUMBER

2. DOCUMENT TITLE

3a. NAME OF SUBMITTING ORGANIZATION

4. TYPE OF ORGANIZATION *(Mark one)* VENDOR USER MANUFACTURER OTHER *(Specify):* \_\_\_\_\_b. ADDRESS *(Street, City, State, ZIP Code)*

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI) – Optional*b. WORK TELEPHONE NUMBER *(Include Area Code) – Optional*c. MAILING ADDRESS *(Street, City, State, ZIP Code) – Optional*8. DATE OF SUBMISSION *(YYMMDD)*

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