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 SUPERSEDING
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FEDERAL SPECIFICATION

ALUMINUM ALLOY FORGINGS

This specification was approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers aluminum alloy die forgings and hand forgings.

1.2 Classification.

1.2.1 Composition. Aluminum alloy forgings covered by this specification shall be of the following compositions as specified, in table 1:

<u>Alloy number:</u>		
2014	2618	6151
2018	4032	7049
2025	5083	7075
2218	6061	7076
2219	6066	7079

1.2.2 Form. Aluminum alloy forgings shall be furnished in the form of die forgings or hand forgings, as specified. If the method is not specified, manufacturers may use any method of forging most convenient.

1.2.3 Temper. Forgings shall be supplied in the temper specified in the order or contract. Forgings supplied in the T652 or T852 tempers shall be solution heat treated, stress relieved by compression to produce a permanent set of 1 to 5 percent, and artificially aged. Forgings in 7049 and 7075 alloy supplied in the T73 or T7352 temper shall be solution heat treated and aged in a manner to develop the mechanical properties shown in tables II, III, and V, and shall be capable of passing the test for resistance to stress-corrosion cracking 4.4.3.

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:

Federal Standards:

Fed. Std. No. 123 - Marking for Domestic Shipment (Civil Agencies).
 Fed. Test Method Std. No. 151 - Metals, Test Methods.

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specifications and Standards and at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

(Single copies of this specification and other product specifications required by activities outside the Federal Government for bidding purposes are available without charge at the General Services Administration Regional Offices in Boston, New York, Washington, DC, Atlanta, Chicago, Kansas City, MO, Dallas, Denver, San Francisco, Los Angeles, and Seattle, WA.

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(Federal Government activities may obtain copies of Federal Specifications, Standards and Handbooks and the Index of Federal Specifications and Standards from established distribution points in their agencies.)

Military Specifications:

MIL-H-6088 - Heat Treatment of Aluminum Alloys.
MIL-I-6866 - Inspection, Penetrant Method of.
MIL-I-8950 - Inspection, Ultrasonic, Wrought Metals, Process for.
MIL-S-13165 - Shot Peening of Metal Parts.

Military Standards:

MIL-STD-129 - Marking for Shipment and Storage.
MIL-STD-410 - Qualification of Inspection Personnel (Magnetic Particle and Penetrant).
MIL-STD-649 - Aluminum and Magnesium Products, Preparation for Shipment and Storage.

(Copies of Military Specifications and Standards required by suppliers in connection with specific procurement functions should be obtained from the procuring 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. Unless a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal shall apply.

American Society for Testing and Materials (ASTM) Standards:

E 8 - Tension Testing of Metallic Materials.
B 117 - Test for Salt Spray (Fog) Testing.

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

National Bureau of Standards (NBS) Handbook:

Circular No. 31 - International Annealed Copper Standards.

(Application for copies should be addressed to the U.S. Department of Commerce, NSB, Washington, DC 20234.)

TABLE I. Chemical composition limits 1/ percent maximum, except where indicated as range

Alloy No.	Copper	Silicon	Iron	Manganese	Magnesium	Zinc	Chromium	Titanium	Nickel	Other elements 2/	Aluminum
2014	3.9-5.0	0.50-1.2	0.7	0.40-1.2	0.20-0.8	0.25	0.10	0.15	-	0.05	Remainder
2018	3.5-4.5	0.9	1.0	0.20	0.45-0.9	0.25	0.10	-	1.7-2.3	0.05	Remainder
2025	3.9-5.0	0.50-1.2	1.0	0.40-1.2	0.05	0.25	0.10	0.15	-	0.05	Remainder
2218	3.5-4.5	0.9	1.0	0.20	1.2-1.8	0.25	0.10	-	1.7-2.3	0.05	Remainder
2219	5.8-6.8	0.20	0.30	0.20-0.40	0.02	0.10	-	0.02-0.10	-	0.05 3/	Remainder
2618	1.9-2.7	0.25	0.9-1.3	-	1.3-1.8	-	-	0.40-0.10	0.9-1.2	0.05	Remainder
4032	0.50-1.3	11.0-13.5	1.0	-	0.8-1.3	0.25	0.10	-	0.50-1.3	0.05	Remainder
5083	0.10	0.40	0.40	0.30-1.0	4.0-4.9	0.25	0.05-0.25	0.15	-	0.05	Remainder
6061	0.15-0.40	0.40-0.8	0.7	0.15	0.8-1.2	0.25	0.04-0.35	0.15	-	0.05	Remainder
6066	0.7-1.2	0.9-1.8	0.50	0.6-1.1	0.8-1.4	0.25	0.40	0.20	-	0.05	Remainder
6151	0.35	0.6-1.2	1.0	0.20	0.45-0.8	0.25	0.15-0.35	0.15	-	0.05	Remainder
7049	1.2-1.9	0.25	0.35	0.20	2.0-2.9	7.2-8.2	0.10-0.22	0.10	-	0.05	Remainder
7075	1.2-2.0	0.40	0.5	0.30	2.1-2.9	5.1-6.1	0.18-0.35	0.20	-	0.05	Remainder
7076	0.30-1.0	0.40	0.6	0.30-0.8	1.2-2.0	7.0-8.0	-	0.20	-	0.05	Remainder
7079	0.40-0.8	0.30	0.40	0.10-0.30	2.9-3.7	3.8-4.8	0.10-0.25	0.10	-	0.05	Remainder

1/ Analysis shall be made only for the elements specifically mentioned in the above table. If, however, the presence of other elements is indicated in the course of routine analysis, further analysis shall be made to determine that these other elements are not present in excess of the limits specified.

2/ Total of all elements not specified shall not exceed 0.15 percent.

3/ Vanadium 0.05-0.15 and Zirconium 0.10-0.25.

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3. REQUIREMENTS

3.1 Forgings shall be produced by hammering or pressing from a cast ingot or from as-fabricated (rolled, hand forged, or extruded) stock of suitable quality and of composition as specified in table I. Whether the forgings are produced from cast ingot or wrought stock, the material shall be sufficiently worked upon completion of forging operations to produce a thoroughly wrought structure.

3.2 Chemical composition.

3.2.1 The chemical composition of the forgings shall be as specified in table I.

3.3 Mechanical properties.

3.3.1 Die forgings. The mechanical properties of test specimens taken as specified in 4.2.3.1 shall be as specified in tables II and III.

TABLE II. Mechanical properties of die forgings and separately forged test bars - test specimen parallel to forging flow (grain) lines

Alloy No.	Temper ^{3/}	Maximum heat treat section thickness Inches	Tensile strength ^{2/} minimum p.s.i.	Yield strength ^{2/} at 0.2 percent offset minimum p.s.i.	Elongation in 2 inches or 4D ^{1/} minimum	
					Forging Percent	Test coupon (forged) Percent
2014	T4	4	55,000	30,000	11	16
2014	T6	Up thru 1	65,000	56,000	6	8
		Over 1 thru 2	65,000	56,000	6	(4)
		Over 2 thru 3	65,000	55,000	6	(4)
		Over 3 thru 4	63,000	55,000	6	(4)
2018	T61	4	55,000	40,000	7	10
2025	T6	4	52,000	33,000	11	16
2218	T61	4	55,000	40,000	7	10
2219	T6	4	58,000	38,000	8	10
2618	T61	4	58,000	45,000	4	6
4032	T6	4	52,000	42,000	3	5
5083	H111 ^{6/}	4	42,000	22,000	14	16
5083	H112 ^{6/}	4	40,000	18,000	16	16
6061	T6	4	38,000	35,000	7	10
6066	T6	4	50,000	45,000	8	12
6151	T6	4	44,000	37,000	10	14
7049	T73	Up thru 2	72,000	62,000	7	10
		Over 2 thru 4	71,000	61,000	7	10
		Over 4 thru 5	70,000	60,000	7	10
7075	T6	Up thru 1	75,000	64,000	7	10
		Over 1 thru 2	74,000	63,000	7	(4)
		Over 2 thru 3	74,000	63,000	7	(4)
		Over 3 thru 4	73,000	62,000	7	(4)
7075	T73	Up thru 3	66,000	56,000	7	10
		Over 3 thru 4	64,000	55,000	7	10
7075	T7352	Up thru 3	66,000	56,000	7	10
		Over 3 thru 4	64,000	53,000	7	10
7076	T61	4	70,000	60,000	10	14
7079	T6	Up thru 1	72,000	62,000	7	10
		Over 1 thru 2	72,000	62,000	7	(4)
		Over 2 thru 3	71,000	61,000	7	(4)
		Over 3 thru 4	71,000	61,000	7	(4)
		Over 4 thru 5	70,000	60,000	7	(4)
		Over 5 thru 6	70,000	59,000	7	(4)

- 1/ D is diameter of test specimen.
- 2/ Tensile and yield strength test requirements may be waived for material in any direction in which the dimension is less than 2 inches because of the difficulty to obtain a tension test specimen suitable for routine control testing.
- 3/ Die forgings in some configurations of these alloys can be purchased in the heat treated and mechanically stress relieved T652 temper conforming to the mechanical properties requirements specified for the T6 temper.
- 4/ When separately forged coupons are used to verify acceptability of forgings in the indicated thicknesses, the properties shown for thicknesses "Up thru 1 inch", including the test coupon elongation, apply.
- 5/ As-forged thickness. When forgings are machined prior to heat treatment the properties will also apply to the machined heat treat thickness provided the machined thickness is not less than one-half the original (as-forged) thickness.
- 6/ Maximum section thickness to which mechanical properties apply (non-heat-treatable-alloys).

Table III. Mechanical properties of die forgings - specimens
not parallel to forging flow lines

Alloy No.	Temper <u>3/</u>	Maximum heat treat section thickness inches	Tensile strength <u>2/</u> , minimum p. s. i.	Yield strength at 0.2 percent offset, minimum p. s. i.	Elongation percent in 2 inch or 4D <u>1/</u> , minimum
2014	T6	Up thru 1	64,000	55,000	3
		Over 1 thru 2	64,000	55,000	2
		Over 2 thru 3	63,000	54,000	2
		Over 3 thru 4	63,000	54,000	2
2219	T6	4	56,000	36,000	4
2618	T61	4	55,000	42,000	4
5083 <u>4/</u>	H111	4	39,000	20,000	12
5083 <u>4/</u>	H112	4	39,000	16,000	14
6061	T6	4	38,000	35,000	5
6151	T6	4	44,000	37,000	6
7049	T73	Up thru 1	71,000	61,000	3
		Over 1 thru 3	70,000	60,000	3
		Over 3 thru 4	70,000	60,000	2
		Over 4 thru 5	68,000	58,000	2
7075	T6	Up thru 1	71,000	61,000	3
		Over 1 thru 2	71,000	61,000	3
		Over 2 thru 3	70,000	60,000	3
		Over 3 thru 4	70,000	60,000	2
7075	T73	Up thru 3	62,000	53,000	3
		Over 3 thru 4	61,000	52,000	2
7075	T7352	Up thru 3	62,000	51,000	3
		Over 3 thru 4	61,000	49,000	2
7076	T61	4	67,000	58,000	3
7079	T6	Up thru 1	71,000	61,000	5
		Over 1 thru 2	70,000	60,000	5
		Over 2 thru 3	70,000	60,000	4
		Over 3 thru 4	70,000	60,000	4
		Over 4 thru 5	68,000	58,000	3
		Over 5 thru 6	68,000	58,000	3

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- 1/ D is a diameter of test specimen.
- 2/ Tensile and yield strength test requirements may be waived for material in any direction in which the dimension is less than 2 inches because of the difficulty to obtain a tension test specimen suitable for routine control testing.
- 3/ Die forgings in some configurations of these alloys can be purchased in the heat treated and mechanically stress relieved T652 temper conforming to the mechanical properties requirements specified for the T6 temper.
- 4/ Maximum section thickness to which mechanical properties apply (non-heat-treatable alloys).

3.3.1.1 A forging representing the first production lot of forgings produced from new or significantly reworked dies, significantly changed forging production procedures, or from significantly changed stock (see 3.1), shall be tested in accordance with 4.2.3.1.

3.3.1.2 If test specimens are taken from forgings of the alloys listed in table III so that the axis is not substantially parallel (within plus or minus 15°) to the metal flow lines in the specimen, the mechanical properties shall conform to the requirements of table III except that the elongation requirements shall be as specified by the procuring activity for test specimens taken so that the reduced section (1) is in immediate proximity to an abrupt change in section thickness; or (2) intersects the parting plane within 1/4 inch of the flash line.

3.3.2 Hand forgings. The mechanical properties of hand forgings of 2014-T6, T652; 7049-T73; 7075-T6, T652, T73; 7079-T6, T652; 6061-T6 or T652; 2618-T61; 2219-T6, T952; and 5083-H111, H112 determined from specimens taken in accordance with 4.2.3.2 shall conform to the applicable properties specified in tables IV thru XI.

3.3.2.1 The properties in tables IV, V, VI, VII, VIII, and IX apply to hand forgings that are essentially rectangular in cross section. The requirements of long-transverse and short-transverse properties apply also to the squares even though both transverse dimensions are equal length. The cross-sectional grain direction, perpendicular to the longitudinal direction, of hexagons and rounds shall be considered the long transverse grain direction. The direction of the long transverse properties shall be identified as required in 3.7. Biscuits, octagons, rings, and contour hand forgings are considered to be special purpose forgings (see 3.3.3).

Table IV. Mechanical properties of alloy 2014 hand forgings 1/

Temper	Thickness $\frac{4}{5}$ / inches	Axis of test specimen	Tensile strength $\frac{2}{}$ / minimum p. s. i.	Yield strength $\frac{2}{}$ / minimum p. s. i.	Elongation $\frac{2}{}$ / percent min. in 2 in. or $\frac{10}{3}$ / 	
T6	Up thru 2	Longitudinal	65,000	56,000	8	
		Long trvs.	65,000	56,000	3	
	Over 2 thru 3	Longitudinal	64,000	56,000	8	
		Long. trvs.	64,000	55,000	3	
		Short trvs.	62,000	55,000	2	
	Over 3 thru 4	Longitudinal	63,000	55,000	8	
		Long. trvs.	63,000	55,000	3	
		Short trvs.	61,000	54,000	2	
	Over 4 thru 5	Longitudinal	62,000	54,000	7	
		Long trvs.	62,000	54,000	2	
		Short trvs.	60,000	53,000	1	
	Over 5 thru 6	Longitudinal	61,000	53,000	7	
		Long trvs.	61,000	53,000	2	
		Short trvs.	59,000	53,000	1	
	Over 6 thru 7	Longitudinal	60,000	52,000	6	
		Long trvs.	60,000	52,000	2	
		Short trvs.	58,000	52,000	1	
	Over 7 thru 8	Longitudinal	59,000	51,000	6	
		Long trvs.	59,000	51,000	2	
		Short trvs.	57,000	51,000	1	
	T652	Up thru 2	Longitudinal	65,000	56,000	8
			Long trvs.	65,000	56,000	3
		Over 2 thru 3	Longitudinal	64,000	56,000	8
			Long trvs.	64,000	55,000	3
Short trvs.			62,000	52,000	2	

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Table IV (Continued)

Temper	Thickness $\frac{4}{5}$ / inches	Axis of test specimen	Tensile strength $\frac{2}{}$ / minimum p. s. i.	Yield strength $\frac{2}{}$ / minimum p. s. i.	Elongation $\frac{2}{}$ / percent min. in 2 in. or 4D $\frac{3}{}$
T852 (Cont)	Over 3 thru 4	Longitudinal	63,000	55,000	8
		Long trvs.	63,000	55,000	3
		Short trvs.	61,000	51,000	2
	Over 4 thru 5	Longitudinal	62,000	54,000	7
		Long trvs.	62,000	54,000	2
		Short trvs.	60,000	50,000	1
	Over 5 thru 6	Longitudinal	61,000	53,000	7
		Long trvs.	61,000	53,000	2
		Short trvs.	59,000	50,000	1
	Over 6 thru 7	Longitudinal	60,000	52,000	6
		Long trvs.	60,000	52,000	2
		Short trvs.	58,000	49,000	1
	Over 7 thru 8	Longitudinal	59,000	51,000	6
		Long trvs.	59,000	51,000	2
		Short trvs.	57,000	48,000	1

1/ Maximum cross-sectional area is 256 square inches.

2/ Tensile property requirements may be waived for material in any direction in which the dimension is less than 2 inches because of the difficulty to obtain a tension test specimen suitable for routine control testing.

3/ D is diameter of test specimen.

4/ Thickness is measured in the short transverse direction and applies to the dimension as forged and before any machining operation.

5/ When the as-forged dimension is 8 inches or less, the guaranteed properties shall be based on the machined thickness at the time of heat treatment.

Table V. Mechanical properties of alloy 7049 hand forgings ^{1/}

Temper	Thickness ^{4/} ^{5/} inches	Axis of test specimen	Tensile strength ^{2/} minimum p. s. i.	Yield strength ^{2/} minimum p. s. i.	Elongation ^{2/} percent min. in 2 in. or 4D ^{3/}
T73	Over 2 thru 3	Longitudinal	71,000	61,000	9
		Long trvs.	71,000	59,000	4
		Short trvs.	69,000	58,000	3
	Over 3 thru 4	Longitudinal	69,000	59,000	8
		Long trvs.	69,000	57,000	3
		Short trvs.	67,000	56,000	2
	Over 4 thru 5	Longitudinal	67,000	56,000	7
		Long trvs.	67,000	56,000	3
		Short trvs.	66,000	55,000	2

- 1/ Maximum cross-sectional area is 256 square inches.
- 2/ Tensile property requirements may be waived for material in any direction in which the dimension is less than 2 inches because of difficulty in obtaining a tensile test specimen suitable for testing.
- 3/ D is diameter of test specimen.
- 4/ Thickness is measured in the short transverse direction and applies to the dimension as forged and before any machining operation.
- 5/ When the as-forged dimension is not greater than 6 inches, the guaranteed properties shall be based on the machined thickness at the time of heat treatment.

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Table VI. Mechanical properties of alloy 7075 hand forgings 1/

Temper	Thickness <u>4/ 5/</u> inches	Axis of test specimen	Tensile strength <u>2/</u> minimum p. s. i.	Yield strength <u>2/</u> minimum p. s. i.	Elongation <u>2/</u> percent min. in 2 in. or 4D <u>3/</u>
T6	Up thru 2	Longitudinal	74,000	63,000	9
		Long trvs.	73,000	61,000	4
	Over 2 thru 3	Longitudinal	73,000	61,000	9
		Long trvs.	71,000	59,000	4
		Short trvs.	69,000	58,000	3
	Over 3 thru 4	Longitudinal	71,000	60,000	8
		Long trvs.	70,000	58,000	3
		Short trvs.	68,000	57,000	2
	Over 4 thru 5	Longitudinal	69,000	58,000	7
		Long trvs.	68,000	56,000	3
		Short trvs.	66,000	56,000	2
	Over 5 thru 6	Longitudinal	68,000	56,000	6
Long trvs.		66,000	55,000	3	
Short trvs.		65,000	55,000	2	
T652	Up thru 2	Longitudinal	74,000	63,000	9
		Long trvs.	73,000	61,000	4
	Over 2 thru 3	Longitudinal	73,000	61,000	9
		Long trvs.	71,000	59,000	4
		Short trvs.	69,000	57,000	2
	Over 3 thru 4	Longitudinal	71,000	60,000	8
		Long trvs.	70,000	58,000	3
		Short trvs.	68,000	56,000	1

Table VI (Continued)

Temper	Thickness $\frac{4}{5}$ / inches	Axis of test specimen	Tensile strength $\frac{2}{}$ / minimum p. s. i.	Yield strength $\frac{2}{}$ / minimum p. s. i.	Elongation $\frac{2}{}$ / percent min. in 2 in. or 4D $\frac{3}{}$
T652 (Cont)	Over 4 thru 5	Longitudinal	69,000	58,000	7
		Long trvs.	68,000	56,000	3
		Short trvs.	66,000	55,000	1
	Over 5 thru 6	Longitudinal	68,000	56,000	6
		Long trvs.	66,000	55,000	3
		Short trvs.	65,000	54,000	1
T73	Up thru 3	Longitudinal	66,000	56,000	7
		Long trvs.	64,000	54,000	4
		Short trvs.	61,000	52,000	3
	Over 3 thru 4	Longitudinal	64,000	55,000	7
		Long trvs.	63,000	53,000	3
		Short trvs.	60,000	51,000	2
	Over 4 thru 5	Longitudinal	62,000	53,000	7
		Long trvs.	61,000	51,000	3
		Short trvs.	58,000	50,000	2
	Over 5 thru 6	Longitudinal	61,000	51,000	6
		Long trvs.	59,000	50,000	3
		Short trvs.	57,000	49,000	2
T7352	Up thru 3	Longitudinal	66,000	54,000	7
		Long trvs.	64,000	52,000	4
		Short trvs.	61,000	50,000	3
	Over 3 thru 4	Longitudinal	64,000	53,000	7
		Long trvs.	63,000	50,000	3
		Short trvs.	60,000	48,000	2

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Table VI (Continued)

Temper	Thickness <u>4/</u> <u>5/</u> inches	Axis of test specimen	Tensile strength <u>2/</u> minimum p. s. i.	Yield strength <u>2/</u> minimum p. s. i.	Elongation <u>2/</u> percent min. in 2 in. or 4D <u>3/</u>
T7352 (Cont)	Over 4 thru 5	Longitudinal	62,000	51,000	7
		Long trvs.	61,000	48,000	3
		Short trvs.	58,000	46,000	2
	Over 5 thru 6	Longitudinal	61,000	49,000	6
		Long trvs.	59,000	46,000	3
		Short trvs.	57,000	44,000	2

1/ Maximum cross-sectional area is 256 square inches.

2/ Tensile property requirements may be waived for material in any direction in which the dimension is less than 2 inches because of difficulty in obtaining a tensile test specimen suitable for testing.

3/ D is diameter of test specimen.

4/ Thickness is measured in the short transverse direction and applies to the dimension as forged and before any machining operation.

5/ When the as-forged dimension is not greater than 6 inches, the guaranteed properties shall be based on the machined thickness at the time of heat treatment.

Table VII. Mechanical properties of alloy 7079 hand forgings 1/

Temper	Thickness <u>4/</u> <u>5/</u> inches	Axis of test specimen	Tensile strength <u>2/</u> minimum p. s. i.	Yield strength <u>2/</u> minimum p. s. i.	Elongation <u>2/</u> percent min. in 2 in. or 4D <u>3/</u>
T6	Up thru 2	Longitudinal	72,000	63,000	9
		Long trvs.	71,000	61,000	5
	Over 2 thru 3	Longitudinal	72,000	62,000	9
		Long trvs.	70,000	60,000	5
		Short trvs.	67,000	56,000	4
		Over 3 thru 4	Longitudinal	71,000	61,000
	Long trvs.		70,000	59,000	5
	Short trvs.		67,000	56,000	4

Table VII (Continued)

Temper	Thickness $\frac{4}{5}$ / Inches	Axis of test specimen	Tensile strength $\frac{2}{}$ / minimum p. s. i.	Yield strength $\frac{2}{}$ / minimum p. s. i.	Elongation $\frac{2}{}$ / percent min. in 2 in. or 4D $\frac{3}{}$	
T652 (cont)	Over 4 thru 5	Longitudinal	70,000	60,000	9	
		Long trvs.	69,000	58,000	4	
		Short trvs.	66,000	55,000	4	
	Over 5 thru 6	Longitudinal	69,000	59,000	9	
		Long trvs.	68,000	58,000	4	
		Short trvs.	66,000	54,000	4	
	Over 6 thru 7	Longitudinal	68,000	58,000	9	
		Long trvs.	67,000	54,000	4	
		Short trvs.	65,000	53,000	4	
	Over 7 thru 8	Longitudinal	67,000	57,000	9	
		Long trvs.	66,000	53,000	4	
		Short trvs.	64,000	52,000	4	
	T652	Up thru 2	Longitudinal	72,000	63,000	9
			Long trvs.	71,000	61,000	5
		Over 2 thru 3	Longitudinal	72,000	62,000	9
Long trvs.			70,000	60,000	5	
Short trvs.			67,000	55,000	3	
Over 3 thru 4		Longitudinal	71,000	61,000	9	
		Long trvs.	70,000	59,000	5	
		Short trvs.	67,000	55,000	3	
Over 4 thru 5		Longitudinal	70,000	60,000	9	
		Long trvs.	69,000	58,000	4	
		Short trvs.	66,000	54,000	3	

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Table VII (Continued)

Temper	Thickness $\frac{4}{5}$ / Inches	Axis of test specimen	Tensile strength $\frac{2}{}$ / minimum p. s. i.	Yield strength $\frac{2}{}$ / minimum p. s. i.	Elongation $\frac{2}{}$ percent min. in 2 in. or $4D \frac{3}{}$
T652 (Cont)	Over 5 thru 6	Longitudinal	69,000	59,000	9
		Long trvs.	68,000	56,000	4
		Short trvs.	66,000	53,000	3
	Over 6 thru 7	Longitudinal	68,000	58,000	9
		Long trvs.	67,000	54,000	4
		Short trvs.	65,000	51,000	3
	Over 7 thru 8	Longitudinal	67,000	57,000	9
		Long trvs.	66,000	52,000	4
		Short trvs.	64,000	50,000	3

- 1/ Maximum cross-sectional area is 256 square inches.
- 2/ Tensile property requirements may be waived for material in any direction in which the dimension is less than 2 inches because of difficulty in obtaining a tensile test specimen suitable for testing.
- 3/ D is diameter of test specimen.
- 4/ Thickness is measured in the short transverse direction and applies to the dimension as forged and before any machining operation.
- 5/ When the as-forged dimension is not greater than 8 inches, the guaranteed properties shall be based on the machined thickness at the time of heat treatment.

Table VIII. Mechanical properties of alloy 6061 hand forgings $\frac{1}{}$

Temper	Thickness $\frac{4}{5}$ / Inches $\frac{6}{}$	Axis of test specimen	Tensile strength $\frac{2}{}$ / minimum p. s. i.	Yield strength $\frac{2}{}$ / minimum p. s. i.	Elongation $\frac{2}{}$ percent min. in 2 in. or $4D \frac{3}{}$
T6 or	Up thru 4	Longitudinal	38,000	35,000	10
		Long trvs.	38,000	35,000	8
		Short trvs.	37,000	33,000	5
T652	Over 4 thru 8	Longitudinal	37,000	34,000	8
		Long trvs.	37,000	34,000	6
		Short trvs.	35,000	32,000	4

- 1/ Maximum cross-sectional area is 256 square inches.
- 2/ Tensile property requirements may be waived for material in any direction in which the dimension is less than 2 inches because of difficulty in obtaining a tensile test specimen for testing.
- 3/ D is diameter of test specimen.
- 4/ Thickness is measured in the short transverse direction and applies to the dimension as forged and before any machining operation.
- 5/ For T652 forging thicknesses greater than 8 inches at the time of heat treatment, the properties shall be as specified in the contract or purchase order.
- 6/ When the as-forged dimension is not greater than 8 inches, the guaranteed properties shall be based on the machined thickness at the time of heat treatment.

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Table IX. Mechanical properties of hand forgings
(maximum thickness - 4 inches) ^{3/} - alloy 2618

Temper	Thickness ^{4/} inches	Axis of test specimen	Tensile strength ^{2/} minimum p. s. i.	Yield strength ^{2/} minimum p. s. i.	Elongation ^{2/} percent min. in 2 in. or 4D ^{1/}
T61	Up thru 2	Longitudinal	58,000	47,000	7
		Long trvs.	55,000	42,000	5
		Short trvs.	52,000	42,000	4
	Over 2 thru 3	Longitudinal	57,000	46,000	7
		Long trvs.	55,000	42,000	5
		Short trvs.	52,000	42,000	4
	Over 3 thru 4	Longitudinal	56,000	46,000	7
		Long trvs.	53,000	40,000	5
		Short trvs.	51,000	39,000	4

^{1/} D is diameter of test specimen.

^{2/} Tensile and yield strength test requirements may be waived for material in any direction in which the dimension is less than 2 inches because of the difficulty to obtain a tension test specimen suitable for routine control.

^{3/} Maximum cross-sectional area is 144 square inches.

^{4/} When the as-forged dimension is not greater than 4 inches, the guaranteed properties shall be based on the machined thickness at the time of heat treatment.

Table X. Mechanical properties of hand forgings
(maximum thickness - 4 inches) ^{3/} alloy 2219-T6, 2219-T852

Temper	Direction	Tensile ^{2/} strength, minimum p. s. i.	Yield strength ^{2/} at 0.2 percent offset, minimum p. s. i.	Elongation percent in 2 inches or 4D ^{1/} , minimum percent
T6	Longitudinal	58,000	40,000	6
	Long trvs.	55,000	37,000	4
	Short trvs.	53,000	35,000	2
T852	Longitudinal	62,000	50,000	6
	Long trvs.	62,000	49,000	4
	Short trvs.	60,000	46,000	3

^{1/} D is diameter of test specimen.

^{2/} Tensile and yield strength test requirements may be waived for material in any direction in which the dimension is less than 2 inches because of the difficulty to obtain a tension test specimen suitable for routine control.

^{3/} For cross-sectional areas greater than 144 square inches, or thickness greater than 4 inches at the time of heat treatment, the properties shall be as specified in the contract or purchase order.

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Table XI. Mechanical properties of hand forgings
(maximum section thickness - 4 inches) 1/ - alloy 5083

Temper	Direction	Tensile 2/ strength, minimum p. s. i.	Yield strength 2/ at 0.2 percent offset, minimum p. s. i.	Elongation percent in 2 inches or 4D 3/, minimum percent
H111	Longitudinal	42,000	22,000	14
	Long trvs.	39,000	20,000	12
H112	Longitudinal	40,000	18,000	16
	Long trvs.	39,000	16,000	14

- 1/ For thickness greater than 4 inches, the properties shall be as specified in the contract or purchase order.
- 2/ Tensile and yield strength test requirements may be waived for material in any direction in which the dimension is less than 2 inches because of the difficulty to obtain a tension test specimen suitable for routine control testing.
- 3/ D is diameter of test specimen.

3.3.3 Special purpose and large forgings. For die forgings and hand forgings (1) of greater cross-sectional area or (2) heat treated in section thickness greater than covered by this specification or (3) when the purpose or conditions under which the forging is to be used so dictates, the requirements shall be as specified in the contract, order, or drawing. In such cases the mechanical properties of test specimens taken from locations indicated on the drawing shall be as specified in the contract, order, or drawing.

3.3.4 When die forgings, other than 2014, 7075 and 7079 and as covered in 3.3.3, are machined before heat treatment, the properties of the as-forged thickness will apply unless the forgings are machined to less than half the original (as-forged) section thickness. Properties of material machined to less than half of original thickness shall be as agreed upon between the contractor and the vendor for properties required greater than covered by the specification.

3.3.4.1 When hand forgings, other than covered in 3.3.3 are machined before heat treatment, the properties of the as-forged thickness will apply regardless of machined section thickness.

3.3.5 The mechanical properties of any forging supplied in any temper (see 6.2) other than one shown for that alloy in tables II through XI, inclusive, shall after suitable heat treatment conform to the applicable properties shown in tables II through XI, inclusive. Specimens shall be taken in accordance with 4.2.3.1 and 4.2.3.2.

3.4 Resistance to stress-corrosion cracking (7049-T73, 7075-T73 and 7075-T7352).

3.4.1 Resistance. Susceptibility to stress-corrosion cracking shall be established by the criteria as covered in 4.9.

3.4.2 Capability. Forgings supplied shall be capable of exhibiting no evidence of stress-corrosion cracking when subjected to the test specified in 4.4.3. The supplier shall maintain records of all lots so tested.

3.5 Internal defects. When so specified (see 6.2), forgings shall be inspected ultrasonically for internal defects. Test methods and limits of acceptability shall be as agreed upon by the vendor and purchasing activity.

3.5.1 Internal defects (Air Force only). Forgings shall be ultrasonically inspected for internal defects in accordance with MIL-I-8950.

3.6 Tolerances. The forgings shall conform to the shape and dimensions specified (see 6.2), within such variations as may be shown on the drawings.

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3.7 Marking of hand forgings. Unless otherwise specified (see 6.2), hand forgings shall be marked continuously along their length with the alloy and temper designation, if applicable, in characters that are clearly legible and that will not be obliterated by ordinary handling. For squares, the marking shall be on the face that is parallel to the direction of the long transverse properties.

3.8 Heat treatment. Unless otherwise specified (see 6.2), applicable tempers of forgings shall be heat treated in accordance with the requirements of MIL-H-6088.

3.9 Workmanship. The forgings shall be of uniform quality and condition, free from blisters, fins, folds, seams, laps, cracks, segregations, spongy areas, or other defects, which would adversely affect their serviceability. Surface defects may be explored and if they can be removed so they do not appear on re-etching (see 4.6) and the required section thickness can be maintained, they shall not be cause for rejection.

3.9.1 When specified (see 6.2), the grainflow pattern shall conform with that of a sample forging, photograph or drawing approved by the procuring activity.

3.9.2 The forgings shall not be repaired by plugging or welding.

3.10 Surface conditioning (Air Force only). Unless otherwise specified, all heat treated and machined die forgings purchased for use on Air Force contracts shall be processed to produce surface compressive stresses in both internal and external parting line areas and areas where "end grains" have been exposed by machining. Surface working by means of shot peening or rolling to induce residual residual surface compressive stresses shall be applied.

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 that supplies and services conform to prescribed requirements.

4.2 Sampling.

4.2.1 Lot.

4.2.1.1 Die forgings. A lot shall consist of forgings of the same shape or group of forgings of similar size and shape of the same alloy and heat treated in the same furnace charge. If forgings are heat treated in a continuous furnace, forgings charged consecutively during continuous operation of the furnace shall be considered a furnace charge. For forgings weighing 5 pounds or less, the maximum weight of a lot shall be 2000 pounds, and for larger forgings it shall be 6000 pounds.

4.2.1.2 Hand forgings. A lot shall consist of not more than 6000 pounds of forgings of the same alloy, temper, heat treat furnace charge (when heat treated), and dimensions 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 to 3.2. Ingots not conforming to this specification shall be rejected. Complete ingot analysis records shall be available at the producer's plant to the procuring activity.

4.2.2.2 Finished product analysis. Unless compliance with 4.2.2.1 is established, an analysis shall be made as specified in method 111 or 112 of Fed. Test Method Std. No. 151, for each 4,000 pounds or less of material comprising the lot, except that not more than one analysis shall be required per piece.

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4.2.3 Mechanical property and stress corrosion test. Unless otherwise specified (see 6.2), at least two standard 0.500 inch round tensile test specimen per Fed. Test Method Std. No. 151 method ASTM E8 (Figure 3) shall be taken to represent the lot. If the cross-sectional area of the forging is too small to permit use of the standard specimen, small size round specimens per Figure 8 or rectangular specimens per Figure 6 of method ASTM E8 shall be used. If the forging is too small to obtain any of these specimens, the test method shall be as directed by the procuring activity (see 6.2). The tensile test specimen used for testing in accordance with 4.4.2 may be utilized for the stress corrosion acceptance test of 4.9.

4.2.3.1 Die forgings.

- (a) At least two tensile specimens, one parallel to forging flow lines and one transverse to forging flow lines, shall be taken from a forging representative of the first production lot of forgings produced from each new die or significantly reworked die, and tested to determine conformance with the requirements of tables II and III. Results of such first item tests shall be made available to the procuring activity.
- (b) For production, the tension test specimen shall be taken from a test coupon forged from the stock used in making the forgings and heat treated with the lot which is represents or from a prolongation of the forgings or from a forging chosen to represent the lot. The test specimen shall be taken so that the axis of the specimen is substantially parallel to the direction of forging flow lines in the test coupon or forging, except that, when specified, an additional test specimen shall be taken so that the axis of the specimen is transverse to the direction of forging flow lines in the test coupon or forging.

4.2.3.2 Hand forgings. The tension test specimens shall be taken from a prolongation of the forgings or from a forging chosen to represent the lot. The specimen representing the longitudinal direction shall be taken so that its axis coincides with the longitudinal center line of the forgings, and the specimen representing a transverse direction shall be taken so that the midpoint of its axis shall lie on the longitudinal center line of the forging. For any specimen, the midpoint of its axis shall be at least one-half of the forging thickness from any surface of the forgings. Tests will regularly be made only in the long transverse direction, but when required by the procuring activity, tests shall also be made in the longitudinal direction or short transverse direction.

4.3 Visual examination.

4.3.1 Tolerances. At least three forgings from each lot shall be measured to determine compliance with 3.6.

4.3.2 Workmanship. Visual examination of at least three forgings shall be made to establish compliance with 3.7, 3.9, and 3.9.2.

4.3.3 Preparation for delivery. The preservation, packing, and marking shall be examined for compliance with section 5.

4.4 Tests.

4.4.1 Chemical analysis. Chemical analysis shall be made by wet chemical or spectrochemical methods in accordance with Fed. Test Method Std. No. 151, method 111 or 112. In case of dispute, Chemical Analysis by Wet Chemical, method 111 of Fed. Test Method Std. No. 151 shall be the basis for acceptance.

4.4.1.1 (Air Force only). Forgings shall be penetrant inspected in accordance with MIL-I-6866. Penetrant materials shall be equal to or greater than Group V sensitivity.

4.4.2 Tension test. Tensile and yield strengths and elongation shall be determined in accordance with ASTM E8. The yield strength shall be determined by the offset method.

4.4.3 Stress-corrosion cracking test. Specimens of 7049-T73, 7075-T73 and 7075-T7352 alloy shall be capable of passing the following stress-corrosion test:

- (a) Thirty days' exposure.
- (b) Stressed in the short transverse direction with respect to grain flow and held at a constant strain. The stress level shall be 75 percent of the longitudinal yield strength specified in table II or V, as applicable.
- (c) The stressed specimen shall be exposed to a solution of 3-1/2 percent NaCl conforming to the purity and oil requirements of ASTM B117, at room temperature, by alternate immersion. The exposure cycle shall consist of 10 minutes immersion in the solution and 50 minutes out of solution. Specimens must be dried prior to each immersion.

4.5 Heat treatment.

4.5.1 Specimens of alloy 2014 material in the solution heat-treated temper (T4) shall not be required to be mechanically tested within 4 days after completion of the heat treatment. If the manufacturer elects, samples may be tested prior to 4 days' aging. If, however, the results fail to conform with the requirements of table II, these tests shall be made after the expiration of 4 days without prejudice.

4.5.2 Discoloration due to heat treatment shall not be cause for rejection.

4.6 Macroscopic examination.

4.6.1 Each die forging shall be etched by swabbing or immersing in an aqueous solution of sodium hydroxide after which it shall be thoroughly rinsed in water followed by a wash in nitric acid or in chromic sulfuric acid solution or other solution where will produce a surface of equivalent suitability for visual inspection. At the option of the procuring activity (see 6.2), a sampling plan may be used in lieu of etching each forging.

4.6.1.1 (Air Force only). Forgings shall be penetrant inspected in accordance with MIL-I-6060. Penetrant materials utilized shall be equal to or greater than Group V sensitivity. At the option of the procuring activity, a sampling plan may be used in lieu of 100 percent penetrant inspection.

4.6.2 When an doubt exists as to the homogeneity of the material, the etched forgings shall be examined with a glass of approximately 10 diameter magnification. A representative forging shall require deep etching of the entire cross section.

4.7 Surface conditioning (Air Force only). Shot peening shall be accomplished in accordance with MIL-S-13165 except that corrosion resisting steel shots will be used in lieu of steel shots. For intensities of 0.010A and over, the shot size shall not be smaller than 0.028 inch diameter.

4.8 Internal defects. When specified (see 6.2), inspection for internal defects shall be conducted in accordance with MIL-I-8950.

4.8.1 Internal defects (Air force only). Unless otherwise specified, all forgings shall be ultrasonically inspected in accordance with MIL-I-8950. Acceptance level shall be Class A for all areas designated as critical on the B/P and Class D for all other areas.

4.9 Acceptance criteria for stress-corrosion cracking. Susceptibility to stress-corrosion cracking for 7049-T73, 7075-T7352 and 7075-T73 forgings shall be established by the following criteria:

- (a) Determine electrical conductivity and tensile properties on a minimum of 3 specimens.
- (b) If the conductivity is below 38.0 percent International Annealed Copper Standard (IACS) (NBS circular No. 31), the material is considered unsatisfactory and must be reprocessed, regardless of property level.
- (c) If the conductivity is 40 percent IACS or higher and tensile properties meet the minimum values specified herein, the forgings are considered to be satisfactory.

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- (d) If conductivity is between 38 and 40 percent IACS, if longitudinal tensile properties meet the minimum limits specified herein, and if the yield strength does not exceed the specified minimum by more than 11,900 pounds per square inch, the forgings are considered to be satisfactory.
- (e) If conductivity is below 40 percent IACS and the yield strength exceeds the specified minimum value by 12,000 pounds per square inch or more, the forgings are considered suspect.
- (f) When forgings are considered suspect, they may be reprocessed or a sample of the forgings may be heat treated for not less than 30 minutes at 870°F. and quenched in cold water. Conductivity shall then be measured within 15 minutes after quenching. If the difference between this measurement and the original measurement on the T73 forgings is 5 percentage points or more, the T73 temper forgings are satisfactory. If the difference is less than 6 percentage points, the T73 forgings must be reprocessed.

4.10 Special inspection procedures. When special purpose or large forgings are specified, the inspection procedure, as related to the number and location of test samples taken from the forgings, shall be subject to the approval of the procuring activity.

4.11 Rejection and retests.

4.11.1 Rejection. If any individual test specimen fails to conform to this specification, the lot represented by the specimen shall be rejected.

4.11.2 Retests. If a lot of material is rejected in accordance with 4.6.1, retests of that lot shall be permitted in accordance with the provisions of Fed Test Method Std. No. 151 by: (a) Taking twice the original number of test specimens from an area in the original sample forging adjacent to the area represented by the failure, or (b) taking the original number of test specimens from an area in each of two other forgings identical to the area in the original sample forging represented by the failure. Should any of these specimens fail to conform to this specification, the entire lot shall be rejected.

5. PREPARATION FOR DELIVERY

5.1 Preservation and packing. All forgings shall be preserved and packed in accordance with the requirements of MIL-STD-649. The procuring activity should specify the levels required. When the levels are not specified, level C shall be used.

5.2 Marking. Marking shall be in accordance with 5.2.1 or 5.2.2, as specified (see 6.2).

5.2.1 Civil agencies. In addition to any special marking required by the contract or order, shipping containers shall be marked in accordance with FED-STD-123.

5.2.2 Military requirements. 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 Alloy 2014 is most commonly used for general applications where high strength is essential. After artificial aging to the temper T6, it has tensile and yield strength second only to alloys 7075, 7076, and 7079.

6.1.2 Alloys 2018, 2218, 2618, and 4032 are used for elevated temperatures (approximately 450°F.) applications. Alloys 2018, 2218, and 4032 have been used for aircraft engine pistons and cylinder heads.

6.1.3 The use of alloys 2025 and 7076 is largely confined to propellers for aircraft and impellers for superchargers and engines.

6.1.4 Alloy 2219 is used for applications which require good weldability and uniformity of strength of welds, moderate strength at room temperature and high strength in the range of 500 to 600°F.

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TABLE XII. Brinell hardness (minimum)

Commercial designation	Brinell hardness
2014-T4	100
2014-T6	125
2018-T61	100
2025-T6	100
2218-T61	100
2618-T61	115
4032-T6	115
6061-T6	80
6066-T6	100
6151-T6	90
7049-T73	135
7075-T6	135
7075-T73	125
7076-T61	140
7079-T6	135

6.7 Alloy and temper designations. The alloys and temper designations used in this specification conform to the designation systems recognized by the Aluminum Association and in accordance with AISI Std. H35.1.

MILITARY INTERESTS:**Custodians:**

Army - MR
Navy - AS
Air Force - 11

Review activities:

DOD-HSA
Army - MI, MJ, AT, AV
Navy - OS, SH, YD
Air Force - 84

User activities:

Army - GL, ME, HC

Preparing activity:

Navy - AS

Civil Agency Coordinating Activities:

COMMERCE-NBS
GSA-FSS
JUSTICE-FPI
POSTAL-PPS
USDA-ARS

Military Coordinating Activity:

DOD-NSA

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6.1.5 Alloy 5083 is a nonheat-treatable, moderate-strength alloy with good weldability.

6.1.6 Alloys 6061 and 6151 are extensively used for intricate parts that are more difficult to forge in the harder alloys. Alloy 6061 is the most resistant to corrosion of any of the aluminum forging alloys.

6.1.7 Alloy 7049-T73 is used in applications requiring high strength and high resistance to stress-corrosion cracking.

6.1.8 Alloy 7075 is used for small and medium size forgings where maximum weight saving is essential.

6.1.8.1 Alloy 7075-T73 or 7075-T7352 is recommended for components which are subjected to assembly stresses in the transverse direction because of its resistance to stress-corrosion.

6.1.9 Alloy 7079 has tensile and yield strength only slightly lower than those of 7075 alloy but has higher elongation, especially in the transverse direction. It has the additional advantage of being less sensitive to the rate of quenching so that full properties are developed in material heat treated in thickness up to 6 inches.

6.2 Ordering data. Purchasers should select the preferred options permitted herein and include the following information in procurement documents:

- (a) Title, number, and date of this specification.
- (b) Alloy number, temper, method of forging, and grain-flow pattern, if required (see 1.2.1, 1.2.2, 1.2.3, 3.3.5 and 3.9.1).
- (c) The applicable drawings (see 3.6).
- (d) Selection of applicable levels of preservation and packing required (see 5.1).
- (e) Any other options desired (see 3.3.3, 3.7, 3.8, 4.3.2, 4.6.1, 5.2, and (see 6.5).

6.3 Special purpose and large forgings. Attention is called to the references herein to special purpose or large forgings, for which special mechanical properties and inspection procedures are necessary. Special attention should be given to the determination of properties, particularly ductility and tensile yield strength in directions normal to the observed grain flow in critically stressed areas in the forgings.

6.4 For information, the minimum Brinell hardness (500 kg. load, 10 mm. ball diameter) usually measured on the surface of the properly heat treated forgings is shown in table XII.

6.5 Temper T652. For hand forgings, the stress-relieved temper, T652, should be given consideration when ordering forgings for complex parts in which distortion in machining may be a problem.

6.6 Definitions.

6.6.1 Capable of. The term "capable of" as used in this specification (see 3.4.2), means that the test need not be performed by the producer of the forgings, however, should subsequent testing by the procuring activity establish that the material does not meet these requirements, the forgings will be rejected.

INSTRUCTIONS: In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge (*DO NOT STAPLE*), and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

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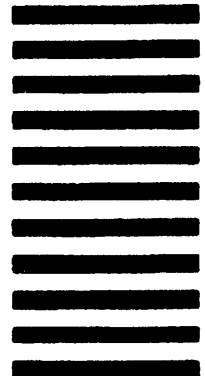
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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER		2. DOCUMENT TITLE	
3a. NAME OF SUBMITTING ORGANIZATION		4. TYPE OF ORGANIZATION <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)</i> - Optional		b. WORK TELEPHONE NUMBER <i>(Include Area Code)</i> - Optional	
c. MAILING ADDRESS <i>(Street, City, State, ZIP Code)</i> - Optional		8. DATE OF SUBMISSION <i>(YYMMDD)</i>	