

**Hardness and Conductivity Inspection
of Wrought Aluminum Alloy Parts**

1. SCOPE:

1.1 Purpose:

This specification establishes hardness and electrical conductivity acceptance criteria of finished or semi-finished parts of wrought aluminum alloys.

1.2 Application:

For nondestructive testing of wrought aluminum alloy parts.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

2.1.1 Aerospace Recommended Practices:

ARP891 Determination of Aluminum Alloy Tempers Through Electrical Conductivity Measurement (Eddy Current)

2.2 ASTM Publications:

Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM E 10 Brinell Hardness of Metallic Materials
ASTM E 18 Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
ASTM E 1004 Electromagnetic (Eddy-Current) Measurements of Electrical Conductivity
ASTM G 34 Exfoliation Corrosion Susceptibility in 2xxx and 7xxx Series Aluminum Alloys (EXCO Test)

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2.3 U.S. Government Publications:

Available from Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

2.3.1 Military Standards:

MIL-STD-1537 Electrical Conductivity Test for Measurement of Heat Treatment of Aluminum Alloys, Eddy Current Method

3. TECHNICAL REQUIREMENTS:

3.1 Equipment:

The equipment used for hardness and electrical conductivity testing shall meet the requirements of ASTM E 10, ASTM E 18, ASTM E 1004, or MIL-STD-1537, as applicable.

3.1.1 Calibration: The test equipment shall be calibrated initially with laboratory (primary) standards and at not longer than three-month intervals thereafter. The calibration shall include confirmation of repeatability.

3.1.2 Verification: The test equipment shall be checked daily or more frequently when in use, against test blocks to ensure accurate and reproducible results. Equipment which does not provide accurate or reproducible results shall be corrected and recalibrated.

3.2 Procedure:

3.2.1 Hardness: Shall be determined in accordance with ASTM E 10 for Brinell hardness and ASTM E 18 for Rockwell hardness.

3.2.2 Electrical Conductivity: Shall be determined in accordance with ASTM E 1004 and ARP891 or MIL-STD-1537.

3.3 Properties:

Parts shall conform to the hardness and electrical conductivity values in Table I for bare alloys and Table II for clad alloys after heat treatment or annealing in accordance with the applicable specification. Alloys/tempers not contained herein shall be referred to the cognizant engineering organization.

4. QUALITY ASSURANCE PROVISION:

4.1 Responsibility for Inspection:

The inspection source shall be responsible for performing all required tests. Purchaser reserves the right to perform any confirmatory testing deemed necessary to ensure that hardness and conductivity conform to the requirements of this specification.

4.2 Classification of Tests:

Not applicable.

4.3 Sampling and Testing:

Shall be in accordance with the applicable heat treatment specification or as agreed upon by purchaser and processing vendor.

4.4 Reports:

The inspection source shall furnish with each shipment a report showing the actual minimum and maximum values obtained. This report shall include the purchase order number, AMS-2658A, heat treatment specification number, part number, and quantity.

5. PREPARATION FOR DELIVERY:

Not applicable.

6. ACKNOWLEDGMENT:

A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.

7. REJECTIONS:

Parts not inspected in accordance with this specification or not conforming to the specified hardness and conductivity requirements, or to modifications authorized by purchaser, will be subject to rejection.

7.1 Nonconforming Parts:

Parts failing to meet the hardness or electrical conductivity acceptance values specified herein shall be either reprocessed in accordance with the limits of the applicable heat treatment specification or referred to the cognizant quality assurance organization for additional testing or evaluation.

8. NOTES:

8.1 A change bar (I) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this specification. An (R) symbol to the left of the document title indicates a complete revision of the specification, including technical revisions. Change bars and (R) are not used in original publications, nor in specifications that contain editorial changes only.

8.2 Parts:

Finished and semi-finished parts also include raw stock heat treated by the user during the fabrication process.

- 8.3 Dimensions and properties in inch/pound units are primary; dimensions and properties in SI units are shown as the approximate equivalents of the primary units and are presented only for information.
- 8.4 Inspection procedures meeting the requirements of this specification have been classified under Federal Supply Classification (FSC) 95GP.

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TABLE I
Bare Aluminum Alloy Hardness and Conductivity Acceptance Values

Alloy	Temper (1)	Hardness					Conductivity % (4)
		Brinell min (2)	Rockwell, min (3)			15T	
			B	E	H		
1100	0	-	-	-	50 max	-	57.0 - 62.0
2004	T6	-	-	92.0	-	-	35.5 - 42.0
2014	0	-	22 max	70 max	95 max	-	43.5 - 51.5
	T3	100	65	95	-	82	31.5 - 35.0
	T4	100	65	95	-	82	31.5 - 35.0
	T6	125	78	102	-	86	35.0 - 41.5
2024	0	-	22 max	70 max	95 max	-	46.0 - 51.0
	T3	100	63	94	-	82	27.5 - 32.5
	T4	100	63	94	-	82	27.5 - 34.0
	T6	125	72	98	-	84	34.0 - 44.0
	T72	125	72	98	-	82	38.0 - 45.0
	T8	120	74	99	-	85	35.0 - 42.5
	T86	135	83	105	-	87.5	37.0 - 41.0
2124	T3	110	69	97	-	-	27.5 - 32.5
	T8	120	74	99	-	-	35.0 - 42.5
2219	0	-	22 max	70 max	95 max	-	44.0 - 49.0
	T3	77	60	92	-	79	26.0 - 31.0
	T31	96 (10)	70	-	-	-	26.0 - 34.0
	T37	100	62	93	-	81	27.0 - 31.0
	T4	100	58	90	-	78	28.0 - 32.0
	T6	110	62	93	-	81	32.0 - 36.0
	T8	115	71	98	-	83	31.0 - 35.0
	T87	125	75	100	-	84	31.0 - 35.0
3003	0	-	-	-	65 max	-	44.5 - 50.5
5052	0	-	-	70 max	95 max	-	34.0 - 37.0
6013	0	-	-	90 max	-	-	-
	T4	-	40	-	-	-	37.0 - 39.0
	T6	-	61	96	-	-	40.0 - 43.0
6061	0	40 max	-	-	75 max	-	42.0 - 50.0
	T4	50	-	60	-	64	35.5 - 43.0
	T6	80	-	85	-	78	40.0 - 50.0
6063	0	-	-	-	70 max	-	57.0 - 65.0
	T1	-	-	37	-	53	48.0 - 58.0
	T4	-	-	40	-	54	48.0 - 58.0
	T5	-	-	44	-	57	50.0 - 60.0
	T6	60	-	70	-	68	50.0 - 60.0
6066	0	-	-	40 max	-	-	42.0 - 47.0
	T4	-	-	85	-	76	34.0 - 41.0
	T6	100	65	95	-	82	38.0 - 50.0
7049	0	-	22 max	70 max	95 max	-	44.0 - 50.0
	T73	135	81	104	-	85	40.0 - 44.0
	T76	140	84	106	-	87	38.0 - 44.0
7050	0	-	22 max	70 max	95 max	-	44.0 - 50.0
	T73	135	81	104	-	85	41.0 - 44.0
	T74	135	82	105	-	86	40.0 - 44.0 (5)
	T76	140	84	106	-	87	39.0 - 44.0

TABLE I
(Continued)
Bare Aluminum Alloy Hardness and Conductivity Acceptance Values

Alloy	Temper (1)	Brinell min (2)	Hardness				Conductivity % (4)
			Rockwell, min (3)				
			B	E	H	15T	
7075	0	-	22 max	70 max	95 max	-	44.0 - 48.0
	T6	135	84	106	-	87	30.5 - 36.0
	T73	125	78	102	-	85	40.0 - 43.0 (5)
	T76	130	82	104	-	86	38.0 - 42.0
7149	0	-	22 max	70 max	95 max	-	44.0 - 50.0
	T73	135	81	104	-	85	40.0 - 44.0
	T76	140	84	106	-	87	38.0 - 44.0
7150	0	-	22 max	70 max	95 max	-	44.0 - 50.0
	T61	145	87	108	-	-	29.0 - 33.5
	T73	135	81	104	-	85	41.0 - 44.0
	T74	135	82	105	-	86	40.0 - 44.0 (5)
	T76	140	84	106	-	87	39.0 - 44.0
	T77	145	87	108	-	87	37.0 - 39.0
7175	0	-	-	-	95 max	-	44.0 - 48.0
	T6	135	84	106	-	87	30.5 - 36.0
	T73	125	78	102	-	85	40.0 - 43.0 (5)
	T74	135	82	104	-	-	38.0 - 42.0
	T76	130	82	104	-	86	38.0 - 42.0
7178	0	-	-	-	95 max	-	43.0 - 47.0
	T6	145	87	108	-	88	29.0 - 34.0
	T76	140	84	106	-	87	38.0 - 42.0
7475	T73	-	-	103	-	-	40.0 - 44.5 (8)
	T76	-	-	105	-	-	38.0 - 42.0 (9)