

TECHNICAL SPECIFICATION		Rev. No. 03
		Date of Issue 16.03.21
FOR ALUMINIUM ALLOY 7075-T6510 EXTRUDED BARS TO ASTM B221M-07		HEPF/QA/SPEC/008
Rev no	Amendment	Date
03	Amendment as per ARDE Ltr No:ARDE/1/1/10-Tech(C1) Dtd:06.01.2021 Tensile specimen as per ASTM B221-07	16.03.21

1. INSPECTION AND TESTING PROCEDURE

This specification shall be used in conjunction with the relevant sections of **ASTM STANDARD B 221M-07 Alloy 7075 T 6510**.

2. QUALITY OF MATERIAL

The material shall be made from Aluminium and alloying constituents, with or without approved scrap, at the discretion of the manufacturer.

Preference: Material shall be Single Strand Extrusion.

3. CHEMICAL COMPOSITION

The chemical composition of the material shall be :-



Elements	Percentage	
	Min	Max
Copper	1.2	2.0
Magnesium	2.1	2.9
Silicon	-	0.4
Iron	-	0.5
Manganese	-	0.3
Zinc	5.1	6.1
Titanium	-	0.2
Chromium	0.18	0.28
Other Elements*	Each 0.05 max	Total 0.15 max
Aluminium	The remainder	

***Subject to the discretion of the Inspection Authority, determination of these elements need be made on a small proportion only of the samples analysed.**

4. CONDITION

4.1 BARS AND EXTRUDED SECTIONS

Unless otherwise agreed and stated on the order, bars for machining and extruded sections shall be supplied in solution treated, stress relieved (by control stretching to a permanent extension not less than 1.5 % and not more than 2.5 %) and precipitation treated condition to T 6510.

The material shall be uniform in quality and shall be free from lamination pipes, slivers, cracks, kinks, warps, wrinkles, deep scratches, and other injurious defects. However, minor marks on the surface of the bars due to heat treatment in the furnaces, minor spots which have been ground in preparation for the ultrasonic testing is acceptable. Material will be supplied having Diameter **135.00 ± 0.50 mm**.

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Length will be in multiples of 333 mm. Minimum Length will be 3663 mm and maximum Length will 4662 mm with tolerance of plus 5 mm (+ 5 mm).

Departure from straightness over any selected length of 1000 mm shall not exceed 1.5 mm. Both faces of the bars are to be parallel and evenly machined.

The extruded Aluminum alloy bars shall be protected by an effective corrosion preventive coating immediately after manufacture.

Each bar shall be continuously marked stating Alloy, size, temper, ultrasonic inspection and producers name / trade mark.

5. HEAT TREATMENT

The material shall be heat treated as specified in relevant sections of ASTM B 221M Alloy 7075 T 6510.

6. PERIPHERAL GRAIN GROWTH

Peripheral coarse grain by etching test shall be conducted at a radius of 1.25mm from the outside surface of the rod.(Thickness of the peripheral grain growth by etching test shall be not more than 1.25mm from the outer surface)

7. MECHANICAL PROPERTIES

7.1 TENSILE TEST

Test pieces (Longitudinal / Transversal) to be made as shown in Annexure – 2a from each Heat (minimum 3 rods) and test result should meet the requirement specified below.

7.1.1 LONGITUDINAL TENSILE TEST

Diameter or minor sectional dimensions of the bar or extruded section		0.2% Proof stress	Tensile Strength	Elongation on gauge length in 5x Diameter (5.65√A)
		MIN MPa	MIN MPa	(%)Min
Over	Up to including	470	540	5
100 mm	150 mm			

7.1.2 TRANSVERSAL TENSILE TEST

- Test is done for record purpose.



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8. **HARDNESS TEST**

140 HB – for information only for each rod tested for tensile test.

9. **ULTRASONIC TESTING**

Extruded bars shall be 100 % inspected ultrasonically as per Standard practice ASTM B 594 – 02, Type 1 Class “A”, Discontinuity Class is as given in ASTM B 221 M –07 Table 3 (i.e. Class “A”). Defect level shall be as per ASTM B 594-02, as specified for Class “A” in Table 1 and section 11 of the Specification ASTM B 594-02.

10. **ELECTRICAL CONDUCTIVITY TEST**

Electrical conductivity. to be carried out for each rod tested for Tensile test on 15mm section as shown in Annexure – 1a, fig1. Data to be furnished for each rod tested for tensile test. Electrical conductivity should be **30.0 to 36.0** % IACS.

11. **RESIDUAL INTERNAL STRESS DETERMINATION**

Absence of residual internal stress should be checked on minimum 3 rods in each heat by cutting Slices having approximately 15 mm thickness. Each slice shall be cut through as shown in Annexure – 1a of fig. 2 up to the center. The width of the slot “t” is the width of the sawing tool. If spring back of material is attained, causing the sawing tool not to move freely, then the test is considered to have failed and material rejected or otherwise accepted.

12. **TEST CERTIFICATE**

Each consignment shall be accompanied with a test certificate indicating the following :-

- i. Test results for Mechanical test (Longitudinal & Transversal), Hardness in BHN, Residual Internal stress determination test, Electrical conductivity in % IACS shall be submitted for minimum 3 rods for each Heat
- ii. Conformance to 100 % Ultrasonic test to ASTM B 594, Type 1 Class A for each consignment.
- iii. Chemical analysis & Peripheral grain growth for each Heat.
- iv. Batch size of manufacture.
- v. Lot size offered for delivery i.e. details of the number of rods and quantity of material in each Heat.
- vi. Details of Sampling Procedure adopted.
- vii. Procedure adopted for testing (Chemical / Physical / Mechanical properties), equipment (with make) used. Indicate standards to which they conform ASTM, BS, DIN etc.
- viii. Accuracy of test results referred.(Uncertainty of test results for chemical analysis.)
- ix. Brief note on the Quality Assurance Scheme adopted during manufacture.



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x. Each rod to be marked with Inspector's acceptance.

Annexure - 1 a

Electrical Conductivity Test Specimen




Fig. - 1

Residual Internal Stress Determination Sample

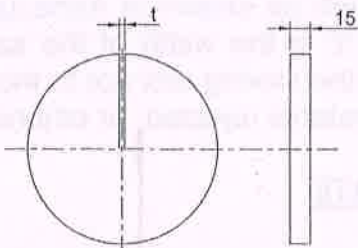



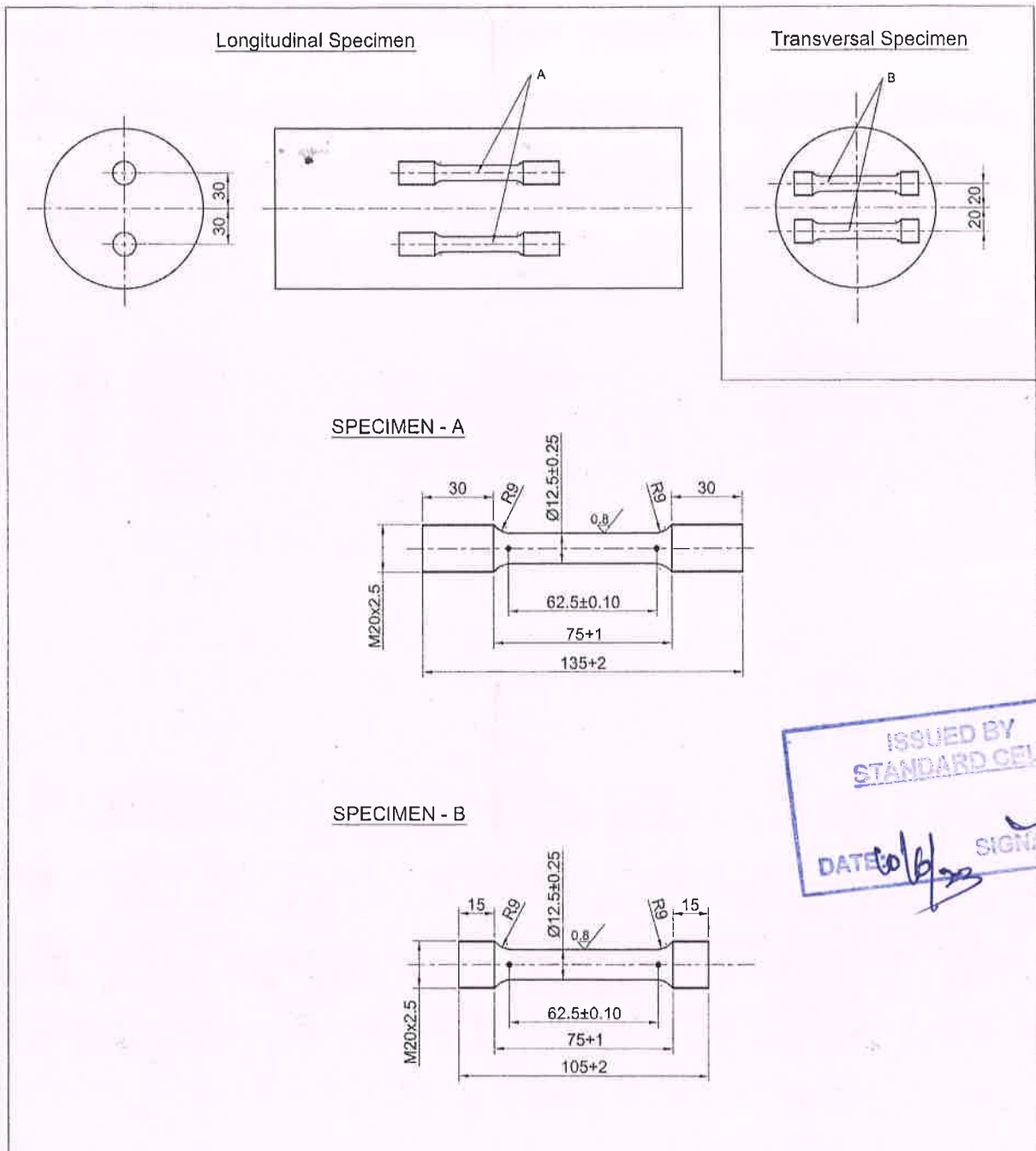
Fig. - 2

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Annexure - 2 a
Test specimen as per ASTM B557M



MONITORING INSTRUCTION FOR INSPECTION		Issue No. 01 Rev. No. 02
		Date of Issue 16.03.2021
ALUMINIUM ALLOY BAR Ø135mm		HEPF/QA/SC/G/002
Rev no	Amendment	Date
01	Type testing procedure included (ARDE 1/1/10 – Tech dated 4.10.18)	23.02.19
02	Amendment of Spec HEPF/QA/SPEC/008 Rev:03 dtd:16.03.21	16.03.21

**BASIC SPECIFICATION : ALUMINUM ALLOY BAR AS PER ASTM B221M-07
Alloy 7075 T 6510.(HEPF/QA/SPEC/008 Rev:03 dtd:16.03.21)**

SAMPLING SPECIFICATION : MIL-STD-105/ANSI ASQC Z 1.4

END USE : 125 mm FSAPDS (SABOT)

TABLE A. INSPECTION CHECK TO BE CARRIED OUT AT FIRM'S PREMISES BY THE FIRM

SL. NO.	CHARACTERITICS	SPECIFICATION / REQUIREMENT	SAMPLE SIZE
1	WORKMANSHIP (VISUAL)	THE MATERIAL SHALL BE UNIFORM AND FREE FROM LAMINATION, PIPES, SILVERS, LAPS, CRACKS, KINKS, WARPS, WRINKLES, DEEP SCRATCHES AND OTHER INJURIOUS DEFECTS.	100%
2	MARKING	EACH BAR TO BE MARKED BY SUPPLIER'S NAME OR CODE AND HEAT NUMBER	
3	PACKING	BARS TO BE PACKED SUITABLY TO AVOID TRANSIT DAMAGES.	
4	DIMENSIONS	Diameter - Ø 135.0 ± 0.5 mm, Length - Multiples of 333+5mm Mirimum length - 3663+5mm Max length - 4662+5mm	
5	CHEMICAL COMPOSITION (%)	As per spec HEPF/QA/SPEC/008 Rev No:03 dtd:16.03.21	****
6	MECHANICAL TEST (LONGITUDINAL)		****
7	MECHANICAL TEST (TRANSVERSAL)		****
8	HARDNESS TEST		****
9	ULTRASONIC TEST		100%
10	ELECTRICAL CONDUCTIVITY		100%
11	PERIPHERAL GRAIN GROWTH		****
12	RESIDUAL INTERNAL STRESS DETERMINATION		****

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**** THREE SAMPLES PER HEAT

NOTE:

1. THE RAW MATERIAL TO BE TESTED BY THE FIRM BY SELECTING THE SAMPLE BY THE FIRM ITSELF FOR CHEMICAL COMPOSITION AND MECHANICAL PROPERTIES IN NABL ACCREDITED OR GOVERNMENT APPROVED LAB OR INTERNATIONALLY REPUTED LABORATORY AS PER TABLE A
2. THE FIRM HAS TO CHECK FOR THE DIMENSIONS, VISUAL DEFECTS, PACKING AND MARKING AS PER TABLE A. AFTER COMPLETION OF TESTS AS PER NOTE- 1, THE FIRM HAS TO SUBMIT THE FOLLOWING DOCUMENTS TO HEPF.
 - I. THE RAW MATERIAL CERTIFICATE FROM THE ORIGINAL MANUFACTURER, HEAT NUMBER, QUANTITY PURCHASED, AND NUMBER OF BARS ARE TO BE MENTIONED IN THE INSPECTION LETTER TO HEPF.
 - II. THE CHEMICAL AND MECHANICAL TEST CERTIFICATES FROM NABL ACCREDITED OR GOVERNMENT APPROVED LABORATORY OR INTERNATIONALLY REPUTED LABORATORY AS PER TABLE A.
 - III. DIMENSIONAL REPORTS INCLUDING VISUAL AS PER TABLE A.
 - IV. GUARANTEE /WARRANTEE CERTIFICATE OF SUPPLIER.

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ALUMINIUM ALLOY BAR Ø135mm		HEPF/QA/SC/G/002
Rev no	Amendment	Date
01	Type testing procedure included (ARDE 1/1/10 – Tech dated 4.10.18)	23.02.19
02	Amendment of Spec HEPF/QA/SPEC/008 Rev:03 dtd:16.03.21	16.03.21

3. ALL THE ABOVE DOCUMENTS MENTIONED AT NOTE NO.2 ABOVE ARE TO BE FORWARDED TO GM/HEPF. HEPF SHALL VERIFY ALL THE DOCUMENTS AS ABOVE AND ACCORD CLEARANCE FOR DESPATCH OF THE MATERIAL TO HEPF IF ALL DOCUMENTS ARE IN ORDER

TABLE B. INSPECTION CHECK TO BE CARRIED OUT ON RECEIPT AT FACTORY.

SL. NO.	CHARACTERITICS	SPECIFICATION / REQUIREMENT	SAMPLE SIZE
1	WORKMANSHIP (VISUAL)	THE MATERIAL SHALL BE UNIFORM AND FREE FROM LAMINATION, PIPES, SILVERS, LAPS, CRACKS, KINKS, WARPS, WRINKLES, DEEP SCRATCHES AND OTHER INJURIOUS DEFECTS.	100%
2	MARKING	EACH BAR TO BE MARKED BY SUPPLIER'S NAME OR CODE AND HEAT NUMBER	
3	PACKING	BARS TO BE PACKED SUITABLY TO AVOID TRANSIT DAMAGES.	
4	DIMENSIONS	Diameter - Ø 135.0 ± 0.5 mm, Length - Multiples of 333+5mm Minimum length - 3663+5mm Max length - 4662+5mm	
5	CHEMICAL COMPOSITION (%)	As per spec HEPF/QA/SPEC/008 Rev No:03 dtd:16.03.21	****
6	MECHANICAL TEST (LONGITUDINAL)		****
7	MECHANICAL TEST (TRANSVERSAL)		****
8	HARDNESS TEST		****
9	ELECTRICAL CONDUCTIVITY		100%
10	PERIPHERAL GRAIN GROWTH		****
11	RESIDUAL INTERNAL STRESS DETERMINATION		****

**** THREE SAMPLES PER HEAT

TABLE C. TYPE TESTING SAMPLES FOR NEW SOURCES OF COMPONENT

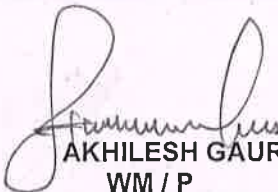
The firm should supply 3 tons of raw material for manufacturing 200 no's of sabot pilot sample for Application/Type test before bulk supply. Out of 200nos, in case of Import source – 24 nos & Indigenous source – 48nos will be proof tested. On satisfactory result clearance will be given for bulk production. If results are not satisfactory, double samples are to be tested and if the results are not meeting the requirements, the lot/batch shall be rejected

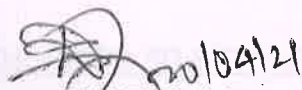



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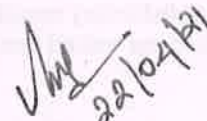
TABLE D. VERIFICATION OF ADEQUACY OF INSPECTION DOCUMENTS.

SL. NO.	INSPECTION DOCUMENTS
1	RAW MATERIAL TEST CERTIFICATE FOR EACH HEAT DULY TESTED FROM NABL OR GOVT. APPROVED OR INTERNATIONALLY REPUTED LABORATORY FOR CHEMICAL, MECHANICAL PROPERTIES, ULTRASONIC TESTING AS PER SPECIFICATION NO. HEPF/QA/SPEC/008 Rev:03 dtd:16.03.21
2	FIRM'S DIMENSIONAL INSPECTION REPORT
3	CERTIFICATE OF INSPECTION ISSUED BY THIRD PARTY INSPECTOR (BVQI) / OEM
4	PACKING SLIP INDICATING HEAT NUMBER AND QTY. DETAILS
5	DECLARATION IN FIRM'S LETTER HEAD HAVING DETAILS OF RAW MATERIAL PURCHASED QTY., SOURCE, EXPECTED YIELD FROM PURCHASED QTY. ETC. TO BE ENCLOSED (FOR EACH HEAT SEPARATELY)
	IN ADDITION TO THE ABOVE SOFT COPIES OF ALL THE CERTIFICATES MENTIONED IN TABLE – A SHALL BE SENT TO E-MAIL ID'S. happqa.ofb@ofb.gov.in , mmhapp.ofb@ofb.gov.in
NOTE	1. ALL TEST REPORTS / CERTIFICATES MUST BE COUNTER SIGNED BY FIRM'S HEAD OF QUALITY AND SHOULD HAVE LINK TO HEPF SUPPLY ORDER NUMBER, QTY. IN EACH CASE 2. EXPLICITLY DEVIATION(S) IF ANY SUCH AS TYPOGRAPHICAL ERROR, VALUES, NUMERIC, OTHER PARAMETER, ETC IS/ARE FOUND IN MONITORING INSTRUCTION OF THE ABOVE STORES, THE RELEVANT STANDARDS CONFORMING TO THE CONCERNED SPECIFICATIONS HEPF/QA/SPEC/008 Rev:03 dtd:16.03.21 SHALL BE REFERRED TO CONFIRM THE PARAMETER


 AKHILESH GAUR (6/4/2021)
 WM / P
 MEMBER / MI COMMITTEE


 SREENIVASA RAO BODALA
 DGM / PM
 MEMBER / MI COMMITTEE


 SEINUNNOM JOSEPH KIPGEN
 DGM / QA
 MEMBER / MI COMMITTEE


 T. PRABHU
 JT. GM / QA
 CHAIRMAN / MI COMMITTEE

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TABLE 1 Chemical Composition Limits^{A, B, C}

Alloy	Silicon	Iron	Copper	Manganese	Magnesium	Chromium	Zinc	Titanium	Vanadium	Other Elements ^D		Aluminum
										Each	Total ^E	
1060	0.25	0.35	0.05	0.03	0.03	...	0.05	0.03	0.05	0.03	...	89.80 min ^F
1100	0.95 Si + Fe	0.05-0.20	0.05	...	...	...	0.10	...	0.05	0.05	...	89.00 min ^F
2014	0.50-1.2	0.7	3.9-5.0	0.40-1.2	0.20-0.8	0.10	0.25	0.15 ^G	...	0.05 ^H	...	remainder
2024	0.50	0.50	3.8-4.0	0.30-0.8	1.2-1.0	0.10	0.25	0.15 ^G	...	0.05 ^H	...	remainder
2219	0.20	0.30	5.8-6.8	0.20-0.40	0.02	...	0.10	0.02-0.10	0.05-0.15	0.05 ^H	...	0.15 ^I
3003	0.6	0.7	0.05-0.20	1.0-1.5	...	...	0.10	...	...	0.05	...	0.15 ^I
Alclad 3003	...	...	3003 Clad with 7072 alloy		...	...	...	...	...	0.05	...	remainder
3004	0.30	0.7	0.25	1.0-1.5	0.0-1.3	...	0.25	...	...	0.05	...	remainder
3102	0.40	0.7	0.10	0.05-0.40	...	...	0.30	0.10	...	0.05	...	remainder
5052	0.25	0.40	0.10	0.10	2.2-2.0	0.15-0.35	0.10	...	...	0.05	...	remainder
5083	0.40	0.40	0.10	0.40-1.0	4.0-4.9	0.05-0.25	0.25	0.15	...	0.05	...	remainder
5086	0.40	0.50	0.10	0.20-0.7	3.5-4.5	0.05-0.25	0.25	0.15	...	0.05	...	remainder
5154	0.25	0.40	0.10	0.10	3.1-3.9	0.15-0.35	0.20	0.20	...	0.05	...	remainder
5454	0.25	0.40	0.10	0.50-1.0	2.4-3.0	0.05-0.20	0.25	0.20	...	0.05	...	remainder
5456	0.25	0.40	0.10	0.50-1.0	4.7-5.5	0.05-0.20	0.25	0.20	...	0.05	...	remainder
6005	0.8-0.9	0.35	0.10	0.10	0.40-0.8	0.10	0.10	0.10	...	0.05	...	remainder
6005A	0.50-0.9	0.35	0.30	0.50 ^J	0.40-0.7	0.30 ^J	0.20	0.10	...	0.05	...	remainder
6060	0.30-0.6	0.10-0.30	0.10	0.10	0.35-0.8	0.5	0.15	0.10	...	0.05	...	remainder
6061 ^K	0.40-0.8	0.7	0.15-0.40	0.15	0.8-1.2	0.04-0.35	0.25	0.15	...	0.05	...	remainder
6082	0.20-0.6	0.35	0.10	0.10	0.45-0.9	0.10	0.10	0.10	...	0.05	...	remainder
6086	0.9-1.8	0.50	0.7-1.2	0.6-1.1	0.8-1.4	0.40	0.25	0.20	...	0.05	...	remainder
6070	1.0-1.7	0.50	0.15-0.40	0.40-1.0	0.50-1.2	0.10	0.25	0.15	...	0.05	...	remainder
6082	0.7-1.3	0.50	0.10	0.40-1.0	0.8-1.2	0.25	0.20	0.10	...	0.05	...	remainder
6105	0.6-1.0	0.35	0.10	0.15	0.45-0.8	0.10	0.10	0.10	...	0.05	...	remainder
6162	0.40-0.8	0.50	0.20	0.10	0.7-1.1	0.10	0.25	0.10	...	0.05	...	remainder
8262	0.40-0.8	0.7	0.15-0.40	0.15	0.8-1.2	0.04-0.14	0.25	0.15	...	0.05 ^K	0.15 ^L	remainder
6351	0.7-1.3	0.50	0.10	0.40-0.8	0.40-0.8	...	0.20	0.20	...	0.05	...	remainder
6483	0.20-0.6	0.15	0.20	0.05	0.45-0.9	...	0.05	...	...	0.05	...	remainder
6550	0.30-0.7	0.10-0.30	0.05-0.20	0.20	0.20-0.6	0.05	0.15	0.10	...	0.05	...	remainder
7005	0.35	0.40	0.10	0.20-0.7	1.0-1.8	0.08-0.20	4.0-5.0	0.01-0.06	...	0.05 ^L	0.15 ^L	remainder
7072 ^M	0.7 Si + Fe	0.10	0.10	0.10	...	...	0.8-1.3	...	...	...	...	remainder
7075	0.40	0.50	1.2-2.0	0.30	2.1-2.9	0.18-0.20	5.1-6.1	0.20 ^N	...	0.05 ^N	0.15	remainder
7116	0.15	0.30	0.50-1.1	0.05	0.8-1.4	...	4.2-5.2	0.05	0.05	0.05 ^O	0.15	remainder
7129	0.15	0.30	0.50-0.9	0.10	1.3-2.0	0.10	4.2-5.2	0.05	0.05	0.05 ^O	0.15	remainder
7178	0.40	0.50	1.6-2.4	0.30	2.4-3.1	0.18-0.26	6.3-7.3	0.20	...	0.05	0.15	remainder

^A Limits are in weight percent maximum unless shown as a range, or stated otherwise.

^B Analysis shall be made for the elements for which limits are shown in this table.

^C For the purpose of determining conformance to these limits, an observed value or a calculated value obtained from analysis shall be rounded to the nearest unit in the last right-hand place of the figures used in expressing the specified limit, in accordance with the rounding-off method of Practice E29.

^D Others includes listed elements for which no specific limit is shown as well as unlabeled metallic elements. The producer may analyze samples for trace elements not specified in the specification. However, such analysis is not required and may not cover all metallic Others elements. Should any analysis by the producer or the purchaser establish that an Others element exceeds the limit of Each or that the aggregate of several Others elements exceeds the limit of Total, the material shall be considered nonconforming.

^E Other Elements—Total shall be the sum of unspecified metallic elements 0.010 % or more, rounded to the second decimal before determining the sum.

^F The aluminum content shall be calculated by subtracting from 100.00 % the sum of all metallic elements present in amounts of 0.010 % or more each, rounded to the second decimal before determining the sum.

^G Upon agreement between the purchaser and the producer or supplier, a Zr + Ti limit of 0.20 % max is permitted. Properties in Specification (Table 2) are not based on the Zirconium and Titanium algorithm.

^H Zirconium, 0.10-0.25 %. The total for other elements does not include zirconium.

^I Manganese plus chromium shall total 0.12-0.50.

^J In 1985 the requirements for 6082 were combined with those for 6061 by revising the minimum chromium from "0.15 %" to "0.04 %." This action cancelled alloy 6082.

^K Bismuth and lead shall be 0.40-0.7 % each.

^L Zirconium 0.08-0.20 %. The total for other elements does not include zirconium.

^M Composition of cladding alloy applied during the course of manufacture. Samples from finished tube shall not be required to conform to these limits.

^N Upon agreement between the purchaser and the producer or supplier, a Zr + Ti limit of 0.25 % max is permitted. Properties in Specification (Table 2) are not based on the Zirconium and Titanium algorithm.

^O Gallium 0.03 % max.

Normen-Download-Beuth-Alerts-Aluminium N. V. - KdNr. 8. 35 - NY-5193517001-2011-01-21 10:57

- E607 Test Method for Atomic Emission Spectrometric Analysis Aluminum Alloys by the Point to Plane Technique Nitrogen Atmosphere
- E716 Practices for Sampling Aluminum and Aluminum Alloys for Spectrochemical Analysis
- E1004 Test Method for Determining Electrical Conductivity Using the Electromagnetic (Eddy-Current) Method
- E1251 Test Method for Analysis of Aluminum and Aluminum Alloys by Atomic Emission Spectrometry
- G47 Test Method for Determining Susceptibility to Stress-

- Corrosion Cracking of 2XXX and 7XXX Aluminum Alloy Products
- Method of Test for Exfoliation Corrosion Susceptibility in 7XXX Series Copper-Containing Aluminum Alloys (EXCO Test) (G34-72)³
- 2.3. ANSI Standards:²

³ The applicable edition in the use of this specification is G34-72, which is available in the gray pages of the Annual Book of ASTM Standards, Vol 02.02

46

B221M - 07

TABLE 2 Continued

Temper	Specified Section or Wall Thickness, mm		Area, mm ²		Tensile Strength, MPa		Yield Strength (0.2 % offset), MPa		Elongation, % min	
	over	Incl	over	Incl	min	max	min	max	In 50 mm	In 6 × Diameter (5.65 √A)
T6 T6510 ^E T6511 ^E	all		all		200		240		10	0
Alloy 6351										
T1		12.50		13 000	180		90		15	13
T11		20.00	all		180		110		16	14
T4		20.00	all		220		130		16	14
T5		6.30	all		260		240		8	
T51	6.30	25.00	all		260		240		10	9
T54	3.20	25.00		13 000	260		230		10	7
T6		12.50		13 000	205		140		10	0
T6		3.20	all		290		255		8	
T6	3.20	20.00	all		290		255		10	0
Alloy 6463										
T1		12.50		13 000	115		60		12	10
T5		12.50		13 000	150		110		8	7
T6, T62 ^F		3.20		13 000	205		170		8	
T6	3.20	12.50		13 000	205		170		10	9
Alloy 6560										
T6	2.50	3.20	all		150		110		8	
T6	2.50	3.20	all		205		170		8	
Alloy 7005										
T53		20.00	all		345		305		10	9
Alloy 7116										
T5	3.20	12.50	all		330		290		8	7
Alloy 7129										
T5, T6		12.50	all		380		340		8	8
Alloy 7075										
O	all		all			275		165	10	9
T6		6.30	all		540		485		7	
T62 ^F		6.30	all		560		605		7	8
T6510 ^E		12.50	all		560		495		7	6
T6511 ^E		70.00	all		560		495		7	6
		70.00		13 000	560		490		7	6
		70.00		20 000	540		485		7	5
		110.00	13 000		540		470		7	5
T73		1.60		20 000	540		470		7	5
T73510 ^F		6.30		13 000	470		400		7	
T73511 ^F		6.30		16 000	485		420		8	7
		35.00		18 000	475		405		7	7
		70.00		13 000	470		395		7	6
		70.00	13 000		450		380		7	6
		110.00	13 000		500		435		7	
		1.25	all		510		440		7	
		3.20	all		510		440		7	
T76		6.30		13 000	510		440		7	
T76510 ^E		6.30		13 000	516		450		7	6
T76511 ^E		12.50		13 000	515		450		7	6
		25.00		13 000	516		450		7	6
		50.00		13 000	516		450		7	6
		75.00		13 000	510		440		7	6
		100.00		13 000	510		435		7	6
F ^D	all		all							6
Alloy 7178										
O	all		all	20 000		275		165	10	9
		1.60	all		565		525		7	
T6		6.30		13 000	580		525		5	
T6510 ^E		35.00		16 000	600		540		5	4
T6511 ^E		60.00		16 000	595		530		5	4
		35.00	16 000		580		515		5	4
		60.00		20 000	585		490		5	4
		80.00		20 000	585		490		5	4

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