INTERNATIONAL STANDARD

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Fourth edition
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Wrought aluminium and aluminium alloys — Extruded rods/bars, tubes and profiles —

Part 2: Mechanical properties

Aluminium et alliages d'aluminium corroyés — Barres, tubes et profilés filés —
Partie 2: Caractéristiques mécaniques

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 79, *Light metals and their alloys*, Subcommittee SC 6, *Wrought aluminium and aluminium alloys*.

This fourth edition cancels and replaces the third edition (ISO 6362-2:2012), which has been technically revised.

ISO 6362 consists of the following parts, under the general title *Wrought aluminium and aluminium alloys — Extruded rods/bars, tubes and profiles*:

— *Part 1: Technical conditions for inspection and delivery*

— *Part 2: Mechanical properties*

— *Part 3: Extruded rectangular bars — Tolerances on shape and dimensions*

— *Part 4: Profiles — Tolerances on shape and dimensions*

— *Part 5: Round, square and hexagonal bars — Tolerances on shape and dimensions*

— *Part 6: Round, square, rectangular and hexagonal tubes — Tolerances on shape and dimensions*

— *Part 7: Chemical composition*

Wrought aluminium and aluminium alloys — Extruded rods/bars, tubes and profiles —

Part 2: Mechanical properties

1 Scope

This part of ISO 6362 specifies the mechanical properties of wrought aluminium and aluminium alloy extruded rods/bars, tubes, and profiles for general engineering applications.

It applies to extruded products.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 6362-1, *Wrought aluminium and aluminium alloys — Extruded rods/bars, tubes and profiles — Part 1: Technical conditions for inspection and delivery*

ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*

ASTM B557M, *Standard Test Methods for Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6362-1 apply.

4 Tensile testing

For the selection of the specimens and tensile testing, see ISO 6892-1 or ASTM B557M.

5 Mechanical properties

Values for mechanical properties of aluminium and aluminium alloys are given in Tables 1 to 3.

For elongation, two different gauge lengths are used. The choice of the gauge length for elongation measurements (A or A_{50mm}) is at the discretion of the producer, unless otherwise agreed.

NOTE A is the percentage elongation on a gauge length of $5{,}65\sqrt{S_o}$. A_{50mm} is the percentage elongation on a gauge length of 50 mm.

Test results shall be rounded in accordance with the rules given in Annex A.

Table 1 — Mechanical properties of rods/bars

Alloy	Temper	Dimensions[a]	Tensile strength R_m MPa		0,2 % proof stress $R_{p0,2}$ MPa		Elongation min.	
			min.	max.	min.	max.	A %	A_{50mm} %
1070	H112	All	55	—	15	—	—	-
1070A	H112	All	60	—	20	—	25	23
1060	H112	$3 \le D$ or $S \le 30$	60	—	30	—	—	25
1050	H112	All	65	—	20	—	—	—
1050A	H112	$D < 35$ or $S < 30$	65	—	20	—	25	23
	O H111	All	60	95	20	—	25	23
1350[b]	H112	All	60	—	—	—	25	23
1100	H112	$D < 35$ or $S < 30$	75	—	20	—	18	18
		$35 \le D$ or $30 \le S$	75	—	20	—	—	—
1200	H112	$D < 35$ or $S < 30$	75	—	25	—	20	18
		$35 \le D$ or $30 \le S$	75		20	—	—	—
2007	T4	D or $S \le 80$	370	—	250	—	8	6
	T4510	$80 < D$ or $S \le 200$	340	—	220	—	8	—
	T4511	$200 < D$ or $S \le 250$	330	—	210	—	7	—
2011	T3	$3 \le D$ or $S \le 40$	310	—	260	—	10	10
		$40 < D$ or $S \le 50$	295	—	235	—	10	12
		$50 < D$ or $S \le 75$	290	—	205	—	10	14
	T4	$3 \le D$ or $S \le 200$	275	—	125	—	14	16
	T6	$3 < D$ or $S \le 75$	310	—	230	—	8	10
		$75 < D$ or $S \le 160$	295	—	195	—	6	8
	T8	$3 \le D$ or $S \le 75$	370	—	275	—	10	10
2011A	T4	$D \le 200, S \le 60$	275	—	125	—	14	12
	T6	$D \le 75, S \le 60$	310	—	230	—	8	6
		$75 < D \le 200$	295	—	195	—	6	—
2014	O[c]	All	—	250	—	135	10	12
	T4 T4510 T4511	All	345	—	240	—	10	12
	T42[d]	All	345	—	205	—	—	12
	T6 T6510 T6511	D or $S \le 12$	410	—	365	—	—	7
		$12 < D$ or $S \le 19$	440	—	400	—	6	7
		$19 < D$ or S, $A \le 16\,000$	470	—	410	—	6	7
		$19 < D$ or S, $16\,000 < A \le 20\,000$	470	—	400	—	6	6
		$19 < D$ or S, $20\,000 < A \le 25\,000$	450	—	380	—	6	6
		$19 < D$ or S, $25\,000 < A \le 30\,000$	430	—	365	—	6	6
	T62[e]	D or $S \le 19$	410	—	365	—	—	7
		$19 < D$ or S, $A \le 16\,000$	410	—	365	—	—	7
		$19 < D$ or S, $16\,000 < A \le 20\,000$	410	—	365	—	—	6

Table 1 *(continued)*

Alloy	Temper	Dimensions[a]	Tensile strength R_m MPa		0,2 % proof stress $R_{p0,2}$ MPa		Elongation min.	
			min.	max.	min.	max.	A %	A_{50mm} %
2014A	O	10 < *D* or *S* ≤ 200	—	250	—	135	10	12
	T4, T4510 T4511	10 < *D* or *S* ≤ 200	345	—	240	—	10	12
	T6	12,5 < *D* or *S* ≤ 100	440	—	400	—	6	—
	T6510	100 < *D* or *S* ≤ 120	430	—	350	—	6	—
	T6511	120 < *D* or *S* ≤ 200	430	—	350	—	6	—
2017	O[c]	All		245		125	—-	16
	T4	*A* ≤ 70 000	345		215		—	12
	T42[d]	70 000 < *A* ≤ 100 000	345		195		—	12
2017A	O	10 < *D* or *S* ≤ 100	—	250	—	150	10	—
	T4 T4510	10 < *D* or *S* ≤ 80	390	—	265	—	10	—
	T4511	80 < *D* or *S* ≤ 200	360	—	220	—	7	—
2024	O[c]	All	—	245	—	125	10	12
	T3510 T3511	*D* or *S* ≤ 6	390	—	295	—	—	12
		6 < *D* or *S* ≤ 19	410	—	300	—	10	12
		19 < *D* or *S* ≤ 38	450	—	310	—	8	10
		38 < *D* or *S*, *A* ≤ 16 000	480	—	365	—	7	10
		38 < *D* or *S*, 16 000 < *A* ≤ 20 000	470	—	335	—	7	8
	T3 T4	*D* or *S* ≤ 6	390	—	295	—	—	12
		6 < *D* or *S* ≤ 19	410	—	305	—	—	12
		19 < *D* or *S* ≤ 38	450	—	315	—	—	10
		38 < *D* or *S* ≤ 100, *A* ≤ 16 000	480	—	365	—	8	10
		38 < *D* or *S* ≤ 100, 16 000 < *A* ≤ 20 000	470	—	335	—	8	8
		38 < *D* or *S* ≤ 100, 20 000 < *A* ≤ 30 000	460	—	315	—	8	8
		100 < *D* or *S* ≤ 200, *A* ≤ 16 000	480	—	365	—	6	10
		100 < *D* or *S* ≤ 200, 16 000 < *A* ≤ 20 000	470	—	335	—	6	8
		100 < *D* or *S* ≤ 200, 20 000 < *A* ≤ 30 000	460	—	315	—	6	8
	T42[d]	*D* or *S* ≤ 19	390	—	265	—	—	12
		19 < *D* or *S* ≤ 38	390	—	265	—	—	10
		38 < *D* or *S*, *A* ≤ 16 000	390	—	265	—	—	10
		38 < *D* or *S*, 16 000 < *A* ≤ 20 000	390	—	265	—	—	8
	T8510 T8511 T81	10 < *D* or *S* ≤ 150	455	—	400	—	4	—
2030	T4	*D* or *S* ≤ 80	370	—	250	—	8	6
	T4510	80 < *D* or *S* ≤ 200	340	—	220	—	8	—
	T4511	200 < *D* or *S* ≤ 250	330	—	210	—	7	—

Table 1 *(continued)*

Alloy	Temper	Dimensions[a]	Tensile strength R_m MPa		0,2 % proof stress $R_{p0,2}$ MPa		Elongation min.	
			min.	max.	min.	max.	A %	A_{50mm} %
3102	H112	All	80	—	30	—	25	23
3003	H112	All	95	—	35	—	—	—
	O H111	All	95	135	35	—	25	20
3103	H112	All	95	—	35	—	25	20
	O H111	All	95	135	35	—	25	20
5005 5005A	H112	All	100	—	40	—	18	16
	O H111	$D \leq 80, S \leq 60$	100	150	40	—	18	16
5019	H112	D or $S \leq 200$	250	—	110	—	14	12
	O H111	D or $S \leq 200$	250	320	110	—	15	13
5049	H112	All	180	—	80	—	15	13
5051A	H112	All	150	—	50	—	16	14
	O H111	All	150	200	50	—	18	16
5251	H112	All	160	—	60	—	16	14
	O H111	All	160	220	60	—	17	15
5052	H112	All	175	—	70	—	—	—
	O	All	175	245	70	—	—	20
5154A	H112	D or $S \leq 200$	200	—	85	—	16	14
	O H111	D or $S \leq 200$	200	275	85	—	18	16
5454	H112	All	215	—	100	—	—	12
	O H111	D or $S \leq 200$	200	275	85	—	18	16
5754	H112	D or $S \leq 150$	180	—	80	—	14	12
		$150 < D$ or $S \leq 250$	180	—	70	—	13	—
	O H111	D or $S \leq 150$	180	250	80	—	17	15
5056	H112	$A \leq 30\,000$	245	—	100	—	—	—
		$30\,000 < A \leq 70\,000$	225	—	80	—	—	—
		$70\,000 < A \leq 100\,000$	215	—	70	—	—	—
5083	H112	D or $S \leq 130, A \leq 20\,000$	275	—	140	—	12	12
	O	D or $S \leq 130, A \leq 20\,000$	275	355	110	—	—	14
5086	H112	D or $S \leq 250$	240	—	95	—	12	10
	O	D or $S \leq 200$	240	320	95	—	18	15

Table 1 *(continued)*

Alloy	Temper	Dimensions[a]	Tensile strength R_m MPa		0,2 % proof stress $R_{p0,2}$ MPa		Elongation min.	
			min.	max.	min.	max.	A %	A_{50mm} %
6101	T6[f]	$3 \le D$ or $S \le 7$	195	—	165	—	—	10
		$7 < D$ or $S \le 17$	195	—	165	—	—	12
		$17 < D$ or $S \le 30$	175	—	145	—	—	14
	T7	$3 \le D$ or $S \le 17$	135	—	110	—	—	10
6101A	T6[f]	D or $S \le 150$	200	—	170	—	10	8
6101B	T6[f,g]	$S \le 15$	215	—	160	—	8	6
	T7[f,h]	$S \le 15$	170	—	120	—	12	10
6005 6005A	T6[f]	D or $S \le 25$	270	—	225	—	10	8
		$25 < D$ or $S \le 50$	270	—	225	—	8	—
		$50 < D$ or $S \le 100$	260	—	215	—	8	—
6005C	T5	D or $S \le 6$	245	—	205	—	—	8
		$6 < D$ or $S \le 12$	225	—	175	—	—	8
	T6[f]	D or $S \le 6$	265	—	235	—	—	8
6110A	T5[f]	D or $S \le 120$	380	—	360	—	10	8
	T6[f]	$D \le 120$ or $S \le 150$	410	—	380	—	10	8
6012	T6[f] T6510[f] T6511[f]	D or $S \le 150$	310	—	260	—	8	6
		$150 < D$ or $S \le 200$	260	—	200	—	8	—
6018	T6[f] T6510[f] T6511[f]	D or $S \le 150$	310	—	260	—	8	6
		$150 < D$ or $S \le 200$	260	—	200	—	8	—
6023	T6[f] T6510[f] T6511[f]	D or $S \le 150$	320	—	270	—	10	8
6351	O H111	D or $S \le 200$	—	160	—	110	14	12
	T4[f]	D or $S \le 200$	205	—	110	—	14	12
	T6[f]	D or $S \le 20$	295	—	250	—	8	6
		$20 < D$ or $S \le 75$	300	—	255	—	8	—
		$75 < D$ or $S \le 150$	310	—	260	—	8	—
		$150 < D$ or $S \le 200$	280	—	240	—	6	—
		$200 < D$ or $S \le 250$	270	—	200	—	6	—
6060	T4[f]	D or $S \le 150$	120	—	60	—	16	14
	T5	D or $S \le 150$	160	—	120	—	8	6
	T6[f]	D or $S \le 100$	190	—	150	—	10	8
	T64[f]	D or $S \le 50$	180	—	120	—	12	10
	T66[f]	D or $S \le 150$	215	—	160	—	8	6

Table 1 *(continued)*

Alloy	Temper	Dimensions[a]	Tensile strength R_m MPa		0,2 % proof stress $R_{p0,2}$ MPa		Elongation min.	
			min.	max.	min.	max.	A %	A_{50mm} %
6360	T4[f]	D or $S \leq 150$	110	—	50	—	16	14
	T5	D or $S \leq 150$	150	—	110	—	8	6
	T6[f]	D or $S \leq 150$	185	—	140	—	8	6
	T66[f]	D or $S \leq 150$	195	—	150	—	8	6
6061	O[c]	All	—	145	—	110	—	16
	T4[f] T4511	All	180	—	110	—	14	16
	T42[d]	All	175	—	85	—	—	16
	T6[f] T62[e] T6511	D or $S \leq 6$ $6 < D$ or S	260 260	— —	240 240	— —	7 9	8 10
6261	O H111	D or $S \leq 100$	—	170	—	120	14	12
	T4[f]	D or $S \leq 100$	180	—	100	—	14	12
	T6[f]	D or $S \leq 20$ $20 < D$ or $S \leq 100$	290 290	— —	245 245	— —	8 8	7 —
6262	T6[f]	D or $S \leq 200$	260	—	240	—	10	8
6262A	T6[f]	D or $S \leq 220$ or $S \leq 155$	260	—	240	—	10	8
6063	O H111	D or $S \leq 200$	—	130	—	—	18	16
	T1	D or $S \leq 12$ $12 < D$ or $S \leq 25$	120 110	— —	60 55	— —	— —	12 12
	T4[f]	D or $S \leq 150$ $150 < D$ or $S \leq 200$	130 120	— —	65 65	— —	14 12	12 —
	T5	D or $S \leq 12$ $12 < D$ or $S \leq 25$	150 145	— —	110 105	— —	7 7	8 8
	T6[f]	D or $S \leq 3$ $3 < D$ or $S \leq 25$	205 205	— —	170 170	— —	— 9	8 10
	T66[f]	D or $S \leq 200$	245	—	200	—	10	8
6063A	O H111	D or $S \leq 200$	—	150	—	—	16	14
	T4[f]	D or $S \leq 150$ $150 < D$ or $S \leq 200$	150 140	— —	90 90	— —	12 10	10 —
	T5	D or $S \leq 200$	200	—	160	—	7	5
	T6[f]	D or $S \leq 150$ $150 < D$ or $S \leq 200$	230 220	— —	190 160	— —	7 7	5 —
6463	T4[f]	D or $S \leq 150$	125	—	75	—	14	12
	T5	D or $S \leq 150$	150	—	110	—	8	6
	T6[f]	D or $S \leq 150$	195	—	160	—	10	8

Table 1 *(continued)*

Alloy	Temper	Dimensions[a]	Tensile strength R_m MPa		0,2 % proof stress $R_{p0,2}$ MPa		Elongation min.	
			min.	max.	min.	max.	A %	A_{50mm} %
6065	T6[f]	$D \leq 220$ or $S \leq 155$	260	—	240	—	10	8
6081	T6[f]	D or $S \leq 250$	275	—	240	—	8	6
6082	O H111	D or $S \leq 200$	—	160	—	110	14	12
	T4[f]	$10 \leq D$ or $S \leq 80$	205	—	110	—	14	14
	T6[f]	$10 \leq D \leq 60$ or $10 \leq S \leq 50$	310	—	260	—	8	7
		$60 < D \leq 150$ or $50 < S \leq 150$	300	—	240	—	8	—
6182	T4[f]	$D \leq 220$ or $S \leq 155$	205	—	110	—	12	10
	T6[f,i]	$9 < D$ or $S \leq 100$	360	—	330	—	9	7
		$100 < D$ or $S \leq 150$	330	—	300	—	8	6
		$150 < D$ or $S \leq 220$	280	—	240	—	6	4
7003	T5	D or $S \leq 12$	285	—	245	—	—	10
		$12 < D$ or $S \leq 25$	275	—	235	—	—	10
	T6[f]	D or $S \leq 50$	350	—	290	—	10	8
		$50 < D$ or $S \leq 150$	340	—	280	—	10	8
7204	O	All	—	245	—	145	—	12
	T4[j]	All	315	—	195	—	—	11
	T6	All	335	—	275	—	—	10
7005	T6[f]	D or $S \leq 50$	350	—	290	—	10	8
		$50 < D$ or $S \leq 200$	340	—	270	—	10	—
7108	T6[f]	D or $S \leq 100$	310	—	260	—	10	8
7108A	T6[f]	D or $S \leq 200$	310	—	260	—	12	10
	T66[f]	D or $S \leq 50$	350	—	290	—	10	8
		$50 < D$ or $S \leq 200$	340	—	275	—	10	—
7020	T6[f]	D or $S \leq 50$	350	—	290	—	10	8
		$50 < D$ or $S \leq 200$	340	—	275	—	10	—
7021	T6[f]	D or $S \leq 40$	410	—	350	—	10	8
7022	T6[f] T6510[f] T6511[f]	D or $S \leq 80$	490	—	420	—	7	5
		$80 < D$ or $S \leq 200$	470	—	400	—	7	—
7049A	T6 T6510 T6511	D or $S \leq 100$	610	—	530	—	5	4
		$100 < D$ or $S \leq 125$	560	—	500	—	5	—
		$125 < D$ or $S \leq 150$	520	—	430	—	5	—
		$150 < D$ or $S \leq 180$	450	—	400	—	3	—
7050	T73511	D or $S \leq 125$, $A \leq 20\,000$	485	—	415	—	7	8
	T74511	D or $S \leq 76$	505	—	435	—	—	7
	T76510	D or $S \leq 127$	545	—	475	—	—	7

Table 1 *(continued)*

Alloy	Temper	Dimensions[a]	Tensile strength R_m MPa		0,2 % proof stress $R_{p0,2}$ MPa		Elongation min.	
			min.	max.	min.	max.	A %	A_{50mm} %
7075	O[c]	$A \leq 20\,000$	—	275	—	165	9	10
	T6, T62[e] T6510 T6511	D or $S \leq 6$	540	—	480	—	—	7
		$6 \leq D$ or $S \leq 75$	560	—	500	—	6	7
		$75 < D$ or $S \leq 110$, $A \leq 13\,000$	560	—	490	—	5	7
		$75 < D$ or $S \leq 110$, $13\,000 < A \leq 20\,000$	540	—	480	—	5	7
		$110 < D$ or $S \leq 130$, $A \leq 20\,000$	540	—	470	—	5	6
		$130 < D$ or $S \leq 150$	500	—	440	—	5	—
	T73[k]	$10 < D$ or $S \leq 25$	485	—	420	—	7	—
		$25 < D$ or $S \leq 50$	475	—	405	—	7	—
		$50 < D$ or $S \leq 70$	475	—	405	—	7	—
		$70 < D$ or $S \leq 100$	470	—	390	—	6	—
	T73510[k] T73511[k]	D or $S \leq 25$	485	—	420	—	7	5
		$25 < D$ or $S \leq 75$	475	—	405	—	7	—
		$75 < D$ or $S \leq 100$	470	—	390	—	6	—
		$100 < D$ or $S \leq 150$	440	—	360	—	6	—

a D (mm) = diameter for round bar.

S (mm) = width across flats for square and hexagonal bar, thickness for rectangular bar.

A (mm²) = cross-section area.

b Electrical conductivity $\gamma \geq 35{,}4$ MS/m.

c The material of temper grade O shall be a basis for materials of temper grades T42 or T62. When requested by the purchaser, the capability to achieve T42 or T62 properties after appropriate heat treatment is demonstrated.

d The mechanical properties of temper grade T42 shall be applied only when the material of temper grade O has been naturally age-hardened after solution treatment by the purchaser. If the material is cold or hot worked prior to solution treatment by the purchaser, its mechanical properties can be lower than the specified values.

e The mechanical properties of temper grade T62 shall be applied only when the material of temper grade O has been artificially age-hardened after solution treatment by the purchaser. If the material is cold or hot worked prior to solution treatment by the purchaser, its mechanical properties can be lower than the specified values.

f Applicable for those after extrusion followed by controlled cooling at a rate rapid enough to hold constituents in solution.

g Electrical conductivity $\gamma \geq 30$ MS/m.

h Electrical conductivity $\gamma \geq 32$ MS/m.

i Properties obtained by the user, however, can be lower than those listed if the material has been formed or otherwise cold or hot worked, particularly in the annealed temper, prior to normal solution heat treatment.

j The mechanical properties of temper grade T4 are the values specified, based on reference values obtained by 1 month of natural ageing at room temperature (approximately 20 °C) after solution treatment.

In the case of the tensile test made before completion of 1 month of natural ageing, the tensile performance of temper grade T4 can be deemed as guaranteed if the test result of the test piece which has been artificially aged after solution treatment is confirmed to satisfy the tensile performance of temper grade T6.

k For materials of thickness 20 mm or above, see EN 755–1, with respect to stress corrosion cracking resistance.