International Standard 3116

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Wrought magnesium alloys — Chemical composition and mechanical properties

Alliages de magnésium corroyés — Composition chimique et caractéristiques mécaniques

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 3116 was developed by Technical Committee ISO/TC 79, *Light metals and their alloys*, and was circulated to the member bodies in May 1980.

It has been approved by the member bodies of the following countries :

Brazil	Italy	South Africa, Rep. of
Canada	Japan	Spain
China	Korea, Dem. P. Rep. of	Sweden
Egypt, Arab Rep. of	Korea, Rep. of	United Kingdom
France	Netherlands	USSR
Germany, F.R.	Norway	
Ireland	Romania	

The member body of the following country expressed disapproval of the document on technical grounds :

USA

This second edition cancels and replaces the first edition (i.e. ISO 3116-1974).

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Wrought magnesium alloys — Chemical composition and mechanical properties

1 Scope and field of application

This International Standard specifies

a) the chemical composition and the minimum mechanical properties of semi-finished products in magnesium-zinc-zirconium alloys;

b) the chemical composition and the minimum mechanical properties of semi-finished products in magnesium-aluminium-zinc alloys.

2 References

ISO/R 190, *Tensile testing of light metals and their alloys.* [1)]

ISO/R 952, *Tensile testing of light metal and light metal alloy tubes.* [1)]

ISO 2092, *Light metals and their alloys — Code of designation based on chemical symbols.*

ISO/R 2107, *Light metals and their alloys — Temper designations.*

3 Requirements

3.1 Chemical composition

3.1.1 The chemical composition of semi-finished products in magnesium-zinc-zirconium alloys shall be as given in table 1.

3.1.2 The chemical composition of semi-finished products in magnesium-aluminium-zinc alloys shall be as given in table 2.

Table 1

Alloy*	Chemical composition, %				
	Alloying elements		Impurities max.		Total other impurities max.
	Zn	Zr	Cu	Ni	
Mg-Zn6Zr	4,8 to 6,2	0,45 to 0,8	0,03	0,005	0,30
Mg-Zn3Zr	2,5 to 4,0	0,4 to 0,8	0,03	0,005	0,30
Mg-Zn1Zr	0,75 to 1,5	0,4 to 0,8	0,03	0,005	0,30

* For designations, see ISO 2092.

Table 2

Alloy*	Chemical composition, %								
	Alloying elements			Impurities max.					Total other impurities max.
	Al	Zn	Mn	Si	Cu	Fe	Ni	Ca	
Mg-Al3Zn1Mn	2,5 to 3,5	0,5 to 1,5	⩾0,2	0,1	0,1	0,03	0,005	0,04	0,30
Mg-Al6Zn1Mn	5,5 to 7,2	0,5 to 1,5	0,15 to 0,4	0,1	0,1	0,03	0,005		0,30
Mg-Al8ZnMn	7,5 to 9,2	0,2 to 1,0	0,1 to 0,4	0,1	0,05	0,005	0,005		0,30

* For designations, see ISO 2092.

1) The revisions of ISO/R 190 and ISO/R 952 will be incorporated in ISO 6892.

3.2 Mechanical properties

Before comparison with the limiting values given in tables 3 and 4, the measured or calculated values of 0,2 % yield strength, or of tensile strength, shall be rounded to the nearest 1 N/mm^2, and those of the percentage elongation rounded to the nearest 1 %.

Test pieces shall be taken in the longitudinal direction; for rolled flat products of thickness greater than 6,0 mm, test pieces may be taken in the long tranverse direction.

3.2.1 The minimum values of the mechanical properties of semi-finished products in magnesium-zinc-zirconium alloys in the temper conditions as defined in ISO/R 2107, shall be as given in table 3.

3.2.2 The minimum values of the mechanical properties of semi-finished products in magnesium-aluminium-zinc alloys in the temper conditions as defined in ISO/R 2107, shall be as given in table 4.

4 Methods of test

4.1 Chemical composition

The determination of the alloying elements given in tables 1 and 2 should be performed in accordance with methods forming the subject of International Standards.

Other methods may be used, but in case of dispute the International Standard methods shall be adopted.

4.2 Tensile test

The tensile test shall be carried out by methods in conformity with ISO/R 190 and ISO/R 952.

Table 3

Type of product	Alloy	Temper	Thickness or diameter (D) mm	Tensile strength R_m N/mm^2*	0,2 % yield strength $R_{p0,2}$ N/mm^2*	Elongation A $5,65\sqrt{S_0}$ %
Bars and solid sections	Mg-Zn6Zr	M	$D \leqslant 50$	300	210	5
		TE	$D \leqslant 50$	310	230	5
	Mg-Zn3Zr	M	$D \leqslant 10$	270	190	8
			$10 < D \leqslant 100$	300	225	8
	Mg-Zn1Zr	M	$D \leqslant 10$	250	170	8
			$10 < D \leqslant 100$	260	185	8
Tubes and hollow sections	Mg-Zn1Zr	M	All section sizes	250	170	5
Forgings	Mg-Zn6Zr	TE	All section sizes	280	180	7
	Mg-Zn3Zr	M		270	180	6
Rolled flat products	Mg-Zn3Zr	M	$D \leqslant 0,5$	250	—	—
			$0,5 < D \leqslant 1,6$	250	160	6
			$1,6 < D \leqslant 6$	265	180	7
			$6 < D \leqslant 50$	250	150	8
	Mg-Zn1Zr	M	$D \leqslant 0,5$	240	—	—
			$0,5 < D \leqslant 1,6$	240	160	5
			$1,6 < D \leqslant 6$	250	170	6
			$6 < D \leqslant 25$	230	130	8
			$25 < D \leqslant 50$	220	120	8

* 1 N/mm^2 = 1 MPa

Table 4

Type of product	Alloy	Temper	Thickness or diameter (D) mm	Tensile strength R_m N/mm²*	0,2 % yield strength $R_{p0,2}$ N/mm²*	Elongation A $5{,}65\sqrt{S_0}$ %
Bars and solid sections**	Mg-Al3Zn1Mn	M	$10 \leqslant D \leqslant 40$	240	150	6
		M	$40 < D \leqslant 65$	230	140	6
	Mg-Al6Zn1Mn	M	$10 \leqslant D \leqslant 40$	270	180	6
			$40 < D \leqslant 65$	260	160	6
	Mg-Al8ZnMn	M	$10 \leqslant D \leqslant 40$	290	190	5
			$40 < D \leqslant 100$	280	190	5
Tubes and hollow sections**	Mg-Al3Zn1Mn	M	$1 \leqslant D \leqslant 10$	230	150	6
	Mg-Al6Zn1Mn	M	$1 \leqslant D < 10$	260	150	6
Rolled flat products†	Mg-Al3Zn1Mn	O	$0{,}5 \leqslant D \leqslant 6$	220	105	11
			$6 < D \leqslant 25$	210	105	9
		HB	$0{,}5 \leqslant D \leqslant 6$	250	160	5
			$6 < D \leqslant 25$	220	120	8
		HD	$0{,}5 \leqslant D \leqslant 6$	260	200	4
			$6 < D \leqslant 25$	250	160	6
Separately forged test pieces§	Mg-Al3Zn1Mn	M	$10 \leqslant D \leqslant 40$	240	130	6
	Mg-Al6Zn1Mn	M	$10 \leqslant D \leqslant 40$	270	150	5
	Mg-Al8Zn1Mn	M	$10 \leqslant D \leqslant 40$	290	190	5
		TE	$10 \leqslant D \leqslant 40$	290	200	4

* 1 N/mm² = 1 MPa

** Test pieces parallel to the direction of extrusion.

† Test pieces taken transversally to the direction of rolling.

§ Separately forged test pieces or test pieces taken parallel to the direction of flow.

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