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**Wrought magnesium and magnesium  
alloys — Extruded rods/bars and tubes**

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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](http://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](http://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 of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 79, *Light metals and their alloys*, Subcommittee SC 5, *Magnesium and alloys of cast or wrought magnesium*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

This document classifies the commercially available magnesium and magnesium alloy extruded rods/bars and tubes into a number of grades suitable for the application to which they might be put.

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# Wrought magnesium and magnesium alloys — Extruded rods/bars and tubes

## 1 Scope

This document specifies the technical conditions for inspection and delivery of wrought magnesium and magnesium alloy rods/bars and tubes for general engineering applications.

It is applicable to wrought magnesium and magnesium alloy extruded round, square and hexagonal rods/bars and seamless round tubes (hereafter referred to as “tubes”).

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3116:2019, *Magnesium and magnesium alloys — Wrought magnesium and magnesium alloys*

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

## 3 Terms and definitions (standards.iteh.ai)

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

### 3.1

#### rod/bar

solid wrought product of uniform cross-section along its whole length, supplied in straight lengths

Note 1 to entry: The cross-sections are in the shape of circles, squares, rectangles or regular hexagons. Products with a square, rectangular or hexagonal cross-section can have corners rounded along their whole length.

Note 2 to entry: A rod is normally less than 6 mm in diameter or minor dimension. In North America, the minimum diameter of a rod is 9,525 mm (0,375 in). Below this limit, the product is called “wire”.

Note 3 to entry: For rectangular bars, the thickness exceeds one-tenth of the width. The term “rectangular bar” includes “flattened circles” and “modified rectangles”, of which two opposite sides are convex arcs, the other two sides being straight, of equal length and parallel.

### 3.2

#### tube

hollow wrought product of uniform cross-section with only one enclosed void along its whole length, and with a uniform wall thickness, supplied in straight lengths or in coiled form, provided the inner and outer cross-sections are concentric and have the same form and orientation

Note 1 to entry: The cross-sections are in the shape of circles, squares, rectangles or regular hexagons. Hollow products with square, rectangular or regular hexagonal cross-sections can have corners rounded along their whole length.

## 3.3

### sample

quantity of molten metal, product or products which is used for the production of *specimens* (3.4)

## 3.4

### specimen

one or more pieces taken from each product in the *sample* (3.3) for the purpose of producing *test pieces* (3.5)

## 3.5

### test piece

piece taken from each *specimen* (3.4) and suitably prepared for a *test* (3.6)

## 3.6

### test

operation to which the *test piece* (3.5) is subjected in order to measure or classify properties

## 4 Orders or tenders

The order or tender shall define the product required and shall contain the following details:

- a) the type and form of the product:
  - 1) the designation of the magnesium or magnesium alloy;
  - 2) the form of the product (sheet, plate, etc.);
- b) the metallurgical temper (degree of hardness or heat treatment condition) of the material for delivery and, if different, the metallurgical temper for use;
- c) the number of this document, i.e. ISO 23694, the specification number or, where none exists, the properties agreed between the supplier and the purchaser;
- d) the dimensions and shape of the product (thickness, width, length, diameter of the coil);
- e) the tolerances of the dimensions and form, with reference to the appropriate clause or subclause of this document;
- f) the quantity;
- g) any requirements for certificates of conformity, test and/or analysis;
- h) any special requirements agreed between the supplier and the purchaser (e.g. drawings).

## 5 Requirements

### 5.1 Designation

The alloy designation and temper shall be in accordance with [Table 1](#). If the alloy to be used is not specified in [Table 1](#), the alloy designation and temper shall be in accordance with ISO 3116:2019 or be agreed upon between the supplier and purchaser and stated in the order.



Table 1 — Alloy designation and temper

Alloy symbol	Alloy designation	Temper	Product type	Diameter or thickness mm
ISO-MgAl4Zn	MAZ40	H112, F	rods/bars	$D \leq 130$
ISO-MgMn2(A)	MM2a	H112, F	rods/bars	$D \leq 130$
ISO-MgZn6Zr(A)	MZK60a	T5	rods/bars	$D \leq 130$
ISO-MgGd7Y5RE1	MVWE751	T5	bars	$D \leq 160$
ISO-MgGd9Y2Nd1Zr	MVW92	H112, T5, T6	bars	$D \leq 50$
ISO-MgGd8Y2ZrAgEr	MVW93M	T5	bars	$D \leq 160$
ISO-MgGd9Y4Zn1Zr	MVW94M	H112	bars	$D \leq 160$
		T5	bars	$D \leq 80$

## 5.2 Production and manufacturing processes

Unless otherwise specified in the order, the production and manufacturing processes shall be left to the discretion of the producer. Unless it is explicitly stated otherwise in the order, no obligation shall be placed on the producer to use the same processes for subsequent and similar orders.

## 5.3 Quality control

The supplier shall be responsible for the performances of all inspection and tests required by the relevant International Standard, specification or customer requests, prior to shipment of the product.

If the purchaser wishes to inspect the product at the supplier's works, he or she shall notify the supplier at the time of placing the order.

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## 5.4 Chemical composition

The chemical composition of ISO-MgAl4Zn, ISO-MgMn2(A), ISO-MgZn6Zr(A), ISO-MgGd9Y2Nd1Zr, ISO-MgGd8Y2ZrAgEr and ISO-MgGd9Y4Zn1Zr shall conform to the requirements specified in [Table 2](#). The chemical composition of other alloys shall conform to the requirements specified in ISO 3116:2019. If the purchaser requires content limits for elements not specified in ISO 3116:2019, these limits shall be stated in the order document.

Table 2 — Chemical composition of ISO-MgAl4Zn, ISO-MgMn2(A), ISO-MgZn6Zr(A), ISO-MgGd9Y2Nd1Zr, ISO-MgGd8Y2ZrAgEr and ISO-MgGd9Y4Zn1Zr

Alloy group	Material designation		Composition % (mass fraction)																				
	Symbol	Designation	Element	Mg	Al	Zn	Mn	Gd	Ce	Nd	Er	Li	Zr	Y	Be	Ag	Si	Fe	Cu	Ni	Others each	Others total	
MgMn	ISO-MgMn2(A)	MM2a	min.	Rem.	—	—	1,3	—	0,15	—	—	—	—	—	—	—	—	—	—	—	—	—	—
			max.	—	0,20	0,30	2,2	—	0,35	—	—	—	—	—	—	0,01	—	0,10	0,05	0,05	0,007	0,01	0,30
MgAl	ISO-MgAl4Zn	MAZ40	min.	Rem.	3,0	0,20	0,15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
			max.	—	4,0	0,80	0,50	—	—	—	—	—	—	—	—	0,01	—	0,10	0,05	0,05	0,005	0,01	0,30
MgZn	ISO-MgZn6Zr(A)	MZK60a	min.	Rem.	—	5,0	—	—	—	—	—	—	0,30	—	—	—	—	—	—	—	—	—	—
			max.	—	0,05	6,0	0,10	—	—	—	—	—	0,90	—	—	0,01	—	0,05	0,05	0,05	0,005	0,01	0,30
MgGdY	ISO-MgGd9Y-2Nd1Zr	MVW92	min.	Rem.	—	1,6	—	8,8	—	0,7	—	—	0,4	1,6	—	—	—	—	—	—	—	—	—
			max.	—	—	2,4	—	—	9,8	—	1,4	—	—	1,0	2,4	—	—	—	0,01	0,02	0,005	0,02	0,20
MgGdY	ISO-MgGd8Y2ZrAgEr	MVW93M	min.	Rem.	—	—	8,0	—	—	—	—	—	0,3	1,8	—	0,02	—	—	—	—	—	—	—
			max.	—	—	—	—	—	9,6	—	—	—	—	0,7	3,2	—	0,50	0,02	0,02	0,005	0,003	0,01	0,1
MgGdY	ISO-MgGd9Y4Zn1Zr	MVW94M	min.	Rem.	—	0,8	—	8,5	—	—	—	—	0,4	3,5	—	—	—	—	—	—	—	—	—
			max.	—	—	1,5	—	—	9,5	—	—	—	—	0,7	4,5	—	—	—	0,005	0,005	0,005	0,02	0,3

**Key**

Rem.: subtract the percentage of all elements except Mg from 100 %.

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## 5.5 Dimensional tolerances

### 5.5.1 The dimensions and tolerances for extruded round, square and hexagonal bars

#### 5.5.1.1 Tolerances on diameter and width across flats

Tolerances on diameter and width across flats shall be in accordance with [Table 3](#).

**Table 3 — Dimensional tolerances**

Dimensions in millimetres

Diameter of circumscribing circle	Tolerances
> 6 to 10	±0,35
> 10 to 18	±0,55
> 18 to 30	±0,65
> 30 to 50	±0,80
> 50 to 80	±0,95
> 80 to 120	±1,10
> 120 to 180	±1,25
> 180 to 250	±1,45
> 250 to 300	±2,65

#### 5.5.1.2 Circularity of round bars

Circularity is measured by the difference between the maximum and minimum diameters measured in the same cross-section.

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The permissible circularity is included in the tolerances on diameter specified in [Table 3](#).

#### 5.5.1.3 Corner radii of square and hexagonal bars

The maximum corner radii of square and hexagonal bars shall be in accordance with [Table 4](#).

**Table 4 — Maximum corner radii**

Dimensions in millimetres

Diameter of circumscribing circle	Maximum value of corner radii
< 25	2,0
≥ 25 to 50	3,0
> 50	5,0

#### 5.5.1.4 Fixed-length tolerances

If fixed lengths are supplied, they shall be agreed between the supplier and purchaser. The permissible tolerance on fixed lengths is  $^{+20}_0$  millimetres.

#### 5.5.1.5 Squareness of cut ends

The squareness of cut ends shall be within 3° for both fixed and random lengths. The squareness of cut ends  $\beta$  shall be measured as shown in [Figure 1](#).