

## Information about the content

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*This specification describes highly deformed TZM rods. Compared to Molybdenum does TZM show higher recrystallization temperature and higher hot tensile strength. Therefore, it is mainly used for applications at elevated temperature.*

## 1 Dimensions and tolerances

### 1.1 Diameter and guaranteed product tolerances

Diameter [mm]	Diameter tolerance [mm]	Cylindrical tolerance [mm]
<b>ground</b>		
0,50 - 0,99	± 0,007	
1,00 - 1,99	± 0,010	
2,00 - 2,99	± 0,015	
3,00 - 15,9	± 0,020	Value within defined Ø-tolerance
16,0 - 24,9	± 0,030	
25,0 - 34,9	± 0,050	
35,0 - 39,9	± 0,060	
≥ 40,0	± 0,20	
<b>cleaned</b>		
0,50 - 4,00	± 2,0 %	
4,10 – 9,40	± 1,50 %	
9,41 - 50,0	± 0,30	Value within defined Ø-tolerance
51,0 - 75,0	± 0,40	
75,1 - 120,0	± 1,00	
121,0 - 165,0	± 1,50	
<b>turned</b>		
40,0 - 49,9	± 0,30	Value within defined Ø-tolerance
50,0 - 165,0	± 0,40	

Tolerances differ from those of the ASTM-specification because of the metric table.



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## 1.2 Product length and straightness

Diameter [mm]	Production length [mm]	Straightness / Meter [mm]	
		Cleaned	Ground / turned
0,50 - 0,99	> 500	< 2,5	< 2,5
1,00 - 9,90	> 300	< 2,0	< 1,5
10,0 - 165,0	> 100	< 1,5	< 1,0

## 1.3 Guaranteed length tolerances

Diameter 0,50 - 30,0 mm						
Nominal length [mm]	≥ 6 - 30	> 30 - 120	> 120 - 400	> 400 - 1000	> 1000 - 2000	> 2000
Length tolerance [mm]	± 0,2	± 0,3	± 0,5	± 0,8	± 1,2	± 2,0
Diameter > 30,0 mm						
Nominal length [mm]	≥ 6 - 30	> 30 - 120	> 120 - 400	> 400 - 1000	> 1000 - 2000	> 2000
Length tolerance [mm]	± 1,0	± 1,5	± 2,5	± 4,0	± 6,0	± 8,0

## 2 Physical and mechanical product properties

<b>Density:</b>	Ø 0,50 - 40,0 mm	≥ 10,15 g/cm <sup>3</sup>
	Ø 40,1 - 80,0 mm	≥ 10,10 g/cm <sup>3</sup>
	Ø 80,1 - 120,0 mm	≥ 10,00 g/cm <sup>3</sup>
	Ø 120,1 - 165,0 mm	≥ 9,90 g/cm <sup>3</sup>

<b>Nondestructive Testing:</b>	For diameters > 15,00 mm: 100 % ultrasonic testing (all types)
	For diameters of 0,50 – 50,0 mm: Eddy current tests on rods with ground surface



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Diameter [mm]	Tensile strength [MPa]	0,2 % Yield strength [MPa]	Elongation [%]	Hardness <sup>a)</sup> [HV 10]
0,50 - 4,76	-	-	-	-
> 4,76 - 22,2	≥ 790	≥ 690	≥ 18	260 - 320
> 22,2 - 28,6	≥ 760	≥ 655	≥ 15	250 - 310
> 28,6 - 47,6	≥ 690	≥ 585	≥ 10	245 - 300
> 47,6 - 73,0	≥ 620	≥ 550	≥ 10	240 - 290
> 73,0 - 90,0	≥ 585	≥ 515	≥ 5	235 - 285
> 90,0 - 120,9 <sup>b)</sup>	≥ 585	≥ 515	≥ 1,5	235 - 285
121,0 - 165,0 <sup>b)</sup>	≥ 585	≥ 515	≥ 1,5	220 - 280

a) The actual value quoted in certificates corresponds to the mean-value of a representative control sample.

b) In ASTM B387 mechanical requirements of rods with a with  $\varnothing > 88,9$  mm are not specified.

The mechanical properties are measured on test samples in stress relieved condition.

## 2.1 Surface condition

Surface:	Cleaned	Ground	Turned
	$\varnothing$ 0,50 - 165 mm	$\varnothing$ 0,50 - 50,00 mm	$\varnothing \geq 40,00$ mm
Roughness:	Diameter [mm]	R <sub>a</sub> [μm] Ground	R <sub>a</sub> [μm] Turned
	≤ 2,50	≤ 0,80	-
	> 2,50 - 50,0	≤ 1,00	-
	≥ 40,0	-	≤ 3,2



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### 3 Chemical composition

Main and minor components	Plansee		Standard	EU-Directive
	Min. content		ASTM B387 (364)	RoHS <sup>a)</sup>
<b>Mo</b>	<b>Balance</b> <sup>b)</sup>		balance	-
<b>Ti</b>	<b>0,40 – 0,55 %</b>		0,40 – 0,55 %	-
<b>Zr</b>	<b>0,06 – 0,12 %</b>		0,06 – 0,12 %	-
Impurities	Max. values [µg/g]		Max. values [µg/g]	Max. values [µg/g]
	Typical	Guaranteed		
Al	1	<b>10</b>	-	-
Cr	3	<b>20</b>	-	-
Cu	2	<b>20</b>	-	-
Fe	5	<b>20</b>	100	-
K	6	<b>20</b>	-	-
Ni	1	<b>10</b>	50	-
Si	2	<b>20</b>	100	-
W	169	<b>300</b>	-	-
C	-	<b>100 - 400</b>	100 - 400	-
H	-	<b>10</b>	-	-
N	5	<b>10</b>	20	-
O	130	<b>500</b>	500	-
Cd	1	<b>5</b>	-	100
Hg <sup>b)</sup>	-	<b>1</b>	-	1000
Pb	-	<b>5</b>	-	1000
Cr (VI)	-	-	-	1000
Organic impurities (e.g. PBB, PBDE, PFOS, PFOA)	- <sup>**)</sup>	- <sup>**)</sup>	-	1000

a) EU-directives 2015/863/EU, 2011/65/EU and 2000/53/EC

b) Metallic purity without W

c) Initial value

<sup>\*\*)</sup> The presence of Cr (VI) and organic impurities can definitely be excluded because of the production process (multiple heat treatments at temperatures above 1000 °C in H<sub>2</sub>-atmosphere).

The chemical composition is checked by means of random sampling. The sampling inspection plan, analysis and evaluation methods are determined in the internal instruction PSE-020-WI-003. The application of the measured values for the chemical analysis is defined in PSE-680-WI-001.

**Remarks:** The specified physical and chemical characteristics are disclosed not regarding measurement accuracy.



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## 4 Packaging, labelling, storage and certification

### 4.1 Packaging, labelling and storage

**Standard individual packing:** rods are either bundled or packed individually.

*Each package will be provided with a label with the following information:*

<b>Producer's name:</b>	Plansee
<b>Plansee order number:</b>	
<b>Lot number:</b>	
<b>Material number:</b>	
<b>Material:</b>	TZM
<b>Dimension:</b>	Rod diameter and length
<b>Surface:</b>	
<b>Quantity:</b>	Total quantity in m or kg
<b>Date:</b>	

The material must be kept in a dry place and protected from mechanical damage. It is best to keep the material in the original packing until used.

**Special packing:** (extra costs will be invoiced)

Special packing should be used if the material is stored under unusual conditions or aggressive atmosphere (e.g. sea air, ...).

### 4.2 Inspection documents

Following inspection documents will be supplied upon customer request according to EN 10 204:

#### **Test report 2.2**

Plansee confirms with this test report that the delivered product meets the specification and gives details of the material properties according to ongoing production surveillance, not directly related to the particular production batch.

**Inspection certificate 3.1** (extra costs will be invoiced)

An inspection officer from Plansee confirms with this inspection certificate that the delivered product meets the specification and gives test results related to the particular production batch.



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## PRODUCT SPECIFICATION

## 5 Order instructions

Please quote following information when ordering:

- Product description
- Quality (the number of this specification must be mentioned)
- Surface condition
- Dimension
- Quantity in m or kg
- Required certificate and content in case of a 3.1 inspection certificate
- *For special packing:* Specification of packaging

For further information on our delivery possibilities, please look into our <http://www.plansee.com>

The rods are delivered in stress relieved condition unless otherwise stated on the purchase order.

## 6 Referenced standards

The standards applied for the test methods are listed in the Plansee standard InfoBase and are made available upon request.

This Product Specification is compliant with ASTM B387 with the exception of the following characteristics:

- Out-of-round tolerances in case of the quality „cleaned “.
- Diameter tolerances in case of the quality “cleaned” for diameters 1,1 – 1,59 mm; 2,53 – 7,14 mm; 15,0 – 22,2 mm and 75,1 – 82,6 mm
- Length tolerances in case of  $L > 2000$  mm and  $\varnothing > 30$  mm

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### Changes to last version:

PSE-610-PS-101 Rev. 02

06.04.2021 SQS/BaumannJ – Formale change:

- Percentage symbol removed from the minimum content in the "Chemical composition" table



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