

## MOLYBDENUM ALLOY APT-3 TZM Arc-Cast Plate 3403

**Description of Product** This specification covers rolled plate of carbon-deoxidized TZM alloy (molybdenum + 0.5 % titanium + 0.08 % zirconium) produced from sheet bar consolidated by the H.C. Starck consumable electrode vacuum-arc-casting process.

**Chemical Characteristics<sup>1)</sup>**  
 (Mass fraction in % [cg/g]; ppm [ $\mu$ g/g])

The chemical composition of the sheet bar used to produce rolled plate shall conform to the following limits:

Mo(By Difference)	min.	99.25	%
Ni	max.	0.002	%
N	max.	0.002	%
O	max.	0.0030	%
Si	max.	0.010	%
Fe	max.	0.010	%
C	0.01	-	0.03 %
Zr	0.06	-	0.12 %
Ti	0.40	-	0.55 %

**Structure** Plate will be supplied in a stress-relieved condition unless otherwise requested.

**Mechanical Properties** Tensile tests will be conducted at room temperature (65°F – 85°F) using in a strain rate of 0.002 to 0.005 in/in/min. through 0.6 % offset and 0.02 to 0.05 in/in/min. to fracture. Tensile properties will be determined on specimens taken transverse to the final rolling direction. Test specimens will be prepared and tested according to ASTM Specification No. E-8, utilizing a gage length of 1 inch.



APT-4 TZM

1) Information on testing methods on request.

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**Physical Characteristics**

Tensile properties shall meet the following minimum values:

Thickness (Inches)	Tensile Strength (psi Minimum)	Yield Strength (0.2 % Offset) (psi Minimum)	Elongation (% Minimum)
.1875 to .500	120.000	100.000	10
Over .500 to 1.000	110.000	95.000	10
Over 1.000 to 1.500	100.000	85.000	8

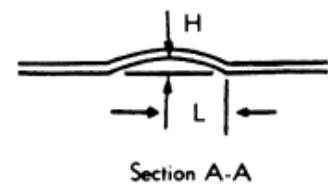
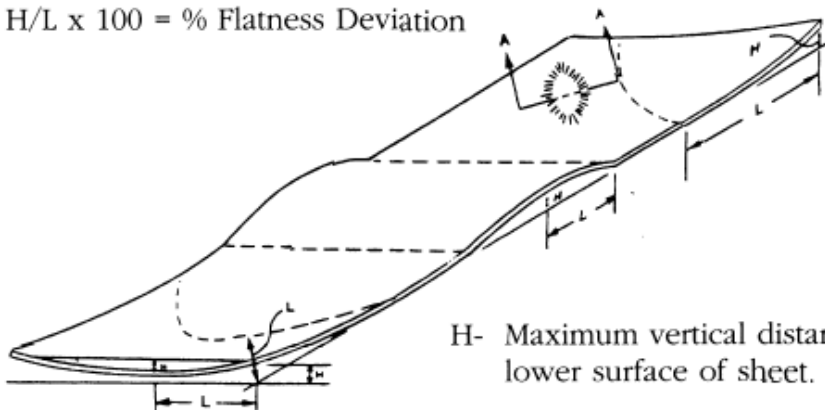
**Thickness Tolerance:**

Thickness (Inches)	Thickness Tolerance (% of Thickness)	Width Tolerance (Inches)	Length Tolerance (Inches)	Flatness Deviation (% Maximum)
.1875 to .500	± 4	+ .125 -0	+ .125 -0	3
Over .500 to 1.000	± 5	+ .125 -0	+ .125 -0	5
Over 1.000 to 1.500	± 5	+ .1875 -0	+ .1875 -0	6

Plates will be sheared, abrasive cut, band saw cut, or water jet cut to the tolerances shown.

**Flatness Tolerance** The deviation from flatness is determined by the following formula:

$H/L \times 100 = \% \text{ Flatness Deviation}$



H- Maximum vertical distance between flat surface and lower surface of sheet.

L- Minimum horizontal distance between highest point on sheet and point contact with flat surface.

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<b>Surface Condition</b>	The plate will be supplied with a matte finish. It will be of uniform quality, clean and free from foreign matter. Major surface defects will be removed by grinding, provided that such conditioning does not reduce dimensions below specified limits.
<b>Hazards identification in Advertising (Directive 67/548/EEC Article 26, Directive 1999/45/EC Article 13 and REGULATION (EC) No 1272/2008 Article 48)</b>	none.
<b>Identification</b>	The material will be identified with appropriate specification number, ingot or lot number, and nominal size. Shipping containers will be marked with the name of the customer and the purchase order number.
<b>Rejection</b>	H.C. Starck must receive written notification of rejected material with the reason for rejection. The right is reserved to inspect rejected material at customer plant for claim validation. The material may be returned only after proper authorization.

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H.C. Starck   
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