MOLYBDENUM ALLOY TZM ABT
Arc-Cast Bar

Description of Product

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

Chemical Characteristics[1)]
(Mass fraction in % [cg/g]; ppm [µg/g])

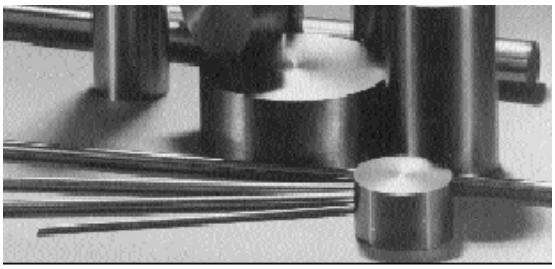
The chemical composition of the billet used for producing the wrought bar shall conform to the following limits:

Mo(By Difference)	min.		99.25	%
*N	max.		0.002	%
*O	max.		0.003	%
Ni	max.		0.002	%
Fe	max.		0.010	%
Si	max.		0.010	%
C	0.01	-	0.030	%
Zr	0.06	-	0.120	%
Ti	0.40	-	0.550	%

*Unless method of analysis is agreed upon, deviations from these limits alone shall not be cause for rejection.

Structure

Bar will be supplied in a stress-relieved condition. Material can be supplied in the recrystallized condition upon request.



Arc-Cast Products

1) Information on testing methods on request.

Mechanical Properties The hardness of stress-relieved material will be determined to conform to the following (measured at mid-radius location):

Diameter Inches	Diameter mm	Hardness, DPH (10 kg) Minimum	Hardness, DPH (10 kg) Maximum
1/8 to 7/8	3.2 - 22.2	260	320
Over 7/8 to 1 1/8	22.2 - 28.6	250	310
Over 11/8 to 1 7/8	28.6 - 47.6	245	300
Over 17/8 to 2 7/8	47.6 - 73.0	240	290
Over 27/8 to 3 1/2	73.0 - 88.9	235	285

All sizes of recrystallized bar shall exhibit mid-radius hardness of 215 DPH maximum.
Tensile tests are conducted at room temperature (65°F to 85°F) with test specimens made and tested to Specification ASTM E-8) using 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 in the longitudinal direction, using such specimens taken from the center of round bars up to 1 ¼“ diameter and from mid-radius location for larger bars, shall meet the following minimum values:

Diameter Inches	Diameter mm	Tensile Strength Minimum KSI	Tensile Strength Minimum Mpa	Yield Strength (0.2 % Offset) Minimum KSI	Yield Strength (0.2 % Offset) Minimum Mpa	Elongation % Minimum
1/8 to 7/8	3.2 - 22.2	115	795	100	690	18
Over 7/8 to 11/8	22.2 - 28.6	110	760	95	655	15
Over 11/8 to 17/8	28.6 - 47.6	100	690	85	585	10
Over 17/8 to 27/8	47.6 - 73.0	90	620	80	550	10
Over 27/8 to 31/2	73.0 - 88.9	85	585	75	515	5

Dimensional Tolerances

Diameter Inches	Diameter mm	Diameter Variation Inches		Diameter Variation mm		Out-of-Round Inches	Out-of-Round mm
1/8 to 9/32	3.2 - 7.1	+0.002	-0.002	+0.05	-0.05	0.004	0.10
Over 9/32 to 13/32	7.1 - 10.3	+0.003	-0.003	+0.07	-0.07	0.006	0.15
Over 13/32 to 5/8	10.3 - 15.9	+0.010	-0.005	+0.25	-0.13	0.012	0.30
Over 5/8 to 7/8	15.9 - 22.2	+0.015	-0.005	+0.38	-0.13	0.015	0.38
Over 7/8 to 1	22.2 - 25.4	+0.020	-0.005	+0.51	-0.13	0.015	0.38
Over 1 to 1 3/8	25.4 - 34.9	+0.020	-0.010	+0.51	-0.25	0.018	0.46
Over 13/8 to 11/2	34.9 - 38.1	+0.020	-0.015	+0.51	-0.38	0.020	0.51
Over 11/2 to 15/8	38.1 - 41.3	+0.025	-0.015	+0.64	-0.38	0.020	0.51
Over 15/8 to 2 41.3	- 50.8 +0.030	-0.020	+0.76	-0.51	0.025	0.64	
Over 2 to 2 1/2	50.8 - 63.5	+0.032	-0.032	+0.81	-0.81	0.025	0.64
Over 21/2 to 31/2	63.5 - 88.9	+0.032	-0.032	+0.81	-0.81	0.027	0.69

Special finished bars can be supplied with a tolerance of ± 0.002 inch for 2 inches diameter or smaller sizes, and ± 0.003 inch for larger size bars.

Maximum variation from straightness will be 0.050 inch per foot.

Maximum variation in cut length will be + ¼ inch, -0.

Surface Condition and

Bars will be supplied with chemically or mechanically cleaned surfaces.

Internal condition

Minor surface imperfections, revealed by dye penetrant inspection, may be removed by conditioning, provided such removal does not reduce dimensions below specified tolerance limits. Special finished bars will be supplied with a surface finish of 90 RMS or better.

The internal integrity of bar >2.0" diameter will be determined by ultrasonic inspection and shall satisfy H.C. Starck Ultrasonic Specification No. H.C. Starck QC-32 (latest version).

Hazards identification in Advertising (Directive 67/548/EEC Article 26, Directive 1999/45/EC Article 13 and REGULATION (EC) No 1272/2008 Article 48)

none.

Identification

Bar will be identified with an appropriate lot number. Each shipping container will be marked with the name of the customer and the purchase order number.

Reports

A product certification report that details pertinent chemical, mechanical, structural and physical integrity features will be provided.

Rejection

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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