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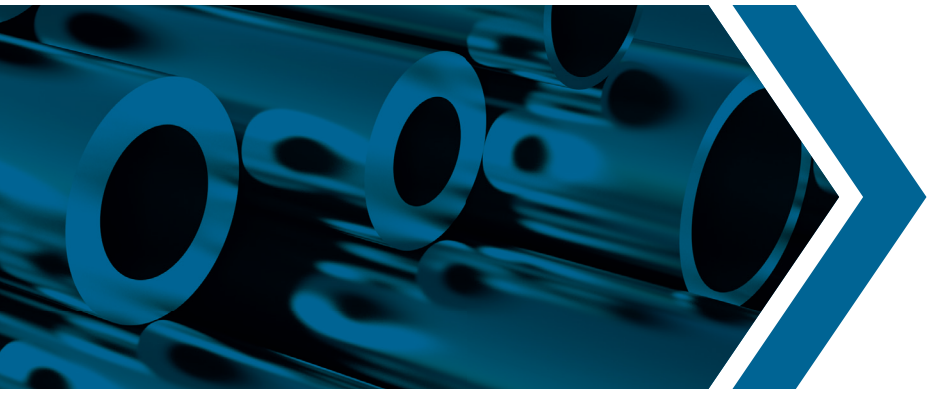


ELMET TECHNOLOGIES

MOLYBDENUM POWDER METALLURGY PRODUCTS

MOLYBDENUM ALLOY PBT
Powder Metallurgy Bar

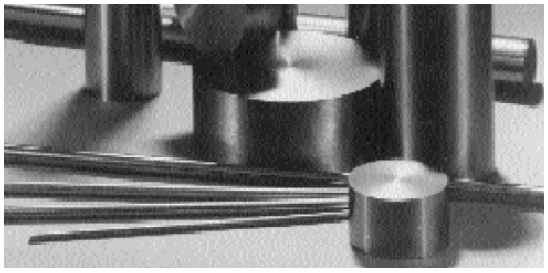
This specification covers molybdenum alloy (Molybdenum + 0.5 % titanium + 0.1 % zirconium) wrought bar produced from pressed and sintered powder metallurgy billet.

CHEMICAL CHARACTERISTICS[1]

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

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

Mo *(By Difference)*	**min.**	**99.2 %**
C	.010 –	0.040 %
*N (Sintered Material)	max.	0.002 %
*O (Sintered Material)	max.	0.040 %
Fe	max.	0.010 %
Ni	max.	0.005 %
Si	max.	0.005 %
Ti	.40 –	0.55 %
Zr	.06 –	0.12 %



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

STRUCTURE

Bars can be supplied in the recrystallized condition upon request.

[1] Information on testing methods on request.

MECHANICAL PROPERTIES

The hardness shall conform to the following range, as measured at mid-radius location:

Diameter		Hardness	DPH (10 kg)
Inches	mm	Minimum	Maximum
1/8 to 7/8	3.2 - 22.2	255	320
Over 7/8 to 1 1/8	22.2 - 28.6	245	310
Over 1 1/8 to 1 7/8	28.6 - 47.6	240	300
Over 1 7/8 to 2 7/8	47.6 - 73.0	235	290
Over 2 7/8 to 3 1/2	73.0 - 88.9	230	285

All sizes of recrystallized bar shall exhibit hardness (mid-radius) of 215 DPH maximum.

Tensile tests are conducted at room temperature (65°F to 85°F [20°C – 30°C]) 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 longinudinal direction, using such specimens taken from the center of round bars

Up to 1 ¼ inch diameter and from mid-radius location for larger bars, shall meet the following minimum values:

Diameter		Tensile Strength Minimum		Yield Strength (.2% Offset) Minimum		Elongation % Minimum
inches	mm	KSI	MPa	KS	Mpa	%
1/8 to 7/8	3.2 - 22.2	115	790	100	690	18
Over 7/8 to 1 1/8	22.2 - 28.6	110	760	95	655	15
Over 1 1/8 to 1 7/8	28.6 - 47.6	100	690	85	585	10
Over 1 7/8 to 2 7/8	47.6 - 73.0	90	620	80	550	10
Over 2 7/8 to 3 1/2	73.0 - 88.9	85	585	75	515	5

Diameter		Diameter Variation		Out-of-Round	
Inches	mm	Inches	mm	Inches	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 1 3/8 to 1 1/2	34.9 - 38.1	+0.020 -0.015	+0.51-0.38	0.020	0.51
Over 1 1/2 to 1 5/8	38.1 - 41.3	+0.025-0.015	+0.64-0.38	0.020	0.51
Over 1 5/8 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 2 1/2 to 3 1/2	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 ± 0.005 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.

SPECIAL AND SURFACE/INTERNAL CONDITION
Bars can be supplied to ASTM 387-90. Bars will be supplied with chemically or mechanically cleaned surfaces. Minor surface imperfections, revealed by dye penetrant inspection, may be removed by conditioning, provided such removal does not reduce dimensions below specified tolerance limits.

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.

HAZARDS IDENTIFICATION IN ADVERTISING (DIRECTIVE 67/548/EEC ARTICLE 26, DIRECTIVE 1999/45/EC ARTICLE 13 AND REGULATION (EC) NO 1272/2008 ARTICLE 48)

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

REJECTION
Elmet TEchnologies must receive written notification of rejected material with the resaon for rejection. The right is reserved to inspect rejected material at customer plant for claim validation. The material may

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