

Tungsten Heavy Alloy (“WHA”) PRODUCTS **Standard Sizes and Material Data Sheet**

Elmet Technologies presses and sinters high quality tungsten heavy alloy (WHA) blocks, rods, and shaped parts. All material is made in the USA at Elmet’s fully integrated facility in Lewiston, Maine. Elmet has a large and growing inventory of standard molds and sizes that can be sold “rough as sintered” or machined to provide tighter tolerances. Sintered WHA blanks can be further rolled or swaged by Elmet to produce plates, sheets, and rods with ultimate tensile strengths exceeding 180 ksi (1240 MPa) and elongations exceeding 5%. Elmet also precision machines WHA parts for use as ballast weights, radiation shields, boring bars, ordnance components, and other components that require high density and good ductility.

CHEMICAL COMPOSITION AND AS-SINTERED MECHANICAL PROPERTIES

STANDARD GRADES

Grade	ET90	ET90NM	ET92.5	ET92.5NM	ET93	ET95	ET95NM	ET97
ASTM B-777	Class 1	Class 1	Class 2	Class 2	-	Class 3	Class 3	Class 4
AMS 7725E	Class 1 Type 2	Class 1 Type 1	Class 2 Type 2	Class 2 Type 1	-	Class 3 Type 2	Class 3 Type 1	Class 1 Type 2
MIL-T-21014D	Class 1	Class 1	Class 2	Class 2	-	Class 3	Class 3	Class 4
W content, wt. %	90	90	92.5	92.5	93	95	95	97
Ni content, wt. %	7.0	8.9	5.3	6.7	5.6	3.5	4.4	2.1
Fe content, wt. %	3.0	1.1	2.2	0.8	1.4	1.5	0.6	0.9
Density, g/cm ³	17.0	17.0	17.5	17.5	17.7	18.0	18.0	18.5
UTS, ksi	≥ 110	≥ 110	≥ 110	≥ 110	≥ 110	≥ 105	≥ 105	≥ 100
UTS, MPa	≥ 758	≥ 758	≥ 758	≥ 758	≥ 758	≥ 724	≥ 724	≥ 689
YS, ksi	≥ 75	≥ 75	≥ 75	≥ 75	≥ 75	≥ 75	≥ 75	≥ 75
YS, MPa	≥ 648	≥ 648	≥ 648	≥ 648	≥ 648	≥ 648	≥ 648	≥ 648
Elongation, %	≥ 5	≥ 5	≥ 5	≥ 5	≥ 5	≥ 3	≥ 3	≥ 2
Hardness, HRC	≤ 32	≤ 32	≤ 33	≤ 33	≤ 33	≤ 34	≤ 34	≤ 35
Mag. perm.	> 1.05	≤ 1.05	> 1.05	≤ 1.05	> 1.05	> 1.05	≤ 1.05	> 1.05

Other alloy compositions and properties may be available as special order

All WHA products are compliant with EU RoHS Directive 2002/95/EC, 2011/65/EU and with REACH Regulation (EC) No. 1907/2006

All WHA defense products are compliant with section 871 of the FY2019 National Defense Authorization Act, codified at 10 U.S.C. 2533c, and the January 28, 2019 acquisition directive from the Office of the Under Secretary of Defense

All raw materials for Elmet’s WHA rod products are obtained from certified conflict-free sources

STANDARD WHA PRODUCT SIZES

WHA Round - Rough As Sintered Sizes

Size	Diameter Tolerance	Length Tolerance
.720" X 12.20"	+/- .030"	+/- .125"
.950" X 12.20"	+/- .060"	+/- .125"
1.30" X 12.20"	+/- .075"	+/- .125"
1.62" X 12.20"	+/- .075"	+/- .125"
1.90" X 12.20"	+/- .075"	+/- .125"
2.10" X 12.20"	+/- .090"	+/- .125"
2.95" X 6.25"	+/- .125"	+/- .125"

ASTM B777 Class 1 Type 2

Class 1 Part Number	Class 1 Price
51093	\$ 200
51094	\$ 292
51095	\$ 455
61188	\$ 800
51096	\$ 925
51091	\$ 1,059
51092	\$ 1,059

ASTM B777 Class 2 Type 2

Class 2 Part Number	Class 2 Price	MOQ by size
51097	\$ 205	5
51098	\$ 297	5
51099	\$ 461	5
61204	\$ 815	10
51100	\$ 946	2
51101	\$ 1,077	2
51102	\$ 1,081	2

4-5 week lead times, includes ASTM B777 cert, volume discounts available. Class 3 & 4 and non magnetic options available upon request

WHA Round Turned Finish Sizes

Size	Diameter Tolerance	Length Tolerance
.625" X 12"	+ .015"-.005"	+ .125"-000
.875" X 12"	+ .015"-.010"	+ .125"-000
1.125" X 12"	+ .030"-.010"	+ .125"-000
1.50" X 12"	+ .030"-.010"	+ .125"-000
1.75" X 12"	+ .030"-.010"	+ .125"-000
2.00" X 12"	+ .030"-.010"	+ .125"-000
2.75" X 6"	+/- .030"	+ .125"-000

ASTM B777 Class 1 Type 2

Class 1 Part Number	Class 1 Price
81184	\$ 283
81185	\$ 395
81186	\$ 561
81252	\$ 915
81187	\$ 1,039
81188	\$ 1,176
81189	\$ 1,176

ASTM B777 Class 2 Type 2

Class 2 Part Number	Class 2 Price	MOQ by size
81196	\$ 294	10
81197	\$ 399	10
81198	\$ 567	10
81222	\$ 925	10
81199	\$ 1,061	4
81200	\$ 1,190	4
81201	\$ 1,193	4

8-9 week lead times, includes ASTM B777 cert, volume discounts available. Class 3 & 4 and non magnetic options available upon request

WHA Block - Rough As Sintered Sizes

Size: T=thickness W=width L=length	Tolerances	Class 1 Weight in KGs
1.75" T X 1.8" W X 6.2" L	+/- 3/16"	5.50
1.60" T X 4.875" W X 4.625" L	+/- 3/16"	10.00
2.30" T X 3.3" W X 5.2" L	+/- 3/16"	11.00
2.20" T X 2.5" W X 7.2" L	+/- 3/16"	11.25
2.375" T X 4.9" W X 4.2" L	+/- 3/16"	13.75
1.60" T X 4.875" W X 7.5" L	+/- 3/16"	16.50
2.375" T X 4.9" W X 5.2" L	+/- 3/16"	17.00
2.375" T X 4.9" W X 6.2" L	+/- 3/16"	20.50
3.0" T X 4.125" W X 6.2" L	+/- 3/16"	21.50

ASTM B777 Class 1 Type 2

Class 1 Part Number	Class 1 Price
61176	\$ 511
61184	\$ 818
61178	\$ 884
61177	\$ 901
61179	\$ 1,073
61185	\$ 1,251
61180	\$ 1,285
61181	\$ 1,561
61186	\$ 1,627

Price per kg	MOQ by size
\$92.95	5
\$81.76	5
\$80.39	5
\$80.09	5
\$78.06	2
\$75.82	2
\$75.56	2
\$76.13	2
\$75.69	2

4-5 week lead times, includes ASTM B777 cert, volume discounts available. Class 2, 3, 4 and non mag options available

WHA Block - Ground Finish Sizes

Size	Tolerances	Class 1 Weight
1.65" T X 1.7" W X 6.0" L	+/- .030"	4.69
1.50" T X 4.750" W X 4.50" L	+/- .030"	8.93
2.20" T X 3.2" W X 5.0" L	+/- .030"	9.80
2.10" T X 2.375" W X 7.0" L	+/- .030"	9.72
2.25" T X 4.75" W X 4.0" L	+/- .030"	11.91
1.50" T X 4.75" W X 7.25" L	+/- .030"	14.39
2.25" T X 4.75" W X 5.0" L	+/- .030"	14.88
2.25" T X 4.75" W X 6.0" L	+/- .030"	17.86
2.875" T X 4.0" W X 6.0" L	+/- .030"	19.22

ASTM B777 Class 1 Type 2

Class 1 Part Number	Class 1 Price
call	\$ 1,102
call	\$ 1,696
call	\$ 1,807
call	\$ 1,835
call	\$ 2,122
call	\$ 2,418
call	\$ 2,474
call	\$ 2,934
call	\$ 3,045

Price per kg	MOQ by size
\$235.12	10
\$189.94	10
\$184.34	10
\$188.73	10
\$178.24	4
\$168.11	4
\$166.25	4
\$164.31	4
\$158.48	4

8-9 week lead times, includes ASTM B777 cert, volume discounts available. Class 2, 3, 4 and non mag options available

Custom Sizes Available. Call if you don't see a size that will work. Project minimums may be required.

CAPABILITIES FOR CUSTOM SIZED MATERIAL

Blocks, sintered	Other sizes with up to 6" to 7" in Width and Height are available with a special mold fee Lengths up to >24" are possible (larger sizes can be limited by weight) The length dimension of some standard mold sizes (above) can be easily reduced It is possible to cut/slice standard sizes into smaller pieces (added cutting fee)
Rods, sintered	0.625 to >4.0" in diameter is possible with special mold fee Lengths up to >24" are possible
Rods, swaged	0.25 to 1.0" in diameter Lengths up to 48" (30" is common for swaged rod) 3/8" and .5" swaged rods are often in stock
Plate, hot rolled	0.25 to 1.0" in thickness Widths and lengths up to 24" Standard sizes include: .125" thick plate 7" x 7" or 12" x 12" .250" thick plate 7" x 7" or 12" x 12" .50" thick plate 7" x 7" or 12" x 12" It is possible to cut/slice standard sizes into smaller pieces (added cutting fee)
Disks, sintered	Elmet has several standard disk sizes available: Disk - 5.1" diameter x 1.65" tall with tolerances of +/- .125" Disk - 3.87" diameter x 1.25" tall with tolerances of +/- .125" 5.25" diameter x 1.65" tall x 0.925" diameter hole with tolerances of +/- .125" 4.1" diameter x 1.31" tall x 1.25"Dia hole with tolerances of +/- .125"

STANDARD LEAD-TIMES

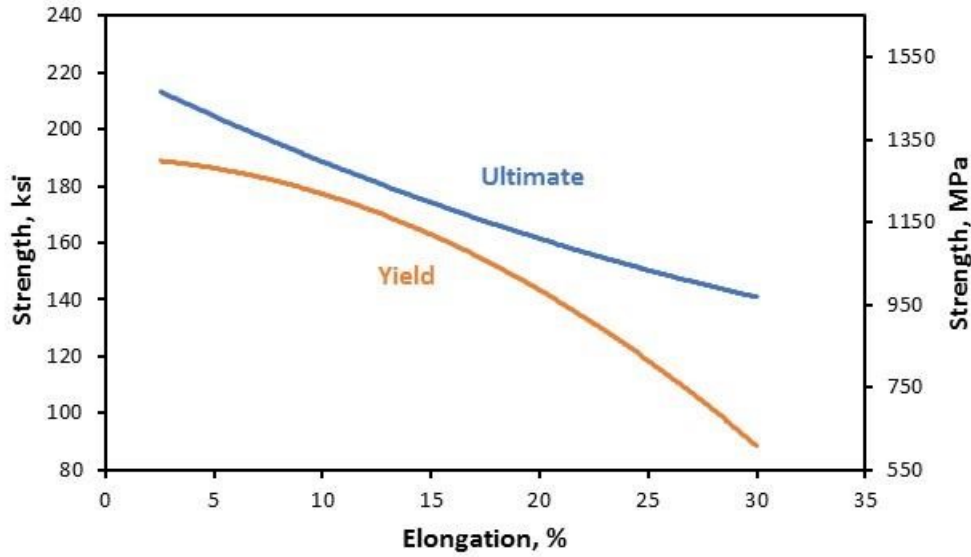
Rough As Sintered – Standard Sizes	Class 1 Type 2 (ET90) and Class 2 Type 2 (ET92.5) – 3-4 weeks Class 3, Class 4 and all non mag blends – 6-7 weeks
Ground Finish – Standard Sizes	Class 1 Type 2 (ET90) and Class 2 Type 2 (ET92.5) – 8-9 weeks Class 3, Class 4 and all non mag blends – 9-10 weeks
Rough As Sintered - New Size / Mold	Class 1 Type 2 (ET90) and Class 2 Type 2 (ET92.5) – 9-10 weeks Class 3, Class 4 and all non mag blends – 10-11 weeks
Ground Finish – New Size / Mold	Class 1 Type 2 (ET90) and Class 2 Type 2 (ET92.5) – 10-11 weeks Class 3, Class 4 and all non mag blends – 11-12 weeks

Prices

Elmet Technologies WHA pricing is subject to change based on raw material markets and other factors. Please contact your Elmet sales representative or the factory for confirmation of the latest pricing and lead-times.

AS-SWAGED WHA ROD MECHANICAL PROPERTIES

Elmet Technologies can adjust swaging and heat-treating conditions to produce WHA rods with specific combinations of strength and ductility.



OPTIONS FOR TYPE OF FINISH

Elmet Technologies offers tungsten heavy alloy in two finish options to meet various customer requirements:

- 1) Rough as sintered (the way the material come out of our sintering furnaces)
- 2) Turned, ground or machined to tighter tolerances

<p>Rough As Sintered Finish</p> <p>Tolerances typically in the +/- 3/16" range</p>	
<p>Turned or Ground Finish</p> <p>Tolerances typically in the +/- .030" range</p>	