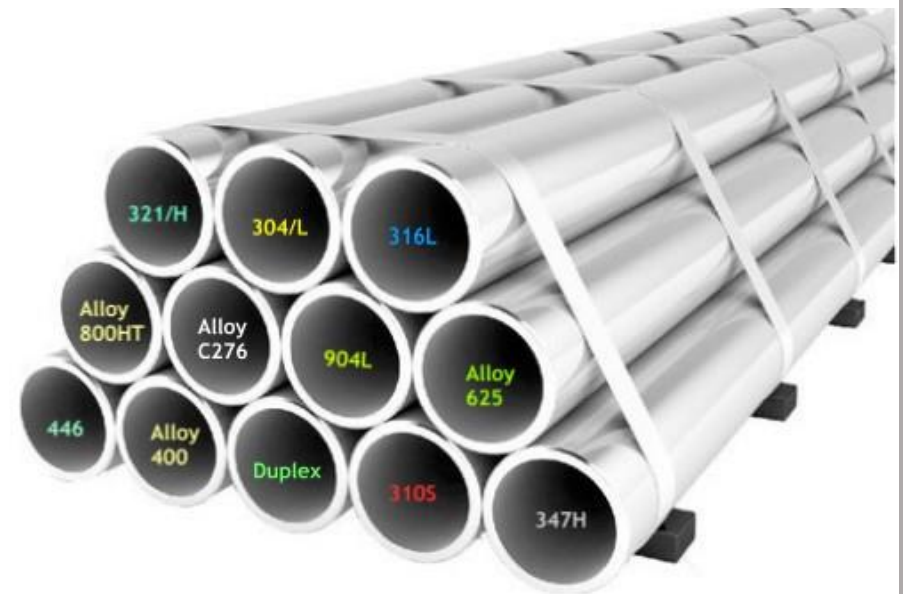


TUNGSTEN

Datasheet for Tungsten

- Pipes & Tubes
- Sheets & Plates
- Bars & Rods, Forgings
- Fittings & Flanges
- Nuts & Bolts
- Valves



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Datasheet for Tungsten

WT10, WT20, WT30, WT40, HA190, HA1925, HA195, HE390, HE395, HE3925, HE397

What is Tungsten?

- Tungsten is known as "wolfram" or "industrial tooth" or "industrial salt" because both of its melting point and specific gravity are much higher than other metals, while its hardness is only second to diamond. Tungsten alloy comes in two ranges – magnetic (the HE range) and non-magnetic (the HA range). With densities up to 18.5g/cm, these grades are the prime choice for adding balance weights, ballast or vibration damping mass where space is limited.
- The high density of tungsten alloy also delivers effective radiation shielding particularly against X-ray and gamma radiation. We also provide a specialist tungsten alloy grade (HM 490) for hot metal applications which offers good hot wear resistance.
- All tungsten alloy grades are reasonably corrosion resistant in both acid and alkaline environments and can easily be plated or painted if necessary. They are easy to clean, non-toxic and non-radioactive.
- Tungsten and tungsten products are mainly used in the fields of tungsten steel, tungsten materials, tungsten chemicals and cemented carbide, wherein cemented carbide has the hugest demand for tungsten. The demand of cemented carbide for tungsten occupies 72% in the European market, 66% in the Japanese market and 54% in the Chinese market.
- **Magnetic tungsten alloy**
Manufactured with a binder of iron and nickel, our magnetic alloys have a tungsten content of 90-97% by weight. These are suitable for many situations where a high density material is required.
- **Non-magnetic tungsten alloys**
For non-magnetic alloys, copper and nickel are the binding agents, with a tungsten content in the range of 90-95%. These non-ferromagnetic alloys are used in a variety of applications, including medical scanners.
- **Technical data**
Tungsten alloy conforms to the internationally recognized standard ASTM B777-15 and AMS 7725E the Aerospace Materials Specification. The non-magnetic grades have been proven to be non-magnetic through independent tests.
- The high hardness is another important property of tungsten metal. Tungsten carbide is the major usage of tungsten, tungsten carbide always called the teeth of modern industry.
- Tungsten carbide has another name as cemented carbide or tungsten cemented carbide, There are so many types of tungsten carbide, the most popular like tungsten carbide cutting tools, tungsten carbide drilling tools, tungsten carbide sealing and tungsten carbide milling tools, the main forms of tungsten carbide are

tungsten carbide rods, tungsten carbide tips, tungsten carbide bar, tungsten carbide inserts, tungsten carbide plates, tungsten carbide seals, tungsten carbide buttons, tungsten carbide balls, tungsten carbide pellets and tungsten carbide dies.

Tungsten Product Specification

| | |
|------------|---|
| Material | High purity Tungsten, Tungsten 90% alloys, Tungsten-6Ni-4Cu, Tungsten-7Ni-3Fe, Tungsten 92.5% alloy, Tungsten-5Ni-3.5Fe, Tungsten 95% alloy, Tungsten-3Ni-2Cu, Tungsten-3Ni-2Fe, Tungsten 97% alloy, Tungsten-2Ni-1Fe, Silver-Tungsten alloy, Copper-Tungsten alloy |
| Purity | ≥99.95% |
| Size: OD | 6.0~200mm, ID: 3.0~180mm, Length: ≤1500 |
| Density | 18.2g~19.3g/cm ³ |
| Technology | Powder metallurgy |

Tungsten Grade Chart

| Grade | | HA 190 | HA 1925 | HA 195 | HE 390 | HE 3925 | HE 395 | HE 397 |
|------------------------------|--------------------|----------------------|----------------------|----------------------|------------------|------------------|------------------|------------------|
| Aerospace industry standards | | | | | | | | |
| ASTM B777-15 | | Non-magnetic Class 1 | Non-magnetic Class 2 | Non-magnetic Class 3 | Magnetic Class 1 | Magnetic Class 2 | Magnetic Class 3 | Magnetic Class 4 |
| AMS 7725E | | Type 1 Class 1 | Type 1 Class 2 | Type 1 Class 3 | Type 2 Class 1 | Type 2 Class 2 | Type 2 Class 3 | Type 2 Class 4 |
| Typical properties* | Units | | | | | | | |
| Tungsten | Nominal % | 90 | 92.5 | 95 | 90 | 92.5 | 95 | 97 |
| Binder | | Ni/Cu | Ni/Cu | Ni/Cu | Ni/Fe | Ni/Fe | Ni/Fe | Ni/Fe |
| Nominal density | g/cm ³ | 17.1 | 17.5 | 17.9 | 17.1 | 17.5 | 18.1 | 18.5 |
| | lb/in ³ | 0.62 | 0.63 | 0.65 | 0.62 | 0.63 | 0.65 | 0.67 |

| | | | | | | | | |
|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|
| 0.2% proof stress | MPa | 675 | 650 | 680 | 645 | 645 | 660 | 660 |
| | ksi | 100 | 95 | 100 | 95 | 95 | 95 | 95 |
| Tensile strength | MPa | 805 | 830 | 805 | 875 | 900 | 910 | 915 |
| | ksi | 116 | 120 | 116 | 126 | 130 | 131 | 132 |
| Elongation on 25mm (1") | % | 7 | 9 | 4 | 25 | 27 | 22 | 12 |
| Hardness | HRC | 24 | 24 | 24 | 27 | 24 | 24 | 25 |

*Properties may vary according to size and shape of part and production conditions. Figures shown are rounded and are typical for coupons (to fig.19 of ASTM E8) measured in accordance with ASTM B777-15; they are offered without warranty or guarantee. It is for the customer to satisfy itself of the suitability of the products for its own particular purposes and environmental conditions.

Tungsten Carbide Grade Chart

| Tungsten Carbide Standard Grade Chart | | | | | | | |
|---------------------------------------|-----------|-----------------------|---------------|-----------------|-----------------|---|------------|
| Industry Code | FCC Grade | Binder Content & Type | Hardness (Ra) | Hardness (HV30) | Density (g/cm3) | Minimum Transverse Rupture Strength (psi) | Grain Size |
| General Purpose Grades | | | | | | | |
| C2 | FC3 | 6% Co | 92 | 1585 | 14.95 | 3,20,000 | Fine |
| C1 | FC4 | 7.5% Co | 91 | 1460 | 14.7 | 3,30,000 | Fine |
| Metal Forming and Wear Grades | | | | | | | |
| C10 | FC10 | 9% Co | 90 | 1360 | 14.6 | 3,60,000 | Medium |
| C11 | FC11 | 12% Co | 89.5 | 1315 | 14.3 | 3,90,000 | Medium |

| | | | | | | | |
|---|-------|-----------|------|------|-------|----------|-----------|
| C12 | FC12 | 15% Co | 88 | 1190 | 14 | 4,20,000 | Medium |
| C13 | FC13 | 20% Co | 85 | 955 | 13.6 | 4,50,000 | Medium |
| C14 | FC25 | 25% Co | 83.2 | 760 | 13.15 | 4,35,000 | Medium |
| Submicron Grades | | | | | | | |
| C3 | FC3M | 6% Co | 93 | 1740 | 14.95 | 3,75,000 | Submicron |
| C2 | FC10M | 10% Co | 91.9 | 1570 | 14.5 | 4,50,000 | Submicron |
| C1 | FC12M | 15% Co | 89.5 | 1315 | 14 | 5,30,000 | Submicron |
| Rotary Drilling and Mining Grades | | | | | | | |
| C11 | FC10C | 10% Co | 88.6 | 1240 | 14.5 | 4,00,000 | Coarse |
| C12 | FC11C | 10% Co | 87.8 | 1175 | 14.5 | 4,25,000 | Coarse |
| Corrosion Resistant Grades | | | | | | | |
| - | FC3N | 6% Ni | 91 | 1460 | 14.95 | 2,75,000 | Fine |
| - | FC10N | 9% Ni | 89.5 | 1315 | 14.6 | 2,90,000 | Fine |
| - | FC8N | 8.5% Ni | 91.5 | 1515 | 14.5 | 3,00,000 | Fine |
| - | FC82 | 15% Ni+Co | 89.9 | 1355 | 9 | 3,10,000 | Fine |
| Special grades to meet specific customer requirements are also available. | | | | | | | |

Chemical Properties of Tungsten

| MARK | OXIDE | CONTENT% | OTHER IMPURITY % | TUNGSTEN % | COLOR | ELECTRON WORK FUNCTION EV |
|------|-------|----------|------------------|------------|--------|---------------------------|
| WT10 | Tho2 | 0.8-1.2 | <0.2 | rest | yellow | 2.6 |
| WT20 | Tho2 | 1.8-2.2 | <0.2 | rest | red | 2.7 |
| WT30 | Tho2 | 2.8-3.2 | <0.2 | rest | purple | 3 |
| WT40 | Tho2 | 3.8-4.1 | <0.2 | rest | orange | 3.5 |

Most of tungsten chemical compounds are Tungsten oxides and tungsten trioxides(WO₃), tungsten oxides are always named tungsten intermediate products, they are tungstic acid, ammonium paratungstate (APT, tungsten oxide content 88.5%);ammonium metatungstate (AMT), sodium tungstate,yellow tungsten oxide (YTO),blue tungsten oxide (BTO), tungsten trioxide (WO₃), violet tungsten oxide (VTO). The other tungsten chemical compounds are most often used industrially as tungsten catalysts, there are tungstic anhydride,pure tungsten oxide, extra pure tungsten oxide (refined tungsten oxide) yellow-green tungsten oxide, Tungstic acid anhydride (Wolframic acid anhydrous, Wolframic acid anhydride), puratronic tungsten(vi) oxide, etc.

Mechanical, Physical and Thermal Properties of Tungsten

| | |
|------------------------|--|
| Atomic Number | 74 |
| Atomic Weight | 183.86 |
| Group Number | 6 |
| Electron Configuration | 1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ 4s ² 3d ¹⁰ 4p ⁶ 5s ² 4d ¹⁰ 5p ⁶ 6s ² 4f ¹⁴ 5d ⁴ |
| CAS Registry Number | 7440-33-7 |
| Atomic Volume | 9.53 |
| Lattice Type | Body Centered Cube |

| | |
|---|-------------------------|
| Lattice Constant at 20 °C, Angstroms | 3.1585 |
| Natural Isotopes | 180, 182, 183, 184, 186 |
| Density @ 20 °C (gm/cc) | 19.3 |
| Density @ 20 °C (lb./cu. in.) | 0.697 |
| Melting Point °C | 3410 |
| Boiling Point °C | 5530 |
| Linear Coefficient of Expansion per °C | 4.3 x 10E-6 |
| Thermal Conductivity @ 20 °C (cal/cm/°C/sec) | 0.4 |
| Specific Heat @ 20 °C (cal/gram/°C) | 0.032 |
| Electronegativity (eV) Pauling | 2.36 |
| Electronegativity (eV) Sanderson | 0.98 |
| Electronegativity (eV) Allred Rochow | 1.4 |
| Electrical Conductivity, % IACS | 31 |
| Electrical Resistivity @ 20 °C (microhm-cm) | 5.5 |
| Electrical Resistivity @ 227 °C (microhm-cm) | 10.5 |
| Electrical Resistivity @ 727 °C (microhm-cm) | 24.3 |
| Electrical Resistivity @ 1727 °C (microhm-cm) | 55.7 |
| Electrical Resistivity @ 2727 °C (microhm-cm) | 90.4 |

| | |
|---|-------------------|
| Electrical Resistivity @ 3227 °C (microhm-cm) | 108.5 |
| Temperature Coefficient of Electrical Resistivity Per °C (0 – 100 °C) | 0.0046 |
| Tensile Strength @ Room Temp., psi | 100,000 – 500,000 |
| Tensile Strength @ 500 °C, psi | 75,000 – 200,000 |
| Tensile Strength @ 1000 °C, psi | 50,000 – 75,000 |
| Poisson's Ratio | 0.284 |
| Hardness (Mineral) | 7.5 |
| Hardness (Vickers) | 343 |
| Hardness (Brinell) | 2570 |
| Reflectivity | 62% |
| Total Emissivity @ 1500 °C | 0.23 |
| Total Emissivity @ 2000 °C | 0.28 |
| Working Temperature, °C | <1700 |
| Recrystallization Temperature, °C | 1300 – 1500 |

We deal in all types of Tungsten products such as: -

| | |
|----------------------|----------------------------------|
| Pure Tungsten | Tungsten Alloy Radiation Shield |
| Tungsten Heavy Alloy | Tungsten Alloy Military Fittings |

| | |
|---------------------------|-------------------------------|
| Tungsten Alloy Composites | Tungsten Alloy Counter Weight |
| Tungsten Carbide | Tungsten Alloy for Welding |
| Other Tungsten | Tungsten Putty Weight |
| Tungsten Bucking Bar | |

Properties of Tungsten

- Tungsten is a **lustrous** and silvery white metal.
- The bulk metal resists attack by oxygen, acids and alkalis.
- Tungsten has the highest **melting point** of any metal.
- Tungsten is used in filaments in incandescent light bulbs, it is also used in electric contacts and arc-welding electrodes.
- Low electronic function
- Good conductivity
- Good electron emission ability
- Good mechanical cutting performance
- High elastic modulus, Low vapor pressure
- High recrystallization temperature

Difference Between Tungsten and Titanium

Which material is the strongest depends on where it is going to be used. There may be an application where a high yield strength is vital but the compressive strength is a non-factor. Understanding the application is essential to selecting the proper materials. In terms of tensile strength, tungsten is the strongest out of any natural metal (142,000 psi). But in terms of impact strength, tungsten is weak — it's a brittle metal that's known to shatter on impact. Titanium, on the other hand, has a tensile strength of 63,000 psi. But when you figure in titanium's density and make a pound-for-pound comparison, it beats tungsten. Looking at titanium in terms of compression strength, it scores much lower on the Mohs scale of hardness.

Applications of Tungsten

| | |
|---------------------|--|
| Cell Phone | Tungsten alloy mobile cubes |
| Watch | Tungsten alloy watch bobs |
| Computers | Tungsten alloys heat sinks for PCB |
| | Tungsten alloy heat base for PCB |
| Dart Sets | Tungsten alloy dart billets, tungsten alloy dart barrels |
| Golf | Tungsten alloy golf clubs |
| Yacht | Tungsten alloy yacht balance, |
| Fishing | Tungsten alloy fishing sinkers |
| Hunting Gun | Tungsten alloy shots and hunting gun's bullets' balls |
| | Tungsten alloy weights roller for meters, |
| Racing Car & Motors | Tungsten alloy balances for racing car |
| | Tungsten alloy crankshafts for motor & auto engines |
| Home | Tungsten alloy Paper Weight. |
| Airplane | Riveting bucking bars for airplanes, |
| Submarines | Tungsten alloy seals for submarine |
| | Tungsten alloy counterweigh , balance for submarine |

*Tungsten Products are also used in Chemical Industries, Cemented Carbide, Alloys, Electronics and Electrical Industries.

Types of Tungsten Products

| | |
|-----------------------------------|--------------------------------------|
| Tungsten Hollow Pipe | Tungsten Heater for High Temperature |
| Tungsten Seamless Pipe | Tungsten Heat Exchanger Tube |
| Tungsten Bush Hex Pipe | Potassium-doped Tungsten Wire |
| Tungsten Round Pipe | Tungsten Welded Pipe |
| Tungsten Alloy Round Pipe | Tungsten Pipe |
| Tungsten Aero engine tube | Tungsten Custom Pipe |
| Tungsten Alloy Custom Pipe | Tungsten Thick Wall Pipe |
| Tungsten Elliptical and Oval Tube | Tungsten Thin Wall Pipe |
| Tungsten Pipe Fittings | Tungsten Forging |
| Tungsten Carbide Pipes/Tubes | Tungsten Fasteners |
| Tungsten Flex pipe | Tungsten Plates, Sheets and Bars |
| Tungsten Alloy Polished Pipe | UNS Tungsten lined pipe |
| Tungsten Exhaust Pipe | Tungsten Micro Tube |
| Tungsten Bar/Billet | Tungsten Wire/Welding Wire |
| Tungsten Boiler Tube | Tungsten Coil Tubing |
| Tungsten Capillary Tube | Tungsten U Shaped Tube |
| Tungsten Carbide Rods | Precision Tungsten Tubing |
| Tungsten Suppliers | Tungsten Pipe Manufacturers |

| | |
|-----------------|--------------------|
| Tungsten Ingots | Tungsten Foil |
| Tungsten Metals | Tungsten Crucibles |

Manufacturing Tungsten Products

| | | |
|---------------------------------------|--|--|
| Tungsten Sheet | Tungsten Plate Cuttings/Profiles | Tungsten Nuts, Bolts and Fasteners |
| Tungsten Plate | Tungsten Foil, Coil | Tungsten Wire |
| Tungsten Blocks/Slabs | Tungsten Strip | Tungsten Ingot |
| Tungsten Rod/Bar | Tungsten Pipes and Tubes | Tungsten Forgings and Castings |
| Tungsten Flanges | Tungsten Forged Fittings | Tungsten Butt weld Fittings |

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Hex Steel Bars
Round Steel Bars & Rod
Flat Steel Bars
Forgings, Rings & Forged Blocks
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Large Diameter Pipe

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