

A2 and A6 Tool Steel Mechanical Properties After Tempering

Two air-hardening cold work tool steels, A2 and A6, are collected here with the hardness, tensile and yield strength, elongation, reduction of area and unnotched Charpy impact that each one leaves after a single temper. A2 is hardened from 945 °C and A6 from 845 °C, and the only variable across the columns of each table is the tempering temperature, so the figures price exactly what a shop gives up in hardness when it buys toughness.

Reference only. This is a reference summary of published practice and not a specification of ours. Each set of figures belongs to the exact hardening and tempering condition named in the caption above it, on one heat of each grade, and a die run at a different tempering temperature will sit somewhere else on these scales. Confirm the working values for a particular die against the material test certificate of the heat you buy before ordering.

A2 tool steel after hardening from 945 °C (1730 °F) and one temper

Tempering temperature, °C	Tempering temperature, °F	Hardness, HRC	Ultimate strength, MPa	Ultimate strength, ksi	Yield strength, MPa	Yield strength, ksi	Elongation in 50 mm (2 in.), %	Reduction of area, %	Unnotched Charpy impact, J	Unnotched Charpy impact, ft-lbf
540	1000	54.1	1858.2	269.5	...	...	...	...	...	...
595	1100	46.7	1603.8	232.6	1269	184	5.0	13.9	...	...

Source, Tool Steels (G. A. Roberts and G. Krauss), Table 11-3, Mechanical properties of A2 and A6 tool steels, printed page 199. A2 figures from Teledyne VASCO. The three dots are printed by the source where it gives no figure for that property. This is a reference summary of published practice and not an Aobo Steel specification.

What the two tables cover

This is a reference summary of published practice and not a specification of ours. Each set of figures belongs to the exact hardening and tempering condition named in the caption above it, on one heat of each grade, and a die run at a different tempering temperature will sit somewhere else on these scales. Confirm the working values for a particular die against the material test certificate of the heat you buy before ordering.

A6 tool steel after hardening from 845 °C (1550 °F) and one temper

Tempering temperature, °C	Tempering temperature, °F	Hardness, HRC	Ultimate strength, MPa	Ultimate strength, ksi	Yield strength, MPa	Yield strength, ksi	Elongation in 50 mm (2 in.), %	Reduction of area, %	Unnotched Charpy impact, J	Unnotched Charpy impact, ft-lbf
175	350	59.7	2137	310	...	...	0.5	1.0	117	86
315	600	55.5	2016.8	292.5	1822.3	264.3	1.0	2.2	163	120
480	900	51.0	1751	254	1510	219	2.5	7.4	170	125

Source, Tool Steels (G. A. Roberts and G. Krauss), Table 11-3, printed page 199. A6 figures from Universal Cyclops Steel Corp. The impact column is unnotched Charpy, so it is not comparable with notched readings for the same steel, and 175 °C is a stress relieving temper rather than a softening one. This is a reference summary of published practice and not an Aobo Steel specification.

Reading the two tables together

The two tables read as the same trade at two different price levels. A2 falls from 54.1 to 46.7 HRC for 55 °C more temper and its ultimate strength follows from 1858.2 to 1603.8 MPa, and the source gives no impact figure for either condition. A6 is carried from 59.7 down to 51.0 HRC while its unnotched Charpy energy rises from 117 to 170 J and its reduction of area from 1.0 to 7.4 per cent, so the toughness side of the trade is priced. The largest gain for the smallest loss sits between 175 and 315 °C, where 4.2 HRC buys 46 J, and the step from 315 to 480 °C costs another 4.5 HRC for only 7 J.

Aobo Steel, tool steel supplier

Aobo Steel supplies tool steel to distributors and mold, tool and die shops, including D2, D3, O1, O2, A2, S7, H13, H11, H10, H21, M2, M42, L6, P20, P20+Ni and 420 and 440C stainless. Forged or hot rolled, annealed or pre-hardened, cut to your sizes, with test certificates. Compiled from Tool Steels (G. A. Roberts and G. Krauss), Table 11-3, Mechanical properties of A2 and A6 tool steels, printed page 199. A2 figures from Teledyne VASCO and A6 figures from Universal Cyclops Steel Corp. The table is reproduced as published and is a reference summary rather than an Aobo Steel specification.

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