

Carbon Tool Steel Temper Chart

The carbon content behind each named carbon tool steel temper, from die temper at 0.70 percent carbon to razor temper at 1.40 percent, with the tools each level was sold for and how far the steel can be welded.

Reference only. The values on this sheet are reproduced from the source named at the foot of it. They are a published reference rather than a specification of ours, and the sheet carries no tolerances. Carbon figures are the approximate content of the finished bar as the source prints them and are not a specification for any single grade. The source prints no weldability note against Smith's tool temper. Composition data is for general reference only, and actual values vary by standard, mill, and heat number.

Temper, approximate carbon and the tools each level was sold for

Source, the table of tempers on printed page 10 of The Heat Treatment of Tool Steel (Harry Brearley), which is PDF page 28 of the copy consulted.

Temper	Approximate carbon (wt %)	Used for	Weldability
Die temper	0.70-0.75	All kinds of dies for deep stamping, pressing, and drop forgings, mining drills to harden only	Easily weldable
Smith's tool temper	0.80-0.85	Large punches, minting and rivet dies, nailmakers' tools, hammers, hot and cold sates, snaps and boilermakers' tools, various smiths' tools, large shear blades, double-handed chisels, caulking tools, heading dies, masons' tools, and general welding purposes	Not stated in the source
Shear blade temper	0.90	Punches, large taps, screwing dies, shear blades, table cutlery, circular and long saws, heading dies	Weldable
General purposes temper	0.90-0.95	Taps, small punches, screwing dies, saw webs, needles, and all general purposes	Weldable
Axe temper	0.95-1.05	Axes, chisels, small taps, miners' drills, jumpers to harden and temper, plane irons	Weldable with care
Cutlery temper	1.0-1.1	Large milling cutters, reamers, pocket cutlery, wood tools, short saws, granite drills, paper and tobacco knives	Weldable with very great care
Tool temper	1.2-1.3	Turning, planing, slotting and shaping tools, twist drills, mill picks, scythes, circular cutters, engravers' tools, surgical cutlery, circular saws for cutting metals, bevel and other sections for turret lathes	Not weldable
Razor temper	1.3-1.4	Razors, barrel boring bits, special lathe tools for turning chilled rolls	Not weldable

Carbon figures are the approximate content of the finished bar as the source prints them and are not a specification for any single grade. The source prints no weldability note against Smith's tool temper. Its note on tool temper reads that the steel can still be welded to itself with a suitable flux and careful handling, and that this applies to ordinary shop methods only.

Read the table from the top down and three things move together. Carbon rises from 0.70 to 1.40 percent, hardness and wear resistance rise with it, and the tools listed at each level get finer and more demanding. Die temper at the top of the table is the toughest level of the group and is the one sold for deep stamping, pressing and drop forging work, where the tool has to absorb impact. Tool temper and razor temper at the bottom are the cutting levels, sold for edges that must hold up without support, and they are the levels that will not tolerate a repair.

The weldability column is the practical test of where a bar sits on the ladder. A die temper bar can be welded by ordinary shop methods, cutlery temper needs very great care, and from tool temper upward the ordinary methods do not apply. A cracked tool can therefore be repaired by welding at the low carbon end of the table and cannot at the high carbon end, which decides whether a large die or punch is worth repairing or has to be replaced.

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 and 420 and 440C stainless. Forged or hot rolled, annealed or pre-hardened, cut to your sizes, with test certificates.

Compiled from The Heat Treatment of Tool Steel (Harry Brearley), the table of tempers on printed page 10. The figures are reproduced from the published table and are a reference summary rather than an Aobo Steel specification.

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