

A2 Tool Steel Heat Treatment Guide

Preheating, austenitizing, quenching and tempering for A2, 1.2363 and SKD12, with the hardness each tempering temperature leaves. Reference summary of published A2 practice, not a heat treatment specification and not an Aobo Steel standard.

Reference only. Aobo Steel supplies A2 tool steel in the annealed condition and does not provide heat treatment services. Verify the values below against the applicable standard, the mill data sheet and the heat treater's own procedure.

A2 Tool Steel Heat Treatment Process Quick Guide

Step	Temperature	Time	Purpose
Preheating	1200-1250F (650-675C)	Until equalized	Reduce thermal gradients
Austenitizing	1750-1775F (955-970C)	~1 hour per inch section	Form austenite
Quenching	Air to ~150F (65C)	–	Form martensite
First temper	400-450F (205-230C)	2 hours per inch	Relieve stress
Second temper	Slightly lower (~25F / 15C)	2 hours per inch	Stabilize structure

Process data source, the Aobo Steel A2 Tool Steel Heat Treatment Guide.

A2 Tool Steel Hardness and Tempering

Tempering Range	Typical Hardness	Practical Use
250-400F (120-200C)	60-63 HRC	Maximum wear resistance
400-450F (205-230C)	58-62 HRC	Standard cold-work applications
~500F (260C)	Decreasing	Avoid (embrittlement risk)
950-1000F (510-540C)	56-57 HRC	Improved toughness and stability

A2 is typically used in the tempered condition. Lower tempering temperatures favor wear resistance, while higher temperatures improve toughness and dimensional stability.

Step-by-Step A2 Tool Steel Heat Treatment Process

1. Preheating

Preheat to 1200-1250F to ensure uniform temperature distribution and reduce internal stress before transformation. Insufficient preheating increases the risk of distortion and cracking.

2. Austenitizing

Austenitizing at 1750-1775F transforms the structure into austenite and partially dissolves alloy carbides. Holding time is based on section thickness, typically about one hour per inch after the part reaches full furnace temperature. Excessive temperature increases retained austenite and reduces hardness stability, while insufficient temperature leads to incomplete hardening.

3. Quenching

Quench in still air or a controlled gas. Cool the part to approximately 150F before tempering. For sections above about 5 inches (127 mm) in diameter, air cooling may not fully harden the core, and alternative cooling methods may be required.

4. Tempering

Tempering occurs immediately after quenching. The first temper at 400-450F reduces internal stress and adjusts hardness. After cooling, a second temper stabilizes the structure and prevents cracking during service.

5. Optional Subzero / Cryogenic Treatment

Subzero or cryogenic treatment may be applied after quenching to improve dimensional stability and consistency in hardness. This treatment transforms retained austenite into martensite and must always be followed by tempering.

A2 Tool Steel Hardness After Heat Treatment

Heat Treatment Stage	Typical Hardness	Practical Meaning
Annealed condition	201-241 HB	Machining condition
As-quenched condition	64-65 HRC	Not suitable for service
Standard tempered condition	58-62 HRC	Typical working hardness
Tempered at ~400F (205C)	60-61 HRC	Wear resistance focused
Tempered at 950-1000F (510-540C)	53-57 HRC	Toughness focused
Cryogenic treatment + tempering	61-62 HRC	Improved stability

A2 Tool Steel Heat Treatment by Application

Application Focus	Typical Tools	Heat Treatment Strategy	Resulting Hardness	Key Outcome
Maximum wear resistance	Blanking dies, shear blades, slitter knives	Low-temperature double temper (~400F / 205C)	60-62 HRC	Maximum edge retention
Balanced wear and toughness	Punches, forming tools	Controlled tempering	58-60 HRC	Reduced chipping
Maximum toughness	Impact-loaded tools	High-temperature temper	56-58 HRC	Improved fracture resistance
Dimensional stability	Precision tools, gages	Cryogenic + tempering	60-62 HRC	Stable size control
Surface wear resistance	Abrasive applications	Nitriding	Surface > core	Enhanced surface life

Tempering temperatures in the table are the ranges the page gives for each application.

Common Heat Treatment Problems and Solutions in A2 Tool Steel

Problem	Root Cause	Practical Solution
Excessive retained austenite / unstable hardness	Overheating during austenitizing	Control temperature; apply cryogenic treatment if needed
Delayed cracking after quenching	Untempered martensite under high stress	Begin tempering at ~150F immediately
Embrittlement	Tempering near 500F (260C)	Avoid this range; apply double tempering
Surface softening or brittleness	Poor furnace atmosphere	Use controlled atmosphere; remove affected layer
Distortion or uneven hardness	Non-uniform heating or large section size	Proper preheating; controlled heating and cooling

Table notes

- Stable A2 heat treatment depends on consistent temperature control, uniform heating, and proper sequencing of quenching and tempering.
- Stress relieving before hardening is recommended for precision parts, and controlled atmospheres are required to prevent surface degradation.
- Large sections require special attention to ensure uniform hardness distribution.
- A2 tool steel has limitations related to section size, temperature sensitivity, and stability.
- Large cross-sections may not fully harden in air, and austenitizing must be controlled within a narrow range.

Aobo Steel, tool steel supplier

Aobo Steel supplies forged tool steel from Huangshi, Hubei, China, where the local supply chain covers ESR melting, vacuum degassing and LF refining, forging, hot rolling, turned and peeled bar, heat treatment and third party inspection. We have worked in tool steel since 2003 and supply to order in cold work grades such as D2, D3 and O1, hot work grades such as H10 and H13, and stainless grades 420, 440C and 4Cr13. A2 is supplied in the annealed condition with mill test certificates to EN 10204 3.1. Reference data compiled from published A2 heat treatment sources and the Aobo Steel A2 Tool Steel Heat Treatment Guide.

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Scan to open the full A2 heat treatment guide with the process steps and the problem table.