

H13 Tool Steel Heat Treatment Guide

Annealing, preheating, austenitizing, quenching and double tempering for H13 hot-work tool steel, with the working hardness each application is put into service at. Reference summary of published H13 practice, not a heat treatment specification and not an Aobo Steel standard.

Reference only. Aobo Steel does not provide heat treatment services. We supply H13 tool steel in the annealed condition, including round bar and flat bar, ready for machining and subsequent heat treatment by the customer. Verify the values below against the applicable standard, the mill data sheet and the heat treater's own procedure.

H13 Tool Steel Heat Treatment Overview

Stage	Main Purpose	Typical Result
Annealing	Soften the steel for machining and relieve stress	Spheroidized structure and lower hardness
Preheating	Reduce thermal shock and equalize temperature	Lower cracking and distortion risk
Austenitizing	Build the hardening base	High hardenability and potential hardness
Quenching	Form the hardened structure	High as-quenched hardness
Tempering	Adjust hardness, toughness, and thermal stability	Final working properties

H13 Tool Steel Heat Treatment Chart

Heat Treatment Phase	Temperature Range (°C)	Temperature Range (°F)	Soak / Hold Time	Cooling / Notes
Annealing	845–900	1550–1650	About 1 hour per inch of thickness	Furnace cool slowly to about 480–500°C, then air cool
Preheating	790–815	1450–1500	Hold until equalized through section	A lower preheat around 704–760°C may be used first for delicate parts
Austenitizing	995–1025	1825–1875	About 20–30 min plus thickness-based hold	1010°C is a common reference hardening temperature
Quenching	-	-	-	Still air or high-pressure gas is standard; interrupted oil quench may be used for very large sections; do not water quench
Tempering	510–620	950–1150	2 hours per inch minimum per cycle	Double tempering is standard; begin tempering immediately after interrupted quench

Process data source, the Aobo Steel H13 tool steel heat treatment guide.

What Hardness Can H13 Reach After Heat Treatment?

The hardness of H13 changes clearly through the heat treatment cycle, so the cleanest way to present it is by condition.

Condition	Typical Hardness
Annealed condition	About 192 to 229 HB
As-quenched condition	Typically about 51 to 54 HRC
Tempered working condition	Commonly about 40 to 50 HRC
Nitrided surface	Commonly above 1000 HV, often about 1100 to 1300 HV

Recommended H13 Heat Treatment and Hardness by Application

For standard die-casting tooling, 44 to 48 HRC is a strong general working range. For high-shock applications, especially hammer forging or tools subjected to severe impact, a lower range, such as 40 to 44 HRC, is often safer because cracking becomes the dominant risk.

Application	Typical Working Hardness	Heat Treatment Priority
Die-casting dies	44 to 48 HRC	Thermal fatigue resistance and hot strength
High-shock forging tools	40 to 44 HRC	Toughness and crack resistance
General hot forging dies	About 38 to 45 HRC	Balance of wear resistance and shock resistance
Extrusion tooling	Medium to high hot-work hardness	Resistance to softening and wear
Nitrided H13 tooling	Tough core with very hard surface	Surface wear resistance with stable core

Step-by-Step: How to Heat Treat H13 Tool Steel

Stage	Shop notes
Annealing	A typical annealing range is 845 to 900°C (1550 to 1650°F). After soaking, H13 should be cooled very slowly in the furnace, typically at about 14 to 15°C per hour, to about 480 to 500°C, then air-cooled to room temperature. For consistency, the annealed hardness of H13 is best reported as approximately 192–229 HB.
Preheating	A typical preheating range is 790 to 815°C (1450 to 1500°F). For delicate parts or more complex sections, an initial preheat of around 704 to 760°C (1300 to 1400°F) may be used. The part should remain at preheat until the temperature is equalized throughout the whole section.
Austenitizing	In many standard industrial cycles, 1010°C (1850°F) is used as the reference hardening temperature for balanced properties. A common rule is 20 to 30 minutes plus additional time based on section thickness, or about 30 minutes per inch for sections over 1 inch thick. If the hardening temperature is too low or the soak is too short, H13 may not reach full hardness. If the temperature is too high, toughness can drop.
Quenching	For very large sections, an interrupted oil quench may be used, though it carries a higher risk of distortion. H13 should not be water quenched. The quench is usually interrupted when the steel reaches about 50 to 66°C (125 to 150°F), and the part is then transferred immediately to tempering.
Tempering	Double tempering is standard practice, and a third temper may be used in some cases. A practical guideline is 2 hours per inch of the thinnest cross-section, with a minimum of 2 hours per cycle. The normal tempering range is best kept between 510 and 620°C (950 and 1150°F). The part should cool back to room temperature between tempers.

Common H13 Heat Treatment Problems and Causes

This section is more useful when organized by failure mode rather than by long theoretical explanation.

Problem	Typical Cause	Practical Result
Quench cracking	Delayed tempering, severe quench, overheating, poor part geometry	Cracks after quench or shortly after cooling
Distortion	Thermal gradients, residual machining stress, poor support	Warping, bending, size change
Surface decarburization	Heating in an unprotected atmosphere	Soft surface and poor wear resistance
Low hardness or soft spots	Underheating, short soak, insufficient cooling in heavy sections	Weak hardness response
Low toughness or embrittlement	Improper tempering or poor heavy-section quenching response	Premature brittle failure
Grinding cracks	Excessive grinding heat after heat treatment	Shallow crack network and rapid service failure

Heat Treatment Considerations for Large H13 Blocks and Dies

Sections above about 305 mm (12 inches) may no longer respond adequately to standard air cooling.

Slow cooling in the core may produce bainite instead of martensite and may also promote grain-boundary carbide precipitation, which lowers toughness.

This is why large-section H13 may require interrupted oil quenching, hot salt methods, or high-pressure gas quenching rather than simple still-air treatment.

In many cases, rough machining before hardening is more realistic than finishing all details first and expecting minimal distortion afterward.

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. H13 is supplied in the annealed condition in round bar and flat bar with mill test certificates to EN 10204 3.1.

Reference data compiled from published H13 heat treatment sources and the Aobo Steel H13 tool steel heat treatment guide.

CONTACT

EMAIL
sales@aobosteel.com

WHATSAPP
[+86 180 6294 5370](https://api.whatsapp.com/send?phone=8618062945370)

WEB
aobosteel.com



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