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420 Stainless Steel Heat Treatment Guide

Preheating, austenitizing, quenching and tempering for 420 stainless steel, with the tempering temperatures and the hardness they leave. Reference summary of published 420 practice, not a heat treatment specification and not an Aobo Steel standard.

Reference only. Aobo Steel supplies 420 stainless steel 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.

420 Stainless Steel Heat Treatment Process at a Glance

Process Stage	Typical Range or Method	Purpose	Practical Note
Cleaning	Before heating	Remove oil, grease, and residues	Dirty surfaces may damage corrosion resistance and surface quality
Protective atmosphere	Vacuum, neutral atmosphere, or neutral salt bath	Reduce oxidation and decarburization	Important for polished parts, molds, and corrosion-resistant applications
Preheating	About 650°C / 1200°F	Reduce thermal shock	Especially useful for large, complex, or precision parts
Austenitizing	About 954–1010°C / 1750–1850°F	Prepare the steel for hardening	Higher end may be used for maximum hardness and corrosion resistance
Soaking	About 30 minutes per inch of greatest section thickness	Heat the section uniformly	Avoid unnecessary over-soaking
Quenching	Air or oil	Form hardened martensite	Choose by part size, shape, and hardness requirement
Tempering	Depends on required properties	Adjust hardness, toughness, and stability	Temper immediately after quenching
Double tempering	Often used for critical parts	Improve stress relief and stability	Cool to room temperature between tempers

Data source, the Aobo Steel 420 Stainless Steel Heat Treatment Guide.

420 Stainless Steel Tempering Chart

Tempering Temperature	Approximate Hardness	Typical Direction	Main Caution
150°C / 300°F	About 52 HRC minimum	High hardness, edge retention, wear resistance	Lower toughness
204°C / 400°F	About 50 HRC minimum	General high-hardness applications	Requires proper quenching
250°C / 480°F	Often above 50 HRC	Plastic molds, polished parts, corrosion-resistant hardened parts	Final hardness depends on prior hardening
316°C / 600°F	About 48 HRC minimum	Moderate hardness with better toughness	Hardness begins to drop
400–450°C / 750–840°F	Around 450 HB or about 47 HRC in some spring tempers	Special spring or property requirements	Should not be used as a general tempering range
427–566°C / 800–1050°F	Generally avoided	Not recommended for most applications	May reduce impact strength and corrosion resistance
593°C / 1100°F and above	Lower hardness	Higher toughness applications	Significant hardness loss

When preheating matters

Part Condition	Reason Preheating Matters
Large sections	Reduces temperature difference between surface and core
Thin or uneven sections	Reduces distortion risk
Sharp corners or complex shapes	Reduces cracking risk
Precision mold parts	Improves dimensional stability
Previously hardened parts	Reduces thermal shock during re-hardening

Air or oil quenching

Quenching Method	Best Used For	Advantage	Caution
Air quenching	Complex, irregular, or precision parts	Lower distortion and cracking risk	May be too slow for some heavy sections
Oil quenching	Heavier sections or parts needing stronger hardening response	Faster cooling and higher hardening response	Higher distortion and cracking risk

Common Heat Treatment Mistakes with 420 Stainless Steel

Mistake	Result	Better Practice
No clear property target	Wrong tempering direction	Define whether the priority is hardness, toughness, corrosion resistance, polishability, or dimensional stability
Poor surface cleaning	Surface damage or reduced corrosion resistance	Clean oil, grease, and residues before heating
No protective atmosphere	Scaling or decarburization	Use vacuum, neutral atmosphere, or neutral salt bath when surface quality matters
Skipping preheating	Higher risk of distortion or cracking	Preheat around 650°C / 1200°F before austenitizing
Wrong quenching method	Cracking, distortion, or insufficient hardness	Select air or oil by section size and geometry
Cooling too slowly	Reduced corrosion resistance	Control cooling through the critical range
Delaying tempering	Quench cracking risk	Temper soon after quenching
Tempering in the danger range	Lower impact strength and corrosion resistance	Avoid about 427–566°C / 800–1050°F unless a qualified procedure requires it
Single temper on critical parts	Lower stress relief and stability	Use double tempering for precision or critical parts
Chasing maximum hardness only	Brittle parts or reduced corrosion performance	Match tempering temperature to the application

Data source, the Aobo Steel 420 Stainless Steel Heat Treatment Guide.

420 Stainless Steel Heat Treatment Direction by Application

Application	Main Requirement	Heat Treatment Direction	Practical Note
Cutlery and blades	Hardness and edge retention	Austenitize properly, quench, then use low-temperature tempering	Avoid excessive tempering temperature if sharpness is required
Surgical and dental instruments	Hardness, polishability, corrosion resistance	Use low-temperature tempering and good surface protection	Surface quality is critical
Plastic molds	Polishability, hardness, corrosion resistance	Low-temperature tempering, often around 204–250°C / 400–480°F	Avoid high-temperature tempering if corrosion resistance matters
Wear parts	Hardness and abrasion resistance	Harden fully and temper in a lower range	Do not reduce hardness unless toughness is required
Shafts, gears, and rollers	Strength and toughness balance	Use an application-specific tempering temperature	Maximum hardness is not always the best target
Springs or tougher components	Toughness over peak hardness	Higher tempering temperature may be used	Hardness will be lower
Complex precision parts	Dimensional stability	Preheat carefully, consider air quenching, and use double tempering	Avoid severe quenching when cracking risk is high

Aobo Steel, tool steel supplier

Aobo Steel supplies forged tool steel and stainless 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. 420 stainless steel is supplied with mill test certificates to EN 10204 3.1.

Reference data compiled from published 420 stainless steel heat treatment sources and the Aobo Steel 420 Stainless Steel Heat Treatment Guide.

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