

1.2510 Mold Steel: A Complete Guide to Properties, Processing Tips, and Precautions



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What is 1.2510 Mold Steel?

1.2510 Mold Steel is a high-carbon, low-alloy cold work mold steel complying with the German DIN standard, and it corresponds to the Chinese grade CrWMn. It boasts excellent hardenability, minimal quenching deformation and outstanding wear resistance, making it a widely used material for precision cold stamping, shearing and forming molds in the cold work machining field.

Key Properties of 1.2510 Steel

- **Minimal deformation (core advantage):** The dimensional stability is extremely high, and the size remains almost unchanged after quenching. This makes it especially suitable for high-precision molds that require strict dimensional tolerance control.
- **Moderate toughness:** It has better impact resistance than Cr12 series high-alloy cold work steels. It is not easy to chip under medium and small impacts, but it is not suitable for heavy-duty stamping of thick plates or high-strength materials.
- **Medium wear resistance:** Its wear resistance is far better than ordinary carbon steel, but inferior to high-wear-resistant steels such as Cr12MoV. It is ideal for small and medium batch production of mold parts.
- **Exceptional machinability:** It performs smoothly in turning, milling, grinding and other machining processes, without excessive tool wear, which helps improve processing efficiency and reduce processing costs.
- **Good hardenability:** It can be fully hardened by oil quenching, and the heat treatment process is simple and easy to operate. After standard quenching and tempering, its hardness can reach HRC 58-62 to meet working requirements.

- **High cost-effectiveness:** It has a well-balanced combination of performance, and its price is more affordable than high-alloy cold work mold steels. It is a cost-effective preferred choice for small and medium-sized precision cold molds.

1.2510 Steel Performance Parameter Tables

1. Chemical Composition of 1.2510

Element	Standard Range (wt.%)	Typical Content (wt.%)	Core Function
C	0.90-1.05	0.95	Improve material hardness and wear resistance, ensure the strength of the steel matrix
Si	0.15-0.35	0.25	Deoxidize the molten steel, enhance the strength and hardness of the steel without reducing toughness
Mn	1.00-1.20	1.10	Improve hardenability and wear resistance, refine pearlite to optimize material structure
P	≤0.035	≤0.035	Harmful impurity, strict control of content is required to avoid reducing material toughness
S	≤0.035	≤0.035	Harmful impurity, controlled content to prevent affecting material toughness and surface quality
Cr	0.50-0.70	0.60	Improve hardenability, wear resistance and slight corrosion resistance of the steel
V	0.05-0.15	0.10	Refine grain size, enhance material toughness and wear resistance, prevent grain coarsening
W	0.50-0.70	0.60	Improve red hardness and high-temperature strength, maintain hardness under slight heating

2. Physical Properties of 1.2510 (Inherent Material Properties)

Performance Index	Numerical Range	Unit	Remarks
Density	7.85	g/cm ³	At room temperature (approx. 20 °C)

Elastic Modulus	193	GPa	Quenched and tempered to 62 HRC at room temperature
Thermal Conductivity	30.0	W/(m·K)	At room temperature (approx. 20°C)
Specific Heat Capacity (approximate)	41	J/(kg·K)	Typical value near room temperature (reference to similar tool steels)
Resistivity	Approx. 0.31-0.35	$\mu\Omega\cdot m$	At room temperature (approx. 20°C), soft annealed state
Average Linear Expansion Coefficient	12.1	$10^{-6} / ^\circ C$	Temperature range: 20-100°C
Average Linear Expansion Coefficient	12.9	$10^{-6} / ^\circ C$	Temperature range: 20-200°C
Average Linear Expansion Coefficient	13.3	$10^{-6} / ^\circ C$	Temperature range: 20-300°C
Average Linear Expansion Coefficient	14.0	$10^{-6} / ^\circ C$	Temperature range: 20-400°C
Average Linear Expansion Coefficient	14.4	$10^{-6} / ^\circ C$	Temperature range: 20-500 °C
Average Linear Expansion Coefficient	14.8	$10^{-6} / ^\circ C$	Temperature range: 20-600 °C
Average Linear Expansion Coefficient	14.9	$10^{-6} / ^\circ C$	Temperature range: 20–700 °C

3. Mechanical Properties of 1.2510 (Force Response Characteristics)

Performance Index	Numerical Range	Unit	Remarks
Brinell Hardness	≤ 190-230	HB	Soft annealed state (delivery condition), after annealing at 740-770°C and furnace cooling
Rockwell C Hardness	34.0-64.0	HRC	Quenched and tempered state, specific hardness depends on tempering temperature (150-650°C)

Working Hardness	58–62	HRC	Recommended working hardness, obtained after standard quenching and tempering at appropriate temperature
Elastic Modulus	210	GPa	Typical value at room temperature after quenching to 62 HRC
Compressive Yield Strength (0.2%)	1350-2200	MPa	Quenched and tempered state, tested at room temperature, value increases with hardness (50-62 HRC)
Tensile Strength (Rm)	≥ 880	MPa	Typical minimum value after quenching and tempering
Yield Strength (Rp0.2)	≥ 680	MPa	Typical minimum value after quenching and tempering
Elongation (A)	≥ 21	%	Typical minimum value after quenching and tempering
Impact Energy (KV)	≥ 21	J	Typical minimum value after quenching and tempering, indicating moderate toughness
Density	7.85	g/cm ³	Typical value at room temperature (20°C)
Thermal Conductivity (20°C)	30	W/(m·K)	Typical value at room temperature
Linear Expansion Coefficient (20–100°C)	12.1	10 ⁻⁶ /°C	Average expansion coefficient in the range of room temperature to 100°C

Typical Applications of 1.2510 Mold Steel

The following table directly lists the application scenarios, fields, specific uses and key remarks of 1.2510 mold steel for quick demand matching:

Application Field	Specific Use	Remarks
Cold stamping molds	Blanking dies, punching dies, trimming dies	Suitable for cold stamping of thin plate (≤3 mm) low carbon steel, copper and aluminum materials, mainly for small precision parts processing
Shearing molds	Scissor dies, trimming dies, cold shear blades, bar shearing cutters	Applicable for shearing plates ≤5 mm or profiles ≤10 mm, requiring balanced wear resistance and impact resistance

Drawing molds	Small and medium-sized drawing dies, drawing punches, blank holders	Used for drawing thin-walled parts (≤ 2 mm) or aluminum alloy parts, with good anti-cracking and wear resistance
Bending molds	V-type bending dies, U-type bending dies, continuous bending dies, thin shrapnel bending dies	Suitable for bending plates ≤ 4 mm or continuous thin plate bending, with good chipping resistance and small deformation
Cold extrusion molds	Small cold extrusion dies, copper and aluminum soft metal cold extrusion dies	For cold extrusion of copper and aluminum materials with thickness ≤ 4 mm, requiring uniform hardness and dimensional stability
Thread-forming molds	Thread rolling dies, thread rolling cutters	Suitable for thread rolling of carbon steel and non-ferrous metal parts ≤ 12 mm, with good processability and wear resistance
Precision electronic molds	Terminal stamping dies, connector forming dies, precision progressive die inserts, electronic connector stamping dies	For high-precision stamping of small electronic parts, relying on its minimal quenching deformation and high dimensional accuracy
Measuring tools and precision parts	Gauges, block gauges, micrometer measuring rods, dial gauge probes, watch part forming molds	Used for precision measuring tools and small precision parts forming, with ultra-high dimensional stability
Tool molds	Hand tool forming molds (screwdriver bits, utility knife blades), hardware tool edge forming molds	For cold forming of ordinary hand tools, suitable for non-high-temperature working conditions, balanced wear resistance and toughness
Other cold work molds	Cold heading dies (small fasteners), embossing dies, wire drawing dies, shearing cutters, textile machinery wear-resistant parts	For cold heading, embossing and wire drawing of small fasteners, with good toughness and dimensional stability
Low-cost medium-batch molds	Zinc alloy die casting mold small inserts, small powder metallurgy pressing molds, rubber mold cavities, furniture hardware molds	Suitable for low-temperature, low-load and medium-batch production, with high cost performance and easy processing

Not Recommended Application Scenarios for 1.2510

Limited by its own performance characteristics, 1.2510 cannot adapt to harsh working conditions such as high temperature, heavy impact and high wear. The table below lists unsuitable fields and alternative

material suggestions:

Not Recommended Field	Specific Situation	Working Condition	Alternative Material Suggestion
Hot work molds	Die casting molds, hot forging dies, hot extrusion dies, hot shearing dies, hot heading dies	Working temperature exceeds 200°C, repeated heating and cooling, alternating cold and hot cycles	H13 (SKD61), 8407 and other special hot work mold steels
Large/large section cold work molds	Large automobile panel blanking dies, large drawing dies (diameter > 300 mm), large cold bending dies	Section thickness >50 mm, insufficient hardenability leads to uneven core hardness	Cr12MoV, DC53 and other cold work steels with better hardenability
High wear resistance molds	High-precision progressive dies, cemented carbide forming dies, coin stamping dies, tile molds	Extremely high wear resistance requirements, long-term harsh friction working conditions	Cr12 series (Cr12MoV), SKH-9 high-speed tool steel
High-impact load molds	Thick plate blanking dies, thick steel plate shear blades, high-strength bolt cold heading dies	Subject to repeated strong impact loads, large deformation resistance and impact force	6CrW2Si, Cr5Mo1V and other high-toughness cold work mold steels
Ultra-high precision molds	Ultra-precision electronic connector molds, precision gear forming dies, precision continuous stamping dies	Dimensional tolerance ≤ 0.01 mm, requiring extreme long-term dimensional stability	High-grade CrWMn, DC53 and other ultra-stable mold steels
High-polishing plastic molds	Transparent plastic injection molds, high-gloss home appliance shell molds, optical part molds	Requiring mirror polishing effect, high surface finish and no pitting defects	S136, NAK80 and other high-purity stainless mold steels
Corrosive environment molds	Acidic plastic injection molds, outdoor molds, corrosive metal powder forming molds	Long-term contact with acidic, salt spray and other corrosive media	4Cr13, S136H and other corrosion-resistant mold steels
Large plastic molds	Large automobile interior molds, large home appliance shell injection	Single mold weight >500 kg, requiring overall uniform hardness and good	P20, 718H and other pre-hardened plastic mold steels

	molds	toughness	
High deformation resistance cold extrusion molds	Stainless steel and high-strength steel cold extrusion molds	High forming pressure, large deformation resistance, heavy-duty cold extrusion working conditions	Cr12MoV, DC53 high-wear-resistant cold work steels

Key Performance Reference (Unsuitability Interpretation)

Performance Index	Typical Value	Brief Interpretation
Working Hardness	58-62 HRC	Hard enough at room temperature, but hardness decays rapidly at high temperature
Thermal Conductivity	30 W/(m·K)	Slow heat dissipation, prone to thermal fatigue and softening under hot working conditions
Impact Energy	≥21 J	Medium toughness, cannot withstand strong impact and heavy load stamping
Linear Expansion Coefficient (20-100°C)	12.1 ×10 ⁻⁶ /°C	Thermal expansion is obvious, not suitable for ultra-high precision temperature change working conditions

Recommended Cutting Tools for 1.2510 Processing

Processing Stage	Coating Selection Priority	Key Tool Parameters	Recommended Brands
Annealed state (soft material) rough machining	TiN, TiCN coating	Cemented carbide end mill (4-flute preferred), high feed efficient cutting, good impact resistance	Zhuzhou Diamond (YG8N), Sandvik, Mitsubishi, Zigong Great Wall
Annealed state (soft material) finishing	TiAlN coating	Integral cemented carbide end mill or ball end mill, sharp edge to ensure surface finish	Walter, Zhuzhou Diamond (YBM253), Sandvik
Tempered state (pre-hardened, HRC20-30) rough machining	TiCN coating (suppress built-up edge)	High-toughness WC-Co cemented carbide tool, good anti-fracture and wear resistance	Zhuzhou Diamond (YC30S, YBG202), Walter (F4040 series)

Tempered state (pre-hardened, HRC20-30) finishing	TiAlN coating	Coated cemented carbide tool, excellent high-temperature wear resistance	Hitachi, Walter, Mitsubishi (VP15TF)
Quenched state (hard material, HRC55-62) finishing	CBN (cubic boron nitride) or ceramic tools	PCBN insert/integral end mill, low cutting speed, anti-chipping edge design	Sandvik (CBN200), Element Six, Kyocera, Kennametal (KBN100)

1.2510 CNC Machining Parameter Selection Logic

All parameters are for reference only, please adjust appropriately according to the actual rigidity of machine tools, tools and processing requirements before formal use.

Core Dimension	Selection Logic	Practical Parameters (specific numerical range by scenario)
Cutting Speed (Vc)	The higher the material hardness, the lower the cutting speed to avoid tool burning. High-quality coated tools and CBN superhard tools can adopt higher speed; rough machining focuses on efficiency, finishing focuses on stability.	· Annealed state rough machining: 110 - 160 m/min· Annealed state finishing: 130 - 170 m/min· Pre-hardened state rough machining: 90 - 130 m/min· Quenched state finishing: 80 - 200 m/min (CBN/PCD tools)
Feed Rate (F)	High feed can be used for rough machining with large cutting depth; reduce feed appropriately for finishing, long tool overhang or hard material machining to prevent vibration and chipping.	· Annealed state rough machining: 150 - 300 mm/min· Annealed state finishing: 50 - 150 mm/min· Pre-hardened state semi-finishing: 150 - 220 mm/min· Quenched state finishing: 60 - 120 mm/min
Cutting Depth (ap)	Rough machining can take large cutting depth to remove allowance quickly; hardened materials and finishing should adopt small cutting depth to avoid tool damage and ensure dimensional accuracy.	· Annealed state rough machining: 2.0 - 4.0 mm· Annealed state finishing: 0.2 - 0.5 mm· Pre-hardened state rough machining: 1.0 - 2.5 mm· Quenched state finishing: 0.05 - 0.3 mm
Spindle Speed (S)	Calculated according to cutting speed and tool diameter; reduce speed appropriately for equipment with poor rigidity to avoid vibration and deformation.	· Annealed state rough machining (Φ12-16 tool): 2190 - 4248 rpm· Annealed state finishing (Φ6-10 tool): 4139 - 9020 rpm· Pre-hardened state rough machining (Φ12 coated tool): 2389 - 3450 rpm· Quenched state finishing (Φ4-6 CBN tool): 4246 - 15915 rpm
Cooling Method	Adequate cooling is required for all processing stages. Rough machining uses cost-effective emulsion; hardened material finishing prefers cutting oil or oil mist for precise temperature control.	· Annealed/pre-hardened rough machining: High-pressure emulsion or water-soluble coolant· Annealed/pre-hardened finishing: Cutting oil or oil mist cooling· Quenched state processing: Pure cutting oil or oil cooling· High-speed finishing: Spindle internal cooling is preferred
Tool Path Strategy	Climb milling is preferred to improve tool life and surface quality; use helical interpolation for deep groove machining; adopt small step size for complex surface finishing.	· Plane/contour machining: Climb Milling· Deep cavity roughing: Helical Interpolation or Z-Level Roughing· Surface finishing: Z-level finish, step size 0.1-0.3 mm· High-precision finishing: Enable high-speed precision instruction, arc transition path

FAQs about 1.2510 Mold Steel

1. What should I do if the 1.2510 mold is easy to chip during blanking?

This failure is mainly caused by excessive thermal stress after heat treatment or stress concentration at

sharp mold edges. Solutions: Conduct staged preheating before quenching to reduce internal stress; add a small rounded corner (R0.1-R0.3 mm) on the mold cutting edge; temper immediately after quenching to fully release residual stress inside the material.

2. What should I do if the 1.2510 mold wears too fast and has a short service life?

The fast wear is usually due to insufficient surface hardness or mismatched material for the processed workpiece. Solutions: Conduct surface nitriding treatment to increase the surface hardness and wear resistance layer; adjust the overall hardness to HRC60-62 via reasonable heat treatment; use special lubricating oil during processing to reduce friction and wear.

3. How to control excessive deformation of the 1.2510 mold after quenching?

Traditional oil quenching is likely to cause uneven cooling and large deformation. Solutions: Replace the heat treatment process with isothermal quenching to improve dimensional stability; carry out deep cold treatment after quenching to stabilize the internal structure and minimize quenching deformation.

4. What should I do if the 1.2510 drawing mold always sticks to the material and scratches products?

The base material of 1.2510 has poor anti-sticking performance. Solutions: Carry out TD treatment or chrome plating on the mold cavity surface to improve anti-sticking and wear resistance; polish the cavity surface to mirror finish; use special drawing lubricating oil during processing to reduce adhesion.

5. Why can't the hardness of 1.2510 mold meet the standard after tempering?

The unqualified hardness is mostly caused by excessively high tempering temperature or inaccurate furnace temperature. Solutions: Calibrate the tempering furnace temperature first; lower the tempering temperature to 180-200°C, conduct twice tempering treatments, and ensure sufficient tempering duration each time.

6. How to prevent 1.2510 mold from cracking during quenching?

Mold cracking is mainly caused by excessive temperature difference during quenching or sharp corners without chamfering. Solutions: Grind all sharp corners into chamfers during rough machining; after quenching heating, air cool for a few seconds first instead of immersing in cooling oil immediately, to slow down the cooling speed and avoid thermal shock cracking.



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