SKD11 Tool Steel Properties, Machining Parameters, and Application Guide

moldsteells	Author: moldsteells Website: moldsteells.com Service: Moldsteells provides one-stop mold steel supply, cut-to-size, and CNC finishing services.

What Is SKD11 Mold Steel?

SKD11 is a high-carbon, high-chromium cold-work tool steel defined by the Japanese JIS standard, equivalent to the Chinese grade Cr12MoV. With a chemical composition of approximately 1.5% carbon and 12% chromium, SKD11 achieves ultra-high hardness of HRC 58–64 and excellent wear resistance. Sections up to 100 mm can be fully hardened, making it suitable for stainless steel stamping, cold extrusion, and precise electronic forming, with production cycles exceeding 100,000 strokes. In the annealed condition, SKD11 offers good machinability.

Main Characteristics of SKD11 Steel

- **High Hardness and Wear Resistance:** Quenched hardness reaches HRC 58–64. Chromium carbides provide excellent abrasion resistance, ideal for stainless steel and high-strength steel stamping dies.
- **Excellent Hardenability:** Mo and V refine grains, enabling full hardening for sections ≤100 mm.
- **High Compressive Strength:** Room-temperature compressive strength reaches 2500–2800 MPa, suitable for cold heading dies.
- **Balanced Toughness:** U-notch impact toughness of 18–25 J, reducing chipping risks.
- **Good Machinability (Annealed State):** Hardness ≤235 HBW after annealing, improving rough machining efficiency.

SKD11 Chemical Composition

Element	Typical Content (%)	Standard Range (%)	Main Function

C	1.50	1.40–1.60	Forms carbides, improves hardness and wear resistance
Cr	12.00	11.00–13.00	Enhances wear resistance and hardenability
Mo	1.00	0.80–1.20	Grain refinement and thermal stability
V	0.35	0.20–0.50	Forms hard carbides, improves wear resistance
Si	0.30	≤0.40	Deoxidation and strengthening
Mn	0.40	≤0.60	Improves hardenability and toughness
P	≤0.025	≤0.030	Impurity, causes grain boundary embrittlement
S	≤0.020	≤0.030	Impurity, forms inclusions
Ni	Trace	≤0.50	Slightly improves toughness
Cu	Trace	≤0.25	Improves corrosion resistance

Physical Properties of SKD11

Property	Value	Unit	Remarks

Hardness (After Heat Treatment)	58–64	HRC	Typical heat-treated hardness
Compressive Strength	2500–2800	MPa	Room temperature
Bending Strength	3800–4200	MPa	Room temperature
Impact Toughness	18–25	J	U-notch, room temperature
Thermal Conductivity (100°C)	29.3	W/(m·K)	Heat transfer capability
Annealed Hardness	≤235	HBW	Machining condition

Typical Applications of SKD11 Mold Steel

- Stainless steel and high-strength steel stamping dies
- Cold extrusion and progressive dies
- Precision electronic connector molds
- Cold heading dies for bolts and nuts
- Fine blanking and exact cutting dies
- Powder metallurgy forming dies
- Wear-resistant parts for reinforced plastic molds

Applications Not Recommended for SKD11

- Large-size or high-impact dies
- Hot working molds (above 250°C)
- Corrosive or humid environments
- Ultra-precision and mirror-polishing molds
- Complex large cavity molds

Recommended Cutting Tools for SKD11 Machining

Machining	Tool Type	Coating	Key	Recommende

Stage		Priority	Parameters	d Brands
Rough Machining (≤HRC40)	Micro-grain carbide end mills, indexable cutters	TiCN > AlCrN > TiAlN	Speed: 60–120 m/minFeed per tooth: 0.1–0.2 mmDepth: 0.3–0.8 mm	ZCC, Jinjian, Sandvik, Mitsubishi, Kennametal
Semi-Finishing (HRC40–55)	Long-neck carbide end mills	TiAlSiN > AlTiN > AlCrN	Speed: 40–80 m/minFeed: 0.08–0.15 mmDepth: 0.1–0.3 mm	ZCC, Kyocera, Sumitomo, Walter
Finishing (HRC55+)	CBN / PCD / Precision Carbide	Uncoated CBN/PCD	Speed: 80–120 m/minFeed: 0.05–0.1 mm	Sumitomo, Kyocera, Sandvik
Deep Hole Machining	Internal coolant carbide drills	TiAlN > DLC	Speed: 80–150 m/minPeck drillingPressure: 10–15 MPa	Guhring, Sandvik, ZCC

SKD11 Machining Parameter Choice Logic

- Tool priority: CBN > Carbide > HSS
- For every 5 HRC increase, reduce speed by 10–15%
- Better machine rigidity allows higher cutting speed
- Corner areas require 30% feed reduction

Common Machining Problems and Solutions

1. Why Does SKD11 Crack Easily?

Due to high residual stress and network carbides, SKD11 has a 30% higher risk of cracking than standard Cr12 steels.

Solution: Quenching at 1020°C, triple tempering at 180°C, spheroidizing annealing, and radius design (R ≥ 0.8 mm).

2. Severe Work Hardening After Machining

Surface hardness may exceed HRC65 after cutting.

Solution: Intermediate tempering, high-feed semi-finishing, and manual polishing.

3. Excessive Heat Treatment Deformation

Volume growth during martensitic transformation reaches 4.5%.

Solution: Step preheating, staged quenching, cryogenic treatment, and aging.

4. Dimensional Drift After Storage

Residual austenite may reach 15–20%.

Solution: Deep cryogenic treatment, dual-temperature tempering, and low-temperature aging.

SKD11 Steel Technical Data PDF Download

Please contact us to obtain the complete SKD11 technical datasheet.

moldsteells	Author: moldsteells Website: moldsteells.com Service: Moldsteells provides one-stop mold steel supply, cut-to-size, and CNC finishing services.