



EXELL S-7 SMDQ | Mold & Die Steel



ELLWOOD

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EXELL S-7 SMDQ MOLD & DIE STEEL

ExELL S-7 SMDQ was developed by ELLWOOD Specialty Steel as a premium tooling quality chromium-molybdenum alloy tool steel for die and mold applications.

ExELL S-7 SMDQ is characterized by:

- Excellent cleanliness
- Very good homogeneity
- High toughness
- Good impact and wear resistance
- Very good polishability
- Good flame and hardening properties
- Good dimensional stability during hardening

TYPICAL ANALYSIS

C	0.50	Mn	0.70
Si	0.30	Cr	3.25
S	0.005max	Mo	1.50

APPLICATIONS

ExELL S-7 SMDQ is very suitable for heavy duty blanking and forming tools because of the good combination of toughness and wear resistance.

Typical applications include upgraded tooling for:

- Stamping
- Blanking
- Punching
- Cropping
- Shearing
- Trimming
- Cold Compacting
- Heading and Other Forming Tools

With the very good cleanliness and homogenous structure, ExELL S-7 SMDQ is an excellent choice for plastic mold applications. It is regularly used for high quality plastic injection, compression, and transfer molds.

IMPROVED MANUFACTURING AND RELATED PERFORMANCE

ExELL S-7 SMDQ is manufactured to standards of premium tooling quality for optimum service performance. From melting through final product testing, the finished product is a material with excellent cleanliness, structure uniformity and mechanical properties.

Some specifics of manufacturing include:

- Special steel melting in advanced, state-of-the-art ASEA-SKF ladle metallurgy and vacuum degassing equipment
- Very precise chemistry control
- Heavy forging reductions from ingot to finished product
- Full spheroidizing anneal treatment
- Complete manufacture within facilities certified to ISO 9002

CHARACTERISTICS

PHYSICAL PROPERTIES

Coefficient of Thermal Expansion, in/in/F

- 400 F - 0.0000069

Thermal Conductivity, BTU/ft hr F

- 70 F - 17
- 400 F - 17.5

Density, lbs/cu.in.

- 70 F - 0.2833

Modulus of Elasticity, psi

- 70 F - 29,000,000
- 400 F - 28,000,000

Specific Heat, Btu/lb F

- 70 F - 0.11

Critical Temperatures

- AC₃ - 1500 F
- AC₁ - 1360 F
- Ms - 425 F



HEAT TREATMENT (General Recommendations)

SURFACE TREATMENTS

- If a locally higher hardness is required, ExELL S-7 SMDQ lends itself readily to flame or induction hardening to HRC 58 - 60 (air cooling)
- Surfaces of ExELL S-7 SMDQ can be easily chrome plated or nitrided with typical or standard methods

STRESS RELIEVING

- To minimize movement during heat treatment, a stress relieve can be used between the rough and finish machine operations of tool making before heat treatment
- After rough machining, heat treat part(s) to equalize, hold 1-2 hours. Furnace cool to 900F and air cool.

ANNEALING

- With a protective atmosphere or vacuum furnace, heat slowly to 1530F. Equalize and hold one hour per inch of thickness. Furnace cool 20F/hr-1000F and equalize. Air cool to room temp hardness-217 HB max.

TOOLMAKING

- For any additional information including flame hardening, welding, machining, grinding, EDM processing, nitriding, or polishing, please contact Ellwood Specialty Steel direct at **800.932.2188**

HARDENING AND QUENCHING

PREHEATING: Heat to 1200-1250F and equalize. Continue heating to hardening temperature.

HARDENING: Protect against oxidation and decarburization. Austenitizing (hardening) temperature range is 1690-1780F but hardening is usually at 1725F. Typical response is:

Hardening Temperature	Hold Time*	As-Quenched Hardness
1700F	60 min.	56-60 HRC
1725F	45 min.	57-61 HRC
1750F	30 min.	57-61 HRC

*Hold Time = time at temperature after tool is fully heated through.

QUENCHING:

Typical quenching media include:

- Circulating air or atmosphere
- Forced air or gas
- Step quench
- Oil (large cross sections)

Temper as soon as quenching temperature reaches 120 - 150F

TEMPERING

Temper immediately after quenching to 150F. Temper two times with intermediate cooling to room temp. ExELL S-7 SMDQ should be heated to the desired tempering temperature (400F minimum) and held a minimum of two hours. Select the tempering temperature based on required hardness (tempering between 700-800F should be avoided to avoid temper embrittlement). Air cool to room temperature. Check hardness and adjust temperature for additional tempering operations. Repeat for second temper.

Tempering Temperature	Hardness HRC
400F	58
480F	55
930F	52
1025F	49
1100F	44

MECHANICAL PROPERTIES

Approximate compressive strength versus hardness at room temperature

Hardness HRC	Compressive Yield Strength
58	300,000 psi
55	295,000 psi
50	240,000 psi
45	200,000 psi
40	160,000 psi
35	120,000 psi

Typical impact strengths at room temperature versus tempering temperature are:

Tempering Temperature	Impact Strength Charpy KCU ft lb
400F	8.5
480F	10.0
750F	6.0
930F	8.0
1025F	10.0

CAPABILITIES

Our ExELL grades are made with the advanced ASEA-SKF steel making capabilities which include an ultra-high powered electric arc furnace with subsequent state of the art ladle refining and vacuum degassing equipment for the most complete and modern ladle metallurgy technology.

- Fully integrated producer of a wide range of specialty tool steels
- Long forging history with optimum forging and heat treating practices
- Developed special material characteristics of product uniformity, cleanliness, machinability, strength, and toughness
- Production facilities certified to ISO 9002

QUALITY ASSURANCE

- Committed to offering products and services which will consistently meet or exceed all quality and performance expectations
- Provides customer and technical service that will ensure complete satisfaction
- Establishes product programs to fully support industry or customer requirements
- Extensive stock programs are supported by very short mill lead times of custom forged products
- Customized stock programs available



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