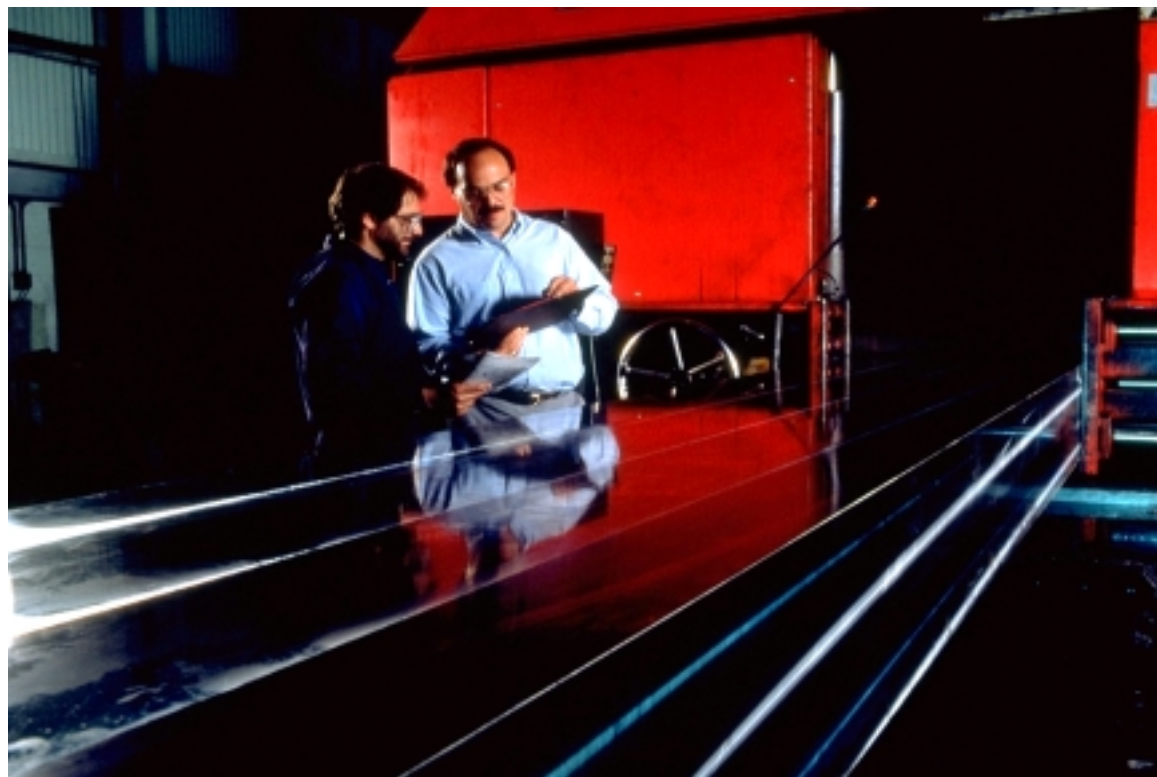


ExELL H-13 SMDQ-N Hot Work Tool Steel



ExELL H13 SMDQ-N is the premium quality H-13 hot work die steel manufactured for high demanding tooling requirements. This chromium-molybdenum-vanadium alloyed tool steel is characterized by these general properties.

- High temperature strength
- Very good toughness and ductility
- Resistance to thermal shock and fatigue
- Easy heat treatment
- Good machinability

APPLICATIONS

ExELL H13 SMDQ-N is used in die casting die applications where a higher level of heat resistance along with good toughness and ductility are required.

ExELL H13 SMDQ-N is manufactured to meet the demanding criteria of NADCA #207, Chrysler NP2080 and other specifications for premium H-13 quality.

ExELL H13 SMDQ-N is also used in most other hot work applications such as forging dies and extrusion tooling components as well as plastic molds and in critical cold or hot knife, punch or holder applications where a combination of strength and toughness are required. Typical applications and required hardness levels are:

DIE CAST TOOLING

| Part | Typical Hardness HRC |
|---------------|----------------------|
| Sprue Parts | 46 – 48 |
| Cores | 46 – 50 |
| Fixed Inserts | 46 – 50 |
| Dies | 42 – 48 |

FORGING DIES

| Work Material | Typical Hardness HRC |
|---------------|----------------------|
| Aluminum | 44 – 52 |
| Copper Alloys | 44 – 52 |
| Steel | 40 – 50 |

EXTRUSION TOOLING

| Component | Aluminum HRC | Copper HRC | Steel HRC |
|---------------|--------------|------------|-----------|
| Dies | 46 – 50 | 44 – 48 | 44 – 48 |
| Liners, stems | 42 – 50 | 42 – 48 | 42 – 48 |

Note: For applications generally involving aluminum, ExELL H-13 SMDQ-N is normally hardened from 1870F whereas for copper alloy and steel tooling, hardening from 1900F is more common.

TYPICAL ANALYSIS

| | | | |
|-----------|------|-----------|------|
| C | 0.39 | Mn | 0.35 |
| Si | 1.00 | Cr | 5.10 |
| Mo | 1.25 | V | 0.90 |



IMPROVED MANUFACTURING AND RELATED PERFORMANCE

ExELL H13 SMDQ-N is manufactured to standards of very high tooling quality for optimum service performance. Material is produced with excellent cleanliness, structure uniformity and mechanical properties. Manufacture includes:

- Special steel melting
- Very precise chemistry control
- Heavy forging reductions
- Special mill thermal treatment
- Complete manufacture, testing and quality assurance within facilities certified to ISO 9002

CHARACTERISTICS

Physical Properties:

Coefficient of Thermal Expansion, in/in/F

| | | |
|-------------|-------|----------|
| 70 - 450 F | _____ | 0.000070 |
| 70 - 1450 F | _____ | 0.000077 |

Thermal Conductivity, BTU in/ft ft hr F

| | | |
|--------|-------|-----|
| 70 F | _____ | 180 |
| 750 F | _____ | 185 |
| 1450 F | _____ | 195 |

Density, lbs/cu.in.

| | | |
|--------|-------|-------|
| 70 F | _____ | 0.281 |
| 750 F | _____ | 0.277 |
| 1450 F | _____ | 0.272 |

Modulus of Elasticity, psi

| | | |
|-------|-------|------------|
| 70 F | _____ | 29,400,000 |
| 750 F | _____ | 29,500,000 |

HEAT TREATMENT (General Recommendations)

Critical Temperatures

- Ac₁ – 1560F
- Ac₃ – 1740F
- Ms – 570F

SURFACE TREATMENTS

Surfaces of ExELL H-13 SMDQ-N can readily be chrome plated, nitrocarburized or nitrided by all commercial processes.

Care must be taken to avoid hydrogen embrittlement in chrome plating. Temper at 400F for 4 hours after plating.

Avoid excessive concentrations of nitrogen during various nitriding processes to avoid white layer and excessive network. Generally, case depths greater than 0.010" are not recommended for hot work applications.

STRESS RELIEVING

After rough machining of an annealed component, heat the part to 1200F, equalize and hold 1 – 2 hours. Furnace cool to 900F and then air cool to room temperature.

For heat treated parts, the stress relieving temperature should be at least 100-150F less than the tempering temperature used in heat treatment, so as not to lower the hardness of the part.

ANNEALING

With a protective atmosphere or vacuum furnace, heat slowly to 1560F. Equalize and hold one hour per inch of thickness. Furnace cool 20F/hr to 1100F

and equalize. Air cool to room temperature. Hardness - 229 HB maximum.

HARDENING AND QUENCHING

Protect against decarburization and oxidation during austenitizing.

Preheating: Heat to 1200F and equalize. Continue heating to 1550F and equalize. Complete heating to hardening temperature.

Hardening: Typical austenitizing range is 1850 – 1920F. Hardening temperature can be adjusted to develop added heat resistance. A hardening temperature of 1870F is normally used for most applications while 1900F can be used for increased heat resistance.

| Hardening Temperature | Hold Time* | As-Quenched Hardness, HRC |
|-----------------------|------------|---------------------------|
| 1870F | 30 min | 53± 2 |
| 1900F | 15 min | 54± 2 |

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

Quenching: Quenching should be performed as rapidly as possible without promoting excessive movement or cracking. Typical quenching media include:

- High speed gas with sufficient positive pressure in vacuum furnace
- Circulating air/atmosphere
- Martempering bath or fluidized bed at 575–1020F, then cool in air
- Warm oil

Temper as soon as quenching temperature reaches 120 – 150F.

TEMPERING

Temper immediately after quenching to about 150F. Temper a minimum of two times with intermediate cooling to room temperature.

Choose the tempering temperature to develop required hardness. ExELL H-13 SMDQ-N should be heated to the desired tempering temperature, equalized and held a minimum of two hours. Air cool to room temperature. Check hardness and adjust temperature for additional tempering operation(s). Repeat for added tempers.

Typical tempering temperature responses follow. (Use for approximate guideline only)

| Tempering Temperature | Harden 1870F HRC | Harden 1900F HRC |
|-----------------------|------------------|------------------|
| 480F | 52 | 53 |
| 1000F | 53 | 54 |
| 1050F | 51 | 53 |
| 1100F | 46 | 49 |
| 1150F | 42 | 46 |
| 1200F | 35 | 37 |

Note: Avoid tempering between 800–975F due to risk of temper embrittlement.

MECHANICAL PROPERTIES

Typical tensile data vs. hardness at RT

| | 52 HRC | 46 HRC |
|---------------------------------|---------|---------|
| Tensile Strength, psi | 260,000 | 205,000 |
| 0.2% Yield Strength, psi | 220,000 | 185,000 |
| % RA | 46 | 56 |
| % Elongation | 10 | 12 |

Typical elevated temperature tensile properties of material hardened and tempered to 46 HRC include:

| Test Temp F | Yield Strength psi | Tensile Strength psi | RA % |
|-------------|--------------------|----------------------|------|
| 1000 | 110,000 | 140,000 | 60 |
| 1100 | 85,000 | 115,000 | 70 |
| 1200 | 45,000 | 70,000 | 80 |
| 1300 | 20,000 | 30,000 | 90 |

TOOLMAKING

For any additional information including machining, welding, grinding, or EDM processing, please

contact Ellwood Specialty Steel direct at **800-932-2188**.

CAPABILITIES

Ellwood Specialty Steel is a fully integrated producer of a wide range of specialty tool steels. Our ExELL grades are made with advanced steel making capabilities.

Our steel making expertise and capability is further enhanced from a long forging history with

optimum forging and heat treating practices to develop very special material characteristics of product uniformity, cleanliness, machinability, polishability, strength, toughness, hardenability and other steel properties. All this from production facilities certified to ISO 9002.

QUALITY ASSURANCE

Ellwood Specialty Steel is committed to provide products and services which will consistently meet or exceed all quality and performance expectations. We will provide customer and technical service that will ensure complete satisfaction.

Being a very flexible integrated producer, Ellwood

Specialty Steel will establish product and stock programs to fully support special customer requirements, in addition to our standard stock programs. Manufacturing is supported by very short mill lead times for custom forged requirements and steel grades.

This information is intended to provide general data on our products and their uses and is based on our knowledge at the time of publication. No information should be construed as a guarantee of specific properties of the products described or suitability for a particular application. Ellwood Specialty Steel reserves the right to make changes in practices which may render some information outdated or obsolete. Ellwood Specialty Steel should be consulted for current information and/or capabilities.



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