# ExELL 2714 Plastic & Hot Work Tool Steel

ELLWOOD SPECIALTY STEEL

**ExELL 2714** was developed by Ellwood Specialty Steel as a special tooling quality nickel-chromium-molybdenum-vanadium steel from international standards for use in plastic and hot work tools. ExELL 2714 is recommended for tooling such as plastic molds and extrusion dies, forging dies, warm shear blades and aluminum extrusion tooling.

**PLASTIC TOOLING**
ExELL 2714 is used for a wide range of plastic injection molds, blow molds, and extrusion dies. ExELL 2714 is a material of choice to upgrade P-20 for better performance with higher hardness and higher toughness along with very good polishing and photoetching properties.

**ALUMINUM EXTRUSION TOOLING**
ExELL 2714 is an economic alternative to AISI H-13 for support tooling. With lower material cost and resulting lower tooling cost than H-13, ExELL 2714 is regularly used in aluminum extrusion tooling for:

- Die rings, bolsters, sub-bolsters, wedge blocks, tool holders, etc.

**FORGING AND OTHER APPLICATIONS**
ExELL 2714 is also used for die blocks, inserts and holders in forging and other general tooling and holder applications.

## TYPICAL ANALYSIS

| | | | |
|---|---|---|---|
| **C** | 0.55 | **Ni** | 1.65 |
| **Mn** | 0.85 | **Cr** | 1.15 |
| **Si** | 0.25 | **Mo** | 0.50 |
| **S** | 0.015 MAX | **V** | 0.10 |

## IMPROVED MANUFACTURING AND RELATED PERFORMANCE

**ExELL 2714** is manufactured to standards of special 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 finish product
- Full spheroidizing anneal treatment
- Prehardening available
- Complete testing and quality assurance within facilities certified to ISO 9002

## CHARACTERISTICS

**Physical Properties:**

**Coefficient of Thermal Expansion, in/in/F**

70 - 400 F ..... 0.0000070
70 - 600 F ..... 0.00000725
70 - 800 F ..... 0.0000075

**Thermal Conductivity, BTU in/ft ft hr F**

70 F ..... 202
650F ..... 210
1300 F ..... 215

**Machinability:** In the annealed condition, ExELL 2714 exhibits a machinability rating of 80% compared to a 1% carbon tool steel. This rating shows the material is easier to machine than AISI H-13.

**Critical Temperatures**

$Ac_1$ – 1350F
$Ac_3$ – 1420F
Ms – 445F

## HEAT TREATMENT (General Recommendations)

### STRESS RELIEVING

To minimize movement during service or heat treatment, a stress relieve can be used between the rough and finish machine operations of tool making for prehardened material or annealed material before heat treatment.

After rough machining, heat the part to 950F (for prehardened material) or 1200F (annealed material), equalize and hold 1 – 2 hours. Furnace cool to 800F, and then air cool.

### ANNEALING

With a protective atmosphere or vacuum furnace, heat slowly to 1300F. Equalize and hold one hour per inch of thickness. Furnace cool 20F/hr to 1000F and equalize. Air cool to room temperature. Hardness - 250 HB max.

## HARDENING AND QUENCHING

Preheating: Heat to 1200–1250F and equalize. Continue heating to hardening temperature.

Hardening: Protect against oxidation and decarburization. Austenitizing (hardening) temperature is adjusted to accommodate quenching medium and required hardness repsonse, temper resistance, etc.

Oil Quenching:

| Hardening Temperature | Hold Time* | As-Quenched Hardness |
|---|---|---|
| 1530 – 1590F | 30 min | 57± 2HRC |

Air Quenching:

| Hardening Temperature | Hold Time* | As-Quenched Hardness |
|---|---|---|
| 1580 – 1640F | 30 min | 55± 2HRC |

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

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

## TEMPERING

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

ExELL 2714 should be heated to the desired tempering temperature and held a minimum of two hours. Select the tempering temperature based on required hardness and prior quenching medium. Air cool to room temperature. Check hardness and adjust temperature for additional tempering operation. Repeat for second temper.

Typical tempering temperature responses are: (Use for approximate guideline only)

| Tempering Temperature | Hardness HRC Oil Quench | HardnessHRC Air Quench |
|---|---|---|
| 800F | 49 | 47 |
| 900F | 47 | 44 |
| 1000F | 43 | 40 |
| 1100F | 40 | 36 |
| 1200F | 36 | 32 |

## SURFACE TREATMENTS

If a locally higher hardness is required, ExELL 2714 lends itself readily to flame or induction hardening to 50-55 HRC (air cooling).

Surfaces of ExELL 2714 can also be easily chrome plated or nitrided by typical or standard methods.

## MECHANICAL PROPERTIES

Approximate tensile strength versus hardness at room temperature:

| Hardness HRC | Tensile Strength |
|---|---|
| 48 | 230,000 psi |
| 46 | 215,000 psi |
| 44 | 200,000 psi |
| 42 | 190,000 psi |
| 40 | 185,000 psi |
| 38 | 155,000 psi |

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

| Test Temp F | Yield Strength psi | Tensile Strength psi | RA % |
|---|---|---|---|
| 600 | 158,000 | 185,000 | 45 |
| 700 | 145,000 | 172,000 | 50 |
| 950 | 90,000 | 130,000 | 65 |
| 1100 | 32,000 | 72,000 | 85 |

## TOOLMAKING

For any additional information including welding, machining, 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 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.

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 programs to fully support industry or customer requirements. Our extensive stock programs are supported by very short mill lead times of custom forged products. Customized stock programs are and can be available for specific customer needs.



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