



ELLWOOD  
SPECIALTY  
STEEL

# ExELL HOT-DIE

## Hot Work Tool Steel

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### Surface Treatments

Surfaces of **ExELL HOT-DIE** can be nitrided by all commercial processes. **ExELL HOT-DIE** is also treated by other surface treatment and coating processes.

### Tool Making

For any additional information to include machining, welding, grinding, or EDM, 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 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.

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 9001.

## QUALITY ASSURANCE

Ellwood Specialty Steel is committed to providing 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 provider, 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.

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 Ellwood Specialty steel reserves the right to make changes in practices which may render some information outdated or obsolete.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.

## ELLWOOD SPECIALTY STEEL

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**ExELL HOT-DIE** is a premium or superior quality hot work die steel manufactured for high heat resistance with a very good level of toughness and ductility. **ExELL HOT-DIE** is produced to meet the requirements of **NADCA 207, Grade C** and other industry specifications. **ExELL HOT-DIE** is designed to offer a CVN impact strength capability similar to a high quality H-13 superior type (NADCA 207, Grade B) but offer the greatest level of heat resistance for all of the NADCA 207 grade types. Application of **ExELL HOT-DIE** will offer longer service life resulting in:

- ★ Longer tool life
- ★ Less repairs
- ★ Fewer die changes
- ★ Fewer tools
- ★ Added production time

## CHARACTERISTICS

**ExELL HOT-DIE** exhibits a combination of properties characterized by:

- ★ Very good high temperature strength
- ★ Very good toughness and ductility
- ★ High level of resistance to thermal shock and fatigue
- ★ Excellent resistance to heat checking, erosion and hot wear
- ★ Good tempering resistance

## TYPICAL ANALYSIS

C	0.38	Cr	5.20
Si	0.25	V	0.65
Mn	0.35	Mo	2.80



## APPLICATIONS

**ExELL HOT-DIE** is used in die casting die applications and related components where the best level of heat resistance is required along with good toughness and ductility. Application hardness would be comparable to the same or similar hardness levels applied to H-13 Superior.

**ExELL HOT-DIE** is used in most other hot work applications such as hot forging press dies and inserts, hot extrusion tooling and forming dies. The use of **ExELL HOT-DIE** in these tools is designed to offer added heat resistance when H-13 or similar alloys are used.





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### IMPROVED MANUFACTURING

*ExELL HOT-DIE* is manufactured to standards of very high tooling quality for optimum service performance without any excessive cost disadvantage. This tool steel grade is produced with excellent cleanliness, structure uniformity and mechanical properties.

Basic manufacturing includes:

- ★ Special steel refining and melting
- ★ Very precise chemistry control
- ★ Heavy forging reductions
- ★ Special homogenizing thermal treatments
  - ★ Most modern melting, remelting and forging equipment
- ★ Complete manufacture, testing and quality assurance within facilities certified to ISO 9001

### PHYSICAL PROPERTIES

#### Density, lbs/cu.in.

70F.....0.283  
750F.....0.278  
1450F.....0.273

#### Thermal Conductivity, BTU in/ft<sup>2</sup> hr F

70F.....185  
750F.....190  
1450F.....195

#### Modulus of Elasticity, psi

70F.....29,450,000

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

70-450F.....0.000070  
70-1450F.....0.000077

### MECHANICAL PROPERTIES

#### Tensile Properties, Room Temperature

	52 HRC	48 HRC	44 HRC
Tensile Strength, psi	275,000	235,000	205,000
0.2% Yield Strength, psi	225,000	195,000	175,000
% RA	45	48	55
% Elongation	13	14	14



### HEAT TREATMENT

#### STRESS RELIEVING

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

#### ANNEALING

With a protective atmosphere or vacuum furnace, heat slowly to 1560F. Equalize and hold 1 hour per inch of thickness. Furnace cool 20F/hr to 1100F and equalize. Cool freely in air to room temperature. Hardness will be 217 max HB.

### 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 1875 - 1900F. A hardening temperature of 1885F is normally used for most applications. Hold at hardening temperature 30 minutes.

#### Quenching

Quenching should be performed as rapidly as possible (50F/min) without promoting excess movement or cracking. Typical quenching media include:

- ★ High speed gas with sufficient positive pressure and circulation in a vacuum furnace
- ★ Warm oil flash quench
- ★ Martempering bath or fluidized bed at 575-1020F, then air cool

**Temper as soon as part reaches 120-150F**

#### Tempering

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

Choose a tempering temperature to develop required hardness. Approximate tempering response is shown in the table (do not temper in the range of 800-975F to avoid temper embrittlement):

1885F Austenitize	
Tempering Temp.	HRC
480F	53
1000F	55
1025F	55
1050F	53
1100F	52
1150F	49

*ExELL HOT-DIE* should be heated to the desired tempering temperature and held a minimum of 2 hours. Air cool to room temperature. Check hardness and adjust temperature for additional tempering operation. Repeat for added tempers.

