



**EXELL™ HOT-DIE**

**Hot Work Tool Steel**



**ELLWOOD**

YOUR METALS PARTNER, FROM MELT TO DISTRIBUTION

## EXELL™ HOT-DIE

ExELL™ Hot-Die is superior quality hot work die steel manufactured for high heat resistance with a very good level of toughness and ductility. 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 H-13 Superior (NADCA 207, Grade B) but offer the greatest level of heat resistance among all of the NADCA 207 grades.

### 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 H13-Superior.

ExELL™ Hot-Die is also used in 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 superior to H-13 or similar alloys.

Hot-Die Offers:

- Longer Tool Life
- Less Repairs
- Fewer Die Changes
- Fewer Tools
- Increased Production Time

## IMPROVED MANUFACTURING

ExELL™ Hot-Die is manufactured to standards of high tooling quality for optimum service performance without excessive cost. This tool steel grade is produced with excellent cleanliness, structure uniformity and mechanical properties.

Basic manufacturing includes:

- Special steel melting and refining
- Precise chemistry control
- Heavy forging reductions
- Special homogenizing thermal treatments
- Modern melting, remelting and forging equipment
- Complete manufacture, testing and quality assurance within facilities certified to ISO 9002

### TYPICAL ANALYSIS

C	0.36
Si	0.25
V	0.65
Mn	0.35
Cr	5.07
Mo	2.80

## PROPERTIES

### PHYSICAL PROPERTIES

**Density, lbs/cu.in.**

- 70 F - 0.283
- 750 F - 0.278
- 1450 F - 0.273

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

- 70 F - 15
- 750 F - 16
- 1450 F - 16

**Modulus of Elasticity, psi**

- 70 F - 29,450,000

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

- 70-450 F - 0.0000070
- 70-1450 F - 0.0000077

### MECHANICAL PROPERTIES

#### TENSILE PROPERTIES (ROOM TEMPERATURE)

	52 HRC	48 HRC	44 HRC
<b>Tensile Strength (psi)</b>	275,000	235,000	205,000
<b>0.2% Yield Strength (psi)</b>	225,000	195,000	175,000
<b>Percent RA</b>	45	48	55
<b>Percent Elongation</b>	13	14	14



## HEAT TREATMENT (General Recommendations)

### 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

### 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 1885F temperature 30 minutes maximum after tool is fully heated through.

### 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 vacuum furnace
- Warm oil flash quench
- Martempering bath or fluidized bed at 575-1020F, then air cool

Temper as soon as part temperature reaches 120-150F. Quenched hardness is typically HRC 54-56.

### TEMPERING:

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

Choose a tempering temperature to develop required hardness. Approximate tempering response is shown in the table.

**\*Note: do not temper in the range of 800-975F to avoid temper embrittlement.**

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.

### SURFACE TREATMENTS:

Surfaces of ExELL™ Hot-Die can be nitrided by all commercial processes. ExELL™ Hot-Die is also compatible with other surface treatment and coating processes.

### TOOL MAKING:

For additional information including welding, machining, grinding or EDM processing, please contact ELLWOOD Specialty Metals - USA direct at 800.932.2188.

### 1885F AUSTENITIZE TEMPERATURE

TEMPERING TEMPERATURE	HARDNESS HRC
1050F	53
1100F	50
1125F	45
1150F	42

## 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 machinability

## CAPABILITIES

ELLWOOD Specialty Metals - USA 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.

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 more. All this from production facilities certified to ISO 9001.

## QUALITY ASSURANCE

ELLWOOD Specialty Metals - USA is committed to providing products and services which consistently meet or exceed your quality and performance expectations. We will provide customer and technical service that will ensure complete satisfaction.

As a flexible provider, we will establish product programs to fully support industry or customer requirements. Our extensive stock programs are supported by short mill lead times of custom forged products.

Customized stock programs are available for specific customer needs.

This information is intended to provide general data on our products, 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 procedures described or suitability for a particular application. ELLWOOD Specialty Metals - USA reserves the right to make changes in practices which may render some information outdated or obsolete. ELLWOOD Specialty Metals - USA should be consulted for current information and/or capabilities.



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