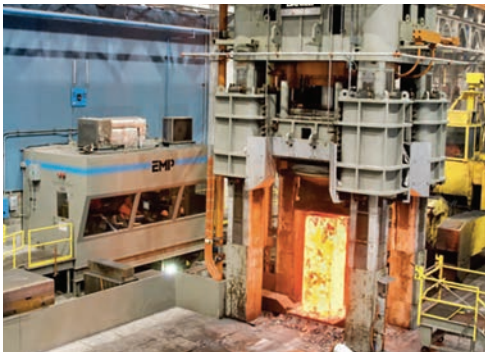
EXELL™ P-20M | Plastic Mold Steel



ELLWOOD

YOUR METALS PARTNER, FROM MELT TO DISTRIBUTION

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ExELL™ P-20M is a modified AISI P-20, premium quality Cr-Ni-Mo alloy steel which is normally supplied in pre-hardened condition. Benefits of using this alloy include:

- No heat treat cost
- No heat treat risk or time lost
- Lowest tooling costs
- Can be surface treated (nitrided, flame hardened, plated, etc.) for added surface performance

ExELL™ P-20M is produced to the highest quality standards with the following general characteristics:

- Good machinability
- Good polishability
- Good texture properties
- Uniform structure and mechanical properties
- Deep hardenability

TYPICAL ANALYSIS

C	0.35	Ni	0.80
Mn	1.50	Cr	2.00
Si	0.35	Mo	0.20

ExELL™ P-20M is used for a wide range of applications:

- Injection molds for thermoplastics
- Large compression molds
- Plastic extrusion and film dies
- Blow molds
- Zinc die cast die
- Holders for die casting dies
- Structural or engineered components with pre-hardened properties

IMPROVED MANUFACTURING AND RELATED PERFORMANCE

ExELL™ P-20M 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
- Precise chemistry control
- Heavy forging reductions from ingot to finished product
- Supplemental machining and lifting holes
- Complete testing and quality assurance within facilities certified to ISO 9001 Standard

Delivery Condition:
Hardened and Tempered

Surface Hardness Range:

	BHN	HRC
Regular	286-327	30-35
High Hard	336-371	36-40

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/ft hr F

- 70 F - 21
- 500 F - 20

Density, lbs/cu.in.

- 70 F - 0.2833

Modulus of Elasticity, psi

- 70 F - 29,700,000
- 400 F - 29,000,000

Specific Heat, Btu/lb F

- 70 F - 0.110

HEAT TREATMENT (General Recommendations)

ExELL™ P-20M is normally supplied in the pre-hardened condition. The chemistry of ExELL™ P-20M is balanced to optimize heat treatment response for both hardenability and toughness to the supplied hardness level, especially for larger mold applications. However, the following thermal treat data may be useful if stress relieving, annealing, or reheat treatment is necessary.

STRESS RELIEVING

To minimize any movement during service or tool making, stress relieving is normally performed between the rough and finish machine operations of tool making for pre-hardened material. Stress relieving is also used after any welding.

- After rough machining, heat the part to 950°F-1000°F (for pre-hardened material)
- Equalize and hold 1-2 hours
- Cool in furnace to 600°F and then air cool

Note: Ensure that prior tempering temperature is not attained or exceeded during stress relieving or hardness level of pre-hardened material will be lower.

ANNEALING

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

HARDENING AND QUENCHING

PREHEATING

- Heat to 1000-1200° F and equalize
- Continue heating to hardening temperature

Note: Heat treatment of machined parts involves a high risk of cracking. Minimize effects of thin and thick sections, sharp changes of section, machine marks, etc.

HARDENING: Protect against oxidation and decarburization. Austentizing (hardening) temperature is normally at 1560° F.

- After heating to hardening temperature, equalize and hold 30 minutes at temperature

Quenching: Oil or polymer quench *Temper as soon as quenching temperature reaches 120-150° F

TEMPERING

- Temper immediately after quenching to around 150° F
- Temper twice, with cooling to room temperature between tempers
- Air cool to room temperature. Check hardness and adjust temperature as needed for second temper
- Repeat for additional temper

Note: ExELL™ P-20M should be heated to the desired tempering temperature and held a minimum of two hours. Select the temperature based on required hardness and prior quenching medium.

Typical tempering temperature responses are:

Tempering Temperature	Hardness (Oil Quench)
850F	HRC44
950F	HRC42
1050F	HRC34
1100F	HRC32
1200F	HRC25

* Use for approximate guideline only

MECHANICAL PROPERTIES

Approximate tensile test properties of ExELL™ P-20M at hardness are:

Hardness HRC	Tensile Strength (PSI)	Yield Strength (PSI)	%Elong
32	155,000	130,000	20
36	170,000	140,000	16

SURFACE TREATMENTS

If a locally higher hardness is required, ExELL™ P-20M lends itself to flame or induction hardening to 50-55 HRC with air cooling. Surfaces of ExELL™ P-20M can easily be chrome/nickel plated or nitrided by any standard method.

TOOL MAKING

For any additional information including welding, machining, grinding or EDM processing, please contact Ellwood Specialty Steel directly 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 complete and modern ladle metallurgy technology.

We have a long history of optimum forging and heat-treating practices to develop special material characteristics of:

- Product uniformity
- Cleanliness
- Machinability
- Ability to polish
- Strength
- Toughness
- Hardenability

QUALITY ASSURANCE

ELLWOOD Specialty Steel is committed to providing consistent products and services that meet or exceed quality and performance expectations. Our excellent customer and technical services will ensure complete satisfaction.

We establish product programs to fully support industry or customer requirements. Our extensive stock programs are also supported by short mill lead times of custom forged products. Customized stock programs are available.

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ISO 9001:2015 Certified

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