



EXELL™ 15-5 PH

Stainless Mold Steel



ELLWOOD

YOUR METALS PARTNER, FROM MELT TO DISTRIBUTION

EXELL™ 15-5 PH

ExELL™ 15-5 PH was developed by ELLWOOD Specialty Metals - USA as a premium quality mold steel. ExELL™ 15-5 PH is a martensitic precipitation hardening stainless steel with certain advantages over conventional stainless mold steels.

Some of these characteristics include:

- Superior corrosion resistance
- Simple heat treatment
- Uniformity of mechanical properties
- Easy to weld
- Good dimensional stability
- Good toughness

MANUFACTURING

ExELL™ 15-5 PH is manufactured to the highest tooling quality standards for optimum service performance. From melting through final testing, the finished steel is a material with very good structure and mechanical property uniformity.

Steel manufacture specifics include:

- Vacuum Arc Remelting (VAR)
- Precise chemistry control
- Heavy forging reductions
- Solution heat treating
- Precipitation (age) hardening if requested
- Complete manufacturing in facilities certified to ISO 9002

APPLICATIONS

ExELL™ 15-5 PH is used in various tooling and engineered parts. Some typical applications include:

- Injection molds for plastics and rubbers
- Medical and food industry tooling
- Extrusion dies
- Compression molds
- Plastic processing equipment
- Engineered components

| TYPICAL ANALYSIS | |
|------------------|-------|
| C | 0.04 |
| Si | 0.30 |
| Mn | 0.70 |
| Cr | 15.20 |
| Ni | 4.80 |
| Mo | 0.25 |
| Cu | 3.70 |
| Cb | 0.30 |

CHARACTERISTICS

PHYSICAL PROPERTIES

Coefficient of Thermal Expansion, in/in/F

- 400F - 0.000006

Thermal Conductivity, BTU/ft hr F

- 70F - 11
- 400F - 13

Density, lbs/cu.in.

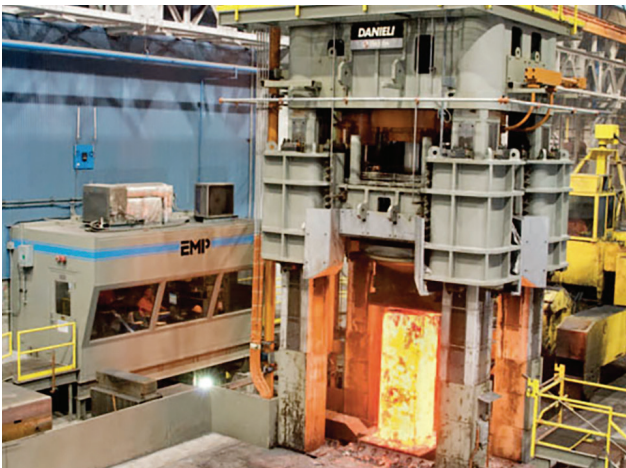
- 70F - 0.283

Modulus of Elasticity, psi

- 70F - 29,000,000
- 400F - 27,700,000

Specific Heat, BTU/lb F

- 70F - 0.11



HEAT TREATMENT (General Recommendations)

ExELL™ 15-5 PH is normally supplied in either the solution annealed condition or the precipitation hardened (aged) condition. However, the following thermal treat data may be useful if stress relieving, aging or re-solution annealing might be necessary.

STRESS RELIEVING

- Stress relieving after aging is generally not performed because of the risk of undesired aging.
- Stress relieving will simultaneously age harden the material. Thus, it is very useful to perform major machining in the solution annealed condition, then age the part as required. The aging treatment in this context will both precipitation harden and stress relieve the material.

SOLUTION ANNEALING

- Solution annealing ExELL™ 15-5 PH should not be necessary.
- However, if material requires to be re-solution annealed treat as follows: Heat to 1900F, equalize, hold 30 minutes at temperature and air quench. Movement and distortion are likely. Resulting hardness will be approximately 30-33 HRC.

AGE HARDENING

If ExELL™ 15-5 PH was not supplied in a specific aged condition (prehardened), the material can be age hardened with a temperature generally between 925° and 1150°F. The aging temperature is selected to attain a desired hardness level.

Aging is performed by uniformly heating and equalizing temperature from surface to center, holding 4 hours at temperature and air cooling. Slight shrinkage will occur after aging on the order of 0.0005 to 0.0010 inches per inch.

Most aging is accomplished by using a 975°F age or higher. A 975°F aging treatment is

used for a balance of hardness and toughness while higher temperature treatments will improve toughness and minimize over-aging, if higher service temperatures are encountered.

| AGE HARDENING | | |
|---------------|----------------|----------------|
| CONDITION | AGING TEMP (F) | HARDNESS (HRC) |
| H925 | 925 | ~42-44 |
| H975 | 975 | ~39-41 |
| H1025 | 1025 | ~38-40 |
| H1150 | 1150 | ~33-35 |

PROPERTY COMPARISONS

| FEATURE | P-20 | HOLDER | S-7 | H-13 | 420 SS | 15-5 PH |
|----------------------|--------|--------|--------|--------|--------|---------|
| TYPICAL HARDNESS | 302 HB | 293 HB | 55 HRC | 52 HRC | 50 HRC | 40 HRC |
| STRENGTH | 2 | 1 | 9 | 7 | 6 | 4 |
| WEAR RESISTANCE | 1 | 1 | 7 | 6 | 5 | 4 |
| TOUGHNESS | 8 | 4 | 3 | 3 | 2 | 6 |
| TEXTURING | 6 | 1 | 5 | 5 | 5 | 8 |
| POLISHABILITY | 3 | 1 | 6 | 7 | 7 | 6 |
| CORROSION RESISTANCE | 1 | 1 | 1 | 1 | 6 | 8 |
| MACHINABILITY* | 4 | 6 | 6 | 6 | 6 | 3 |
| WELDABILITY | 6 | 4 | 4 | 4 | 4 | 8 |
| NITRIDING ABILITY | 6 | 5 | 4 | 7 | N/A | N/A |
| FLAME HARDENING | 7 | 7 | 2 | 2 | 2 | N/A |

*Machinability of P-20, Holder, and 15-5 PH is rated in the pre-hardened condition. S-7, H-13, and 420 are rated in the annealed condition. Overall ratings are 1-10 where 1 is the lowest rating.

TOOLMAKING

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

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 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 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.

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.

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.

ELLWOOD Specialty Metals - USA 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 can be available for specific customer needs.



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