ALLOY CAST PRODUCTS, INC.

"Dependably providing all domestic and foreign marketplaces with specification quality castings for over 30 years"

SPECIALIZING IN:
Heat, Wear, and Corrosion resistant castings of:

REXALLOY®

and other fine COBALT based alloys,
as well as ALL grades of Stainless Steel.

- Prototype Development
- Short Runs
- Long Production Runs

PHONE 1-908-245-2255
FAX 1-908-245-3267

700 Swenson Drive, Kenilworth, New Jersey 07033-1317
U.S.A.
ALLOYS

Our complete REXALLOY™ line, all Cobalt based alloys and all Stainless Steels cast to any specification. (Nickel and Iron based alloys are also available)

MELTING

75-175 KW High Frequency and Low Frequency Coreless Induction Air Melts from (4) Main Furnaces. "State of the art" computer tracked high efficiency power units provide you with "Pass-Along" economies.

MACHINING SERVICES

Die, pattern and tooling manufacture. Vertical Spindle flat Grinding (up to 36" chucks). Centerless Grinding with "through-feed" and "in-feed" up to (3") outside diameter. Production Lathe work (15" swing). Production Honing and Polishing, as well as "hand polishing".

TECHNICAL SERVICES

Alloy research and development, technique and process recommendations. Chemistry and physical property testing through independent outside laboratories. Hybrid alloys created for specific needs.

CASTING TECHNIQUES AVAILABLE: (ALL STATIC)

SAND CASTING

Wood or metal patterns, with or without cores. Cold draw, hot bake Silica Sand molds for larger capacity, heavier castings. Any application.

RESIN SHELL SAND MOLD

Specially coated silica sands, round and subangular grain types, come in contact (under pressure) with HOT metal patterns. This is a Hot Draw, Hot Bake process. After curing the mold is drawn from the pattern with very faithful dimensional reproduction. Ambient temperature molds are cast producing low stress parts with high quality as cast surfaces. All applications. Restricted to smaller sized castings.

INVESTMENT CASTING

One of the oldest "lost wax" processes. Now referred to as "SOLID MOLD". Metal dies are injected with wax, these wax replica's are sprued, coated with refractories, then set into Stainless Steel Flasks where they are surrounded by an additional refractory slurry. The "SOLID MOLDS" go through a gradual drying and de-wax process to insure size and prevent distortion. Hence the term "PRECISION CASTING". Prepared molds are held in a high temperature oven in the final phase. The hot "SOLID MOLDS" are then cast. A high temperature well insulated "SOLID MOLD" will cause a slower rate of metal solidification and the castings grain structure will be relative to these desired mechanical properties produced in the as-cast state. All applications. See page 4 for illustration.

CERAMIC MOLDS

Also a "lost wax" process which begins the same way as "INVESTMENT CASTING", however the completed wax mount will be coated with several layers of ceramic bone china refractories to create a hard shell. De-waxing creates a free standing ceramic mold which will be fired and cast. Although the mold is hot, it's materials will cause a faster rate of solidification than that of "SOLID MOLD'S". This creates a slightly different grain structure allowing incredible tight tolerances to be achieved in the cast state. All applications. Expands the dimensional limitations of the "SOLID MOLD".

GRAPHITE MOLD

For an as cast quick chill to produce a desired grain structure. Mostly for tool bits and tips or other cutting application. Molds are permanent and are made of graphite. Limited applications.
**Question 1: What is RexAlloy?**

**Answer:**

RexAlloy® 33 is a standard all-purpose grade of a family of cast non-ferrous cobalt-chromium-tungsten alloys having exceptional characteristics which render it suitable for cutting tools operating at greater speeds than are possible with the high speed steels, and also for many room temperature and elevated temperature wear resisting applications. There are many grades of RexAlloy®, designed to meet varied applications. We’ll help you select the right one for your application.

**Question 2: What is its advantage over carbides and high speed tool steels?**

**Answer:**

It has a hardness of about 60 Rockwell C, which is unaffected by repeated heatings to elevated temperatures; an exceptionally high red-hardness; superior resistance to abrasive and metal to metal wear; superior corrosion resistance; the property of being completely non-magnetic; a low coefficient of friction and a high degree of dimensional stability.

**Question 3: What are the best applications for RexAlloy® cutting tools?**

**Answer:**

RexAlloy® tools offer marked economies over high speed tools, especially for those machining operations not suited for tungsten-carbide tools. RexAlloy® tools are most commonly used for roughing and semi-finishing operations when high metal removal rates are desired. In these operations and others, it is unlikely that tungsten-carbide will match the toughness of RexAlloy®, or that the super high speed steels will equal the red hardness and tool life of RexAlloy®.

**Technical Data:**

**Abrasion and Wear Resistance**

Conventional indentation hardness tests or Rockwell tests do not generally determine the relative wear resistance of RexAlloy® as compared with other materials such as tool steels. High carbon-high chrome tool steels commonly used for maximum resistance to abrasion or wear can be heat treated to about 64 Rockwell C (885 VPN). RexAlloy®, for non-cutting applications, has a hardness of about 56 Rockwell C (654 VPN). However, the hardness of the individual micro-constituents gives an entirely different picture: the primary carbides in RexAlloy® are much harder than the large carbides in high carbon-high chrome tool steel, 1810 VPN as compared to 1390 VPN, although the matrix in RexAlloy® is softer, 488 VPN as compared to 840 VPN. Thus, the conventional Rockwell tests provide an average hardness which mask the effect of hard and soft constituents in a cast heterogenous alloy of this type. It is the large surface area of massive primary high-hardness carbides which produces the wear resistant quality of RexAlloy®.

**Elevated Temperature Hardness**

RexAlloy® has a high degree of red hardness. The comparison between RexAlloy® and hardened Rex AA, 18-4-1, high speed steel is shown in the following tabulations: Hardness at temperature — BHN*

<table>
<thead>
<tr>
<th>Temperature—F</th>
<th>Tool Steels</th>
<th>RexAlloy®</th>
<th>Percent of Room Temp. Hardness Retained</th>
</tr>
</thead>
<tbody>
<tr>
<td>1200 (648.89°C)</td>
<td>18-4-1 High Speed Rex AA</td>
<td>510 (52 HRC)</td>
<td>470 (50 HRC)</td>
</tr>
<tr>
<td>1400 (760.00°C)</td>
<td>220 (18.60 HRC)</td>
<td>450 (48 HRC)</td>
<td>425 (46 HRC)</td>
</tr>
<tr>
<td>1600 (871.11°C)</td>
<td>155 (53 HRC)</td>
<td>395 (42 HRC)</td>
<td>340 (37 HRC)</td>
</tr>
<tr>
<td>1800 (982.22°C)</td>
<td>135 (N/A)</td>
<td>77.06%</td>
<td></td>
</tr>
<tr>
<td>2000 (1093.30°C)</td>
<td>110 (N/A)</td>
<td>67.88%</td>
<td></td>
</tr>
</tbody>
</table>

*Converted from BHN to Brinell at Temperature. On cooling to room temperature, RexAlloy® retains its original hardness.

**Mechanical Properties**

- Tools for Cutting Applications: 60 to 63 Rockwell C
- Parts for Non-Cutting Applications: 52 to 59 Rockwell C
- Tensile Strength, psi: 50,000 to 60,000
FORMING AND HEAT TREATMENT

REXALLOY® 33 cannot be formed in any way by hot or cold working and does not respond to heat treatment. Its high red hardness is obtained in the as-cast condition, and is not appreciably affected by heating at temperatures up to 2000 degrees Fahrenheit. However, heating some REXALLOY® tools at temperatures above 1600 degrees Fahrenheit, constantly, causes a gradual reduction in their cutting life.

GRINDING

REXALLOY® is generally finished by grinding. Any soft wheel, not coarser than 46 or finer than 60 in Grade “X” or “J”, is suitable for machine grinding REXALLOY®. Light feeds should be taken to avoid heat checking. REXALLOY® should not be quenched during grinding. Complete details on manual and machine grinding of REXALLOY® will be furnished upon request.

BRAZING

REXALLOY® is most satisfactorily joined to steel or other REXALLOY® parts by brazing. Silver brazing shim stock or wire using a paste type flux is recommended for brazing. The essentials of the process include clean ground or machined surfaces, coated with a rich mix of the flux and use of a brazing strip or shim stock between the flat faces. Heat is applied by use of an oxy/acetylene torch or induction. The base material and the REXALLOY® part are equally brought up to a temperature of about 1400°F. A stainless steel rod is used to “puddle” or move the REXALLOY® part back and forth about 1/8” or more to break up any flux or gas inclusions. The rod is used to push the REXALLOY® part into place and apply pressure until the braze alloy solidifies in cooling.

For REXALLOY® with over 1/2” square area a Tri-Met shim is recommended. This is a copper sheet to which the braze alloy has been roll-bonded on both sides. The copper does not melt during the heat cycle, it allows the REXALLOY® to cool without cracking. Handy and Harman’s cadmium free Braze 505 with 2% nickel and Handy Flux or Handy B-1 (black) flux are recommended. Shim stock, flux and Tri-Met are available from Lucas-Milhaupt, Inc. Cudahy, WI, a Handy & Harman subsidiary, 1-800-558-3856.

THE PROCESS OF INVESTMENT CASTING (CERAMIC MOLDS)

1. INJECTION MOLD DESIGN & MANUFACTURE
2. MAKE A WAX PATTERN
3. WAX PATTERN ASSEMBLY
4. DIPPED IN CERAMIC SLURRY
5. CASTING
6. PRE-HEAT BURN-OUT
7. PATTERNS ARE MELTED OUT OF MOLD
8. SIFTED ONTO REFRACOTORY GRAIN
9. CASTING ARE REMOVED FROM SPRUE
10. GATE STUBS GROUND OFF
11. SPECIFIC and NORMAL INSPECTION, QUALITY CONTROL
12. PACKAGING & DELIVERY