INTRODUCTION

The alloy is a high strength, nickel base, precipitation hardening alloy which gains its high strength through the precipitation of gamma prime as a result of titanium and aluminum additions and through solid solution strengthening from additions of chromium, cobalt, and molybdenum. Precipitated carbides provide additional strengthening by pinning grain boundaries which reduce grain boundary sliding at elevated temperatures. The alloy is used for critical parts that require high strength at elevated temperatures. It is produced by vacuum induction melting (VIM) followed by vacuum arc remelting (VAR) and/or electroslag remelting (ESR). Applications include turbine and compressor discs, shafts, spacers, turbine cases, fasteners and other miscellaneous hardware.

Super Waspaloy alloy is a higher strength, thermo-mechanically processed grade that has slightly lower carbon content and higher titanium and aluminum contents.

SPECIFICATIONS

• AMS 5704 - Forgings: solution, stabilization, and precipitation heat treated
• AMS 5706 - Forgings, bars, and rings: solution heat treated
• AMS 5707 - Forgings, bars, and rings: solution, stabilization and precipitation heat treated
• AMS 5708 - Forgings and bars: solution heat treated
• AMS 5709 - Forgings and bars: solution, stabilization and precipitation heat treated

PHYSICAL PROPERTIES

Melting Range:
2,425 to 2,565 °F (1,329 to 1,407 °C)

Density:
0.296 lbs/in³ (8.20 gm/cc)

HEAT TREATMENT

Solution treatment is at 1,825 to 1,900 °F (996 to 1,038 °C), 4 hours, water or oil quench or 1,975 °F (1,079 °C), ½ or 4 hours, air cool. Stabilization treatment is 1,550 °F (843 °C), 4 or 24 hours, air cool. Aging is at 1,400 °F (760 °C) for 16 to 24 hours, air cool.

HARDNESS

The hardness in the fully heat treated condition ranges from 34 to 44 Rockwell C.

OXIDATION & CORROSION RESISTANCE

The alloy has good oxidation resistance up to 1,600 °F (871 °C) for intermittent service where thermal cycling exists, and up to 1,900 °F (1,038 °C) for continuous service in atmospheres encountered in jet engines. The alloy has excellent resistance to stress corrosion cracking and adequate hot corrosion resistance.
**FORGEABILITY/FORMABILITY**

The alloy is hot worked from 1,850 to 2,150 °F (1,010 to 1,177 °C). Final forging reductions should be large enough to prevent critical strains, which result in catastrophic grain growth during solution annealing. The alloy should be cold formed in the solution treated conditions. Because of its high rate of work hardening, frequent anneals are necessary for severe cold forming operations.

**MACHINABILITY**

The alloy is difficult to machine in all heat treated conditions. The optimum condition for most machining operations is in the solution treated and partially aged condition where the hardness is about 30 Rockwell C. Sharp tools and rigid setups are required and positive cuts should be made using a minimum of 0.015" depth of cut to prevent work hardening. Speeds must not be too high to prevent excess heating and poor tool life.

**WELDABILITY**

The welding of this alloy is difficult. Fusion welding should be performed in the solution treated condition using inert gas welding techniques and Waspaloy filler metal. Part restraint should be minimized. In some applications, the components are overaged prior to welding to minimize cracking. After welding or brazing, the assemblies should be re-solution annealed and aged.

**SPECIAL PRECAUTIONS**

All lubricants and coolants, particularly sulfur-bearing, should be removed prior to heat treating or brazing. Forgings or parts that have been heat treated in oxidizing or sulfurous atmospheres should be machined to remove all surface attack.

### Chemical Composition

<table>
<thead>
<tr>
<th>Element</th>
<th>C</th>
<th>Mn</th>
<th>Si</th>
<th>S</th>
<th>P</th>
<th>Cr</th>
<th>Ni</th>
<th>Co</th>
<th>Fe</th>
<th>Mo</th>
<th>Ti</th>
<th>Al</th>
<th>B</th>
<th>Zr</th>
</tr>
</thead>
<tbody>
<tr>
<td>% w/w, min.</td>
<td>0.03</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>18.0</td>
<td>Bal</td>
<td>12.0</td>
<td>-</td>
<td>3.5</td>
<td>2.75</td>
<td>1.2</td>
<td>0.003</td>
<td>0.02</td>
</tr>
<tr>
<td>% w/w, max.</td>
<td>0.10</td>
<td>0.10</td>
<td>0.15</td>
<td>0.015</td>
<td>0.015</td>
<td>21.00</td>
<td>-</td>
<td>15.0</td>
<td>2.0</td>
<td>5.0</td>
<td>3.25</td>
<td>1.6</td>
<td>0.010</td>
<td>0.08</td>
</tr>
</tbody>
</table>
Data are typical, are provided for informational purposes, and should not be construed as maximum or minimum values for specification or for final design, or for a particular use or application. The data may be revised anytime without notice. We make no representation or warranty as to its accuracy and assume no duty to update. Actual data on any particular product or material may vary from those shown herein. U.S. and foreign patents; other patents pending. TM is trademark of and ® is registered trademark of ATI Properties, Inc. or its affiliated companies. ® The starburst logo is a registered trademark of ATI Properties, Inc. © 2014 ATI. All rights reserved.