NITRALLOY 135™ MODIFIED VAC-ARC®
PREMIUM NITRIDING STEEL

Typical Composition

<table>
<thead>
<tr>
<th>Element</th>
<th>C</th>
<th>Mn</th>
<th>Si</th>
<th>Cr</th>
<th>Mo</th>
<th>Al</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.40</td>
<td>0.60</td>
<td>0.30</td>
<td>1.60</td>
<td>0.35</td>
<td>1.20</td>
</tr>
</tbody>
</table>

GENERAL CHARACTERISTICS

NITRALLOY 135 MODIFIED VAC-ARC steel is a low alloy nitriding grade with moderate hardenability. It has been designed to provide a high case hardness and to maintain its core strength during the nitriding cycle. VAC-ARC remelting is employed to provide preferred ingot solidification and superior microcleanliness. Nitrалloy 135 Modified Vac-Arc steel is also produced by vacuum induction melting followed by vacuum arc remelting (VIM-VAR).

FORGING


HEAT TREATMENT

Anneal: Heat to 1700°F (927°C) and slow cool or subcritical anneal at 1250-1300°F (675-704°C).
Normalize: Heat to 1800°F (982°C) hold for 1-4 hours and air cool.
Austenitize: Heat to 1700-1750°F (927-954°C) for ½ hour per inch of cross section and quench into oil or water. Water quenching is preferred when the cross section exceeds 1 inch in thickness.
Temper: Heat to 1000-1300°F (538-704°C) depending on the desired hardness. Material should be tempered for 1 hour per inch of thickness.
Nitride: The nitriding time, temperature and method will vary depending upon the requirements of the final product. The nitriding temperature is usually between 900 and 1100°F (482 and 593°C).

APPLICATIONS

Aircraft gears, shafts, pinions, crankshafts, cams, camshafts and bolts.

FORMS AVAILABLE

Billets; hot rolled round, square and flat bars; rough turned, centerless ground or cold drawn bars.
NITRALLOY 135™ MODIFIED VAC-ARC®

TYPICAL MECHANICAL PROPERTIES (CORE)

<table>
<thead>
<tr>
<th>Size of Section in cm</th>
<th>U.T.S in ksi</th>
<th>Y.S in ksi</th>
<th>El. (%)</th>
<th>R of A (%)</th>
<th>Hardness HBW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 1½</td>
<td>3.8</td>
<td>135</td>
<td>930</td>
<td>100</td>
<td>690</td>
</tr>
<tr>
<td>1½ - 3</td>
<td>3.8 - 7.6</td>
<td>125</td>
<td>860</td>
<td>90</td>
<td>620</td>
</tr>
<tr>
<td>3 - 5</td>
<td>7.6 - 12.7</td>
<td>110</td>
<td>760</td>
<td>85</td>
<td>580</td>
</tr>
</tbody>
</table>

Mid-radius tests of fully heat treated bars. Heat treating times were dependent on section size. Hardened at 1725°F (940°C) and quench Tempered at 1200°F (648°C) and air cool The 3 and 5" bars were water quenched, all others were oil quenched.

JOMINY END QUENCH HARDENABILITY

![Jominy hardenability graph]

Jominy hardenability band based on limited data. These data should not be used for specification requirements.

SPECIFICATIONS

The following popular industry specifications are offered for general familiarization and cross-reference purposes. This list contains several air melt specifications, so indicated, as purchase of VAC-ARC material against these documents may warrant consideration. This should not be considered a complete listing.

AMS 6470 (Air Melt) 299-947-036 (Bell Helicopter)
AMS 6471 299-947-083 (VIM-VAR) (Bell Helicopter)
AMS-S-6709 (Air Melt) B50TA314 (General Electric)