Corrosion Resistant
Self-Lubricating
Rod End Bearings

NHBB

New Hampshire Ball Bearings, Inc.
A Minebea Company

ASTRO DIVISION
Customers are searching for alternatives to cadmium-plated products and that's why NHBB has become the first industry-qualified source for stainless steel rod ends.

Our stainless steel (CRES), cadmium-free, self-lubricating rod end series is the first to meet the new industry standard, AS81935/6, /7, /8 and /9. This series offers equivalent dimensions and performance to cadmium-plated AS81935/1, /2, /4, and /5 rod ends without the potential risks and regulatory burdens—including European Union environmental regulations—associated with cadmium.

The CRES rod end series is manufactured from corrosion-resistant PH13-8Mo stainless steel. PH13-8Mo combines a high level of corrosion resistance and strength, coupled with superior toughness and transverse mechanical properties. For more corrosion resistance, the ball component can also be made of PH13-8Mo stainless steel.

At NHBB's Astro Division, we manufacture products to our customers’ exacting requirements. While we are well-positioned to provide standard CRES self-lubricating rod end bearings at a competitive price, we are dedicated to supporting our customers through the design and production of custom bearings, next-up assemblies, and machined parts. Please contact Astro’s sales or engineering teams for assistance with your specific requirements.

**NHBB Part Numbering Cross Reference Examples**

<table>
<thead>
<tr>
<th>NEW STANDARD</th>
<th>CURRENT STANDARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS81935/6</td>
<td>AS81935/1</td>
</tr>
<tr>
<td>ADNEC03</td>
<td>ADNE3J</td>
</tr>
<tr>
<td>ADNEC16</td>
<td>ADNE16J</td>
</tr>
<tr>
<td>AS81935/7</td>
<td>AS81935/2</td>
</tr>
<tr>
<td>ADNC03</td>
<td>ADN3J</td>
</tr>
<tr>
<td>ADNC16</td>
<td>ADN16J</td>
</tr>
<tr>
<td>AS81935/8</td>
<td>AS81935/4</td>
</tr>
<tr>
<td>ADNEC03-382</td>
<td>ADNE3-382</td>
</tr>
<tr>
<td>ADNEC16-382</td>
<td>ADNE16-382</td>
</tr>
<tr>
<td>AS81935/9</td>
<td>AS81935/5</td>
</tr>
<tr>
<td>ADNC03-345</td>
<td>ADN3-345</td>
</tr>
<tr>
<td>ADNC16-345</td>
<td>ADN16-345</td>
</tr>
</tbody>
</table>

**DESIGNING WITH STAINLESS STEEL:**

When specifying stainless steel rod ends, we recommend paying careful attention to the material composition of mating components in order to prevent the potential development of galvanic corrosion resulting from contact of the corrosion resistant steel directly with more active (anodic) materials. If you have any questions about galvanic compatibility, please contact Astro's Product Engineering Group at 603.524.0004.
## Rod End Bearings – Self-Lubricating

### Corrosion Resistant (CRES) – AS81935/6

Wide—Male Thread

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### Materials

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Ball</th>
<th>Race</th>
<th>Liner</th>
<th>Body</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catalog No.</td>
<td>CRES 440C</td>
<td>CRES 17-4PH</td>
<td>AMS 5630</td>
<td>AMS 5643</td>
</tr>
<tr>
<td>55-62 HRC</td>
<td>28-37 HRC</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Optional ball material:

- Catalog PH13-8Mo
- No. + C
- AMS 5629
- 43 HRC minimum hardness

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### Performance Properties – Wide

<table>
<thead>
<tr>
<th>AS81935/6 Dash No.</th>
<th>No Load Rotational Breakaway Torque</th>
<th>Ultimate Static Radial Load</th>
<th>Axial Static Proof Load</th>
<th>Fatigue Load</th>
<th>Approx. Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADNEC03 -03</td>
<td>5.6</td>
<td>2,380</td>
<td>1,000</td>
<td>1,470</td>
<td>0.072</td>
</tr>
<tr>
<td>ADNEC04 -04</td>
<td>5.6</td>
<td>4,860</td>
<td>1,000</td>
<td>2,380</td>
<td>0.072</td>
</tr>
<tr>
<td>ADNEC05 -05</td>
<td>1.15</td>
<td>7,180</td>
<td>1,100</td>
<td>2,770</td>
<td>0.087</td>
</tr>
<tr>
<td>ADNEC06 -06</td>
<td>1.15</td>
<td>8,550</td>
<td>1,680</td>
<td>3,570</td>
<td>0.136</td>
</tr>
<tr>
<td>ADNEC07 -07</td>
<td>1.15</td>
<td>12,000</td>
<td>1,850</td>
<td>4,800</td>
<td>0.183</td>
</tr>
<tr>
<td>ADNEC08 -08</td>
<td>1.15</td>
<td>19,500</td>
<td>2,040</td>
<td>7,880</td>
<td>0.278</td>
</tr>
<tr>
<td>ADNEC10 -10</td>
<td>1.15</td>
<td>21,900</td>
<td>2,430</td>
<td>9,180</td>
<td>0.424</td>
</tr>
<tr>
<td>ADNEC12 -12</td>
<td>1.15</td>
<td>29,300</td>
<td>2,810</td>
<td>11,600</td>
<td>0.639</td>
</tr>
<tr>
<td>ADNEC14 -14</td>
<td>1.24</td>
<td>34,500</td>
<td>3,320</td>
<td>13,100</td>
<td>0.963</td>
</tr>
<tr>
<td>ADNEC16 -16</td>
<td>1.24</td>
<td>80,300</td>
<td>4,340</td>
<td>30,400</td>
<td>2.546</td>
</tr>
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</table>

- Based on bolt bending fatigue strength 180,000 psi.
- Shank limitation

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### Notes:

1. Bearings listed in the tables are approved for procurement to AS81935.
2. Operating temperature range per AS81935: -65 to 325 °F. Broader temperature capabilities are achievable.
3. All dimensions are in inches unless otherwise specified.

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### Optional Keyway:

-03 through -08 sizes per AS81935/3
-10 through -16 sizes per NAS 559
**Rod End Bearings – Self-Lubricating**

**Corrosion Resistant (CRES) – AS81935/7**

**Wide—Female Thread**

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**Material:**

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Ball</th>
<th>Race</th>
<th>Liner</th>
<th>Body</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catalog No.</td>
<td>CRES 440C</td>
<td>AMS 5630</td>
<td>PTFE/Fabric Bonded to Race</td>
<td>PH13-8Mo</td>
</tr>
<tr>
<td></td>
<td>CRES 17-4PH</td>
<td>AMS 5643</td>
<td>I.D. No Lub. Required</td>
<td>AMS 5629</td>
</tr>
<tr>
<td></td>
<td>55-62 HRC</td>
<td>28-37 HRC</td>
<td></td>
<td>40-44 HRC</td>
</tr>
</tbody>
</table>

- Optional ball material:
  - PH13-8Mo
  - AMS 5629
  - 43 HRC minimum hardness

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**Part Number Coding:**

- ADD ‘L’ FOR LEFT-HAND THREAD
- ADD ‘W’ FOR KEYSLOT
- ADD ‘WW’ FOR DEEP KEYSLOT
- ADD ‘C’ INDICATES PH13-8Mo BALL
- ADD ‘K’ FOR KEYSLOT
- ADD ‘L’ FOR LEFT-HAND THREAD

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**Performance Properties – Wide:**

<table>
<thead>
<tr>
<th>AS Dash No.</th>
<th>No Load Rotational Breakaway Torque</th>
<th>Ultimate Static Radial Load</th>
<th>Axial Static Proof Load</th>
<th>Fatigue Load</th>
<th>Approx. Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>M81935/7</td>
<td>In-lbs.</td>
<td>lbs.</td>
<td>lbs.</td>
<td>lbs.</td>
<td>lbs.</td>
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<tr>
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<td>-03</td>
<td>5-6</td>
<td>2,360</td>
<td>1,000</td>
<td>1,470</td>
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<td>ADNC04</td>
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<td>5-6</td>
<td>4,860</td>
<td>1,000</td>
<td>2,380</td>
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<tr>
<td>ADNC05</td>
<td>-05</td>
<td>1-15</td>
<td>7,180</td>
<td>1,100</td>
<td>3,020</td>
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<tr>
<td>ADNC06</td>
<td>-06</td>
<td>1-15</td>
<td>8,550</td>
<td>1,160</td>
<td>3,570</td>
</tr>
<tr>
<td>ADNC07</td>
<td>-07</td>
<td>1-15</td>
<td>12,000</td>
<td>1,850</td>
<td>4,800</td>
</tr>
<tr>
<td>ADNC08</td>
<td>-08</td>
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<td>19,500</td>
<td>2,040</td>
<td>8,260</td>
</tr>
<tr>
<td>ADNC10</td>
<td>-10</td>
<td>1-15</td>
<td>21,900</td>
<td>2,430</td>
<td>9,180</td>
</tr>
<tr>
<td>ADNC12</td>
<td>-12</td>
<td>1-15</td>
<td>29,300</td>
<td>2,810</td>
<td>11,600</td>
</tr>
<tr>
<td>ADNC14</td>
<td>-14</td>
<td>1-24</td>
<td>34,500</td>
<td>3,320</td>
<td>13,100</td>
</tr>
<tr>
<td>ADNC16</td>
<td>-16</td>
<td>1-24</td>
<td>80,300</td>
<td>4,340</td>
<td>30,400</td>
</tr>
</tbody>
</table>

*Based on bolt bending fatigue strength 180,000 psi.

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**Notes:**

1. Bearings listed in the tables are approved for procurement to AS81935.
2. Operating temperature range per AS81935: -65 to 325 °F. Broader temperature capabilities are achievable.
3. All dimensions are in inches unless otherwise specified.

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**Optional Keyslot:**

- For keyslot details, contact Astro’s Product Engineering Group.
**Corrosion Resistant (CRES) – AS81935/8**

**Narrow—Male Thread**

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**Part Number Coding:**
- **M81935/8**
- ADD 'L' FOR LEFT-HAND THREAD
- BALL DIA. CODE IN MULTIPLES OF 1/16 INCHES
- BALL: 440C BALL
- BORE DIA. CODE IN MULTIPLES OF 1/16 INCHES
- M81935/8
- ADD 'K' FOR KEYWAY

**Material:**
- **Catalog No.**
  - CRES 440C
  - AMS 5630
  - 55-62 HRC
  - PH13-8Mo
- **Ball Race Liner Body**
  - Catalog No.
  - AMS 5643
  - 28-37 HRC
  - AMS 5629
  - 40-44 HRC
- **Optional ball material:**
  - Catalog No.
  - PH13-8Mo
  - AMS 5629
  - 43 HRC minimum hardness
  - +C

**Performance Properties – Narrow:**
- **AS M81935/8**
- **Dash No.**
  - ADNEC03-382
  - ADNEC04-382
  - ADNEC05-382
  - ADNEC06-382
  - ADNEC07-382
  - ADNEC08-382
  - ADNEC10-382
  - ADNEC12-382
  - ADNEC14-382
  - ADNEC16-382
  - ADNEC03-382
  - ADNEC04-382
  - ADNEC05-382
  - ADNEC06-382
  - ADNEC07-382
  - ADNEC08-382
  - ADNEC10-382
  - ADNEC12-382
  - ADNEC14-382
  - ADNEC16-382

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**Notes:**
1. Bearings listed in the tables are approved for procurement to AS81935.
2. Operating temperature range per AS81935: -65 to 325 °F. Broader temperature capabilities are achievable.
3. All dimensions are in inches unless otherwise specified.

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**Optional Keyway:**
- -03 through -08 sizes per AS81935/3
- -10 through -16 sizes per NAS 559

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**Keyway Flat (G) tolerance for ADNEC03-382 is +.000/-.060.**
Rod End Bearings – Self-Lubricating

Corrosion Resistant (CRES) – AS81935/9
Narrow—Female Thread

Part Number Coding:

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Ball</th>
<th>Race</th>
<th>Liner</th>
<th>Body</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADNC03-345</td>
<td>0.3125</td>
<td>0.941</td>
<td>0.219</td>
<td>PH13-8Mo</td>
</tr>
<tr>
<td>ADNC04-345</td>
<td>0.3750</td>
<td>1.131</td>
<td>0.278</td>
<td>440C</td>
</tr>
<tr>
<td>ADNC05-345</td>
<td>0.4375</td>
<td>1.294</td>
<td>0.337</td>
<td>440C</td>
</tr>
<tr>
<td>ADNC06-345</td>
<td>0.5000</td>
<td>1.495</td>
<td>0.395</td>
<td>440C</td>
</tr>
<tr>
<td>ADNC07-345</td>
<td>0.5625</td>
<td>1.742</td>
<td>0.453</td>
<td>440C</td>
</tr>
<tr>
<td>ADNC08-345</td>
<td>0.6250</td>
<td>1.978</td>
<td>0.511</td>
<td>440C</td>
</tr>
<tr>
<td>ADNC09-345</td>
<td>0.6875</td>
<td>2.214</td>
<td>0.569</td>
<td>440C</td>
</tr>
<tr>
<td>ADNC10-345</td>
<td>0.7500</td>
<td>2.451</td>
<td>0.627</td>
<td>440C</td>
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<tr>
<td>ADNC11-345</td>
<td>0.8125</td>
<td>2.688</td>
<td>0.685</td>
<td>440C</td>
</tr>
</tbody>
</table>

Materials:

- CRES 440C
- CRES 17-4PH
- PTFE/Fabric
- Bonded to Race
- PH13-8Mo
- 440C
- 40-44 HRC

Notes:

1. Bearings listed in the tables are approved for procurement to AS81935.
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Performance Properties – Narrow

<table>
<thead>
<tr>
<th>AS No.</th>
<th>No Load Rotation Breakaway Torque</th>
<th>Ultimate Static Radial Load</th>
<th>Axial Static Proof Load</th>
<th>Fatigue Load</th>
<th>Approx. Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>M81935/9</td>
<td>Dash No.</td>
<td>lbs.</td>
<td>lbs.</td>
<td>lbs.</td>
<td>lbs.</td>
</tr>
<tr>
<td>ADNC03-345</td>
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<td>150</td>
<td>1,100</td>
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<td>-04</td>
<td>5.6</td>
<td>5,500</td>
<td>430</td>
<td>1,300</td>
</tr>
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<td>-05</td>
<td>1.15</td>
<td>8,900</td>
<td>700</td>
<td>2,000</td>
</tr>
<tr>
<td>ADNC06-345</td>
<td>-06</td>
<td>1.15</td>
<td>13,400</td>
<td>1,100</td>
<td>3,100</td>
</tr>
<tr>
<td>ADNC07-345</td>
<td>-07</td>
<td>1.15</td>
<td>18,200</td>
<td>1,400</td>
<td>4,200</td>
</tr>
<tr>
<td>ADNC08-345</td>
<td>-08</td>
<td>1.15</td>
<td>24,600</td>
<td>2,040</td>
<td>5,700</td>
</tr>
<tr>
<td>ADNC10-345</td>
<td>-10</td>
<td>1.15</td>
<td>39,500</td>
<td>2,430</td>
<td>9,200</td>
</tr>
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<td>2,940</td>
<td>13,500</td>
</tr>
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<td>-14</td>
<td>1.24</td>
<td>77,800</td>
<td>3,100</td>
<td>18,400</td>
</tr>
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<td>-16</td>
<td>1.24</td>
<td>101,000</td>
<td>3,570</td>
<td>24,000</td>
</tr>
</tbody>
</table>

Optional Keyslot:

- Standard: +0.020
- Deep: +0.020

For keyslot details, contact Astro’s Product Engineering Group.
Astro Division, Laconia, NH

Astro designs and manufactures highly specialized custom bearings, next-up assemblies, and machined parts requiring significant engineering expertise and specialty materials. Our stringent process controls and advanced planning system enable us to satisfy unique production requirements and provide improved delivery scheduling as part of our continuous improvement culture and commitment to customer satisfaction.

PRODUCTS
- Rod ends
- Sphericals
- Link assemblies
- Bushings
- Loader slot bearings
- Custom-lined parts
- Bearings up to 22” O.D.
- Next-up assemblies & machined parts

NMB, KARUIZAWA, JAPAN*
- Rod ends
- Sphericals
- Spherical roller bearings
- Self-aligning roller bearings
- Next-up assemblies & machined parts

QUALITY CERTIFICATIONS
- ISO 9001:2008
- AS9100, Rev C
- Boeing D6-82479
- FAA FAR 21.303

NADCAP
- AC7102 – Heat-treating
- AC7108 – Chemical processing
- AC7114 – Nondestructive testing
- AC7118 – Composites/bonding

ENVIRONMENTAL MANAGEMENT CERTIFICATION
- ISO 14001:2004

* Astro is the North American sales representative for products manufactured by NMB’s facility in Karuizawa, Japan, giving customers access to a global supply of high quality commercial aerospace parts.