



New Hampshire Ball Bearings, Inc.  
— A Minebea Company —

# inside track

## HiTech Expands Heat Treat Facility – Validates Carburizing Process

The HiTech Division has validated a process for carburizing steel nine short months after completing the new heat treat facility. As a result, the company is primed to supply carburized bearings to the aerospace market.

Carburizing is a case-hardening technique specified in certain aerospace applications. The material M50 NIL is typically used in high-speed main shaft engine applications where conventional through-hardened steels cannot perform. M50 NIL can handle much higher stress levels that result from the speeds involved in turbine engines.

HiTech's investment in carburizing began with the expansion of its Peterborough facility. The 11,000 sq. ft. addition, which was completed in 2005, houses the heat treatment facility and the materials testing lab. By the fall of that year, HiTech



*HiTech's new vacuum furnace.*

had relocated its furnaces, ovens and cooling units to the new space and installed a new furnace that is capable of vacuum carburizing.

The new vacuum furnace heats bearing components in an oxygen-free environment and exposes them to acetylene, a simple gaseous hydrocarbon. By carefully controlling the temperature and flow of the gas, carbon diffuses into the steel's surface. Hardening is completed when

the high-carbon surface layer is quenched, thus superimposing a case with good wear and fatigue resistance onto a tough, low-carbon steel core. This increases the metal's wear resistance and durability, which is essential in applications where fracture toughness and resistance to high-cycle fatigue is critical.

When it comes to carburizing steel, choosing a new furnace is merely the first step in a larger effort to develop the know-how. A manufacturer must also design and validate the process itself. It fell to Steve Carey, HiTech's Manager of Materials Engineering and the one who oversees the heat treatment facility, to figure out how. Steve worked steadily for nine months, consulting with a team of engineers from around the facility, to develop a robust carburizing process.

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## Precision Receives Stryker Award

New Hampshire Ball Bearings has solidified its position as a leading supplier of bearings to a major manufacturer of medical instruments.

Stryker Instruments, a division of Stryker Corporation, recently gave its "Supplier of the Year" award to the Precision Division. In addition, Precision serves as Stryker's preferred bearing supplier and technical resource on all current and new instrument products.

One key to Precision's success is its production capabilities. The Chatsworth facility is a leader in applying high-volume production methods to ultra-precision bearing designs. Paul Spencer, Precision's Operations Manager, says



*Stryker Instruments is a leading manufacturer of operating room instruments that make surgery more efficient, reduce trauma and improve techniques.*

the division has performed exceptionally well during a time of increasing demand. "Shipments to Stryker have increased, but we have managed to achieve a near perfect score with on-time deliveries and product quality."

Alan Paynter, Precision's Product Sales Manager, is not surprised by the division's performance. "Our success depends upon

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## Precision Receives Award

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timely deliveries with a focus on scheduling flexibility, coupled with unwavering quality."

Another key has been engineering support, best illustrated by Precision's fast turnaround times on prototypes. "When companies like Stryker look to build long-term relationships with suppliers, engineering support is a critical factor in that analysis," said Mike Katra, NHBB's Sales Manager for the Central Region. "Stryker looks for suppliers that can quickly adapt to change, and short-cycle prototyping is a strong indicator of that ability."

Perhaps the most important key is that of product innovation. The products that Precision supplies to Stryker must perform at ultra-high speeds under difficult, even corrosive, conditions. To ensure performance, Precision has invested heavily in R&D capabilities, including an extensive test lab. "With our test lab, we can quickly analyze the factors that extend the operational life of bearings," Alan said. "Stryker has chosen to work with us in large part because of our commitment to innovation."

Alan believes that, ultimately, Precision's success was the result of teamwork. "Everybody here deserves credit for the success we've had with Stryker," he said. "It was a total divisional effort, which was thoroughly supported by Executive Management."

## Smooth. Quiet. Advanced. Promote!

Dental bearings are the focus of a new marketing campaign launched recently by the Precision Division. The campaign, which is targeted at the dental after-market, stresses the product line's long life, consistent performance and quiet operation. The campaign reinforces the link between bearing quality and a rebuilder's bottom line. By selecting the right bearing, distributors and rebuilders can better service their customers and face fewer repairs under warranty. Ads are scheduled to appear in several issues of the industry trade publications *Proofs* and *Dental Products Report*.



## NHBB Launches Revamped Website



The new version features enhanced graphics and improved navigation. See for yourself by visiting [www.nhbb.com](http://www.nhbb.com).

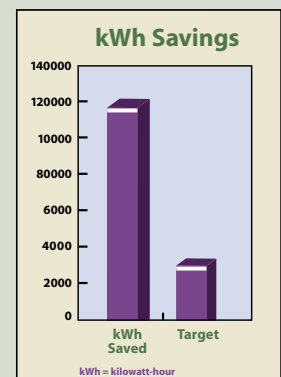
### Editor's Notes:

Stryker Instruments is known for a wide range of innovative operating room products, from leading power tools to advanced systems for waste management, irrigation, personal protection and pain management. Stryker's goal is to improve the surgical experience by developing instruments that are more reliable, more intuitive and less complicated to use.

Recent NHBB innovations, such as its patented Composite Metal Polymer, have resulted in surgical instruments that perform better, longer. Precision Division engineers incorporated silver plating into the design, taking advantage of silver's antimicrobial properties. Tests have confirmed that, in addition to extending the life of dental and surgical bearings, the silver-plated retainers can help fight the spread of hospital-related infections.

## Employees Participate in Campaign to Save Energy

Employees of New Hampshire Ball Bearings pledged to save energy by participating in the ENERGY STAR® *Change a Light, Change the World* campaign. NHBB far exceeded its goal to encourage 100 employees to change at least one incandescent bulb or fixture at home with one that has earned the government's ENERGY STAR® label. To date, NHBB has received 102 pledges to change 415 bulbs. Their actions have the potential to save more than 117,030 kWh of energy and 184,675 pounds of greenhouse gas emissions.



# Product Profile: NMB's Aircraft Self-Aligning Roller Bearings

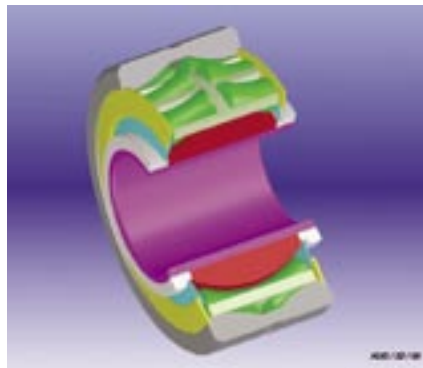
NHBB Astro markets a series of self-aligning roller bearings manufactured by Minebea Rod End Business Unit, Karuizawa, Japan (NMB hereafter). By integrating NMB's product with its own, Astro offers a complete line of rolling element and plain spherical rod end bearings suitable for the most demanding commercial aerospace applications.

NMB's self-aligning roller bearing rod end and annular products, which are covered under SAE Aerospace Standard AS8952 and AS8914, respectively, are specified in flight control linkages where rolling elements are necessary but the load requirements exceed the capacity of equivalent-sized ball bearing rod ends. Self-aligning roller bearings enable low-friction motion while maintaining a high-load capability through oscillatory and misalignment motion.

Self-aligning roller bearings possess a complex internal geometry. The compound radii of the inner and outer raceways support hourglass-shaped rollers. This design maximizes the contact areas, thereby increasing the bearing's load capacity. To increase the bearing's fatigue resistance the raceways are carburized (case hardened) and superfinished. NMB makes both single- and double-row self-aligning roller bearings; the double-row rod ends include a retainer that separates the rollers in order to reduce rolling friction, by reducing rolling element stiction.

NMB has designed a precessing roller set for double-row self-aligning roller

bearings that helps prevent fretting corrosion. This occurs when motion within the bearing is so minute that lubricant is forced away from the bearing's load zone, which can lead to a roughening of the contacting surfaces due to highly localized frictional heating. Fretting damage is usually found in flight control applications on high-speed aircraft, where the flight control surfaces controlled by the self-aligning roller bearings are subject to small-amplitude, high-speed dither motions. NMB's precessing roller set counteracts the effects of dithering by forcing the rollers to index and rotate around the outer race. This action, which is caused by the specialized geometry of the machined components, allows the rollers to continually index around the raceways, which maintains enough lube thickness to prevent fretting.



*Double-row roller geometry.*

Self-aligning roller bearing bodies, which are typically made from steels that lack corrosion resistant properties (CRES), are susceptible to corrosion caused by environmental conditions (rain, salt spray, etc.). Since the races are carburized, the body material must have certain elements in its alloy matrix to allow for the carburization process. Unfortunately, most CRES materials cannot be carburized due to their unique heat treat process. To prevent corrosion, NMB uses galvanic protective coatings, such as cadmium plating, on the outer surfaces.

NMB manufactures self-aligning roller bearings that may be re-lubricated in the field. These bearings utilize a specially designed flexible seal and lubricator fitting. Since grease protects the components from corrosion and wear, this



feature can extend the operating life of this product. Provisions for re-lubrication must be carefully evaluated, however, as lube fittings are a potential source of weakness in high-stress regions of the rod end housing.

While special features like precessing roller sets and lube fittings offer unique performance enhancements, they often come with important trade-offs. That is why it is important to consult the factory before making your final selection. To ensure that the bearing you select conforms to the requirements of your particular application, contact NHBB Astro Division, your "one stop shop" for rod end bearings.

Scott McNeil, [smcneil@nhbb.com](mailto:smcneil@nhbb.com)  
Product Engineering Manager, NHBB Astro

## *Editor's Notes:*

*Research is being conducted on the carburization of CRES materials. A new family of nitrogen steels for rolling elements and inner races, referred to as CREN steels (corrosion resistant nitrogen steels), may eventually be available for these products.*

*Zinc nickel plating is also in the early phases of testing as a replacement for cadmium, but it should be noted that zinc nickel is typically dichromate sealed and presents a hexavalent chromium hazard concern. Zinc nickel is not a totally "green" alternative to cadmium plating.*

## **Typical roller bearing rod ends include:**

- Shank connecting the bearing to the airframe assembly
- Head functioning as a housing and integral outer raceway
- Inner race with bore
- Single or double rows of rollers
- Retainer (either standard or precessing) for double rows of rollers
- Shields and seals for protecting the rolling elements from contaminants
- Optional lube fittings



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www.nhbb.com



### Rodrigo Martinez

Inside Sales Rep,  
Precision Division,  
Chatsworth, CA

Years at NHBB: 14

## NHBB in Person

Before joining New Hampshire Ball Bearings, Rodrigo Martinez worked for the company's sister division, NMB (USA), where he served first as Shipping Department lead and later as the Inside Sales Coordinator.

In his current role, Rodrigo's responsibilities vary widely: He answers inquiries from OEM customers and distributors via phone, e-mail and fax, issues quotations, tracks and expedites customer orders and reviews and responds to his customers' web-based MRP reports. Rodrigo performs these duties primarily for customers based in the Central Region of the United States. One of his key accounts is Stryker Instruments (see related article on the front page of this newsletter).

### Challenges:

"At New Hampshire Ball Bearings every day is different from the last, which makes coming to work interesting. For many of my customers, I am their first and main point of contact with the factory. It gives me a tremendous feeling of accomplishment when I am able to take care of their immediate needs and concerns.

Here in Chatsworth, our biggest challenge is responding to the increasing influx of new orders, which shows no sign of slowing down. So far, we have managed to keep pace through prompt service and improved procedures."

## Validating Carburizing Process

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To guide him in this effort, Steve adopted a systematic methodology that has been in use at NHBB for several years. Six Sigma (the method) is used to isolate and control variations in manufacturing that cause product defects. At the beginning, Steve identified the key variables that could directly affect the vacuum carburizing process. He then ran test after test, generating data on such parameters as part geometry, carburizing temperature, gas flow, and boost/diffuse pressures and times and their respective ratios. After fine-tuning variables through dozens of cycles, Steve was able to hone in on a process that produced consistent, high-quality results.

"Six Sigma was the critical piece to this whole process," Steve said. "It enabled us to carefully monitor every variable and to make adjustments to the process

until we found exactly what we were looking for."

Now that HiTech's investment in carburizing has reached a new phase, the division is working with customers to develop prototypes for new projects, and production could begin sometime next year. This is welcome news to its customers in the aerospace market. "By bringing this capability in-house, we move closer to becoming a full-range manufacturer," said HiTech's Product Sales Manager, Jim Geary. "A company that can build an increasing number of specialized products becomes that much more valuable to its customers."

As Jim's statements about this move reveal, meeting customer needs is the driving force behind this effort. "We listened to our customers," said Jim. "Since they were looking to us to expand capability on several fronts, we decided it made sense to take this on as well."

Steve Carey applauds the decision. "As a company, it's critical that we strategically acquire and develop new technology in response to ever-changing customer needs and demands."

### Editor's Notes:

In November of 2006, Steve Carey presented his validation process at a conference sponsored by ASM International's Heat Treatment Society. The conference was attended by scientists, engineers, technicians and managers from various segments of the industry, including industrial end users, commercial suppliers and academic institutions. Carey also plans to publish his findings in the Society's magazine, Heat Treating Progress.

Now that NHBB has perfected an in-house carburizing process, Steve Carey is gearing up for NADCAP accreditation. His goal is to receive accreditation for carburizing by March 2007. This will add to NHBB's current list of NADCAP accreditations, which include heat treatment, hardness testing, metallography and non-destructive testing (NDT).