



News

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BATTLING NEPTUNE

By Mark Cook and Tim Patrick – Yates Industries

It is estimated that two percent of the United States Gross Domestic Product is spent dealing with corrosion.¹ The "axis of evil" in off shore applications of hydraulic and pneumatic cylinders is water, salt and air. Over time, these elements eat away at the carbon steel rods causing corrosion and eventually requiring the cylinders to be replaced.

Although the problem occurs across all off shore applications, none is more critical to the safety and well-being of the country than the United States Navy. Within the Navy's arsenal are two elements that project power and American strength, the carrier battle groups and the elite special warfare operations group, the Navy Seals. As the front line defense and deterrent for the United States, equipment failure is not an option.

Yates Industries and Vickers & Associates have collaborated with the Navy to combat the "axis of evil" and improve the durability of cylinder rods to resist the effects of this corrosive environment.

Currently, tests are underway on cylinders used by spotting dollies aboard the USS Nimitz and USS Ronald Regan nuclear aircraft carriers. Spotting dollies² (TA-35's) are Omni directional heavy aircraft tow tractors and air-launched weapon loaders. This mission critical equipment, which services ninety fixed wing aircraft and helicopters aboard each carrier, is constantly exposed to harsh conditions.

Yates Industries engineers began by examining damaged cylinders from both ships. Based on the results of their findings, they first upgraded cylinder



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capacity from 2,000 to 3,000 PSI. They also improved the design and construction of seals to resist the effects of the saltwater environment. To tackle the corrosion problem they decided to manufacture two batches of cylinders each using a different manufacturing process.

Yates Industries manufactured the first batch of cylinder piston rods with 1045 steel, which has higher tensile and yield properties to handle buckling and direct shear loads. The rods were then turned, ground and polished to a 12 RMS finish. Finally, the rods went through a Nitrotec (Nitriding Oxidizing Protection) heat-treating process that adds surface hardness and corrosion resistance. This process is different from regular heat-treating because it only treats the top layers between 5-50 mm (0.0002"-0.002"). Extensive tests have proven that Nitrotec treated steel outperforms standard steel rods at resisting corrosion.

The other batch of cylinders was built using 17-4PH precipitation-hardened martensitic stainless steel that contains 17% chromium and 4% nickel. Hard chrome plating was added to retard rust, which is inherent in this material because of the carbon content.

"Both of these techniques are excellent choices," said Mark Cook, Vice President, Yates Industries. "There is no question that both systems will last longer than the original products. Eventually, we anticipate expanding the applications of this design to amphibious ships, Navy Seal attack boats and many other off shore applications."

¹ http://en.wikipedia.org/wiki/Stainless_steel (May 25, 2009)

² <http://www.navair.navy.mil/lakehurst/nlweb/api-defined.asp> (May 23, 2009)



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