



Environmentally Friendly Tubes Offer a Cleaner Choice.

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A new environmentally friendly precision machined tube has been developed that may replace conventional industrial hard chrome plated tubes. These tubes have little environmental impact with a waste product of water unlike conventional chrome plated products that can and do leave a negative impact on the environment. The NitroSteel® process is a thermal treatment used to harden and oxidize the surface making these tubes ideal for cylinder applications. This tubing has gained recognition and has been nominated in both 2008 and 2009 for the Presidential Green Engineering and Chemistry Awards.



These precision machined tubes are processed using a nitrided and oxidized heat treatment method that gives the surface of the tube a hard wear layer while maintaining control of the



surface finish and size. These tubes have a low co-efficient of friction and hard wear layer ideally suited for cylinder applications. The waste product generated from processing is water.

This furnace treatment entails a conventional gaseous nitro-carburizing method with an addition of a pre-cooling oxidation sequence. Nitro-carburizing takes place with a programmed atmosphere of ammonia and a carrier gas. Following the heat cycle the treated product is then furnace cooled or quenched in an oil emulsion. The surface of the steel is converted to a non-metallic epsilon iron nitride (E-FE3N), to a depth of 0.001". Following nitriding, an oxidizing atmosphere is then introduced to produce the thin (40 micro inch), corrosion resistant, black colored surface film of Fe3NO3-4. Beneath the hard (64 to 71Rc) iron nitride compound layer is a nitrogen rich diffusion zone. The iron nitride compound layer is the basis for the steel's extraordinary wear and corrosion resistance, while the diffusion zone provides some limited dent resistance. Following the heat cycle the treated product is then furnace cooled or oil emulsion quenched.

Extended Corrosion Resistance

Although these tubes nitriding parameters are similar to those used for traditional gaseous nitro-carburizing, special emphasis is given to optimizing the iron nitride layer's suitability for the subsequent oxidation. The focus is on the creation of an iron nitride layer with

controlled columnar porosity. This surface porosity, extending approximately half the depth of the iron nitride layer, allows penetration of the surface oxide film to a depth equal to the porosity. This "impregnation" of oxides into the hardened wear layer dramatically increases corrosion resistance while the oil carrying capability of the porosity itself significantly improves surface lubricity. Treated products offer a guaranteed 150 hours of corrosion resistance per ASTM B-117 Neutral Salt Spray testing and will have a Rating of 10 per ASTM B-537 which is no corrosion to the unaided eye.



Tubes and bars processed by this method are not the solution for all applications. Induction hardened chrome plated bars cannot be replaced by this process. Induction hardened tubes or bars continue to offer excellent dent resistance. Stainless steel chrome plated tubes and bars can have better corrosion resistance depending on the environment. Each application should be carefully weighed on what product gives the best performance and makes the most economic choice. Nitro-tuff tubes and bars can make sense for many applications and is a cleaner choice.

Robert Rick is Merchandising Manager for Commercial Fluid Power (a division of JRH Industries). Commercial Fluid Power produces Nitro-Tuff tubes in standard and special sizes for pneumatic cylinders.

More information can be found at the following web address:
www.CommercialFluidPower.com



To the Left: Note that the Neutral Salt Spray Test Booth is using Nitrided Rods on Cylinders for Corrosion Resistance.