

# HIGH TEMP Low Actuation Linear Motion

By Michael Quinn/LM76

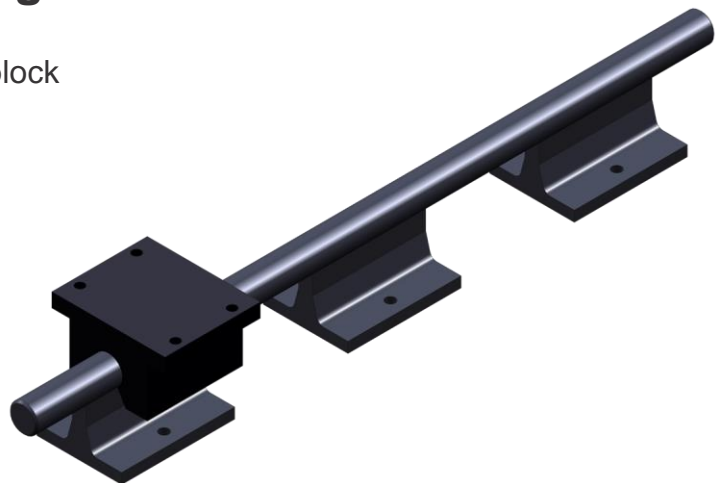
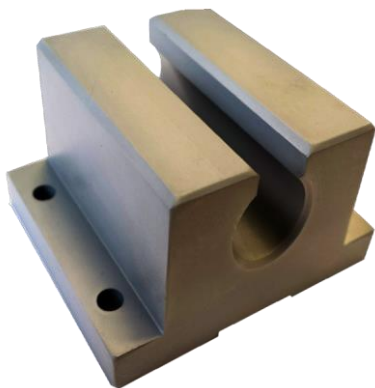
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## Naval System Employs 440C Stainless Pillow Blocks and Shaft Assembly with Armoloy™ Coating

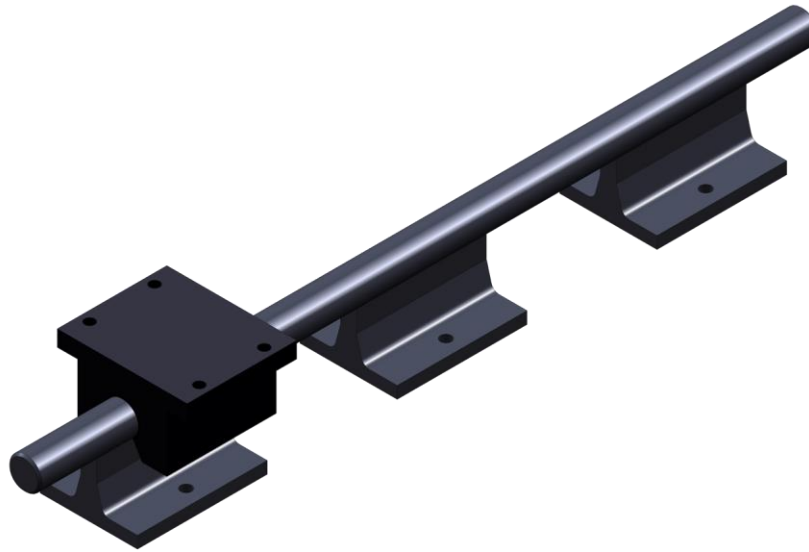
LM76 was asked to design a linear lock/unlock system for a naval design engineering firm. The requirements were straight forward:

- System must endure 2 seconds of 1000° F temperature
- Resist salt water and temperature induced corrosion
- Provide self-lubricating, low friction actuation after long periods of static positioning

The 440C Stainless/Armoloy© coated pillow block is a 1 piece, unitized design.



440C Stainless pillow block, shafting and supports are all coated with Armoloy©



## DESIGN CONSIDERATIONS

This application is beyond the capabilities of conventional linear bearings. According to Mike Quinn from LM76, “Due to the high temperature demands (2 second 1000° F) ball, roller, PTFE and polyimide sleeve bearings were ruled out immediately. We needed a design that would guarantee self-lubrication, low frictional response, resist thermal shock, resist corrosion, resist wear and easily actuate after long periods of remaining static and in a locked position.”

## MATERIALS

440C stainless was chosen because it is case hardened and very wear resistant. To further enhance hardness and corrosion resistance, we chose Armoloy’s TDC<sup>®</sup> coating. The TDC coating increased hardness from Rc60 to Rc78. Moreover, it offers superior corrosion resistance against salt water, temperature and gases. Another essential attribute was TDC’s low friction - critical to the success of this system. Since this system must operate after long periods in a static position, it is imperative that we not see any type of corrosion that would hinder or freeze actuators in place.

## THERMAL EXPANSION

To accommodate thermal shocking, LM76 engineering knew they would have to employ materials across all component levels (shaft, supports and pillow blocks) ensuring uniform expansion and contraction. Thus we chose to manufacture all components from the same material - 440c stainless.

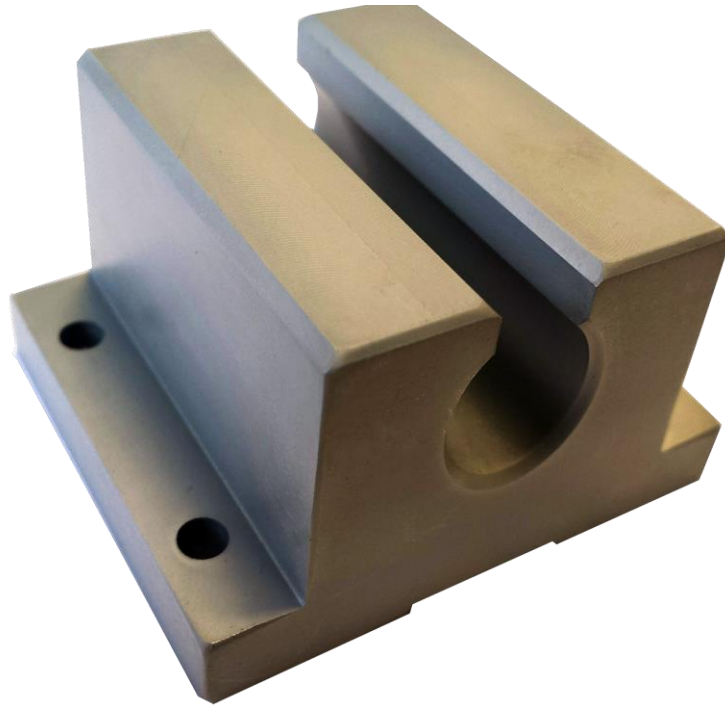
## SEGMENTED SUPPORT RAIL

With all naval applications, system weight is closely scrutinized. To meet weight criteria, we chose to machine special support segments instead of employing a continuous support rail.

## SHAFT DEFLECTION

One of the questions asked in the design phase centered on shaft deflection and how the TDC coating would respond to it. Unlike traditional surface coatings, TDC's micro structure is comprised of nodules or spheres. As the shaft deflects, the nodules rearrange themselves to accommodate the deflection. Thus there is no cracking or micro fracturing of the treated surfaces. These nodules also provide point contact loading as opposed to line-to-line contact, lowering friction.

## ONE PIECE, UNITIZED PILLOW BLOCK



The pillow blocks were machined from 440c bar stock and function as both pillow block and bearing surface. By designing a 1 piece pillow block/bearing, we cancelled out any issues regarding tolerance stack-up and dissimilar expansion rates. The Aromoly<sup>®</sup> coating gives us the frictional qualities we need for levers to move freely when actuated. Aromoly<sup>®</sup> TDC is one of the few materials that can run successfully on itself.

## APPLICATIONS

As material specialists, we see this combination (440C and Armoloy TDC) useful in the following applications:

- Fire Door Hinges
- Oven Hinges
- Salt Water Linear Actuators
- Hydro Power Plant Slew Gates
- Aerospace/Marine/Space Systems
- Weapon Systems/ Fire Arms
- Bio/Pharma/Medical (FDA Compliant)

or anywhere low actuating, self-lubricating, corrosion and heat resistant motion are application requirements . If you have an application you would like to discuss, please call Mike Quinn at 1-800-513-3163 or email: [mquinn@LM76.com](mailto:mquinn@LM76.com)