

## BIONX™

**INDUSTRY:**  
Medical

**APPLICATION:**  
Ankle Prosthesis

**COMPONENT:**  
Ball Screw

**LOCATION:**  
Massachusetts



## BACKGROUND

Nye was contacted by BionX™ Medical Technologies Inc., a leader in the field of prosthetic devices. The company was working on designing powered “smart” prostheses, in particular an ankle prosthetic. Their design used a small precision ball screw to continually adjust the angle of the prosthetic foot relative to the lower leg. The ball screw is actuated by a battery powered electric motor. BionX™ needed our help in maximizing the life of the ball screw while keeping the battery size small. Initial wear tests run by BionX™ showed better results from 2 mm ceramic balls than 2 mm steel balls.

## CHALLENGE

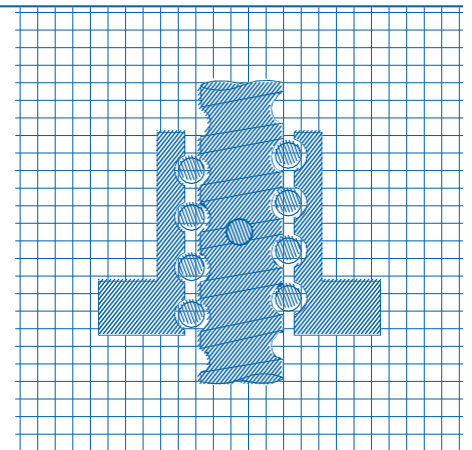
- Which low friction lubricant can help minimize the amount of energy needed to actuate the ball screw while prolonging the operation time of the battery?

## SOLUTION

### RHEOLUBE® 374A

A lithium soap thickened, medium viscosity synthetic hydrocarbon grease

- Rust-inhibited
- Excellent performance under high shock loads
- Superior corrosion performance
- Spec'd in for use lubricating the landing gears of wide-body aircrafts



## RESULTS

Using an SRV®4 simulation, Nye engineers were able to screen several greases with the provided dimensional values for the ball screw components, as well as the range of speeds and forces that the screw would see. Based on Nye's recommendation, and after some of their own testing, BionX™ finalized their ball screw design using steel balls and Rheolube® 374A in their ankle prosthetic.

| Base Oil Properties      | Conditions                | Rheolube® 374A     | Test Method |
|--------------------------|---------------------------|--------------------|-------------|
| Chemistry                |                           | PAO / Lithium Soap |             |
| Temperature Range        |                           | -54 to 177°C       |             |
| Kinematic Viscosity      | 40°C                      | 121 cSt            | ASTM D-445  |
|                          | 100°C                     | 16.9 cSt           |             |
| Viscosity Index          |                           | 159                | ASTM D-2270 |
| <b>Grease Properties</b> |                           |                    |             |
| NLGI Grade               |                           | 2                  | ASTM D-217  |
| Penetration              | Worked (60x)              | 267                | ASTM D-217  |
| 4 Ball Wear              | 1hr, 1200RPM - 40 kg load | 0.44 mm            | ASTM D-4172 |
| Low Temp Torque          | Starting (-54°C)          | 6781 g/cm          | ASTM D-4172 |
|                          | Running (1 hr, -54°C)     | 1879 g/cm          |             |
| SRV, Step Load           |                           | 2000 N             | ASTM D-5706 |

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Nye Lubricants is a leader in the innovation, formulation and provision of synthetic lubricants, enabling and improving breakthrough products and critical new technologies. We bring proven experience, deep technical knowledge and customer focus to solve our customers' toughest challenges, adding tangible value to products in a wide range of industries and applications.

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ISO 9001:2015  
 IATF 16949:2016  
 ISO 14001:2015  
 ISO 13485: 2016  
 AS 9001D