Checking Plastic and Lubricant Compatibility Helps Avoid Warranty Problems

By George B. Mock III

It was a warranty nightmare.

Several years back, a well-known manufacturer of thermostats began getting calls from distributors all over Europe. The thermostats didn't work. The problem: a tiny, a-b-s gear train failed. The design wasn't faulty; the culprit was the lubricant — a light ester-based grease. Ester molecules are so similar to a-b-s resins that they act as slow solvents. In this case, they destroyed the gear train and left the thermostats inoperable.

More recently, to reduce the cost of a small but critical hinge in one of its products, another manufacturer chose a less rigid grade of plastic and altered the molding process. The lubricant, a synthetic hydrocarbon that had worked well on the more rigid plastic hinge, was not changed — or re-tested. Typically synthetic hydrocarbons are quite compatible with most plastics. The new plastic material, however, had less cross-linking, which allowed it to physically absorb some of the lubricating oil. The absorption of the oil coupled with the internal stress common to most spring-loaded hinges, caused the new hinge to crack well within the warranty period.

The lesson is clear. Synthetic lubricants for plastic parts can be formulated to reduce wear, noise, and backlash. They can be designed to lower power consumption for robust applications and accommodate the very low torque of micro-powered gear boxes. They can even withstand temperatures from -70 to 200 °C. But when selecting a lubricant for plastic or elastomer parts, compatibility must be tested.

Certainly, there are some guidelines for the initial selection of a synthetic base oil for plastic or elastomer components. For example, esters should be used with extreme caution with polycarbonate, polyester, polyphenylene oxide, polystyrene, polysulfone, polyvinyl chloride, Buna S, Butyl, natural rubber, and neoprene. Fluoroethers and silicones, in contrast, are compatible with most plastics and elastomers. And synthetic hydrocarbons can generally be used with all plastics but not all elastomers. But selecting the right lubricant for engineered materials is as much art as it is science. Under conditions of high mechanical stress, high temperature, poor elastomer/plastic quality, or any combination of these conditions, the only way to ensure compatibility is ultimately through rigorous testing.

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Nye offers a 2' x 3' Engineers Reference Chart that rates the compatibility of synthetic base oils with more than 20 plastics and elastomers, which can serve as a guide to lubricant selections. The chart also defines common grease gellants and additives, lists grades of grease stiffness, offers a handy conversion table, estimates the cost of grease per device, and more.

For more information about lubricant and plastic compatibility or to request a free chart, contact Nye at 12 Howland Rd., Fairhaven, MA 02719. Telephone: (508) 996-6721, fax: (508) 997-5285, or at techhelp@nyelubricants.com. ■

Figure 3 – A Free Engineering Reference Chart which rates the compatibility of plastics and elastomers with various synthetic lubricant base oils, is available from Nye Lubricants by calling (508) 996-6721.

Material Compatible with Synthetic Oils & Greases*
(At Room Temperature)

	Synthetic Hydrocarbons	Esters & Polyglycols	Silicones (All Types)	Fluorinated Ethers
Plastics				
Acetals	A	A	A	A
Polyamides	A	A	A	A
Phenolics	A	A	A	A
Terephthalates	A	A	A	A
Polycarbonates	A	C	A	A
ABS resins	A	C	A	A
Polyphenylene oxide	A	C	A	A
Polysulfones	A	C	A	A
Polyethylenes	B	B	A	A
Rubbers				
Natural Rubbers	C	C	A	A
Buna S	C	C	A	A
Butyl	C	C	A	A
Ethylene propylene	C	B	A	A
Nitrile (Buna N)	A	B	A	A
Neoprene	A	C	A	A
Silicone	B	B	C	A
Fluoroelastomers	A	C	A	A

Legend: A=Usually OK; B=Be Careful; C=Causes Problems

*Caution: These compatibility ratings are intended to be guidelines for design engineers when selecting lubricants. Under high mechanical stress, high temperature, poor plastic/elastomer quality, or any combination of these conditions, compatibility can be compromised. Any synthetic lubricant used with a plastic or elastomeric component should be tested to ensure compatibility in a specific application.