

# Team 5: Alternative Non-Metallic Materials for Transfer Pump End Cap

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## Project Description

The transfer pump end cap is an important component in Stanadyne's model DB diesel fuel pumps, used in heavy equipment and trucks. The end cap holds the transfer pump components to the fuel pump head and contains the fuel inlet port. It is currently machined from 1018 bar stock steel and carbonitrided. The part's thin walls and low tolerance internal and external threads leads to difficult machining and potential distortion during heat treatment, resulting in defective parts. As a result, Stanadyne sought to replace the material for the end cap. The project goal was to identify and propose non-metallic materials that are compatible with the diesel environment, meet the structural needs, and are economically feasible. Prototypes were fabricated and tested by Stanadyne for their functionality and long term durability.

Through extensive research, it was determined that a polymer would be the best option to replace the metallic end cap. PEEK, PAI, FEP, and PTFE were deemed the four best polymeric options due to their mechanical properties, working temperature ranges, chemical compatibility, and cost to manufacture. Several tests were then carried out including fluid immersion, tensile testing, and toughness testing. An immersion test was performed on these materials to find the rate of absorption and property changes after being soaked in water, kerosene, and a mixture of fuels at elevated temperatures. Samples of each material were cut into 1" diameter disks and placed in separate glass jars filled with each testing fluid. The jars were then put in a furnace at 100-120°C and the samples' mass and volume were collected every 12 hours until steady state was reached. Tensile and toughness tests were performed before and after immersion testing to study how soaking the materials changed their mechanical properties. The top two performing materials were officially proposed to Stanadyne for them to begin prototyping.

