

## Hydraulic Fluid Efficiency Studies in Low-Speed High-Torque Motors

Paul Michael, MSOE

### **Abstract**

This paper presents an investigation of the fluid viscosity properties that affect the Low-Speed High-Torque (LSHT) efficiency of hydraulic motors. LSHT efficiency is important because it often determines the minimum displacement (size) and operating pressure of mobile hydraulic equipment. The viscosity, viscosity index, HTHS viscosity, piezoviscosity and shear stability of prototype fluids have been characterized. These hydraulic fluids have been evaluated in a full-scale hydraulic dynamometer. This dynamometer was constructed specifically for the testing of hydraulic motors. Geroler, axial piston and radial piston motors have been evaluated. Low-speed (1 RPM) testing has been performed under constant pressure conditions in accordance with the ISO 4392-1 standard test method. Startability testing has been performed under constant load conditions in accordance with ISO 4392-2. In startability and 1 RPM testing, the axial piston motor exhibited a 4 to 7 percent efficiency gain with a high viscosity index hydraulic fluid. The radial piston and geroler motors showed less of an improvement. The results of this investigation show that viscosity index can affect the torque output of hydraulic motors.

Key words, Energy efficiency, hydraulic fluids, hydraulic motors, piezoviscosity