

ENGINEERING

High-Pressure Water Hydraulic Test Rig for Research and Education

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In the vast majority of hydraulics applications, oil is used as a pressure medium, although water provides a much more environmentally friendly pressure medium. However, using tap water instead of hydraulic oil leaves a challenge in design, even if one with enormous economic and environmental advantages. Tighter seals and more expensive materials are needed for the construction of water hydraulic components due to water's low viscosity and possible phase changes under certain operating conditions. In order to further explore water as an alternative pressure medium, a new water hydraulic test rig (WHTR) developed at Maha Fluid Power Research Center will attempt to characterize water hydraulic components, while educating university students about basic principles of high-pressure hydraulic power systems on which many aircraft, agricultural, marine, and biomedical systems are based. The test rig is currently located in the Mechanical Engineering

building at Purdue University's West Lafayette campus to facilitate educational experiences. Meaningful tests on high-pressure water valves, pumps, and motors have been accomplished. Additionally, a hydraulically powered blower system with variable speed and load was implemented to experiment with a hydrostatic transmission system. The Purdue University water hydraulic test rig has the ability to be an educational tool and provide meaningful fluid power research.

Research advisor Andrea Vacca says, "The development of a green technology based on the use of tap water is an open engineering challenge in the field of high-pressure hydraulic systems. The developed test apparatus facilitates research on water hydraulic components such as pumps, motors, and valves; but in particular permits student exposure to the current research challenges of the fluid power discipline. In fall 2011, the test apparatus was utilized for lab experiences by 218 junior students in mechanical engineering, meeting the goals of the educational project 'Fluid Power in Fluid Mechanics,' supported by the National Science Foundation."