



## SERVICE PROFILE

# Oil Flushing

### Overview

Flushing of hydraulic and lubrication oil systems is employed to ensure that new rotating and hydraulic equipment will start up and operate as designed, significantly reducing the potential for premature failure. Maintenance and downtime on equipment can be minimized by performing an effective system cleaning during commissioning and following periodic maintenance and repair services. Any facility that has a low tolerance for failures can use this service key pillar for their preventative maintenance program.

When performing a cleaning job, FourQuest Energy designs the flushing paths in loops to maximize flow rates throughout the system. It is important that all parts of the system see turbulent flow regimes. Turbulent flow occurs when the Reynolds number is greater than 4000.

The Reynolds number formula is used for characterizing different flow regimes:

$$Re = \frac{\rho v D_H}{u}$$

Where:  $D_H$  is the diameter of the pipe;  $L$ , (m)  
 $v$  is the velocity of the fluid in the pipe  
 (SI units: m/s)  
 $u$  is the dynamic viscosity of the fluid  
 (Pa·s or N·s/m<sup>2</sup> or kg/(m·s))  
 $\rho$  is the density of the fluid (kg/m<sup>3</sup>)

Re < 2300 = Laminar flow  
 2300 < Re < 4000 = transition flow  
 Re > 4000 = turbulent flow

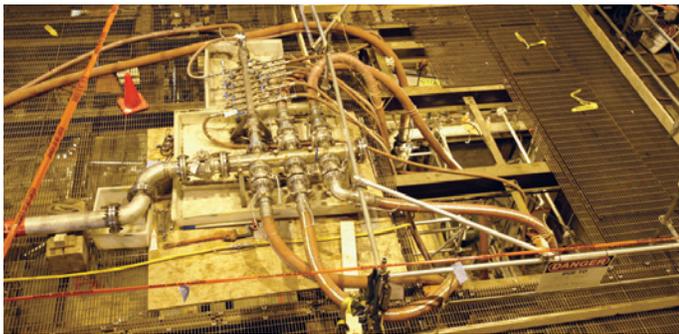


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## Contaminants

Contaminants such as water, rust, loose scale, weld slag, sand, dirt, and oils are removed from the system with a proper preoperational cleaning, reducing the wear, scoring, and damage bearings, control valves, instrumentation, and critical operating systems are subjected to. The cleaning process is normally conducted in three stages: removal of oils and varnishes, velocity flushing to remove debris, introduction and filtration of the lubrication oil. It is not unusual for the actual system oil to contain significant particulate which must also be removed to prevent damage to the operating equipment. For this reason, any oil introduced into the system after flushing must be filtered to a stringent specification dictated by the equipment vendor.



## Equipment

FourQuest Energy utilizes external flushing equipment, which has been designed by our engineers to perform circulation, heating, and filtration of oil systems. This external equipment can provide higher flow rates than the equipment onboard the installed oil system. It is also capable of controlled system heating, resulting in significantly reduced flushing times and cost for the equipment operator.

The FourQuest skid allows the flexibility and ease of installing a variety of sizes of filter media to target debris based on their dimensions. Integral to the skid is a reverse flow manifold which allows the system to be flushed in either direction by simply manipulating four valves.

During the flushing of systems, critical components are usually bypassed to prevent debris from becoming trapped. For example, the bearing housings on lubrication systems are typically bypassed to avoid having particulate drop out in the bearings. It is also advantageous to bypass the oil reservoirs, as they allow any particulate picked up in the cleaning flow to be deposited at the bottom.

## Applications within the energy industry for this lubrication and hydraulic oil flushing include:

### 1. Cleaning of hydraulic control systems

Examples are systems controlling large isolation valves on coker drums and jacking systems for offshore equipment.

### 2. Rotating equipment lubrication oil system cleaning

Examples are steam turbines, large pumps, and gas turbine systems.



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