

Mercury-Free PVT Apparatus for Thermophysical Property Analysis of Hydrocarbon Reservoir Fluids



New Fluid Analysis System for Reservoir Fluids Allows Flexibility, Easy Service, and Minimum Maintenance

Thermophysical analysis of the pressure, volume, and temperature (PVT) of reservoir fluids is essential in determining the performance and recovery factor for a given reservoir, the design of surface production and handling facilities, and the design of pipelines for remote production sites. The traditional method of PVT measurements involves mercury. This method requires elaborate and time consuming calibrations and tedious cleaning procedures and maintenance and exposes the instrument operator to the health hazards associated with mercury. Additionally, the mercury-based system does not provide information on the true state of the system.

A new mercury-free instrumentation system was developed and tested with the aid of a grant from the Department of Energy's Inventions and Innovation Program. The Mercury-Free Phase Behavior System is a completely operational research laboratory for studying thermophysical properties of reservoir fluids such as phase behavior, density, and viscosity. The system consists of two high-pressure cells connected by small-bore tubing through a sapphire sight glass. A 400-cc primary cell contains a shaft-driven piston, while a 600-cc secondary cell contains a floating piston. Phase volume measurements are performed by positioning the interface at the sight glass reference point. The system calculates the volume above and below the reference point, which corresponds to the upper- and lower-phase volumes, respectively. This method yields very accurate measurements and volume resolution of 0.008 cc/mm, compared with 1 cc/mm in a traditional mercury cell.

The system is ready for operation with minimal installation. Its modular design provides several advantages, including improved accuracy and performance, the ability to upgrade or add components, and simplified maintenance. Central computer control of the system allows a single operator to perform experiments with safety and accuracy. Cost savings occur at the oil exploration and production level where fast and accurate data can reduce the cost of the drilling program or highlight problems in fluid production.



The Mercury-Free Phase Behavior System

Overview

- ◆ Developed by Ruska Instrument Corporation
- ◆ Marketed by Chandler Engineering, LLC
- ◆ Commercialized in 1990
- ◆ 35 units installed mostly overseas (4 in the US)

Applications

Analyzes hydrocarbon fluids and allows operation of the surface recovery units at a better pressure

Capabilities

Fluid phase behavior analysis of oil reservoirs, including pressure, volume, temperature (PVT), and viscosity.

Benefits

- ◆ Provides real-time data through computer control.
- ◆ Provides graphical user interface and automation of certain tests through data acquisition and control software.
- ◆ Provides very accurate phase volume measurements.
- ◆ Provides many operator safety features.
- ◆ Avoids worker exposure to mercury and environmental contamination due to mercury spills.