



Core Flooding Apparatus

User guide

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1. Introduction

1.1. System Overview

The Core Flood System enables to perform (i) liquid permeability measurement, (ii) unsteady state 2-phase relative permeability, (iii) EOR processes such as water flooding, gas flooding and (iv) formation damage tests.

Tests can be conducted using reservoir or outcrop core material at specified temperatures and pressures.

Confining pressure can be up to 690 bar or 10,000 psi maximum. Temperature can be up to 150 °C or 302 °F maximum. The pore pressure is measured at inlet and outlet ports of the core sample by using low pressure transducers. Pressure taps are used to monitor the pressure along the core thanks to pressure transducers. Likewise, the confining pressure is measured with an analogue gauge. All wetted components are of Stainless Steel 316L. The system includes oven, pumps, vacuum pump, mud pump, valves, core holder, accumulators, back pressure regulator, transducers and data logger which are mounted on specific chassis. Operation of the system is controlled through a computer. Data logger and some basic calculations are performed through the software in the computer. The software operates under the Microsoft Windows operating system for multitasking capability. This gives the user maximum versatility in performing tests. Each of the key components is discussed in later sections of this manual.



1.2. Injection Pump

Pump is capable of constant flow operation over wide pressure range. The pumps design incorporates motor driven pistons, pressure measurement to comply with most application requirements. Fluid delivery is

possible at constant rate or constant pressure. The pump has a flow rate range adjustable from 0.001 to 100 ml/min by increment of 0.001 ml. The maximum pressure rating is 690 bar or 10,000 psi. The pump is controlled from its own front panel.

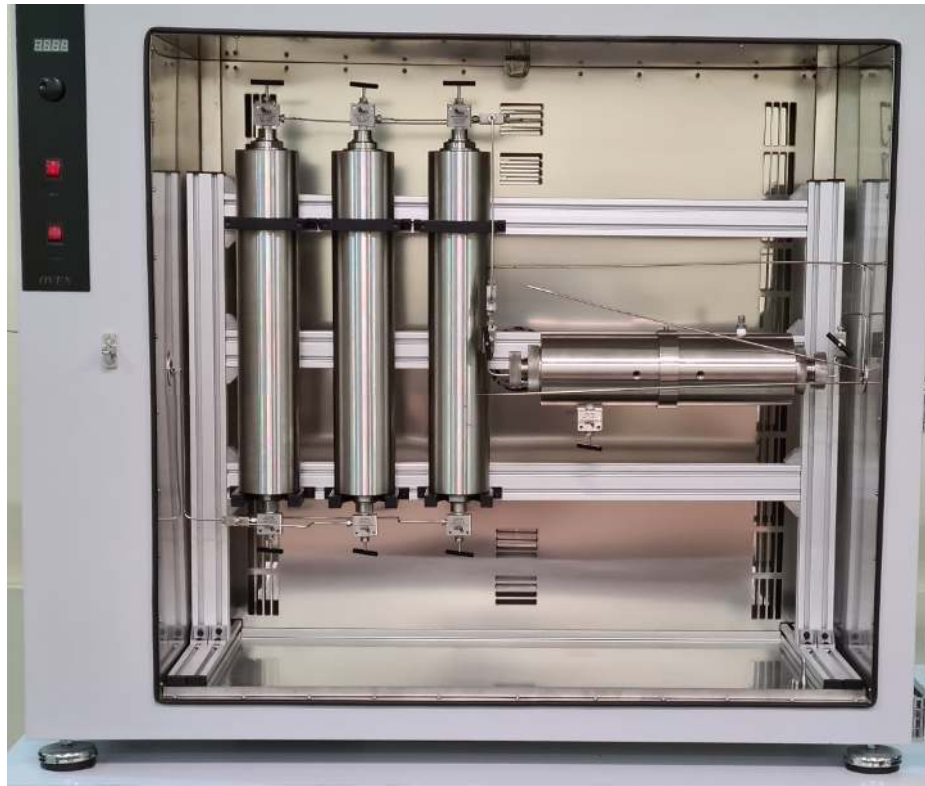


1.3. Mud Pump

The mud pump placed in the oven allows for mud fluid flowing across the face of the core sample. The pump includes a chamber with two gears rotating together. The chamber of the pump has a capacity of 100 ml. The pump automatically circulates the mud fluid in a closed-system (loop) comprising three valves and a 3/8 in tubing coil in order to increase the heated mud volume. The pump has a flow rate range adjustable from 100 to 6,000 ml/min. The maximum pressure rating is 400 bar or 5,801.5 psi.

1.4. Accumulators

The accumulators supplied as part of the system allow you to maintain the test fluids at reservoir condition during experiment. Accumulators are basically cylinders equipped with two end plugs and one floating piston, which separates the cylinder by a driving chamber and a test chamber. The driving chamber contains the driving fluids (deionized water or hydraulic oil) while the test chamber contains the test fluids. The standard capacity of the cylinders is 1 liter. Accumulators have a maximum rating of 690 bar or 10,000 psi and 150 °C or 302 °F.



1.5. Core Holder

The core holder is used for placing the core into it and perform the experiment. The core sample is held within a rubber sleeve by confining pressure. The confining pressure simulates reservoir overburden pressure. An inlet and outlet distributor plug allows fluids and gases to be injected through the core sample. All internal volumes are kept to a minimum so that accurate flow data can be determined. A unique feature of the core holder is that the core holder does not need to be completely disassembled to remove the core sample. Particularly, the sleeve remains in place when removing the core sample. By releasing the confining pressure and unscrewing the end plug, the core sample can be easily removed without exposing it to the confining fluid. This allows the core sample to be easily installed or removed. The core holder was designed to accept core length from 5 to 15 cm using the built-in adjustment and diameter of 38.1 mm (1.5 in). Core holders have a maximum rating of 690 bar or 10,000 psi. The temperature rating is 150 °C or 302 °F.



1.6. Heating System

The measurements can be conducted at representative reservoir temperatures using an oven (air bath), which heats the core holder, accumulators and core sample. Take care to not adjust it above 150 °C or 302 °F, the maximum rating of the core holder and the system.



1.7. Back Pressure Regulator

The BPR consists of two chambers separated by a piston with a needle connected to it on the lower side. The upper chamber receives the gas and water pressure and the lower chamber receives the process pressure. The BPR acts as a comparator. When the upper pressure is higher than the process pressure, the needle seals off the pressure and maintains the pressure. Inversely, when the process pressure exceeds the upper pressure, the needle opens up and the excess process fluid flows out. A hydraulic hand pump allows to control the upper pressure via a buffering cylinder. The BPR has a maximum rating of 690 bar or 10,000 psi.



1.8. Pressure Transducers

The pressure transducers supplied as part of the system are Rosemount pressure transducers. The standard full-scale range is 690 bar or 10,000 psi. As a standard configuration, one monitors the inlet pore pressure of the core, one monitors the outlet pore pressure of the core, and two monitors the pore pressures along the core.



1.9. Electrical Connections

Electric voltage required for all system is:

220-230 VAC, 50 Hz, 4.6 kW.

Power is distributed as follows:

The oven is 220-230 VAC, 50 Hz, 4.0 kW

The injection pump is 220-230 VAC, 50 Hz, 0.6 kW

The monitor(s), computer(s) and other accessories can be plugged on standard 220-230 VAC, 50 Hz sockets.

It is **highly** recommended to plug the all system into a surge suppressor (UPS).

2. System Capabilities

2.1. Overall System

Max. Conf. Press.	690 bar (10,000 psi)
Max. Pore Press.	690 bar (10,000 psi)
Temp. Range	room temperature to 150 °C (302 °F) maximum
Multiple Fluids	up to 3 different fluids
Wetted Material	316 Stainless Steel
Electrical	220-230 VAC, 50 Hz, 4,600 W