

OFITE

MODEL 90

CEMENT PERMEAMETER

INSTRUCTIONAL

MANUAL

OPERATING INSTRUCTIONS

OFITE MODEL 90 CEMENT PERMEAMETER

INSTALLATION

1. The OFITE Model 90 requires a nitrogen source of 200 psi. The nitrogen line is attached to the back of the unit via a ¼" NPT female fitting.

SAMPLE PREPARATION

A four gang brass mold is supplied with the unit that can make cement samples one inch diameter by one inch long.

1. Lightly grease the internals of the mold assembly and the upper and lower plate to prevent the cement from adhering to the surface. Place the mold assembly on top of the lower plate
2. Prepare the cement mixture to be tested according to the procedures as outlined by API Specification 10.
3. Carefully pour the cement into the molds and "puddle" each mold to remove any entrapped air. Wipe any excess cement from the mold assembly.
4. Place the upper plate on top of the mold assembly. Clamp the plates together using the four screws provided.
5. The mold assembly should be cured in either a heated water bath or an HPHT Curing Chamber.
6. After the samples have cured remove the four screws that hold the upper and lower plates together. Then remove the three screws that hold the mold assembly together. The cement specimens can now be tested in the permeameter.

PERMEABILITY DETERMINATION TO NITROGEN

1. Place a dry cement specimen into the rubber specimen holder
2. Place the rubber specimen holder into the sleeve and place between the pressure plates on the permeameter.
3. Using your hand screw the bottom plate upwards as tight as possible to insure a good seal between the cement specimen and the rubber specimen holder.

4. Make certain that the pressure regulator is turned fully counter-clockwise and open the nitrogen supply valve.
5. Open the valve on "FLOWMETER 1" by turning **fully** counter-clockwise. "Flowmeter 2" should be used for specimens with very low permeability.
6. Turn the regulator clockwise until the steady state scale reading (center of float) on the flowmeter registers 10. Record the inlet pressure (P_i) from the pressure gauge.
7. Record the inlet pressures of scale readings in increments of 10 (i.e. 20, 30, 40, 50, 60, 70, etc). A sample data sheet is included in the appendix of this manual.

NITROGEN FLOWMETER CALIBRATION DATA

Flowmeter 1

Scale Reading	Flowrate (cc/min)
150	139.20
140	124.50
130	111.40
120	98.50
110	89.70
100	81.00
90	70.90
80	63.20
70	55.90
60	49.60
50	41.30
40	31.10
30	25.30
20	22.90
10	17.60

Flowmeter 2

Scale Reading	Flowrate (cc/min)
150	30.97
140	27.77
130	25.08
120	21.87
110	19.17
100	17.31
90	15.30
80	12.85
70	10.94
60	9.65
50	7.98
40	5.41
30	5.11
20	4.05
10	2.94

DATA INTERPRETATION

Permeability is calculated via Darcy's Law which is stated mathematically:

$$K = \frac{2000P_o Q \mu L}{A(P_i^2 - P_o^2)}$$

Where:

K = Permeability in md

P_o = Outlet Pressure in Atm

P_i = Inlet Pressure in Atm

Q = Flowrate in cc/min

μ = Viscosity in cp (The viscosity of nitrogen is 0.1756 cp at ambient conditions)

L = Specimen Length in cm

A = Cross Sectional Area in cm²

PERMEABILITY CALCULATIONS WITH THE SOFTWARE PROVIDED

And Excel spreadsheet was provided to assist in the permeability calculations. All of the cement specimen information should be entered in the red boxes. Choose either the Flowmeter 1 table or the Flowmeter 2 table and enter the inlet pressures (P_i) in the red boxes that correspond to the flowmeter scale readings. Permeability is automatically calculated and plotted on the chart. The chart should be linear as Darcy's equation assumes laminar flow. Any data which deviates from linear is invalid.

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