PERMEABILITY AND FLUX TESTING OF BENTOMAT® CL

Specimens of Bentomat CL were tested for permeability in flexible wall permeameters. Testing was performed over four days with very small flows occurring which were likely attributable to side wall leakage around the specimens. Hydraulic conductivity and flux were calculated using these small flow values, showing that the permeability and flux of Bentomat CL are well below the certified maximum values.

CETCO's membrane-laminated GCLs are essentially impermeable; for this reason, there is little reason that a permeability or flux test should be required for these products. In fact, our experience has shown that it is quite difficult to test these products due to the occurrence of leakage around the sides of the test specimens. Great care must be taken to eliminate this flow pathway, and even then, some limited sidewall leakage occurs.

The attached data from J & L Testing Co. shows permeability data for Bentomat CL. In all cases, it was not possible to eliminate sidewall leakage, and a very small flow (0.05-0.15 cm^3) occurred during the four-day tests. This sidewall leakage causes a "permeability" value of around 1-2 x 10^{-11} cm/sec and a flux value of around 5 x 10^{-11} m^3/m^2/sec.

Because of the extreme care and diligence required to set up these test specimens, and because the result of the test is essentially a foregone conclusion, CETCO does not perform permeability or flux tests on the CL products for MQC purposes.

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SUMMARY OF FLEX WALL PERMEABILITY TEST RESULTS
ASTM D-5084 (Method A)

JLT

Client	:	CETCO	Date	:	06-29-0C(Rev 1)
Project Location	:		Job No.	:	2KS2561-04
Sample Number	:	Roll 356	Tested By	:	MLB/DL
Description	:	Bentomat CL Lot 200025	Checked By	:	JB
Permeant Fluid	:	De-Aired Water			

Physical Property Data

Initial Height (in)	:	0.23 (1)	Final Height (in)	:	0.240
Initial Diameter (in)	:	4.00	Final Diameter (in)	:	4.00
Initial Wet Weight (g)	:	48.90 (1)	Final Wet Weight (g) (1)	:	75.00
Wet Density (pcf)	:	64.40	Wet Density (pcf)	:	94.65
Moisture Content %	:	24.70	Moisture Content %	:	91.10
Dry Density (pcf)	:	51.64	Dry Density (pcf)	:	49.53

(1) Clay portion only

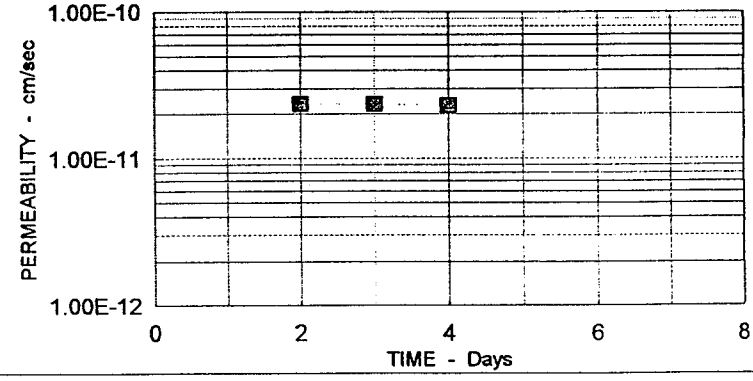
Note: Computed Mass/Unit Area = 1.18 psf at 20% moisture content

Test Parameters

Fluid		: Deaired Water	**Effective**		
Cell Pressure	(psi)	: 60.00	**Confining Pressure (psi)**	:	**10**
Head Water	(psi)	: 52.00	Gradient	:	460.00
Tail Water	(psi)	: 48.00			

Permeability Input Data

Flow, Q	(cc)	:	0.15
Length, L	(in)	:	0.24
Area, A	(sqin)	:	12.57
Head, h	**(psi)**	:	**4.00**
Time, t	(min)	:	2882.00
Temp, T	(Deg C)	:	21.0



Computed Permeability

PERMEABILITY, K = 2.32E-11 (cm/sec) at 20 Degrees C
AT 4 DAYS

Note: Flow is most likely side wall leakage

SYSTEM CONFIGURATION

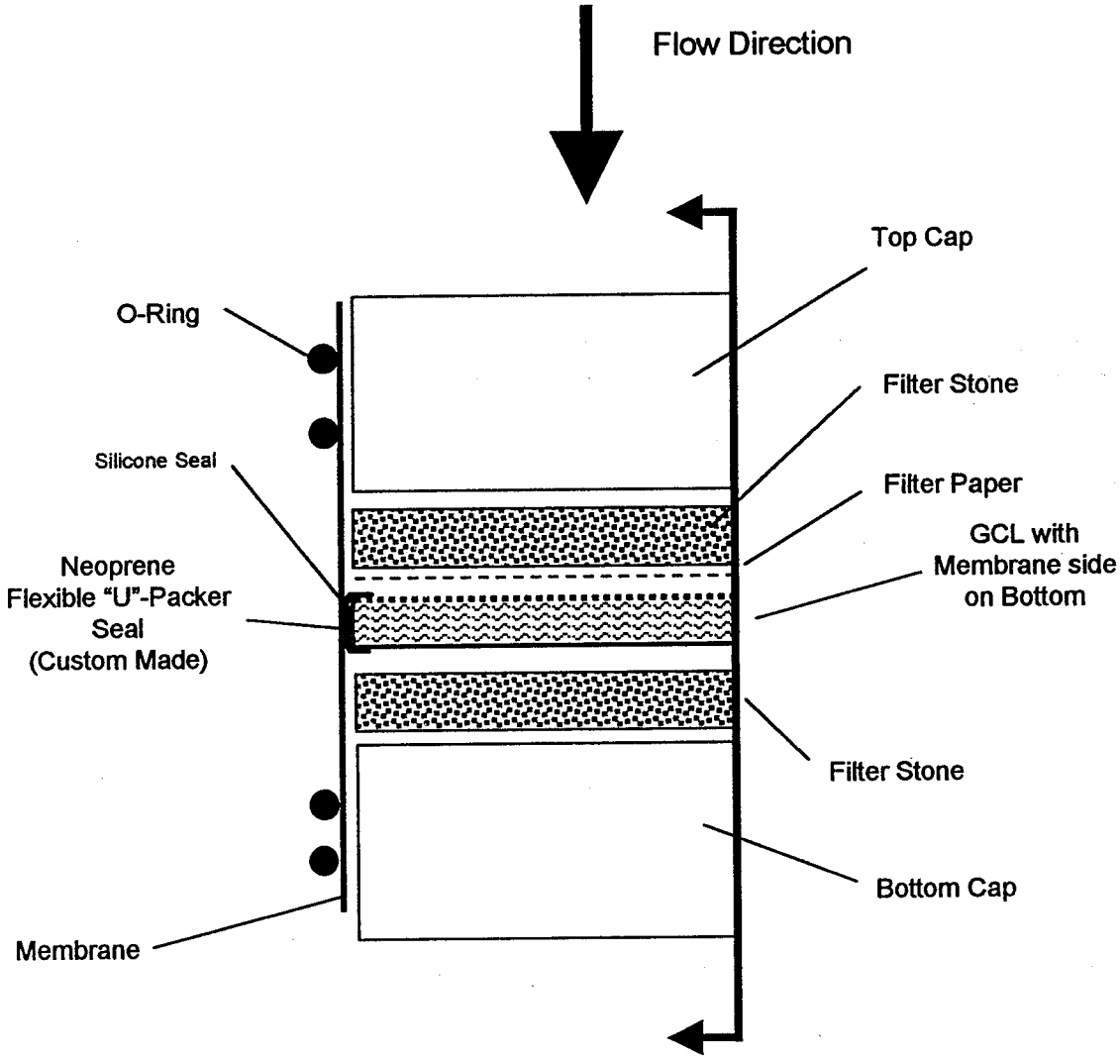


FIGURE 1