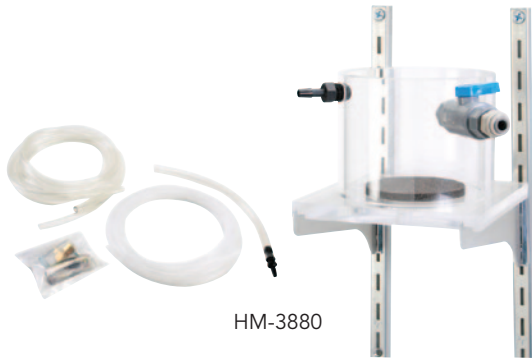




HM-3804



HM-3880



HM-3701



HM-3861

HM-3861 Detail

**Constant Head Permeameter Cells**

Use to determine the coefficient of permeability by the constant head method for laminar flow of water through granular soils. Two manometer ports are grooved & screened on the inside. Distance between ports is always equal to diameter. 100 mesh screens used to prevent migration of material through valves & tubing during test. Acrylic chamber permits viewing sample. Spring incorporated into top cap to apply 5-10 lbs. force against top stone or screen to prevent soil density changes. End caps & clamping ring of anodized aluminum. Each chamber complete with: valves; porous stones or perforated screens, depending on the diameter of sample; tubing for connection to water source and manometer tubes. Permeameters without manometer outlets available. Complies with ASTM D2434; BS 1377 Part 5. Shipping wt. 7 to 12 lbs. (3.2 to 5.4kg)

Permeameter Cells	Model
2.5" (63mm) Permeameter Cell	HM-3801
3.0" (76mm) Permeameter Cell	HM-3802
4.5" (114mm) Permeameter Cell	HM-3803
6" (152mm) Permeameter Cell	HM-3804
9" (229mm) Permeameter Cell	HM-3805

**Manometer Tube Stand, Wall Mount— HM-3860**

**Manometer Tube Stand, Free Standing— HM-3861**

Economical manometer tube setup for use with many permeameters. Two acrylic tubes with valves mounted on aluminum rail, with scale for monitoring flow volumes. Scale is 100cm long with cm and mm graduations. Each tube has its own valve to allow running two tests. Choose wall mount or free standing. Complies with ASTM D2434. Shipping wt. 8 lbs. (3.7kg)

**Constant Head Tank, 1000cc— HM-3880**

**Constant Head Tank, 4000cc— HM-3881**

Acrylic tank with regulating valve for flow control of water and a porous media on bottom to filter out air bubbles. Maintains constant water head via an overflow port. Includes: saddle valve for connection to either de-aired or tap water source; rails for wall mounting with easy height adjustment and tubing for hook-up to test chamber. Shipping wt. 8 lbs. (3.7kg)

**Compacting Hammer— HM-3701**

Rod with sliding weights on a 2" (51mm) dia foot. Stop allows adjusting height of drop up to 8" (203mm). Includes one 1/4 lb. (100g) and one 2-1/4 lb. (1kg) weight. Shipping wt. 6 lbs. (2.72kg)



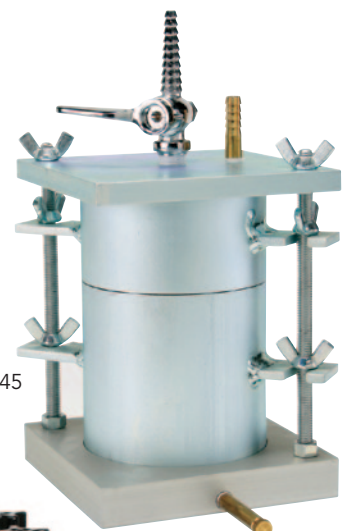
HM-3892



HM-3892 Detail



H-4146



H-4145



HM-3915

**Constant/Falling Head Permeameters**

For use with granular soils in determining the coefficient of permeability via the constant or falling-head method for laminar flow of water. Compact and portable unit includes manometer tube, scale and permeameter base attached to a platform. Funnel provides adjustable constant head reservoir. Spring incorporated into top cap to apply 5-10 lbs. force against top stone or screen to prevent soil density changes. End caps and clamping ring of anodized aluminum. Each set complete with: permeameter; manometer tube; two funnels; either porous stones or perforated screens depending on diameter, and tubing for connection to water source. Shipping wt. 13 lbs. (5.9kg)

Permeameter Sets	Model
2.5" (63mm) Permeameter Set	HM-3891
3.0" (76mm) Permeameter Set	HM-3892
4.5" (114mm) Permeameter Set	HM-3893
6" (152mm) Permeameter Set	HM-3894
9" (229mm) Permeameter Set	HM-3895

**Compaction Permeameter, 4" — H-4145**

**Compaction Permeameter, 6" — H-4146**

For determining permeability of clay, sand, and gravel soils. Uses Proctor plasticity compaction method. Two-piece cylindrical mold includes: upper plate with valve; water inlet/outlet; filter base plate; and filter stones. 6"W x 6"D x 12"H. Complies with ASTM D5856. Shipping wt. 18 lbs. (8.16kg)

Compaction Permeameter Parts	Model
Filter Stone for H-4146	H-4148X
Porous Stone for H-4146	H-4148.6
Spring for H-4146 and H-4145	H-4145.8
Filter Stone for H-4145	H-4148
Porous Stone for H-4145	H-4184.100

**Shelby Tube Permeameter, 2" — HM-3913**

**Shelby Tube Permeameter, 2.5" — HM-3914**

**Shelby Tube Permeameter, 3" — HM-3915**

Allows you to perform permeability tests within a Shelby tube without removing the sample. Ideal for cohesionless materials and sands. It is suggested that the specimen be ejected at test conclusion and examined for voids or large aggregate, which possibly could affect the test results. Two sets of end caps fit over a Shelby tube liner up to 6" long. End caps each contain valve to control flow of permeants through the specimen, along with a porous stone to prevent material from flowing into and clogging the valve. End caps are anodized aluminum. Includes o-rings, connecting rods, clamping knobs, and tubing. Shelby tube not included. Shipping wt. 6 lbs. (2.72kg)

## Permeability/Hydraulic Conductivity

Permeability testing measures the rate of discharge of water under laminar flow conditions through a unit cross-sectional area of a porous medium under a unit hydraulic gradient and standard (20°C) temperature conditions. In permeability testing, soil is subjected to water under a known pressure, and the flow is measured. The coefficient of permeability (k), or simply permeability, expresses the ability of water to flow through the particular medium. The "Constant Head" test method is applicable to coarse granular soils such as sands and gravels. The "Falling Head" test method is applicable to fine grain soils. Either method may be used to test clay soils.

### Humboldt FlexPanels

Humboldt FlexPanels provide a simple and highly efficient distribution system for providing air, water and deaired water for use in permeability and triaxial testing applications. The FlexPanel's simple, straight-forward configuration, with its integral burettes provides a condensed/compact design that takes up less counter space than competing systems with air/water bladders.

The long, narrow burette design of Humboldt's FlexPanels provide faster test processing times when compared to larger, shorter burette systems, while providing the same volume. This is due to the reduced amount of meniscus formation in the narrower burettes, which allows the water level to drop faster, resulting in faster readings. In addition, the use of longer/narrower burettes and a scale graduation of 0.02ml, also provides an easier-to-read and more accurate scale.

FlexPanels also feature a bias regulator and bridge. The bias regulator maintains the differential pressure when confining and back pressures are increased. The bridge delivers simultaneous control of base and top pressures through the use of just one regulator. This feature minimizes operator time and reduces the margin of error in opening and adjusting regulators during a test. The Humboldt Flexpanel System is comprised of 5 separate panel configurations, which can be grouped together to accommodate from 1 to 5 cell setups.

### Fast and Easy Setup and Operation

Humboldt FlexPanels make setup fast and easy with clearly labeled ports and quick-connect hookups. Operation is just as easy with clearly labeled controls, large gauges and easy-to-read burette markings.

All Humboldt FlexPanels use no-volume change Swagelock valves and Fairchild constant-bleed type precision regulators for accurate control. All inlets and outlets utilize quick-connects to ensure fast, accurate setup to permeater cells, as well as air, water and drain hook ups. Fittings, tubing and connectors are supplied with each unit. All FlexPanels are designed to handle air pressures up to 150 psi. For testing contaminated samples, Humboldt offers an optional Toxic Interface Unit, which prevents toxic fluids and vapors from entering the FlexPanel.

### Humboldt FlexPanels Features:

Humboldt FlexPanels provide an accurate and easy-to-operate solution for controlling compressed air, water, deaired water and vacuum without the need for air/water bladder interfaces to produce the pressures necessary for permeability and triaxial testing. FlexPanels utilize a set of three burettes to control cell, top cap and base pedestal pressures. This extremely versatile pressure system controls the pressure, water, de-airing tank and vacuum from a single panel. The three burettes allow for the control of the cell pressure and the back pressure for each cell. They can monitor volume change in the sample and can be used to measure the flow of water through the sample for permeability testing.



HM-4150



HM-4140



HM-4150A



HM-4160



HM-4160A

FlexPanels can manually measure volume change or permeability in a triaxial test sample without the use of a volume change apparatus, a distinct benefit when compared to air/water bladder systems.

- Bias pressure regulator allows simultaneous control of confining & back pressures, while maintaining a constant differential
- Longer Burette and 0.02ml graduation give more accurate results, better productivity, and faster turnaround
- Uses no-volume-change Swagelock valves
- Bridge feature delivers simultaneous control of base and top pressures by adjusting one pressure regulator simplifying testing
- Quick-connect hookups for fast and reliable set up.
- Master control panel houses digital pressure readout for the controlling pressure, inlet vacuum regulator & gauge, inlet pressure regulators & gauge, de-aired water tank controls, tap & de-aired water supply outlets, and pressure & vacuum outlets
- Comply with ASTM D5084; BS 1377 Part 6 1990.

**Control Panels**

The HM-4140 stand-alone control panel or the integral control panels on the HM-4150 and HM-4160 provide pressure controls and readouts for permeability and triaxial applications. All three controllers provide identical controls, which include: a digital, readout pressure meter, a pressure supply gauge, a master pressure regulator, a vacuum supply gauge, a master vacuum regulator, de-aired water tank controls, tap and de-aired water supply outlets and pressure and vacuum outlets.

**Auxiliary Panels**

The HM-4150A and HM-4160A auxiliary panels provide additional sets of burettes, which can be used to expand the capacity of a system. Each set of three (3) burettes provide the controls necessary for another cell to be used. The HM-4150A provides one (1) set of burettes and the HM-4160A provides two (2) sets. Humboldt recommends any combination of up to five (5) burettes sets can be used with each control panel.



Rear of panel showing quick-connect hookups and plumbing.

**Humboldt FlexPanels**

	HM-4140.3F	HM-4140M.3F	HM-4150.3F	HM-4150M.3F	HM-4160.3F	HM-4160M.3F	HM-4150A	HM-4160A
Pressure/Resolution	2-150 psi (0.1 psi)	14-1000 kPa (1 kpa)	2-150 psi (0.1 psi)	14-1000 kPa (1 kpa)	2-150 psi (0.1 psi)	14-1000 kPa (1 kpa)	NA	
Vacuum	0-14.7 psi or 30 Hg	(0-100kPa) or 30 Hg	0-14.7 psi or 30 Hg	(0-100kPa) or 30 Hg	0-14.7 psi or 30 Hg	(0-100kPa) or 30 Hg		
Inner Burette								
Cell	50cc x 0.1 cc (ml)							
Top	10cc x 0.02 cc (ml)							
Base	10cc x 0.02 cc (ml)							
Outer Burette								
Cell	400cc (ml)							
Top	460cc (ml)							
Base	460cc (ml)							
Voltage	110/220VAC 50/60Hz						NA	
Power	6 watts							
Operating Temperature	14 to 158°F (-10 to 70°C)							
Dimensions	8 x 8 x 37.5" (203 x 203 x 952mm)		8 x 25.5 x 37.5" (203 x 648 x 952mm)		8 x 43.5 x 37.5" (203 x 1105 x 952mm)		8 x 19.5 x 37.5" (203 x 495 x 952)	8 x 37.5 x 37.5" (203 x 952 x 952)
Shipping Weight	35lb (16kg)		95lb (43kg)		145lb (66kg)		107lb (49kg)	157lb (71kg)



**Toxic Interface Unit— HM-4190**

Safe and convenient means of performing permeability tests of corrosive or toxic permeants. Flexible Viton bladder accumulator interfaces between control panel and sample drains on permeameter. Serves as a fluid separator to prevent permeant from entering control panel. Also prevents contact of air with permeant, thus no toxic or corrosive vapors can escape into lab. Handles any fluid compatible with stainless steel, Teflon, and the Viton bladder. Unit measure 8" H x 5" dia. Two units are required for each cell. Shipping wt. 6 lbs. (2.72kg)



HM-4190





HM-4188B

**Permeability Cells**

HM-4188B permeability cells are constructed of high-quality materials throughout for long-lasting performance. The cell top and base are precision machined from 6061 T6 aluminum and then hard-coated and Teflon-impregnated for a durable finish. To facilitate sample setup, the chamber and cell top can be quickly and easily removed by loosening the three knobs that hold the upper assembly to the base. The clear acrylic chamber provides a working pressure of 150 psi (1,000 kPa) and is tested to 250 psi (1,700 kPa).

The cell has five, no-volume-change, valves aligned along the front of the cell for maximum convenience. Two valves handle top drainage, two valves handle bottom drainage, and one valve handles filling/emptying and providing confining pressure to the cell.



**Triaxial Cells— HM-4199**

For those who plan to do triaxial tests in addition to permeability testing, consider using HM-4199B and HM-4199SS Triaxial Cells for the added convenience of using one cell for both tests.

The removable base pedestal accommodates various sample diameters from 35mm to 4 inch, see charts below for model numbers corresponding to the size needed. Cells are available with black-anodized aluminum or stainless steel top caps and base pedestals, refer to chart below.

Brass valves are standard with these cells, but stainless steel valves (stainless steel is typically used with hazardous materials) are an option, please inquire. Cell dimensions are: 13-3/4" H x 8-3/4" dia. (349.2 x 222.3mm). Overall dia. is: 11" (279.4mm). Complies with ASTM D5084.



HM-4188.28

To order individual Top Caps or Pedestal Bases, use the part number for the set of the desired size indicated at left and add a "T" suffix for a Top and a "B" suffix for a base, i.e. HM-4188.20B would be the part number for a 2" Base Pedestal.

Permeability Cells and Top Cap/Base Pedestal Sets				
Size	Standard Cell	Stainless Cell*	Anodized Aluminum**	Stainless Steel*
35mm	HM-4188B	HM-4188SS	HM-4188.35	HM-4188.35SS
1.4"			HM-4188.14	HM-4188.14SS
1.5"			HM-4188.15	HM-4188.15SS
50mm			HM-4188.50	HM-4188.50SS
2.0"			HM-4188.20	HM-4188.20SS
70mm			HM-4188.70	HM-4188.70SS
2.8"			HM-4188.28	HM-4188.28SS
100mm			HM-4188.100	HM-4188.100SS
4.0"			HM-4188.40	HM-4188.40SS



### Expansion Index Consolidometer— HM-2405

Self-contained unit for conducting expansion tests on cured soil specimens. After compaction in stainless steel ring, specimen is placed in the consolidometer with air-dried porous stones, and loaded with a stainless steel weight. Specimen is allowed to consolidate for 10 minutes, after which it is immersed in distilled water for up to 24 hrs. During this time, height of specimen is recorded to determine maximum swell. Corrosion resistant, durable anodized aluminum and stainless steel construction. Includes anodized aluminum base & collar, stainless steel specimen ring and weight, 12.6 lb. (5.7kg) loading weight, and 3.99" dia. x 1/2" (101.4 x 12.5mm) porous stones. **Order dial indicator below.** 6" dia x 11" H (152 x 279 mm). Complies with ASTM D4829, California Test Method UBC 29-2.

Shipping wt. 20 lbs. (9 kg)

### Dial Indicator, for HM-2405 Consolidometer— H-4471

0.5 x 0.0001" dial indicator.

### Replacement Porous Stones— HM-4184.399T

Porous stones for use with HM-2405 consolidometer, 3.99" x 0.5".

Accessories	Model
Dial Indicator, 0.2" range x 0.0001"	H-4460
Dial Indicator, 0.5" range x 0.0001"	H-4471
Dial Indicator, 1.0" range x 0.001"	H-4458.1
Compaction Hammer	HM-3701

### Soil Volume Change Meter (PVC)— HM-2415

Use to evaluate potentially dangerous swelling/shrinking conditions found in clay soils in commercial/residential development sites. PVC (potential volume change) refers to maximum possible volume change a soil could undergo when submitted to changing moisture conditions. It features fast and simple operation, measuring both shrinkage and swelling of soils and is ideal for gauging swelling of clay soils. Includes: H-4454.010, 1,000 lb. (4.5 kN) capacity proving ring, mold assembly, loading cap, porous stones, loading pistons, 2-3/4" (70 mm) dia. specimen ring (HM-1220.70), and conversion charts. 7-1/4" (184 mm) dia. base x 15-1/2" (394 mm) height. Shipping wt. 30 lbs. (13.6 kg)

### Compaction Base and Collar, 2.440"— HM-1975-D

### Compaction Base and Collar, 2.500"— HM-1975-E

The compaction base and collar is used to produce a soil sample for use with the basic swell/expansion consolidometers. Use HM-3701 compaction hammer. Shipping wt. 7 lbs. (3kg)

### Basic Swell/Expansion Consolidometers—

#### 2.440"— HM-1972-1D

#### 2.500"— HM-1972-1E

A self-contained consolidometer used to conduct swell expansion tests on soil specimens. Set includes: stainless steel base/acrylic ring device with adjustable, dial indicator standard and bracket, a compaction specimen ring, top and bottom porous stones and a 60 psf stainless steel loading weight. Consolidometer can also be used with cutting ring, listed below, instead of supplied compaction ring for use in acquiring samples from undisturbed Shelby tube samples. Dial indicator necessary for test, choose from those listed below. Alternative loading weights are available, please enquire. Shipping wt. 8 lbs. (4kg)

Components	HM-1972-1D
Stainless steel Cutting Ring	HM-1220.24.8
Stainless steel Compaction Ring	HM-1972-3D
60 PSF Stainless steel Loading Weight	HM-1972-6D
Stainless steel Compaction Ring	HM-1972-3D
Top Porous Stone	HM-4184.240
Base Porous Stone, 3.31" dia. x 1/4" thick	HM-4184.331

Components	HM-1972-1E
Stainless steel Cutting Ring	HM-1220.25.8
Stainless steel Compaction Ring	HM-1972-3E
60 PSF Stainless steel Loading Weight	HM-1972-6E
Stainless steel Compaction Ring	HM-1972-3E
Top Porous Stone	HM-4184.2485
Base Porous Stone, 3.31" dia. x 1/4" thick	HM-4184.331