



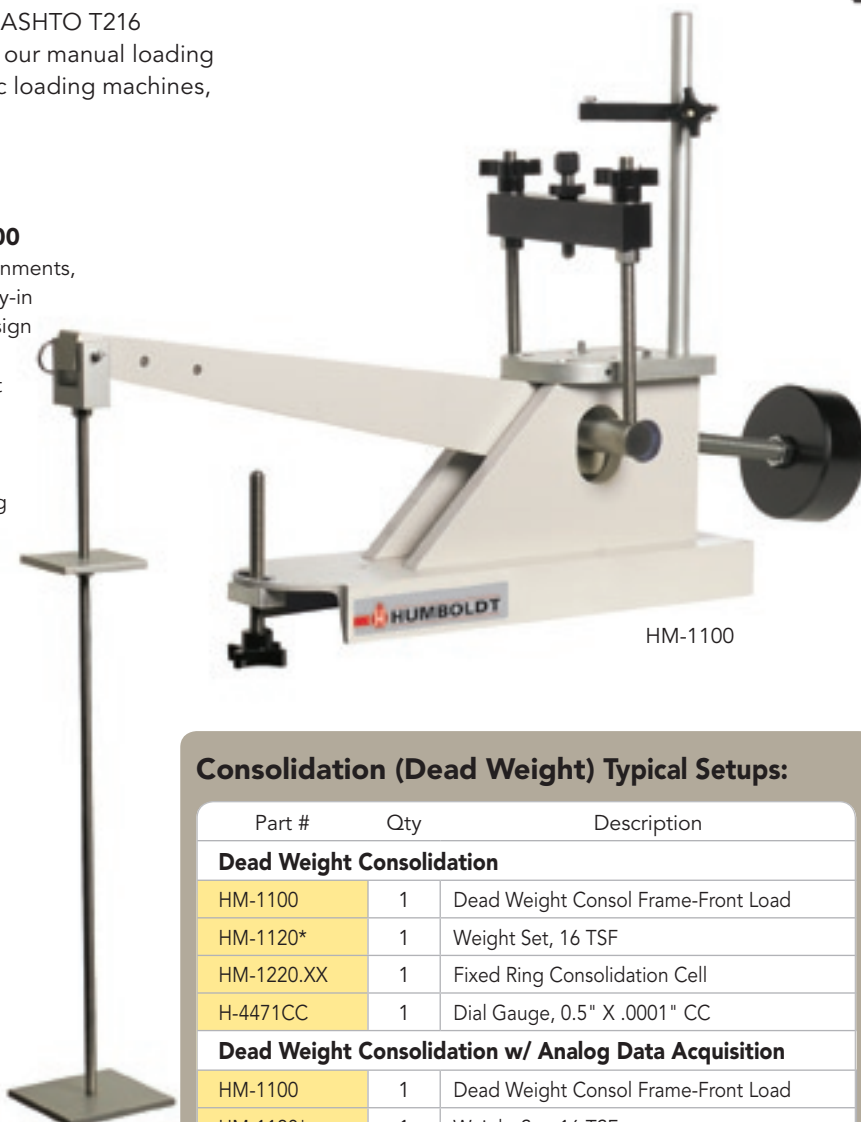
Consolidation testing (ASTM D2435, D4546; AASHTO T216 and BS 1377 part 5) can be handled with either our manual loading machine, the HM-1100 or one of the pneumatic loading machines, the HM-2432 or HM-2470A.

### Dead-Weight Consolidation Frame— HM-1100

Able to survive in even the harshest laboratory environments, the HM-1100 will provide you with reliable service day-in and day-out. The design features a rugged frame design manufactured from aluminum with stainless steel vertical rods, horizontal cross arms and beam support rods. The load arm incorporates 9:1, 10:1, and 11:1 beam ratios for greater flexibility and loading weight requirements. Using the 10:1 ratio on 2.5" (63 mm) diameter samples, the system is capable of producing load up to 48 tsf (4,597 kPa).

#### Features include:

- Triple beam ratios minimize loading weight requirements
- 48 tsf (5,148 kPa) maximum load capacity
- Aluminum and stainless steel construction for corrosion resistance and long life
- Wide range of consolidation cells available in fixed ring, floating ring, permeability and backpressure designs
- Loading weights available in both, tsf and kg versions
- Available with standard mechanical dial gauges, digital indicators or with strain transducers (LSCT) coupled to one of our data loggers



HM-1100

#### Specifications

|                       |   |
|-----------------------|---|
| Load Capacity         | 48 tsf (4,597 kPa)  |
| Beam Ratios           | 9:1, 10:1 and 11:1  |
| Frame Construction    | Heavy-duty aluminum frame with stainless steel vertical, horizontal and beam support rods |
| Cell Platform         | Anodized aluminum with locating pins for centering cells.                                 |
| Dimension (W x D x H) | 7-3/4" x 32" x 19-1/2"<br>(197 x 812 x 495 mm)  |
| Weight                | 47 lbs. (104kg)   |
| Shipping Weight       | 62 lbs (137kg)  |

#### Single-Station Consolidation Frame Stand— HM-1100.1

#### Triple-Station Consolidation Frame Stand— HM-1100.3

Simple, steel frame structure to hold HM-1100 Consolidation frames.

### Consolidation (Dead Weight) Typical Setups:

| Part #   | Qty | Description                                   |
|--|-----|---|
| <b>Dead Weight Consolidation</b>                             |     |   |
| HM-1100  | 1   | Dead Weight Consol Frame-Front Load           |
| HM-1120*   | 1   | Weight Set, 16 TSF                            |
| HM-1220.XX   | 1   | Fixed Ring Consolidation Cell                 |
| H-4471CC   | 1   | Dial Gauge, 0.5" X .0001" CC                  |
| <b>Dead Weight Consolidation w/ Analog Data Acquisition</b>  |     |   |
| HM-1100  | 1   | Dead Weight Consol Frame-Front Load           |
| HM-1120*   | 1   | Weight Set, 16 TSF                            |
| HM-1220.XX   | 1   | Fixed Ring Consolidation Cell                 |
| HM-2310.04   | 1   | Strain Transducer 0.4" (10mm)                 |
| HM-2310BR  | 1   | Strain Transducer Bracket                     |
| HM-2325A.3F  | 1   | MiniLogger 4 CH Analog Data Acquisition       |
| HM-1100SW  | 1   | HMTS Consolidation Reporting Software         |
| <b>Dead Weight Consolidation w/ Digital Data Acquisition</b> |     |   |
| HM-1100  | 1   | Dead Weight Consol Frame-Front Load           |
| HM-1120*   | 1   | Weight Set, 16 TSF                            |
| HM-1220.XX   | 1   | Fixed Ring Consolidation Cell                 |
| HM-4469.10   | 1   | Digital Indicator 1" x .0001" (25 x 0.002 mm) |
| HM-4469C   | 1   | Data Cable for Indicator                      |
| HM-2330D.3F  | 1   | MiniLogger 4 CH Digital Data Acquisition      |
| HM-1100SW  | 1   | HMTS Consolidation Reporting Software         |

**Part Numbers** ending in .XX require a size code to be entered referring to the sample size to be tested.

**For Consolidation** samples, sizes are: .20 = 2.0"; .242 = 2.42"; .25 = 2.5"; .30 = 3.0"; .40 = 4.0"; .50 = 50mm; .70 = 70mm; .75 = 75mm, and .100 = 100mm.

\*For Metric applications, use HM-1122, Weight Set, 32kg.



HM-2432

### Con-Matic Consolidation Machine— HM-2432

Compact and easy-to-use, the HM-2432 pneumatic consolidation load frame is used to estimate the rate and amount of settlement anticipated for a proposed structure. The unit applies loads instantly without impact for stress-controlled consolidation testing; and, maintains the load regardless of sample compression. Its small footprint saves valuable lab counter space while maintaining its versatility by supporting fixed ring, floating ring, or permeability cells. Available with standard mechanical dial gauge, digital indicators or with strain transducers (LSCT) coupled to one of our data loggers. Meets ASTM D2435, D4546; AASHTO T216; BS 1377 part 5.

### English Models

**Con-Matic 32 TSF (110V 50/60Hz)— HM-2432**

**Con-Matic 32 TSF (220V 50/60Hz)— HM-2432.4F**

### Metric Models

**Con-Matic 32 kg/cm<sup>2</sup> (110V 50/60Hz)— HM-2432M**

**Con-Matic 32 kg/cm<sup>2</sup> (220V 50/60Hz)— HM-2432M.4F**

### Features include:

- Highly sensitive and accurate in lower load ranges
- Integral digital readout simplifies checking applied load and setup of predetermined load
- Adjustable upper cross beam
- Instantaneous loading without impact
- Flexible load choice
- Not sensitive to shock
- Choice of English or Metric models

### Consolidation (Pneumatic) Typical Setups:

| Part #   | Qty | Description                                   |
|--|-----|---|
| <b>Pneumatic Consolidation</b>                                       |     |   |
| HM-2432  | 1   | ConMatic 32 TSF, 110/50-60                    |
| HM-1220.XX   | 1   | Fixed Ring Consolidation Cell                 |
| H-4471CC   | 1   | Dial Gauge, 0.5" X .0001" CC                  |
| <b>Pneumatic Consolidation w/ Analog Transducer Data Acquisition</b> |     |   |
| HM-2432  | 1   | ConMatic 32 TSF, 110/50-60                    |
| HM-1220.XX   | 1   | Fixed Ring Consolidation Cell                 |
| HM-2310.04   | 1   | Strain Transducer 0.4" (10mm)                 |
| HM-2310BR  | 1   | Strain Transducer Bracket                     |
| HM-2325A.3F  | 1   | MiniLogger 4 CH Analog Data Acquisition       |
| HM-1100SW  | 1   | HMTS Consolidation Reporting Software         |
| <b>Pneumatic Consolidation w/ Digital Indicator Data Acquisition</b> |     |   |
| HM-2432  | 1   | ConMatic 32 TSF, 110/50-60                    |
| HM-1220.XX   | 1   | Fixed Ring Consolidation Cell                 |
| HM-4469.10   | 1   | Digital Indicator 1" x .0001" (25 x 0.002 mm) |
| HM-4469C   | 1   | Data Cable for Indicator                      |
| HM-2330D.3F  | 1   | MiniLogger 4 CH Digital Data Acquisition      |
| HM-1100SW  | 1   | HMTS Consolidation Reporting Software         |

**Part Numbers** ending in .XX require a size code to be entered referring to the sample size to be tested.

**For Consolidation** samples, sizes are: .20 = 2.0"; .242 = 2.42"; .25 = 2.5"; .30 = 3.0"; .40 = 4.0"; .50 = 50mm; .70 = 70mm; .75 = 75mm, and .100 = 100mm.



## Typical Consolidation Data Acquisition Setups Using Humboldt MiniLoggers

Soil— Lab



HM-1100 with HM-1220.25, HM-2310.10, HM-2310BR and HM-2325A.3F



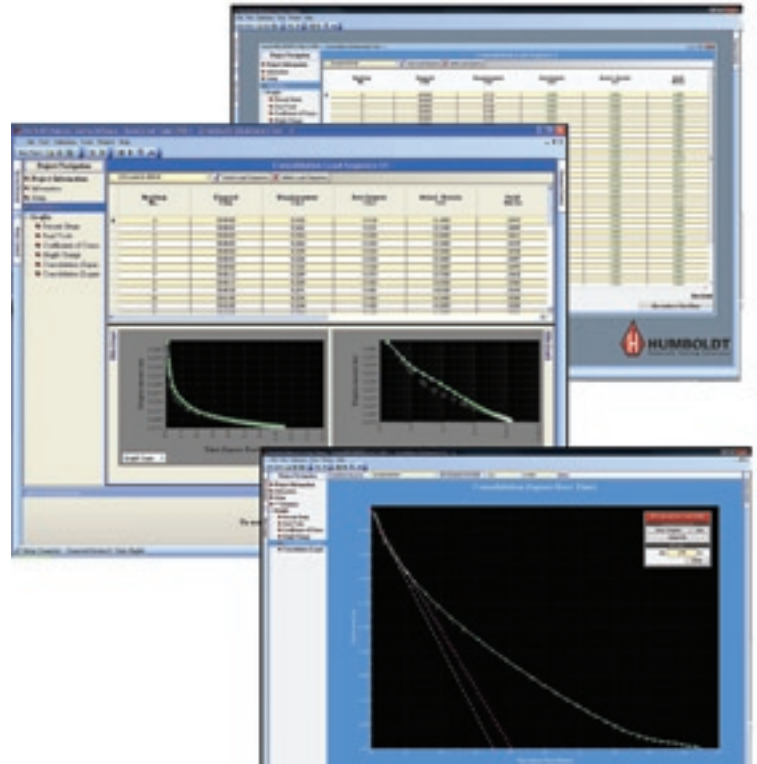
HM-1100 with HM-1220.25, HM-4469C, and HM-2330D.3F



HM-2432 with HM-1220.25, HM-2310.10, HM-2310BR and HM-2325A.3F



HM-2432 with HM-1220.25, HM-4469C, and HM-2330D.3F



### HMTS Reporting Software, Consolidation Module— HM-1100SW

Humboldt Material Testing Software (HMTS) provides a complete solution for the acquisition, recording and presentation of test data, as well as controlling testing operations when used in conjunction with compatible Humboldt testing equipment. HMTS works in conjunction with Microsoft Excel to present test data in easy-to-read Excel workbook format files, which can be evaluated directly or sent to any computer using Microsoft Excel.

The Consolidation Module provides a simple, test-specific interface to control Consolidation test operations and automatically record data while also displaying it in real-time tables and graphs.

Technicians can be freed-up for other duties with the assurance that all test data is being collected and saved.

- Test Information is stored, and all calculations are performed automatically
- Live tests and live graphing capabilities (real-time)
- Complete test report including all calculations and graphs required for testing
- Review and export tests using Microsoft Excel

**See page 72 for more information on Humboldt's HMTS software.**

### HMTS Reporting Software and the ConMatic IPC

The ConMatic IPC includes the Advanced, Module level of the Humboldt Material Testing Software (HMTS), which provides a complete solution for the acquisition, recording and presentation of test data, as well as controlling testing operations when used in conjunction with compatible Humboldt testing equipment. The HMTS software and the ConMatic IPC unit provide complete automation of incremental pressure controller for performing incremental consolidation and one-dimensional swell tests. The HMTS controls the test functions and automatically records data while also displaying it in real-time tables and graphs. Technicians can be freed-up for other duties with the assurance that all test data is being collected and saved.



## ConMatic IPC, Automated Consolidation System— HM-2470A.3F

The ConMatic IPC is a fully-automated, incremental pressure controller for performing incremental consolidation and one-dimensional swell tests. The ConMatic IPC allows consolidation and constant load and volume swell tests to be run automatically, freeing up technicians for other tasks and reducing the duration of the testing procedures by more than half—effectively saving time and manpower and increasing lab profitability. One ConMatic automated system can replace the production of several manual machines— running incremental consolidation tests according to ASTM D2435 Method B, where successive load increments are applied after 100% primary consolidation.

Once a sample has been placed onto the test platform and the test conditions set, the ConMatic IPC, used in conjunction with a computer and Humboldt's HMTS software, performs all consolidation tests, including moving to the next stress level, without operator assistance. The system automatically moves through the different test parameters specified by the user with incremental consolidation tests typically being completed in 24 to 48 hours. The HMTS software records readings from the force and displacement transducers to control the unit's exceptionally accurate stepper motor. Test results are recorded and rendered in real-time on the computer screen while test data is stored and calculations are performed automatically. The HMTS software provides:

- Live tests and live graphing capabilities (real-time)
- Complete test reporting including all calculations and graphs required for testing
- Review and exporting of tests using Microsoft Excel
- Smart Test Function: automatically picks up where it left off if the test was not finished due to unexpected events within your computer

The unique design of the ConMatic IPC system enables the user to choose from multiple tests and run them independently and simultaneously.

### Applicable Test Standards

ASTM: D2435, D4546, AASHTO: T216, BS: 1377:5

**Order Consolidation cells: page 52**

**Order Instrumentation: page 76**

**The ConMatic IPC system requires a supply of good clean compressed air and a computer, please contact Humboldt for system requirements.**



HM-2470A.3F  
with HM-1220.25,  
HM-2310.10 and  
HM-2310BR

### ConMatic IPC Typical Setup:

| Part #      | Qty | Description                           |
|-------------|-----|---------------------------------------|
| HM-2470A.3F | 1   | ConMatic IPC                          |
| HM-1220.XX  | 1   | Fixed Ring Consolidation Cell         |
| HM-2310.10  | 1   | Linear strain transducer, 1.0" (25mm) |
| HM-2310BR   | 1   | Strain Transducer Bracket             |
| HM-1100SW   | 1   | HMTS Consolidation Reporting Software |

### Specifications

|                       |   |
|-----------------------|---|
| Sample Size           | up to 4" (100mm)                            |
| Maximum Load          | 2200lbf (10kN)                              |
| Vertical Clearance    | 8.25" (210mm)                               |
| Horizontal Clearance  | 7.75" (197mm)                               |
| Maximum Piston Travel | 0.5" (12.7mm)                               |
| Dimension (L x W x H) | 12 x 12 x 30 inches<br>(300 x 300 x 750 mm) |
| Weight                | 42 lbs. (19Kg)                              |



### Fixed Ring Consolidation Cell—

Complete cell assembly features stainless steel construction and self-trimming cutter ring. Cutter ring rests inside clamping ring on lower porous stone, which is larger than the sample. The top porous stone and loading pad rest on the sample. The assembly is fixed on the cell base and enclosed within an acrylic cylinder open to the atmosphere, which permits saturation of the sample. The cell comes complete with all the parts illustrated in the drawing below.



| Fixed Ring Consolidation Cell |             |
|-------------------------------|-------------|
| 2.0"                          | HM-1220.20  |
| 2.42"                         | HM-1220.242 |
| 2.5"                          | HM-1220.25  |
| 3.0"                          | HM-1220.30  |
| 4.0"                          | HM-1220.40  |
| 50mm                          | HM-1220.50  |
| 70mm                          | HM-1220.70  |
| 75mm                          | HM-1220.75  |
| 100mm                         | HM-1220.100 |

### Floating Ring Consolidation Cell—

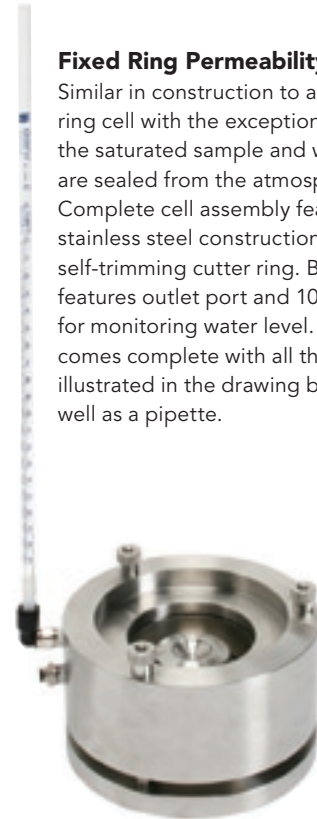
Complete cell assembly features stainless steel construction with self-trimming cutter ring. Similar in construction to a fixed ring cell with the exception that the lower porous stone fits inside the cutter ring and can move vertically within it. The sample ring is also free to move vertically. The cell comes complete with all the parts illustrated in the drawing below.



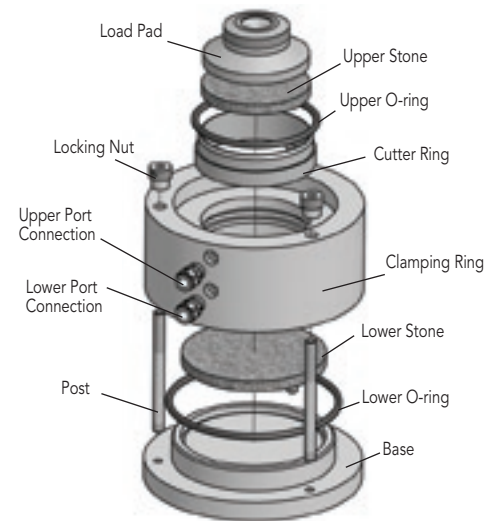
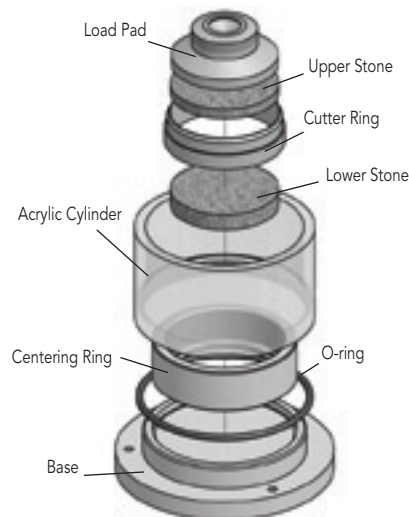
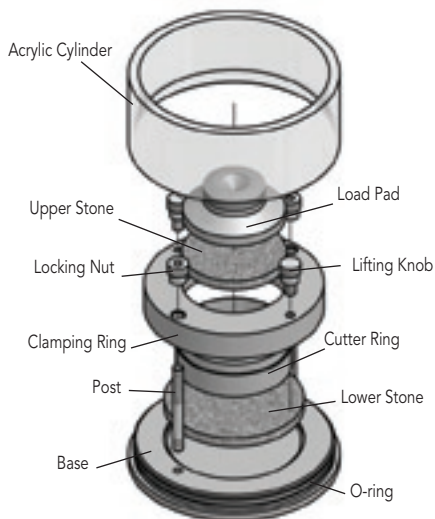
| Floating Ring Consolidation Cell |             |
|----------------------------------|-------------|
| 2.0"                             | HM-1210.20  |
| 2.42"                            | HM-1210.242 |
| 2.5"                             | HM-1210.25  |
| 3.0"                             | HM-1210.30  |
| 4.0"                             | HM-1210.40  |
| 50mm                             | HM-1210.50  |
| 70mm                             | HM-1210.70  |
| 75mm                             | HM-1210.75  |
| 100mm                            | HM-1210.100 |

### Fixed Ring Permeability Cell—

Similar in construction to a fixed ring cell with the exception that the saturated sample and water are sealed from the atmosphere. Complete cell assembly features stainless steel construction and self-trimming cutter ring. Base features outlet port and 10cc pipette for monitoring water level. The cell comes complete with all the parts illustrated in the drawing below, as well as a pipette.



| Fixed Ring Permeability Cell |             |
|------------------------------|-------------|
| 2.0"                         | HM-1230.20  |
| 2.42"                        | HM-1230.242 |
| 2.5"                         | HM-1230.25  |
| 3.0"                         | HM-1230.30  |
| 4.0"                         | HM-1230.40  |
| 50mm                         | HM-1230.50  |
| 70mm                         | HM-1230.70  |
| 75mm                         | HM-1230.75  |
| 100mm                        | HM-1230.100 |





Consolidation Cell Components

|                                       | 2.0"          | 2.42"         | 2.5"          | 3.0"          | 4.0"          | 50mm          | 70mm          | 75mm          | 100mm          |
|---------------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|----------------|
| Load Pad (All)                        | HM-1220.20.10 | HM-1220.24.10 | HM-1220.25.10 | HM-1220.30.10 | HM-1220.40.10 | HM-1220.50.10 | HM-1220.70.10 | HM-1220.75.10 | HM-1220.100.10 |
| Upper Stone (All)                     | HM-1220.20.11 | HM-1220.24.11 | HM-1220.25.11 | HM-1220.30.11 | HM-1220.40.11 | HM-1220.50.11 | HM-1220.70.11 | HM-1220.75.11 | HM-1220.100.11 |
| Lower Stone (Floating)                | HM-1210.20.7  | HM-1210.24.7  | HM-1210.25.7  | HM-1210.30.7  | HM-1210.40.7  | HM-1210.50.7  | HM-1210.70.7  | HM-1210.75.7  | HM-1210.100.7  |
| Lower Stone (Fixed & Permability)     | HM-1220.25.7  | HM-1220.25.7  | HM-1220.25.7  | HM-1220.25.7  | HM-1220.40.7  | HM-1220.25.7  | HM-1220.25.7  | HM-1220.25.7  | HM-1220.40.7   |
| Acrylic Cylinder (Fixed)              | HM-1220.25.2  | HM-1220.25.2  | HM-1220.25.2  | HM-1220.25.2  | HM-1220.40.2  | HM-1220.25.2  | HM-1220.25.2  | HM-1220.25.2  | HM-1220.40.2   |
| Acrylic Cylinder (Floating)           | HM-1210.25.2  | HM-1210.25.2  | HM-1210.25.2  | HM-1210.25.2  | HM-1210.40.2  | HM-1210.25.2  | HM-1210.25.2  | HM-1210.25.2  | HM-1210.40.2   |
| Centering Ring (Floating)             | HM-1210.20.12 | HM-1210.24.12 | HM-1210.25.12 | HM-1210.30.12 | HM-1210.40.12 | HM-1210.50.12 | HM-1210.70.12 | HM-1210.75.12 | HM-1210.100.12 |
| Clamping Ring (Permability)           | HM-1230.20.9  | HM-1230.24.9  | HM-1230.25.9  | HM-1230.30.9  | HM-1230.40.9  | HM-1230.50.9  | HM-1230.70.9  | HM-1230.75.9  | HM-1230.100.9  |
| Clamping Ring (Fixed)                 | HM-1220.20.9  | HM-1220.24.9  | HM-1220.25.9  | HM-1220.30.9  | HM-1220.40.9  | HM-1220.50.9  | HM-1220.70.9  | HM-1220.75.9  | HM-1220.100.9  |
| Base (Floating & Permability)         | HM-1230.25.1  | HM-1230.25.1  | HM-1230.25.1  | HM-1230.25.1  | HM-1230.40.1  | HM-1230.25.1  | HM-1230.25.1  | HM-1230.25.1  | HM-1230.40.1   |
| Base (Fixed)                          | HM-1220.25.1  | HM-1220.25.1  | HM-1220.25.1  | HM-1220.25.1  | HM-1220.40.1  | HM-1220.25.16 | HM-1220.25.1  | HM-1220.25.1  | HM-1220.40.1   |
| Cutter Ring (All)                     | HM-1220.20.8  | HM-1220.24.8  | HM-1220.25.8  | HM-1220.30.8  | HM-1220.40.8  | HM-1220.50.8  | HM-1220.70.8  | HM-1220.75.8  | HM-1220.100.8  |
| Lower O-ring (Floating & Permability) | HM-003053     | HM-003053     | HM-003053     | HM-003053     | HM-003056     | HM-003053     | HM-003053     | HM-003053     | HM-003056      |
| Lower O-ring (Fixed)                  | HM-003052     | HM-003052     | HM-003052     | HM-003052     | HM-003024     | HM-003052     | HM-003052     | HM-003052     | HM-003024      |
| Upper O-ring (Permability)            | HM-003057     | HM-003058     | HM-003054     | HM-003059     | HM-003060     | HM-003057     | HM-003061     | HM-003062     | HM-003063      |
| Post (All)                            | HM-1220.25.3  | HM-1220.25.3  | HM-1220.25.3  | HM-1220.25.3  | HM-1220.25.3  | HM-1220.25.3  | HM-1220.25.3  | HM-1220.25.3  | HM-1220.25.3   |
| Locking Nut (All)                     | HM-1220.25.5  | HM-1220.25.5  | HM-1220.25.5  | HM-1220.25.5  | HM-1220.25.5  | HM-1220.25.5  | HM-1220.25.5  | HM-1220.25.5  | HM-1220.25.5   |
| Lifting Knob (All)                    | HM-1220.25.6  | HM-1220.25.6  | HM-1220.25.6  | HM-1220.25.6  | HM-1220.25.6  | HM-1220.25.6  | HM-1220.25.6  | HM-1220.25.6  | HM-1220.25.6   |
| Port Connection Upper (Permability)   | HM-003027     | HM-003027     | HM-003027     | HM-003027     | HM-003027     | HM-003027     | HM-003027     | HM-003027     | HM-003027      |
| Port Connection Lower (Permability)   | HM-003055     | HM-003055     | HM-003055     | HM-003055     | HM-003055     | HM-003055     | HM-003055     | HM-003055     | HM-003055      |
| Filter Paper                          | HM-4189.20    | HM-4189.25    | HM-4189.25    | HM-4189.30    | HM-4189.40    | HM-4189.20    | HM-4189.28    | HM-4189.30    | HM-4189.40     |
| Calibration Disk                      | HM-1220.20.4  | HM-1220.24.4  | HM-1220.25.4  | HM-1220.30.4  | HM-1220.40.4  | HM-1220.50.4  | HM-1220.70.4  | HM-1220.75.4  | HM-1220.100.4  |

**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 1 5-1/2" H (394 mm). Shipping wt. 30 lbs. (16.3 kg)

**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-2415