Asphalt

Testing Equipment For Construction Materials

HUMBOLDT

Heavy-Duty, Auto Marshall Compactor
ASTM D6926, D5581, AASHTO T245, PTM705

Humboldt automatic, Marshall compaction machines are designed to provide a stable and rigid mechanism for producing 4" or 6" diameter asphalt pills used in Marshall tests. These Marshall compaction machines are available in two types of configurations: one with a rotating mold with a tapered-foot hammer assembly, and the other, a stationary mold with a flat-foot hammer. Both models feature a heavy-duty design, which stands up well to the constant jarring caused by the compaction process.

These machines feature an automatic counter, which allows the operator to preset the number of blows desired and, turns off the machine when a cycle is completed. After the number of blows has been set, the operator can start the machine with a push button and keep track of the number of blows on an LED readout. A cam-action lever operates the integral mold holder to facilitate insertion and removal of the compaction mold.

Machines can be ordered with either 4" or 6" molds, but can easily be altered later to accommodate the other size by purchasing a hammer and test molds of the desired size.

Each machine includes: the mechanical compactor, ASTM-compliant pedestal, an automatic counter and hammer assembly, (1) compaction mold, and (1) package of paper discs. rotating-mold configuration machines come with a tapered-foot hammer assembly and stationary-mold configuration machines come with a flat-foot hammer assembly.

Rotating Mold Configuration

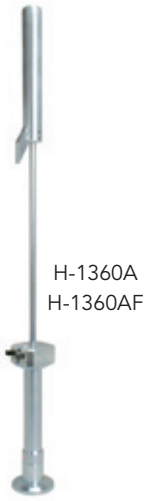
4" Dia. Specimens, 115V 60Hz	H-1364R
6" Dia. Specimens, 115V 60Hz	H-1366R
4" Dia. Specimens, 230V 60Hz	H-1364R.2F
6" Dia. Specimens, 230V 60Hz	H-1366R.2F
4" Dia. Specimens, 230V 50Hz	H-1364R.5F
6" Dia. Specimens, 230V 50Hz	H-1366R.5F

Ship wt. 330lbs. (149.6kg)

Stationary Mold Configuration

4" Dia. Specimens, 115V 60Hz	H-1364
6" Dia. Specimens, 115V 60Hz	H-1366
4" Dia. Specimens, 230V 60Hz	H-1364.2F
6" Dia. Specimens, 230V 60Hz	H-1366.2F
4" Dia. Specimens, 230V 50Hz	H-1364.5F
6" Dia. Specimens, 230V 50Hz	H-1366.5F

Ship wt. 320lbs. (145.15kg)


H-1360A
H-1360AF


H-1360B
H-1360BF

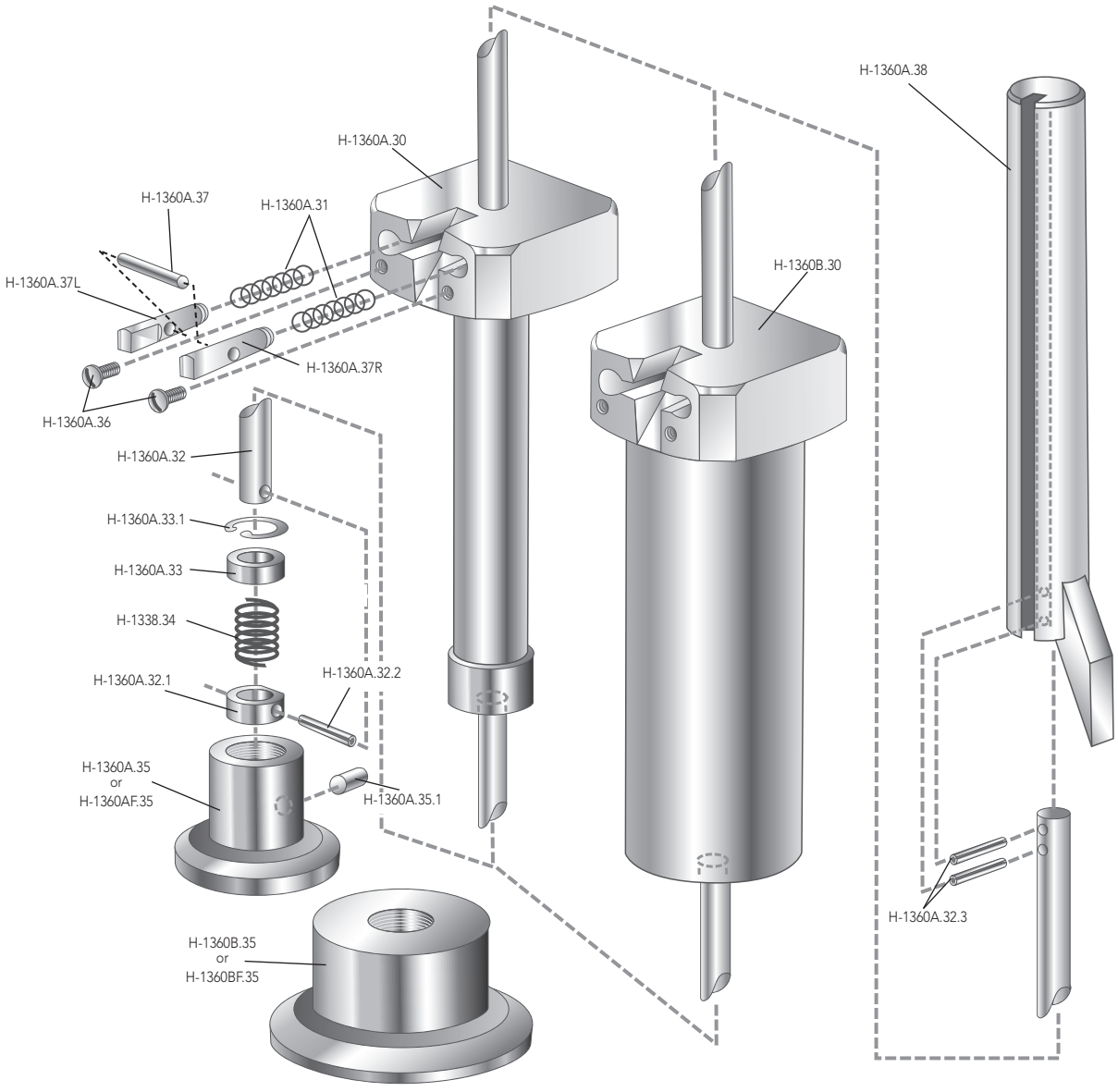

H-1347M


H-1334BA
H-1334BA.4F

Ovens and hotplates can be used to facilitate the heating of molds and hammers for better testing control. See page 251 for ovens and page 256 for hotplates.

Replacement Parts for Heavy-Duty Automatic, Single Compactors

Item	Part No.
4" Hammer with tapered foot (rotating mold)	H-1360A
6" Hammer with tapered foot (rotating mold)	H-1360B
4" Hammer with flat foot (stationary mold)	H-1360AF
6" Hammer with flat foot (stationary mold)	H-1360BF
Lift chain for H-1364, H-1366 series compactors	H-1360.21
Replacement ASTM-compliant pedestal for compactors	H-1347M
Replacement counter & proximity switch, 120V	H-1334BA
Replacement counter & proximity switch, 230V	H-1334BA.4F



Hammer Assemblies and Replacement Parts

Item	Part No.	Item	Part No.
Sliding weight, 10 lb (for 4" mold)	H-1360A.30	Anvil release arm weldment	H-1360A.38
Sliding weight, 22.5 lb (for 6" mold)	H-1360B.30	Hammer release arm	H-1360A.38.1
Hammer slide shaft	H-1360A.32	Anvil, top	H-1360A.38.2
Spring retainer, anvil	H-1360A.32.1	Spring (Foot)	H-1338.34
Spring washer, anvil	H-1360A.33	Spring (Release)	H-1360A.31
Hammer foot, 4" tapered	H-1360A.35	0.25" dia. x 1" large roll pin	H-1360A.32.2
Hammer foot, 4" flat	H-1360AF.35	0.1875" dia. x 1.5" roll pin	H-1360A.32.3
Hammer foot, 6" tapered	H-1360B.35	Internal retaining ring	H-1360A.33.1
Hammer foot, 6" flat	H-1360BF.35	0.3125" dia x 0.5" large dowel pin	H-1360A.35.1
Hammer release pin, left hand	H-1360A.37L	1/4-20 x 1/2" large truss head screw	H-1360A.36
Hammer release pin, right hand	H-1360A.37R	0.25" dia. x 1.375" Large dowel pin	H-1360A.37


H-1336D


H-1346D


H-1356D

4" Automatic, Single Compactor with Stationary Base

ASTM D6926, AASHTO T245, PTM705

This compactor automatically compacts samples at a preset number of hammer blows and shuts off at completion. The compactor features a stationary base with flat-foot hammer. Unit includes mechanical compactor, automatic counter, ASTM-compliant oak compaction pedestal, (1) hammer and (1) H-1341A mold assembly. Additional mold and hammer assemblies are recommended for efficient testing operations, allowing you to preheat multiple molds and hammers to speed testing.

4" Single Compactor, 115V 60Hz	H-1336D
4" Single Compactor, 230V 60Hz	H-1336D.2F
4" Single Compactor, 230V 50Hz	H-1336D.5F

Ship wt. 226lbs. (102.5kg)

4" Automatic, Double Compactor with Rotating Base

ASTM D6926, AASHTO T245, PTM705

This compactor automatically compacts two samples simultaneously at a preset number of hammer blows and shuts off at completion. The compactor features rotating bases with tapered-foot hammers. Unit includes mechanical compactor, automatic counter, ASTM-compliant oak compaction pedestal, (2) hammers and (2) H-1337 mold assemblies. Additional mold and hammer assemblies are recommended for efficient testing operations, allowing you to preheat multiple molds and hammers to speed testing.

4" Double Compactor, 115V 60Hz	H-1346D
4" Double Compactor, 230V 60Hz	H-1346D.2F
4" Double Compactor, 230V 50Hz	H-1346D.5F

Ship wt. 265lbs. (120.2kg)

4" Automatic, Triple Compactor with Rotating Base

ASTM D6926, AASHTO T245, PTM705

This compactor automatically compacts three samples simultaneously at a preset number of hammer blows and shuts off at completion. The compactor features rotating bases with tapered-foot hammers. Unit includes mechanical compactor, automatic counter, ASTM-compliant oak compaction pedestal, (3) hammers and (3) H-1337 mold assemblies. Additional mold and hammer assemblies are recommended for efficient testing operations, allowing you to heat multiple molds and hammers to speed testing.

4" Triple Compactor, 115V 60Hz	H-1356D
4" Triple Compactor, 230V 60Hz	H-1356D.2F
4" Triple Compactor, 230V 50Hz	H-1356D.5F

Ship wt. 351lbs. (181.4kg)

Replacement Parts for Standard-Duty, Automatic Compactors

Item	Model #
4" hammer with flat foot (stationary base) for H-1336D	H-1338A
4" hammer with tapered foot (rotating base) for H-1346D, H-1356D	H-1338B
4" hammer with "Canadian" tapered foot (rotating base) for H-1346D, H-1356D	H-1338C
Marshall Compaction Mold 4" for Stationary Base Compactors	H-1341A
Marshall Compaction Mold 4" for Rotating Base Compactors	H-1337
Lift Chain for H-1336D, H-1346D and H-1356D	H-1336.21
Replacement Counter and proximity switch for Compactors, 115V	H-1334B
Replacement Counter and proximity switch for Compactors, 230V	H-1334B.4F
Replacement Pedestal for H-1336D Marshall Compactor	H-1347M
Replacement Pedestal for H-1346D Marshall Compactor	H-1347.2M
Replacement Pedestal for H-1356D Marshall Compactor	H-1347.3M


H-1338A
H-1338B
H-1338C


H-1341A

H-1337

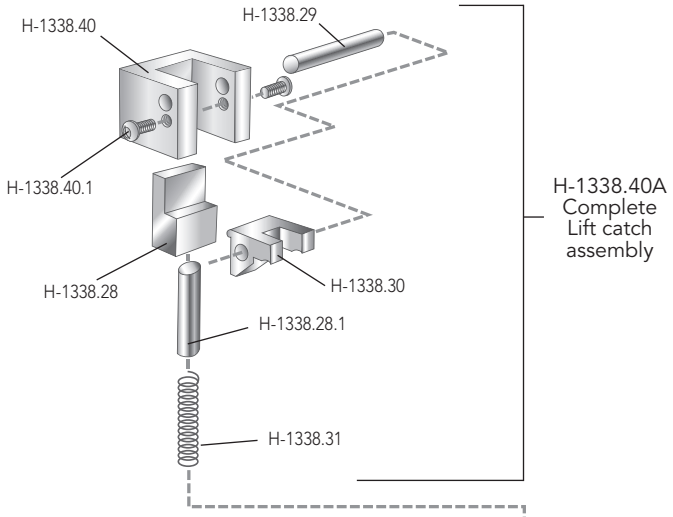

H-1347.3M
H-1347.2M
H-1347M


H-1334B
H-1334B.4F

To facilitate the heating of molds and hammers,
See page 251 for Ovens and page 256 for Hotplates.

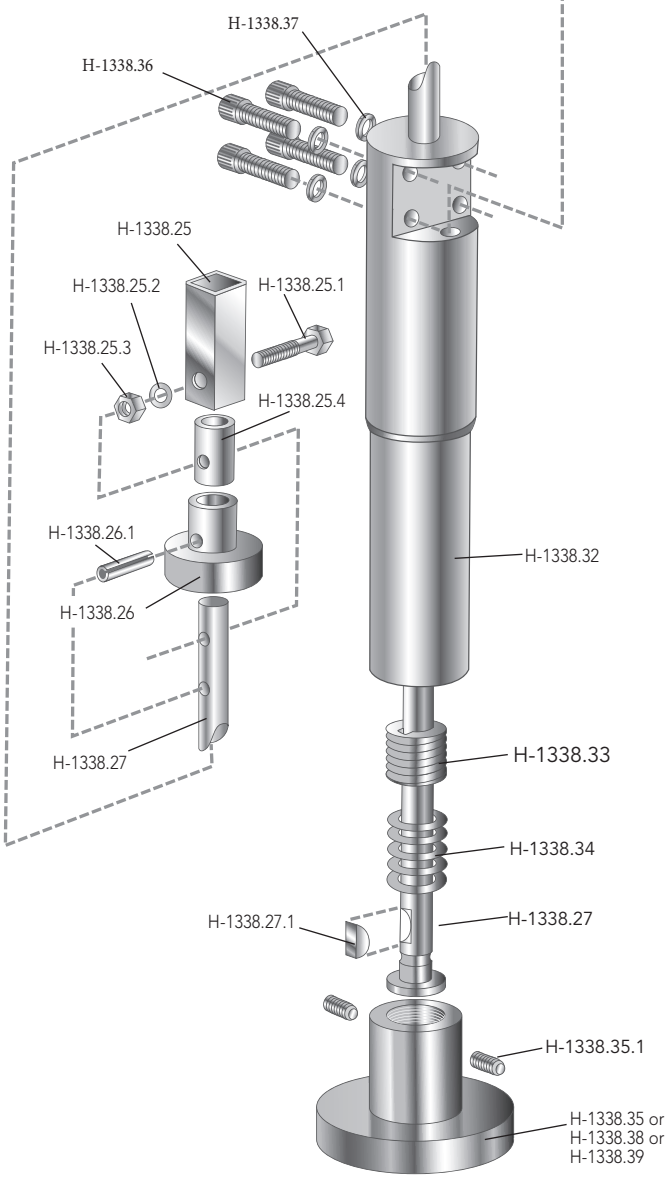
Lift Catch Assembly and Replacement Parts

Item	Model #
Complete lift catch assembly	H-1338.40A
Release block	H-1338.28
Pin	H-1338.28.1
Clevis pin	H-1338.29
Lift catch	H-1338.30
Spring	H-1338.31
Screw	H-1338.36
Washer	H-1338.37
Release housing	H-1338.40
Screw for release housing	H-1338.40.1



Hammer Assemblies and Replacement Parts

Item	Model #
Clevis pin with screw	H-1338.29
Locator guide	H-1338.25
Hex head bolt	H-1338.25.1
Washer	H-1338.25.2
Nut	H-1338.25.3
Spacer	H-1338.25.4
Hammer handle	H-1338.26
Spring pin	H-1338.26.1
Hammer rod	H-1338.27
Key	H-1338.27.1
Hammer weight (complete)	H-1338.32
Plug	H-1338.33
Spring	H-1338.34
Hammer foot, flat	H-1338.35
Hammer foot, tapered	H-1338.38
Hammer foot, Canadian spec	H-1338.39
Screw for foot (2 required)	H-1338.35.1
Socket Head Screw, 5/16 x 18 x 1.25"	H-1338.36
Washer	H-1338.37




H-1345


H-1340


H-1340G


H-1343


H-1347


H-1345.5

H-1345.6


H-1328A

Hand Compactor Set for 4" Molds
ASTM D6926

Compactor set that facilitates hand compaction of 4" Marshall specimens. Set features ASTM-compliant oak pedestal with hammer support rod, which holds hammer in perpendicular alignment to base during compaction. Also features a mold holder, which keeps the mold securely positioned during compaction. Set includes: H-1340G compaction hammer; H-1347 pedestal with ASTM-compliant steel plate; H-1341A compaction mold; H-1343 compaction mold holder; H-1345.6 hammer support rod, and H-1345.5 adjustable guide. Additional mold and hammer assemblies are recommended for efficient testing operations, allowing you to preheat multiple molds and hammers to speed testing.

4" Hand Compactor Set — H-1345
Ship wt. 165lbs. (74.8kg)

4" Hand Compaction Hammer
AASHTO T245

Hammer used to compact asphalt mixture in the compaction mold. Flat circular face is 3.875" (98mm) dia.; hammer is 10 lb. (4.54kg.), sliding weight and has a free fall of 18" (457mm). Additional mold and hammer assemblies are recommended for efficient testing operations, allowing you to preheat multiple molds and hammers to speed testing.

4" Hand Compaction Hammer — H-1340
Ship wt. 18.5lbs. (8.3kg)

4" Hand Compaction Hammer w/ Finger Guard
ASTM D6926

Compacts asphalt mixture in the compaction mold. Hammer has finger guard at base of sliding weight. Flat circular face is 3.95" (100.3mm) dia.; hammer is 10 lb. (4.54kg.) sliding weight and has a free fall of 18" (457mm). Additional mold and hammer assemblies are recommended for efficient testing operations, allowing you to heat multiple molds and hammers to speed testing.

4" Hammer w/Finger Guard — H-1340G
Ship wt. 20lbs. (9.0kg)

Mold Holder for Hand Compaction
ASTM D6926

Holder mounts on compaction pedestal and centers the compaction mold under the hammer for fast, repeatable operation. Mold holder keeps mold, collar and base plate securely positioned during compaction.

Mold Holder for Hand Compaction — H-1343
Ship wt. 4.8lbs. (2.1kg)

Pedestal for 4" Hand Compactor
ASTM D6926

This oak pedestal is necessary for stabilizing molds during compaction. The ASTM-compliant oak compaction pedestal is 8" x 8" x 18" (203 x 203 x 457mm), capped with 12" x 12" x 1" (305 x 305 x 25mm) steel plate. The pedestal mounts to a concrete slab with four angle brackets located at the bottom of pedestal.

Pedestal for 4" Hand Compactor — H-1347
Ship wt. 82lbs. (37.1kg)

Hammer Guide, Adjustable
Hammer guide for hand compactor testing.

Hammer Guide, Adjustable — H-1345.5
Ship wt. 2.6lbs. (1.1kg)

Hammer Support Rod
Hammer support rod for hand compactor testing. Mounts to pedestal.

Hammer Support Rod — H-1345.6
Ship wt. 9.3lbs. (4.2kg)

Marshall Mix Design and Testing Booklet
This booklet covers the Marshall mix design criteria; equipment necessary to perform the tests; sample preparation and testing procedures; data analysis, as well as moisture susceptibility testing methods.

Marshall Mix Design Booklet — H-1328A
Ship wt. 9lbs. (4.1kg)

Ovens and hotplates can be used to facilitate the heating of molds and hammers for better testing control. See page 251 for ovens and page 256 for hotplates.


H-1367, H-1367MM


H-1361


H-1341A


H-1337, H-1337MM


H-1353A


H-1355


H-1341P
H-1361P


H-1348
H-1363


H-1331

Marshall Compaction Mold, 6" or 150mm
ASTM D6926, AASHTO T245

6"or 150mm compaction mold assembly for preparing test specimens with the H-1366 and H-1366R compactors. Can be used with rotating or stationary base models. Mold is machined from seamless tubing and plated. Mold is comprised of a base plate, mold cylinder and extension collar.

Compaction Mold, 6"	H-1367
Compaction Mold, 150mm	H-1367MM
Ship wt. 15lbs. (6.8kg)	

Marshall Compaction Mold, 4" (Rotating Base)
ASTM D6926, AASHTO T245

4" compaction mold assembly for preparing test specimens with the H-1364R rotating base compactors. Mold is machined from seamless tubing and plated. Mold is comprised of a base plate, mold cylinder and extension collar.

Compaction Mold, 4"	H-1361
Ship wt. 9lbs. (4kg)	

Marshall Compaction Mold, 4" (Stationary Base)
ASTM D6926, AASHTO T245

4" compaction mold assembly for preparing test specimens with H-1336D mechanical compactor and H-1340 and H-1345 hand compactors. Mold is machined from seamless tubing and plated. Mold is comprised of a base plate, mold cylinder and extension collar. Base plate and collar are interchangeable with either end of the forming mold. Forming mold is 4" (102mm) ID by 3" (76mm) high.

Compaction Mold, 4" (Stationary Base)	H-1341A
Ship wt. 8lbs. (3.6kg)	

Marshall Compaction Mold, 4" or 100mm (Rotating Base)

4" or 100mm compaction mold assembly for preparing test specimens with the H-1346D and H-1356D rotating-base compactors. The mold is machined from seamless tubing and plated. Mold is comprised of a base plate, mold cylinder and extension collar. Base plate of mold is designed to link with rotating base feature of compactors causing the mold to rotate during compaction. Forming mold is 4" (102mm) ID by 3" (76mm) high and interchangeable with either end of the forming mold. Forming mold is 4" (102mm) ID by 3" (76mm) high.

Compaction Mold, 4" (Rotating Base)	H-1337
Compaction Mold, 100mm (Rotating Base)	H-1337MM
Ship wt. 8lbs. (4kg)	

Paper Disks
ASTM D5581, D6926, AASHTO T245

Circular, smooth-edged 4" or 6" diameter disks, which can be placed in the bottom of compaction molds prior to filling with asphalt mixture to facilitate removal of the sample from the mold. Use with all molds.

Paper Disks, 4" package of 1000	H-1341P
Paper Disks, 6" package of 500	H-1361P
Ship wt. 0.8lbs. (0.3kg)	

Mold Extractors
ASTM D5581, D6926, AASHTO T245

Used with compression tester for removing 4" or 6" specimens from compaction molds.

Mold Extractor, 4"	H-1348
Mold Extractor, 6"	H-1363
Ship wt. 3.6lbs. (1.6kg)	

Storage Can for Marshall Samples

4" dia. x 5.5" tall metal can with lid for storing Marshall mix samples.

Storage Can, 4"	H-1331
Ship wt. 2.8lb. (1.27kg)	

Sample Ejector, Hand-Operated
ASTM D5581, D6926, AASHTO T245

Designed for lab and field use to extract asphalt samples from either 4" or 6" compaction molds. The ejection force is generated by means of a 3-ton (27.7kN) capacity hand-operated hydraulic jack. The cast-aluminum ejector head assembly can be positioned at different heights through the use of quick release pins. This enables the operator to easily match the ejection travel to the height of the mold being used. Maximum stroke distance for this ejector is 7.5". Overall dimensions: 13"W x 6"D x 27"H (330 x 152 x 686mm).

Sample Ejector, Hand-Operated	H-1353A
Ship wt. 46.2bs. (20.9kg)	

Sample Ejector, Motorized
ASTM D5581, D6926, AASHTO T245

Similar in design and construction to the H-1353A series sample ejector, this model features the use of a 5-ton capacity motorized hydraulic pump and ram assembly. The unit incorporates extended upright rods in order to accommodate both standard 4" or 6" asphalt compaction molds, as well as the taller gyratory compaction molds. Maximum stroke distance for this ejector is 9.25". Overall dimensions excluding pump: 13"W x 6"D x 29"H (330 x 152 x 737mm).

Sample Ejector, 120V 60Hz	H-1355
Sample Ejector, 220V 50/60Hz	H-1355.4F
Ship wt. 81lbs. (36.7kg)	

Marshall and SCB Load Frames

HM-5030.3F

The HM-5030 Master Loader provides the ultimate solution for a lab looking to perform Marshall, Hveemand SCB testing, but would also like to be able to use the load frame for all their other testing needs as well. The digital MasterLoader provides that ability by easily handling asphalt compression testing, as well as soil tests such as CBR and triaxial tests including UU, CU, CD and UC.

The digital MasterLoader has the ability to work as a stand-alone unit, which can perform Marshall tests at the push of a button; or with the aid of Humboldt's NEXT software, the Marshall software module and a computer, it can be automated to run tests and gather data in real-time data acquisition in the form of charts and graphs. The HM-5030 is ideal for road construction projects in either mobile or fixed labs, educational institutions and consulting firms.

Humboldt MasterLoader Marshall Solution

ASTM D5581, D6926, D6931; AASHTO T245, T283; BS 598; EN12697-34

Designed for applications requiring multi-purpose loading systems, such as road construction projects in either mobile or fixed labs, educational institutions and consulting firms, the HM-5030 Master Loader is ideal for just about any application from

See pages 112-115 for more information on the HM-5030 Master Loader and its Stand-alone and Computer-controlled capabilities

road construction to high-volume commercial and educational laboratories.

While the HM-5030 has been specifically designed for soil testing labs conducting multiple testing operations including: UU, CU and CD triaxial, UC, CBR and LBR, it is also perfect for running Marshall, Hveem, TSR and SCB asphalt tests as well. Its heavy-duty design and precise stepper-motor control provide a stable platform for years of reliable service allowing the HM-5030 to perform any tests required up to its load capacity of 11000 lbf (50kN).

Like all Elite Series load frames, the HM-5030 is built around Humboldt's integral, 4-channel data logger with touch-screen control, which allows the load frame to be used as a standalone device capable of full test control and data logging. It can also be controlled by a networked computer at any location with access to the network.

Load capacity	11000 lbf (50kN)
Speed range	0 - 3.0000 in/min. 0 - 75.0000 mm/min.
Data channels	4
Platen Size / Travel	10" (254mm) / 4" (100mm)
Data storage	1000 tests and up to 3000 readings per test
Clearance, vertical	40" (1000mm)
Clearance, horiz.	15" (380mm)
Voltage	110/220V 50/60Hz. 5.0 amps

Master Loader, 110/220V 50/60 Hz **HM-5030.3F**

Shipping wt. 300 lb (136kg)

Marshall, TSR, SCB Load Frame

ASTM D5581, D6926, D6931; AASHTO T245, T283; BS 598; EN12697-34

HM-5120 Loader has been specifically designed to handle Marshall, TSR and SCB applications. Its heavy-duty design and precise stepper-motor control provide a stable platform for years of reliable service. From educational institutions and consulting firms to high-volume commercial labs and construction projects, the HM-5120 Loader can handle these applications with ease.

The HM-5120 is built around Humboldt's integral, data logger with touch-screen control, which allows the load frame to be used as a standalone device capable of full test control and data logging. It can also be controlled by a networked computer at any location with access to the network. Adding the Marshal-specific Software Module allows you to better control your Marshall test procedure. The HM-5120 is sold as a Load Frame ONLY, refer to the recommended accessories chart for items needed to perform Marshall and TSR and SCB testing.

These new waterproof, touch screens provide colorful, at-a-glance monitoring of testing functions without the use of a computer. Operators can see all the data in several formats at the machine while the test is running. Data can then be transfered to a computer for use with Humboldt's Next Software for report generation.

This machine can also be controlled from a computer using Humboldt's NEXT software. This software provides robust machine control, data acquisition and report generation. Because the HM-5120 is connected to your network, your computer can be placed in the your lab, in the next room or at a different location. Adding the Marshal-specific Software Module allows you to better control your Marshall test by guiding you through the specific process.

The HM-5120 is sold as a Load Frame ONLY, refer to the recommended accessories chart for items needed to perform Marshall and TSR and SCB testing.

Load capacity	11000 lbf (50kN)
Speed range	2 in/min. 50.8mm/min.
Data channels	2
Platen Size / Travel	10" (254mm) / 4" (100mm)
Data storage	1000 tests and up to 3000 readings per test
Clearance, vertical	40" (1000mm)
Clearance, horiz.	15" (380mm)
Voltage	110/220V 50/60Hz. 5.0 amps

Marshall Load Frame, 110/220V 50/60 Hz **HM-5120.3F**

Shipping wt. 300 lb (136kg)

Marshall and SCB Load Frames

Humboldt's HM-5030 amd HM-5120 load frames are part of our Elite Series of load frames, which provide both stand-alone and computer control options. In stand-alone mode, these load frames provide a 7" (178mm) touch-screen controller. These new waterproof, touch screens provide colorful, at-a-glance monitoring of testing functions without the use of a computer. Operators can see all the data in several formats at the machine while the test is running. Data can then be viewed simultaneously or downloaded later to a computer in the lab, in the next room or at a different location, while also providing report generation capabilities from within Humboldt's NEXT software or our enhanced test-specific modules.

Stand-Alone Control

Touch-Screen Controller provides:

- multi-channel data acquisition
- Hi-res, 7", waterproof, touch-screen provides total control and real-time graphical display of tests
- Machine/Test control and data acquisition via touch-screen
- Control both channels at the same time
- Calibration of channels to load cell and transducer
- Real-time graphical chart and numerical display of tests via touch-screen display
- Effective sampling rate of 50 readings per second
- Stores up to 1000 tests with 3000 points per test
- 2 USB ports. One in front for data transfer and the rear port is for powering a wireless access point.

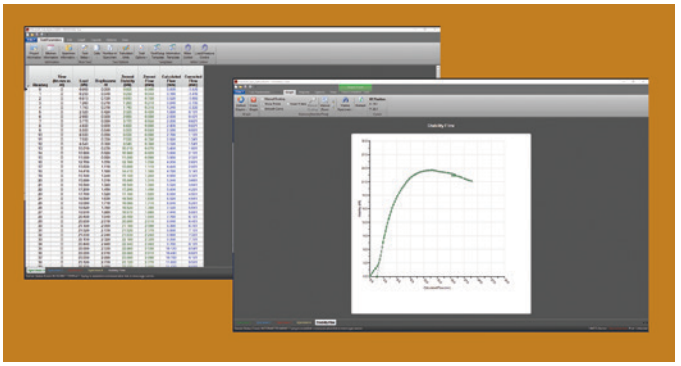
Computer Control

Humboldt's Next software is included with all Elite Series Load Frames. This software provides robust machine control, calibration, data acquisition and report generation for those using a computer to control consolidation testing operations.

In addition, operators have the ability to view and control testing operations from a PC in the lab, in the next room or at a different location, while also providing report generating capabilities using the consolidation test-specific software module.

- Machine control, and data acquisition via networked computer
- Provides the ability to use Next Software's, advanced test-specific modules
- Real-time graphical chart and numerical display of tests via computer display
- Effective sampling rate of 50 readings per second
- Stores unlimited tests with up to 3000 points per test.
- Up to 255 individual tests can be run simultaneously from a single PC
- Provides advanced graphing capabilities
- Provides full-unit customization

HM-5005SW Marsahll Software Module



See page 94-95 for more information on Humboldt's NEXT Software.

- Reports can also be exported to Excel or a CSV file, if desired, and, we can provide custom integration/export solutions for LIMS, EQuIS, gINT, etc.

NEXT Marshall Software Module

ASTM D5581, D6926, D6931; AASHTO T245, T283; BS 598; EN12697-34

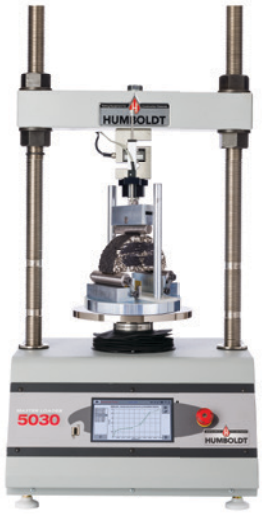
Humboldt's NEXT software is used to control the operation of Humboldt's testing machines, as well as provide data acquisition and reporting of test data. The software provides a computer-based platform with the ability to configure testing machines and the testing process; calibrate transducers, load cells and digital indicators; specify testing parameters and limits, operate the machine during the testing and provide detailed reports of the data collected in tabular or graphical formats.

From controlling a single operation to a complete geotechnical lab, Humboldt's NEXT data acquisition software, in conjunction with compatible Humboldt testing equipment, provides a complete solution for the acquisition, recording and presentation of test data. NEXT software is included with many of Humboldt's load frames, consolidation and direct shear machines; providing robust machine control, calibration, data acquisition and report generation for those using a computer to control load frame operations.

- test-specific setup, which guides you through the process and includes selecting data collection parameters that best fit the specific test
- input specific project information for each test, such as project name, client information, etc
- all test-specific initial, intermediate, and final parameters required by ASTM and BS standards are dynamically calculated for you, based on your input of specimen information, such as size, weight, etc
- tabulated test data, graphs and all test-specific calculations are provided in real time, allowing you to monitor tests in process
- generate test-specific reports that include all graphs and data presented in a project

NEXT Marshall Software Module HM-5005SW

Download



Semi-Circular Bending setup shown on HM-5030

Recommended Marshall, TSR and SCB Accessories for use with HM-5030 and HM-5120 Load Frames

Part #	Description
HM-2300.100	S-type load cell, 11,000lbf (50kN)
HM-2310.10	Strain Transducer, 1" (25mm)
HM-2305.10	Strain Transducer, 1" (25mm) Required for HM-5120 ONLY.
HM-4178BRT	Displacement transducer bracket
HM-2305BRT	Displacement transducer bracket Required for HM-5120 ONLY.
HM-5005SW	Marshall software module
H-1342	Marshall breaking head, 4"
H-1362	Marshall breaking head, 6"
H-1349	Lottman breaking head, 4"
H-1369	Lottman breaking head, 6"
H-1351	Semi-circular Bend Test Breaking Head

Marshall Load Frames

HM-2850

H-1339B

H-1335
Basic Marshall Test Set

Multi-Speed Load Frame

ASTM D5581, D6926, D6931, AASHTO T245, T283, BS 598, EN12697-34

The HM-2850 Multi-speed Load Frame is designed for those who want a high-quality, but simple, multi-purpose load frame without built-in data acquisition capabilities. The HM-2850 is ideal for applications where the operator is either not concerned with data acquisition; or, already has or is planning to construct their own data acquisition system. With its large 7" color, touchscreen, the HM-2850 provides the operator with the ability to precisely select any speed with four-decimal accuracy within the machine's speed range.

The HM-2850 features a quiet, direct drive stepper motor that provides a range of loading speeds from .0001 to 2.2500 in/min. This speed range is more than adequate for the majority of standard soil tests. The HM-2850 also incorporates a separate, dedicated control to accommodate 2.00 in/min. for use in Marshall and TSR Testing, as well as a rapid travel speed of 2.25 in/min for moving the platen into position quickly. Speeds are controlled through the use of edit keys and the digital display.

Specifications	
Load capacity	11000 lbf (50kN)
Speed range	.0001 - 2.2500 in/min. 0.00254 - 57.1500 mm/min.
Platen Size / Travel	8" (203mm) / 3" (76mm)
Clearance, vertical	40" (1000mm)
Clearance, horiz.	15" (380mm)
Dimensions (l x w x h).	17 x 22 x 51 inch (432 x 559 x 1295mm)
Voltage	110/220V 50/60Hz. 5.0 amps

Multi-Speed Load Frame, 110/220V 50/60 Hz HM-2850.3F

Shipping wt. 300 lb (136kg)

Marshall Compression Machine

ASTM D5581, D6926, D6931, AASHTO T245, T283, BS 598, EN12697-34

Compression machine designed specifically for testing the resistance to plastic flow of bituminous paving mixtures— the Marshall test. Machine has a one-speed motor with reversing switch that produces a uniform vertical movement of 2" (51mm) per minute. Unit includes a H-4454.100 calibrated load ring and dial indicator for determining test load. Load capacity is 11,000 lbf. (50kN). Maximum piston travel is 3.5" (88mm). Overall dimensions are: 18" x 18" x 38.5"H (457 x 457 x 978mm).

Typical Setup for Marshall Testing

Description	Qty	Part #
Marshall load frame (choose one)	1	H-1339B HM-2850
Load Ring, 11,000 lbf (50kN)	1	H-4454.100
Dial flow meter kit w/ Dial gauge 1.00" x 0.01"	1	H-1344
Marshall breaking head, 4"	1	H-1342

Compression Machine, 120V 60Hz H-1339B
Compression Machine, 220V 60Hz H-1339B.2F
Compression Machine, 220V 50Hz H-1339B.5F

Ship wt. 250lbs. (113.3kg)

Chart Recorder Accessory Kit

This kit is comprised of a H-1329LR chart recorder, an LVDT and a H-2300.100 load cell for converting a H-1339B Marshall compression machine into an automatic Marshall compression tester and recorder. Includes LVDT sensor, electronic load cell and plotter assembly.

Chart Recorder Kit, 120V 60Hz H-1329CK
Chart Recorder Kit, 220V 50Hz H-1329CK.5F

Ship wt. 18lbs. (8.2kg)

Digital Accessory Kit

Four-channel digital display for use with the H-1339. Includes: s-type 11,000 lbf (50kN) load cell; 0.4" (10mm) linear strain transducer; transducer bracket, and 4-channel miniLogger.

Digital Accessory Kit H-1324A.3F

Ship wt. 10lbs. (4.5kg)

Basic Marshall Test Set

ASTM D5581, D6926, D6931, AASHTO T245, T283, BS 598, EN12697-34

Basic test set for evaluating stability and plastic flow (Marshall tests) of bituminous paving mixtures. Includes all the basic testing equipment for performing these tests. Ideal setup for field lab applications, as well as dedicated Marshall test labs. Included in the set are: (1) H-1339B–Marshall compression machine; (1) H-1340– 4" hand compaction hammer; (2) H-1341A– 4" Marshall compaction molds; (1) H-1342–4" Marshall breaking head; (1) H-1343– mold holder for hand compactor; (1) H-1344– dial flowmeter with guide sleeve; (1) H-1347– pedestal for 4" hand compactor; (1) H-1348– 4" mold extractor, and (1) H-1390– water bath. 230V models include a H-1390.4F water bath.

Metric version includes: (1) H-1339B, 220V Marshall compression machine; (1) H-1340– 4" hand compaction hammer; (2) H-1341A– 4" Marshall compaction molds; (1) H-1342M–100mm Marshall breaking head; (1) H-1343– mold holder for hand compactor; (1) H-1344.2M– dial flowmeter with guide sleeve; (1) H-1347– pedestal for 4" hand compactor; (1) H-1348– 4" mold extractor, and (1) H-1390, 230V water bath.

Marshall Test Set, 120V 60Hz H-1335
Marshall Test Set, 220V 60Hz H-1335.2F
Marshall Test Set, 220V 50Hz H-1335.5F
Marshall Test Set-Metric, 230V 60Hz H-1335M.2F
Marshall Test Set-Metric, 230V 50Hz H-1335M.5F

Ship wt. 325lbs. (147.4kg)

H-1342, H-1362
H-1342M

H-1349, H-1369
H-1349M, H-1369M

H-1351

H-4454.100

H-4454.100D

H-1344.2

H-1344

Marshall Breaking Head,
ASTM D6927

Marshall breaking heads consist of an upper and lower cylindrical segment having 3" inside radius of curvature for 6" samples and 2" for a 4" sample. The lower segment is mounted on a base with two perpendicular guide rods extending vertically from the base. One guide rod is larger than the other, with a correspondingly larger guide sleeve in the upper segment to ensure correct assembly. Guide sleeves in the upper segment bring the two sections together without appreciable binding or loose motion on the guide rods.

Marshall Breaking Head, 4"	H-1342
Marshall Breaking Head, 6"	H-1362
Ship wt. 25lbs. (11.3kg)	

Marshall Breaking Head, Metric

Marshall breaking heads consist of an upper and lower cylindrical segment. The lower segment is mounted on a base with two perpendicular guide rods extending vertically from the base. One guide rod is larger than the other, with a correspondingly larger guide sleeve in the upper segment to ensure correct assembly. Guide sleeves in the upper segment bring the two sections together without appreciable binding or loose motion on the guide rods.

Marshall Breaking Head, 100mm	H-1342M
Ship wt. 25lbs. (11.3kg)	

Lottman Breaking Head
ASTM D6931, AASHTO T283

Breaking heads for testing tensile strength. H-1349 has 0.5" wide upper and lower segments for use on 4" samples. H-1369 has 0.75" wide upper and lower segments for use on 6" samples.

Lottman Breaking Head, 4"	H-1349
Lottman Breaking Head, 6"	H-1369
Lottman Breaking Head, 100mm	H-1349M
Lottman Breaking Head, 150mm	H-1369M
Ship wt. 10.2lbs. (4.6kg)	

Semi-Circular Bending (SCB) Head
ASTM D8044; AASHTO TP124

The H-1351 Semicircular Bend fixture has been designed for use with the test methods above. The H-1351 SCB head can be configured in two ways. The first utilizes the upper and lower segments of the breaking head. The lower segment is comprised of a base with two perpendicular guide rods extending vertically and an upper segment mounted to the lower segment by sliding on the vertical guide rods. The holes in the upper segment are lined with brass to reduce binding as it moves up and down the guide rods. In this configuration the upper swivel contact bar is mounted to the upper breaking head segment.

In the second configuration, the upper swivel contact bar is separated from the upper breaking head bar and is mounted directly to the load cell. If using this method, precise alignment can be achieved by using the alignment guide, which is included.

The H-1351 Semi-circular Bending Head can be used in conjunction with one of the Humboldt's load frames, such as the HM-5030 Master Loader or HM-5120 Marshall frames. It may also be used with your present load frame, which meets the test's speed requirements. Humboldt offers additional Data Loggers with instrumentation for data acquisition of the SCB test results using the SCB breaking head when used with your present load.

Semi-Circular Bending (SCB) Head	H-1351
Ship wt. 25lbs. (11.3kg)	

Dial Flowmeter Kit
ASTM D6927

Used to measure flow during Marshall testing. Consists of a special dial indicator with a maximum position brake assembly and a guide sleeve, which fits over either guide rod of a H-1342 or H-1362 Marshall breaking head. H-1344 has a range of 1.00" with 0.01" divisions and the H-1344M has a range of 25mm with 0.25mm divisions

Dial Flowmeter Kit	H-1344
Dial Flowmeter Kit, Metric	H-1344M
Ship wt. 2lbs. (.9kg)	

Dial Gauge For Flowmeter
ASTM D6927

Consists of a special dial indicator with a maximum position brake assembly. The H-1344 has a range of 1.00" with 0.01" divisions and the H-1344M has a range of 25mm with 0.25mm divisions

Dial Gauge For Flowmeter	H-1344.2
Dial Gauge For Flowmeter, Metric	H-1344.2M
Ship wt. 1lbs. (.45kg)	

Marshall Test Load Ring
ASTM E74

These calibrated load rings with dial gauges come with a unique serial numbered for positive identification. The dial gauges read in inches, but each load ring comes with a calibration chart showing lbf vs. deflection in inches, kN vs. deflection in millimeters and kN vs. deflection in inches for easy conversions. Units are calibrated in lbs. force every 20 lbs. from 0 to 1,000 lbs. and every 50 lbs. from 1,000 to 11,000 lbs. with adequate deflection to interpolate to 10 lbs., in kg force and kN. Comes with 3/4"-16 female, threaded mount.

11,000 lbf (4,550kgf, 50kN)	H-4454.100
5,500 lbf (2,500kgf, 25kN)	H-4454.050
Ship wt. 11lbs. (4.9kg)	

Marshall Test Digital Load Ring
ASTM E74

Calibrated load rings with digital indicators come with a unique serial numbered for positive identification. Each load rings comes with a calibration chart showing the relationship between deflection and pounds force for the individual ring. Units are calibrated in lbf every 20 lbs. from 0 to 1,000 lbs. and every 50 lbs. from 1,000 to 11,000 lbs. with adequate deflection to interpolate to 10 lbs., in kg force and kN. Comes with 3/4"-16 female, threaded mount.

11,000 lbf (4,550kgf, 50kN)	H-4454.100D
5,500 lbf (2,500kgf, 25kN)	H-4454.050D
Ship wt. 11lbs. (4.9kg)	

Guide Sleeve For Flowmeter Kit
ASTM D6927

Guide sleeve for use with dial gauge to measure flow during Marshall testing. Device fits over either guide rod of a H-1342 or H-1362 Marshall breaking head and provides mounting of dial gauge.

Guide Sleeve For Flowmeter Kit	H-1344.1
Ship wt. 0.6lbs. (.27kg)	

Water Baths


H-1394

H-1392, H-1390


H-1380

- Auto-tuning is fast & effortless
- Rapid cycling provides fast system response
- Dual, digital display simultaneously shows set point and process temperature
- Ramp-to-set point handles critical temperature processes smoothly
- Set point range limiting protects process and equipment
- Percent power limit protects components from stress
- Operator lockout guards against unwanted changes
- All exposed parts are stainless steel. Front panel is water and corrosion resistant.

Humboldt water baths feature a microprocessor-based digital controller for precise temperature control throughout their temperature range of ambient to 180°F (82°C) at an accuracy of +/-0.1% of input span. The dual digital display simultaneously shows the set point and the process temperature at a glance.

Humboldt water baths are fully insulated to help maintain constant temperatures easily. Models H-1390 and H-1392 can accommodate (12) 4" diameter or (3) 6" diameter Marshall specimens at a time. And the model H-1394 can accommodate (16) 4" and (9) 6" diameter Marshall specimens at a time. All models include a stainless steel shelf, which supports specimens while allowing 2" of free circulating water above and below specimens. Models H-1390 and H-1394 also utilize a magnetic stirring bar to induce water flow within the bath and ensure a uniform temperature is maintained. Model H-1392 does not have a magnetic stirring bar. All exposed areas are stainless steel and the front control panel is both water and corrosion resistant.

Deluxe Water Bath

ASTM D6927, D5581 and D4867

Microprocessor-based control for precise temperatures throughout the range. Includes magnetic circulator, ensuring constant water temperature, and, a stainless steel shelf, which stands 2" (51mm) above the bottom of the unit for free circulation of water above and below test samples. Volume is 7.76 gallons (29.40L) and dimensions are: ID: 19.5" W x 11.5" D x 8" H (495.3 x 292.1 x 203.2mm).

Water Bath, Deluxe 120V 60Hz	H-1390
Water Bath, Deluxe 220V 50/60Hz	H-1390.4F

Ship wt. 44lbs. (19.9kg)

Water Bath

ASTM D6927, D5581 and D4867

Microprocessor-based control for precise temperatures throughout the range. Includes a stainless steel shelf, which stands 2" (51mm) above the bottom of the unit for free circulation of water above and below test samples. Volume is 7.76 gallons (29.40L) and dimensions are: ID: 19.5" W x 11.5" D x 8" H (495.3 x 292.1 x 203.2mm).

Water Bath, 120V 60Hz	H-1392
Water Bath, 220V 50/60Hz	H-1392.4F

Ship wt. 43lbs. (19.5kg)

Large Deluxe Water Bath

ASTM D6927, D5581 and D4867

Microprocessor-based control for precise temperatures throughout the range. Includes magnetic circulator, ensuring constant water temperature, and, a stainless steel shelf, which stands 2" (51mm) above the bottom of the unit for free circulation of water above and below test samples. Volume is: 17 gallons (63.4L) and dimensions are 20" x 20" x 10" deep (508 x 508 x 254mm).

Water Bath, Large 120V 60Hz	H-1394
Water Bath, Large 220V 50/60Hz	H-1394.4F

Ship wt. 75lbs. (34kg)

Economy Water Bath

Low-cost alternative water bath for heating specimens holds eight standard 4" stability molds. Supporting shelf above the bottom allows water circulation around specimens. Automatic thermostatic control with a range of 150° to 500°F (65° to 160°C). ID 11.5 x 19.5 x 5.5" (293 x 497 x 140mm) deep. H-1380.4F uses a step-down transformer, which is included, for electric conversion.

Water Bath, Economy 120V 60Hz	H-1380
Water Bath, Economy 220V 50/60Hz	H-1380.4F

Ship wt. 18lbs. (8.16kg


Typical Rice Test Setup


H-1750

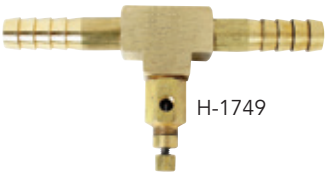
H-1755A


H-1750

H-1751

Pycnometer Size Comparison.


H-1820


H-1749


H-12090


H-1754D

Vacuum Pycnometer Set (4.34L) for Rice Test
ASTM D2041; AASHTO T209, T283

Used in rice testing to determine the maximum specific gravity of bituminous paving mixtures with maximum aggregate size up to 19.1mm (.75"). The H-1750 provides a 4.34L volume with a 2.9L max. sample volume and typically a 2500g required sample size and a 7.5" ID x 6" depth. Set includes aluminum volumetric canister; volumetric lid; flat, vinyl vacuum lid with O-ring and a metal water vacuum aspirator with 3/8" IPT and 6' hose with release valve and fittings. Unit achieves vacuum using an aspirator or optional vacuum pump.

This set is also available in stainless steel, order H-1750SS. For those who want to use smaller test samples, the H-1751 is available. The H-1751 provides a 2.9L volume with a 1.9L maximum sample volume for a typical sample size of 1500g. It measures 7.5" ID x 4" depth, **but the H-1751 does not comply with ASTM specs**.

A larger volume model pycnometer is also available. It provides a 5.8L volume with a 3.9L maximum sample volume and a 4000g typical sample size. It measures 7.5" ID x 8" depth.

All models can be used with H-1756A vibrating apparatus or H-1782 de-airing device, and H-1754D manometer, sold separately. See page 165 for vacuum pumps. Replacement parts are available, please inquire.

Vacuum Pycnometer Set, 6" (4.34L)	H-1750
Vacuum Pycnometer Set, SS, 6" (4.34L)	H-1750SS
Vacuum Pycnometer Set, 4" (2.9L)	H-1751
Vacuum Pycnometer Set, 8" (5.8L)	H-1755A

Ship wt. 13lbs. (5.8kg)

Pycnometer Replacement Lid
Replacement lid for models H-1750, H-1751 and H-1755A.

Pycnometer Replacement Lid	H-1750.2

Ship wt. 4lbs. (1.8kg)

Pycnometer Lid, O-Ring
Replacement o-ring for models H-1750, H-1751 and H-1755A.

Pycnometer Lid, O-Ring	H-1750.3

Ship wt. 0.05lbs. (0.02kg)

Vacuum Pycnometer Set, Large-Capacity
AASHTO T209, T283

Large-capacity unit, 10L (2.64 gal.), 6000g (13.2 lbs.) sample weight, with maximum aggregate size of 50mm (2"). The set features a domed, transparent cover for easy observation of sample testing, perforated plastic shelf, which some States require; water inlet valve and .25" ID hose, quick-disconnect, vacuum gauge, vacuum hose and aspirator with 3/8" NPT fitting. Flange OD is 10.75" (273mm); maximum clearance above plate is 7.75" (197mm). Use with H-1826A.3F vibrating table, and H-1754D manometer, sold separately. See page 165 for vacuum pumps. Replacement parts are available, please inquire. Dimensions: 9.5" ID x 12.125" (240 ID x 311mm)

Vacuum Pycnometer Set, Large	H-1820

Ship wt. 10lbs. (4.5kg)

Manometer, Digital
A precise measurement device designed to replace mercury-filled manometers used in Rice test applications. This portable, hand-held device can be easily moved around the laboratory. Holes are provided for bench or wall mounting and a .375" barb fitting is used for quick connections. The instrument features a digital display range of 0 to 1000mm Hg (absolute) at a resolution of 0.1mm Hg. The device has a rated accuracy of +/-0.5% full scale and is powered by one 9V battery or AC adapter, both are included.

Manometer, Digital, 120V 60Hz	H-1754D
Manometer, Digital, Certified	H-1754D-CA
Manometer, Digital, 220V 50/60Hz	H-1754D.4F
Manometer, Digital, Certified	H-1754D.4F-CA

Ship wt. 2lbs. (.9kg)

Slow-Release Valve for Vacuum Pycnometers
ASTM D2041; AASHTO T283

For use with H-1750, H-1755SS, H-1751, H-1755A and H-1820 for greater accuracy and shorter dry back time. Brass valve maintains 30mm vacuum pressure on sample.

Valve, Slow-Release	H-1749

Ship wt. 0.6lbs. (.2kg)

Aspirator Filter Pump
Provides excellent performance for providing a vacuum for pycnometer applications. Water inlet is .375" and length is 5.375" (137mm).Nickel-plated with serrated tail and side arm.

Aspirator Filter Pump	H-12090

Ship wt. 0.25lbs. (.11kg)

Rice Test

H-1756.3F

H-1826.3F

H-1782

HA-1665

H-1753 shown in use with H-1782

H-4296A

H-4296

De-airing Agitator
ASTM D2041; AASHTO T209, T283

Heavy-duty, vibrating, de-airing agitator for use with H-1750, H-1750SS, H-1751 and H-1755A pycnometers keeps sample material loose for more reliable test results. Strong, rugged-duty vibrators and sturdy bases having integral, heavy-duty on/off switches. Exclusive quick-release cam/lock fasteners allow quick placement and removal of canister.

De-airing Agitator, 120/220V 50/60Hz H-1756.3F
Shipping wt. 16 lbs (7.2kg)

De-airing Agitator, Large
AASHTO T209, T283

For use with the H-1820 large pycnometer. Heavy-duty vibrating Apparatus keeps sample material loose for more reliable test results. Strong, rugged-duty vibrators and sturdy bases having integral, heavy-duty on/off switches. Exclusive quick-release cam/lock fasteners allow quick placement and removal of canister.

De-airing Agitator, 120/220V 50/60Hz H-1826.3F
Shipping wt. 18 lbs (8.16kg)

De-Airing Flask Attachment

For use with H-1756A and H-1782, flask not included.

De-Airing Flask Attachment H-1753
Shipping wt. 1.3 lbs (.58kg)

Orbital De-Airing Device

The Humboldt orbital de-airing device is designed for use in maximum specific gravity and density determinations of bituminous paving mixtures. Through the use of an orbital shaking action, material densification that entraps air is virtually eliminated, resulting in more accurate and uniform test results. The front panel incorporates a variable speed controller with a range of 10 to 250 rpm and an LED programmable timer with an accuracy of better than ±0.1%. The orbital diameter of the 11" x 12" (279 x 305mm) platform is set at 1.5" (38.1mm). Taking up little counter space, the base is 10" x 10" (154 x 154mm) and has an overall height of 16" (406mm). Quick release clamps are used to permit quick mounting and removal of the pycnometer. The optional H-1753 flask attachment allows the user to conduct tests using a laboratory flask.

Orbital De-Airing Device, 120V 60Hz H-1782
Orbital De-Airing Device, 220V 50/60Hz H-1782.4F
Shipping wt. 38 lbs (17kg)

Auto Rice Controller
ASTM D2041; AASHTO T209, T283

The AutoRice is an automatic control unit allowing laboratory technicians to conduct maximum specific gravity tests with the press of a button. Designed to accurately control and monitor the vacuum preessure, vacuum time and shaker vibration frequency, AutoRice ensures more consistent inter-laboratory repeatability and accuracy. The AutoRice will start the vacuum pump, regulate the vacuum pressure, precisely control the vacuum time and monitor the shaker frequency. Currently, the AutoRice acceleration monitor and shaker frequency is a parameter that is not monitored during the test. Data from the Rice test can be downloaded via the USB port, where results can be reviewed to assure accuracy and adherence to test specifications. The unique, compact design allows AutoRice to fit on a benchtop or mount to a wall and works with glass flasks and metal container setups.

AutoRice Controller HA-1665
Ship wt. 25lbs. (11.4kg)

Digital Timer, Humboldt

Humboldt's portable digital timers automatically shuts off electrical equipment at a set time of up to 60 minutes or 99 seconds. Feature easy-to-use digital interface and two-plug, AC receptacle. The accuracy for both versions is 0.5%.

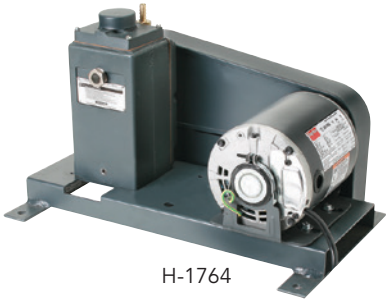
Digital Timer, Minute, 120V 50/60Hz H-4296A
Digital Timer, Minute, 220V 50/60Hz H-4296A .4F
Digital Timer, Second, 120V 50/60Hz H-4299
Digital Timer, Second, 220V 50/60Hz H-4299.4F
Ship wt. 3lbs. (1.3kg)

Universal Analog Timer

Portable timer automatically shuts off electrical apparatus at set time up to 60 minutes. Features two-plug AC receptacle.

Universal Analog Timer, 120V 60Hz H-4296
Universal Analog Timer, 220V 50/60Hz H-4296.4F
Shipping wt. 2.6 lbs (1.1kg)


H-1762


H-1764


H-1770


H-1763A


H-1759


H-1758

H-1757


H-1766.2


H-1768.3


H-1766.3

High Vacuum Pump

Direct-drive two-stage rotary sliding vane high vacuum pump features gas ballast and trap to reduce risk of oil being sucked into the system. Produces free air displacement 85L per minute (3 cu. ft. per minute) and maximum vacuum 29-30". Operating temperature is 30 to 170°F (-1.11 to 76.6°C). Has 0.25" OD intake ports for 0.25" ID tubing. Dimensions: 11.25" x 15.5" x 6.5" (28.6 x 39.4 x 16.5cm).

High Vacuum Pump 120V 60Hz H-1763A
High Vacuum Pump 220V 50/60Hz H-1763A.4F

Shipping wt. 31 lbs (14kg)

Two-Stage Oil-less Vacuum Pump,

Split-capacitor four-pole, two-stage oil-less diaphragm vacuum pump pulls 29" Hg maximum-obtainable vacuum.

Two-Stage Pump, 120V 60Hz H-1762
Two-Stage Pump, 230 50/60Hz H-1762.4F

Shipping wt. 25.7 lbs (11.6kg)

Two-Stage Vacuum Pump

Designed for continuous use, this two-stage, belt-driven pump operates on the oil-sealed rotary vane principle and is ideal for distillation, filtration, degassing and as a roughing pump for high-vacuum systems. Pumps are mounted on rectangular steel base plate and include V-belt and belt guard that totally encloses belt and pulleys. Pump pulls 29-30" maximum vacuum. Includes initial supply of oil plus an extra quart of HyVac® oil.

Two-Stage Pump, 120V 60Hz H-1764
Two-Stage Pump, 230 60Hz H-1764.2F
Two-Stage Pump, 230 50Hz H-1764.5F

Shipping wt. 55 lbs (24.9kg)

Vacuum Pump

High-vacuum, small capacity, general-purpose vacuum pump with belt guard has two-stage construction for efficiency with low maintenance. Features metal vanes and vented exhaust for introduction of air to remove condensible vapors. Pump is filled with oil; an extra quart is included. Exhaust filter is available separately. Guaranteed ultimate vacuum is 25-29" (635-736mm) mercury, and free-air displacement is 25L/min. (0.9cfm).

Vacuum Pump, 120V 60Hz H-1770

Shipping wt. 80 lbs (36kg)

Indicating Drierite Air Drying Unit

Easily installs in-line between vacuum pump and rice test equipment. This refillable unit measures 2.625" by 11.375" (667 x 289mm) with hose barbs at both ends, which can accept 0.25" to 0.375" flexible tubing. Supplied complete with 650g of 8 mesh, indicating desiccant.

Indicating Drierite Air Drying Unit H-1759

Shipping wt. 3.1 lbs (1.4kg)

Indicating Drierite Desiccant

ASTM D2041

Indicating drierite is impregnated with cobalt chloride. This desiccant is blue when dru and changes to pink upon absorption of moisture. The color change is pronounced and clearly visible. This makes indicating drierite valuable when it is necessary to know with certainty that dryness is being maintained and to signal when the drying agent should be replaced. It has the same efficiency as regular drierite and can be regenerarted for reuse.

Indicating Drierite Desiccant, 1lb/8 mesh H-1758

Shipping wt. 2 lbs (.9kg)

Indicating Drierite Desiccant, 5lb/8 mesh H-1761

Shipping wt. 10 lbs (4.5kg)

Drierite Desiccant, 8 mesh

ASTM D2041

Replacement desiccant for air drying unit. Protects vacuum pump by removing final traces of moisture.

Drierite Desiccant, 1 lb H-1757

Shipping wt. 2.5 lbs (1.1kg)

Drierite Desiccant, 5 lb H-1767

Shipping wt. 9 lbs (4kg)

Vacuum Pump Oil

High purity oil with low vapor pressure that does not materially increase at temperatures up to 50°C (122°F) and viscosity sufficiently low for use at 125°C (59°F). Oil remains fairly constant up to 50°C (122°F).

Vacuum Pump Oil, 1 Quart H-1766.2

Shipping wt. 3 lbs (1.3kg)

Vacuum Pump Oil, 1 Gallon H-1766.3

Shipping wt. 9 lbs (4kg)

Vacuum Pump Oil, 5 Gallon H-1766.4

Shipping wt. 41.2 lbs (18.6kg)

Vacuum Pump Oil, 1-Qt. (Case of 12) H-1766.5

Shipping wt. 25 lbs (11.3kg)

Vacuum Pump Oil,1 Gallon (Case of 6) H-1766.6

Shipping wt. 54.6 lbs (24.7kg)

Flushing Oil for Vacuum Pumps, 1 gallon

Purges contaminants and condensables, such as water and solvents from all mechanical vacuum pumps. Use between oil changes minimizes contamination of new oil by residue from old oil; extends pump life.

Flushing Oil for Vacuum Pumps, 1 gal. H-1768.3

Shipping wt. 8.3 lbs (3.7kg)


H-3839


H-3843A


H-3842A


H-3841.1


H-3841.2

Mixer, 5-Qt.
This mixer can be used for mixing asphalt mixes in the lab. The H-3839 operates on the principle of planetary action where the beater reaches every part of a batch, rotating on its axis in opposite directions as it moves around the bowl. This mixer thoroughly blends, mixes and aerates all ingredients for a consistent, predictable finished batch. Selective agitator transmission has 3 speed settings: 139, 285 and 591 RPM. Direct gear drive and a heavy-duty motor ensure constant mixing speeds under load. A locking hand-lever provides precise raising and lowering of the mixing bowl. Base dimensions: 10.375 x 15" (264 x 381mm). Height: 17" (432mm). The mixer includes a stainless steel bowl, wire whip, dough hook and an aluminum flat beater. It is suggested that a stainless steel beater or a Humboldt extreme-duty whisk be purchased for asphalt mixing applications as the standard mixer parts do not wear well in asphalt applications.

Mixer, 5-Qt. (4.73L), 120V 60Hz	H-3839
Mixer, 5-Qt. (4.73L), 230V 60Hz	H-3839.2F
Mixer, 5-Qt. (4.73L), 230V 50Hz	H-3839.5F

Shipping wt. 55 lbs (25kg)

H-3839 Accessories and Replacement Parts

Description	Model
Bowl lid, acrylic	H-3846L
Beater—stainless steel, flat-type	H-3841.1
Bowl—stainless steel, 5 qt. (4.73L)	H-3841.2
Wire loop whip—stainless steel	H-3841WW
Dough hook, aluminum	H-3841DH

Laboratory Bench Mixer, 12-Qt. (11.35L)
The Hobart model HL-120 bowl has a 12-qt. (11.35L) mixing capacity and a 15-minute motor-driven timer. Planetary action of the beater assures thorough blending and mixing. Selective agitator transmission has 3 speed settings: 106, 196 and 358 RPM. Includes stainless-steel bowl, flat-type aluminum grid beater and aluminum dough hook. Base dimension: 14.75" x 20" x 29.5265" (375 x 508 x 750cm).

Laboratory Bench Mixer, 12-Qt. (4.73L)

120V 60Hz	H-3842A
230V 50/60Hz	H-3842A.4F

Shipping wt. 185 lbs (83.9kg)

H-3842A Accessories and Replacement Parts

Description	Model
Aluminum beater	H-3842A.1
12-qt. stainless steel bowl	H-3842A.2
Aluminum dough hook	H-3842ADH
Stainless steel wire loop whip	H-3842AWW

Laboratory Bench Mixer 20-Qt. (18.92L)
The Hobart HL-200 mixer has a positive gear drive and planetary mixing action to deliver positive results. Selective agitator transmission has 3 speed settings: 107, 198 and 361 RPM. Exclusive stirring switch provides low (53RPM) speed to facilitate adding liquids to semi-solids. Includes stainless-steel bowl and flat-type aluminum grid beater. Base dimension: 21" x 2 1.5" x 41.25" (533 x 546 x 1048cm).

Laboratory Bench Mixer, 20-Qt. (18.92L)

120V 60Hz	H-3843A
230V 50/60Hz	H-3843A.4F

Shipping wt. 230 lbs (104.3kg)

H-3843A Accessories and Replacement Parts

Description	Model
Aluminum beater	H-3843A.1
20-qt. stainless steel bowl	H-3843A.2
Aluminum dough hook	H-3843ADH
Stainless steel wire loop whip	H-3843A.WW


H-3843AHW


H-3842HW

Humboldt Extreme-Duty Whisks
Custom, hand-made extreme duty whisks are formed from 0.25" dia. stainless steel rod. Designed to stand up to the abuse of mixing heavy aggregate asphalt mixes in the mixers listed above.

Description	Model
For H-3843A (Hobart HL-200 1/2HP) current	H-3843AHW
For H-3842A (Hobart HL-120 1/2HP) current	H-3842AHW
For H-3839 (Hobart N-50A-10) current	H-3841HW
Hobart 20-quart mixer old model (prior to 2007)	H-3843HW
Hobart 12-quart mixer old model (prior to 2007)	H-3842HW

Extreme-duty whisks for previous models, H-3842 (Hobart A-120) and H-3843 (Hobart A-200) are available, please call.

Replacement parts for previous models, H-3842 (Hobart A-120) and H-3843 (Hobart A-200) are available, please call.


H-1690


H-1692


H-1690.2


H-1690.3


H-1692.9


H-4122


H-4122QF


H-1691


H-1690.1


H-1692.5


H-1692.8A


H-4121

Asphalt/Concrete Mixer, 5 gal., Stationary
Chain-driven mixer, ideal for sample batch mixing in either laboratory or field. Separate utility bucket cradles securely inside enameled-steel mixer frame. Maximum capacity 70 lbs (50lb recommended). Built for continuous duty performance. Choice of 4 Mixing angles. Mix bucket speed is 60 rpm with 0.5 HP motor. Configuration includes bucket, H-1690.2 paddle and accessory chain guard.

Asphalt/Concrete Mixer, 5 gal., Stationary

120V 60Hz	H-1690
220V 50Hz	H-1690.5F
	Shipping wt. 55.4 lbs (25.1kg)

H-1690 Mixer Accessories

Description	Model
Mixing paddle for 5 gal. H-1690 mixer	H-1690.2
Deluxe mixing paddle for 5 gal. H-1690 mixer	H-1690.3
Bucket & cover for 5 gal. H-1690 Mixer	H-1690.1

Asphalt/Concrete Mixer, 5 gal., Mobile,
Direct-drive, 5 gallon, portable mixer with 8" semi-pneumatic wheels for mobility. Mix bucket speed is 60 rpm with 0.5 HP motor. Includes mix bucket only. **Order desired paddles separately.**

Asphalt/Concrete Mixer, 5 gal., Mobile

120V 60Hz	H-1691
220V 50Hz	H-1691.5F
	Shipping wt. 84 lbs (38.1kg)

Asphalt/Concrete Mixer, 10 gal., Mobile,
10 gallon, portable mixer with 8" semi-pneumatic wheels for mobility. Mix bucket speed is 60 rpm with 0.5 HP motor. Includes mix bucket only. **Order desired paddles separately, see below.**

Asphalt/Concrete Mixer, 10 gal., Mobile

120V 60Hz	H-1692
220V 50/60Hz	H-1692.4F
	Shipping wt. 97 lbs (44kg)

H-1691, H-1692 Mixer Accessories

Description	Model
Asphalt paddle for 5 gal. portable mixer	H-1691.6A
Concrete paddle for 5 gal. portable mixer	H-1691.8A
Concrete paddle for 10 gal. portable mixer	H-1692.9
Mix bucket for 5 gal. mixer	H-1691.4
Mix bucket for 10 gal. mixer	H-1692.5

Sample Buckets (25pk)
Use Funnel to significantly reduce the hopper size when reduction of smaller samples is desired.

Sample Buckets (25pk)	H-4121
	Shipping wt. 3lbs (1.4kg)

QuarterMaster™ Asphalt Mix Sample Splitter
The QuarterMaster™ is ideal for dividing the larger asphalt mix samples required in Superpave specifications. The hopper accepts samples up to 120 lb (54kg) of any mix with aggregate between 9.5 to 37.5mm and quarters it into four equal parts. In operation, a simple throw of a lever divides the sample. Using the device ensures greater control, consistency and uniformity in the preparation of test samples. **The unit is supplied complete with four sample buckets.** Dimensions are 14"W x 17"D x 48"H (356 x 432 x 1219mm). To assist operation, order a H-1702 materials handling scoop.

QuarterMaster™ Sample Splitter	H-4122
	Shipping wt. 100 lbs (45.3kg)

QuarterMaster™ Quick Funnel Insert
Use Funnel to significantly reduce the hopper size when reduction of smaller samples is desired.

QuarterMaster™ Quick Funnel Insert	H-4122QF
	Shipping wt. 11.2 lbs (5.08kg)

QuarterMaster™ Replacement Bucket
Replacement galvanized metal bucket for use with QuarterMaster™.

QuarterMaster™ Replacement Bucket	H-3372
	Shipping wt. 4lbs (1.8kg)

HA-5100.3F

Specifications	
Maximum Load	Electronically limited to 3500lbf (15.5kN)
Load Transducer	Normally 87psi (600 kPa) Maximum 145psi (1000 kPa)
Actuator Stroke	1.2" (30mm)
Frequency	0 to 30 Hz
Electrical Supply	110/260V 50/60 Hz, 1 Ph
Compressed Air	100-145psi (7-10 bar) @ 600 L/min (21cfm)
Dimensions	31" x 40" x 76" (780 x 1000 x 1920mm)
Working Space Required (WxDxH)	32.5" x 65" x 83" (825 x 1650 x 2100mm)
Desktop PC	Included

HA-5105

Servo-Pneumatic Universal Testing Machine (15.5kN)
ASTM D7369, D4123, D3497, D7313; AASHTO TP31, TP62, TP79, T307; EN 12697 Annex A, B, C, D and E, EN 12697-44 SCB; NCHRP 1-28A,19, 9-29

This machine is a development of the NAT which was developed by Keith Cooper and Professor Steven Brown at the University of Nottingham. The use of a high precision servo-pneumatic valve in conjunction with a low-friction actuator and sophisticated data acquisition and control, results in a performance that is equal to many servo-hydraulic systems.

Accurate, digitally generated waveforms are applied by the actuator producing repeatable stress variations in test specimens that are simulative of those in a road pavement due to moving traffic. The actuator is double-acting allowing both compressive and tensile forces to be applied. A tri-axial cell system is available for the measurement of the resilient modulus of unbound materials.

Features:

- Low cost dynamic loading universal test system ideally suited to testing asphalt and unbound granular materials
- Double acting low friction actuator with integral stroke transducer
- Utilizes high performance ceramic spool servo-valve
- High quality stainless steel frame
- Accessories available to perform a range of standard and non standard test methods

Software:

- User friendly, intuitive and reliable Windows® software developed using LabVIEW™
- Standard test software available to meet specific EN, ASTM and AASHTO test methods
- Universal test software for the development of test methods using static, sinusoidal, haversine, square, triangular with user selected frequencies and data collection rates
- Stored test data can be imported into a spreadsheet package to be analysed by the user
- Utilities are included for transducer check, diagnostic routines and calibration

Software:

- User friendly, intuitive and reliable Windows® software developed using LabVIEW™
- Standard test software available to meet specific EN, ASTM and AASHTO test methods
- Universal test software for the development of test methods using static, sinusoidal, haversine, square, triangular with user selected frequencies and data collection rates
- Stored test data can be importedinto a spreadsheet package to be analysed by the user
- Utilities are included for transducer check, diagnostic routines and calibration

15.5kN Univ. Testing Machine 115-260V 50/60Hz HA-5100.3F
Ship wt. 79 lbs. (36kg)

cDAC Advanced Data Acquisition System
A configurable design to meet your needs with up to 7 modules (max. 4 of each type) from the following per cDac unit: Interface, Acquisition, Digital , Servo. Integral SIL-4 safety relay to ensure the highes level of user safety. Universal input 110 to 264V 50/60Hz. 250W power supply.

- 20-bit resolution, 5kHz per channel
- will accept any voltage transducer in any channel using TEDS thermocouples
- 1024 data points per cycle
- up to 16 digital input and output channels
- Ethernet, USB,RS232 to PC communication

cDAC Advanced Data Acquistion HA-5105
Shipping wt. 20 lbs (9.1kg)

Specifications	
Maximum Load	Electronically limited to 5620lbf (25kN)
Load Transducer	Variable dependant on capacity
Actuator Stroke	2" (50mm)
Frequency	0 to 70 Hz
Electrical Supply	230V 60 Hz, 3 Ph 400V 50Hz, 3-Ph
Compressed Air	100-145psi (7-10 bar) @ 100 L/min (21cfm)
Cabinet Dimensions	40" x 52" x 95" (825 x 1300 x 2400mm)
Power Pack Dimensions	25" x 23" x 35" (630 x 580 x 890mm)
Working Space Required (WxDxH)	40" x 52" x 95" (825 x 1300 x 2400mm)
Desktop PC	Included

HA-5105


HA-5200.3F

Servo-Hydraulic Universal Testing Machine (25kN)
ASTM D7369, D4123, D3497, D7313; AASHTO TP31, TP62, TP79, T307; EN 12697 Annex A, B, C, D and E, EN 12697-44 SCB; NCHRP 1-28A,19, 9-29; INVE 749, 754

The Servo-Hydraulic Universal Testing Machine (CS-UTM-HYD) is a well-designed, inexpensive machine specifically developed for the testing of materials used in pavement construction.

A motorized, adjustable crosshead reduces the time between test setups. The programmable temperature cabinet provides the possibility to perform frequency/temperature sweeps. Accurate waveforms are digitally generated and applied by the actuator producing repeatable conditions that are simulative of those created by moving or static vehicles. The actuator is double-acting allowing both compressive and tensile forces to be applied. Various systems are available for the measurement of the modulus of unbound materials.

Features:

- Designed to perform a range of tests on asphaltic paving materials, sub-grade soils and granular sub-base materials
- Double acting fatigue rated hydraulic actuator with integral stroke transducer
- Utilizes Star servo valve with "Sapphire Technology"
- Motorized adjustable lower crosshead with automatic hydraulic frame clamping
- Integral programmable temperature controlled cabinet
- Accessories available to perform a range of standard and non-standard test methods

Software:

- User friendly, intuitive and reliable Windows® software developed using LabVIEW™
- Standard test software available to meet specific EN, ASTM and AASHTO test methods
- Universal test software for the development of test methods using static, sinusoidal, haversine, square, triangular with user selected frequencies and data collection rates
- Stored test data can be imported into a spreadsheet package to be analysed by the user
- Utilities are included for transducer check, diagnostic routines and calibration

25kN Univ. Testing Machine, 400V 50Hz HA-5200.7F
Ship wt. 79 lbs. (36kg)

cDAC Advanced Data Acquisition System
A configurable design to meet your needs with up to 7 modules (max. 4 of each type) from the following per cDac unit: Interface, Acquisition, Digital , Servo. Integral SIL-4 safety relay to ensure the highes level of user safety. Universal input 110 to 264V 50/60Hz. 250W power supply.

- 20-bit resolution, 5kHz per channel
- will accept any voltage transducer in any channel using TEDS thermocouples
- 1024 data points per cycle
- up to 16 digital input and output channels
- Ethernet, USB,RS232 to PC communication

cDAC Advanced Data Acquistion HA-5105
Shipping wt. 20 lbs (9.1kg)

Digital Controller, Accessories

HA-5105

HA-5110, HA-5110

HA-5112

cDAC Controller and Data Acquisition

cDAC is a digital data acquisition and control unit, which when used with DIMENSION software, gives you the power to perform the most demanding of tests with your materials testing equipment. Both are designed with the ease of use and reliability required for standard testing and the flexibiilty and advace ccapabilities required for research.

A Congurable design to meet your needs with up to 7 modules (max. 4 of each type) from the fol-lowing per cDAC unit: Interface, Acquisition, Dig-ital, Servo. Integral SIL-4 safety relay to ensure the highest level of user safety. Universal input (110 to 264)VAC, (47 to 63)Hz,250W power supply.

Interface Module

- 100Mbit/s Ethernet TCP/IP and UDP connection to PC provides for fast and robust communications
- RS232/422/485 serial port for connection to environmental chambers and other ancillary equipment
- USB port for direct data logging
- Atmel AT91SAM Smart ARM-based Microcontroller for high performance

Servo Module

- Dual 5kHz control loops per module
- 0.01 to 100Hz cycle frequency to meet all your testing needs.
- Digital on-the-y adjustment of all PID parameters
- Multichannel selectable feedback from any sensor (or sum of or difference between sensors) on any acquisition card
- Hardware function generator
- Bumpless transfer between control methods
- Texas instruments TMS320DSP digital signal processor
- 16-bit Analog Voltage (±10V and (0 to 10V) and Current (±40mA, (0 to 20)mA, and (4 to 20mA) control output for servo valve or other control device

Digital Module

- 4 x 24V opto-isolated digital inputs with 100mA sink capacity (each can be configured as counters)
- 4 x 24V opto-isolated digital outputs to drive auxiliary hydraulic/pneumatic solenoid valves with 1.6A drive capacity per channel (each can be configured as a PWM source)
- NXP LPC2148 ARM7TDMI-S based hig-performance 32-bit RISC microcontroller

Acquisition Module

- Any combination of up to 8 sensors per module (load cells, LVDTs, RTDs, strain gauge bridges, pressure transducers, and many, many more)
- TEDS (Transducer Electronic Datasheet) sensors for plug and play measurement
- Synchronous acquisition of all sensor measurements from all modules to eliminate data-skew
- Multiple segment 5th order polynomial linearization of sensors for supreme accuracy
- 24-bit resolution on all channels
- 5kHz acquisition rate per channel
- Anti-alias filters to prevent high-frequency interference
- Auto-ranging ampliers with the following gain steps: 1/8, 1/4, ½, 1, 2, 4, 8, 16, 32, 64, 128
- (0 to 10)V, 24V, and (0 to 20)mA power supplies for sensors
- Texas instruments TMS320DSP digital signal processor

Dimension Features

- Transducer database to store and manage your sensors
- Standard test library for quick and reliable testing to ASTM, AASHTO, CEN Standards
- Configurable waveform and summary data capture allows total control over the information gathered during a test
- Profile builder gives ultimate exibility to design and store custom testing regimes
- Test screen shows a graphical view of all connected transducers and calculated values in real time

cDAC Controller and Data Acquisition — HA-5105
Shipping wt. 13lbs (6kg)

Triaxial System T307

AASHTO T307

Use the HA-5110 triaxial system to perform T307 on 8" (200mm) and 4" (100mm) specimens of unbound material. It can be used to perform EN12697-25B on 4" (100mm) specimens if ordered with steel platens.

For T307+ use the HA-5111 for 12" (300mm) and 6" (150mm), 8" (200mm) and 4" (100mm) specimens of unbound material. It can be used for EN12697-25B if ordered with steel platens.

Triaxial System T307 — HA-5110
Triaxial System T307+ — HA-5111
Shipping wt. 15lbs (7kg)

Resilient Modulus Test System

ASTM D4123; AASHTO TP31

Resilient modulus test system to perfrom AASHTO TP31 and ASTM D4123. Test software to meet the latest standard specifications.

Resilient Modulus Test System — HA-5112
Shipping wt. 10lbs (4.5kg)

Resilient Modulus Test System

ASTM D7369

Resilient modulus test system to perfrom ASTM D7369. Test software to meet the latest standard specifications.

Resilient Modulus Test System — HA-5113
Shipping wt. 10lbs (4.5kg)

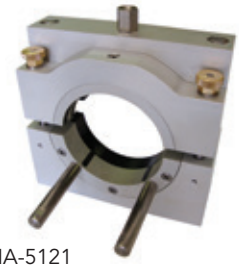
HA-5114

HA-5115

HA-5117

HA-5118

HA-5119



HA-5121

HA-5122

HA-5120

Simple Performance Test

AASHTO TP62

Test system to perform dynamic modulus according to AASHTO TP62 Simple Performace Test. Test software to meet the latest standard specifications.

Simple Performance Tes HA-5114

Shipping wt. 15lbs (7kg)

Indirect Tensile Creep

ASTM D6931

Indirect tensile creep is determined by applying a static load of fixed magnitude along the diametral axis of a specimen. The horizontal and vertical deformations measured near the center of the specimen are used to calculate a tensile creep compliance as a function of time. It can also be used for other tests, such as ASTM D6931. Only available with hydraulic option.

Indirect Tensile Creep HA-5115

Shipping wt. 10.2lbs (4.6kg)

Indirect Tensile Modulus and Fatigue

EN 12697-26 (C & E)

Indirect tensile stiffnes modulus and fatigue measurement system EN 12697-26 (Annex C and E). Test software to meet latest standard specifications.

Indirect Tensile Modulus & Fatigue HA-5116

Shipping wt. 25lbs (11.3kg)

Dynamic and Static Creep

EN 12697-25 (A)

Dynamic and static creep measurement system to perform EN 12697-25 (Method A) and DD226. Test software to meet latest standard specifications.

Dynamic and Static Creep HA-5117

Shipping wt. 6lbs (2.7kg)

Direct Compression and Tension

EN 12697-26 (D & E)

Direct compression and tension measurement system to perform EN 12697-26 Annex D and E. Test software to meet latest standard specifications.

Direct Compression and Tension HA-5118

Shipping wt. 5lbs (2.3kg)

Dynamic and Static Creep Flow

EN 12697-25 (A)

Dynamic and static creep (flow) measurement system with confining stress to perform EN 12697-25 Method B Test software to meet latest standard specifications. Note: this item can be used to perform EN 12697-25 Method A if a 3.8" (96mm) top platen is ordered. Software is also available to perform Flow Time and Flow Number.

Dynamic and Static Creep Flow HA-5119

Shipping wt. 515lbs (7kg)

Tack Coat Quality Tester

Proposed standard method of test for determining the tack coat quality of asphalt pavement in the field or laboratory.

Tack Coat Quality Tester HA-5121

Shipping wt. 7lbs (3.2kg)

Asphalt Beam Fatigue Test Fixture

Asphalt Beam Fatigue Testing Fixture is used to determine the fatigue life of asphalt aggregate mixtures. Asphalt beam fatigue testing fixture is proven to meet SHRP M009 and UC Berkeley specifications for fatigue life testing of asphalt aggregate mixtures.

Asphalt Beam Fatigue Test Fixture HA-5122

Shipping wt. 15lbs (7kg)

Precision Unbound Material Analyzer

The Precision Unbound Material Analyzer (PUMA) is a new type of laboratory test equipment designed to fill the gap between expensive and complex laboratory tools, such as triaxial cells, and more empirical methods, such as the California Bearing Ratio test. It is designed to generate realistic values of modulus for use in road pavement design. The PUMA can be used to test unbound, hydraulically bound and asphaltic materials. It has been designed as a low cost, easy-to-use practical tool, but one that is capable of generating scientifically meaningful data (Modulus and Resistance to Permanent Deformation), for use in road pavement design. It can be used to test specimens made from granular material, soil or lightly stabilized material etc. with a maximum particle size of 1.24" (31.5mm).

The Puma is proposed as a direct equivalent to the Springbox with the advantage that initial stress conditions can be accurately controlled. It is a simple test, suited to generic specification, which holds the promise of increased confidence in pavement foundation design, particularly in cases where favorable weather conditions during construction result in unrepresentatively high Dynamic Plat Test (DPT) values or in cases where stabilized soils or cold-mix asphalt are employed.horizontal, and the number of load cycles if desired.

Precision Unbound Material Analyzer HA-5120

Shipping wt. 10lbs (4.55kg)

Hamburg Wheel Tracker

HA-5300.4F

Hamburg Wet and Dry Wheel Tracker

AASHTO T324; EN 12697-22; Various State standards

The Hamburg (Immersion) wheel tracking test is used to evaluate the resistance to rutting and moisture susceptibility of asphalt mixtures. AASHTO-T324 is the generally referred to test standard, although many states modify this procedure to meet their specific requirements. Outside of the U.S. both AASHTO-T234 and EN12697-22 are followed.

What differentiates the Hamburg from other wheel tracking methods is the use of water to condition the temperature of the specimens rather than air. It is believed that the water, in some tests, strips the aggregate which creates a tertiary phase that is distinct from the permanent deformation which occurs in dry wheel tracking tests. The use of stainless steel wheels on a weighted cantilevered arm, in conjunction with water has led some people to refer to Hamburg wheel tracking as a 'torture test'. Certainly it is the case that less well constructed machines will shake to pieces due to the aggressive nature of the test. The Cox Hamburg is manufactured in California from thick solid stainless steel. Painted steel panels and parts are not an option for the Hamburg test. Our Hamburg is built to last decades not just a couple of years, which is why it comes with a five year warranty.

A rigid frame construction is also essential for accurate results. Cheaply produced machines will flex machine and quality of test results go hand in

hand. and vibrate with deeper rut depths. Quality

The Cox Hamburg will output more precise and accurate results than any other Hamburg machine – guaranteed.

Specifications	
Wheel Speed	Variable between 15 and 30 cycles (30 to 60 passes) per minute
Wheel Load	158 ± 1.0lbf (705 ± 4.5N)
Variable Speed Range	15 to 30 RPM
Slab Thickness	2-4" (50 - 100mm), different thicknesses can be tested with spacers
Rut Depth Transducer Range	2" (50mm)
Temperature Range	Ambient to 158 °F (70°C)
Electrical Supply	220-240V 15 A, 1 Ph (single phase with a neutral and ground)
Dimension (WxDxH)	57" x 55" x 50" (1430 x 1380 x 1260mm)
Desktop PC	Included

Features:

- Full super rigid stainless steel construction
- The most rugged, precise and accurate Hamburg wheel tracker available
- Auto arm lift for fully automated test procedure and user safety
- True sinusoidal motion
- Mechanical recirculating water bath for accurate control of the water temperature to better than ±0.5C
- Two displacement transducers with a resolution of 0.01mm, positioned in line with the wheel to ensure accurate measurement of the rut
- Continuous rut and rut profile measurement throughout the test
- Analysis software to automatically pick the inflection point and analyse the output data
- Air hood option for dry tests
- Stainless steel and rubber wheels available
- Built-in timer to start tests automatically
- AASHTO T324, a variety of DOT methods and EN12697-22
- Anytime remote access support
- Quality build in the USA

Software:

- User friendly, intuitive and reliable Windows® software developed using LabVIEW™
- Specifically written to meet AASHTO and ASTM standards
- The user interface can be translated into the user's preferred language – please inquire
- Stored test data can be analyzed and compared with other test data utilizing a spreadsheet package
- Utilities are included for curve fitting of acquired data; testing of system's inputs and outputs; phase correction and a transducer database for storing calibration factors

Includes full software control of arms individually at outset and completion of test, with stainless steel frame, includes full software package, traceable calibration certificate and desk PC. To perform testing according to AASHTO T324

Hamburg Wheel Tracker, 240V 50/60Hz **HA-5300.4F**

Ship wt. 1520lbs. (687kg)

Accessories	Model
*Stainless steel molds 12.6" x 10.2" x 2.4" (320 x 260 x 60mm)	HA-5300.1
Stainless Steel molds: 12.6" x 10.2" x 4" (320 x260x 100mm) deep	HA-5300.2
Stainless steel molds 12" x 12" x 2" (305 x 305 x 50mm)	HA-5300.3
Stainless steel molds 12" x 12" x 4" (305 x 305 x 100mm)	HA-5300.4
*Plastic mold for double cores 6" tested simultaneously to be inserted in stainless steel mold 12.6" x 10.2" x 4" (320 x 320 x 260mm)	HA-5300.5
Stainless steel wheel AASHTO T324-02	HA-5300.6
Rubberized Stainless steel wheel EN 12697-22	HA-5300.7
Powered winch and stainless steel mast	HA-5300.8
Stainless steel base and working parts option	HA-5300.9
Guarding, powder coated steel	HA-5300.10
Guarding, stainless steel	HA-5300.11
Chiller assembly	HA-5300.12
Air Heating hood	HA-5300.13

*Included with machine– 2 of each.

Specifications	
Maximum Roller Load	6750 lbf (30kN) over 12" (305mm) roll width
Trolley Travel	±6" (150mm) or ±8"(200mm)
Speed	Variable up to 10 cycles/min.
Slab Thickness	1.6 to 5.3" (40 to 135mm)
Electrical Supply	110V 60 Hz, 1 Ph 240V 50Hz, 1 Ph
Dimensions	23.6" x 57" x 74.8" (600 x 1450 x 1900mm)
Working Space Required (WxDxH)	63" x 67" x 79" (1600 x 1700 x 2000mm)
Desktop PC	Not required

HA-5700

Hydraulic Compact Steel Roller Compactor

ASTM D04 - WK34713; EN 12697-33 STEEL ROLLER

The Roller Compactor is considered to be the method of laboratory specimen compaction that results in slabs of asphaltic paving materials with properties that most closely simulate those of materials in the highway. Slabs can be compacted to target mixture densities using loads that are equivalent to those of full-scale compaction equipment.

This compactor is hydraulically powered and controlled by a programmable logic controller (PLC) connected to an HMI (Human Machine Interface), which the operator can use to select the number of passes. A manual pressure control is adjusted to set the required load. The main function of the Compact Steel Roller is to produce slabs for beam fatigue and wheel tracking tests.

Features:

- Steel wheeled roller segments
- Solid machine frame
- Optional heated head for reducing mixture sticking to roller during compaction
- Model for compaction of 320 x 260mm (12.6 x 10.2 inch) and 305 x 400 mm (12 x 15.75 inch) slabs
- Slab depth from 40 to 135 mm (1.6 to 5.3 inch)
- Slabs can be used as wheel-tracking specimens, and cored to make indirect tensile test specimens or cut into beams for 4-Point Bending Test
- Roller Compactor molds will fit Cox & Sons Wheel Trackers so that compacted slabs can be wheel-tracked without de-molding
- Maximum compaction load of 30kN (6750lbf) per 305 mm (12 inch) roll width (equivalent to largest on-site static rollers)
- Speed control
- HMI for operator selection of number of passes
- Vibrating roller option with adjustable frequency to simulate on-site vibratory rollersdard and non-standard test methods

Hydraulic Compact Steel Roller Compactor HA-5700
Hydraulic Compact Steel Roller Compactor HA-5700.5F

Ship wt. 79 lbs. (36kg)

Accessories	Model
Steel and aluminum quick release mold for roller compactor or wheel tracker, 12" x 15.75" x 2" (305 x 400 x 50mm) deep	HA-5700.3
Steel and aluminum quick release mold for roller compactor or wheel tracker, 12" x 15.75" x 4" (305 x 400 x 100mm) deep	HA-5700.4

Beam Bending Test

HA-5500.3F

Specifications	
Force Transducer	2250lbf (10kN)
Specimen Transducer Range	±0.09" (3 x ±2.5mm)
Actuator Stroke	0.4" (10mm)
Frequency	0.1 to 60 Hz
Electrical Supply	400V 50Hz, 3 Ph
Compressed Air	100-145psi (7-10 bar) @ 100 L/min (3.5cfm)
Test Frame Dimensions	41.5" x 43" x 83" (1050 x 1100 x 2100mm)
Working Space Required (WxDxH)	81" x 83" x 90.5" (2050 x 2100 x 2300mm)
Desktop PC	Included

Large Hydraulic, Four-Point Bending Beam Machine
ASTM D7460; AASHTO T321; EN 12697-24 Annex D, EN 12697-26 Annex B

The CRT-LH4PT-BB uses advanced servo-hydraulic technology and a high-speed digital data acquisition and control system together with user-friendly software. During testing both graphical and tabular data are displayed on screen and test data is stored to disc in Microsoft Excel™ compatible format. The test frame is housed in a Temperature Controlled Cabinet with fan-assisted air circulation and a temperature range of -20 to 30°C. The unique constant torque clamping and three-transducer deflection measurement system of the

CRT-LH4PT-BB can be configured to accept different beam sizes. This means that the ratio between beam dimensions and maximum aggregate size of test specimens will satisfy the requirements of the relevant European specifications.

Features:

- Frequency range 0.1 to 60Hz
- High-quality, Servo-Hydraulic Four-Point Bending Machine
- Double-acting, fatigue-rated hydraulic actuator with integral stroke transducer
- Utilises Star servo valve with "Sapphire Technology"
- Unique, three-transducer, on-specimen deflection measurement system
- Accepts various beam sizes: 380 to 660mm in length and 50 x 50mm and 100 x 100mm cross sections.
- Temperature Controlled Cabinet range -20 to 30°C
- Sinusoidal controlled strain or controlled stress fatigue test modes
- Constant torque motorized specimen clamping to eliminate errors due to localized beam indentation
- Self-contained loading system
- User friendly software for determination of fatigue resistance and stiffness modulus
- Supplied with certification of a UKAS-accredited calibraton
- Covered for noise reduction

Software:

- User friendly, intuitive and reliable Windows® software developed using LabVIEW™
- Specifically written to meet AASHTO and ASTM standards
- The user interface can be translated into the user's preferred language – please inquire
- Stored test data can be analyzed and compared with other test data utilizing a spreadsheet package
- Utilities are included for curve fitting of acquired data; testing of system's inputs and outputs; phase correction and a transducer database for storing calibration factors

Large, Hydraulic Four-Point Bending Beam,

400V 50Hz, 3PH	HA-5500.7F.3
208-230V 60Hz, 3PH	HA-5500.2F.3

Ship wt. 1435 lbs. (650kg)

Accessories	Model
Dummy PVC beam 2" x 2" x 15" (50 x 50 x 380 mm)	HA-5400.1
Dummy PVC beam 4" x 4" x 26" (100 x 100 x 660 mm)	HA-5400.2

Specifications	
Force Transducer	2248lbf (10kN)
Specimen Transducer Range	± 0.04" (1mm)
Actuator Stroke	0.4" (10mm)
Frequency	0.1 to 30 Hz
Electrical Supply	110/260V 50/60Hz, 1 Ph
Compressed Air	100-145psi (7-10 bar) @ 600 L/min (21cfm)
Test Frame Dimensions	18" x 7.5" x 22.5" (440 x 190 x 570mm)
Data Acquisition Enclosure	15" x 11" x 5.5" (360 x 280 x 140mm)
Working Space Required (WxDxH)	32.5" x 65" x 83" (826 x 1650 x 2100mm)
Desktop PC	Included

HA-5400.3F

Stand-Alone, Four-Point Bending Beam Machine

ASTM D7460; AASHTO T321; EN 12697-24 Annex D, EN 12697-26 Annex B

The CS-SA4PT-BB uses advanced servo pneumatic technology and a high-speed digital data acquisition and control system together with user-friendly software. During testing both graphical and tabular data are displayed on screen and test data is stored to disc in Microsoft® Excel® compatible format. The clamps are at 118.5mm (4.67 inch) centers (the distance between the outer clamps is 335.6mm (14 inches) according to AASHTO specifications but the height and width of the beam can be varied).

Features:

- Frequency range 0.1 to 30Hz[1]
- Low cost pneumatic stand alone four point bending machine
- Utilizes a low-friction actuator and high performance ceramic spool servo-valve
- On-specimen measurement system removes errors due to frame flexure
- Accepts AASHTO beam sizes
- Sinusoidal controlled strain or controlled stress fatigue test modes
- Constant torque motorized specimen clamping to eliminate errors due to localized beam indentation
- Self-contained loading system
- User friendly software for determination of fatigue resistance and stiffness modulus

Software:

- User friendly, intuitive and reliable Windows® software developed using LabVIEW™
- Specifically written to meet AASHTO and ASTM standards
- The user interface can be translated into the user's preferred language – please inquire
- Stored test data can be analyzed and compared with other test data utilizing a spreadsheet package
- Utilities are included for curve fitting of acquired data; testing of system's inputs and outputs; phase correction and a transducer database for storing calibration factors

Four-Point Bending Beam, 110/220V 50/60Hz HA-5400.3F

Ship wt. 79 lbs. (36kg)

Accessories	Model
Dummy PVC beam 2" x 2" x 15" (50 x 50 x 380 mm)	HA-5400.1
Cabinet, temperature-controlled	HA-5400.3

HA-5000

Specifications	
Speed	Normally 30 rpm
Stress	Normally 87psi (600 kPa) Maximum 145psi (1000 kPa)
Actuator Stroke	9.85" (250mm)
Internal Angle of Gyration	0.2 to > 2°
Electrical Supply	115V +-10% 50/60 Hz 230V +-10% 50/60 Hz
Specimen Ø mm (inch)	6 " (150mm) and 4 (100mm)
Compressed Air	100-145psi (7-10 bar) @ 350 L/min (12.5cfm)
Mixtures	Wet, dry and rubber
Dimensions	31" x 40" x 76" (780 x 1000 x 1920mm)
Working Space Required (WxDxH)	79" x 79" x 87" (2000 x 2000 x 2200mm)
Desktop PC	Included

Superpave GYR Gyratory

ASTM D6925; AASHTO T312; CS9010-1115; CS9010-1230; SHRP M-002, T 0736-2011; TEX-241-F; EN 12697-10

Compaction is achieved by the application of a vertical stress (normally 600KPa (87psi)) via end platens to a known mass of asphaltic mixture within a 150 and 100mm (6 and 4inch) internal Ø mold. The longitudinal axis of the mold is rotated (gyrated) at a fixed angle to the vertical while the platens are kept parallel and horizontal. During compaction the height of the sample is automatically measured and both the mixture density and void content calculated.

Features:

- Automatic mold insertion and retraction on side table which allows cooling time before extraction without loss of compaction time (especially important for rubberized asphalt)
- 150 mm and 100 mm (6 and 4 inch) internal Ø molds can be tested without changing parts
- Cold mix (emulsion) materials can be compacted and the expelled fluid collected
- Ethernet and multiple USB connections for data acquisition and control system
- User friendly LabVIEW™ software displays results in real time
- Machine calibrated with traceable equipment
- Option for mold up to 300 mm (11.8 inch) high
- Manufactured in California

Software:

- User friendly, intuitive and reliable Windows® software developed using LabVIEW™
- Software allows 3 methods of compaction – number of gyrations, height and target density. The operator is guided through every step of the compaction
- Real-time display of current height, density & void content (%) Data is recorded to disk at regular intervals for further analysis
- Utilities are included for transducer check, diagnostic routines and calibration

Superpave Gyratory, 115V 50/60Hz **HA-5000**
Superpave Gyratory, 230V 50/60Hz **HA-5000.4F**

Ship wt. 1120 lbs. (508kg)

Accessories Included	Model
Specimen Extruder, Manual (1)	HA-5000.1
6" (150mm) Internal Ø mold & platens with specimen temperature measurement (1)	HA-5000.2
6" (150mm) Internal Ø mold & platens (1)	HA-5000.3
Shear force display	HA-5000.13
Specimen Temperature Measurement	HA-5000.14
6" (150mm) circle filter papers (100pk)	HA-5000.15

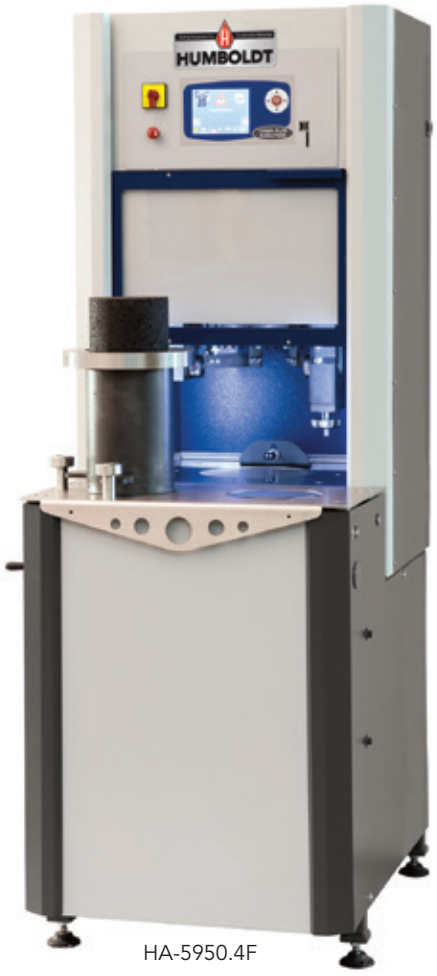
Accessories	Model
4" (100mm) Internal Ø mold & platens, slotted for emulsion mix	HA-5000.4
4" (100mm) Internal Ø mold & platens, slotted– includes features for specimen temperature measurement	HA-5000.5
6" (150mm) Internal Ø mold & platens, slotted for emulsion mix	HA-5000.6
4" (100mm) Internal Ø mold & platens (1)	HA-5000.8
4" (100mm) Split Mold	HA-5000.9
6" (150mm) Spacer to compact 2.5" (63mm) height on Gyratory	HA-5000.10
Spacer, 100mm to compact 63mm height on HA-5000	HA-5000.11
Calibration kit for internal angle lead	HA-5000.12
Specimen Extruder, Automatic	HA-5000.17
4" (100mm) Circle Filter Paper (100 pk)	HA-5000.16

Specifications	
Verticle Load (150mm)	10 to 1000 kPa (1000 kPa–10 bar) (800 kPa–8 bar) (700 kPa–7 bar)
Verticle Load (100mm)	23 to 1500 kPa with 7 bar compressor
Vertical Load Control	Auto electronic system
Gyration Rate	Adjustable from 5 to 60 work cycles/min.
Gyratory Angle Adjustable	0 to 2.4°
Number of Cycles	Adjustable from 1 to 5000
Electrical Supply	230V 50/60 Hz
Compressed Air	100-145psi (7-10 bar) @ 350 L/min (12.5cfm)
Mixtures	Wet, dry and rubber
Dimensions	25.2" x 19.7" x 41.3" (640 x 500 x 1050mm)

Accessories	Model
Specimen Cylinder, 4" (100mm)	HA-5950.1
Specimen Cylinder, 6" (150mm)	HA-5950.2
Cylinder w/Holes, 4" (100mm)	HA-5950.3
Cylinder w/Holes, 6" (150mm)	HA-5950.4
Penetration Pistion, 4" (100mm)	HA-5950.5
Penetration Pistion, 6" (150mm)	HA-5950.6
Metallic Disk, 4" (100mm)	HA-5950.7
Metallic Disk, 6" (150mm)	HA-5950.8
Filter Paper, 4" (100mm)	HA-5950.9
Filter Paper, 6" (150mm)	HA-5950.10
Auto Specimen Extruder	HA-5950.11
Bench	HA-5950.12
Wheels	HA-5950.13
Internal Angle Measurer	HA-5950.14
Calibration Check for Internal Angle Measure	HA-5950.15

HA-5950.1, HA-5950.2

HA-5950.3, HA-5950.4



HA-5950.4F

HA-5950.14

Superpave Gyratory

ASTM D6925; AASHTO T312; CS9010-1115; CS9010-1230; SHRP M-002, T 0736-2011; TEX-241-F; EN 12697-10

This Gyratory Compactor is used to simulate and reproduce the real compaction conditions of actual road paving operations in determining the compaction properties of asphalt.

Its fully-automatic compaction operation provides that both rotary and vertical forces are applied to the specimen by the mechanical head. The gyratory's rigid, steel frame ensures that excellent angle control is maintained through the testing operation.

Load is applied by an electro-pneumatic cylinder, which is servo-controlled by a precision pressure regulator while the height is measured by a linear transducer. Gyratory motion is generated by an eccentric high-precision system allowing an easy set up with precision and constant angle of gyration. The rotation speed is controlled by an inverter through on-board computer control.

In addition to testing standard mixes the Gyratory can also test cold emulsified asphalt mixes using one of the available perforated molds. Machines are factory calibrated to the selected internal angle.The touch-screen, icon-based interface allows for easy test parameter set up and test execution, as well as data acquisition and data processing.

- Rigid steel frame ensuring excellent angle control.
- Electro-pneumatic action with servo-controlled regulator.
- Full-color, touch-screen control unit
- PC Software for control, acquisition and data processing.
- Optional shear stress measurement.
- Optional integrated balance.
- Optional integrated extruder.

The machine provides direct connection to a LAN network and the internet, which allows for remote machine control, as well as remote communication with technicians for immediate diagnostics and problem solving and for software updates.

Unlimited memory storage with: 2 USB ports, 1 SD card. Machine is factory calibrated and supplied with the internal angle set to 1.16° as rspecified by ASTM, AASHTO Specifications.

Superpave Gyratory, 230V 50/60Hz **HA-5950.4F**

Ship wt. 529lbs. (240kg)

Overlay Tester

HA-5600

Overlay Tester

ASTM WK26816; CS-TOT

In recent years many mixture design methods have produced materials that are stiffer, leaner and more resistant to rutting, however, such materials are often more susceptible to fatigue and reflection cracking. The Texas Overlay Tester (CS-TOT) was designed to simulate the expansion and contraction movements that occur in the vicinity of joints or cracks and which result in reflection cracking in overlays. With the CS-TOT it is possible to characterize both the crack initiation and crack propagation properties of asphalt mixtures. Cox & Sons has developed the CS-TOT, which is a dedicated, state-of-the-art piece of equipment for carrying out this test.

Features:

- Dedicated no compromise Texas Overlay machine
- Designed according to the proposed ASTM
- Integral surface-mounted, touch-screen control
- Double GSF cold rolled container slides for ultra accurate inline sample deformation
- Intelligently designed specimen gluing and "zero stress" carrying frame
- Fitted with high performance hydraulic actuator and powerpack
- Ergonomically designed for easy operation

Overlay Tester, 120V 60Hz	HA-5600
Overlay Tester, 240V 50Hz	HA-5600.5F

Ship wt. 1102 lbs. (500kg)

Accessories	Model
Disc-shaped, compact tension fixtures	HA-5600.1
Semi-circular bending * (-5 °C to + 40 °C)	HA-5600.2
"Zero Stress" carrying frame to align the two base plates and fix the specimen prior to testing with specimen alignment	HA-5600.3
0.25" (6.25 mm) spacer bar for plate separation and alignment	HA-5600.4
10 lb (4.5kg) weight (in the shape of the specimen to ensure load is spread evenly and does not overhang the edges of the specimen)	HA-5600.5
Calibration kit	HA-5600.6

Specifications	
Measurement Interval	0.01
Waveform Type	Cyclic triangular and constant displacement or a combination
Maximum Displacement	0.025 to 0.2 (0.6 to 5.1mm)
Resolution of Displacement Measurment	0.00004" (1 µm)
Control Loop Rate	>1000 Hz
Load Cell Capacity	5500 lb (25kN)
Load Cell Accuracy	0.25 %FS
Cycle Time	5 to 1000 s
Cycle Time Measurement Resolution	0.1%
Temperature Control Range	23 to 104°F (-5 to 40°C)
Temperature Control Accuracy	±0.9°F (0.5°C)
Ambient Temperature Range	59 to 86°F (15 to 30°C)
Test End Conditions	(0 to 100)% load reduction and/or (0 to 10000) cycles
Specimen Dims Length: Height: Width:	5.9 ± 0.08" (150 ± 2mm) 1.5 to 2 ± 0.02" (38 to 50 ± 0.5mm) 3" (76mm)
Plate Dims Length: Height (Optional): Width:	11.8" (300mm) 0.51 or 0.75" (13 or 19mm) 5.9" (150mm)
Base Plate Material	Stainless steel
Base Plate Hardness (Brinell)	95 (Not lower than that of 6061-T6 aluminum)
Plate Groove Depth x Width	0.059 x 0.051" (1.5 x 1.3mm)
Plate Groove Separation	0.25" (6.35mm)
Initial Separation of Plates	0.079" (2mm)
Vertical movement of sample (% of crack opening)	<3
Dimensions (WxDxH)	62" x 25" x 43" (1580 x 650 x 1100mm)

H-1640B.4F

H-1641T

Pressure Aging Vessel (PAV3), 230V 50/60Hz
ASTM D6521-05; AASHTO R280-6; EN 14769

The PAV3 pressure aging vessel is used to simulate in-service oxidative aging of asphalt binder according to procedures developed by the Strategic Highway Research Program (SHRP). The PAV3 consists of a vertical, stainless steel pressure vessel in a stainless steel cabinet with encased band heaters, a precision sample holder for simultaneous testing of ten specimens, a set of ten TFOT specimen trays, a pressure controller, temperature controller, pressure and temperature measurement devices, temperature and pressure recorder, and a specimen loading and unloading tool.

The H-1640B.4F PAV3 features a compact, bench-top design with integral ASME code section VIII, division 1; 1992 A 93 pressure vessel controlled using a 7", full-color, touch-screen display, which is tilted for greater visibility. Operating pressure is 2.10 ±0.05 MPa (304psi). Temperature is 80 to 115°C (176 to 239°F) and programmable from 50 to 150°C (122 to 302°F). Between 80 to 115°C (176 to 239°F) the tolerance is well within ± 0.1°C. Temperature uniformity is ± 0.5°C. Pressurization is programmable from 1 hour to 99 hours. This enables AASHTO R28, ASTM D5621, and EN 14769 specifications to be met without any special programming and also enables greater freedom for research and development projects. Real-time graphs are visible from the touch-screen controller while the unit's network-ready modem enables the PAV3 to be controlled from PCs and mobile devices when connected to a network.

Data acquisition of temperature, pressure, and time is collected throughout the aging process. Once the aging process is complete, a .csv file can be created and saved via the USB port on the front of the PAV3. Once the .csv file has been created, it can easily be viewed and manipulated in Microsoft Excel® or other spreadsheet programs.

The PAV3 sample holder is a one-piece, solid device requiring no assembly and is easy to achieve an accurate level position with the leveling ring in the vessel. There is also room for a small bubble level between slots for verification purposes.

The PAV3 includes a network-ready modem, which provides connection to the internet, permitting the user to access the PAV3 with a mobile device or PC using a VNC viewer app program. VNC connection enables the user to connect, monitor, and control the PAV3 from a remote location. The PAV3 can be programmed with a custom IP address, so the number of PAV3s on a single network is essentially endless.

Pressure Aging Vessel, 230V 50/60Hz H-1640B.4F
Shipping wt. 433 lbs (193kg)

H-1640B.4F PAV3 Accessories & Components

Description	Model
UPS battery backup system	H-1640.1
PAV verification kit	H-1640.2
PAV o-ring	H-1640.3
CGA adapter	H-1640.4
High-pressure hose	H-1640.5
Specimen pans set	H-1640.6
Regulator, single-stage	H-1640.7
Pan handling tool	H-1640.8
Specimen rack	H-1640.9

Vacuum Degassing Oven (VDO)
ASTM D6521-05; AASHTO R28-06

The vacuum degassing oven (VDO) is used to precisely and accurately degas pressure-aged binder samples and is designed for rapid removal of entrapped air bubbles in asphalt specimens to the required 15 ±1.0kPa (25.5Hg). The network-ready 7in (178mm) touch-screen controller features easy menu-driven operation in multiple language options for fast programming of vacuum, temperature values and soak times. The controller display indicates time, temperature, and current process stage, with alerts at the end of each test. When connected to a network with an Ethernet cable, the VDO Touch can be operated remotely via smart phones, tablets, or PC's. USB Ports allow easy software upgrades.

The compact, table-top unit is constructed of stainless steel with a hinged lid to conserve space while allowing easy access to the stainless steel vacuum chamber. The oven holds up to (8) 4 oz. (114ml) or (4) 8 oz. (236ml) sample containers and features a self-contained, automatic vacuum system.

Temperatures in the VDO Touch vacuum chamber are measured by a platinum RTD probe with a range from ambient to 200°C with accuracy to ±5°C. Soak and degass times are both programmable up to 4,320 minutes. The rugged stainless steel cabinet, chamber and cover are easy to maintain, and the removable cover features a heat-resistant glass viewing window for monitoring purposes The VDO includes (4) 236ml (8oz) sample tins, and a specimen removal tool for easy loading and unloading of samples. Dimensions: 24" x16" x12" (610 x 406 x 304mm).

H-1642

H-1642T

Features:

- Automated tabletop degassing oven for rapid removal of entrapped air bubbles in asphalt specimens
- Network-ready, 7" touchscreen controller provides simple control to input vacuum, temperature and soak time values
- Ethernet cable connection enables remote operation via smart device
- Capacity for eight 4oz (118ml) or four 8oz (236ml) sample containers

Specifications

Description	Model
Operating pressure	15±1.0 kPa (25.5Hg)
Temperature range	Ambient to 200°C
Temp. resolution	0.1° C
Accuracy	± 5° C

Vacuum Degassing Oven, 120V 60Hz H-1641T
Vacuum Degassing Oven, 230V 50/60Hz H-1641T.4F
Shipping wt. 185 lbs (84kg)

H-1641T VDO Accessories & Components

Description	Model
UPS battery backup system	H-1640.1
VDO verification kit	H-1641.7
Sample container, 8 oz. (236ml) 12 (pk)	H-1641T.1
Sample container, 4 oz. (118ml) 12 (pk)	H-1641T.6
VDO verification thermometer	H-1641T.2
VDO vacuum verification gauge	H-1641T.3
VDO calibration block	H-1641T.4
VDO vessel cap	H-1641T.5

Bending Beam Rheometer

ASTM D6648; AASHTO T313-02

The bending beam rheometer (BBR) performs flexural tests on asphalt binder and similar specimens per tests, initially developed by the Strategic Highway Research Program (SHRP), which consist of a constant force being applied to a specimen in a chilled fluid bath in order to derive specific rates of deformation at various temperatures. The complete BBR system consists of a fluid bath base unit, a three-point bend test apparatus, which is easily removed from the base unit for specimen loading and unloading, an external cooling unit with temperature controller and a calibration hardware kit with carrying case. The unit features an integral, stainless steel load frame and in-line, blunt-point loading shaft. The large, easy-to-read digital display shows load, displacement, and bath temperature for ease of setup and operation. Real-time displacement, loading, and temperature graphs are displayed during the test cycle and can be re-plotted and re-scaled as needed for easy viewing.

The BBR uses a linear, variable-displacement transducer (LVDT) with a range of 6.35mm and accuracy to ±2mm measures deflection. The temperature-compensating 500g load cell with mechanical overload protection ensures accurate load results. Safe, rapid cooling of the ethylene glycol mixture test fluid to -40° to 25°C is provided by a mechanical refrigeration system. Process temperature is controlled and monitored by two, independent, platinum RTD temperature transducers maintaining temperature stability.

The BBR comes with a pre-loaded software package, which allows for device configuration, daily verifications, test setup, test initiation, and reporting. It also includes five aluminum specimen molds with mylar strips, a Calibration Kit with required weights, and confidence beam. Calibrated test weights and a certified LVDT (NIST-traceable). The easy-to-use software allows daily verification and periodic calibration of load cell, LVDT, and RTD transducers Dimensions: 49" x 49" x 41" (1,245 x 1,245 x 1,040mm). An adequate compressed air source must be supplied by user.

Bending Beam Rheometer, 120V 60Hz H-1642
Bending Beam Rheometer, 230V 50Hz H-1642.5F
Shipping wt. 520 lbs (235.8kg)

Bending Beam Rheometer with Touch Screen

ASTM D6648; AASHTO T313, TP87 BS EN 14771

The Bending Beam Rheometer 3 (BBR3) has been designed to perform flexural tests on asphalt binder and similar specimens as part of the PG grading system according to Superpave. The BBR3 is a state of the art internal computer system incorporating touchscreen technology. The BBR3's new external cooling unit is now more compact and omits less noise during operation. Programmable test parameters allow users to input and save their own unique settings, allowing the BBR3 to satisfy a diverse range of testing applications.

The BBR3 is made up of a fluid bath base with a built-in touchscreen computer, load frame, external refrigeration unit, and a calibration kit with carrying case. During operation, a known force is applied to the center of a horizontally supported specimen beam submerged in a cold liquid bath while internal software calculates the flexural creep stiffness of the beam. Used in part to determine a sample's critical cracking temperature and low temperature PG grade, the BBR3's -400C to 250C temperature range is effciently calculated by a platinum RTD measuring device. The 500g load cell and changeable specimen supports easily transition the BBR3 for crack sealant testing, and the free standing external cooling unit ensures that the cooling fluid maintains a constant temperature.

Programmable test parameters allow the user to define a test and save those parameters for later testing. Predefined test parameters include the standard ASTM BBR test, as well as the crack sealant test and the sliver test.

The BBR3's programmable test parameters


H-30069.2F

H-30068.2F


H-30068.6

include: Deflection Plot, Load Plot, Bath Temperature, Stirrer Speed, Specimen size, Testing Times, Load, and Testing Company.

The BBR3 features a Displacement Transducer accuracy of 0.097 micron, a measurement resolution of 0.006g, and a Deformation Accuracy of 0.097. While other BBR models may favor Peltier cooling, the BBR3 operates more efifciently without it.

Reporting features on the new BBR3 include the ability to name your sample and enter any important notes. With the new BBR3, your data is collected twice per second n addition to these

new features, BBR3 users now also have the ability to upload their company logo directly into their test report.

Once the BBR3 has been connected to a network, users have the ability to access their equipment using a mobile phone, tablet, or PC. This also allows users to connect to a wireless printer, making it easy to print data and test results. A USB port on the back of the unit is also available for users who prefer to connect a printer directly.

In addition to the USB port on the back of the BBR3, a USB port on the front of the unit allows for user friendly software updates. Operators can also use this USB port to download data onto a flash-drive, or connect a wireless keyboard for more e cient data input.

BBR3 Touch, 120V 60Hz	H-1642T
BBR3 Touch, 230V 50Hz	H-1642T.5F

Shipping wt. 250 lbs (115kg)

H-1641T VDO Accessories & Components

Description	Model
Specimen Mold Set (5 per set)	H-1642.1
Mylar Strips, 5 sets of 3 ea.	H-1642.2
BBR Calibration Kit	H-1642.3

Rolling Thin Film Oven

ASTM D2872; AASHTO T240; EN 12591;CTM 346

The Rolling Thin Film Oven (RFTO) is used to measure the effect of heat and air on a moving film of semi-solid asphaltic material and is an indicator of the approximate change in properties during conventional hot-mixing. The results of this treatment are determined from measurements of the asphalt properties before and after the test. Through the use of a programmable, temperature controller and a 4-digit, digital display system, along with a solid-state heater and 200-watt heating element, the oven accurately maintains the specified test temperature of ±1°F at 325°F (±0.5°C at163°C).

The oven also features: double-wall construction; door with double-pane viewing window; symmetrical top and bottom vents; air plenum, and squirrel-cage-type 1725 rpm fan

The RFTO is available in a standard model with a glass flow meter or with a digital flow meter. Both models are identical other than the meter.

The oven includes a 200 to 14,000 ml/min flow meter, moisture meter, 0 to 100 psi air pressure gauge with regulator, rotating (15rpm) test rack and eight glass specimen jars. Overall dimensions 40"W x 36"H x 26"D (1016 x 3292 x 660mm). A clean, dry compressed air source is required for oven operation.

Rolling Thin Film Oven, 208-230V 60Hz	H-30068.2F
Rolling Thin Film Oven, 208-230V 50Hz	H-30068.5F
Digital RTFO, 208-230V 60Hz	H-30069.2F
Digital RTFO, 208-230V 50Hz	H-30069.5F

Shipping wt. 480 lbs (217.7kg)

Specifications	
Construction	Double-walled, 16-gauge welded steel exterior. 18-gauge corrosion-resistant, stainless steel interior
Insulation	Insulation 3.5" (89mm) of high density fiberglass
Controller	Programmable microprocessor, UL listed
Temperature Display	Measured Temperature: 4 digit red LEDs Temperature Set Point: 4 digit green LEDs
Thermal Protection	Prevents overheating in the event of control failure
Temperature Range	Ambient to 200°C (390°F)
Vents	Double exhaust vents for dissipation of expended volatile from specimen
Air Flow Adjustment	Needle valve (long taper)
Air Pressure Gauge	Range 0 - 100 psi
Heat Exchanger	5/16" dia. copper tube

Rolling Thin Film Oven Accessories

Lab stand with wheels	H-30068.6
Silica gel, 1.5 lb can	H-30068.7
Dry air system	H-30068.8
Jar cooling rack	H-30068.3
Bottle scraper	H-30068.2
Digital mass flowmeter	H-30068.9
ASTM 13C Thermometer	H-2610.13C
Additional specimen bottles	H-30068.12
Oven Tongs	H-30068.1

Bitumen Testing

H-1637.3F

H-1631

HA-1635

Rotational Viscometer and Rheometer

ASTM D4402; AASHTO T316

The Fungilab Master Series Expert L range rotational viscometer and Thermosphere with a precison-temperature controller provide an excellent solution for those looking for SHRP asphalt binder testing equipment specifically designed to meet the requirements of AASHTO T316/ASTM D4402 high-temperature test methods. The H-1637 Master Series Expert provides a measuring range of 20-6,000,000 cP with 54 speeds in a range from 0.01 to 200 rpm. A graphic display delivers clear data readings and an intuitive full-touch keypad provides efficient data selection. A USB connection allows for data transfer to a PC Excel format. The thermosphere features temperature control to 300°C with an accuracy of 0.5°C for ambient to 80°C, <1.0°C for 80 to 150°C and <1.5°C for 150 to 300°C.

Viscometer/Thermosphere includes: TL5 spindle, alignment bracket, thermocontainer with safety guard and insulating cap, extracting tools and temperature controller.

Rotational Viscometer, 100/240V 50/60Hz H-1637.3F
Shipping wt. 120 lbs (54.4kg)

Viscometer/Rheometer Accessories and Parts

Thermosphere chambers, 100pk.	H-1637.1
Thermosphere chambers, 50pk.	H-1637.2
Spindle (TL5)	H-1637.3
Spindle (TL6)	H-1637.4
Spindle (TL7)	H-1637.5
Silicone Std. Oil, RT 30,000 (600ml)	H-1637.6
Silicone Std. Oil, RT 60,000 (600ml)	H-1637.7
Silicone Std. Oil, RT 100,000 (600ml)	H-1637.8

Loss-on-Heat Thin Film Oven

ASTM D6, D1754; AASHTO T47, T179; BS2000

This dual-purpose 16ft^3 oven can be used for loss-of-heat test and thin film test for bitumen and asphaltic materials. The loss-on-heat oven determines the effect on asphaltic materials of heating in an oven under prescribed conditions. The results are reported in terms of change in sample mass and/or changes in selected properties such as viscosity, penetration and ductility as evidenced by test data taken before and after the oven cycle.

The oven features a stainless steel interior, a powder-coated steel exterior and a double-glazed door window for viewing the test chamber. Side-mounted controls are comprised of a microprocessor digital control and an independent overheat thermostat. Two rotating platforms are supplied to perform both types of tests.

The oven's temperature range is: ambient to 365°F (180°C), pre-set to 163°C ± 1°C. Dimensions are: internal chamber: 15" (H) x 20.5" (W) x 18" (D) (38 x 52 x 46cm); external dimension 22.5" (H) x 34" (W) x 25" (D) (57 x 87 x 63cm). External Dimension does not include motor or handle.

Loss-On-Heat Oven, 120V 60Hz H-1631
Loss-On-Heat Oven, 220V 50Hz H-1631.5F
Shipping wt. 300 lbs (136kg)

Loss-On-Heat Oven Accessories

Sample container, ASTM D6	H-1631.1
Thin film oven pan, stainless steel for ASTM D1754	H-1540

Dynamic Shear Rheometer

ASTM D7175; AASHTO MP1, R29; T315

The Dynamic Shear Rheometer (DSR) has been specifically designed to satisfy the demands of high throughput grade testing of Asphalt binders (bitumen), to AASHTO (American Association of State Highway and Transportation Officials) industry standards.

The DSR asphalt rheometer is proven as the benchmark system for Quality Control testing to industry standards in regulated markets worldwide.

Developed in close association with industry researchers to meet all instrument criteria and test protocols of AASHTO (American Association of State Highway and Transportation Officials) standards. Compact, integrated unit designed specifically for ease of use and robustness in high throughput Asphalt binder (bitumen) test enviroments. Air bearing and mechanical bearing options to provide robust and cost-effective measurement platforms for any industrial laboratory or remote field testing location.

Integrated fluid immersion cell specifically based on patented principle for temperature control of highly thermally-sensitive asphalt or bitumen samples. Rapid thermal equilibration and elimination of thermal gradients in the sample - essential for consistent and reliable data, and optimized sample throughput. Excellent temperature stability and accuracy, with a resolution of ± 0.01°C. Rapid, robust manual gap set, with pre-set gaps for AASHTO tests for simplicity of use. Active thermal mode to ensure constant gap is maintained for all temperature test points. Plate measuring systems (both upper and lower plates) designed to comply with industry standards (AASHTO). Dedicated AASHTO specification QC software package (TruGrade) available

Dynamic Shear Rheometer, 120V 60Hz HA-1635
Dynamic Shear Rheometer, 220V 50Hz HA-1635.5F
Shipping wt. 240lbs (109kg)

F85930-33
F85938

AY1087X1

H-30145E

H-1304

Asphalt Content/Binder Ignition Furnace

ASTM D6307

The asphalt content/binder furnace with internal automatic balance is an environmentally-friendly and cost-effective method for the accurate determination of asphalt content. Developed by NCAT, the National Center for Asphalt Technology. The furnace's large capacity handles samples up to 4,000 grams. Ignition method reduces testing time compared to solvent testing methods and automatic operation frees technicians for other tasks. Temperature range is: 392 to 1202°F (200 to 650°C). 4,800 watt operation Accurate internal balance monitors weights automatically throughout ignition to within ±0.1 gram. Easy operation—simply enter sample weight, calibration factor, load the sample, and push start, when unit beeps at test end, push stop, and sign receipt. Door safety features, such as a software-activated door lock, an automatic interlock that cuts power when door is open, full 180 degree door opening and door hinge lock eliminate harmful solvents and make operation easy. Ignition Furnace comes complete with accessory package AY1087X1. CE-approved. Chamber dimensions: 14"W x 10.5"H x 14"D (355 x 266 x 355mm). Shipping dimensions: 32"W x 32"D x 60"H (813 x 813 x 1524mm).)

Content/Binder Ignition Furnace w/ Accessory Package, 240V 50/60Hz, 20 amp — F85930-33
Shipping wt. 383 lbs (173.7kg)

Content/Binder Ignition Furnace w/ Accessory Package, 208V 60Hz, 23 amp — F85938
Shipping wt. 280 lbs (127kg)

Content/Binder Ignition Furnace (furnace only), 240V 50/60Hz, 20 amp — F85930-33X
Shipping wt. 357 lbs (161.9kg)

Content/Binder Ignition Furnace (furnace only), 208V 60Hz, 23 amp — F85938X
Shipping wt. 230 lbs (104.3kg)

Description	Part #
Exhaust tubing, 3"ID (sold by foot)	H-1515
Exhaust tubing, stainless, 3"ID (sold by foot)	H-1515SS
Printer paper	PRX2
Baskets (set of 2)	AY1087X6

Accessory Package for Ignition Furnaces

Accessory package includes: 4 baskets, 2 trays, 2 covers, handle, cooling cage, insulated plate, gloves, face shield, 4 rolls of printer tape, balance calibration plate and anderol oil.

Ignition Furnace Accessory Package — AY1087X1
Shipping wt. 75 lbs (34kg)

Heavy-Duty Lab Bench Oven

ASTM D6925

Forced draft oven capable of maintaining 437°F (225°C), more than adequate for both short-term aging of asphalt samples and heating aggregates, asphalt binders and equipment for use in ASTM D6925. The .7ft3 (198L) capacity provides ample room for all applications. The oven features a calibrated dial-type temperature controller (model H-30145) or a digital PID microprocessor temperature controller (model H-30145E). These ovens are constructed of corrosion-resistant, aluminized steel interiors and exteriors coated in an exclusive "high-tech" bronze polyester finish. The large, high-impact thermal plastic door handles provide durability and remain cool-to-the-touch during operation. Ovens come with (2) heavy-duty, chrome-plated wire shelves, which can support 80 lbs. (36kg).

Dimensions are: internal chamber: 26" (H) x 20" (W) x 26" (D) (660 x 508 x 660mm); external dimension 33" (H) x 24" (W) x 32" (D) (838 x 610 x 813mm).

Lab Bench Oven, 120V 60Hz — H-30145
Lab Bench Oven, 120V 60Hz — H-30145E
Lab Bench Oven, 230V 50/60Hz — H-30145.4F
Lab Bench Oven, 230V 50/60Hz — H-30145E.4F
Shipping wt. 206 lbs (93.4kg)

Heavy-Duty Lab Oven Accessories

Description	Part #
Floor Stand, 1 fixed shelf	H-30150
Floor cabinet, 2 sliding shelves	H-30155
Exhaust adapter for 3" pipe	H-30181
Shelf w/ mounting rails	H-30145S

Rhoma-Sol™ Specialty Emulsifier

Spray-on solution used in the removal of asphalt and tack oil from tessting, paving, oiling, patching, reclaiming and other work zone equipment. Contains no hazardous petroleum solvents and is 100% biodegradable. Flammable, must ship by truck domestically and as Dangerous Goods Internationally.

Rhoma-Sol™ Specialty Emulsifier — H-1304
Shipping wt. 2 lbs (0.9kg)

See page: 303-307 for more bench oven choices, as well as accessories. See page 320 for gloves for use with these ovens.

Ductility

H-1068CB

HA-1068.3F

Interior of HA-1068 showing test molds, screw drive and disengage lever.

Elite Series Automated Ductilometer

ASTM D113, D5892, D6084,

The HA-1068 Ductilometer features Humboldt's Elite Series Controller. This touch-screen controller provides you with full, graphical monitoring of all testing functions in a stand-alone application, while also providing the ability to control the machine from a networked computer or just port data from the controller to a networked computer.

The HA-1068 Controller provides precise speed control of the DC, stepper motor maintaining constant speed, entirely vibration-free, from 5 to 100mm/min. The unit provides for three test briquettes per testing sequence with a maximum carriage travel (elongation) of 150cm and an automatic stop feature. The machine also provides a manual disengage lever for quickly disengaging the screw drive to return the testing carraige back to the start position after a test completion.This feature allows multiple tests to be run without having to wait for the machine to reset itself.

The HA-1068 has a stainless steel interior with an overflow connection, and a baked enamel stainless steel-wrapped exterior. Gears are bronze or brass; all other parts are solid brass to prevent rusting. Finned stainless steel tubes beneath a false bottom provide efficient thermal transfer. A single stainless steel lead screw mounted above water level prevents agitation of water and premature rupture of specimens. A traveling pointer adjusts to zero starting position and indicates exact position of carriage on a linear centimeter scale attached to trough's front edge.

Stand-Alone Control

In stand-alone mode the controller provides you with full, graphical monitoring of all testing functions, while maintaining full computer control when desired. The seven-inch, waterproof screen provides at-a-glance monitoring of testing functions, in a real-time graphical display, without the use of a computer, building upon Humboldt's dedication to modular, stand-alone data acquisition.

You will be able to run tests and display results while viewing tabulation, basic x-y graphs and instrument readings in real-time during the test, using user-defined, basic data acquisition. Test data is stored in the device and can be downloaded to a USB drive via the machine's FRONT USB port or the data can be transferred to a computer via the LAN port.

A second USB port located on the back of the machine can also be used to power a wireless access point, which can provide a wireless hook-up with a computer, if no LAN is available.

Computer Control

Humboldt's Next software is included with the HA-1068 ductility machine. This software provides robust machine control, calibration, data acquisi-tion and report generation for those using a com-puter to control testing operations.

In addition, operators have the ability to view and control testing operations from a PC in the lab, in the next room or at a different location, while also providing report generating capabilities.

The HA-1068 Ductilometer is available with or without a circulating temperature controller. The temperature controller provides a solid-state, thermostatically controlled bath and circulator to maintain water temperature within a ±0.9°F (±0.5°C). The termperature range is: -10°C to 80°C and the heating capacity is 1000W with a 0.1°C stability. Includes a 6' (183cm) cord, feed-through switch and 3-prong plug and 3 standard H-1080 briquette molds with H-1090 plates. Trough overall dimensions: 11.75" x 74" x 6.375"H (30 x 188 x 16cm).

Acrylic Cover is included with this machine.

Elite Series Ductilometer, 120/220V 50/60Hz	HA-1068.3F
Shipping wt. 425 lbs (193kg)	

Circulating Temperature Controller

The H-1068CB Circulating Temperature Control-ler is designed for use with the H-1068X ductility machine. It provides a solid-state, thermostatically controlled bath and circulator to maintain water temperature within a ± 0.9°F (± 0.5°C). Tem-perature range is: -10°C to 80°C. 1000W heating capacity with 0.1°C stability. Dimensions: 25" x 9" x 19" (635 x 229 x 483mm).

Circulating Temp. Control, 120V 60Hz	H-1068CB
Circulating Temp. Control, 220V 60Hz	H-1068CB.2F
Circulating Temp. Control, 220V 50Hz	H-1068CB.5F
Shipping wt. 80 lbs (36.2kg)	

Interior of HA-1060 showing test molds, screw drive and disengage lever.

Interior of HA-1060 showing force determination transducer set up.

H-1060.4F

Elite Series Ductilometer, Refrigerated
ASTM D113, D5892, D6084, AASHTO T51

Humboldt's Elite Series refrigerated Ductilometer features Humboldt's Elite Series Controller. This touch-screen controller provides you with full, graphical monitoring of all testing functions in a stand-alone application, while also providing the ability to control the machine from a networked computer or just port data from the controller to a networked computer or by USB

The HA-1060 Refrigerated Ductilometer is mounted into a polypropylene bath designed for use with sodium chloride solutions. The cabinet is constructed of a heavy-gauge, enamel-finish steel lower cabinet and stainless steel upper cabinet. It is fully-insulated and the sealed space between the inner and outer walls protects the low-thermal conductivity properties of the foam and fiberglass combination (tested and proven to have the best K factor). A high-capacity pump assures positive circulation in the bath to provide close temperature control. Three-direction flow regulation is handled with flow cut-off valves that engage when equilibrium is reached. A sensitive, magnetic-setting, electronic relay control panel for heat and refrigeration maintains temperature range of 32°F (0°C) to 86°F (30°C) by 0.1°F (0.1°C).

The HA-1060 Controller provides precise speed control of the DC, direct-drive motor maintaining constant speed, entirely vibration-free. from 5 to 100mm/min. The unit provides for three test briquettes per testing sequence with a maximum carriage travel (elongation) of 150cm and an automatic stop feature. The machine also provides a manual disengage lever for quickly disengaging the screw drive to return the testing carraige back to the start position after a test completion.This feature allows multiple tests to be run without having to wait for the machine to reset itself.

The HA-1060 has a stainless steel interior with an overflow connection, and a baked enamel stainless steel-wrapped exterior. Gears are bronze or brass; all other parts are solid brass to prevent rusting. Finned stainless steel tubes beneath a false bottom provide efficient thermal transfer. A single stainless steel lead screw mounted above water level prevents agitation of water and premature rupture of specimens. A traveling pointer adjusts to zero starting position and indicates exact position of carriage on a linear centimeter scale attached to trough's front edge.

Stand-Alone Control

In stand-alone mode the controller provides you with full, graphical monitoring of all testing functions, while maintaining full computer control when desired. The seven-inch, waterproof screen provides at-a-glance monitoring of testing functions, in a real-time graphical display, without the use of a computer, building upon Humboldt's dedication to modular, stand-alone data acquisition.

You will be able to run tests and display results while viewing tabulation, basic x-y graphs and instrument readings in real-time during the test, using user-defined, basic data acquisition. Test data is stored in the device and can be downloaded to a USB drive via the machine's FRONT USB port or the data can be transferred to a computer via the LAN port. A second USB port located on the back of the machine can also be used to power a wireless access point, which can provide a wireless hook-up with a computer, if no LAN is available.

Computer Control

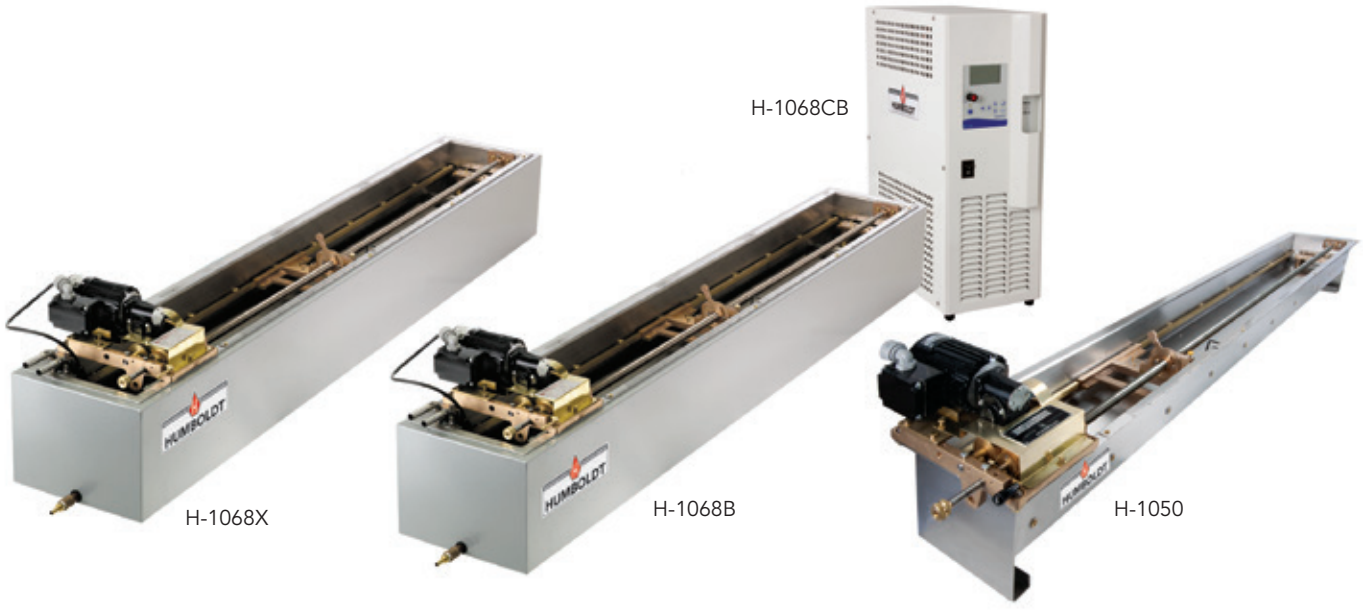
Humboldt's Next software is included with the HA-1060 Ductilometer. This software provides robust machine control, calibration, data acquisi-tion and report generation for those using a com-puter to control testing operations.

In addition, operators have the ability to view and control testing operations from a PC in the lab, in the next room or at a different location, while also providing report generating capabilities.

Includes 3 standard H-1080 briquette molds with H-1090 plates and an integral, clear acrylic cover to aid in temperature control. Cabinet is 90 x 41 x 23" (229 x 104 x 58cm)..

Elite Ductilometer, Refrig., 220V 50/60Hz H-1060.4F
Shipping wt. 1066 lbs (484kg)

Ductility



Humboldt Ductilometer

ASTM D113, D5892, D6084, AASHTO T51

Humboldt Ductilometers determine ductility of formed asphalt/cement or semi-solid bitumen by measuring the distance of elongation before reaching the breaking point of a briquette sample, which is pulled apart at a specific speed and temperature. The H-1068X is a three-speed machine designed for standard and force ductility tests. The unit tests three briquettes simultaneously and its DC, direct-drive motor maintains constant speed, entirely vibration-free. Speeds of 1/4, 1 or 5cm per minute are selected via lever shift on mechanical gear box.

A single stainless steel lead screw mounted above water level prevents agitation of water and premature rupture of specimens. A traveling pointer adjusts to zero starting position and indicates exact position of carriage on a linear centimeter scale attached to trough's front edge. Maximum carriage travel (elongation) is 150cm with an automatic stop.

The Unit has a stainless steel interior with an overflow connection, and a baked enamel stainless steel-wrapped exterior. Gears are bronze or brass; all other parts are solid brass to prevent rusting. Finned stainless steel tubes beneath a false bottom provide efficient thermal transfer. Includes a 6' (183cm) cord, feed-through switch and 3-prong plug. Includes 3 standard H-1080 briquette molds with H-1090 plates. Trough overall dimensions: 11.75" x 74" x 6.375"H (30 x 188 x 16cm). **H-1068PC Acrylic Cover is recommended to maintain constant tank temperatures.**

Humboldt Ductilometer

Humboldt Ductilometer, 120V 60Hz	H-1068X
Humboldt Ductilometer, 220V 60Hz	H-1068X.2F
Humboldt Ductilometer, 220V 50Hz	H-1068X.5F

Shipping wt. 240 lbs (108.8kg)

Ductilometer, Temperature-Controlled

ASTM D113, D5892, D6084, AASHTO T51

The H-1068 Ductilometer builds on the H-1068X machine and adds a circulating temperature-control unit. Solid-state thermostatically controlled bath and circulator maintain water temperature within a ± 0.18°F (± 0.1°C). The H-1068B is a three-speed machine designed for Standard and Force Ductility tests. The unit tests three briquettes simultaneously and its DC, direct-drive motor maintains constant speed, entirely vibration-free. Speeds of 1/4, 1 or 5cm per minute are selected via lever shift on mechanical gear box.

A single stainless steel lead screw mounted above water level prevents agitation of water and premature rupture of specimens. A traveling pointer adjusts to zero starting position and indicates exact position of carriage on a linear centimeter scale attached to trough's front edge. Maximum carriage travel (elongation) is 150cm with an automatic stop.

The Unit has a stainless steel interior with an overflow connection, and a baked-enamel, stainless steel-wrapped exterior. Gears are bronze or brass; all other parts are solid brass to prevent rusting. Finned stainless steel tubes beneath a false bottom provide efficient thermal transfer. Includes a 6' (183cm) cord, feed-through switch and 3-prong plug. Includes 3 standard H-1080 briquette molds with H-1090 plates. Trough overall dimensions: 11.75" x 74" x 6.375"H (30 x 188 x 16cm). **H-1068PC Acrylic Cover is recommended to maintain constant tank temperatures.**

Ductilometer, Temperature Controlled

Ductilometer, 120V 60Hz	H-1068B
Ductilometer, 220V 60Hz	H-1068B.2F
Ductilometer, 220V 50Hz	H-1068B.5F

Shipping wt. 410 lbs (185.9kg)

Ductility Machine, Basic

ASTM D113, D5892, D6084, AASHTO T51

The H-1050 is a three-speed machine designed for standard and force ductility tests. It includes a quality mechanical gear box. Speeds of 1/4, 1 or 5cm per minute are selected via lever shift on mechanical gear box. The unit is a bare-bones, economical ductility machine, which does NOT include a wrapped exterior or thermal-finned, stainless steel tubes for enhanced thermal transfer.

Ductility Machine, Basic ,120V 60Hz	H-1050
Ductility Machine, Basic, 220V 60Hz	H-1050.2F
Ductility Machine, Basic, 220V 50Hz	H-1050.5F

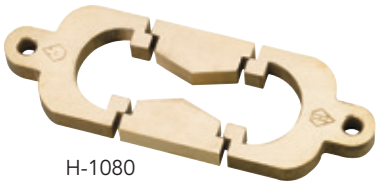
Shipping wt. 200 lbs (90.7kg)

Circulating Temperature Controller

The H-1068CB Circulating Temperature Controller is designed for use with the H-1068X ductility machine. It provides a solid-state, thermostatically controlled bath and circulator to maintain water temperature within a ± 0.9°F (± 0.5°C). Temperature range is: -10°C to 80°C. 1000W heating capacity with 0.1°C stability. Dimensions: 25" x 9" x 19" (635 x 229 x 483mm).

Circulating Temp.Control, 120V 60Hz	H-1068CB
Circulating Temp.Control, 220V 60Hz	H-1068CB.2F
Circulating Temp.Control, 220V 50Hz	H-1068CB.5F

Shipping wt. 80 lbs (36.2kg)

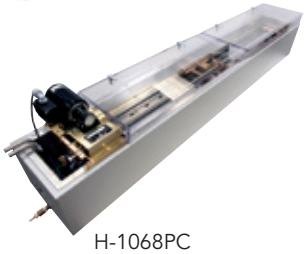

H-1080


H-1030


H-1090.3


H-1090


H-1068.100


H-1068PC


HA-1061


HA-1062


HA-1063

Ductility Briquette Mold
ASTM D113

Mold for making test briquettes for use with any ductility testing machine. H-1080 briquette mold has angled sides for use in standard test. Four accurately machined interlocking brass segments are interchangeable with same parts from different molds; no parts identification marks are needed for matching. End pieces, designed to hold specimens being elongated, are provided with mounting holes.

Ductility Briquette Mold — H-1080
Shipping wt. 0.8 lb (0.36kg)

Elastic Recovery Mold
ASTM D5892, D6084, AASHTO T301

Mold for making test briquettes for use with any ductility testing machine. H-1030 briquette mold has straight sides for use in forced tests. Requires H-1090 or H-1090.3 base plates. Four accurately machined interlocking brass segments are interchangeable with same parts from different molds; no parts identification marks are needed for matching. End pieces, designed to hold specimens being elongated, are provided with mounting holes.

Elastic Recovery Mold — H-1030
Shipping wt. 1.1 lb (0.49kg)

Base Plate

Brass, base plate for single mold. Flat surface provides uniform contact with mold and surfaces. 5.5" x 2" x .125" (140 x 51 x 3mm)

Base Plate, Single Mold — H-1090
Shipping wt. 0.6 lbs (0.27kg)

Base Plate, Triple Mold

Brass base plate for triple mold. Flat surface provides uniform contact with bottom surfaces mold. 5.5" x 8" x .125" (140 x 203 x 3mm)

Base Plate, Triple Mold — H-1090.3
Shipping wt. 1.8 lbs (0.8kg)

Cover for Ductilometers (Clear, Acrylic)

Temperature control cover made from clear acrylic sheet. Can be used with all ductility machines, except HA-1060, which comes with one.

Ductility Machine Cover — H-1068PC
Shipping wt. 40 lbs (18kg)

Ductilometer Stand

Designed for use with Humboldt Ductilometers, places machine at working height and includes a shelf for circulating temperature controller. Features square steel legs. Needs assembly.

Ductilometer Stand — H-1068.100
Shipping wt. 200 lbs (90.7kg)

Force Determination Transducers

Force determination transducers for use with Humboldt Elite Series Ductilometers. Provides precise tensile strength measurement of any material, preparation, procedure or type of test to an accuracy of 0.01 lbs. Attaches over existing pin in ductilometer without tools or machine modification. Can accommodate three adapters simultaneously. Electric components are located out of the water bath. Sold individually, Elite Series Ductilometer can accomodate up to 3 at a time.

Force Determination Transducer — HA-1061
Shipping wt. 4 lbs (2.3kg)

Calibration Device, Force Transducers

Calibration device for Humboldt Elite Series Ductilometer force determination transducers. Provides simple and precise calibration of transducers. Includes calibration pedestal, storage pedestal, dead weight hanger and weight set.

Calibration Device, Force Transducers — HA-1062
Shipping wt. 15 lbs (6.8kg)

Force Determination Kit for Ductilometers

This force determination kit is designed for use with manual control ductilometers like the H-1068X and H-1068B. It provides (3) Force Determination Transducers, a HM-5320 Data Logger and (1) Force Transducer Calibration Device. This kit will allow you to do force determinations and the Data Logger will allow you to monitor the test and its results. Humboldt's Elite Series Data Logger provides four individual, 24-bit analog to digital converters with an instrumentation excitation supply of 10 VDC. The analog Logger is ideal for use with instruments, such as pressure transducers, load cells, and strain transducers. It provides data storage for 1000 readings per channel. See page 133 for more information.

Force Determination Kit — HA-1063
Shipping wt. 30 lbs (13.6kg)

Penetrometers


H-1200


H-1240


H-1240D


H-1250


H-1252

Penetrometer, Universal

ASTM D5, D217, D1168, D1321, D1403, D1831, D5329; AASHTO T49, T187 and others

Direct-reading instrument for precision penetration measurements of bituminous materials, cement, petrolatum and waxes, as well as food, cosmetics and pharmaceutical products. Unit has 5" diameter indicator dial, graduated in 400 divisions of 0.1mm, corresponding to 40mm penetration. Zero preset to eliminate errors. Includes 47.5g plunger with 3.2mm hole, and two loading weights (50g and 100g). Overall dim. 10.5" x 13" x 22" (266.7 x 330.2 x 558.8mm).

Penetrometer, Universal H-1200
Shipping wt. 25 lbs (11kg)

Penetrometer, Electric

ASTM D5, D217, D1168, D1191, D1321, D1403, D1831, D1855; AASHTO T49, T187 and others

Takes our H-1200 universal penetrometer and adds an automatic digital timer to it. The timer's release mechanism is switchable between seconds minutes, or hours. Timer may be set in 1/10th second intervals. Plunger releases with push of a button, and automatically stops after the preset time duration. H-1240.4F adds a voltage adapter and internal switch on the timing mechanism to change cycle to 50Hz

Penetrometer, Electric, 120V 60Hz H-1240
Penetrometer, Electric, 220V 50/60Hz H-1240.4F
Shipping wt. 32 lbs (15kg)

Penetrometer, Digital

ASTM D5, D217, D1168, D1191, D1321, D1403, D1831, D1855; AASHTO T49, T187 and others

The H-1240D penetrometer adds a digital gauge to the H-1240 electric penetrometer to provide precise at-a-glance readings, as well as the ability to automatically start a test with a button push and have the test end after a preset duration.

Penetrometer, Digital, 120V 60Hz H-1240D
Penetrometer, Digital, 220V 50/60Hz H-1240D.4F
Shipping wt. 26.2 lbs (11.8kg)

Penetrometer for Battery Paste

Battery Paste Penetrometer combines the H-1200 and a H-1255 grease cone, which has a hardened steel tip with a special plunger. Total needle weight is 60g ±.050g.

Penetrometer for Battery Paste H-1202
Shipping wt. 25 lbs (11kg)

Penetrometer, Portable

ASTM D5, D217, D1168, D1191, D1321, D1403, D1831, D1855; AASHTO T49, T187 and others

Lighter and smaller than H-1200 for field work, unit's micrometer adjusts for accurate settings, as well as coarse adjustment for approximate settings. Only one additional 50g loading weight is included with a H-1280 needle. Overall dim. 7" x 7" x 16" (178 x 178 x 406mm).

Penetrometer, Portable H-1250
Shipping wt. 14 lbs (6.3kg)

Penetrometer for Battery Paste, Portable

Battery Paste Penetrometer combines the H-1250 and a H-1255 grease cone, which has a hardened steel tip with a special plunger. Total needle weight is 60g ±.050g.

Penetrometer for Battery Paste, Portable H-1252
Shipping wt. 9 lbs (4.08kg)

Deluxe Water Bath

ASTM D6927, D5581 and D4867

Microprocessor-based control for precise temperatures throughout the range to 180°F. Includes magnetic circulator, ensuring constant water temperature, and, a stainless steel shelf, which stands 2" (51mm) above the bottom of the unit for free circulation of water above and below test samples aided by magnetic stir bar, included. Volume is 7.76 gallons (29.40L) and dimensions are: ID: 19.5" W x 11.5" D x 8" H (495.3 x 292.1 x 203.2mm)

Deluxe Water Bath, 120V 60Hz H-1390
Deluxe Water Bath, 220V 50/60Hz H-1390.4F
Ship wt. 44lbs. (19.9kg)

Water Bath

ASTM D6927, D5581 and D4867

Microprocessor-based control for precise temperatures throughout the range. Includes a stainless steel shelf, which stands 2" (51mm) above the bottom of the unit for free circulation of water above and below test samples. Volume is 7.76 gallons (29.40L) and dimensions are: ID: 19.5" W x 11.5" D x 8" H (495.3 x 292.1 x 203.2mm).

Deluxe Water Bath, 120V 60Hz H-1392
Deluxe Water Bath, 220V 50/60Hz H-1392.4F
Ship wt. 43lbs. (19.5kg)

Economy Water Bath

Low-cost alternative water bath for heating specimens holds eight standard 4" stability molds. Supporting shelf above the bottom allows water circulation around specimens. Automatic thermostatic control with a range of 150° to 500°F (65° to 160°C). ID 11.5" x 19.5" x 5.5" (293 x 497 x 140mm) deep. H-1380.4F uses a step-down transformer, which is included, for electric conversion.

Deluxe Water Bath, 120V 60Hz H-1380
Deluxe Water Bath, 220V 50/60Hz H-1380.4F
Ship wt. 18lbs. (18.16kg)

Transfer Dish

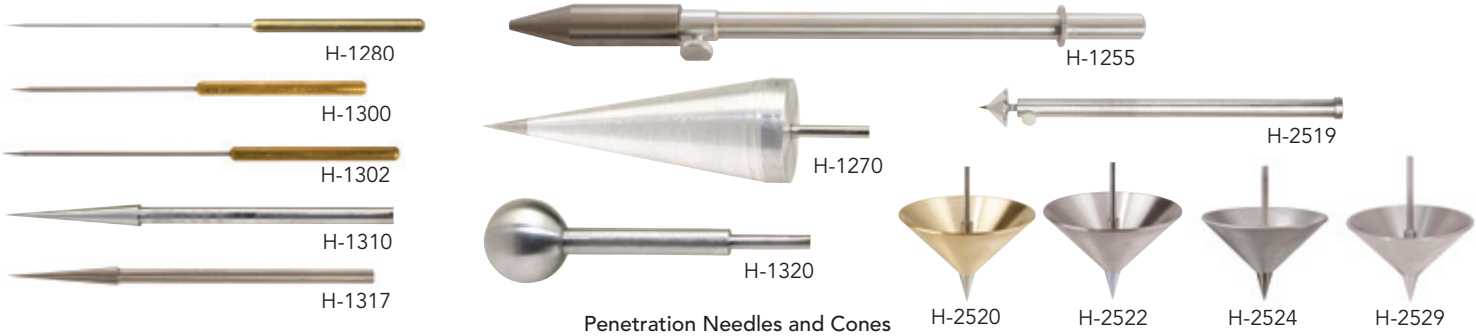
ASTM D5

Plastic transfer dish has flat bottom, straight sides and metal centering lugs with magnet in the bottom. Size is: 3.75" dia. x 3.25" deep (95 x 83mm).

Transfer Dish H-1352
Shipping wt. 0.9 lb (0.4kg)


H-1392


H-1352



Penetration Needles and Cones

Bituminous materials ASTM D5; AASHTO T49, IP49; ASA Std. A37.1; Fed Spec. SS.R. 406C, Meth. 214.01	Standard hardened stainless steel needle, 40-45mm exposed needle length. Wt. 2.5g.	H-1280
	Standard hardened stainless steel needle, 40-45mm exposed needle length. Certified to ASTM accuracy by independent laboratory. Wt. 2.5g.	H-1300
	Long hardened stainless steel needle, 50-55mm exposed needle length. Wt. 2.5g.	H-1290
	Long hardened stainless steel needle, 50-55mm exposed needle length. Certified to ASTM accuracy by independent laboratory. Wt. 2.5g.	H-1302
Waxes with 250 or less penetration ASTM D1321	Hardened stainless steel wax penetration needles with tapered point, blunt tip of truncated cone. Ferrule is approx. 3.2mm dia. Wt. 2.5g.	H-1310
	Same as H-1310. Certified to ASTM accuracy	H-1317
Battery paste	Hardened stainless steel tip with special plunger. Total wt. 60g ± .050g.	H-1255
Joint sealant for asphalt & concrete pavements ASTM D5329	Resilience ball penetration tool. Total wt. 27.5g.	H-1320

Measuring firmness of solid and plasticized fats: shortenings, butters AOCS Cc 16-60	20° aluminum cone, 3.2mm ferrule,0.8mm stainless steel blunt tip. Overall length 106mm. Wt. 45g.	H-1270
Recovery of used grease, small samples ASTM D1403	1/4 scale. (Not considered a substitute for full-size cone specified in ASTM D217.) Wt. 9.38g	H-2519
Grease testing penetrometers ASTM D217, D937 ASA Std. Z11.3	Hollow 90° brass cone, highly polished stainless steel tip. Removable nut and stem. Wt. 102.5g.	H-2520
	Hollow 90° stainless steel cone, highly polished stainless tip. Removable nut and stem. Wt. 102.5g.	H-2522
ASTM D2884	Hollow 90° Magnesium cone and plunger. Total cone wt. 30.0g	H-2524
Food, Paste, Paints U.S. Dept of Agriculture	Hollow 90° Aluminum cone and tip. Total wt. 35g	H-2529
Applications requiring 90· cones, ASTM D217, D937 ASA std. Z11.3	Stainless steel replacement tip, nut and stem.	H-2525

Moisture Boxes, Aluminum

OD	ID	Height	Inside Ht.	Volume cu. in./fl. oz.	Model
2" (51mm)	1.975 (50mm)	.875" (22mm)	0.865" (22mm)	2.650 (44cc) 1.47 (44ml)	H-4926
2.5" (64mm)	2.470 (63mm)	1.75" (44mm)	1.746" (44mm)	8.366 (137cc) 4.64 (137ml)	H-4927
3" (76mm)	3.000 (76mm)	1" (25mm)	0.985" (25mm)	6.963 (114cc) 3.86 (114ml)	H-4928
3.5" (89mm)	3.490 (89mm)	2" (51mm)	1.990" (51mm)	19.037 (312cc) 10.55 (312ml)	H-4929

Aluminum Moisture Boxes

Flat-bottom, straight-side seamless aluminum box has tight fitting cover, which fits bottom of box as well. Protects sample from exposure during storage and weighing operations.

Aluminum Moisture Boxes See chart at left

Tin Sample Cups

Flat-bottom, seamless tin sample cups have telescoping covers. Hold samples for determining penetrations.

Tin Sample Cups See chart at left

Sample Cups, Tin

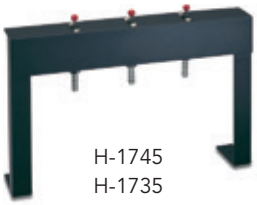
Capacity	Dimensions	Quantity	Model
2.5 oz (71g)	1.87" (47.5mm) ID, 1.42" (36mm) deep	48	H-1350.3A
3 oz (85g)	2.25" (57.1mm) ID, 1.42" (36mm) deep	36	H-1350.3
4.7 oz (133g)	2.42" (61.5mm) ID, 1.67" (42.6mm) deep	36	H-1350.4A
5.6 oz (159g)	2.59" (66mm) ID, 1.72" (43.4mm) deep	36	H-1350.6A
8.2 oz (232g)	3.05" (77.5mm) ID, 1.97" (50mm) deep	18	H-1350.8A
16 oz (454g)	4" (102mm) ID, 2.375" (60.3mm) deep	1	H-1350.16
42.3 oz (1200g)	6.12" (155mm) ID, 3" (76.2mm) deep	1	H-1350.42
70.5 oz (2000g)	6.12" (155mm) ID, 5" (127mm) deep	1	H-1350.70


H-4929


H-1350.70


H-1720


H-1730


H-1745
H-1735


H-1733


H-1722

Constant Temperature Bath, 100°C
ASTM D445

Specifically designed for precise viscosity determination with glass capillary viscometers, the H-1720 baths offer superior temperature control to 100°C. The H-1720 offers a 12"Dia x 12"H (305mm x 305mm). bath jar that can accommodate most viscometers.

These baths maintain accurate temperature control of ± 0.01°C within the range of 20°C to 100°C (±0.01°C), providing the temperature sensitivity required by ASTM D445 for kinematic viscosity measurements with glass capillary viscometers. Two electric heating elements inside the bath rapidly heat the medium to any desired temperature within the range.

The H-1720 bath chamber is a cylindrical clear glass vessel 12" d ia x 12"H (305mm x 305mm). A stainless steel baffle located in the center of the bath provides a plain reflective background to aid in viewing instruments. The top cover contains seven round holes 2" (51mm) in diameter for insertion of viscometer holders, allowing up to seven viscosity measurements to be made simultaneously. Covers are supplied for capping unused holes. Two additional holes 10mm in diameter, are provided for thermometers. All wetted parts of the Constant Temperature Bath are made of stainless steel or glass. The frame is fabricated from heavy aluminum and coated with a corrosion-resistant epoxy finish. **Viscometers, holders, bath oil, and thermometers must be purchased separately.** Dimensions: 16"w x 14.25"d x 24"h (407 x 362 x 610mm).

Constant Temp. Bath, 120V 60Hz H-1720
Constant Temp. Bath, 220V 50/60Hz H-1720.4F
Shipping wt. 80 lbs (36.2kg)

Constant Temperature Bath, 150°C
ASTM D445

The H-1730 constant temperature bath maintains the accurate control required by ASTM D445 for kinematic viscosity measurements with glass capillary viscometers. The H-1730 baths offer superior temperature control to 150°C. Within the range of 20 to 100°C, temperature is controlled to 0.01°C; above 100°C temperature it is controlled to 0.03°C.

The H-1730 bath chamber is a cylindrical clear glass vessel 12"dia x 12"H (305mm x 305mm). A stainless steel baffle is located in the center of the bath to provide a good background for viewing viscometers. Two fluorescent lamps illuminate the interior of the bath brightly and uniformly, without glare. Two heating elements inside the bath rapidly heat the bath medium to any temperature within the bath range. The top cover contains seven round holes 2" (51mm) in diameter. Up to seven glass capillary viscometers (in holders) can be placed in the bath. Other hole configurations can be supplied on special order.

A solid-state control circuit, equipped with a stainless steel-encased thermistor provides proportional control of temperature. A motor-driven stirrer ensures a uniform temperature throughout the bath.

All wetted parts of the bath are made of stainless steel or glass. The bath housing is fabricated from heavy aluminum and coated with a corrosion-resistant epoxy finish. **Viscometers, holders, bath oil, and thermometers must be purchased separately.** Dimensions: 17.25"w x 18.25"d x 23"h (438 x 464 x 584mm).

Constant Temp. Bath, 120V 60Hz H-1730
Constant Temp. Bath, 220V 50/60Hz H-1730.4F
Shipping wt. 123 lbs (56kg)

Temperature Bath Storage Pedestal

This Heavy-duty, two-drawer unit provides a pedestal for constant temperature baths, as well as storage of accessories and consumables. It provides elevated viewing of the bath and ample room for storage of viscometers and other accessories. Dimensions: 18" W x 18" D x 6.5" H (457 x 457 x 165mm)

Temperature Bath Storage Pedestal H-1722
Shipping wt. 40 lbs (18.1kg)

Vacuum Manifold

Vacuum manifold with manual valves for applying vacuum or pressure to capillary-type viscometers. Designed for use with the H-1720 and H-1730 constant temperature baths. Integral brackets permit mounting on bath covers. Two models are available: one for the H-1730, which has four valves and one for the H-1720, which has three valves. Both Include a 10-foot length of rubber vacuum tubing, .25" bore x .625 OD, for connection to vacuum/pressure regulators. Housing is epoxy-coated aluminum, overall 13"W x 2.75"D x 9"H (330 x 70 x 229mm)

Vacuum Manifold for H-1720 H-1745
Vacuum Manifold for H-1730 H-1735
Shipping wt. 6 lbs (2.7kg)

IBF Bath Oil

Oil for constant temperature baths operating at less than 135°C (275°F). 6-gallon container (2.3L)

UBF Bath Oil H-1732
Shipping wt. 50 lbs (22.6kg)

Bath Fluid, High-Temperature Silicone

This clear, colorless, oily liquid has a nominal viscosity of 50 centistokes at 25°C, with a viscosity/temperature coefficient of 0.59. The boiling point is over 360°C with a flash point above 535°F. Fluid has a maximum volatility, with 0.5% weight loss over 24 hours at 150°C.

Bath Fluid, Silicone, .5 Gallon H-1733
Shipping wt. 20 lbs (9.07kg)

H-1741H H-1741V

H-1746.7

H-1747.1

Digital Vacuum Pressure Regulators

ASTM D2171

These digital vacuum regulators (DVR) are designed for precise measurement and control of vacuum at 300 mm Hg below atmospheric pressure. Unlike other vacuum regulators, the solid-state H-1741H and H-1741V Regulators use no mercury. Both units are identical except that one is a horizontal configuration and the other is vertical.

DVR meters display the amount of vacuum in mm/Hg or one of nine other units of measurement selected using a keypad on the meter.

In asphalt laboratories the digital vacuum regulator (DVR) may be used in conjunction with Cannon-Manning, Asphalt Institute, and Modified Koppers vacuum viscometers for measurement of highly viscous materials such as asphalt cement at 60°C (140°F) according to ASTM D 2171. The DVR is also useful in other laboratory systems where accurate measurement and control of vacuum is required.

Both the H-1741H and H-1741V are equipped with an internal vacuum pump and do not require an external vacuum source.

The internal set points for the instrument gauge are preset to regulate vacuum at 300 ± 0.5 mm Hg below atmospheric pressure (the vacuum required by ASTM D 2171). These set points may be altered to fit the user's specific needs within the DVR's operating range of 28 to 410 mm Hg below atmospheric pressure.

Reading accuracy: ±0.5mm HG. Operating temperature: 0 to 40°C (32 to 104°F). Upper/lower safety limit: 746mm HG below atmospheric pressure. Choice of horizontal: 18.5"w x 18"d x 6.75"h (470 x 457 x 171mm) or vertical: 6.75"w x 18"d x 18.5"h (171 x 457 x 470mm).

Digital, Vacuum Pressure Regulator

Regulator, Horizontal,120V 60Hz	H-1741H
Regulator, Horizontal, 220V 50/60Hz	H-1741H.4F
Regulator, Vertical,120V 60Hz	H-1741V
Regulator, Vertical, 220V 50/60Hz	H-1741V.4F

Shipping wt. 30 lbs (13.6kg)

Zeitfuchs® Cross-Arm Viscometer and Holder

ASTM D445, D446, D2170; AASHTO T201; ISO 3105

These models are used to determine kinematic viscosity of liquid asphalts, road oils and distillation residues of liquid asphalts at 140°F (60°C) and of asphalt cements at 275°F (135°C), requiring a charge of only 1 to 3ml. They are easily filled and cleaned while immersed in a temperature bath and need not be removed. The viscometers require a liquid depth of 9" (229mm). Includes round metal holder for 2" (51mm) dia. hole and certificate of calibration.

Zeitfuchs® Cross-Arm Viscometer see chart to right

Shipping wt. 2 lbs (.9kg)

Asphalt Institute Vacuum Viscometer

ASTM D2170, D2171

Designed for measurement of highly-viscous materials, such as asphalt cement at 60°C (140°F), viscometer contains a graduated capillary instead of timing bulbs. Applicable to materials with a viscosity range of 0.036 to 80,000 poise. They require a minimum sample volume of only 3ml and require a liquid bath depth of 180 mm (7.1 inches). Includes permanently-attached, round metal holder for 2" (51mm) dia. hole and certificate of calibration.

Asphalt Inst. Vacuum Viscometer see chart below

Shipping wt. 2 lbs (.9kg)

Zeitfuchs® Cross-Arm Viscometer and Holder

Size	Approx. Constant Cs/Sec.	Range of Centistokes	Model
1	0.003	0.6 to 3	H-1746.1
2	0.01	2 to 10	H-1746.2
3	0.03	6 to 30	H-1746.3
4	0.1	20 to 100	H-1746.4
5	0.3	60 to 300	H-1746.5
6	1.0	200 to 1,000	H-1746.6
7	3.0	600 to 3,000	H-1746.7
8	10	2,000 to 10,000	H-1746.8
9	30	6,000 to 30,000	H-1746.9
10	100	20,000 to 100,000	H-1746.10

Asphalt Institute Vacuum Viscometers

Viscometer Size/No.	Viscosity Range (Poise)	Approx. Constant poise/second at 300mm Hg Vacuum			Model
		at B	at C	at D	
25	42 to 800	2	1	0.7	H-1747.1
50	180 to 3,200	8	4	3	H-1747.2
100	600 to 12,800	32	16	10	H-1747.3
200	2,400 to 52,000	128	64	40	H-1747.4
400R	9,600 to 140,000	500	250	160	H-1747.5
800R	38,000 to 5,800,000	2000	1000	640	H-1747.6

H-2165

H-2166A

H-2166A shown with (4) Automatic Timers, which need to be ordered in addition to the H-2166A bath, see below.

Saybolt Viscosity Bath

ASTM D88, D244, E102; AASHTO T72

Designed for Saybolt universal and furol viscosity testing, this constant temperature bath meets all ASTM and AASHTO requirements for precise temperature control. The micro-processor PID circuitry assures accurate temperature control within ASTM tolerances throughout the range of ambient to 464°F (240°C). Temperature stability is ±0.05°F (±0.03°C)

Simple push-button controls and dual digital displays are used for easy setting and monitoring of the baths temperature. With a capacity of four viscometers and 60ml receiving flasks, the bath features sliding draft shields, chemical-resistant alignment plates for handling of flasks and a glare-free fluorescent backlight for easy viewing of test sample. The insulated bath interior is constructed entirely of heavy-gage stainless steel and the built-in overflow pipe and drain valve simplifies filling the bath oil to the required level. A chemical resistant top plate provides insulation and is easily removed to allow for cleaning of the bath interior. The bath is supplied complete with four thermometer supports, four port covers, four chained corks, two port closures, tube nut wrench, orifice wrench, withdrawal tube and oil strainer. Viscometer tubes, orifices, receiving flasks, oil and thermometers are not included and must be ordered separately.

Saybolt Bath, 120V 60Hz	H-2165
Saybolt Bath, 220-240V 50/60Hz	H-2165.4F

Shipping wt. 100 lbs (45.3kg)

Saybolt Viscosity Bath, For Automatic Timers

ASTM D88, D244, E102; AASHTO T72

Constant termperature viscosity bath designed for use with one to four Automatic Saybolt Viscosity Timing Sensors. **Bath is sold with no timers, order auto timers separately.** Fetures simple push-button controls and dual digital displays are used for easy setting and monitoring of the baths temperature.

With a capacity of four viscometers and 60ml receiving flasks, the bath features sliding draft shields, chemical-resistant alignment plates for handling of flasks and a glare-free fluorescent backlight for easy viewing of test sample. The insulated bath interior is constructed entirely of heavy-gage stainless steel and the built-in overflow pipe and drain valve simplifies filling the bath oil to the required level. A chemical resistant top plate provides insulation and is easily removed to allow for cleaning of the bath interior. A cooling coil for tap water or refrigerated coolant is provided for operation at near-ambient termperatures. Steel cabinet has leveling feet and a chemical-resitant polyurethane-epoxy finish.

Temperature range is ambient to 464°F (240°C) and temperature stability is ±0.05°F (±0.03°C). Bath capacity is 5 gallons (19L) and recommended bath medium is water or suitable heat transfer fluid. Included accessories: Cleaning plunger; chained corks; oil strainer; withdrawal tube; tube nut wrench; orifice wrench; port closures; port covers and thermometer supports.

Saybolt Viscosity Bath, 120V 60Hz	H-2166A
Saybolt Viscosity Bath, 220-240V 50/60Hz	H-2166A.4F

Shipping wt. 82 lbs (37kg)

Automatic Timers for Saybolt Viscosity Bath

ASTM D88, D244, E102; AASHTO T72

At the push of a button, the automatic timer starts the sample flow, senses the 60mL end point and digitally records and displays the efflux time in 0.1 seconds resolution with an accuracy of 0.05%. Automatic timing improves testing accuracy and convenience, eliminating the chain and cork assembly and the need to manually time each sample. One to four automatic timers can be fitted to the H-2166A Saybolt vicosity bath.

Saybolt Viscosity Timing Sensor, 120V 60Hz	H-2167
Saybolt Viscosity Timing Sensor, 220-240V 50/60Hz	H-2167.4F

Shipping wt. 5 lbs (2.2kg)


H-2183


H-2171


H-2180


H-2175

H-2177


H-2176


H-2189


H-2199


H-2174
H-2174C


H-2173


H-2196

CAUTION

These thermometers contain mercury. There are restrictions on their sale and shipment. Please check laws in your area or contact us before ordering. Due to Illinois law, Humboldt must drop-ship these items from New Jersey. Mercury Thermometers require ground shipment in the U.S. International and air shipments ship as Dangerous Goods.

Test Apparatus Setup for bituminous materials

Description	Qty.	Model #
Saybolt viscometer bath	1	H-2165 H-2165.4F H-2166A H-2166A.4F
Viscometer tube	4	H-2180
Furol orifice	4	H-2174
Displacement ring	4	H-2194
Receiving flask for H-2165	4	H-2176
or Borosilicate flask for H-2166	4	H-2179
Technical oil, white	5	H-2189
ASTM Thermometer*	1	H-2600.17F
or ASTM Thermometer*	1	H-2600.17C

Test Apparatus Setup for lubricants, insulating oils and heater fuels

Description	Qty.	Model #
Saybolt viscometer bath	1	H-2165 H-2165.4F H-2166 H-2166.4F
Viscometer tube	4	H-2180
Universal orifice	4	H-2173
Receiving flask for H-2165	4	H-2176
or Borosilicate flask for H-2166	4	H-2179
Technical oil, white	5	H-2189
ASTM thermometer*	1	H-2600.17F
or ASTM thermometer*	1	H-2600.17C

Saybolt Viscosity Bath Accessories

ASTM D88, D244, E102; AASHTO T72

Description	Model
Cleaning plunger	H-2175
Borosilicate glass receiving flask, 60ml (for H-2165)	H-2176
Borosilicate glass receiving flask, 60ml (for H-2166)	H-2179
Withdrawal tube	H-2177
Oil strainer	H-2178
Technical oil, white, (1 gal.) suitable for use up to 230°F (110°C)	H-2189
High-temp. Dow-Corning 200 fluid (100 centistokes), 5 gallon, wt.40lb (18kg)	H-2199
Displacement ring	H-2194
Thermometer support	H-2195
Orifice wrench	H-2196
Socket wrench	H-2197
Thermometer* (66 to 80°F)	H-2600.17F
Thermometer* (19 to 27°C)	H-2610.17C
Thermometer* (94 to 108°F)	H-2600.18F
Thermometer* (34 to 42°C)	H-2610.18C
Thermometer* (120 to 134°F)	H-2600.19F
Thermometer* (49 to 57°C)	H-2610.19C
Thermometer* (134 to 148°F)	H-2600.20F
Thermometer* (57 to 65°C)	H-2610.20C
Thermometer* (174 to 188°F)	H-2600.21F
Thermometer* (79 to 87°C)	H-2610.21C
Thermometer* (204 to 218°F)	H-2600.22F
Thermometer* (95 to 103°C)	H-2610.22C

Components

Description	Model
Tubes with Orifices	
Brass saybolt viscometer tube w/ stainless steel universal orifice	H-2180
Brass saybolt viscometer tube w/stainless steel furol orifice	H-2182
Stainless saybolt viscometer Tube w/stainless steel furol orifice, includes wrench	H-2183
Brass saybolt viscometer tube w/stainless steel universal and furol orifice, includes wrench	H-2184
Stainless saybolt viscometer tube w/ universal and furol orifice, includes wrench	H-2185
Orifices	
Stainless steel universal	H-2173
Stainless steel furol	H-2174
Stainless steel furol, calibrated	H-2174C
Tubes	
Stainless steel saybolt viscometer tube	H-2171
Brass saybolt viscometer tube	H-2172


H-1530.2


H-1535


H-2560


H-1400


H-1510

Ford Viscosity Cups
ASTM D333, D365, D1200

Used in determining viscosity of paint, lacquers and related coatings. Cup body is machined from aluminum; orifice is brass. Orifice not included with H-1530 cup, order from chart below. Cup/Orifice combinations should be selected to provide an efflux time within the 20 to 100-second range. Measurements with the Ford viscosity cup should be made at a temperature of 25°C ±0.1° (77°F ±0.2°) with a H-2610.17C (or H-2600.17F) thermometer. **Order thermometers and stand separately.**

Ford Cup w/ No. 1 Orifice	H-1530.1
Ford Cup w/ No. 2 Orifice	H-1530.2
Ford Cup w/ No. 3 Orifice	H-1530.3
Ford Cup w/ No. 4 Orifice	H-1530.4
Ford Cup w/ No. 5 Orifice	H-1530.5

Shipping wt. 1.2 lb (0.5kg)

Viscosity Cup Stand
Features leveling base and adjustable support bracket for H-1530 Ford viscosity cup.

Viscosity Cup Stand H-1535

Shipping wt. 5 lbs (2.3kg)

Cloud and Pour Point Apparatus Set
ASTM D97, D117, D2500

Used to test flow characteristics of petroleum oils using cloud and pour points. Includes glass bath jar, polished brass cylinder mounted on metal tripod base, glass test cylinder, cork bottom disc and top rings. **Order thermometer separately.**

Cloud and Pour Point Apparatus Set H-2560

Shipping wt. 5.3 lb (2.4kg)

Cloud and Pour Components

Description	Model
Metal tripod base	H-2560.1
Glass test jar	H-2560.3
Glass battery bath jar	H-2560.5
Brass cylinder	H-2560.2
Cork disks	H-2595
Cork rings	H-2598
Thermometer* -36 to 120°F	H-2600.5F
Thermometer* -38 to 50°C	H-2610.5C
Thermometer* -112 to 70°F	H-2600.6F
Thermometer* -80 to 20°C	H-2610.6C

Spot Test of Asphaltic Materials Set
AASHTO T102

Spot test set only for asphaltic products derived from petroleum not to be used for natural asphalts containing non-bituminous matter insoluble in xylene. Includes 250ml erlenmeyer flask, filter paper, 10ml pipette and rubber stopper.

Spot Test of Asphaltic Materials Set H-1510

Shipping wt. 3 lb (1.3kg)

Asphalt Viscosimeter Float Test Set
ASTM D139, AASHTO T50

Used to test flow behavior or consistency of certain bituminous materials and tar products via a float test. Includes calibrated aluminum float and three brass collars. Individual components can be ordered. **Order thermometer separately.**

Asphalt Viscosimeter Float Test Set H-1400

Shipping wt. 0.6 lb (0.27kg)

Float Test Set Components

Description	Model
Float only	H-1410
Collars only (set of three)	H-1420

CAUTION

These thermometers contain mercury. There are restrictions on their sale and shipment. Please check laws in your area or contact us before ordering. Due to Illinois law, Humboldt must drop-ship these items from New Jersey. Mercury Thermometers require ground shipment in the U.S. International and air shipments ship as Dangerous Goods.

H-1569

H-1570

H-1595

Shown with Thermometers, not included, order separately

H-1596

H-1575

H-1588

H-8900

H-8980

Softening Point Apparatus, Double
ASTM D36, E28; AASHTO T53

Ring and ball method Apparatus for softening point determinations for use with asphalts, pitches, tars and most resins. Includes 800ml beaker with brass, double set-up fixture with cover and thermometer port with stopper, 2 shouldered rings, 2 ball centering guides and 2 standard balls. **Order required thermometer separately.**

Softening Point Apparatus, Double H-1569

Shipping wt. 2lbs (.9kg)

Softening Point Apparatus, Quad
ASTM D36, E28; AASHTO T53

Ring and ball method Apparatus for softening point determinations for use with asphalts, pitches, tars and most resins. Includes burner, beaker, support stand, 4 rings, wire gauze with ceramic center, thermometer clamp, 4 shouldered rings and stems with hardened steel ball. **Order required thermometer separately.**

Softening Point Apparatus, Quad H-1570

Shipping wt. 2lbs (.9kg)

Softening Point Apparatus Set w/ Burner
ASTM D36, E28; AASHTO T53

Single, ring and ball method softening point apparatus set, including burner. This set can be used for single determinations such as: asphalts, pitches, tars and most resins. Includes burner, beaker, support stand, 1 ring, wire gauze with ceramic center, thermometer clamp, 1 shouldered ring and stem with hardened steel ball. **Order required thermometer separately.**

Softening Point Apparatus Set w/Burner H-1595

Shipping wt. 10lbs (4.5kg)

Softening Point Apparatus Set w/ Hotplate
ASTM D36, E28; AASHTO T53

Single ring and ball method softening point apparatus set, including hotplate. This set can be used for single determinations such as: asphalts, pitches, tars and most resins. Includes 6" x 6" electric hotplate as a heat source rather than a gas burner. The hotplate provides an easy-to-set analog temperature control knob with graduated scale and LED display. Temperature range is: ambient to 540°C (Ambient to 1004°F). Includes beaker, support stand, 1 ring, wire gauze with ceramic center, thermometer clamp, 1 shouldered ring and stem with hardened steel ball. **Order required thermometer separately.**

Softening Point Apparatus Set w/Hotplate
120V 60Hz H-1596
220V 50/60Hz H-1596.4F

Shipping wt. 18.4lbs (8.3kg)

Thermometers* for Softening Point Apparatus

Description	Model
30 to 180°F (ASTM 15F)	H-2600.15F
-2 to 80°C (ASTM 15C)	H-2610.15C
85 to 392°F (ASTM 16F)	H-2600.16F
30 to 200°C (ASTM 16C)	H-2610.16C
30 to 350°F (ASTM 113F)	H-2600.113F
-1 to 175°C (ASTM 113C)	H-2610.113C

CAUTION

These thermometers contain mercury. There are restrictions on their sale and shipment. Please check laws in your area or contact us before ordering. Due to Illinois law, Humboldt must drop-ship these items from New Jersey. Mercury Thermometers require ground shipment in the U.S. International and air shipments ship as Dangerous Goods.

Description	Model
Brass, shouldered ring, Top: 23mm OD, 19.8mm ID; Bottom: 19mm OD, 15.9mm ID; Top to Shoulder: 4.4mm High; Shoulder to Bottom: 2mm High, 10 per package	H-1575
Hardened steel ball, .375" 99.5mm) dia.; weight between 3.45 and 3.55g, 10 per package	H-1580
Ball centering guide for shouldered rings, ball is centered on specimen by 3 locator pins	H-1588
Ring and stem assembly with 16" (406mm) long brass wire stem with shouldered brass ring	H-1602
Steel, clamp hook supports suspended thermometers. Locks into any position with check nut, Maximum distance from center of muff to hook: 4.25" (108mm), minimum distance is: 3.875" (89mm)	H-8900
Thermometer clamp with adjustable 360° muff, phosphor-bronze jaws, 3.5" (89mm) long	H-8950
Thermometer clamp, similar to H-8950, but holds H-1602 ring and stem and thermometer together	H-8980
Base (Cast iron) w/ Support Rod	H-21220
Burner	H-6220
Beaker, 800ml, Graduated	H-4911.800
Hot plate, 6" x 6" with LED Display	H-4942
Wire Gauze, 5" x 5" w/ceramic material center	H-25865

Samplers, Flash Point, Residue


H-2400


H-1990


H-2495

Bacon Bomb Samplers, 8oz. (237ml)
ASTM D4057, D6074, D1265

Bacon Bomb Samplers can be used to obtain samples from storage tanks, tank cars and drums. when the sampler is lowered into the tank and hits the bottom, a plunger assembly opens to admit the material. The plunger closes again when the bomb is withdrawn, forming a tight seal. Equipped with plunger locking cam for tight closure during transport. Available in plated brass or stainless steel. 2" dia. x 10" L. (51 x 254mm).

Bacon Bomb Sampler, 8oz, Brass	H-2405B
Bacon Bomb Sampler, 8oz, Stainless	H-2405S

Shipping wt. 4lbs (1.8kg)

Bacon Bomb Samplers, 16oz. (473ml)
ASTM D4057, D6074, D1265

Bacon Bomb Samplers can be used to obtain samples from storage tanks, tank cars and drums. when the sampler is lowered into the tank and hits the bottom, a plunger assembly opens to admit the material. The plunger closes again when the bomb is withdrawn, forming a tight seal. Equipped with plunger locking cam for tight closure during transport. Available in plated brass or stainless steel. 2.75" dia. x 12"L (70 x 305mm).

Bacon Bomb Sampler, 16oz, Brass	H-2406B
Bacon Bomb Sampler, 16oz, Stainless	H-2406S

Shipping wt. 6lbs (2.7kg)

Bacon Bomb Samplers, 32oz. (946ml)
ASTM D4057, D6074, D1265

Bacon Bomb Samplers can be used to obtain samples from storage tanks, tank cars and drums. when the sampler is lowered into the tank and hits the bottom, a plunger assembly opens to admit the material. The plunger closes again when the bomb is withdrawn, forming a tight seal. Equipped with plunger locking cam for tight closure during transport. Available in plated brass or stainless steel. 2.75" dia. x 15.25"L. (70 x 387mm).

Bacon Bomb Sampler, 32oz, Brass	H-2407B
Bacon Bomb Sampler, 32oz, Stainless	H-2407S

Shipping wt. 8lbs (3.6kg)

Weighted Beaker

For beaker sampling from tank cars, tank trucks, shore tanks, ship and barge tanks. Copper construction with weighted bottom. Includes handle and chained cork. Takes all level samples, as well as running and outlet samples. Select .75" (19mm) opening for light crude oils, light lubricating oils, kerosenes, gasolines, transparent gas oils, diesel fuels and distillates. Select 1.5" (38mm) for heavy crude and fuel oils, heavy lubricating oils and nontransparent gas oils. Body is 3.375" dia. x 14"L. (86 x 356mm).

Weighted Beaker, .75" (19mm)	H-2400
Weighted Beaker, 1.5" (38mm)	H-2401

Shipping wt. 5lbs (2.2kg)

Tag, Open-Cup Flash Tester
ASTM D1310, D3143; AASHTO T79

For determination of flash points of liquids having a flash point up to 230°F (110°C) and cutback asphalts with flash points of less than 200°F (93°C). Includes Pyrex cup, base and liquid bath with overflow, pivoting ignition taper with pilot light and reference bead and thermometer holder. **Order H-2610.9C thermometer, leveling device and draft shield separately.**

Tag, Open-Cup Tester, 120V 60Hz	H-1990
Tag, Open-Cup Tester, 230V 50/60Hz	H-1990.4F
Tag, Open-Cup Tester, Gas	H-1995

Shipping wt. 37.1lbs (16.8kg)

Parts for Tag, Open-Cup Flash Tester

Description	Model
Replacement Pyrex cup	H-1990.1
Leveling device	H-1990.2
Draft shield	H-1990.3
Thermometer, range: 20 to 230°F	H-2600.9F
Thermometer, range: -5 to 110°C	H-2610.9C

Conradson Carbon Residue Apparatus
ASTM D189, D2416

Tests petroleum products to determine the amount of carbon residue left after evaporation and pyrolysis of an oil and to indicate relative coke-forming propensities. Includes burner, tripod, refractory block, nickel chrome triangle, nickel crucible and cover, Skidmore crucible, porcelain crucible and monel hood and bridge. Component parts available separately.

Conradson Carbon Residue Apparatus	H-2495

Shipping wt. 7.1lbs (3.2kg)

Parts for Conradson Apparatus

Description	Model
Porcelain crucible	H-2494
Skidmore crucible and cover	H-2497
Carbon residue apparatus hood	H-2496
Nickel crucible with cover	H-2498
Refractory block insulator ring	H-2505

H-2085

Cleveland Flash and Fire Point Tester

ASTM D92, D117; AASHTO T48

Used to determine flash and fire points by the cleveland open-cup method. Consists of electric Heater with rheostat, flash point platform with Thermometer holder, test burner and flash cup. Utilizes a 1250W-10 amp, nickel-chromium heater with stepless variable control for accurate, repeatable, rate-of-rise temperature settings per specifications. Heater is enclosed in a stainless steel housing with cooling vents.

Thermometer position is adjustable and provides the ability to raise the thermometer out of the way to facilitate the placement and removal of the test cup. Test flame requires a gas supply and the test flame can be adjusted through the use of the built-in needle valve. **Order thermometer separately.**

Cleveland Flash Tester, 115V 60Hz H-2085
Cleveland Flash Tester, 220V 50/60Hz H-2085.4F

Shipping wt. 14lbs (6.3kg)

Replacement Parts

Description	Model
Electric heater with rheostat (1250W)	H-2085.1
Flash-point platform	H-2085P
Test burner w/ holder	H-2112
Flash cup	H-2060
Supra-board plate	H-2095.4.2
Thermometer*	H-2600.11F

CAUTION

These thermometers contain mercury. There are restrictions on their sale and shipment. Please check laws in your area or contact us before ordering. Due to Illinois law, Humboldt must drop-ship these items from New Jersey. Mercury Thermometers require ground shipment in the U.S. International and air shipments ship as Dangerous Goods.

H-2095

Cleveland Flash and Fire Point Tester

ASTM D92, D117; AASHTO T48

Used to determine flash and fire points by the cleveland open-cup method. Consists of a Humboldt, high-temperature burner, which is directly attached to the test support stand, for sample heating with a built-in, gas line extension for the test flame. Test flame burner and the heating burner include separate, integral, adjustment controls for regulating the flame. Includes flash point platform with thermometer holder, test burner and flash cup.

Thermometer position is adjustable and provides the ability to raise the thermometer out of the way to facilitate the placement and removal of the test cup. Flame size is adjustable through the use of the built-in needle valve. **Order thermometer separately.**

Cleveland Flash Tester, Gas H-2095

Shipping wt. 15lbs (6.8kg)

Replacement Parts

Description	Model
Cast-Iron support base	H-21335
High-temp burner w/ adjustable valve orifice	H-5605X
Test burner w/ holder	H-2112
Flash-point platform	H-2095P
Supra-board plate	H-2095.4.2
Platform coupling assembly	H-2095.5
Flash cup	H-2060
Thumb screw	H-3050.7
Thermometer*	H-2600.11F

H-2100

Cleveland Flash and Fire Point Tester

ASTM D92, D117; AASHTO T48

Used to determine flash and fire points by the cleveland open-cup method. Consists of a free-standing, Humboldt, high-temperature burner and a separate test flame burner, which is directly attached to the test support stand. Test flame burner and the heating burner include separate, integral, adjustment controls for regulating the flame. Includes flash point platform with Thermometer holder, test burner and flash cup.

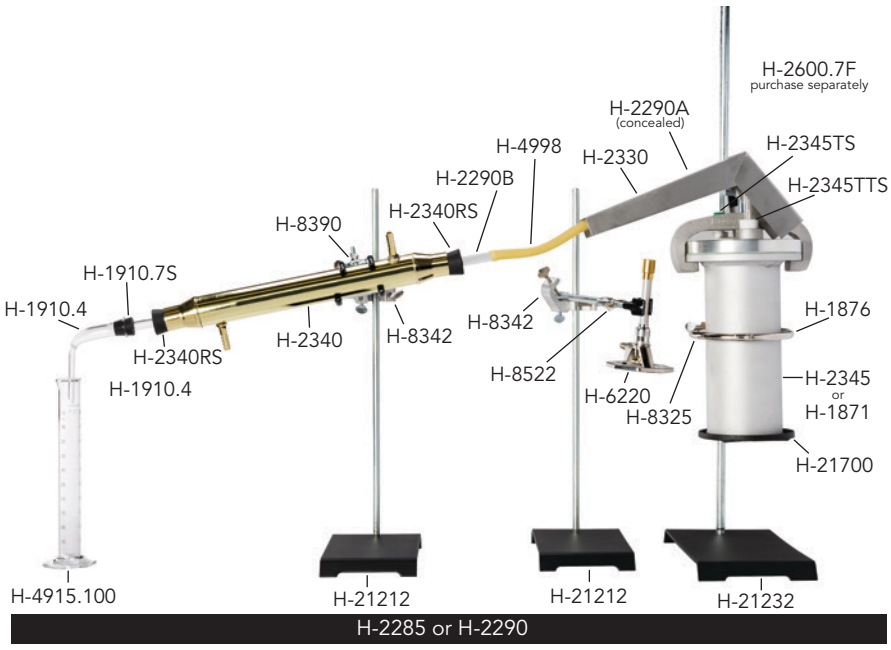
Thermometer position is adjustable and provides the ability to raise the thermometer out of the way to facilitate the placement and removal of the test cup. Flame size is adjustable through the use of the built-in needle valve. **Order thermometer separately.**

Cleveland Flash Tester, Natural Gas H-2100

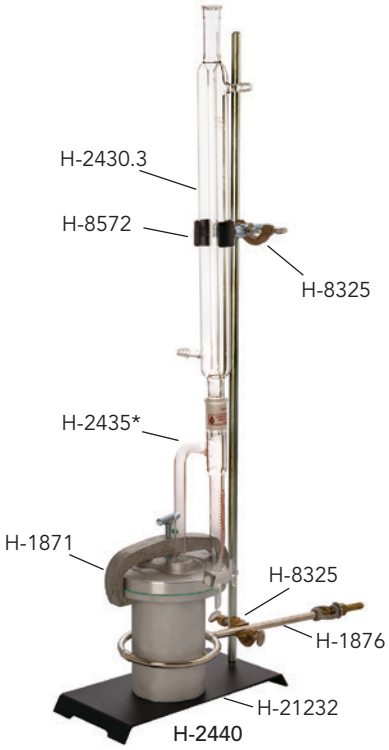
Shipping wt. 19lbs (8.6kg)

Replacement Parts

Description	Model
Cast-iron support base	H-21335
Support rod	H-21370
High-temp. burner	H-5550
Test burner	H-2112
Flash cup platform	H-2111
Flash cup	H-2060
Thermometer clamp	H-8900
Thermometer*	H-2600.11F



H-2285 or H-2290



H-2440, H-2442

Distillation Set for Residue and Oil Distillate in Emulsified Asphalts

ASTM D6997; AASHTO T59

The distillation set is designed to meet the requirements of the Standards listed above. Use of this set will allow the user to accurately determine the representative portion of residue in emulsified asphalts. Two models are available, The H-2285 uses the large H-2345 still and the H-2290 uses the small H-1871 still. For a detailed explanation of the test procedure refer to the ASTM or AASHTO standards listed above. The complete set is comprised of the items listed in the chart below. **Order H-2600.7F thermometer separately.**

Distillation Set for Emulsified Asphalt **H-2285**

Shipping wt. 28lbs (12.7kg)

Distillation Set for Emulsified Asphalt **H-2290**

Shipping wt. 30lbs (13.6kg)

Distillation Set Components

Description	Model
Still, aluminum, small	H-1871
Ring burner	H-1876
Support stands (2 in set)	H-21212
Support stand	H-21232
Support shelf	H-21700
Burner	H-6220
Condenser	H-2340
Graduated cylinder	H-4915.100
Tube shield	H-2330
Straight glass tube	H-2290B
Bent glass tube	H-2290A
Adapter	H-1910.4
Clamp, brass	H-8325
Clamp	H-8390
Clamp holders (2 in set)	H-8342
Clamp	H-8522
Rubber tubing	H-4998
Still stopper (1)	H-2345TTS
Stopper, ptfe	H-2345TS
Stoppers, rubber (2)	H-2340RS
Stopper, rubber	H-1910.7S

Dean Stark Moisture Test Apparatus, Gas Type

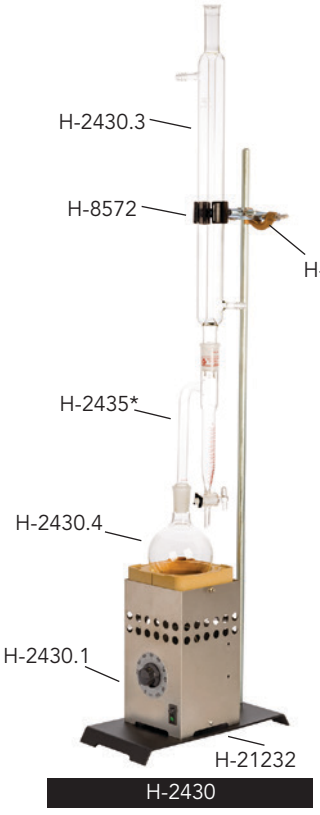
ASTM D95, D244, D1461,E123; AASHTO T59, T110

The Dean Stark moisture test apparatus is used to determine the water content in petroleum products, tars, emulsified asphalts and other bituminous materials by the distillation method. The distillation process allows the water in the test sample to be isolated and collected in the receiver of the Trap. This model uses an aluminum still, which is heated by a gas, ring burner. The complete set is comprised of the items listed in the table below.

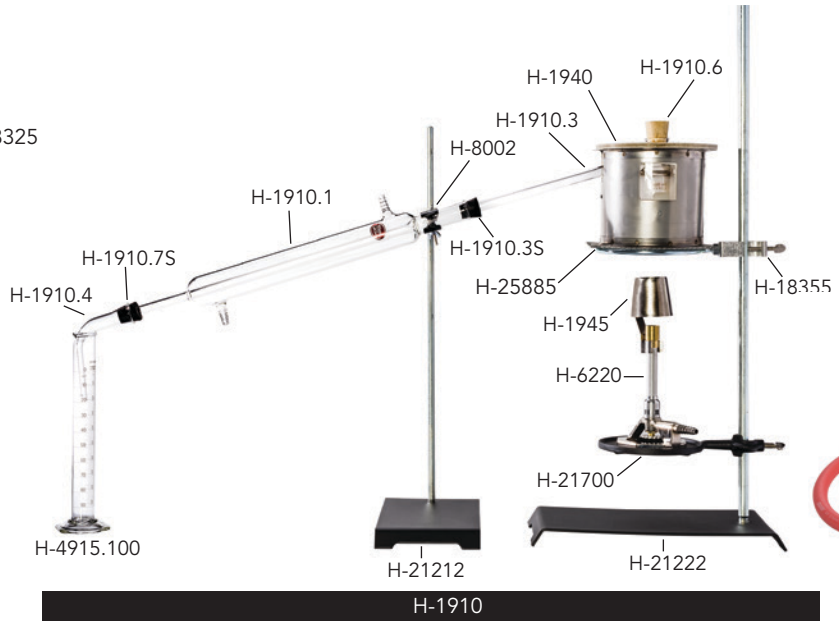
Description	Model
Ring burner	H-1876
Aluminum still, 0.95L	H-1871
Distillation trap, 20ml, 25ml, or 10ml	H-2435.25 H-2435.10
Condenser, liebig	H-2430.3
Support stand	H-21232
Clamp, brass	H-8325
Clamp, round jaw, coated	H-8572

Dean-Stark, Gas-Heated, 20ml **H-2440**
Dean-Stark, Gas-Heated, 10ml **H-2442.10**
Dean-Stark, Gas-Heated, 25ml **H-2442.25**

Shipping wt. 30lbs (13.6kg)



H-2430



H-1910

Dean Stark Moisture Test Apparatus, Electric
ASTM D95, D244, D1461,E123; AASHTO T59, T110
The dean stark moisture test apparatus is used to determine the water content in petroleum products, tars, emulsified asphalts and other bituminous materials by the distillation method. The distillation process allows the water in the test sample to be isolated and collected in the receiver of the Trap. This model uses a glass flask, which is heated by an electric heater. The complete set is comprised of the items listed in the table below.

Description	Model
Electric, heater 0-750W	H-2430.1
Flask, 500ml	H-2430.3
Distillation trap, 25ml, or 10ml	H-2435.25 H-2435.10
Condenser, liebig	H-2430.3
Support stand	H-21232
Clamp, brass	H-8325
Clamp, round jaw, coated	H-8572

Dean-Stark, Electric-Heated, 10ml H-2430
Dean-Stark, Electric-Heated, 25ml H-2430.4F
Shipping wt. 30lbs (13.6kg)

Distillation Set for Cut-Back Asphaltic (Bituminous) Products
ASTM D402; AASHTO T78
The H-1910 distillation set is designed to meet the requirements of the Standards listed above. Use of this set will allow the user to measure the amount of the more volatile constituents in cutback asphaltic products. For a detailed explanation of the test procedure refer to the ASTM or AASHTO standards listed above. The complete set is comprised of the items listed in the chart below. **Order H-2600.8F thermometer separately.**
Distillation Set for Cut-Back Products H-1910
Shipping wt. 16.8lbs (7.6kg)

Description	Model
Flask	H-1910.3
Condenser	H-1910.1
Adapter	H-1910.4
Distillation shield	H-1940
Flame shield	H-1945
Graduated cylinder	H-4915.100
Burner	H-6220
Clamp	H-8002
Support ring	H-18355
Support stand	H-21212
Support stand	H-21222
Support shelf	H-21700
Wire gauze	H-25885
Stopper, rubber	H-1910.7S
Stopper, rubber	H-1910.1S
Stopper, cork	H-1910.6

Particle Charge Meter Set
ASTM D7402; AASHTO T59
The particle charge meter identifies cationic emulsified asphalts by the migration of the particles to a negatively charged electrode (cathode) by means of a direct current. Allows selection of emulsified asphalts that are compatible with the available aggregate or sand. Set includes particle charge meter with positive- and negative-identified electrodes; a set of two H-2452 steel plates.
Particle Charge Meter Set, 110V 60Hz H-2450
Particle Charge Meter Set, 220V 50/60Hz H-2450.4F
Shipping wt. 12.9lbs (1.3g)

Particle Charge Meter Stainless Steel Plates
ASTM D7402; AASHTO T59
Set of two 1" x 4" (25.4 x 101.6mm) stainless steel plates for use with H-2450.
Particle Charge Meter Plates H-2452
Shipping wt. 0.3lbs (.1kg)

Solubility of Bituminous Materials Test Set
ASTM D4, D2042; AASHTO T44
Test set is used to determine the degree of solubility in trichloroethylene of asphalt materials having little or no mineral matter. The portion that is soluble represents the active cementing constituents.
Solubility of Bitumen Material Test Set H-1550
Shipping wt. 6lbs (2.7kg)

Distillation Accessories


H-2345

H-1871


H-1876


H-1940


H-1946


H-2330


H-1945


H-2348


H-2340


H-2435.25


H-2435.10


H-2435.5


H-2435.20

Still, Aluminum
ASTM D95, D244, D1461,D6997, E123; AASHTO T59, T110
Used primarily in standards for determining water in crude petroleum, tars and derivatives of those materials. Large model, 3.75" x 9.5" (95mm x 241mm) ID, has three tubulures, two drilled 10/18 and one drilled 24/40). The small model, 3.5" x 6" (89mm x 152mm) ID, has a 1 qt, (0.95L) capacity and one tubulure. Both are cast aluminum.

Still, Large Aluminum	H-2345
Still, Small Aluminum	H-1871

Shipping wt. 6.5lbs (2.9kg)

Stoppers for Stills
Teflon stoppers for use with H-2345 and H-1871 Stills.

Stopper for Glass Tubing	H-2345TS
Stopper for Thermometer	H-2345TTS

Shipping wt. 0.2lbs (0.09kg)

Ring Burner
ASTM D244; AASHTO T59
Can be used with all gases. 4.75" (121mm) ID x 5.5" (140mm) OD. Overall shank length is 11" (279mm) with .375" (10mm) serrated hose connection. Guide pins keep burner equidistant around still. Fletcher attachment regulates gas and air.

Ring Burner H-1876

Shipping wt. 1.4lbs (.63kg)

Distillation Shield
ASTM D402; AASHTO T78
Use with H-1880. Flanged, open-end, stainless steel cylinder with .125" ceramic lining and two-part cover. For use with 500ml flask. Flame distillation only

Distillation Shield H-1940

Shipping wt. 1.5lbs (.68kg)

Flame Shield
ASTM D402; AASHTO T78
Use with H-1880. Stainless steel, spot-welded cone 2" (51mm) dia. at bottom with spring clip to fit 7/16" to .625" (11 to 16mm) burner tubes.

Distillation Shield H-1945

Shipping wt. 0.3lbs (.1kg)

Burner Chimney
Fits standard 4" (102mm) rings.

Burner Chimney H-1946

Shipping wt. 3lbs (1.3kg)

Condenser Jacket
ASTM D244; AASHTO T59
For use with H-2285 and H-2290. Brass, 15" long inlet/outlet tubulures on opposite sides of jacket.

Condenser Jacket H-2340

Shipping wt. 3lbs (1.3kg)

Connecting Tube Shield
ASTM D244; AASHTO T59
For use with H-2285 and H-2290. Stainless steel.

Connecting Tube Shield H-2330

Shipping wt. 1lbs (.45kg)

Still Cleaner
Use with H-1871 and H-2345. Tool to remove residue from interior of still, 13" x 4" (328 x 101mm) diameter.

Still Cleaner H-2348

Shipping wt. 1.3lbs (.58kg)

Glass Distillation Trap, 25ml
ASTM D95, D1461; AASHTO T78
25ml distillation trap graduated 0.1ml from 0 to 25ml.

Glass Distillation Trap, 25ml H-2435.25

Shipping wt. 1.1lbs (.49kg)

Glass Distillation Trap, 10ml
ASTM D95, D1461; AASHTO T78
10ml distillation trap graduated 0.1ml from 0 to 1ml and 0.2ml from 1ml to 10ml.

Glass Distillation Trap, 10ml H-2435.10

Shipping wt. 1lbs (.49kg)

Glass Distillation Trap, 5ml
ASTM D95, D1461; AASHTO T78
5ml distillation trap graduated 0.1ml.

Glass Distillation Trap, 5ml H-2435.5

Shipping wt. 1lbs (.45kg)

Glass Distillation Trap, 20ml
20ml distillation trap graduated 0.1ml.

Glass Distillation Trap, 20ml H-2435.20

Shipping wt. 1.5lbs (.68kg)

H-1451


H-1456


H-1461

Asphalt Centrifuge Extractor (Explosion Proof)
ASTM D2172; AASHTO T164

The asphalt centrifuge extractor is designed for determining the percentage of bitumen in asphaltic mixtures. Available in 1500g and 3000g capacities, these extractors conform to the explosion-proof standards for the safety of operating personnel.

All models feature a removable, aluminum bowl assembly, which quickly lifts out of the sealed housing for efficient specimen handling. A simple, control knob adjusts bowl speed up to 3600 rpm, and, an electric brake stops the centrifuge in seconds when extraction is complete. The heavy, cast-aluminum bowl cover latches securely in place and features an integral solvent dispensing cup for easy pouring of the solvent into the bowl. Power is supplied by a reliable 1/8hp DC motor. Extractors are supplied complete with 25 filter discs. Replacement filter discs (100-packs) are available, see page: 188.

Dimensions: 1500g units: 12" x 20" x 22" (305 x 508 x 559mm); 3000g units: 14" x 20" x 22" (356 x 508 x 559mm).

Extractor, 1500g, 115V 60Hz	H-1451
Extractor, 1500g, 220V 50/60Hz	H-1451.4F
Extractor, 3000g, 115V 60Hz	H-1474
Extractor, 3000g, 220V 50/60Hz	H-1474.4F

Shipping wt. 85lbs (38.5kg)

Asphalt Centrifuge Extractor (Open-Motor)
ASTM D2172; AASHTO T164

This extractor is an open-motor version of the explosion-proof models described above. While it is safe to operate, it does not provide the added safety of the explosion-proof design. Available only in a 1500g model, this extractor is a great economical choice or for those who need an extractor, but may not use it extensively.

Extractor, 1500g, 115V 60Hz	H-1452
Extractor, 1500g, 220V 50/60Hz	H-1452.4F

Shipping wt. 90lbs (40.8kg)

Centrifuge Extractor (Explosion Proof)
ASTM D2172; AASHTO T164

Available in 1500g and 3000g capacities, these extractors conform to the explosion-proof standards for the safety of operating personnel.

All models feature a removable aluminum bowl assembly, which quickly lifts out of the sealed housing for efficient specimen handling. A simple, control knob adjusts bowl speed. The heavy, cast-aluminum bowl cover latches securely in place and features an integral solvent dispensing cup for easy pouring of the solvent into the bowl.

Extractors are supplied complete with 25 filter discs. Replacement filter discs (100-packs) are available, see page: 188.

Dimensions: both sizes: 18" x 18" x 18" (457 x 457 x 457mm).

Extractor, 1500g, 115V 60Hz	H-1466
Extractor, 1500g, 220V 50/60Hz	H-1466.4F
Extractor, 3000g, 115V 60Hz	H-1473
Extractor, 3000g, 220V 50/60Hz	H-1473.4F

Shipping wt. 75lbs (34kg)

Centrifuge Extractor (Open Motor)
ASTM D2172; AASHTO T164

This extractor is an open-motor version of the explosion-proof models described above. While it is safe to operate, it does not provide the added safety of the explosion-proof design. This extractor is a great economical choice or for those who need an extractor, but may not use it extensively. Not available in 220V model.

Extractor, 1500g, 115V 60Hz	H-1456
Extractor, 3000g, 115V 60Hz	H-1471

Shipping wt. 70lbs (31.7kg)

Auto Centrifuge Extractor, (Explosion Proof)
ASTM D2172; AASHTO T164

These extractors feature automated, auto control of the unit. Timer allows unit to run unattended for a specific period of time (1 to 10 minutes). Unit brakes and stops automatically when time expires and holds last test cycle settings in memory for repeatable tests. Time and speed can be set quickly with the rotating dials below the digital display that shows the settings. The controller can also be wall- or remotely-mounted for visual ease as well as vibration isolation.

Power is supplied by a reliable 1/8hp DC motor. Extractors are supplied complete with 25 filter discs. Replacement filter discs (100-packs) are available, see page: 188.

Extractor, 1500g, 115V 60Hz	H-1461
Extractor, 1500g, 220V 50/60Hz	H-1461.4F
Extractor, 1500g, 115V 60Hz	H-1465
Extractor, 1500g, 220V 50/60Hz	H-1465.4F

Shipping wt. 114lbs (51.7kg)

Auto Centrifuge Extractor (Open Motor)
ASTM D2172; AASHTO T164

This extractor is an open-motor version of the explosion-proof models described above. While it is safe to operate, it does not provide the added safety of the explosion-proof design. This extractor is a great economical choice or for those who need an extractor, but may not use it extensively. Not available in 220V model.

Centrifuge Extractor, 1500g, 115V 60Hz	H-1460
Centrifuge Extractor, 3000g, 115V 60Hz	H-1464

Shipping wt. 76lbs (34.4kg)

Centrifuge Extractor Replacement Parts

Description	Model
Bowl for H-1456, H-1466	H-1456B
Bowl for H-1471, H-1473	H-1471B
Bowl cover, H-1456, H-1466	H-1456BC
Bowl cover, H-1456, H-1466	H-1471BC
Cover nut	H-1471N
Clamp, all models	H-1471C
O-Ring, all models	H-1471RV
Brake band, all models	H-1456BB
Brake band assembly, all	H-1471BBA

See page 264 for centrifuge extractor filter paper.

H-1485.627

H-1449

H-1857A

Filter Papers for Centrifuge Extractors

All filter papers for centrifuge extractors have a medium speed and a flow rate of 85 ml/min. The thickness is 0.71" with a 4 micron retention. Filters come in packages of 100.

Extractor / Size	Model
H-1451, H-1452 (9.75"OD x 1.75"ID)	H-1481.627
H-1474 (11.625"OD x 5"ID)	H-1485.627
H-1456, H-1466, H-1460, H-1461 (10"OD x 5"ID)	H-1487.627
H-1471, H-1473, H-1464, H-1465 (12.25"OD x 5"ID)	H-1489.627

Filter Papers for Centrifuge Extractors See chart

Shipping wt. 4lbs (1.81kg)

Vacuum Extractor

ASTM D2172 (Method E); AASHTO T164

Basic vacuum extractor for use in quantitative determinations of bitumen in hot-mixed paving mixtures and pavement samples. The H-1449 provides a 12" (305mm dia filtering surface. Unit includes a connecting hose, (100) H-1497.613 filter papers and test procedure instructions. Use with a 4,000cc erlenmeyer flask and a vacuum pump, see below. For replacement filter paper, use H-1497 series paper.

Vacuum Extractor **H-1449**

Shipping wt. 58.6lbs (26.5kg)

Vacuum Extractor Components & Accessories

Description	Model
Fluorosilicone o-ring	H-1448.1
Stainless steel plate, as provided	H-1448P
Stainless steel plate, heavy-duty	H-1448HP
Rubber Tubing	H-1448RT
Clear, Heavy-wall, Vacuum Tubing	H-1446
4,000cc erlenmeyer flask, meets ASTM D2172 and AASHTO T164 (Method E)	H-4913.4M
8" Sieve adapter	H-1447
High-vacuum pump (see page 165 for info)	H-1763A H-1763A.4F

Centrifuge Extractor, Filterless

ASTM D1856; AASHTO T164

The continuous-flow filterless centrifuge extractor is ideally suited for use in the extraction of mineral fines from bitumen-laden solvents obtained from standard asphalt extraction tests. In operation, the solvent suspension is fed through the top funnel into a special aluminum beaker, (2) H-1857.5 supplied). Using the high, 11,000 rpm centrifugal force, the liquid moves up the beaker wall and out the overflow tube while the solids remain for easy removal at test completion. The system allows the continuous feeding of the suspension until the solids-retaining capacity of the beaker is reached. The unit is supplied complete with a No. 18 (1.0mm) and No. 200 (75µm) sieve for placement at the top of the inlet funnel. Using this arrangement, an asphalt mix extraction test can be carried out by pre-dissolving the mix with solvent and then pouring the sample into the sieve. Dimensions: 20" x 15" x 33" (508 x 380 x 840mm).

Centrifuge Extractor, Filterless

120V 60Hz	H-1857A
230V 60Hz	H-1857A.2F
230V 50Hz	H-1857A.5F

Shipping wt. 154lbs (69.8kg)

Aluminum Beaker

Replacement aluminum beaker for use with the filterless centrifuge extractor.

Aluminum Beaker **H-1857.5**

Shipping wt. 2lbs (.9kg)

Filter Papers for Vacuum Extractors

Size	Filter Speed	Flow Rate (ml/min.)	Thickness	Retention (µm)	Per Pkg.	Model
33cm dia.	Very fast	360	0.51	48	50	H-1497.617
33cm dia.	Very fast	435	1.02	31	100	H-1497.633
33cm dia.	Fast	235	0.25	24	100	H-1497.615
33cm dia.	Medium	60	0.17	6	100	H-1497.613
33cm dia.	Medium	85	0.71	4	100	H-1497.627


H-1499


H-1495


H-1495.1
H-1499.1

H-1495.2A
H-1499.2A


H-1494A


H-1497.613


H-1440

Reflux Extractor Sets

ASTM D2171, D2172; AASHTO T164 Method B

Used to determine the percentage of bitumen in a paving mixture using hot solvent extraction. Available in 1000g and 3000g versions.

The 1000g set includes: (2) 500g wire screen cones, copper condenser with 0.5" inlet/outlet water tubes, glass jar 6" OD x 18" H (152mm x 457mm) with ground open edges for a tight fit, a H-4942, 6" square hot plate and a 100-pack of 33cm filter paper.

The 2000g set includes: (2) 1000g wire screen cones, copper condenser with 0.5" inlet/outlet water tubes, glass jar 8.75" OD x 18" H (222mm x 457mm) with ground open edges for a tight fit, a H-4943, 9" square hot plate and a 100-pack of 40cm filter paper.

Reflux Extractor, 1000g, 120V 60Hz H-1495
Reflux Extractor, 1000g, 220V 50/60Hz H-1495.4F
Shipping wt. 29.3lbs (13.2kg)

Reflux Extractor, 2000g, 120V 60Hz H-1499
Reflux Extractor, 2000g, 220V 50/60Hz H-1499.4F
Shipping wt. 55lbs (24.9kg)

Reflux Extractor, 1000g Components

Description	Model
Wire screen cone, 500g sample holder (set of 2)	H-1495.1
0.5" Tube copper condenser w/ inlet/outlet water tubes	H-1495.2A
Glass jar with ground open edges	H-1495.3
Electric hot plate	H-4942
Filter paper, 33cm, 100-pack	H-1497.613
FibreChem circle, 8.5"	H-1496

Reflux Extractor, 2000g Components

Description	Model
Wire screen cone, 1000g sample holder (set of 2)	H-1499.1
0.5" Tube copper condenser w/ inlet/outlet water tubes	H-1499.2A
Glass Jar with ground open edges	H-1499.3
Electric hot plate	H-4943
Filter paper, 40cm, 100-pack	H-1498.613
FibreChem circle, 8.5"	H-1496

Pressure Limit Device

For use with reflux extractor kits to protect copper condenser from excessive pressure. For use with 0.5" tubes.

Pressure Limit Device H-1494A
Shipping wt. 0.5lbs (0.22kg)

Asphalt Dispensers

Round, melting pot has stainless steel crucible (18 gauge) and shell (20 gauge) to facilitate easy clean up. Choice of 6 quart, or 12 quart models. Includes heavy-duty, adjustable bench mounting stand, which fits either size. Dual-point temperature control allows independent temperature for pot (0-350°) and for valve (1-10°). Digital display may be read in either Centigrade or Fahrenheit. Other features include: multiple-circuit blanket heater for very uniform heat; no-drip 1" ball valve dispenser, 7.25" (184mm) above work surface; 50-watt valve heater; 3" (76mm) fiberglass insulation; separate aluminum cover; 6' power cord.

6-qt capacity— 800 watts; 1

2-qt capacity— 1,200 watts;

Asphalt Dispenser, 6Qt, 120V 60Hz H-1440
Asphalt Dispenser, 6Qt, 220V 50/60Hz H-1440.4F
Shipping wt. 30lbs (14kg)

Asphalt Dispenser, 12Qt, 120V 60Hz H-1442
Asphalt Dispenser, 12Qt, 220V 50/60Hz H-1442.4F
Shipping wt. 20lbs (19.1kg)

Filter Papers for Reflux Extraction

Filter papers for use with reflux extractor sets.

Size	Filter Speed	Flow Rate (ml/min.)	Thickness	Retention (µm)	Per Pkg.	Model
33cm dia.	Very fast	360	0.51	48	50	H-1497.617
33cm dia.	Very fast	435	1.02	31	100	H-1497.633
33cm dia.	Fast	235	0.25	24	100	H-1497.615
33cm dia.	Medium	60	0.17	6	100	H-1497.613
33cm dia.	Medium	85	0.71	4	100	H-1497.627
40cm dia.	Medium	85	0.71	4	100	H-1498.627
40cm dia.	Medium fast	60	0.17	6	100	H-1498.613
40cm dia.	Medium fast	235	0.25	24	100	H-1498.615
40cm dia.	Very fast	300	0.51	48	50	H-1498.617

(40cm filter paper is used with H-1499 only)