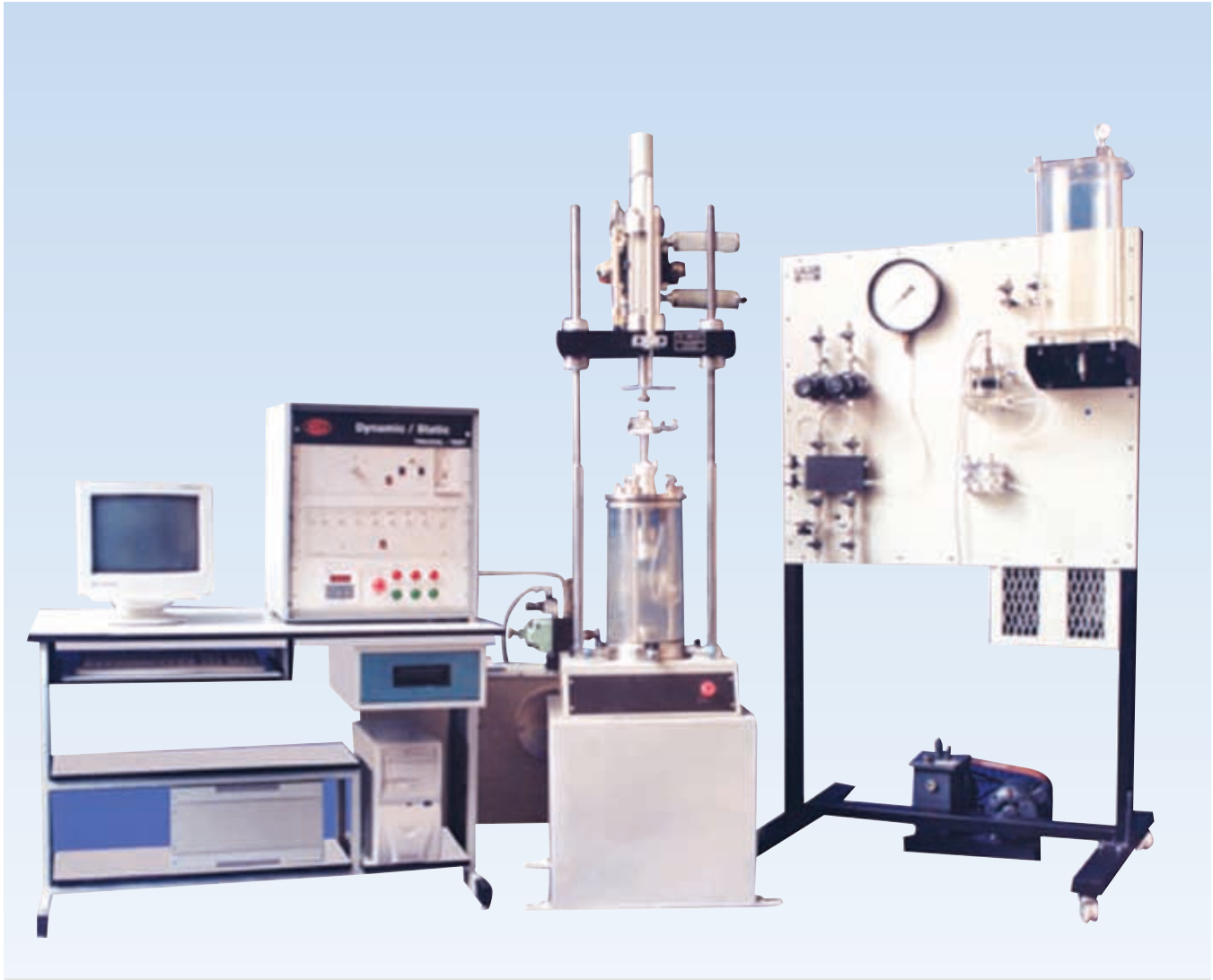




CYCLIC-~~QM~~-STATIC TRIAXIAL TESTING MACHINE AS PER ASTM 3999 AND 5311



HS28.610

The system is suitable for:

- i) Stress controlled and strain controlled cycling upto 10 Hz.
- ii) Normal Stress path control, both in drained and undrained condition.
- iii) Routine triaxial testing with programmable strain rate.
- iv) K_0 consolidation and swelling.(optional)

The system is a highly advanced combination of electronics and hydraulics.

The main components of the system are:

- i) Load Frame with Actuator
- ii) Triaxial Cell
- iii) Control Panel
- iv) Power Pack

v) Processing and Data Acquisition System.

Load Frame

It is free standing two pillar type load frame. Cross head carrying the hydraulic actuator is moveable on threaded columns to adjust the height to suit particular Triaxial Cell. It can accommodate Triaxial Cells with sample size up to 100 mm diameter.

Capacity : 20 kN
 Horizontal Clearance : 350 mm
 Vertical Clearance : 900 mm



LOAD FRAME

Actuator

It is a double acting equal area hydraulic actuator with a total stroke of 100 mm. Manifold attached to the actuator carries state-of-the-art servo valve and nitrogen filled accumulators.



ACTUATOR

TRIAXIAL CELL

Standard Triaxial Cell can accommodate sample size, ranging from 38 mm to 75 mm diameter. with L/D ratio of 1:2. It has a submersible load cell connected to the transfer bar. Linear bearings ensure smooth movement of the transfer bar (plunger). Sensors for pore pressure and back pressure are attached to the stainless steel base.

Confining Pressure : 10 kg/cm²

Specimen Size : 38 mm dia x 76 mm ht./50 mm dia x 100mm ht./75mm dia x 150 mm ht.

Submersible load cell : 5kN - 20 kN (to be specified at the time of placing order)

(Other sizes optional)



TRIAXIAL CELL

independent lines one for confining pressure and the other for back pressure. De-airing chamber of roughly 15 liters capacity is fixed on the panel.

Confining Pressure : 10 kg/cm²

Back Pressure : 10 kg/cm²

De-airing chamber : 15 liters

Volume change: 200cc*0.01cc

PNEUMATIC CONTROL PANEL

Pore pressure sensor/ Back pressure sensor : 10 kg/cm²

Pneumatic control panel is fitted with very sensitive pressure regulators. There are two



PNEUMATIC CONTROL PANEL



Power Pack

Power Pack is hydraulic power pack that transmits enough oil at requisite pressure to the actuator that can subject the sample to frequency of 10 Hz with displacement of 2 mm.

Capacity of the tank: 100 Litres
 Flow of Pump : 15 liters/min.
 Power of motor : 7.5H.P.
 Heat Exchanger : Included

total controlling and acquiring data on line. Some of the specification of the controlling card are given below.

32 Bit PCI Bus
 Up to 16 single ended inputs
 16 bit analog input resolution with sampling rate up to 250 KHz
 Programmable Bipolar / Uni-polar analog input
 Programmable gain x1, x2, x4, x5, x8
 2 channels D - A outputs with wave-



DIGITAL CONTROLLER

Counter : 7 Digits. (Programmable up to 1 million cycles)

APPLICATION SOFTWARE

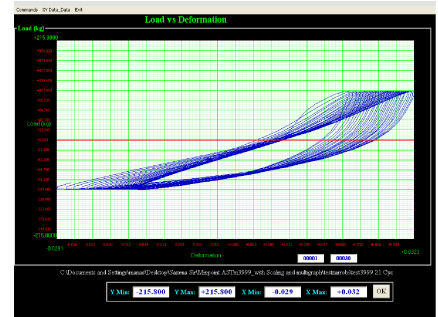
Online Software for Dynamic Test

Displays the following plots (Graphical Presentation) Online plot Load Vs Time, Pore Pressure Vs Time and Vertical Deformation Vs Time

Online displays Load, Vertical Deformation, Lateral Deformation (optional), Confining Pressure and Pore Pressure in respective engineering units.



POWER PACK



COURTESY NIT SILCHAR

DATA ACQUISITION AND CONTROLLING WITH DEDICATED COMPUTER

The system has signal conditioning unit that process the signals from all the sensors i.e.

Load Cell *kN
 Displacement Sensor 20/50mm
 Pore Pressure Sensor 20 bar
 Lateral Deformation sensors (optional) 10mm
 Confining Pressure 20 bar

Add on card is fixed in the computer for

form generation capability.
 A - D and D - A fully auto calibration
 Completely jumper less and software configurable

It is supported by a user friendly software for conducting various types of test on soil specimens. The system can store data for off line analysis.

Type of wave forms : Sine, Square, Triangular Haver Sine
 Frequency range : 0.1 Hz - 10 Hz.
 Ram rate : Upto full load/ displacement in 100 minutes

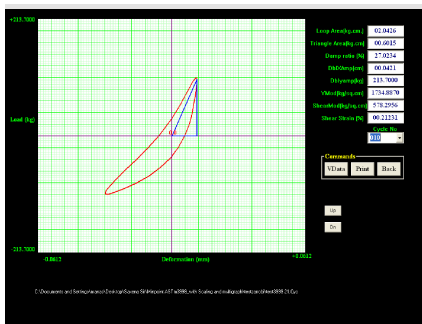
NOTE:- * Selection to be made at the time of ordering with capacity ranging from 5 to 20kN.



OFFLINE SOFTWARE FOR DYNAMIC TEST

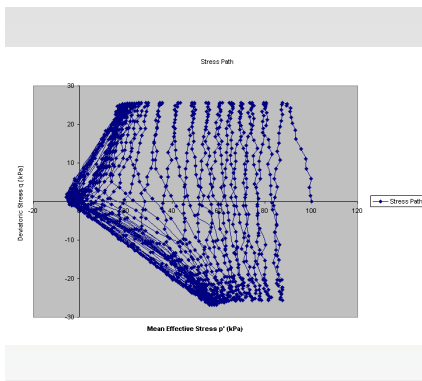
As per ASTM 3999 It provides the following graphs.

- Load Vs Deformation
- Deviatoric Stress Vs Time
- Excess Pore Pressure Vs Time
- Deviatoric Stress Vs Mean Eff. Stress
- Effective Stress Ratio Vs Axial Strain
- Deviatoric Stress Vs Axial Strain (%)
- Excess Pore Pressure Vs Axial Strain (%)
- Excess Pore Pressure Vs Cycle Number
- Cycle Pore Pressure Vs Cycle Number
- Cycle Pore Pressure Ratio Vs Cycle Number
- Double Amplitude Axial Strain Vs Cycle Number



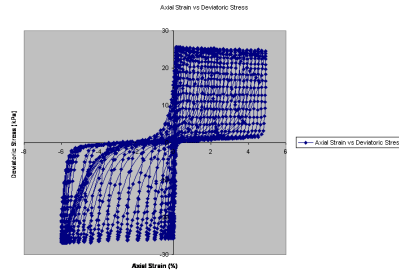
Courtesy NITSilchar

As per ASTM 5311 It provides the following graphs.



Courtesy IISc Bangalore

- Double amplitude axial strain Vs No. of Cycles
- Change in $a = (c + \sigma)/2$; c Peak cyclic stress in compression; Vs No. of Cycles



Courtesy IISc Bangalore

- Cyclic Pore water pressure ratio Vs No. of Cycles
- Percent Load drift between maximum load and measured load Vs No. of Cycles

SOFTWARE FOR STATIC TRIAXIAL TEST

Application Software for Static Test

Displays the following plots (Graphical Presentation)

- 1 Online plot Load Vs Time
- 2 Vertical Deformation Vs Time

Online stores the data of Load, Vertical Deformation, Lateral Deformation, Confining Pressure, Pore Pressure and volume change.

The salient features of the Software are :

Does all the calculation of UC, UU, CU, CU and CD Triaxial tests & plots all the related graphs.

Calculates the following :

- 1 Evaluates t_{100} .
 - 2 Stress Strain rate depending upon the drainage condition for CD and CU test.
- For the tested specimen the program provides estimation of :

- Dry Density
- Moisture Contents
- Void Ratios
- Degree of saturation

Computer

Pentium IV - 3.0Ghz or higher 512MB RAM, 80 GB HDD, CD writer, Standard Keyboard, Scroll Mouse, Color Monitor, Deskjet Printer (if required)
(Note : Computer with latest configuration will be supplied).

HL102.55

Vacuum Pump

Suitable for operation on 220 V, 50 Hz, single phase supply.

Air Compressor

In busy laboratories, where several pressure outlets are needed for different tests, the use of central air compressor is very economical. Using pressure regulators (sup-



AIR COMPRESSOR

plied on order) desired regulated pressures can be tapped out from the same compressor maintaining pressure slightly more than the desired test pressures.

HL102.05

10 kg/cm²

Optional

Displacement sensor for lateral measurement up to ±5 mm. (Other special models on request).



CALIBRATION EQUIPMENT

Dead Weight Tester

Calibration Jig for Pressure Transducer (Dead Weight Type)

Dead Weight Pressure Gauge Testers are used for calibrating and standardizing pressure gauges and pressure transducers upto a pressure of 1000 bar (kg/sq.cm) H EICO Dead Weight Pressure Gauge Testers are so designed and manufactured that extremely small variations and very small pressures can be measured with great accuracy i.e. upto $\pm 0.1\%$ or better. The standardizing pressure is developed by loading with standardized weights a vertically arranged ram which works in a cylinder filled with oil.. This cylinder is connected to an oil reservoir through an isolating valve. A priming pump, a pressure pump, pressure gauge adaptors etc. are also connected to the cylinder. A set of standardized weights, for the testing range of the tester, is supplied with each instrument. A set of adaptors for different sizes of pressure gauge threads is also provided along with a set of spanners, a needle puller and a screw driver.

Dead Weight Pressure Gauges Testers are offered in four models.

HL 80

Single Ram, Single Gauge Type.

HL82

Single Ram, Two Gauge Type

HL84

Double Ram, Single Gauge Type.

HL86

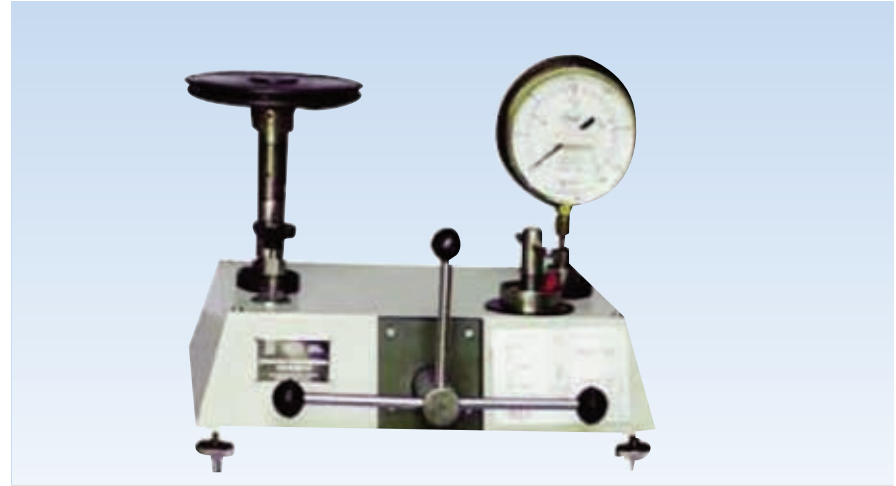
Double Ram, Two gauge Type.

●● HL80

Single Ram Single Gauge Type

Suitable for standardizing one pressure gauge against dead weights. These testers have only one pressure range. The apparatus comprised the following main components.

- i) A precisely ground and lapped ram of



HS 80.05

known effective area moving without friction in an accurately honed cylinder and provided with a loading platform at its top.

- ii) A set of standardized weights for the test range.
- iii) A priming pump-cum-oil reservoir for quick initial setting of the unit.
- iv) A high pressure screw type pump for adjustment during the test at higher pressures.
- v) An isolating valve for the priming pump.
- vi) Pressure gauge adaptor.
- vii) A set of spare pressure gauge adaptors.
- viii) Two open ended spanners and a needle puller.

The apparatus is assembled on a sturdy base with leveling screws and is encased in a sheet metal cover. This type of apparatus is available for the following standard test ranges.

Cat. No.	Range(bar)
HL80.05	0.5 - 25
HL80.10	0.5 - 50
HL80.15	1.0 - 100
HL80.20	2.0 - 200
HL80.25	2.0 - 300
HL80.30	5.0 - 500
HL80.35	5.0 - 750
HL80.40	5.0 - 1000

●● HL 82

Single Ram Two Gauge Type

These models are very useful for situations

warranting frequent checking of pressure gauges, when calibration against a dead weight system becomes much time consuming and cumbersome. Out HL 82 series of testers have the dual arrangements of testing the pressure gauges against standardized weights as well as by comparing the test gauge with a calibrated master gauge, which is very quick and convenient.

The dead weight loading rams in these models, can be isolated by an isolating valve included in the hydraulic circuit while comparing the test gauge with a master gauge.

Supplied complete with a set of weights, spanners, needle puller, pressure gauge adaptors but without the Master Gauge. Available in the following ranges.

Cat. No.	Range(bar)
HL82.05	0.5 - 25
HL82.10	0.5 - 50
HL82.15	1.0 - 100
HL82.20	2.0 - 200
HL82.25	2.0 - 300
HL82.30	5.0 - 500
HL82.35	5.0 - 750
HL82.40	5.0 - 1000



●● **HL 84**

Double Ram Single Gauge Type

Similar HL80 but with two telescopic rams to give two ranges of pressure with the same set of weights. Low capacity pressure gauges and high capacity pressure gauges can be tested with the same precision on these testers.

HL 84

Cat No.	Low Pressure Range	High Pressure Range
HL84.30.	0.5 - 50 bar	5 - 500 bar
HL84.35	0.5 - 75 bar	5 - 750 bar
HL84.40	0.5 - 100 bar	5 - 1000 bar

HL 86 DOUBLE RAM WITH 2 GAUGE ADOPTERS

Cat No.	Low Pressure Range	High Pressure Range
HL86.30	0.5 - 50 bar	5 - 500 bar
HL86.35	0.5 - 75 bar	5 - 750 bar
HL86.40	0.5 - 100 bar	5 - 1000 bar

Calibration Jig for Proving Ring/Load Cell

Lever Type

This is very sensitive and useful for calibration of load measuring instruments like proving ring/load cells up to maximum capacity of 2000 kg. It is Multiple Lever Loading Device, designed on a standard lever ratio, loads being given through standard dead weights. A worm gear attachment, operated through a lead screw, always keeps the loading beam in a horizontal position. It has an accuracy better than $\pm 0.1\%$. Calibration jigs are available in three different capacities.

CAT. NO.	CAPACITY
HS30.20	0-500kgf x 10 kgf.
HS30.30	0-1000kgf x10 kgf
HS30.40	0-2000kgf x10 kgf

Hydraulic Type

It is very simple in design and work on similar principle as that of a hydraulic press. It

is a dead weight type calibration system consisting of friction free, gland less hydraulic ram, pressurised through very accurate weight system.

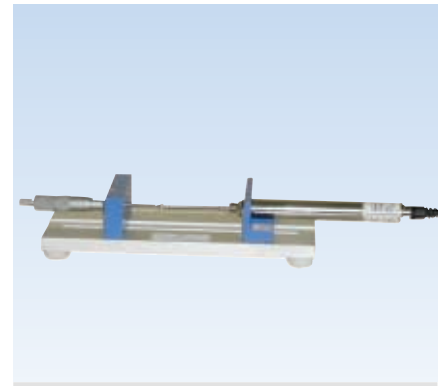
The overall accuracy of the unit is $\pm 0.3\%$. Models are available from 20kN to 2000kN.

CAT. NO.	CAPACITY
HS30.55	5-50kN
HS30.60	0-500 kN
HS30.65	0-1000 kN

Calibration Jig for L.V.D.T/Dial Gauge

●● **HS 29.545.1**

The equipment consists of two brackets, one for fixing the L.V.D.T/ Dial Gauge required to be calibrated and the other movable one, fitted with a micrometer screw gauge of required range, both fitted on a sturdy base. The least count of screw gauge is 0.001mm with range varying from 0 to 100mm as per actual requirement.



HS 29.545.1