Wykeham Farrance Limited (WF)

Established in 1940 WF have manufactured testing equipment for the commercial and educational field of geotechnical engineering.

WF has a long standing international reputation for excellent design and quality.

WF in house knowledge, innovation and quality make us the No1 supplier of geotechnical products worldwide.

Dynamic Hollow Cylinder

Four axis control giving magnitude, direction, waveshape and frequency of the major and minor principle stresses.

Cyclic Simple Shear

Two axis control giving constant volume, constant height in shear with control of frequency and wave shape.

Cyclic Triaxial

Three axis control of axial, radial and back pressure with control of magnitude, frequency and wave shape.

DataMan Logger

16 Channel high speed logger. 10 readings per second. Blue tooth communication, stand alone or PC control. Software for test set-up, calibration and test recording.

Triaxial cells recognised throughout the world, original design features maintained. Standard, Advanced and Unsaturated ranges. Sample size 35 - 150mm diameter. Pressure ranges up to 3400kPa

Bender Elements

Suction Transducer
Dynamic Hollow Cylinder Apparatus

The Wykeham Farrance Dynamic Hollow Cylinder Apparatus allows the investigation of the rotation of principle stress within the soil sample. It does this by independently controlling the direction and magnitude of the three principle stresses in Consolidation, Monotonic and Cyclic Shear.

The WF system is computer controlled with five control channels and up to sixteen data acquisition channels.

Base Frame
The hollow cylinder cell is mounted on a base frame which gives excellent rigidity for axial and radial loading of the sample. The base frame also supports the axial and torsional actuators, control and data acquisition system, air water interfaces and volume change.

Triaxial Cell
150mm triaxial cell for 100mm outside diameter and 60mm inside diameter x 200mm long samples. The cell has an internal frame which holds the load/torque transducer. All the fill, empty and drainage ports from the top cap and base pedestal are positioned in the triaxial cell base. All internal transducer cables exit through the base. This allows the sample to be accurately set up, with all transducers placed, before the cell top is positioned.

Axial Actuator
The axial double acting pneumatic actuator is mounted on the base of the triaxial cell ensuring good alignment. It is fitted with a digital servo valve which controls the force displacement frequency and wave shape. The actuator can apply an axial load of +/- 10kN, with a stroke of +/- 25mm.

Torsional Actuator
The torsional double acting pneumatic actuator is mounted on a platform in the base frame. It is fitted with a digital servo valve which controls the force displacement frequency and wave shape. The actuator can apply a torsional force of +/-200Nm, with 90 degrees of rotation.

Inner Cell Pressure
The inner cell pressure is applied through digitally controlled air valves in closed loop with the cell pressure transducer.

Outer Cell Pressure
The outer cell pressure is applied through digitally controlled air valves in closed loop with the outer cell pressure transducer.

Back Pressure
Back Pressure is applied through digitally controlled air valves in closed loop with the back pressure transducer. Frequencies up to 1 Hz on simultaneous 4 axis control which is essential for applying magnitude and direction of the major and minor principle stresses.

Anisotropy of soil samples
Effects of principal stress rotation
Effects of intermediate principal stress
Computer Control and Data Acquisition System (CDAS)

The CDAS is a compact self-contained unit that provides all critical control, timing and data acquisition functions for the test and the transducers. The CDAS and computer communicate through a standard RS232 C serial interface or high speed USB interface at 10Hb/s.

The data acquisition module has sixteen normalised (+/- 10v range) transducer input channels. These channels are digitised by accurate, high speed 20 bit analogue to digital (A/D) converters for data analysis and presentation.

The control module has five channels for feedback control. Two are dedicated to the actuators for vertical stress and torsional stress and three are dedicated to the servo control valves for inner and outer cell pressures and back pressure.

Supervised by the PC, the CDAS automatically controls the operation of loading for individual types of test. The CDAS directly controls the servo valve to apply the requested loading rate or waveform, cell pressure and back pressure. While the specimen is being subjected to loading forces, the CDAS captures data from the transducers and transfers these, via an RS232 serial or USB link, to the PC for processing, display and storage.

Software

The software sections the test into five stages

1 General
   This is where you enter:-
   Operator
   Sample Identification
   Dimensions
   - Initial inner sample diameter
   - Initial outer sample diameter
   - Initial sample height
   File name

2 Saturation
   Inner/Outer pressure increment (stepped or continuous)
   Back pressure differential
   Target time

3 Consolidation
   Three types of consolidation are offered

Isotropic Consolidation
   Data entered for:-
   - Initial mean normal stress
   - Target mean normal stress
   - Target time

Anisotropic consolidation - Type A
   Data entered for:-
   - Initial mean normal effective stress
   - Target axial stress
   - Earth pressure coefficient
   - Intermediate principal stress coefficient
   - Target time

Anisotropic consolidation - Type B
   Data entered for:-
   - Initial mean normal effective stress
   - Target mean normal effective stress
   - Target deviator stress
   - Initial major principal stress direction
   - Target major principal stress direction
   - Initial intermediate principal stress coefficient
   - Target intermediate principal stress coefficient
   - Target time
4 Monotonic shear (Stress control)
Data entered for:
Drainage condition: Drained or Undrained
Intermediate principal stress coefficient during shear
Monotonic shear direction
Isotropically consolidated
Major principal stress direction
Anisotropically consolidated
Induced deviator stress direction
Loading rate of induced deviator stress
Termination octahedral shear strain

5 Cyclic shear
Data entered for:
Drainage condition: Drained or Undrained
Intermediate principal stress coefficient during shear
Cyclic shear direction
Isotropically consolidated
Major principal stress direction
Anisotropically consolidated
Induced deviator stress direction
Induced cyclic deviator stress (Asymmetric cyclic loading is possible)
forward from the starting point:
backward from the starting point
Frequency
Termination octahedral shear strain
Termination number of cycles
Transducers

Load Torque Transducer  +/-9kN, +/- 200Nm submersible transducer. 
The transducer is fitted to the internal frame of the triaxial cell. The reaction of the applied forces is transmitted through the internal triaxial cell frame into the base frame it measures the load and torque applied to the sample independently. 
The 9kN axial load has a resolution of 0.3N 
The 200Nm torque has a resolution of 0.01Nm.

Radial Displacement Transducer  +/-50mm travel displacement transducer. This transducer is mounted on the radial torque actuator. It has a dual purpose of being the part of the closed loop system for controlling the position of the actuator and monitoring the radial movement or rotation of the sample. 
The +/-50mm travel will have a resolution of 1.5micron or 5sec of arc.

Axial Displacement Transducer  +/- 25mm displacement transducer mounted on the axial actuator. It has a dual purpose of being the part of the closed loop system for controlling the position of the actuator and monitoring the axial movement of the sample. 
The +/-25mm travel will have a resolution of 1.5micron.

Inner Cell Pressure Transducer  1000kPa cell pressure transducer is mounted close to the triaxial cell base; it is in a closed loop with the digital servo valve for control of the cell pressure. The 1000kPa pressure will have a resolution of 0.05kPa.

Outer Cell Pressure Transducer  1000kPa cell pressure transducer is mounted close to the triaxial cell base, it is in a closed loop with the digital servo valve for control of the inner cell pressure. The 1000kPa pressure will have a resolution of 0.05kPa.

Pore Water Pressure Transducer  1000kPa pore pressure transducer mounted close to the triaxial cell base. The 1000kPa pressure will have a resolution of 0.05kPa.

Sample Volume Change

Transducer  100cc volume change transducer mounted on a shelf in the base frame, it monitors the sample volume change. This volume change value is used within the cell volume change and the radial strain to calculate the sample volume change and outer diameter. 100cc volume change will have a resolution of 0.005cc.

Inner Cell Volume Change Transducer  100cc volume change transducer mounted on a shelf in the base frame, it monitors the inner cell volume change. This volume change value is used to calculate the sample inner diameter. 100cc volume change will have a resolution of 0.005cc.

All transducers are fitted with an in line calibration module.
which normalizes all the transducer outputs. This means that transducers can be changed or moved without the need to re-calibrate.

Transducer, stores all transducer calibration data, serial numbers reallocating a transducer is just a stroke on the keyboard.

Wave Shape, stores all wave shapes standard and user defined.

Test, stores all test set up data. Tests can be reproduced at any time with the same routine as previously used.

Universal Tuning Program, allows you to tune the system to obtain the best wave shape.

Hardware

The hollow cylinder cell is mounted on a base frame which provides the support and reaction to all the applied stresses to the sample. It also houses the vertical and torque actuators, air water interfaces, the control and data acquisition system, the auxiliary air cylinder on which is mounted the control valves for the inner, outer and back pressures. All transducers except the load /torque transducer are positioned in the base frame.

Top Cap and Base Pedestal Set.

Special top cap and base pedestal set 100mm with 60mm inside diameter.
Both are designed to accept the special internal membranes. Porous discs with fins are fixed to the top cap and base pedestal for gripping the sample when the rotational stresses are applied. Both are supplied with two ports for drainage and pore water pressure.

Base Pedestal

Sample Preparation Equipment

This kit comprises of the following:
A motorised soil lathe to allow an extruded or a block sample to be machined to 100mm diameter. The motorized soil lathe has a drilling attachment which will allow a 60mm diameter hole to be drilled in stages. A three part split former is supplied to allow trimming of the sample ends and allow sample movement without damage.
A set of internal and external moulds for preparing unbound samples. The external mould is a three part mould which sits on the triaxial cell base. It has a vacuum connection to suck the membrane onto the inner wall of the mould. Essential when preparing low density samples. The inner mould is in segments to allow it to contract and be withdrawn after the sample has been prepared

Optional Accessories

Radial and Strain Transducers. +/- 2.5mm strain transducers which are mounted on the sample. Measures the change in sample height / diameter over the middle third of the sample. Resolution of 0.1 micron.

High Air Entry Top Cap and Base Pedestal Set special set with the pedestals fitted with high air entry stones for testing partially saturated or unsaturated samples.

De-aired Water System. Gravity fed supply of de-aired water to the inside and outside of the hollow cylinder sample.

Compressed Air System. Minimum 800kPa working pressure.
Sample Dimensions

1. Sample Dimensions
   \[ \begin{align*}
   H & \text{ sample height (mm)} \\
   D_i & \text{ sample inner diameter (mm)} \\
   r_i & \text{ sample inner radius (mm)} \\
   l_i & \text{ radial movement of inner wall (mm)} \\
   D_o & \text{ sample outer diameter (mm)} \\
   r_o & \text{ sample outer radius (mm)} \\
   l_o & \text{ radial movement of outer wall (mm)}
   \end{align*} \]

2. Applied Force and Pressures
   \[ \begin{align*}
   W & \text{ applied axial load (N)} \\
   T & \text{ applied torque (N·m)} \\
   P_i & \text{ confining inner cell pressure (kPa)} \\
   P_o & \text{ confining outer cell pressure (kPa)}
   \end{align*} \]

3. Applied Stresses
   \[ \begin{align*}
   \sigma_a & \text{ axial (vertical) stress} \\
   \sigma_r & \text{ radial stress} \\
   \sigma_h & \text{ horizontal (circumferential) stress} \\
   \tau_{ah} & \text{ shear stress}
   \end{align*} \]

Ordering Information

Dynamic Hollow Cylinder
Apparatus for 200mm high
samples, 100mm OD and 60mm
ID. With 20 bit closed loop Control
and Data Acquisition system to
apply axial and radial stresses up
to 9kN, 200Nm at 1Hz
240V 50Hz 1ph
As above but 110V 60Hz 1ph
Sample preparation Kit for Hollow
Cylinder to produce samples 60mm
ID x 100mm OD. 240V 50Hz 1ph
As above but 110V 60Hz 1ph
Air compressor 10 Bar max
working pressure. 240V 50Hz 1ph
As above but 110V 60Hz 1ph
Panel mounted de-airing tank
Valve panel for use with de-airing tank
Vacuum pump, 240V 50Hz 1ph
As above but 110V 60Hz 1ph

12440 12441 12445 12447 12100 12101 11670 11680 33312 33314