SOIL MECHANIC

In all aspects of civil engineering and particularly in soil mechanics, during the design stage the engineer must ensure that the analysis of soil properties relates directly to the relevant foundation or structure.

Using procedures involving extracting, examining and testing representative samples the engineer can create a model very close to the real situation.

In recent years we have seen a significant contribution to experimental analysis resulting from more sophisticated testing procedures, updating of many International Standards and publication of good testing manuals and procedures.

Contents

SOIL MECHANICS

CONSOLIDATION

The typical consolidation test determinates the rate and magnitude of consolidation of a soil specimen restrained laterally and subjected to a number of successive increments of vertical loads.
The complete line includes front loading oedometer, Constant rate of strain cells and hydraulic consolidation cells starting from the analogue configuration up to the fully automatic PC-controlled systems.

Oedometers

- **Standard front-loading oedometer,** manual application of vertical load using dead weights.
- Electronic version: displacement transducers connected to automatic data acquisition system GEODATALOG8 (see page 84)
- Analog version: dial gauge or digital dial gauge

- ACE EmS **Fully automatic oedometer** : comes loaded with the new environmentally friendly Electromechanical Servoactuation (EmS) technology. Silent, compact and high-performing, enabling you to expand your laboratory gradually and seamlessly

Constant rate of strain

In addition to the most common incremental loading consolidation, different tests can be performed measuring the magnitude and rate-of-consolidation of saturated cohesive soils using continuous controlled-strain axial compression allowing also the base excess pressure. Consolidation test using CRS cells can be performed more quickly, without compromising results accuracy, compared to the standard incremental loading test. Using CRS cells it is possible to monitor continually the excess pore pressure so tests can run at maximum speed further increasing test specimen throughput. The CRS Cell is used in conjunction with other equipment (Load frame, pressure system, pore pressure and accessories).

For this reason, different options are available:

- Upgrading kit for ACE EmS
- Activation kit for AUTOTRIAX2
- Standard Triaxial System with GEODATALOG8

Hydraulic consolidation

Incremental loading consolidation test can also be performed with a different device that applies vertical force using hydraulic pressure. This type of cell overcomes the complexity usually associated with hydraulic oedometers and allows more information to be gathered from the soil sample. (e.g. low permeability by hydraulic pressure).

- **Hydrocon**: Specific for saturated soil test; two testing modes are available - manual and electronic - with automatic data acquisition GEODATALOG8. During the test back and axial pressure are applied and vertical settlement, pore pressure and variation of volume are measured.
- **Hydrocon Unsaturated (SWCC)**: specific for unsaturated soil test; electronic testing mode with automatic data acquisition GEODATALOG8 is available; Its base is fitted with a High Air Entry Stone (HAES) which enables a soil/water characteristic suction curve to be obtained. In addition to Hydrocon model air pressure is also applied.

ADVANCED SERIES

Automatic Computerized Oedometer

26-WF31E20

EmS TECH

An advanced system featuring the automated PC-controlled of the complete consolidation test

STANDARD

- BS 1377:5
- ASTM D2435
- ASTM D3877
- ASTM D4546
- NF P94-091
- EN 17892:5

ACE EmS

FEATURES and ADVANTAGES

» Versatile fully automatic Oedometer soil consolidation testing machine featuring incremental loading, swelling, CRS (constant rate of strain), CHG (controlled hydraulic gradient) and unconfined test.

» Environmentally friendly and quiet the ACE EmS benefits from the new Electromechanical Servoactuation (EmS) technology requiring no dead weights or large and noisy air compressors, thus drastically reducing noise levels.

» Small footprint featuring a benchtop shorter than 50 cm.

» Modular and expandable, gradually connect up to 60 units via LAN port using the same PC software SOILMASTER allowing you to build your laboratory without interruption - resulting in excellent return on investments.

» Highly performant with load capacity of up to 20 kN, equivalent to 10,000 kPa on 50.47mm Oedometer consolidation cell.

» Optimized PID closed-loop control delivering fast, smooth and accurate loading and precise load holding through the multiple test steps.

Modular and expandable, gradually connect up to 60 units via LAN port using the same PC software SOILMASTER

Optional local user interface with 6" touch screen high resolution color display allowing full control of a single unit, without a PC, including full test execution. USB pen drive included for unlimited storage, TXT format data output

This is one of the many **ADVANCED** products from the CONTROLS Group range.

To get more info visit **www.controls-group.com** or link directly to the QRCode

Front Loading Oedometer

STANDARD

▸ BS 1377:5 ▸ ASTM D2435
▸ ASTM D3877 ▸ ASTM D4546
▸ NF P94-091 ▸ EN 17892:5

The oedometer consolidation test determines the rate and magnitude of consolidation of a soil specimen restrained laterally and subjected to a number of successive vertical load increments

26-WF0302
Front loading oedometer
- Overall dimensions: 500 x 200 x 750 mm (height without hanger x width x length)
- Weight: 21 kg approx.

MAIN FEATURES

» Rigid aluminum alloy frame

» 3 lever arm position: 9:1, 10:1,11:1. Max loading 1848 kg corresponding to 9.061 MPa (92.40 kgf/cm^2) on a 20 cm^2 specimen

» Can be fitted with traditional dial gauge or linear transducer for connection to the Geodatalog 8 data acquisition and processing system

Three oedometers (26-WF0302) complete with cells, dial gauges (30-WF6401), weight set, mounted on a consolidation bench (26-WF0312)

Consolidation cells, dial gauge/displacement transducer, weight sets and bench are not included and have to be ordered separately. See Accessories

Consolidation cells and spare parts

Suitable for both fixed ring oedometer consolidation and falling head permeability tests. The cell is constructed of aluminum and comes complete with all the parts illustrated in the exploded view.

Code	Specimen Dimensions (dxh) mm	Specimen area cm^2	Cell dim. (dxh) mm	Weight kg	Calibration disc, code	Upper porous disc	Lower porous disc	Cutting ring
26-WF0320	50.47 x 20	20.00	139 x74	1.3	**26-WF0320/9**	**26-WF0320/4**	**26-WF0325/10**	**26-WF0320/3**
26-WF0321	63.50 x 20	31.67	139 x74	1.3	**26-WF0321/9**	**26-WF0321/4**	**26-WF0326/10**	**26-WF0321/3**
26-WF0325	71.40 x 20	40.00	139 x74	1.3	**26-WF0325/9**	**26-WF0325/4**	**26-WF0325/10**	**26-WF0325/3**
26-WF0326	75.00 x 20	44.16	139 x74	1.3	**26-WF0326/9**	**26-WF0326/4**	**26-WF0326/10**	**26-WF0326/3**
26-WF0335	112.80 x 25	100.00	200 x74	3.0	**26-WF0335/9**	**26-WF0335/4**	**26-WF0335/10**	**26-WF0335/3**

Consolidation bench

26-WF0312
Bench for up to three oedometers. Weight 30 kg

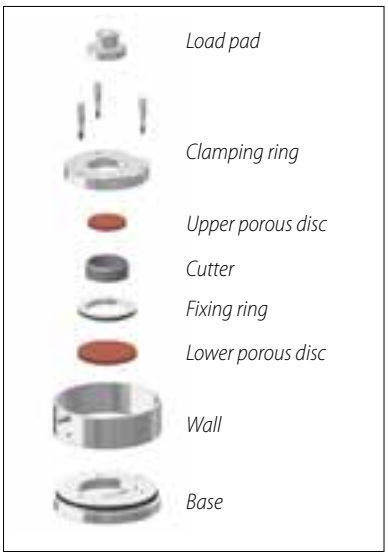
Weight sets

26-WF0230/C2
Weight set, 64 kg in total, comprising: 2 x 0.25, 1 x 0.5, 1 x 1, 1 x 2, 1 x 4 and 7 x 8 kg weights.

26-WF0230/D2
Weight set, 80 kg in total, comprising: 2 x 0.25, 3 x 0.5, 1 x1, 1 x2, 3 x 5 and 6 x 10 kg weights.

Single slotted weights

See page 56



Exploded view of consolidation cell 26-WF0320

Analog measuring device

30-WF6401
Dial gauge, 12 mm travel, 0.002 mm resolution.

As alternative

82-D1262/B
Digital dial gauge, 25 mm travel, 0.001 mm resolution.

Electronic measuring devices

30-WF6207
Linear potentiometric transducer, 10 mm travel.

Note: *in case displacement transducer is supplied complete with data acquisition system, then a traceable calibration certificate is on request.*

Data acquisition and processing System

30-WF6008

Note: *For more information on the Geodatalog 8, Geo-Analysis Template* *see page 84*

30-WF6008/T1
Consolidation Geo-Analysis template conforming, to BS 1377:5

30-WF6008/T8
Consolidation Geo-Analysis template conforming, to ASTM D2435.

30-WF6016/T8A
Consolidation Geo-Analysis template conforming, to ASTM D4546.

Permeability

26-WF0338/A
Permeability attachment with 50 ml graduated burette

Three oedometers 26-WF0302, complete with cells, 30-WF6207 displacement electronic transducers connected to 30-WF6008 GEODATALOG, and 26-WF0312 consolidation bench and PC..

26-WF0338/A fitted to the 26-WF0302 with cell 26-WF0320

Weight application guide

This information is intended to make it easy to select the weight set that is appropriate for the cell size, the beam ratio and the maximum load applied.

Cell model	26-WF0320 Beam ratio 1:10		26-WF0321 Beam ratio 1:11		26-WF0325 Beam ratio 1:10		26-WF0326 Beam ratio 1:9		26-WF0335 Beam ratio 1:10	
For max. pressure	32 kg/cm^2	64 kg/cm^2	20 t/ft^2	40 t/ft^2	16 kg/cm^2	32 kg/cm^2	16 kg/cm^2	32 kg/cm^2	8 kg/cm^2	16 kg/cm^2
Weight set 26-WF	0230/C2	0230/C2	0230/C2	0230/C2	0230/C2	0230/C2	0230/D2	0230/D2	0230/D2	0230/D2
Add. weight 27-WF	-	8 x 0275/A	-	8 x 0275/A	-	8 x 0275/A	-	8 x 0277/A	-	8 x 0277/A
Total weight kg	64	128	64	128	64	128	80	160	80	160

Constant Rate of Strain cells (CRS)

STANDARD

▸ ASTM D4186

This cell is used to measure the magnitude and rate-of-consolidation of saturated cohesive soils using continuous controlled-strain axial compression. The specimen is restrained laterally and drained axially to one surface. The axial force and base excess pressure are measured during the deformation process.

Three different models are available:

26-WF0360/A
Constant rate of Strain (CRS) suitable for external load cell

26-WF0360/AS
Constant rate of Strain (CRS) suitable for submersible load cell

26-WF0360/AD
Adapter for triaxial cell model 28-WF4070

For a complete test configuration (Pressure system, pore pressure, Displacement transducer, Volume change and other accessories) visit our website or ask for the cooperation of our specialists.

Common FEATURES

» Continuous monitoring of test parameters (axial load, pore pressure, axial compression) and detailed plotting of the consolidation curve

» Max working pressure 3500 kPa

» Specimen size: 63.5 x 25.4 mm (d x h)

» Relatively short time to perform consolidation test

» Particularly suitable for cohesive saturated soils

26-WF0360/A Specific FEATURES

» To be used with external load cell

» Typically used as additional accessories for Ace EmS or in a standard triaxial system

» Easily upgradable for using submersible load cell

CRS - Constant rate of Strain Cell (26-WF0360/A) to be used with external load cell

26-WF0360/AS Specific FEATURES

» To be used with submersible load cell

» Typically used as additional accessories for automatic Triaxial System AUTOTRIAX 2 or in a standard triaxial system

CRS - Constant rate of Strain Cell (26-WF0360/AS) to be used with Submersible load cell

26-WF0360/AD Specific FEATURES

» To be used with Submersible load cell

» To be used as adapter for banded triaxial cell (model 28-WF4070)

» Typically used as additional accessories for automatic Triaxial System AUTOTRIAX 2

CRS – Constant Rate of Strain (26-WF0360/AD) fitted on lower base of banded triaxial cell.

The CRS-fitted ACE EmS combined with the HYDROMATIC pressure volume/controller system:

- allows real saturation of soil samples,
- significantly reduces test time resulting in higher specimen test throughput,
- monitors the excess pore pressure throughout the test, and;
- provides complete control via PC software

Hydraulic consolidation cells

The Hydrocon hydraulic consolidation apparatus are used to determine the magnitudes and rates of consolidation of soil specimens saturated and unsaturated of relatively low permeability by hydraulic pressure.

Two models are available:

26-WF0345
Hydrocon, hydraulic consolidation cell for 100 mm diameter samples

26-WF0346
Hydrocon SWCC consolidation cell for 100 mm diameter unsaturated samples.

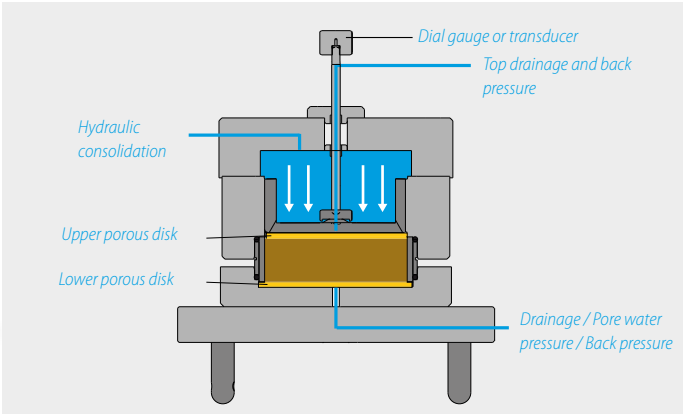
Common FEATURES

- Hydraulic loading
- Maximum working pressure: 3500 kPa
- No weights required
- Suitable for 100 mm dia. samples
- Suitable for compacted clay
- Compact design, occupies less space than conventional oedometers
- Possibility to measure both pore and back pressure during testing
- Possibility to make permeability measurement by generating a vertical flow of water through the sample
- Overall dimensions: 260 x 450 mm (d x h)
- Weight: 5 kg. approx.

26-WF0345 HYDROCON Specific FEATURES

- Specific for saturated soil sample according to BS 1377:6 without lateral drainage
- Two testing modes available: manual or with automatic data acquisition
- 3 lines pressures (axial load, upper and lower drainage)

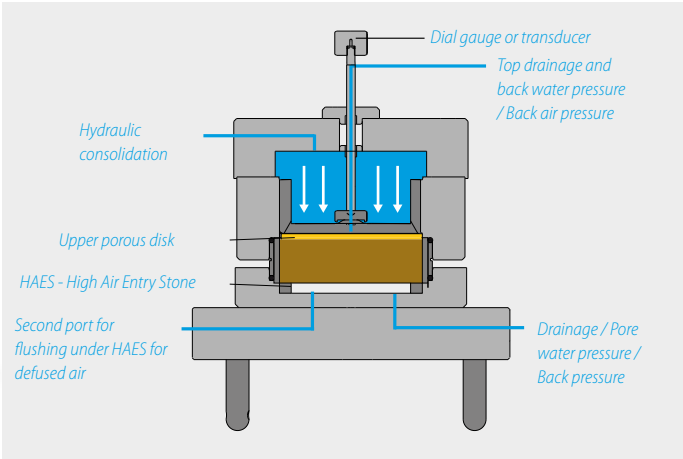
26-WF0345 Hydrocon, hydraulic consolidation cell for 100 mm diameter samples



26-WF0346 HYDROCON SWCC Specific FEATURES

- Specific for unsaturated soil sample
- Testing mode with automatic data acquisition
- 4 lines pressures (axial load, upper and two lower drainage air and water)
- 3 bar High Air Entry stone included
- Additional High Air Entry Stone (1, 5, 15 Bar) available as option

26-WF0346 Hydrocon SWCC consolidation cell for 100 mm diameter unsaturated samples.



For a complete test configuration (Pressure system, pore pressure, Displacement transducer, Volume change and other accessories) visit our website or ask for the cooperation of our specialists.

DIRECT/RESIDUAL SHEAR

In the traditional direct shear test, the soil specimen (either undisturbed, remoulded or compacted) is placed in a rigid metal box that is composed of two halves that can slide horizontally and be subjected to a normal constant stress. The main limitation of the conventional shear box is that it is not possible to apply the shearing action for a large displacement of the soil specimen. To overcome this problem, ring shear apparatus, also known as Bromhead Apparatus, has been developed. In the ring shear apparatus, the specimen is annular shaped and subjected to a normal constant stress and an unlimited rotational displacement.

The product range includes :

Direct/residual shear machines - Small shear box

DIGISHEAR **Digital direct/residual shear machine: it can be fitted in two different versions:**

- Analog version: two dial gauges and one load ring
- Electronic version: two displacement transducers and load cell connected to automatic data acquisition system , the typical solution where central data acquisition is used.

AUTOSHEAR **Digital direct/residual shear machine with built-in data acquisition**, fitted with electronic measurement

SHEARMATIC EmS **Fully automatic direct/residual shear machine** comes loaded with the new environmentally friendly Electromechanical Servo-actuation (EmS) technology. Silent, compact and high performing, enabling you to expand your laboratory gradually and seamlessly.

Direct/residual shear machines - Large shear box

SHEARMATIC 300 ideal for soil and other materials that contain large particles of up to 20 mm. Sample size up to 300 mm square can be tested, with inserts allowing the testing of smaller sample sizes.

Residual shear machine – Ring shear

TORSHEAR EmS **Fully automatic ring shear machine** comes loaded with new environmental friendly Electromechanical Servo-actuation (EmS) technology. Silent compact and Highly performing, enabling you to extend your laboratory gradually and seamlessly.

Automatic
Shear testing machine
27-WF21E80

EmS TECH

Versatile fully automatic Direct/Residual soil testing machine featuring direct, residual shear testing and consolidation test

ADVANCED SERIES

SHEARMATIC EmS

STANDARD

- ASTM D3080 - AASHTO T236
- BS 1377:7
- BS EN ISO 17892-10
- NF P94-071

Detail of Shearmatic EmS fitted with Consolidation accessories and consolidation cell for automatic performance of the consolidation test

FEATURES AND BENEFITS

» Fully automatic, standalone Direct / Residual Shear soil testing system managed by local user interface with 6" touch screen high resolution color display that can also accurately perform Oedometric Soil Consolidation tests using appropriate consolidation cells.

» High-performing with maximum vertical and horizontal force of up to 10 kN, infinite variable speed from 0.00001 to 15.00000 mm/min and adjustable number of cycles from 1 to 99.

» Save time and ensure test accuracy with straight horizontal transmission of force facilitated by high stiffness load chain shear box, driving head and load cell, eliminating horizontal load measurement in accuracies.

» Fast, smooth and accurate loading delivered by integrated optimized PID closed-loop control with precise load ensured by a load cell directly mounted on the loading tip.

» Totally flexible- choose to control unit either via the Integrated local user interface or via PC, tablet or smartphone.

» Modular and expandable with optional dedicated software - gradually connects up to six units via LAN port using the same PC software allowing you to build your laboratory without interruption - resulting in excellent return on investments.

» Environmentally friendly and quiet - the Shearmatic EmS benefits from the new Electromechanical Servoactuation (EmS) technology requiring no dead weights or large and noisy air compressors, thus drastically reducing noise levels.

» Long-life and low maintenance with corrosion-free, techno-polymeric shear box carriage. Lightweight and easy to clean, the top-quality techno-polymeric material offers excellent resistance to corrosion, wear and tear and to chemicals often mixed with soil specimens.

» Save space with its small footprint smaller than 1 m.

DIGISHEAR
Direct/Residual Shear testing machine

STANDARD

▸ ASTM D3080 ▸ AASHTO T236
▸ BS 1377:7 ▸ BS EN ISO17892-10 ▸ NF P94-071

27

DIGISHEAR 27-WF20D60 with accessories, fit in the analogical mode.

27-WF20D60
DIGISHEAR Direct and residual shear testing machine with digital LCD display. 110-230 V, 50-60 Hz, 1 ph

MAIN FEATURES

» Maximum shear force: 5 kN
» Maximum vertical force: 5 kN, using the 10:1 cantilever device
» Infinitely variable speed drive from 0.00001 to 15 mm/min
» Compatible with shear boxes up to 100 mm diameter or square
» Sturdy shear box techno-polymeric carriage untouchable by corrosion
» Loading ram, shear box, load-measuring system are perfectly aligned to avoid distortions with the possibility of mechanical backlash adjustment
» Digital control and display of speed. LCD row by 20 characters, easy to operate by the membrane keyboard
» Can be equipped in the analogical or in the electronic mode with data acquisition and processing

Accessories to fit the machine in analogical mode

Load

27-WF1002/ST
Load ring 2000 N cap. with adapter

or, as alternative:
27-WF1003/ST
Load ring 5000 N cap. with adapter

Dial Gauge

30-WF6401
Dial gauge for vertical deformation, 12x0.002 mm

30-WF6402
Dial gauge for horizontal deformation, 30 mm travel, 0.01 mm resolution

Or, as alternative:

82-D1262/B
Digital dial gauge, 25 mm travel 0.001 mm resolution

DIGISHEAR is supplied without shear box assembly, slotted steel weights and load/displacement measurement apparatus which can be analogical or electronic with data acquisition and processing. All these items have to be selected and ordered separately.
See above and next page

27-WF1002/ST load ring with adapter

30-WF6401 Dial gauge for measuring vertical deformation, 12 mm x 0.002 mm resolution

Accessories to fit the machine in electronic mode

Load

27-WF0377/ST
Load cell, 5000 N cap. complete with adapters

Displacement

30-WF6207
Linear potentiometric transducer, 10 mm travel for vertical deformation, complete with mounting block

30-WF6208
Linear potentiometric transducer, 25 mm travel for horizontal displacement, complete with mounting block

Data acquisition unit

30-WF6008
GEODATALOG, 8 channels data acquisition unit, 110-240 V, 50- 60 Hz, 1 ph, supplied complete with DATACOMM 2 software for PC data acquisition.
See page 84

Template for data processing

30-WF6008/T2
Direct and residual shear Geo-Analysis template conforming to BS 1377:7,

or as alternative:
30-WF6008/T9
Direct and residual shear Geo-Analysis template conforming to ASTM D3080

GEODATALOG 8 data acquisition 30-WF6008

AUTOSHEAR
Direct/Residual Shear testing machine

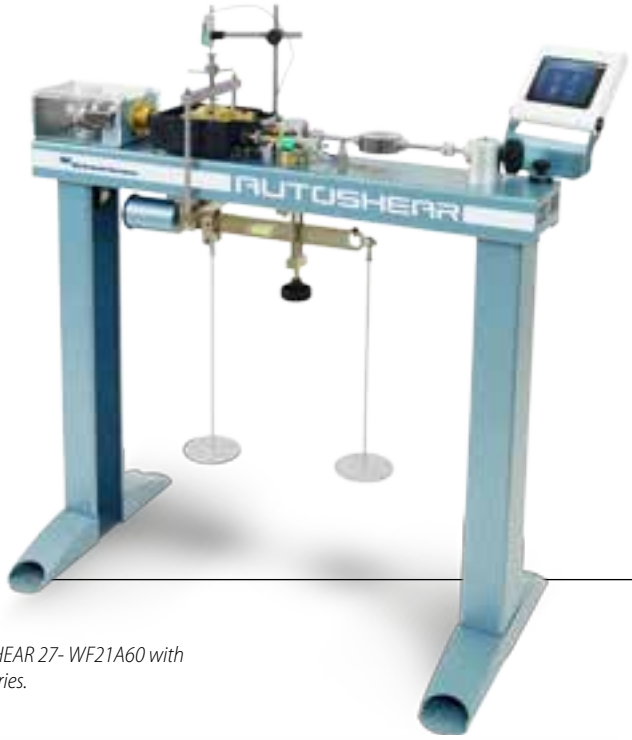
STANDARD

ASTM D3080 ▸ AASHTO T236
▸ BS 1377:7 ▸ BS EN ISO17892-10 ▸ NF P94-071

27-WF21A60
AUTOSHEAR Direct and residual shear testing machine with automatic built-in data acquisition, 110-230 V, 50-60 Hz, 1 ph

MAIN FEATURES

- Maximum shear force: 5 kN
- Maximum vertical force: 5 kN, using the 10:1 cantilever device
- Infinitely variable speed drive from 0.00001 to 15 mm/min
- Compatible with shear boxes up to 100 mm diameter or square
- Sturdy shear box techno-polymeric carriage untouchable by corrosion
- Loading ram, shear box, load-measuring system are perfectly aligned to avoid distortions with the possibility of mechanical backlash adjustment
- User interface 6" touch-screen color display for numerical and graphical plotting of the readings
- Three analog channels: one for load cell and two for displacement transducers
- Number of cycles adjustable from 1 to 99
- USB pen drive for unlimited storage capacity and TXT format data output
- Optional PC control via LAN port and dedicated software



AUTOSHEAR 27- WF21A60 with accessories.

Detail of shear box housing made of high resistance techno-polimeric material and digital measurements

Accessories to fit the machine in electronic mode

Load

27-WF0377/ST
Load cell, 5 kN cap. complete with adapters

Displacement

30-WF6207
Linear potentiometric transducer, 10 mm travel for vertical deformation, complete with mounting block

30-WF6208
Linear potentiometric transducer, 25 mm travel for horizontal displacement, complete with mounting block

Template for data processing

30-WF6008/T2
Direct and residual shear Geo-Analysis template conforming to BS 1377:7

or as alternative:

30-WF6008/T9
Direct and residual shear Geo-Analysis template conforming to ASTM D3080

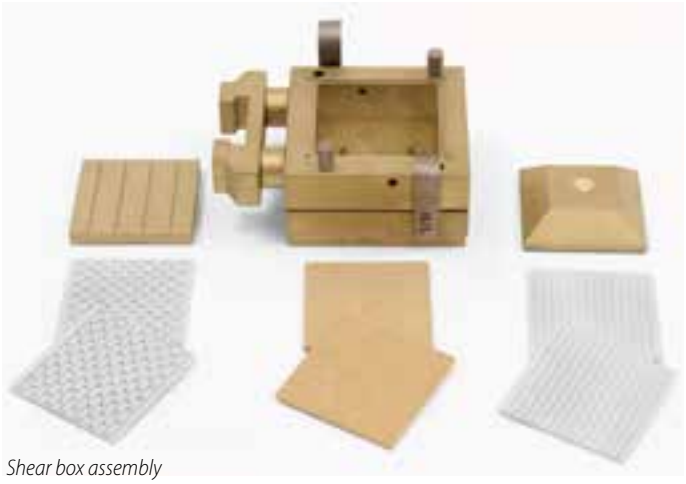
AUTOSHEAR is supplied without shear box assembly, slotted steel weights and load/displacement measurement apparatus. All these items have to be selected and ordered separately. See above and next page

Detail of high stiffness load chain shear box - driving head - load cell

Direct/Residual Shear Testing Machines (Accessories)

Shear boxes and accessories

Manufactured from brass and designed to contain the water that surrounds the specimen. They consist of a square box with a rigid walled round or square hole complete with adapter loading pad, retaining plate, 2 grids, 2 perforated grids and 2 porous plates. Shear boxes are suitable for all Wykeham Farrance direct/residual shear testing machines. Weight approx.: from 2.5 to 4 kg



Shear box assembly

Sample cutter square and extrusion dolly

Shear box assemblies and accessories

	60-square	100- square	50-round	60-round	63.5- round	100- round
Shear box	**27-WF0215/B**	**27-WF0216/B**	**27-WF0217/B**	**27-WF0218/B**	**27-WF0219/B**	**27-WF0222/B**
Sample cutter*	**27-WF0215/B7**	**27-WF0216/B7**	**27-WF0217/B7**	**27-WF0218/B7**	**27-WF0219/B7**	**27-WF0222/B7**
Extrusion dolly*	**27-WF0215/8**	**27-WF0216/8**	**27-WF0217/8**	**27-WF0218/8**	**27-WF0219/8**	**27-WF0222/8**

Spare parts for shear box assemblies

Box code	WF0215/B	WF0216/B	WF0217/B	WF0218/B	WF0219/B	WF0222/B
Loading pad	**27-WF0215/B2**	**27-WF0216/B2**	**27-WF0217/B2**	**27-WF0218/B2**	**27-WF0219/B2**	**27-WF0222/B2**
Base plate	**27-WF0215/B3**	**27-WF0216/B3**	**27-WF0217/B3**	**27-WF0218/B3**	**27-WF0219/B3**	**27-WF0222/B3**
Porous plate**	**27-WF0215/4**	**27-WF0216/4**	**27-WF0217/4**	**27-WF0218/4**	**27-WF0219/4**	**27-WF0222/4**
Plain grid plate**	**27-WF0215/B5**	**27-WF0216/B5**	**27-WF0217/B5**	**27-WF0218/B5**	**27-WF0219/B5**	**27-WF0222/B5**
Perforated grid plate**	**27-WF0215/B6**	**27-WF0216/B6**	**27-WF0217/B6**	**27-WF0218/B6**	**27-WF0219/B6**	**27-WF0222/B6**

** Not supplied with the shear box. They have to be ordered separately.* *** Two pieces are supplied with each shear box*

Weight sets

27-WF0230/C3
Weight set, 37.5 kg in total, comprising: 2 x 0.25, 2 x 0.5, 2 x 1, 3 x 2, 3 x 4 and 2 x 8 kg weights.

27-WF0230/C4
Weight set, 34 kg in total, comprising: 2 x 1, 1 x 2 and 3 x10 kg weights. (additional)

Single slotted weights

27-WF0270/A
Slotted steel weight, 0.25 kg ± 3 g.

27-WF0271/A
Slotted steel weight 0.5 kg ± 3 g.

27-WF0272/A
Slotted steel weight, 1 kg ± 5 g.

27-WF0273/A
Slotted steel weight, 2 kg ± 5 g.

27-WF0274/A
Slotted steel weight, 4 kg ± 5 g.

27-WF0275/A
Slotted steel weight, 8 kg ± 10 g.

27-WF0276/A
Slotted steel weight, 5 kg ± 5 g.

27-WF0277/A
Slotted steel weight,10 kg ± 10 g.

Slotted steel weights

Extrusion dolly and sample cutter, round.

SHEARMATIC 300
Large shear testing machine

STANDARD

- ASTM D3080
- BS 1377:7
- EN ISO 17892-10

MAIN FEATURES

» Sample size up to 300 mm

» 100 kN shear and consolidation force

» Infinitely variable speed control from 0 to 11.00000 mm/min

» Automatic hydraulic application of pre-set consolidation steps (up to 50)

» Automatic test management from consolidation to failure: the operator is only requested to remove the clamping screws of the shear box

» Straight connection between shear box, drive unit and load cell for the axial transmission of the horizontal force along the shearing plane, instead of the classic "swan neck"

» Easy and immediate set up of the test parameters via the large digital graphic display

» Possibility to set different speeds and travel (forward and reverse) in the residual shear tests

» Each single step of axial force can be applied instantaneously or by means of a linear ramp in a pre-set time interval

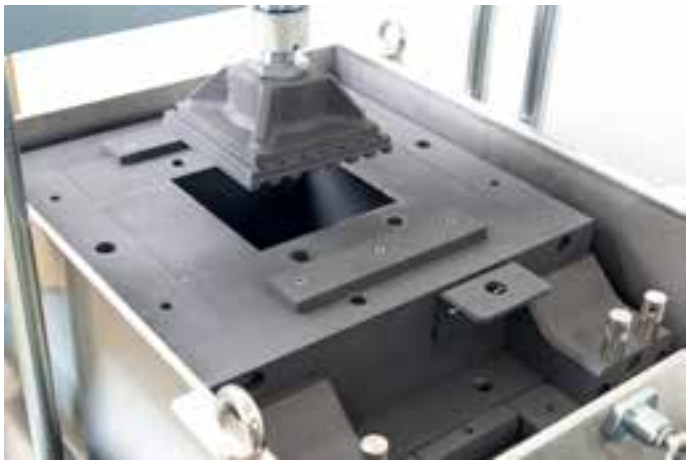
» Different and independent data recording for consolidation and failure

The SHEARMATIC 300 automatic machine is ideal for soil and other materials that contain large particles of up to 20 mm largest dimension. Sample size up to 300 mm square can be tested, with inserts allowing the testing of smaller sample sizes.

Two models available with different type of Shear box: in coated steel or in stainless steel for testing highly corrosive materials

Technical specification

- Sample size: up to 300 mm. Can be reduced to 150 mm using sample insert. See accessories.
- Shear and vertical force: 100 kN
- Speed range: infinitely variable from 0 to 11.00000 mm/min
- Maximum travel: 75 mm
- Steps of consolidation: up to 50
- Power: 2000 W
- Overall dimensions: (wxdxh) 1470x758x1570 mm approx.
- Weight approx.: 800 kg



Detail of Large shear box of Shearmatic 300 fitted with 150 mm insert. (model 27-WF2304/1)

Ordering information

SHEARMATIC 300 stainless steel shear box

27-WF2304/INOX
SHEARMATIC 300, large automatic shear box apparatus, 100 kN cap., with stainless steel shear box assembly for 300 mm square samples. 220 V, 50 Hz, 1 ph

27-WF2304/INOXZ
Same as above but 110 V, 60 Hz, 1 ph

SHEARMATIC 300 coated steel shear box

27-WF2304
SHEARMATIC 300, large automatic shear box apparatus, 100 kN cap., with coated steel shear box assembly for 300 mm square samples. 220 V, 50 Hz, 1 ph

27-WF2304/Z
Same as above but 110 V, 60 Hz, 1 ph

Accessories

27-WF2304/1
150 mm squared sample insert of coated steel for 300 mm shearbox to be used with model 27-WF2304

27-WF2304/1S
150 mm squared sample insert of stainless steel for 300 mm shearbox to be used with model 27-WF2304/INOX

27- WF2304/2
Two additional platens 300x300 mm made of coated steel for non-granular material

27-WF2304/2S
Two additional platens 300x300 mm made of stainless steel for non-granular material

Template for data processing

30-WF6008/T2
Direct and residual shear Geo-Analysis template conforming to BS 1377:7

or as alternative:

30-WF6008/T9
Direct and residual shear Geo-Analysis template conforming to ASTM D3080

ADVANCED SERIES

Automatic Ring shear machine

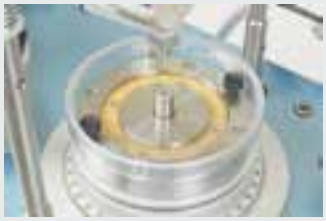
27-WF22E02

Fully automatic ring shear machine featuring residual shear testing

TORSHEAR EmS

STANDARD

- ASTM D6467
- ASTM D7608
- BS 1377:7
- BS EN 17892-10



Detail of 40 cm² stainless steel ring shear box fitted with easily removable sintered porous stones with specialized pattern design.

This is one of the many **ADVANCED** products of CONTROLS Group range.

To get more info visit **www.controls-group.com** or link directly to the QRCode

FEATURES AND BENEFITS

» Fully automatic standalone ring shear soil testing system managed by local user interface with 6" touch screen high resolution color display for performing torsional ring shear test in drained condition to determine the residual shear strength of cohesive soil.

» Environmentally friendly and quiet - the Torshear EmS benefits from the new Electromechanical Servoactuation (EmS) technology.

» It requires neither dead weights nor large and noisy air compressors

» Lightweight and compact system is easy to handle, can be located on a standard bench, has a small footprint and maximizes the use of space in your laboratory. Smart and easy-to-use system with removable load cells and displacement transducers simplifies testing, maintenance and calibration.

» Modular and expandable — the optional dedicated software allows you to gradually connect up to six units via LAN port using the same PC enabling you to build your laboratory without interruption and resulting in excellent return on investments.

» High-performing with maximum vertical stress 1,200 kPa and maximum shear stress 1,000 kPa, infinite variable speed from 0.00001 to 1000°/min, with pre-shearing stage selectable and adjustable number of cycles of shearing.

» Less than 800 mm wide, the system can be placed on a standard laboratory bench, without the need for a separate stand.

Consolidation bench

27-WF0226
CONSOLIDATION BENCH FOR SHEAR BOXES

Used to apply a constant load on a sample placed on a shear box to reduce the testing time when more than one sample has to be tested and only one shear machine is available.

MAIN FEATURES

- 3 loading jokes and hangers
- 3 lever-arm loading devices with a load amplification ratio of 10:1
- Holds up to 3 shear boxes
- Can be equipped with analog or digital mode
- Dimensions (wxdxh): 2310 x 500 x 1215mm
- Weight. 120 kg approx..

ACCESSORIES

Analog measuring device

30-WF6401
Dial gauge, 12 mm travel, 0.002 mm resolution.

Electronic measuring devices

30-WF6207
Linear potentiometric transducer, 10 mm travel.

Data acquisition and processing system

See page 84

Weight sets

See page 56

Detail of shear box case fitted in analog mode

Detail of shear box case fitted in electronic mode

Laboratory vane apparatus

27-WF1730
LABORATORY VANE APPARATUS

The laboratory vane apparatus is based on an original concept of the Transport and Road Research Laboratory of the United Kingdom. This test method covers the miniature vane test in very soft to stiff saturated fine-grained clay-type soils.

MAIN FEATURES

- Includes one vane 12.7 x 12.7 mm
- Supplied with four calibrated springs
- The test can be performed directly on the sample or in the sample contained in the sampling tube using holding sampling tubes attachments
- Motorizing attachment is also available conforming to ASTM or BS standard
- Weight. 11 kg approx.

27-WF1730 Laboratory vane apparatus

Detail of motorizing attachment

ACCESSORIES

Alternative Vanes

Model	D	H
27-WF1732	25.4	25.4
27-WF1733	12.7	25.4
27-WF1734	12.7	19

Motorizing attachment

Model	Standard	Speed [°/min]	Voltage
27-WF1730/2	BS 1377:7	6 to 12°	220V,50Hz, 1ph
27-WF1730/2Y	BS 1377:7	6 to 12°	220V,60Hz, 1ph
27-WF1730/3	ASTM D4648	60 to 90°	220V,50Hz, 1ph
27-WF1730/3Y	ASTM D4648	60 to 90°	220V,60Hz, 1ph
27-WF1730/4	ASTM D4648	60 to 90°	110V,60Hz, 1ph

Holding sampling tubes attachment

27-WF1736
Attachment to hold sample tubes of 38 and 100 mm dia.

TRIAXIAL SYSTEMS

The stress-strain behavior of soil is typically investigated with a triaxial test on undisturbed, remoulded or compacted specimens which are subjected to different stress levels and variable drainage conditions, simulating as closely as possible the site conditions and the effects of constructions, excavations, embankments, landslides, wave propagation, and seismic events.

Types of triaxial test: test descriptions

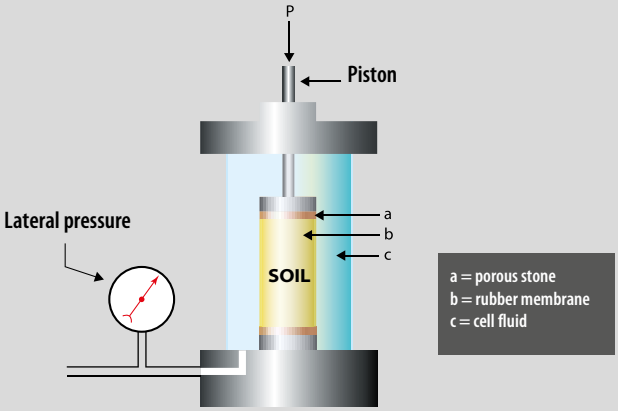
TOTAL STRESS - UNCONSOLIDATED UNDRAINED (UU) TEST

STANDARD

ASTM D2850 · BS 1377:7 · EN17892-8 · NF P94 070 · NF P94 074

With this method the shear strength is measured in terms of total stress. The soil specimen is not allowed to consolidate and maintains its original structure and water content, so that its compressive strength depends only on the level of geostatic stress in the field.

Tests are often carried out on three specimens from the same sample, each subjected to a different confining pressure. Provided that the soil is fully saturated, the shear strength will be the same for each test and is known as "undrained shear strength".



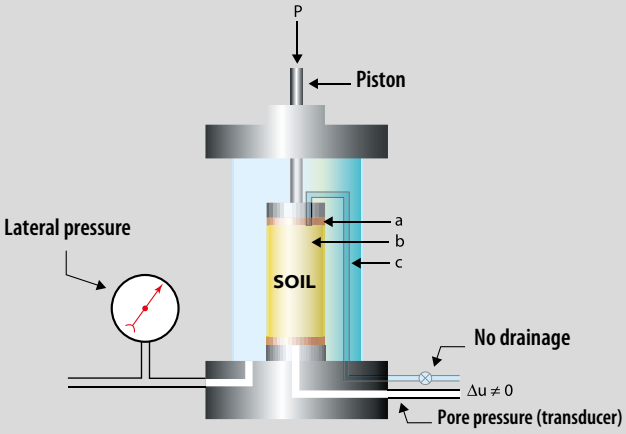
EFFECTIVE STRESS - CONSOLIDATED UNDRAINED (CU) TEST

STANDARD

ASTM D4767 · BS 1377:8 · EN 17892-9 · NF P94 070 · NF P94 074

With this test method the shear strength is measured in terms of effective stress. The specimen is saturated and allowed to consolidate (i.e. to change its structure and water content) at the required confining pressure. At the end of consolidation, the specimen is subjected to a controlled application of load, during which no drainage is allowed and pore pressure is measured. The effective stresses are calculated as the difference between the total stress and the pore pressure.

Since the shear strength is affected by the effective stresses, by testing a set of three specimens at different confining pressures, it is possible to define the failure envelope according to Coulomb's model and define the parameters c' and φ'.

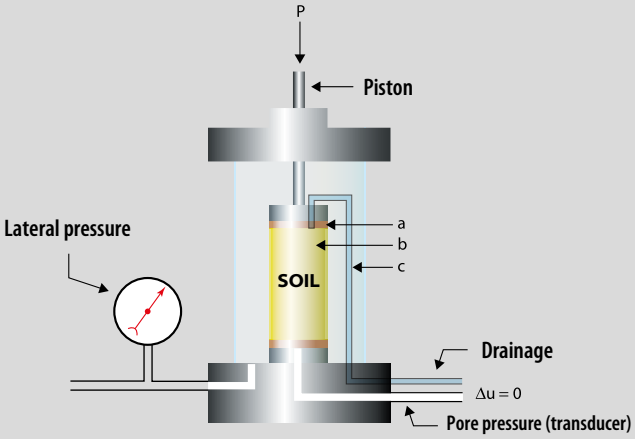


EFFECTIVE STRESS - CONSOLIDATED DRAINED (CD) TEST

STANDARD

ASTM D7181 · BS 1377:8 · EN 17892:9 · NF P94 070 · NF P94 074

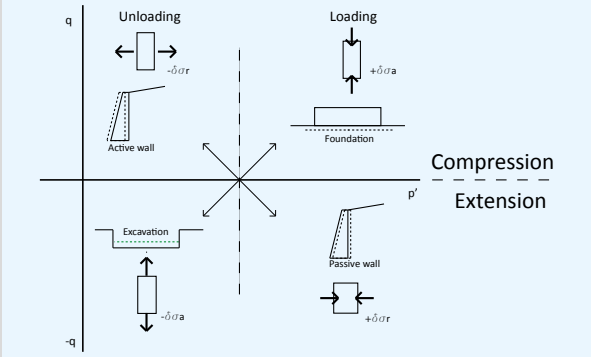
This test method is the same as the CU test except that the failure stage is carried out very slowly to prevent any change in the pore pressure inside the specimen, which is allowed to drain. Calculation of the total and effective stresses and failure envelope are also the same as for the CU test.



STRESS PATH TEST

Events on site such as excavation, construction or natural occurrences can produce changes in the magnitude and ratio of the principal stresses (major and minor). In a stress path test the horizontal and vertical pressures applied to the specimen are managed independently, which allows the behaviour of a soil subjected to anisotropic loading and unloading to be replicated and measured in the laboratory.

This test can only be accurately and reliably performed with an automatic servo-controlled closed-loop system.



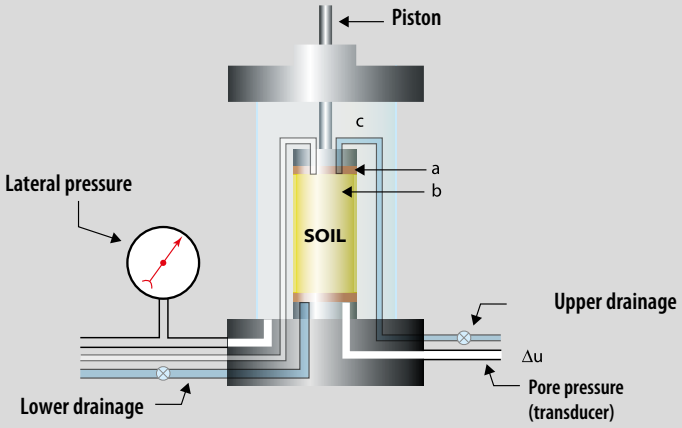
PERMEABILITY TEST IN A TRIAXIAL CELL

STANDARD

ASTM D5084 › BS 1377:6 › CEN-ISO/TS17892-11

The triaxial permeability test involves saturating and consolidating the specimen to the required effective stress in the same way as for a CD or CU test, but instead of a failure stage, water is allowed to flow through the specimen under a pre-defined difference of pressure and the rate of flow is measured. From this measurement the soil permeability is calculated.

Three independent pressure systems are used for this test; for the confining pressure, the drainage line to the top of the specimen and the drainage line to the base of the specimen.



UNSATURATED SOIL TEST

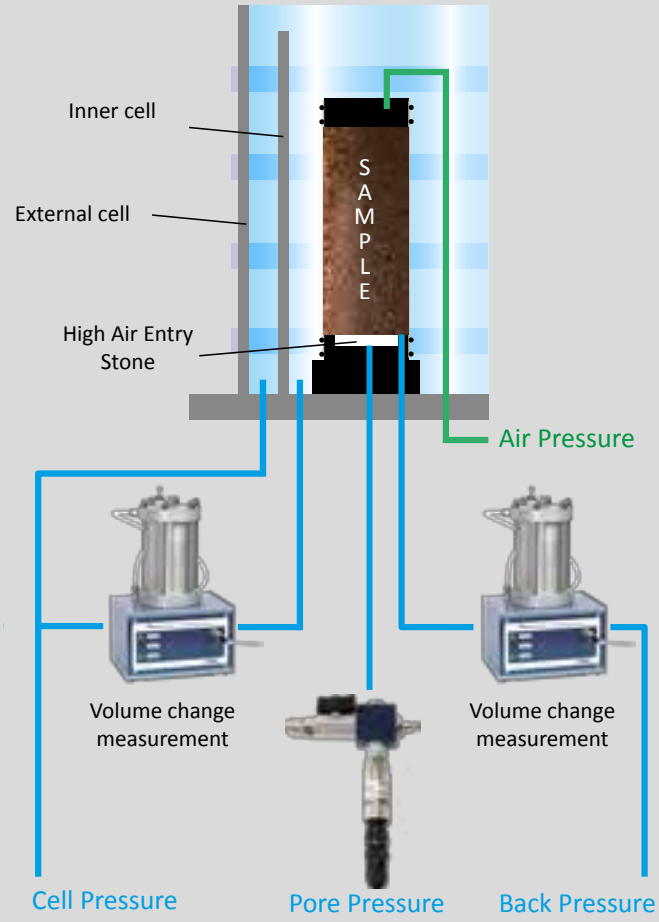
An unsaturated testing system is used when effective stress testing is required that recreates in-situ conditions of specimens that exist in a naturally unsaturated state (for example soil that is higher than the water table).

In an unsaturated soil, the voids between soil particles are filled with both air and water, and surface tension forces create a negative pore water pressure (or suction) which pulls the soil particles together and increases the strength of the soil. Saturating the soil (replacing the air in the voids with water) results in a positive pore water pressure which pushes the soil particles apart and reduces the overall strength. Because of this, it is not desirable to saturate unsaturated or partially saturated material, but neither can it be tested using conventional triaxial systems because the negative suction causes problems with the equipment.

The solution to this problem is to use what is known as the axis translation method, which involves applying an air pressure via the top cap (in the same way as a water back pressure in a saturated test). This raises the pressure inside the sample to a positive value which, in turn, applies a positive pressure to the porous stone and to the pore water pressure transducer.

A special triaxial cell is used for the test, with a double wall which allows the total change in sample volume to be measured, and a high air entry stone in the base pedestal that allows water to pass but not air.

Using the axis translation method with the double-wall cell allows effective stress testing to be carried out on unsaturated material.



TRIAXIAL SYSTEMS

With 75 years of expertise, Wykeham Farrance is the soil testing specialist. We have recently launched a new generation of Triaxial Systems, which are strictly compliant with International Standards. The following pages detail our 4 triaxial systems with increasing levels of sophistication. Coupled with a wide range of accessories presents a vast array of more than 8,000 configurations, which satisfies any customer requirement.

Triaxial System with analog measurements is the ideal basic solution to perform standard triaxial tests, such as effective and total stress, for laboratories that don't require digital measurement. All the data acquisition and test management are made in manual mode.

Triaxial System with automatic built-in data acquisition is the simplest compact solution for standard triaxial testing (effective and total stress). It can be equipped with standard air/water interface pressure system or with automatic pressure/volume controllers. No requirement for external data acquisition and/or PC.

Triaxial System with automatic external data acquisition is the expandable compact solution for standard triaxial testing (effective and total stress) and for many other soil tests. It can be equipped with standard air/water interface pressure system or with automatic pressure/volume controllers. Data acquisition can be shared with other soil testing equipment (e.g. consolidation and shear) acquisition and/or PC.

Fully Automatic PC controlled Triaxial System AUTOTRIAX 2: the advanced triaxial testing system that can automatically and contemporaneously run up to 6 independent tests without human intervention.

Standard triaxial system with analog measurements

STANDARD

▸ BS 1377:7 ▸ BS 1377:8 ▸ BS 1377:6 ▸ ASTM D2850
▸ ASTM D4767 ▸ ASTM D7181 ▸ ASTM D5084
▸ EN 17892: 8 ▸ EN 17892: 9

Standard triaxial system with analog measurement is the ideal basic solution for performing standard triaxial tests such as effective and total stress that don't require digital measurement. All the data acquisition and test management are made in manual mode.

Power supply is only required for air compressor and for triaxial load frame during failure stage.

Standard triaxial configuration with analog measurement can be easily extended in subsequent steps, in order to perform additional triaxial tests or it is also suitable for future upgrade to digital measurement system.

TEST
Total Stress (UU)
Effective Stress (CU,CD)
Permability
Unconfined
CBR
Others

MAIN FEATURES

» Fully analog data measurement using dial gauge, load ring, double burette and pore pressure manometer;

» Measuring with dedicated manometer, ensuring a negligible change in volume of the circuit of the pore pressure, as required by the Standards;

» Pressure system using air/water interface and triaxial panel with air pressure regulators;

» Easily extended with dedicated accessories to perform additional tests such as permeability, unconfined, CBR, etc.;

» Easily upgradable to digital measurement system

SYSTEM COMPONENTS

More than 400 system configurations are available depending on type of test, sample size, pressure system. Please contact us for full details.

Standard triaxial system with built-in digital data acquisition

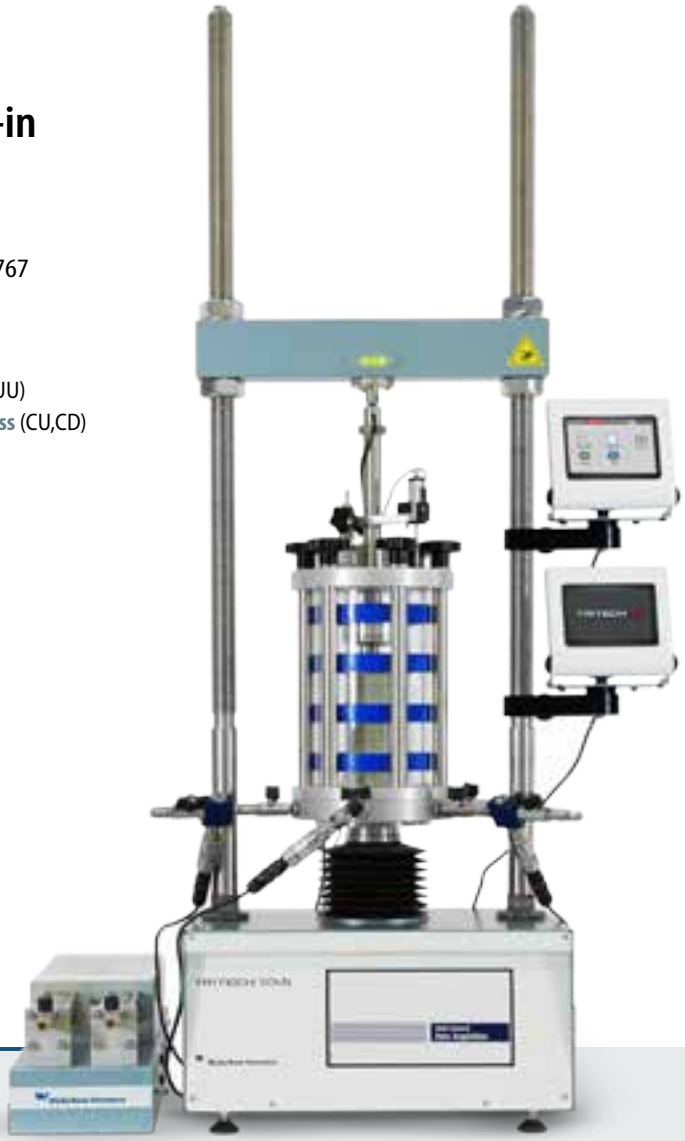
STANDARD

▸ BS 1377:7 ▸ BS 1377:8 ▸ BS 1377:6 ▸ ASTM D2850 ▸ ASTM D4767
▸ ASTM D7181 ▸ EN 17892: 8 ▸ EN 17892: 9

28

Standard triaxial system with built-in digital data acquisition measurement is the ideal compact solution for performing standard triaxial tests such as effective and total stress for educational customers not needing external data acquisition and PC. All data is saved to a flash memory stick.

TEST
Total Stress (UU)
Effective Stress (CU,CD)
Unconfined
CBR
Others



MAIN FEATURES

» On-board (via USB) automatic data acquisition for all the sensors required (vertical displacement, axial force, cell pressure, back pressure, pore pressure, volume change);

» User friendly 6" touch screen color panel for local control of load frame and monitoring of the four channels in real time;

» PC not strictly required for test management: tests can be easily managed from the 6" touch screen;

» Compact configuration with small footprint;

» Additional control mode, including machine and data acquisition via remote PC and software;

» Additional package for data processing and reporting, fully compliant with ASTM and BS-EN standards

Additional FEATURES
with Hydromatic Standalone solution

» Easier installation and saving space: compressed air apparatus, control panels and ancillary air/water systems no longer required;

» Closed loop automatic control and management of cell and back pressure;

» User friendly 6" touch screen color panel for local control of pressure and measurement in real time of pressure and volume change;

» Ergonomic and versatile support of the control panel to be adjusted according the user's preferences.

SYSTEM COMPONENTS

- Load frames: TRIAX 4C or TRITECH 4C page 69
- Triaxial cell: Standard or Banded page 71
- Pressure System: Air/water interface or HYDROMATIC STANDALONE page 76
- Digital measuring system page 79
- Template for data processing and reporting page 85
- De - airing System page 82

More than 2000 system configurations are available depending on type of test, sample size, pressure system. Please contact us for full details.

Standard triaxial system with external/expandable data acquisition

STANDARD

▸ BS 1377:7 ▸ BS 1377:8 ▸ BS 1377:6 ▸ ASTM D2850 ▸ ASTM D4767
▸ ASTM D7181 ▸ ASTM D5084 ▸ EN 17892: 8 ▸ EN 17892: 9

Standard triaxial system with external digital data acquisition measurement is the ideal expandable solution for performing standard triaxial tests such as effective and total stress in commercial laboratories needing central data acquisition to be shared with others machines.

TEST

Total Stress (UU)
Effective Stress (CU,CD)
Permability
Unconfined
CBR
Unsaturated
Others

MAIN FEATURES

» Expandable solution, suitable not only for standard triaxial testing (effective/total stress) but also for other types of soil testing;

» Data acquisition shared with other soil testing equipment: the transducers can be grouped and combined by the user for matching different applications;

» PC software for remote calibration of the channels and fully comprehensive data acquisition management;

» Multiple and flexible triaxial configuration (e.g. one frame and three cells) to perform simultaneously saturation, consolidation and monotonic shear;

» Additional package for data processing and reporting, fully compliant with ASTM and BS-EN Standards.

Additional FEATURES
with Hydromatic Standalone solution

» Easier installation and saving space: compressed air apparatus, control panels and ancillary air/water systems no longer required;

» Closed loop automatic control and management of cell and back pressure;

» User friendly 6" touch screen color panel for local control of pressure and measurement in real time of pressure and volume change;

» Ergonomic and versatile support of the control panel to be adjusted according the user's preferences;

» LAN connection to the GEODATALOG8: pressure and volume measurements can be easily synchronized with the other readings and transmitted at the same time to a PC

SYSTEM COMPONENTS

- Load frames: TRIAX or TRITECH page 68
- Triaxial cell: Standard or Banded page 71
- Pressure System: Air/water interface or HYDROMATIC STANDALONE page 76
- Digital measuring system page 79
- Template for data processing and reporting page 85
- De - airing System page 82

More than 2500 system configurations are available depending on type of test, sample size, pressure system. Please contact us for full details.

ADVANCED
SERIES

Automatic PC Controlled triaxial system

29-WFDIA2

The optimization of advanced technologies in hardware and software components for high efficiency triaxial tests

AUTOTRIAX EmS

STANDARD

- BS 1377:7
- BS 1377:7
- BS 1377:8
- BS 1377:6
- ASTM D2850
- ASTM D4767
- ASTM D7181
- ASTM D5084
- EN 17892: 8
- EN 17892: 9

This is one of the many **ADVANCED** products of CONTROLS Group range.

To get more info visit **www.controls-group.com** or link directly to the QRCode

FEATURES and BENEFITS

» 24/7 testing without interruption, maximizing productivity and reducing demands on your staff.

» Multitasking, user friendly Windows-based, the PC software complies with relevant standards.

» Automatic execution of up to six independent triaxial tests from start to finish with only one PC

» Real time display of all the transducers and calculated data for all live tests, with plots of measured and calculated data selectable by the user.

» Automatic control in real time of standard and non-standard tests (e.g. stress path tests)

» Ability to install software and fit additional accessories as required will enable the Autotriax EmS to perform many types of tests.

» The modular concept of the Autotriax EmS for easy expansion and upgrade.

» External factors and inconsistencies between different operators are minimized; test procedures are always repeatable and compliant.

» High-speed PC closed loop control for continuous monitoring and instantaneous reaction of systems components.

AUTOTRIAX2

DATA ACQUISITION AND CONTROL UNITS

- It manages pressure/volume controller, load frames, cell and back pressures, solenoid valves and transducers
- Transmits data and information between the software and all the active components
- Calibration data of connected transducers are saved in the firmware of the units
- Four different versions are available to offer maximum flexibility
- The modular design concept allows easy extension of the system

HYDROMATIC

PRESSURE AND VOLUME CONTROLLER

- Generates water pressure regulated under closed-loop control up to 3500 kPa or 1700 kPa
- Powers up to two hydraulic pressure lines and measures both the associated volume changes
- Measure pressure and volume change with high-resolution, respectively 0.1 kPa and 0.001 cc
- High volume capacity 250 cc
- No air compressor required

SERVOFLOW

AIR PRESSURE CONTROLLER AND WATER VOLUME CHANGE FOR UNSATURATED SOIL TESTS

- Automatic control of air pressure for unsaturated soil testing
- Low air consumption
- Measures the total volume change of an unsaturated soil sample in the double-wall triaxial cell
- Up to 1000 kPa air pressure regulation
- Volume change has a physical capacity up to 100cc, but thanks to automatic switching it can measure automatic volume change continuously

Deviator and shear stress plotted against axial strain during a monotonic shear stage (left), a saturation cell pressure increments with the graph showing the pore water pressure responding as the cell pressure is increased to the target

DEVICE MANAGEMENT SOFTWARE

Designed for setting up the configuration and allocation of the components of each triaxial system

TEST SOFTWARE

EFFECTIVE and TOTAL STRESS
Automatic or manual control of saturation, consolidation (for effective stress tests) and shear stage, according to ASTM and BS.

STRESS PATH MODULE (1) (2)
Activation code for stress path stages, with independent control of axial and radial stresses.

K_0 MODULE (1) (2)
Activation code for K_0 stages, with closed-loop control of the cross-sectional area of the soil sample.

PERMEABILITY MODULE (1)
Activation code for automatic or manual control of triaxial permeability stages.

UNSATURATED SOIL MODULE (1)
Activation code for automatic or manual control of unsaturated soils – axis translation method.

CRS – CONSTANT RATE OF STRAIN (1)
Activation code for automatic or manual control of Constant Rate of Strain

CBR – CALIFORNIA BEARING RATIO (1)
Activation code for CBR test

UNCONFINED (1)
Activation code for Unconfined test

(1) *An additional license must be purchased to unlock this module*
(2) *A vacuum top cap and submersible load cell must be used for tests with stages in extension*

Triaxial system components and accessories:

Triaxial load Frames

WYKEHAM FARRANCE's electro-mechanical TRITECH machines are the original high-performance load frames for triaxial tests. Introduced by the company over 50 years ago, they have undergone continuous development and are the ideal solution for advanced laboratories that want to perform high quality tests at high levels of productivity. High performance series, 50 and 100 kN cap., in two versions: standard (28-WF4005 and 28-WF4010) and with built-in data acquisition (28-WF4005/4C and 28-WF4010/4C), particularly suitable for advanced laboratories.

TRITECH

28-WF4005, 28-WF4005/4C, 28-WF4010, 28-WF4010/4C

Common FEATURES

- Ideal solution for advanced and research laboratories that require high productivity levels and high quality tests
- Designed for soil testing laboratories conducting UU, CU, CD and stress path* (compression/extension) tests
- Due to the variable speed range, unconfined, CBR and Marshall tests can also be performed
- Suitable for automatic PC-controlled triaxial testing (see AUTOTRIAX EmS system)*
- Maximum compression capacity: 50 kN or 100 kN
- Speed range from 0.00001 to 99.99999 mm/min
- Maximum sample diameter (for triaxial testing): 150 mm
- The quality of the design avoids vibrations that may affect the specimen
- Large high-contrast 4 x 20-character display with 6-key membrane keyboard*

TRITECH 50 and TRITECH 100 fitted with banded triaxial cell submersible load cell and pore pressure transducer

**Only for model 28-WF4005 and WF4010*

Ordering information

28-WF4005
Tritech50, Triaxial load frame 50 kN capacity 110-240 V, 50-60 Hz, 1 ph

28-WF4010
Tritech100, Triaxial load frame 100 kN capacity 110-240 V, 50-60 Hz, 1 ph

28-WF4005/4C
Tritech50, Triaxial load frame 50 kN capacity with 4 channels built-in data acquisition 110-240 V, 50-60 Hz, 1 ph

28-WF4010/4C
Tritech100, Triaxial load frame 100 kN capacity with 4 channels built-in data acquisition 110-240 V, 50-60 Hz, 1 ph

Models	28-WF4005	28-WF4010	28-WF4005/4C	28-WF4010/4C
4 built-in channels			●	●
Maximum sample diameter, mm	150	150	150	150
Minimum testing speed, mm/min	0.00001	0.00001	0.00001	0.00001
Maximum testing speed, mm/min	99.99999	99.99999	99.99999	99.99999
Maximum compression force, kN	50	100	50	100
Maximum tensile force, kN	5	5	5	5
Minimum vertical clearance, mm	335	390	335	390
Maximum vertical clearance, mm	1100	1140	1100	1140
Horizontal clearance, mm	364	498	364	498
Platen diameter, mm	158	158	158	158
Platen travel, mm	100	100	100	100
Dimensions, mm (h x w x d) (approx.)	1460 x 505 x 380	1830 x 600 x 520	1460 x 655 x 380	1830 x 750 x 520
Power, W	600	680	600	680
Weight, kg (approx.)	98	120	98	120

Triaxial load Frames

Standard triaxial system with built-in digital data acquisition measurement is the ideal compact solution for performing standard triaxial tests such as effective and total stress for educational customers not needing external data acquisition and PC. All data is saved to a flash memory.

TRITECH 50 and TRITECH 100 with 4 built-in channels fitted with banded triaxial cell submersible load cell and pore pressure transducers

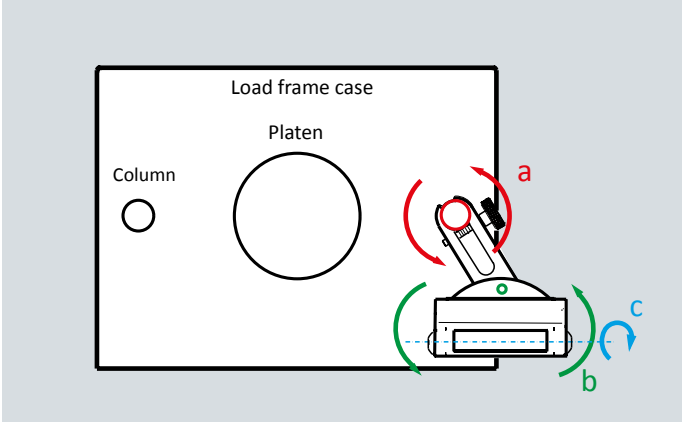
TRITECH

28-WF4005/4C , 28-WF4010/4C

Additional FEATURES

- » Wide 6" waterproof touch screen color graphic display allowing machine control, stream on screen data plot and tabulation;
- » Double control mode including machine and data acquisition via local touch screen display or from remote PC (not included) and software (included);
- » USB port to connect a memory stick (included with the machine) for test data storage;
- » Effective sampling rate up to 50 / sec;
- » LAN communication;
- » Automatic test start and stop according to preset conditions;
- » Local and remote transducers calibration through the dedicated software;
- » Graphical and numerical display of readings;
- » Multi-jointed display support.

Detail of the Tritech legendary gearbox, The system is designed to minimize the vibration and allow smooth transmission



The touchscreen controller is mounted on an ergonomic, multi-jointed support that allows its position to be adjusted in four different ways: changing the height of the support; rotating the support (a); swiveling the touchscreen (b); tilting the touchscreen (c)

Triaxial system components and accessories:

Triaxial load Frame

WYKEHAM FARRANCE's electro-mechanical TRIAX machines have been specifically designed for triaxial applications and are ideal for commercial laboratories that need a versatile machine capable of performing a wide range of tests.

TRIAX

28-WF4001 and 28-WF4001/4C

Common FEATURES

- Ideal solution for commercial laboratories a machine to perform high quality triaxial tests in addition to unconfined and general purpose compression tests.
- Designed for soil testing laboratories to perform UU, CU and CD triaxial tests on samples from 38 to 70 mm diameter.
- Maximum load frame capacity: 50 kN
- Maximum testing load depending on the selected test speed (variable from 40 to 7 kN). The choice of the opportune load cell capacity shall take into account this value
- Speed range from 0.00001 to 50.8 mm/min
- Large high-contrast 4 x 20-character display and 6-key membrane keyboard*
- Maximum sample diameter (for triaxial testing): 70 mm

**Only for model 28-WF4001*

TRIAX fitted with standard triaxial cell, dial gauge and load rings; TRIAX with 4 built-in channels fitted with standard triaxial cell, external load cell and displacement transducer.

TRIAX

28-WF4001/4C

Additional FEATURES

- Wide 6" waterproof touch screen color graphic display allowing machine control, stream on screen data plot and tabulation;
- Double control mode including machine and data acquisition via local touch screen display or from remote PC (not included) and software (included);
- USB port to connect a memory stick (included with the machine) for test data storage;
- Effective sampling rate up to 50 / sec;
- LAN communication;
- Automatic test start and stop according to preset conditions;
- Local and remote transducers calibration through the dedicated software;
- Graphical and numerical display of readings;
- Multi-jointed display support.

Model	28-WF4001	28-WF4001/4C
4 built-in channels		●
Maximum sample diameter, mm	70	70
Minimum testing speed, mm/min	0.00001	0.00001
Maximum testing speed, mm/min	50.8	50.8
Maximum load frame capacity, kN	50	50
Minimum vertical clearance, mm	390	390
Maximum vertical clearance, mm	725	725
Horizontal clearance, mm	380	380
Platen diameter, mm	158	158
Platen travel, mm	100	100
Dimensions, mm (h x w x d) (approx.)	1250 x 495 x 495	1250 x 645 x 495
Power, W	600	600
Weight, kg (approx.)	90	90

Ordering information

28-WF4001
Triax, Triaxial load frame 50 kN capacity 110-240 V, 50-60 Hz, 1 ph

28-WF4001/4C
Triax , Triaxial load frame 50 kN capacity with 4 channels built-in data acquisition 110-240 V, 50-60 Hz, 1 ph

Triaxial system components and accessories:

Standard Triaxial Cells

Standard triaxial cells essentially consist of a transparent polycarbonate chamber which has a top plate with a piston assembly fitted into it and a double flange base fitted to the bottom. Three (or six) simple thumb-screws are used to clamp the upper part of the cell to the base, which makes assembly and disassembly a very quick and simple operation.

Main FEATURES

- » Maximum working pressure of 1700 kPa
- » Light alloy construction, stainless steel ram and O-ring seal
- » Suitable for submersible and/or external load cell
- » Four on/off no-volume change valves fitted as standard
- » For sample sizes between 35 and 100 mm dia.
- » Suitable for total and effective stress tests
- » Rapid assembly design
- » Cells are designed to accommodate a specimen with a height twice its diameter
- » Pedestal, top caps, porous disc, rubber membranes and sealing rings are not included. See accessories.

Ordering information

28-WF0410/B
Standard triaxial cell for 35, 38 and 50 mm diameter samples

28-WF0411/B
Standard triaxial cell for 35, 38, 50 and 70 mm diameter samples

28-WF0416/B
Standard triaxial cell for 70 and 100 mm diameter samples

ACCESSORIES

Pedestal

Cell code Sample diameter, mm	28-WF0410/B	28-WF0411/B	28-WF0416/B
35	28-WF0410/A1	28-WF0411/A1	
38	28 WF0410/A2	28-WF0411/A2	
50	28-WF0410/A3	28-WF0411/A3	
70		28-WF0411/A4	28-WF0416/A1
100			28-WF0416/A2

Test			
Effective stress/Total stress	●	●	●

Model	28-WF0410/B	28-WF0411/B	28-WF0416/B
Nominal size diameter mm	50	70	100
For spec. size diameter mm	35 to 50	35 to70	35 to100
Max. working pressure [kPa]	1700	1700	1700
Max. height [mm]	450	500	560
Inlet points for top/bottom drainage, cell pressure, and pore pressure	4	4	4
Quick coupling for two drainage lines on the base	Included	Included	Included
Diameter mm (including valves)	270	310	340
Weight approx.[kg]	5	8	15

Detail of standard triaxial cell fitted with submersible load cell

Top Cap and Accessories

	Sample dimension	35	38	50	70	100
1	Top cap	**28-WF0420/A3**	**28-WF0422/A3**	**28-WF0425/A3**	**28-WF0428/A3**	**28-WF0432/A3**
2	Pair of porous discs	**28-WF0420/A4**	**28-WF4034**	**28-WF4054**	**28-WF4074**	**28-WF4104**
3	Membrane, 10 pieces	**28-WF0420/A5**	**28-WF4035**	**28-WF4055**	**28-WF4075**	**28-WF4105**
4	O Rings, 10 pieces	**28-WF0420/7**	**28-WF4036**	**28-WF4056**	**28-WF4076**	**28-WF4106**
5	Membrane stretcher	**28-WF0420/8**	**28-WF4031/A**	**28-WF4051/A**	**28-WF4071/A**	**28-WF4101/A**
6	O Ring placing tool	**28-WF0420/10**	**28-WF4031/B**	**28-WF4051/B**	**28-WF4071/B**	**28-WF4101/B**
7	Two part split former	**28-WF0420/A6**	**28-WF0422/A6**	**28-WF0425/A6**	**28-WF0428/A6**	**28-WF0432/A6**
8	Two part split mould	**28-WF0420/13**	**28-WF4031/D**	**28-WF4051/D**	**28-WF4071/D**	**28-WF4101/D**
9	Lateral filter drains, pack of 50	**28-WF0420/A9**	**28-WF4031/E**	**28-WF4051/E**	**28-WF4071/E**	**28-WF4101/E**
10	Filter discs, pack of 100	**28-WF0420/5**	**28-WF4031/F**	**28-WF4051/F**	**28-WF4071/F**	**28-WF4101/F**
11	Hand sampler	**28-WF0420/9**	**28-WF4031/G**	**28-WF4051/G**	**28-WF4071/G**	**28-WF4101/G**

28-WF4005/39
Platen adapter to fit standard triaxial cell (model 28-WF0410/B) onto TRITECH50

28-WF0410/B5
Piston locking device to hold the triaxial cell ram on triaxial cell model 28-WF041X/B

Standard triaxial cell, fitted with submersible load cell, displacement transducer

Triaxial cell and sample preparation accessories

Triaxial system components and accessories:

Banded triaxial cells

Banded triaxial cells essentially consist of a transparent chamber which is banded to prevent excessive expansion during the test. The design of the cell ensures vertical alignment of the loading ram by clamping the Perspex wall separately from the cell top. From 28-WF4070 to 28-WF4150 cells can be fitted with an upgrading kit so that tests can be performed using local strain transducers and bender elements.

Ordering information

28-WF4050
Banded triaxial cell for 38 and 50 mm diameter samples

28-WF4070
Banded triaxial cell for 38, 50 and 70 mm diameter samples

28-WF4100
Banded triaxial cell for 38, 50, 70, 100 mm diameter samples

28-WF4150
Banded triaxial cell for 38, 50, 70, 100, 150 mm diameter samples.

Main FEATURES

- Maximum working pressure of 2000 kPa or 3500 kPa (28-WF4050; 28-WF4070)
- Light alloy construction, stainless steel ram and O-ring seal
- Built-in cell ram clamp
- Five on/off no-volume changes valves fitted as standard
- For sample sizes between 38 and 150 mm diameter
- Suitable for submersible and/or external load cell
- Rapid assembly design
- Cells are designed to accommodate a specimen with a height twice its diameter
- Pedestal, top caps, porous disc, rubber membranes and sealing rings are not included. See accessories.
- Suitable perform stress path tests and dynamic test using a vacuum attachment (28-WF4070; 28-WF4100; 28-WF4150)
- Can be upgraded with an advanced kit making them compatible with mini on sample transducers and bender elements (28-WF4070; 28-WF4100; 28-WF4150)

ACCESSORIES

Pedestal

Cell code Sample diameter mm	28-WF4050	28-WF4070	28-WF4100	28-WF4150
38	28-WF4031/5	28-WF4031/7	28-WF4031/10	28-WF4031/15
50	28-WF4051/5	28-WF4051/7	28-WF4051/10	28-WF4051/15
70		28-WF4071/7	28-WF4071/10	28-WF4071/15
100			28-WF4101/10	28-WF4101/15
150				28-WF4151/15

Model	28-WF4050	28-WF4070	28-WF4100	28-WF4150
Nominal size diameter (mm)	50	70	100	150
Diameter range (mm)	38 to 50	38 to70	38 to100	38 to150
Max. working pressure (kPa)	3500	3500	2000	2000
Max. height [mm]	410	550	600	710
Inlet points for top/bottom drainage, cell pressure, and pore pressure	5	5	5	5
Quick coupling for two drainage lines on the base	Included	Included	Included	Included
Vacuum attachment for vacuum top cap for extension tests	○	Included	Included	included
Upgrading option for use of mini-on-sample transducers and bender elements	○	With **28-WF4070/ADV**	With **28-WF4100/ADV**	With **28-WF4150/ADV**
Diameter including valves (mm)	350	400	440	520
Weight approx.[kg]	7	18	21	40

Test				
Effective stress/Total stress	●	●	●	●
Stress path		●	●	●
Dynamic test		●	●	●
On sample/Bender elements		●	●	●

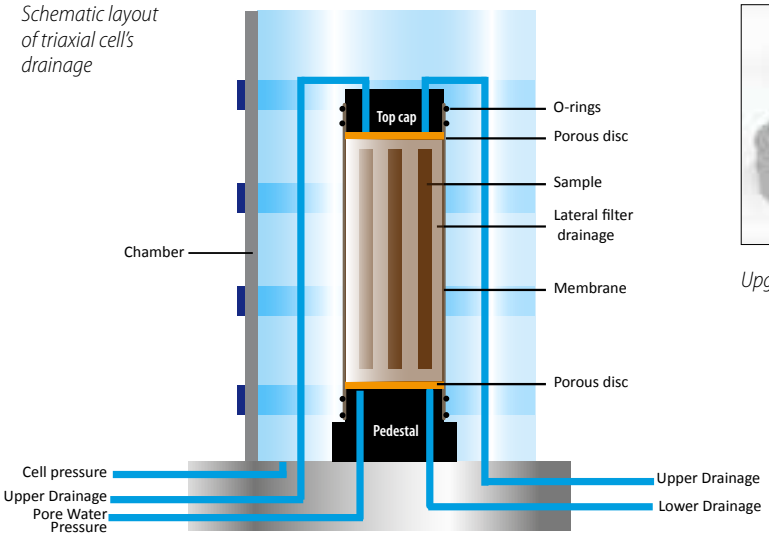
Top Cap and Accessories

Triaxial cell and sample preparation accessories

	Sample dimension	38	50	70	100	150
1	Top cap	**28-WF4032/A**	**28-WF4052/A**	**28-WF4072/A**	**28-WF4102/A**	**28-WF4152/A**
2	Vacuum top cap*	**28-WF4032/AV**	**28-WF4052/AV**	**28-WF4072/AV**	**28-WF4102/AV**	**28-WF4152/AV**
3	Base disc	**28-WF4033**	**28-WF4053**	**28-WF4073**	**28-WF4103**	**28-WF4153**
4	Pair of porous discs	**28-WF4034**	**28-WF4054**	**28-WF4074**	**28-WF4104**	**28-WF4154**
5	Membrane, 10 pieces	**28-WF4035**	**28-WF4055**	**28-WF4075**	**28-WF4105**	**28-WF4155**
6	O Rings, 10 pieces	**28-WF4036**	**28-WF4056**	**28-WF4076**	**28-WF4106**	**28-WF4156**
7	Membrane stretcher	**28-WF4031/A**	**28-WF4051/A**	**28-WF4071/A**	**28-WF4101/A**	**28-WF4151/A**
8	O Ring placing tool	**28-WF4031/B**	**28-WF4051/B**	**28-WF4071/B**	**28-WF4101/B**	**28-WF4151/B**
9	Two parts split mould	**28-WF4031/D**	**28-WF4051/D**	**28-WF4071/D**	**28-WF4101/D**	**28-WF4151/D**
10	Lateral filter drains, pack of 50	**28-WF4031/E**	**28-WF4051/E**	**28-WF4071/E**	**28-WF4101/E**	**28-WF4151/E**
11	Filter discs, pack of 100	**28-WF4031/F**	**28-WF4051/F**	**28-WF4071/F**	**28-WF4101/F**	**28-WF4151/F**
12	Hand sampler	**28-WF4031/G**	**28-WF4051/G**	**28-WF4071/G**	**28-WF4101/G**	-
13	Two part split former with vacuum attachment	**28-WF4031/H**	**28-WF4051/H**	**28-WF4071/H**	**28-WF4101/H**	**28-WF4151/H**

** Used for stress path and dynamic testing with dedicated triaxial cell with vacuum attachment*

Schematic layout of triaxial cell's drainage



Upgrading kits, 28-WF4070/ADV, 28-WF4100/ADV, 28-WF4150/ADV

Triaxial system components and accessories:

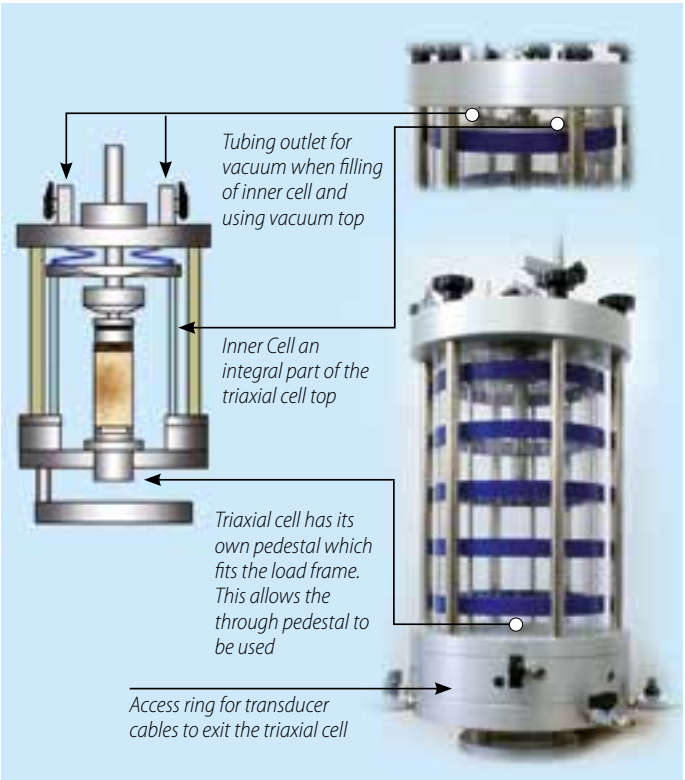
Double wall triaxial cell - Unsaturated Test

Double wall triaxial cell with inner wall, complete with access ring for transducer cables. The cell has to be completed with the base pedestal with High Entry Stone. See accessories. For detailed information and a complete test configuration please visit our website.

Main FEATURES

- » Ideal solution for measuring volume change in unsaturated soil test
- » To be used together with High Air Entry Stone mounted in the specific pedestal, for Axis translation method
- » Maximum working pressure up to 2000 kPa
- » Two models available up to 70 mm sample or up to 100 mm sample
- » Suitable for 50, 70 ,100 mm diameter sample
- » Including vacuum attachment for vacuum top cap for extension test suitable also for saturated soil sample
- » Different capacity of HAES from 1 bar up to 15 bar

Model	28-WF4170	28-WF4171
For spec. size diameter mm	50 to 70	50 to100
Max. working pressure kPa	2000	2000
Max. height [mm]	690	795
Inlet points	6	6
Quick coupling for two drainage lines on the base	Included	Included
Vacuum attachment	Included	Included
Diameter mm (including valves)	478	535
Weight approx.[kg]	30	50



ACCESSORIES

Triaxial cell unsaturated pedestal.
Including 3 bar High Air Entry Stone (HAES).

Dia. mm	For cell 28-WF4170	For cell 28-WF4171
50	**28-WF4170/50**	**28-WF4171/50**
70	**28-WF4170/70**	**28-WF4171/70**
100	-	**28-WF4171/100**

Alternative High Air Entry Stones (HAES).
The 3 bar HAES included in the pedestal can be easily replaced with stones of 1, 5 or 15 max. pressure, as indicated in the following table.

Pedestal dia. mm Max pressure	50	70	100
1 bar	**28-WF4150/1B**	**28-WF4170/1B**	**28-WF4171/1B**
5 bar	**28-WF4150/5B**	**28-WF4170/5B**	**28-WF4171/5B**
15 bar	**28-WF4150/15B**	**28-WF4170/15B**	**28-WF4171/15B**

Components of pedestal set for unsaturated cell:
1) Pedestal for unsaturated test;
2) High Air Entry Stone HEAS) sealed on aluminum ring;
3) Aluminum compensation ring;
4) Aluminum plate for saturated soil test;
5) Porous stone for saturated soil test

Triaxial system components and accessories:

Pressure Systems

We propose three different systems:

- Oil/Water pressure apparatus
- Air/Water pressure system
- Hydromatic Standalone - pressure/volume controller

28

Each system has to be completed with the De-airing water system. See page 82

HYDROMATIC

Standalone - pressure/volume controller

Hydromatic standalone is a general-purpose water pressure source and volume change controller. It is driven by a stepper motor, which enables the unit to measure the volume change.

Main Menu

Main FEATURES

- » Multi-positioning, ergonomic and removable 6" color touch screen controller
- » Powers one or two hydraulic pressure lines and measures the associated volume changes
- » Generates water pressure regulated under closed-loop control up to 3500 kPa or 1700 kPa
- » USB pen drive for local data storage
- » Connectable to the GEODATALOG 8 via LAN port allowing data transmission to PC by the DATACOMM 2 software
- » High resolution measurement of pressure (0.1 kPa) and volume change (0.001 cc)
- » High volume capacity, 250 cc
- » Lightweight with a small footprint,
- » No air compressor required

Auto Control: Automatic execution of pre-programmed steps of pressure and/or volume change

Ordering information

28-WF45DG
HYDROMATIC standalone closed loop pressure/volume controller,3500 kPa max. pressure. Powers two hydraulic pressure lines and measures the associated volume change. Supplied with pressure transducers and de-airing blocks. 110-240V, 50-60Hz, 1 ph

28-WF45SG
HYDROMATIC standalone closed loop pressure/volume controller, same as above but powering one pressure line.

28-WF43DG
HYDROMATIC standalone closed loop pressure/volume controller, 1700 kPa max. pressure. Powers two hydraulic pressure lines and measures the associated volume change. Supplied with pressure transducers and de-airing blocks.110-240V, 50-60Hz, 1 ph

28-WF43SG
HYDROMATIC standalone closed loop pressure/volume controller, same as above but powering one pressure line.

Note: *on request traceable calibration certificates of pressure and volume measurement are available*

The Hydromatic body can be positioned vertically, for a compact arrangement of testing components

Triaxial system components and accessories:

Pressure Systems

AIR/WATER PRESSURE SYSTEM AND CONTROL PANELS

Bladder air/water pressure cylinders

The system comprises the Distribution panel, Bladder cylinder (one for each pressure line) and Air compressor.

The cell, made from transparent acrylic tube, flanged between two light alloy discs, incorporate a rubber membrane and can operate continuously at a pressure up to 1000 kPa. The unit acts as a reservoir/interface between compressed air, used as a pressure source and water used as the pressurizing medium in the triaxial cell.

Main FEATURES

- Used to deliver pressurized water up to 1000 kPa to triaxial cells by the pressure distribution panels.
- High degree of accuracy
- Bladder enables the use of de-aired water
- Large reservoir to cope with long term tests and large samples
- Dimensions: diameter 178 x 410 mm
- Weight: 5.8 kg approx.

Pressure distribution panels

Two models available: 28-WF4330 for two pressure lines and 28-WF4331 for three pressure lines. They include precision air regulators, pressure outlets and quick release fittings.

28-WF4331 Three lines pressure

Ordering information

28-WF4320
Bladder air/water pressure cylinder

28-WF4330
Two lines pressure distribution panel, complete with air regulators and pressure outlets.

28-WF4331
Three lines pressure distribution panel, complete with air regulators and pressure outlets.

28-WF4330/2
Digital pressure gauge, range 0-2000kPa x 1kPa division

28-WF4191
Nylon tubing 8x6 mm (ID-OD) 10 m coil

Note: *For a suitable laboratory air compressor and related accessories (Air filter, Nylon tubing etc.) see page 433*

OIL/WATER PRESSURE SYSTEM

This apparatus provides an infinitely variable constant pressure using an adjustable spring type dead weight pressure feedback system connected in-line with a pump and an oil/water interchange vessel.The apparatus comprises: hydraulic pump, honed piston/spring assembly, cylindrical oil/water interchange vessel, pressure gauge, valves, 2 kg of oil.

Main FEATURES

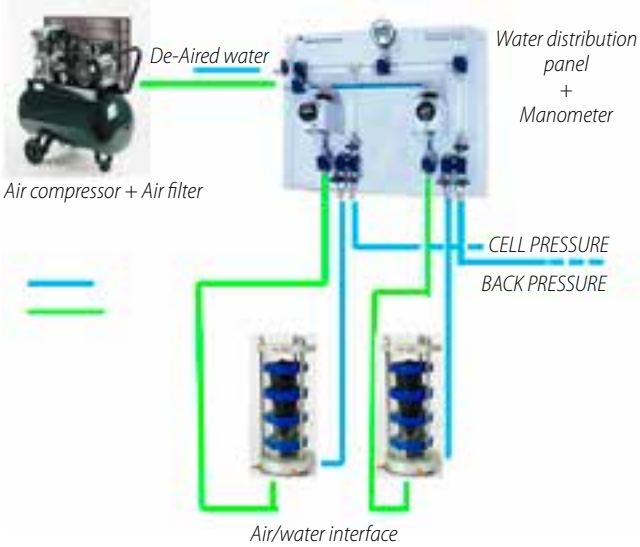
- Generates and automatically controls the set pressure up to a maximum of 3500 kPa (500 p.s.i.) within ± 0.5%
- Very stable over long periods
- Required pressure set using precision hand wheel control
- Stepless pressure increments
- No weights nor calibration required
- Dimensions: 310 x 300 x 400 mm
- Weight approx.: 16 kg

Ordering information

28-WF4312
Oil and water constant pressure apparatus for pressure up to 3500 kPa. 230 V, 50 Hz, 1 ph

28-WF4314
Same as above but 110 V, 60 Hz, 1 ph

Typical layout with air/water interface system for a standard triaxial system



Triaxial system components and accessories:

Manual measurement system for triaxial testing

LOAD – LOAD RINGS

They can be directly connected to the adapter fit on the crosshead of triaxial frames. Using the 28-WF1049 connector (see accessories) they can be adapted to our complete range of triaxial cells.

Supplied complete with calibration chart.

- High resolution dial gauge. 0.001 mm
- Accuracy: ±1%
- Dimensions: 182 mm diameter 214 mm high
- Weight approx.: 1.2 to 2.2 kg

Ordering information

Capacity [kN]	Model
1	**82-T1000/1M**
2	**82-T1000/2M**
5	**82-T1000/5M**
10	**82-T1000/10M**

Other capacites are available..

Accessories

28-WF1049
Connector for triaxial cells

AXIAL STRAIN - DIAL INDICATORS

50 mm dial diameter, clockwise rotation. Supplied complete with rear mounts for connection to load rings.

- Weight approx.: 200 g

Travel [mm]	Model
30	**28-WF6402**
50	**28-WF6403**

PORE PRESSURE – PRESSURE MANOMETER

Pore water pressure can be measured using a Pressure manometer with anti-twist device that can be fitted directly to the triaxial cell.

28-WF4451
Digital manometer 2000 kPa capacity x 1 kPa division for measuring pore water pressure in triaxial systems with manual measurement. Supplied with anti-twist device and de-airing block

VOLUME CHANGE - DOUBLE BURETTE VOLUME CHANGE APPARATUS

Comprising two measurement tubes, which have a 25 ml burette mounted internally and an acrylic tube externally. The burette tubes are connected directly to a reversing valve system, which is used to reverse the direction of travel of the interface in the measurement tubes without affecting the direction of flow of water to or from the triaxial cell. The unit also includes a by-pass valve system when volume change measurement is not required. Burettes are calibrated to Class A.

Ordering information

28-WF4400
Double burette volume change apparatus
Dimensions: 130x682x87 mm
Weight approx.: 3 kg

Accessories

28-WF4400/1
Red dye hydrocarbon soluble pack for 500 ml

Triaxial system components and accessories:

Electronic measurement system for triaxial testing

LOAD – EXTERNAL LOAD CELL

Used to measure the axial force applied to the specimen in the triaxial cells.

Complete with connector to the upper beam of our Triaxial load frames.

Ordering information

Cap. [kN]	Model
3.5	**28-WF0370/T**
10	**28-WF0373/T**
25	**28-WF0374/T**
50	**28-WF0375/T**
100	**28-WF0376/T**

VOLUME CHANGE – VOLUME CHANGE DEVICE

The apparatus provides an electrical signal directly proportional to the volume of water flowing through the unit. The apparatus comprises a piston connected to a 25 mm travel linear transducer and sealed against a precision-machined calibration chamber.

Technical specification
- Capacity: 100 cc
- Dimension: 260x280x400 (w x dxh)

28-WF4410
Automatic volume change apparatus

LOAD – SUBMERSIBLE LOAD CELL

Submersible (internal) load cells have been designed to work inside the triaxial cells. They have a lower hysteresis and very good linearity together with a substantial over load safety feature.

Ordering information

Cap. [kN]	Triaxial cell model	Model
1	**28-WF0410/B** **28-WF4050** Diam. Ram 15.5 mm	**28-WF6350**
5		**28-WF6352**
10		**28-WF6354**
1	**28-WF0411/B** **28-WF0416/B** **28-WF4070** Diam. Ram 25 mm	**28-WF6351**
5	**28-WF4100**	**28-WF6353**
10	**28-WF4150**	**28-WF6355**
25		**28-WF6356**
50		**28-WF6357**

PORE PRESSURE – PRESSURE TRANSDUCERS

Used for measuring soil pore water pressure

Cap. [kPa]	Model
1000	**28-WF6300/A**
2000	**28-WF6301/A**
3500	**28-WF6302/A**

Accessories

28-WF6310
De-airing block

Pressure transducer with de-airing block

AXIAL STRAIN – DISPLACEMENT TRANSDUCERS

Used for measuring axial deformation on soil sample

Potentiometric transducer

Travel [mm]	Model
25	**30-WF6208**
50	**30-WF6209**
100	**30-WF6210**

Accessories

28-WF6220
Mounting bracket for 28-WF4050 and 28-WF0410/B

28-WF6221
Mounting bracket for 28-WF4070; 28-WF4100; 28-WF4150; 28-WF4170; 28-WF4171; 28-WF0411/B; 28-WF0416/B

In case all the sensors here presented, are supplied complete with data acquisition system, then a traceable calibration certificate is available on request. For ordering information add suffix 'C' to the relevant product code (e.g. 28-WF6208/C)

Triaxial system accessories:

Measurement of maximum shear modulus (Gmax) Bender elements

Bender elements allow the measurement of the maximum shear modulus (Gmax) of a soil sample and from this data to evaluate the stiffness of a soil. Gmax is generally associated with shear strain levels of about 0.001% and is a key parameter in small strain dynamic analysis, such as those to predict soil behavior or soil structure interaction during earthquakes, explosions or machine and traffic vibrations.

Main FEATURES

- » Used for Gmax determination in soil sample
- » Compact and convenient smart-unit with LAN PC connection
- » Includes signal generator and receiver to measure S & P wave velocities giving more in-depth specimen analysis
- » Easy flight time calculations with intuitive software using dedicated algorithm
- » Versatile multi-wave generator (sine, haversine, morlet).
- » Obtain high resolution results with flexible Data Acquisition at up to 15 Mega Samples/Second
- » Use with Banded triaxial cells upgraded with suitable kits or standalone with optional accessories
- » Suitable for specimen with diameters ranging from 50 to 150mm
- » Multi-frequency test up to 100 kHz
- » Maximum working pressure of 3500 kPa

Ordering information

Diameter [mm]	Triaxial cell	Compression test only *	Compression / extension test **
50	28-WF4070	**28-WF4057/PS**	**28-WF4058/PS**
70	28-WF4070	**28-WF4077/PS**	**28-WF4078/PS**
	28-WF4100	**28-WF4077/PS1**	**28-WF4078/PS1**
100	28-WF4100	**28-WF4107/PS**	**28-WF4108/PS**
150	28-WF4150	**28-WF4157/PS**	**28-WF4158/PS**

** kit includes top cap, pedestal and pair of sintered ring porous stone*
***kit includes vacuum top cap, pedestal, pair of sintered ring porous stone*

Accessories

28-WF4200
Compact and convenient smart-unit, includes signal generator and receiver to measure S & P wave velocities. LAN PC connection. PC Not included.

Bender elements setup offering the possibility to test specimen without using triaxial cell

For complete information and details, including complete test configurations, please ask for the co-operation of our specialist

User friendly bender elements software

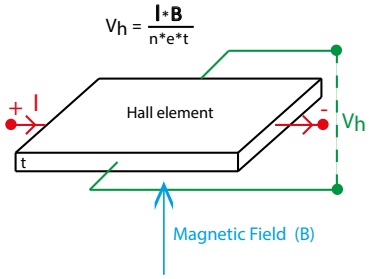
Triaxial system accessories:

Local strain measurement – Mini On-sample

In conventional triaxial testing the stiffness of a soil specimen is determined by external measurement of displacement. Such measurement is subjected to errors caused by deflections of loading system and bedding of the porous stone onto the ends of the specimen. Local axial and radial strain transducers avoid these problems.

Main FEATURES

- » Suitable for specimen diameters from 38 to 150mm
- » Maximum working pressure of 3500 kPa
- » For use with Banded triaxial cells upgraded with suitable kits and Double wall triaxial cells
- » Axial and radial deformation measured directly on the triaxial test specimen
- » Suitable for static and dynamic data acquisition by triaxial systems



Local strain transducers are supplied in a kit which includes one radial and two axial transducers suitable for 38mm, 50mm,70mm, 100mm and 150mm specimen diameters. Mounting accessories such as radial belt, mounting brackets and jig are also included.

Sample Diameter [mm]	Static tests	Dynamic tests
38	**28-WF4039/KM**	**28-WF4039/KN**
50	**28-WF4059/KM**	**28-WF4059/KN**
70	**28-WF4079/KM**	**28-WF4079/KN**
100	**28-WF4109/KM**	**28-WF4109/KN**
150	**28-WF4159/KM**	**28-WF4159/KN**

NOTE: *The transducers mentioned above are also available with traceable calibration certificates 28-WF4XXX/KMC or 28- WF4XXX/KNC*

Transducers mounted on a sample

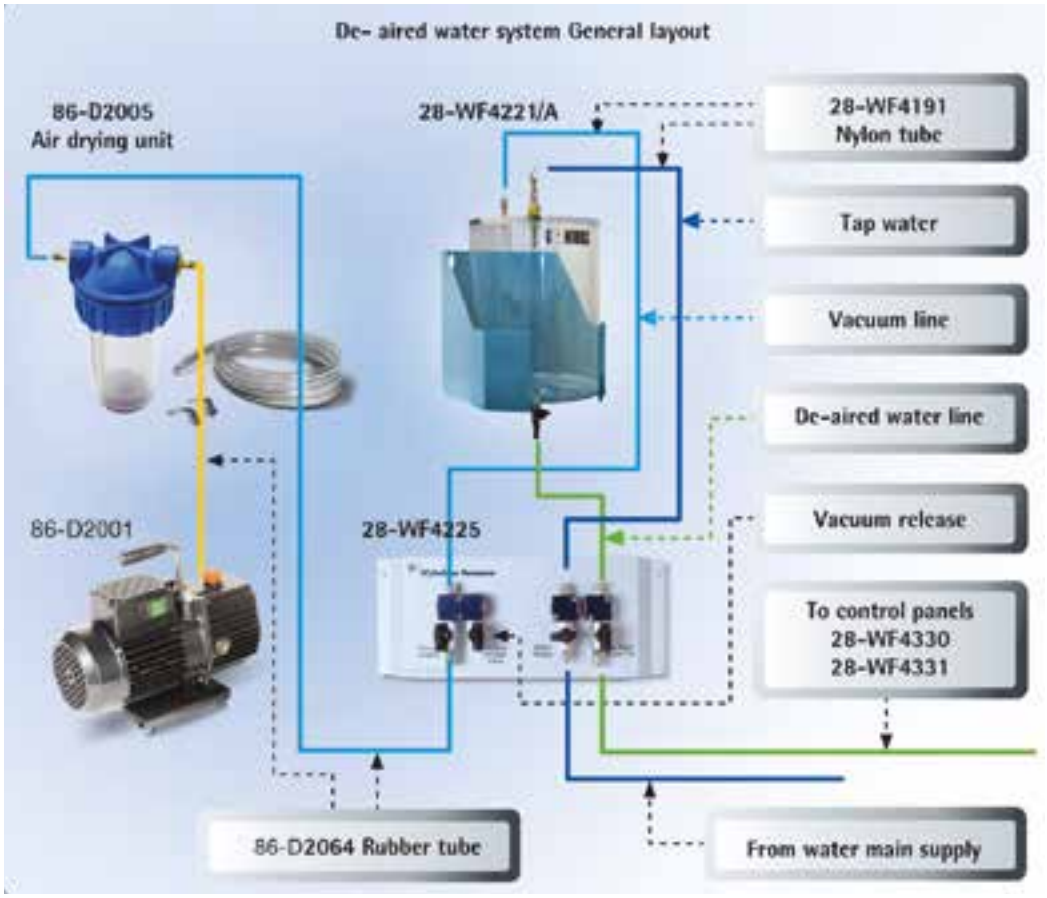
Banded triaxial cell 28-WF4070 fitted with upgrading kit 28-WF4070/ADV for using bender elements and local strain transducers

Triaxial system accessories:

De-Airing water system

De-airing the water that will be used to fill triaxial cells, pressure systems and volume change measurement apparatus, is essential for properly saturating soil specimens.
The system comprises the following:

- A de-airing tank (two versions are available with 7 or 23 L capacity)
- Vacuum pump with air drying unit
- Valve panel
- Tubing and accessories



DE-AIRING WATER TANK

Transparent acrylic cylinder fitted with a water spray inlet, an air inlet and a metal stand. Can be wall mounted

Models	28-WF4220/A	28-WF4221/A
Capacity	7 l	23 l
Dimensions	579 X200 X 209	619 x 320 x 311
Weight approx.:	6.4 kg	12 kg

VALVE PANEL

To control the water going in and out of the de-airing tank. For connecting the de-airing tank to the vacuum pump.
Dimensions: 510 x 200 x 30 mm
Weight approx.: 3 kg

28-WF4225
Valve panel for use with de-airing tank

TUBING

28-WF4191
Nylon tubing 6mm bore x 8mm outside diameter, 10 meter length

86-D2064
Rubber tube diameter 6.5 x 16.5 mm 2 m long, for vacuum pumps

VACUUM PUMP AND AIR DRYING UNIT

The vacuum pump 86-D2001 has to be used with the air drying unit (86-D2005) filled with silica gel desiccant (86-D0819). This is recommended to avoid/limit water vapour mixing with the oil in the pump. When the pump will be used intensively, use of the outlet mist filter (86-D2001/3) is also recommended, which collects any oil vapour issuing from the oil reservoir during operation.

VACUUM PUMP

Free air displ.: 75 l/min
Ultimate vacuum: 0.1 mbar
Dimensions: 300 x 150 x 240 mm
Weight approx.: 8.5 kg

AIR DRYING UNIT

Plastic frame with acrylic cylinder
Dessicant capacity : 500 g approx..
Dimensions: diameter 185 x 300 mm approx..
Weight (empty): 1 kg approx..

OUTLET MIST FILTER (OPTIONAL)

Weight approx.: 0.7 kg

Ordering information

Vacuum pump and Air drying unit

86-D2001
Portable vacuum pump, free air displacement 75 l/min, ultimate vacuum 0.1 mbar. 230V/50-60Hz/1Ph

86-D2001/Z
As above but 110V/60Hz/1Ph

86-D2005
Air drying unit. For use with Silica gel with indicator, 86-D0819 (OPTIONAL)

86-D2001/3
Outlet mist filter

Triaxial system accessories:

Determination of permeability of normal and contaminated soil sample

STANDARD

▸ ASTM D5084 ▸ BS 1377:6 ▸ CEN-ISO/TS 17892-11

PERMEABILITY SYSTEM USING TRIAXIAL CELL

This system has been developed for the laboratory measurement of the hydraulic conductivity (coefficient of permeability) of water saturated porous materials. The test is performed using a triaxial cell fit with 5 no-volume change valves: 2 for upper drainage, 2 for lower drainage and 1 for water pressure. The cell is connected with three independent pressure systems for the cell fluid, the drainage line to the top of the specimen and the drainage line to the base of the specimen. The complete test system includes:

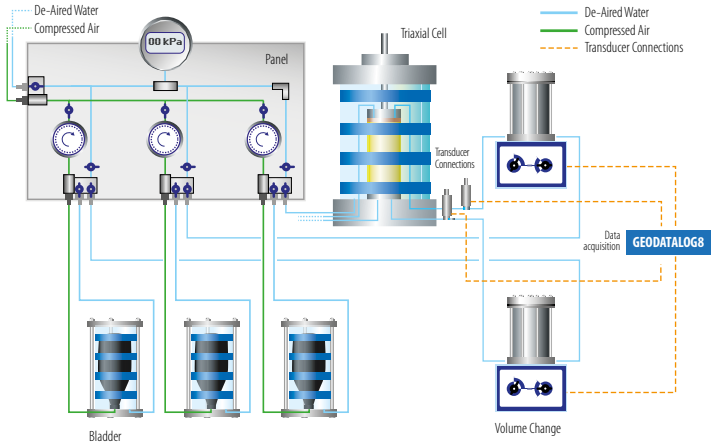
- Triaxial cell with accessories for 38, 50, 70 or 100 mm specimens
- Pressure control panel, three pressure lines
- Bladder type air/water pressure system
- De-airing water system and accessories

For a complete test configuration please visit our website.

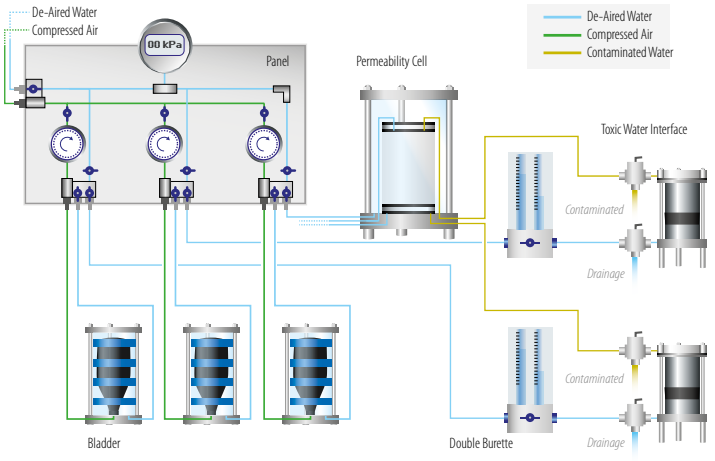
PERMEABILITY CELL FOR CONTAMINATED SOIL SAMPLES

The permeability cell is available with stainless steel valves for use with contaminated soils. The toxic interface chamber 28-WF0194/3 is recommended to be fit between control panel and permeability cells to avoid toxic permeants from entering the control panel. This also prevents contact of air with the permeant, thus no toxic or corrosive vapours can escape into the laboratory.

Permeability tests in triaxial cell with data acquisition



Permeability tests in triaxial cell with contaminated water



Ordering information

28-WF0194/B
Permeability cell with stainless steel valves for use with contaminated soil
- Dimensions:
  300x355 mm (dxh) approx.
- Weight approx.: 5 kg

28-WF0194/3
Toxic interface chamber
Weight: approx. 3 kg

Accessories

Sample diameter mm	70	100
Pedestal	28-WF0194/B1	28-WF194/B2
Porous discs	28-WF4074	28-WF4104
Membranes	28-WF4075	28-WF4105
O-Rings	28WF4076	28-WF4106
O-Ring placing tool	28-WF4071/B	28-WF4101/B
Suction device	28-WF4071/A	28-WF4101/A
Two part split former	28-WF4071/D	28-WF4101/D

GEODATALOG 8
Data acquisition Unit

30

30-WF6008
GEODATALOG 8, MULTIPURPOSE, WITH DEDICATED SOFTWARE

GEODATALOG 8 is a multipurpose data logger which works directly connected to a PC. Data is automatically transferred to the PC in real time for live monitoring of the tests progress. GEODATALOG 8 records and monitors in real time the measurements requested for soil mechanics testing, as: consolidation, shear, triaxial, permeability and many others.

The data acquisition unit is supplied complete with general purpose DATACOMM 2 PC software for fully comprehensive data management of both GEDOTALOG 8 and HYDROMATIC.

DATACOMM 2 software combines the active channels into customizable groups by the operator. Data acquisition for each group is an independent task which can be started/stopped automatically with specific acquisition and logging mode. Software allows remote calibration of the connected sensors up to 10 points with polynomial fitting curve up to eight degrees.

ASCII format data export is available in combination with our geotechnical Geo-Analysis-Templates suitable for post-processing and printout of test certificates according to the most important international Standards.

Main FEATURES

» Up to 8 independent input channels.

» Modular and flexible concept Network configuration of up to 64 independent channels.

» LAN / Ethernet connection to PC via dedicated software (included).

» Compatible with load cells, pressure transducers, strain gauges, LDT/ LVDT/potentiometric displacement transducers.

» Effective resolution: 131,000 points.

» Sampling rate up to 500 readings per second per channel.

» Numerical and graphical display of readings via PC software.

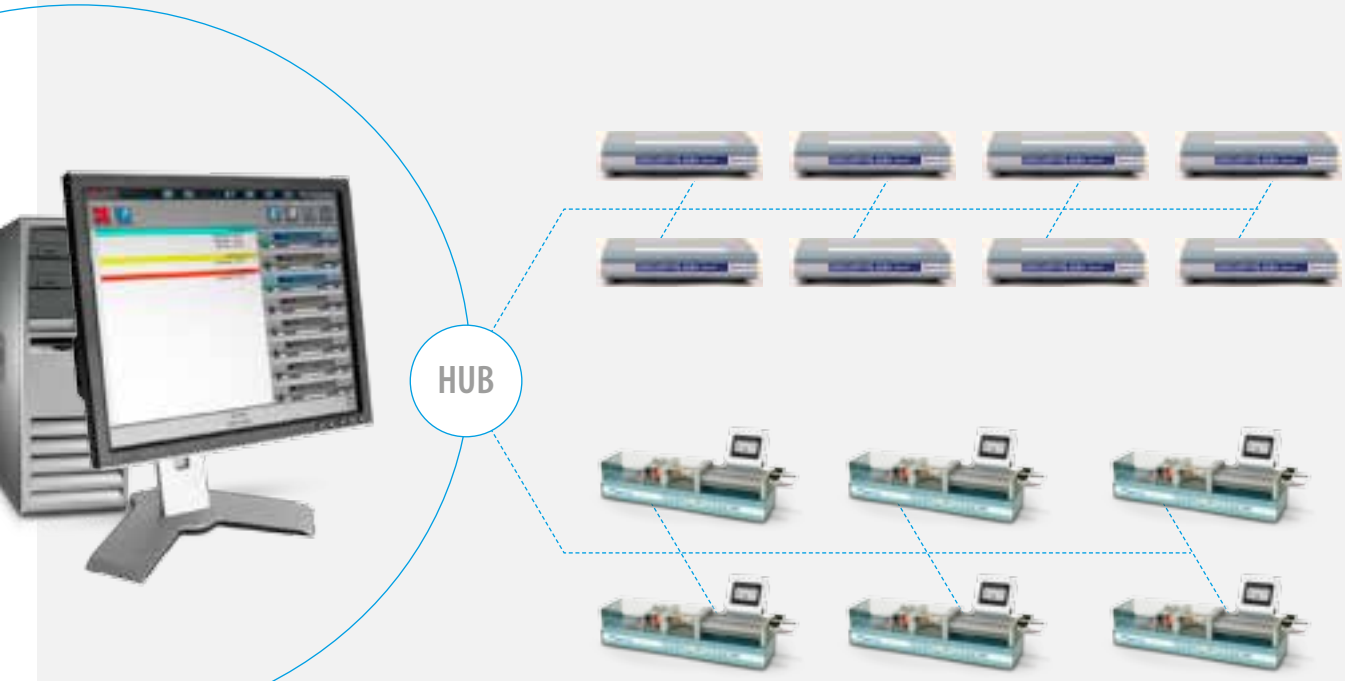
» Possibility to synchronize pressure and volume data coming from HYDROMATIC with data from the other connected transducers

» The transducers can be grouped and combined by the user for matching different applications.

» It is possible to perform various tests (e.g. shear, consolidation, triaxial) in parallel, each one having independent clock, channels and logging mode

Technical Specification

- Requires connected PC
- Number of channels: 8
- Network mode: Up to 8 units
- Sampling rate: Up to 500 readings/second per channels
- Real resolution: 131,000 points
- Communication port: LAN / Ethernet
- Excitation (VEXC): from 1 V to 10 V for each couple of channels (up to 4)
- Datalogger input: 0-10 V; 0-20 mA
- Software: DATACOMM 2 (included)
- Dimensions approx lxdxh [mm]:290x195x61
- Weight approx [kg]: 1.6 kg
- Power supply: 110-220V,50-60 Hz, 1ph



Software and data processing

DATACOMM 2 software combines the active channels into customizable groups by the operator. Data acquisition for each group is an independent task which can be started / stopped automatically with specific acquisition and logging mode.

ASCII format data export is available for combination with our Geo-Analysis-Templates suitable for post-processing and printout of test certificates according to the most important international Standards. See data processing

Accessories

Electronic measurement device

See page 79

Cable

82-P9008/ELT
Set of four cables for connecting sensors to DATALOG8 (82-P9008) and GEODATALOG8 (30-WF6008)

Extension cable

30-WF6042
Transducer extension cable, 6 m length

30-WF6044
Transducer extension cable, 12 m length

Lan Hub

26-WF4645
LAN Hub with 8 ports for Wykeham Farrance devices.

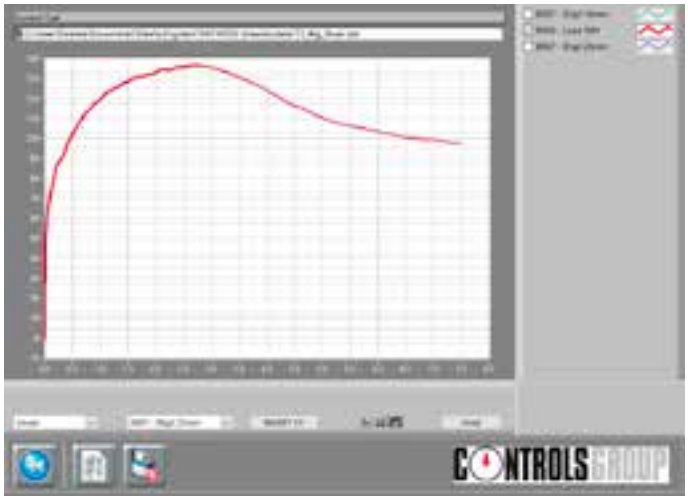
DATACOMM 2 - Channels configuration. The transducers can be grouped and combined by the user for matching different applications.

Our team of experts has developed a set of templates for specific tests and Standards that process all test data recorded by the DATACOMM 2 software. Templates, created using MS Excel®-based programs, allow the user to import data files, calculate results and produce test reports in conformance with all the relevant international Standards.

Some templates also enable the user to receive the raw data obtained from GEODATALOG 8 while performing multiple tests, automatically with real-time data processing increasing test throughput (e.g. consolidation, shear); please refer to (*) in the table below.

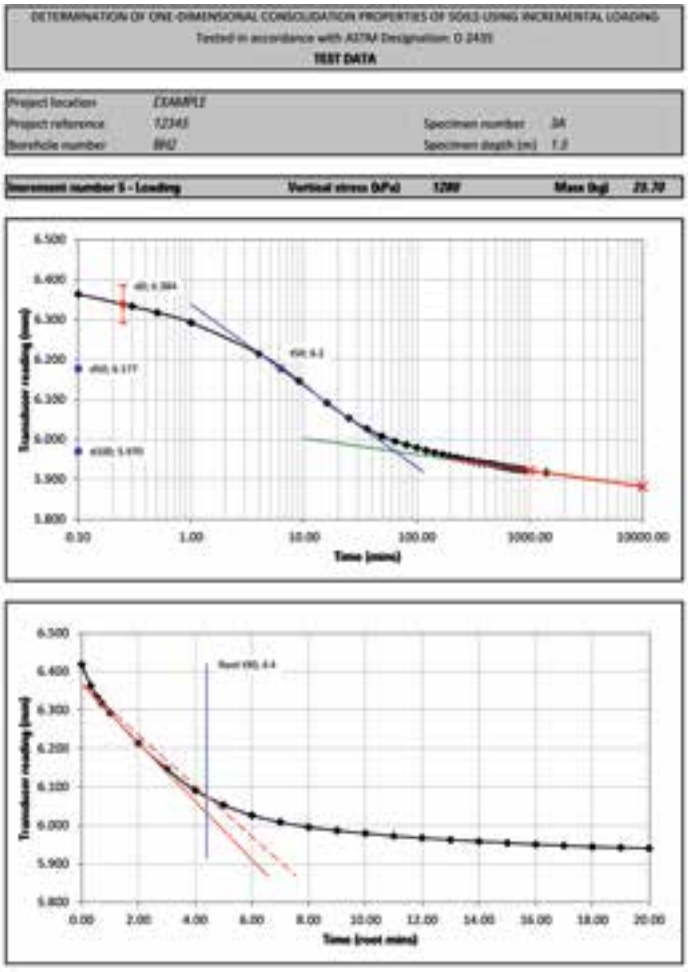
Test		Standard	Ordering information
Consolidation	Incremental loading	BS 1377:5	**30-WF6008/T1***
		ASTM D2435	**30-WF6008/T8***
	Swelling	ASTM D4546	**30-WF6016/T8A**
	CRS	ASTM D4186	**30-WF6016/T6**
	Hydraulic consolidation	BS 1377:6	**30-WF6016/T12**
	SWCC -Hydraulic consolidation	-	**30-WF6016/T13**
Shear	Direct/residual	BS 1377:7	**30-WF6008/T2***
		ASTM D3080	**30-WF6008/T9***
	Ring	BS 1377:7	**30-WF6016/T3**
		ASTM D6467	**30-WF6016/T16**
Triaxial	Effective stress	BS 1377:8	**30-WF6016/T4**
		ASTM D4767 - ASTM D7181	**30-WF6016/T11**
	Total stress	BS 1377:7	**30-WF6016/T5**
		ASTM D2850	**30-WF6016/T10**
Other tests	Permeability	BS 1377:6	**30-WF6016/T14**
	CBR	BS 1377:4	**30-WF6016/T7**
	Unconfined	ASTM D2166	**30-WF6016/T15**

Software and data processing

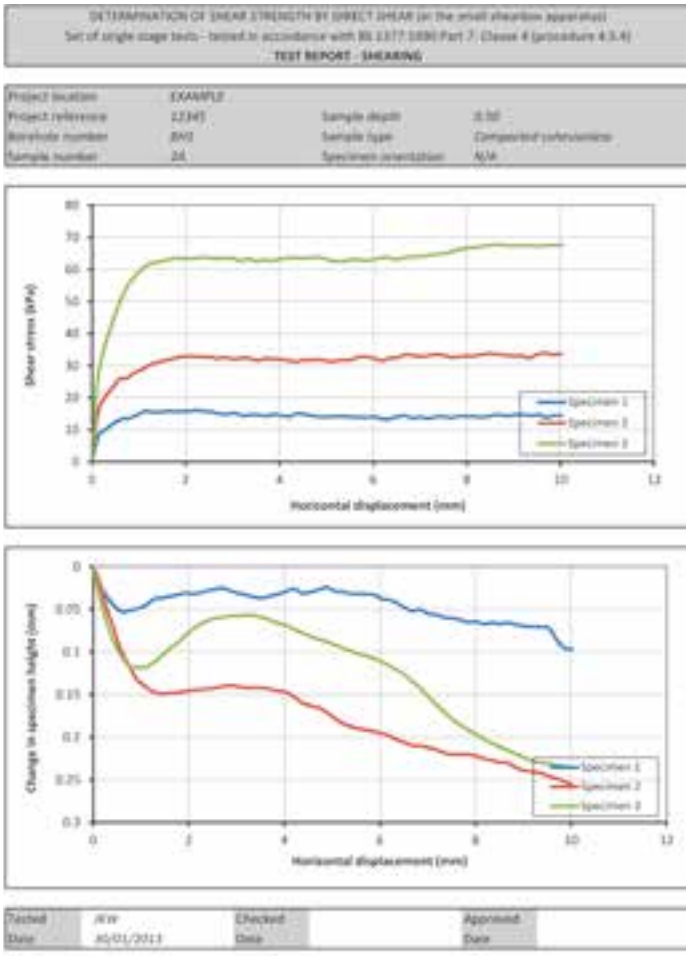


Real time raw testing data coming from 5 kN load during direct shear test

Channels (load cell, vertical displacement transducer and horizontal displacement transducer) and template assignment for performing direct shear test with real-time data processing using our Geo-Analysis templates



Example of a consolidation test analysis with the 30-WF6008/T8 Geo-Analysis template (ASTM standard), t50 and t90 calculations



Example of a direct shear test processed with the 30-WF6008/T2 Geo-Analysis template (BS EN ISO standard): the top plot shows shear stress versus horizontal displacement; the bottom plot shows change in specimen height versus horizontal displacement

Calibration equipment for geotechnical laboratory

Any laboratory needs to verify periodically the calibrations of their electronic measuring systems, in order to produce reliable and accurate results. Equipment for calibrating force, displacement, volume change and pressure measuring devices are described below.

FORCE MEASUREMENT

For calibration of force measuring devices we offer the following load cells fitted with digital readout unit, supplied complete with ACCREDIA calibration certificate according to EN ISO 376.

Load Cell

30-WF0372/SIT
5 kN load cell complete with ACCREDIA calibration certificate and stainless steel loading seat.

Stainless steel loading seat for load cell model 30- WF0372/SIT

30-WF0373/SIT
50 kN load cell complete with ACCREDIA calibration certificate and stainless steel loading seat.

Reference load cell 30- WF0372/SIT or 30-WF0373/SIT

NOTE: *In order to issue the calibration certificate, the load cell must be ordered complete with digital readout unit 30-WF6601*

Digital readout unit

30-WF6601
Digital readout unit for load cells

NOTE: *one digital readout unit can be used for both load cells*

PRESSURE MEASUREMENT

Pressure calibrations are performed with a digital pressure gauge, supplied complete with ACCREDIA calibration certificate.

30-WF6305/SIT
50 bar digital pressure gauge complete with ACCREDIA calibration certificate.

VOLUME CHANGE

Calibration of the volume change apparatus can be simply performed by weighing the water coming out of the device, using any digital balance with 0.01 g resolution.

DISPLACEMENT MEASUREMENT

Calibration of displacement measuring devices can be performed with either the analog or digital micrometer 25 and 50 mm travel respectively, 0.001 mm resolution. The 25 mm travel is available optionally, with traceable calibration certificate and the 50 mm travel with ACCREDIA certificate adding the suffix /C to the code.

Code	Travel [mm]	Res. [mm]	Version	Note
30-WF0652	25	0.001	Analog	
30-WF0652/C	25	0.001	Analog	Traceable calib. certificate
30-WF0653	50	0.001	Digital	
30-WF0653/C	50	0.001	Digital	ACCREDIA calib. certificate

30-WF0653 with digital micrometer

LOCAL STRAIN MEASUREMENT

The calibration is performed with a special device that can also be used for standard linear displacement transducers with up to 50 mm travel.

- Frame capable of positioning the micrometer horizontally and vertically
- Adaptors for both vertical and radial strain transducers
- Resolution 0.001 mm
- Dimensions 260 x 60 x 100 mm (w x d x h)
- Weight: 1.5 kg approx..

30-WF0653/K
Calibration device for local strain transducers and standard linear displacement transducers up to 50 mm travel

30-WF0653/KC
As above but complete with ACCREDIA certificate

DYNAMIC TESTING SYSTEMS

31

The dynamic properties of soils such as stress-strain characteristics have been recognized as integral aspects of construction designs such as maritime, seismic engineering, placement of foundations of machines or structures subjected to different dynamic interactions.

The correct description of the soil behavior within the range of small deformations is also an extremely important element in the prediction of the movement of structures and how they interact with subsoil, and thus has a great impact on the quality of the actual mapping of the internal forces in the structural system of the whole building, including the foundations.

Stiffness modules for very small deformations are now recognized as fundamental properties of the soil. For this reason, in geotechnical engineering we commonly use information obtained from laboratory and field dynamic and seismic tests to solve conventional problems of interaction between the building and the subsoil.

Different systems are available to cover the wide range of deformations due to these different causes.

Dynamic Triaxial system

31-WF70E06

ADVANCED SERIES

EmS TECH

Dynatriax EmS adopts the new Electromechanical Servoactuation technology. It offers excellent reliability, accurate testing and lower maintenance requirements.

DYNATRIAX EmS

STANDARD

- BS 1377:7
- ASTM D2850
- ASTM D4767
- BS 1377:8
- BS 1377:6 ASTM D7181
- ASTM D5311
- ASTM D3999
- AASTHO T0307

For detailed information, including complete test configurations, please visit our website or contact our team of specialists

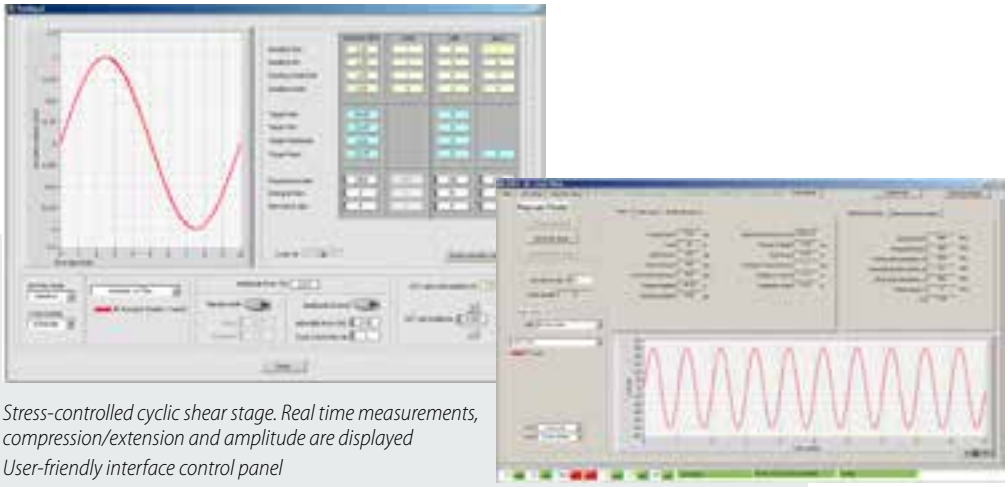
This is one of the many **ADVANCED** products of CONTROLS Group range.

To get more info visit **www.controls-group.com** or link directly to the QRCode

MAIN FEATURES

- Electromechanical Servoactuation, no need for compressed air or hydraulic power supply for the vertical force
- Capability to perform Static (effective stress and stress path), Dynamic and Unsaturated soil triaxial tests
- Maximum dynamic load: 15 kN
- Maximum static load: 10 kN
- Triple-axes closed loop control of axial load/displacement, cell and back pressure
- Automatic compensation of cell/back pressure during dynamic stage
- Operating frequency more than 10 Hz (depending on test conditions)
- Complete automation of all test stages using a high sensitivity closed loop PID feedback
- Options available for bender elements testing and for local strain transducers
- Standard and user defined wave shapes which can mimic the real in situ measurements (earthquakes)

Wykeham Farrance | CONTROLS GROUP



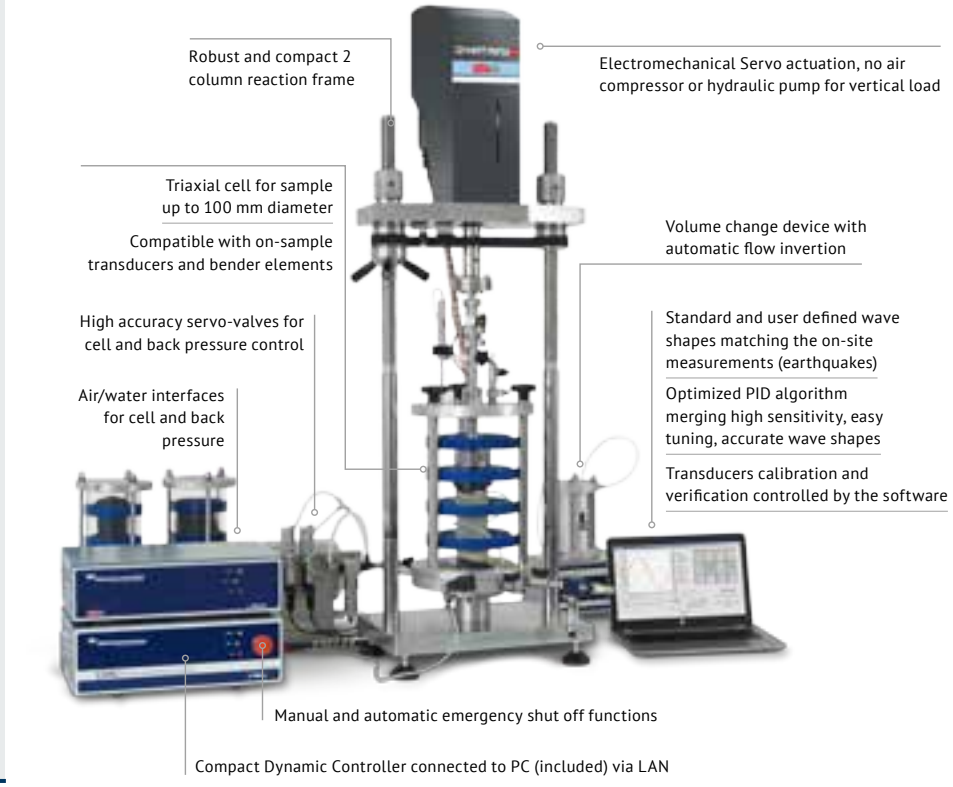
Stress-controlled cyclic shear stage. Real time measurements, compression/extension and amplitude are displayed

User-friendly interface control panel

PID CONTROL

An extremely efficient algorithm with larger gain ranges gives enhanced sensitivity, making it easier to tune the system and achieving more accurate wave shapes.

Recently added features include manual and automatic amplitude control which compensate for small changes that may occur in the system during cycling, ensuring that the required peaks are consistently reached. The improved tuning panel, with its more user-friendly interface, provides all the tools necessary to optimize the system control during static and cyclic test stages.



- Test set-up by unique programmable multi-stage procedure. When a test is running, it is possible to access all parameters to expand and modify the stages as per the response of the specimen
- Manual and automatic emergency shut off function
- Multitasking, user-friendly Windows-based software pre-installed on the PC
- Extra-accurate transducers calibration adopting linear or polynomial regression or multi-coefficient linearization
- 208-230 V, 50-60 Hz, 1 ph or 110 V, 60 Hz, 1 ph

The base system includes:

ELECTRO-MECHANICAL VERTICAL LOAD APPLICATION

-high performance motorized actuator, 15 kN capacity, backlash-free and noiseless

-sophisticated PID closed-loop control, ensuring load is reached fast, smoothly and accurately and then maintained with high level of accuracy. The submersible load cell delivers high accuracy from the lowest values

REACTION FRAME

DATA ACQUISITION, PROCESS AND CONTROL

The CDC (Compact Dynamic Controller) manages up to 3 closed loop axes (axial load/displacement, cell and back pressure) with an effective loop rate of 10 kHz and performs the test completely automatically including the on/off valves for the drainage line and for the air supply to the triaxial cell.

SENSORS

Load cell, LVDT transducer, pressure transducers, volume change have to be ordered separately

TRIAXIAL CELL AND ACCESSORIES

PRESSURE SYSTEM

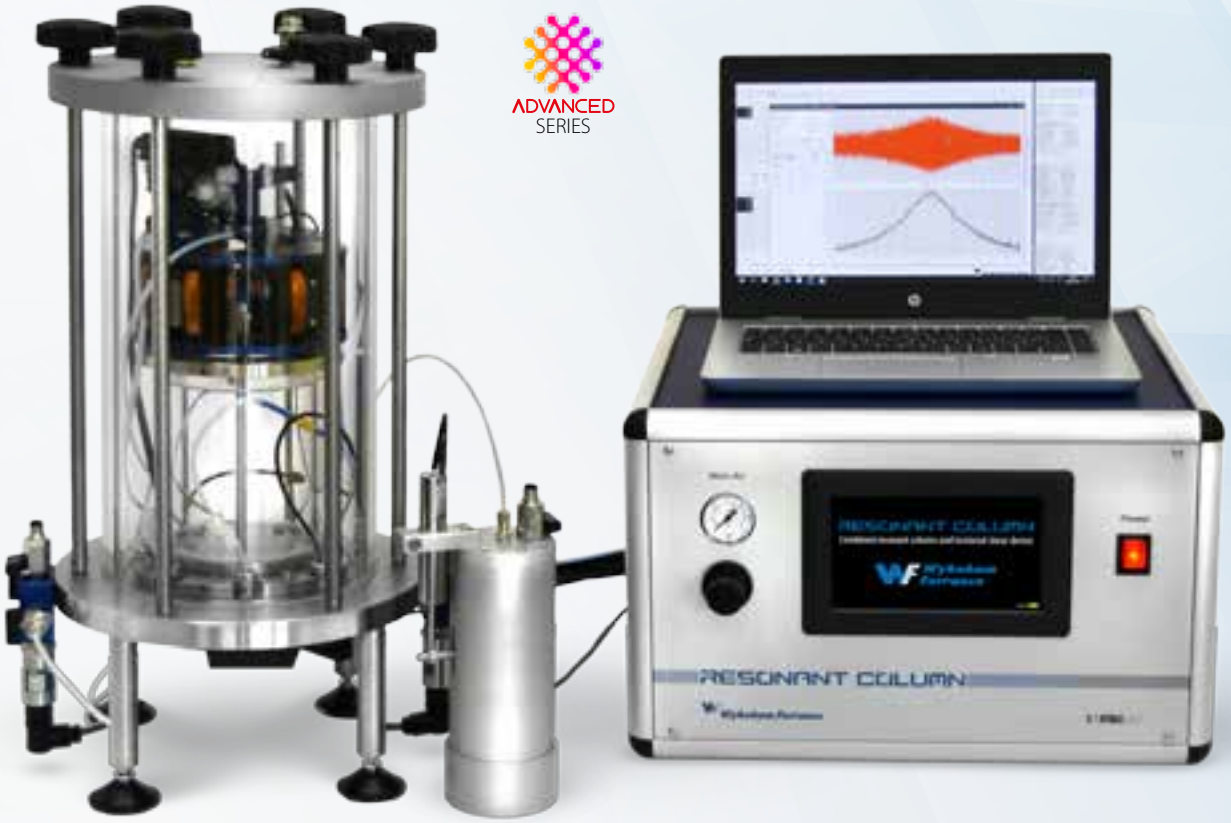
Air/water interface for cell and back pressure are required.

NOTE: *System requires air compressor, air filter and de-airing water system.*

Resonant Column and Cyclic Torsional Shear Device

31-WF8600

Resonant Column combines the features of both resonant column and cyclic torsional shear for evaluating shear modulus and damping ratio versus shear strain



ADVANCED SERIES

Resonant Column

STANDARD ASTM D4015

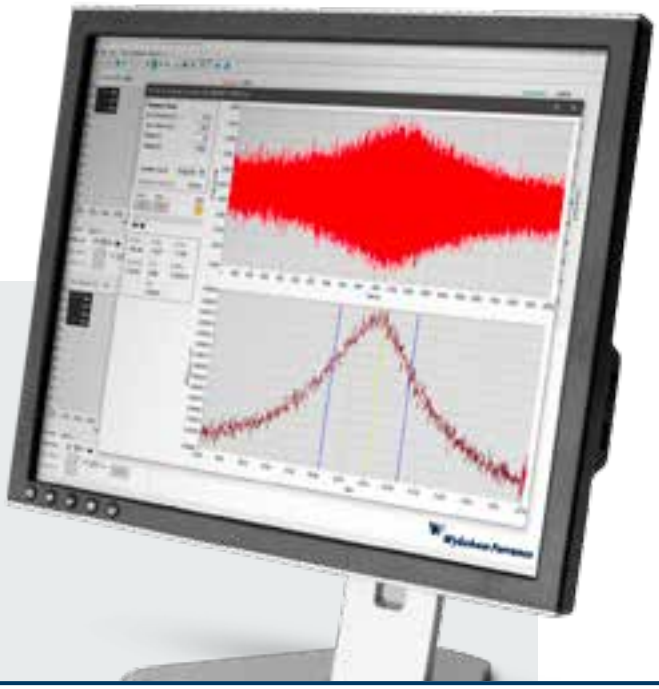
For complete information and details, including complete test configurations, please visit our website and ask for the co-operation of our specialists

This is one of the many **ADVANCED** products of CONTROLS Group range.

To get more info visit **www.controls-group.com** or link directly to the QRCode

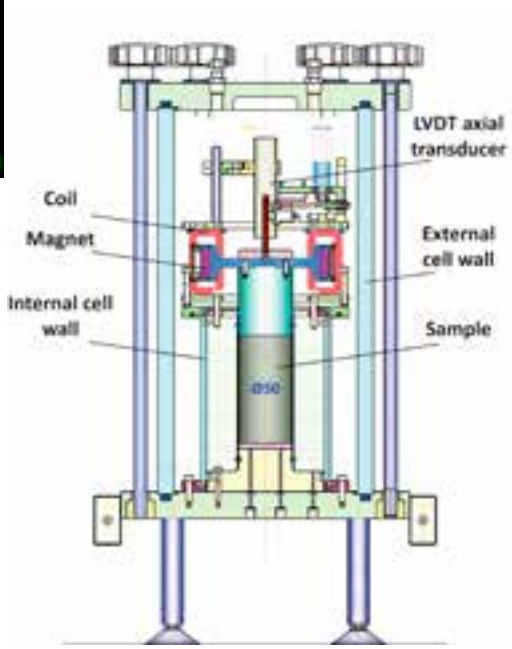
MAIN FEATURES

- Combined Resonant Column / Torsional Shear device in a single unit
- Stainless steel cell with acrylic transparent cylinder won't rust or corrode increasing your equipment longevity.
- Intuitive high resolution 7" color touchscreen display makes cell, back and pore pressure easy to monitor.
- Automatic detection of fundamental frequency
- RC: damping ratio from half power bandwidth, free vibration data and white noise
- TSS: damping ratio from hysteresis loops
- Maximum torque: 1.5 Nm
- Maximum angular deformation: 10°
- Maximum cell and back pressure: 1 MPa
- Suitable for 50 mm dia. specimen (or 38 mm on request)
- Integrated signal generator and oscilloscope
- Upper and bottom drainage guarantees proper sample saturation
- Internal floating frame for large angular and axial deformation
- 10 channels signal conditioning unit



The excitation Voltage is fixed and the frequency increased by steps (RC discrete) or continuously (RC chirp) in automatic increments or steps.
The system records the shear strain and calculates the Fundamental Resonant Frequency corresponding to the maximum

Cell, back and pore pressure monitoring via high resolution 7" color touchscreen display



- » USB data acquisition and signal generation board
- » Two electro-pneumatic converters for cell and back pressure
- » Laptop PC with dedicated software included
- » Software manages the following stages: saturation, consolidation, Resonant frequency, Torsional Shear
- » Excitation frequency: Dynamic (RC) 1-300 Hz; Cyclic (TS) from 0 to 50 Hz maximum
- » Multivoltage – Multifrequency power supply 230 V - 50Hz or 110 V- 60Hz, 1 ph

The system consists of the following components:

TRIAXIAL CELL

Stainless steel cell with acrylic transparent cylinder with 170 mm int. dia. x 200 mm ext. dia., including channels for bottom and top drainages; internal floating frame for assembling the electrical motor that applies the torsional load. Test accessories for 50 mm (or 38 mm available on request) diameter specimens.
N°2 calibration bars kit + n°1 calibration weight.

MAIN CONTROL BOX, LAPTOP PC AND SOFTWARE

Compact unit connected to laptop PC contains all control, power supply and electrical and pneumatic devices. This system contains also the air actuators (I/P converters) and the amplification equipment.
High resolution 7" color touchscreen display for cell, and pore pressure monitoring

SENSORS

The sensor kit contains: Axial LVDT transducer, volume change apparatus, three pressure transducers, two Eddy current displacement sensors with high precision motorized proximity sensors positioning, low noise MEMS accelerometer.

NOTE: *System requires air compressor, air filter and de-airing water system.*

ADVANCED SERIES

Cyclic simple shear

31-WF7500

The cyclic simple shear apparatus is generally used for research in the dynamic field of soil behavior and can quite easily simulate many different field loading conditions.

Cyclic Simple Shear

STANDARD ▸ ASTM D6528

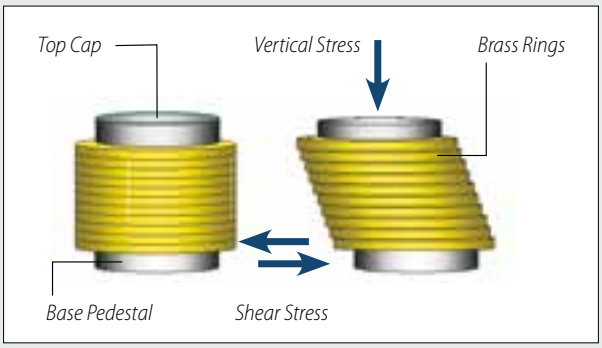
For complete information and details, including complete test configurations, please visit our web site and ask for the corporation of our specialists

This is one of the many **ADVANCED** products of CONTROLS Group range.

To get more info visit **www.controls-group.com** or link directly to the QRCode

MAIN FEATURES

- » Possibility to simulate many different field loading conditions:
  - Stability under seismic events
  - Degradation of shear stress
  - Evaluation of the liquefaction parameters
- » Possibility of constant height shear test
- » Possibility of constant stress test
- » Possibility of constant rate of strain test
- » Shear strain is induced by horizontal movement at the bottom of the sample relative to the top.
- » Operating frequency up to 10 Hz (depending on test condition)
- » 5 kN horizontal and vertical actuators
- » 5 kN load cells fitted in-line with actuators, 1 N accuracy
- » Built-in transducers +/- 15 mm travel for each actuator
- » External transducer +/- 5 mm travel for controlling and maintaining sample height



Schematic Stress condition of the sample in the cyclic simple shear

Sample Preparation using wooden dolly included the machine.

- » Suitable for 70 mm dia. specimen or 50 mm using dedicated adapters
- » Constant diameter of the sample during the test. Any change in volume can only be as a result of vertical movement of the top platen.
- » Multivoltage – Multifrequency power supply 230 V - 50Hz or 110 V- 60Hz, 1 ph

The system consists of the following components:

SIMPLE SHEAR MACHINE

It consists of a simple shear load frame, an air receiver with axial (vertical) and lateral (horizontal) loading control valves and two 5 kN actuators, built into a specially designed floor-mounted cabinet. Each actuator has an internal displacement transducer, which relays the actuator piston position back to the computer. The sample is positioned on a pedestal with a top cap that is rigidly fixed and houses a 70 mm diameter vertical ram in a linear bearing to allow axial movement but prevent lateral movement and covered by a rubber membrane placed and secured with O-rings.

To maintain a constant diameter (K0 conditions) the sample is laterally confined by a series of brass rings.

The bottom half is mounted on roller bearings in the same way as in a standard shear box apparatus.

IMACS - INTEGRATED MULTI-AXIS CONTROL SYSTEM

The IMACS is a compact self-contained unit that provides all critical control, timing and data acquisition functions for the test and the transducers. These channels are digitized by accurate, high speed 20-bit (A/D) converters for data analysis and presentation. The control module has four channels for feedback control, two are dedicated to the actuator for axial load/displacement, the other two are dedicated to the application of the lateral load/ displacement.

SENSORS

Two Load cells, built-in displacement transducers for each actuator and external transducer for controlling and maintaining sample height. Each one is supplied with proper in-line signal conditioning pods for normalizing all the transducer output.