Soils Testing Equipment

It is vitally important to know the characteristics of soils in construction projects because soil mechanics affect the performance of foundations, backfill, embankments, drainage, etc. It is also necessary to understand the behaviour of soils under varying conditions of moisture, loading, stress, temperature, etc. ELE International designs and manufactures a comprehensive range of soil sampling and testing equipment to meet this requirement in accordance with international standards for both field and laboratory testing. ELE's materials testing equipment enables the accurate classification of soils and the measurement of key parameters such as moisture, density, shear strength, permeability, bearing capacity, compaction and CBR, consolidation, Atterberg limits - shrinkage limit, plastic limit, and liquid limit, particle size distribution, sand equivalent value, slope stability, triaxial soil strength, pore water pressure, effective stress, soil chemistry and much more. Providing everything from a simple pocket penetrometer to a sophisticated triaxial soil testing system with control and data acquisition software, ELE's soils testing range includes all the equipment necessary to run standard test methods in the field or the laboratory.

In-situ Sampling & Preparation

In-situ Sampling & Preparation

The correct sampling, description and preparation of soil and soil mixtures is necessary if subsequent tests are to be meaningful and provide representative results. Various national and international standards specify a range of procedures and equipment necessary to ensure representative sampling.

With the use of simple hand tools, it is often possible to obtain detailed information regarding the sub-surface structure and hence the likely engineering characteristics of the area under investigation.

Soil Colour Charts

Munsell Soil Colour Charts

Product Code: 23-7150

Munsell Soil Colour Charts are an affordable way to evaluate the type of soil that is present within a given area. The binder is set up to allow users to make soil colour evaluations in the field quickly and easily. The soil classification system that has been developed around the Munsell Colour System is an established and accepted process to assign a soil type. This classification system has been used in the United States for more than 55 years to aid the management and stewardship of natural resources. Through the use of Munsell Soil Colour Charts, practitioners from a wide range of professions can share reliable and consistent information about the colour of soils at a particular site with colleagues anywhere around the world.

Munsell Soil Colour Charts are used by a variety of industries and professions such as universities and high schools, forestry, forensics, environmental and soil science, building and contracting, landscaping, real estate, health departments, geology and archaeology.

The following pages are included in the Munsell Soil Colour Charts:

- Munsell 10R Soil Chart.
- Munsell 10YR Soil Chart.
- Munsell 2.5Y Soil Chart.
- Munsell 2.5YR Soil Chart.
- Munsell 5Y Soil Chart.
- Munsell 5YR Soil Chart.
- Munsell 7.5YR Soil Chart.
- 10Y - 5GY Colours - Olive Greens Soil Chart.
- Gley 1 & 2 (2 - Separate Charts) Soil Charts.
- Munsell 5R Individual Soil Chart.
- Munsell 7.5R Individual Soil Chart.
- New White Page, 7.5R, 10YR and 2.5Y.

Durable binder contains 440 Munsell Colour Standards:

- Featuring ISCC-NBS colour names.
- Munsell alpha-numeric notation.

Colour produced on water resistant substrate.

Features Munsell notations for each colour providing:

- Value (degree of lightness).
- Hue (colour).
- Chroma (degree of saturation).

Used with medium, fine grained and coarse grained rocks.

Pages are cleanable and can be exposed to standard environmental conditions in the field.

Specifications	
Binder Size W x H x D (mm)	150 x 196 x 25
Page Size (mm)	111 x 184
Weight (kg)	0.9

Sample Mixers

A regular laboratory requirement is the mixing of samples with water and/or other constituents to provide a homogeneous mixture prior to subsequent testing. The following range of mixers provide an efficient means of mixing samples.

Bench-Mounting Mixer 4.7 Litre Capacity complete with Bowl, Beater & Whisk

Product Code: 23-6191/01, 23-6191/06

Mixer shown with Isomantle Electric Heater accessory.

Product Standards:

BS 598-107, BS 1377-1, BS 1924-1, EN 12697-35

The mixer has three electrically switched mixing speeds which obviates the need to switch off during speed selection. The mixing head comprises a beater which contra-rotates about a central shaft using planetary gearing. A lever-acting lifting device facilitates the insertion and removal of the bowl. This mixer is suitable for the mixing of soil samples, mortar, bituminous mixtures and associated materials where comparatively small samples are being prepared. Supplied with Stainless Steel bowl, beater and whisk.

Specifications	
Dimensions (mm)	545 x 380 x 550
Beater Speeds (rpm)	L 136, M 281, H 580
Central Shaft Speeds (rpm)	L 60, M 124, H 255
Rated Power (W)	500
Weight (kg)	20.2
Product Code	**Power Supply**
23-6191/01	220-240 V AC, 50 Hz, 1 ph
23-6191/06	220-240 V AC, 60 Hz, 1 ph

Spares/Consumables:

Stainless Steel Bowl 4.7 litres (23-6191/10)

Accessories:

Isomantle Electric Heater (45-5580/01)

Specifications	
Power Supply	220-240 V AC, 50-60 Hz, 1 ph

Beater (23-6191/11)

Whisk (23-6191/12)

Hand Boring & Sampling

The items listed provide the engineer with an economic range of equipment for field survey work. Using this equipment it is possible to obtain disturbed or undisturbed samples at reasonable depths, subject to ground conditions. Most items may be inter-connected.

Auger Heads (Soil & Gravel)

Product Standards:

ASTM D1452/D1452M, AASHTO T203

These auger heads are suitable for boring in cohesive soils or sands and gravels. The soil augers are constructed of heavy duty steel plates forming an open tube partly interlocked at the cutting end. Gravel augers comprise a one piece steel casting with a spiral point and two plates designed to close when lifting samples from the borehole. The Dutch Auger is of similar construction to the Soil Augers and is particularly useful in very fine silt-clay sands. This range of durable augers is based on a threaded joint system enabling items to be interchanged and extended to any depth required.


23-1501


23-1504


23-1517


23-1525

Specifications			
Product Code	Head Size/Dia. (mm)	Head Type / Suitability	Weight (kg)
23-1501	100	Cohesive Soils	1.5
23-1504	150	Cohesive Soils	2.5
23-1517	150	Gravel and Sand	1.2
23-1525	50	Dutch Soil (Fine Silty Sand)	1.5

In-situ Sampling & Preparation

Extension Rods, Handles & Tools

Product Standards:

ASTM D1452/D1452M, AASHTO T203

Product Code	Product	Weight (kg)
23-1541	Auger Extension Rod 1 m	1.7
23-1543	Stillson Wrench size 14 (2 required)	1.2
23-1547	Auger Handle and T piece	2
23-1577	Sample Tube 38 x 230 mm	-
23-1579	Sample Tube Adaptor	-
23-1587	Jarring Link (for driving Sample Tube)	4
23-1617	Auger one piece fine silty sand 40 mm	1.5

Riffle Box Set (Sample Dividers)

Product Standards:

EN 932-1, EN 933-3, BS 1377-2, BS 812-1,
ASTM C136/C136M

Designed for the rapid preparation of samples, the ELE range of riffle boxes are constructed of heavy gauge sheet metal, with particular attention given to reinforcement of the partitions to maintain the accuracy of the slot dimensions. The units offered are supplied in a range of sizes from 7 mm to 64 mm slots.

Individual Riffle Boxes / Specifications

Product Code	No. Slots	Max Particle Size (mm) BS	Max Particle Size (mm) EN	Slot Width (mm)	Approx Capacity (ltrs)	Weight (kg)
23-3000	12	4.5	3.5	7	0.3	1.5
23-3050	12	8.5	6.5	13	2.0	6.0
23-3070	12	10.0	7.5	15	2.0	8.0
23-3100	10	12.5	9.5	19	4.0	9.0
23-3150	10	16.5	12.5	25	4.0	11.5
23-3170	10	20.0	15.0	30	4.0	17.5
23-3200	8	25.0	19.0	38	11.0	17.5
23-3300	8	33.0	25.0	50	14.0	22.5
23-3350	8	42.5	32.0	64	18.0	27.0

Large Sample Splitter

Product Code: 23-3425

Product Standards:

EN 932-1, EN 933-3, BS 1377-2, BS 812-1, ASTM C136/C136M

The splitter is designed for the reduction of test samples which are too large in volume to be conveniently handled. It divides samples so that half is representative of the original total sample and handles material up to 6 inches in particle size. The lever-actuated unit is constructed of heavy gauge welded steel with a hopper which holds up to 1 cu. ft. The single splitter chute provides wide flexibility in sizes of opening and adjustment is provided for chutes of 0.5, 1.5, 2, 3, 4 or 6 inches by positioning of the chute bars. Overall height is approximately 1 metre. Hopper size 735 mm long x 480 mm wide (approx).

Complete with 2 material pans and a bag-loading chute.

Specifications	
Capacity	1 cu. ft. (0.028 m^3); for sand sizes up to 4 inches (102 mm)
Hopper	Lever-actuated, clamshell design
Chute Bars	48 aluminium bars, 1/2 inch (13 mm) width
Chute Area	24 inches (610 mm) overall width
Chute Openings	Adjustable; 1/2, 1, 1-1/2, 2, 3, 4, or 6 inches
Frame	Welded, heavy-gauge steel
Chute Attachment (L x W x H)	Replaces pan to allow sample collection in bag; 28-1/4 x 7 x 5-1/2 inches (718 x 178 x 140 mm)
Material Pans (L x W x H)	Two included; 25-3/4 x 9 x 6-1/2 inches (654 x 22 9 x 165 mm)
Overall Dimensions (L x W x H)	29 x 19 x 39 inches (737 x 483 x 999 mm)
Weight	Shipping: 142 lbs (64 kg)

Accessories:

Sample Bag - 10 x 18 inches (254 x 457 mm) (23-1420)

Sample Bag - 17 x 32 inches (432 x 813 mm) (23-1422)

Sample Reduction

The reduction of particles within the soil mass is necessary for a number of tests. For most purposes crushing of individual particles must be avoided. This reduction process is best achieved using a porcelain mortar and rubber headed pestle.

Mortar & Pestle, Porcelain

Product Code: 23-3505

Product Standards:

BS 1924-1, BS 1377-2, ASTM D421

Thick walled porcelain mortar; 107 mm internal diameter and porcelain pestle.

Rubber Headed Pestle

Product Code: 23-3500

Product Standards:

BS 1924-1, BS 1377-2, ASTM D421

Specially made for gently grinding soils without breaking the individual particles.

Specifications	
Weight (kg)	0.12

In-situ Sampling & Preparation

Extruders & Soil Lathes

The removal of soil cores from sampling tubes must be accomplished with the minimum of disturbance, particularly when small specimens have to be prepared in order to carry out laboratory tests. Large extrusion forces used indiscriminately will compress soil resulting in false values of shear strength and consolidation.

Soil Extruders

Hydraulic Sample Extruder Kit 38 mm Hand Operated

Product Code: 23-4090

Product Standards:

BS 1377-4, BS 1924-2, BS 598-107, EN 12697-30, EN 13286-2, EN 13286-47, ASTM D1587/1587M, ASTM D698, ASTM D1557, ASTM D1883

This Sample Extruder comprises a vertically mounted lever action hydraulic jack, with the body extended to form a chamber which accommodates a 38 mm diameter sample tube. Supplied complete with trimming knife, wire saw, 38 mm split former and cutting tool.

Proctor/Core Cutter Extruder Frame & Hydraulic Jack. Extrudes 100 mm/4 inch diameter specimens

Product Code: 23-4200

Product Standards:

BS 1377-4, BS 1924-2, BS 598-107, EN 12697-30, EN 13286-2, EN 13286-47, ASTM D1587/1587M, ASTM D698, ASTM D1557, ASTM D1883

Adaptor plates will be supplied; extrudes samples from BS Compaction Mould, Proctor Mould 100 mm, Core Cutter and Marshall Mould. Maximum extrusion force 20 kN.

Specifications

Product Code	Extrudes samples from:
24-9000	BS Compaction Mould
24-9060	Proctor Mould
29-5300	100 mm Core Cutter
45-6310	Marshall Mould

Accessories:

Steel Block (45-6463)

CBR/Core Cutter Extruder Frame & Hydraulic Jack. Extrudes 150 mm/6 inch diameter specimens

Product Code: 23-4250

Product Standards:

BS 1377-4, BS 1924-2, BS 598-107, EN 12697-30, EN 13286-2, EN 13286-47, ASTM D1587/1587M, ASTM D698, ASTM D1557, ASTM D1883

Comprises a frame and hydraulic jack with adaptor plate supplied. Extrudes samples from BS CBR Mould and ASTM CBR Mould.

Specifications

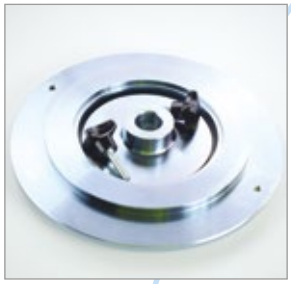
Product Code	Extrudes samples from:
24-9198	BS CBR Mould
24-9228	ASTM CBR Mould

Accessories:

Adaptor Plate for 23-4250 to extrude 100 mm/4 inch diameter and Marshall Specimens (23-4300)

Product Standards:

BS 1377-1



To be used with 23-4250. Comprising an adaptor plate, retaining screws and a nominal 100 mm ram plunger. Enables extrusion from all ELE 100 mm moulds and core cutters listed in the 100 mm Proctor/Core Cutter Extruder Frame.

Specifications

Weight (kg)	2.2

Soil Lathes

Soil Lathe - Hand Operated for 38 mm diameter specimens up to 100 mm long

Product Code: 23-5800

For producing 38 mm diameter specimens. The lathe platen is adjustable in height and will accept specimens up to 100 mm in length.

- Lightweight frame construction for both laboratory and field use.
- Sturdy plated steel uprights serve as guides for wire saw during final trimming procedure.
- Adjustable upper platen trimming for various sample heights. Wire Saw and other trimming accessories not included; order separately.

Specifications

Max specimen length (mm)	100
Specimen dia (mm)	38

Accessories:

Wire Saw (81-0708)

Straight Edge (24-9010)

Trimming Knife (81-0710)

38 mm Split Former (23-4120)

38 mm Cutting Tool (23-4140)

In-situ Sampling & Preparation

Specimen Trimmer - Hand Operated for 1.4 & 2.8 inch Samples

Product Code: 23-5802

Specimen Trimmers are designed to simplify precision trimming of soil samples for triaxial, shear, unconfined compression, and other tests requiring standard cylindrical specimens. This trimming frame is supplied complete with vane type grips for both 1.4 inches (35 mm) and 2.8 inches (70 mm) diameter specimens, and a narrow wire saw.

- Lightweight frame construction for both laboratory and field use.
- Sturdy plated steel uprights serve as guides for wire saw during final trimming procedure.
- Samples are held securely during trimming through vane type grips.
- Adjustable upper gripper platen for various sample heights.
- Plated steel uprights and gripper assemblies for rust resistance and long life. Includes Wire Saw.

Specifications	
Trim samples to either:	1.4 inches (35 mm) dia
	2.8 inches (70 mm) dia
Uprights	Positioned to guide wire saw to control final sample dia, plated steel
Sample Grips	Vane type; hold sample during trimming, plated steel
Overall Dimensions W x D x H	7 x 5 x 14 inches (178 x 127 x 356 mm)
Weight	Net 16 lbs (7.3 kg)

Soil Sample Trimming Knife

Product Code: 81-0710

Wire Saw

Product Code: 81-0708

Split Former 38 mm

Product Code: 23-4120

Split Former with quick release clamps.

Soil Sample Cutting Tool

Product Code: 23-4140

Used for end preparation of 38 mm samples.

Rapid Method by Speedy Moisture Tester

The new range of Speedy Moisture Testers, which now includes an Electronic Balance and a heavy duty plastic case, uses a technique based on the fact that water will react with calcium carbide to form a gas and that the quantity of gas formed is directly proportional to the water present. The gas pressure is indicated on a built-in pressure gauge. Designed for the most demanding on-site conditions, the new waterproof and durable case offers high levels of protection.

The new model comprises: Speedy Moisture Tester, Electronic Balance, Beaker, Cleaning Cloth, Cap, Washer, Scoop, Steel Pulverising Balls and Cleaning Brushes.

Used to weigh a sample before placing it in the Speedy Moisture Tester, the portable battery powered balance includes an LCD display with a measuring range 0-200 g x 0.1 g. The % moisture content of the sample is read directly from the calibrated pressure gauge.

Product Code	Model	Moisture Range (%)	Gauge div. (%)	Sample Weight (g)	Weight (kg)
23-7462	G2 Large	0 to 50	0.5	8	7.5
23-7502	D2 Small	0 to 20	0.2	6	5.5
23-7452	D2 Large	0 to 20	0.2	20	8.4

Product Standards:

ASTM D4944, AASHTO T217, BS 812-109

- Reliable and accurate moisture measurement in the field.
- Direct reading in percent moisture.
- Rapid results in minutes.
- Carry case and portable electronic balance included.

Accessories:

Calcium carbide powder - 500 g (23-7700)

Calcium carbide powder - 12 x 500 g (23-7702)

Speedy Calibration Unit (23-7600)

Oven Drying Method

The standard method for determining the moisture content of soil is the Oven Drying Method, which is recommended for a Soils Laboratory.

Grouped Product Standards:

BS 2648, EN 932-5, BS 1924-1, BS 1377-1, BS598-107, EN 12697-32, ASTM C127

For full Drying Oven products available see page 270 of the Laboratory Equipment Section

Required Equipment

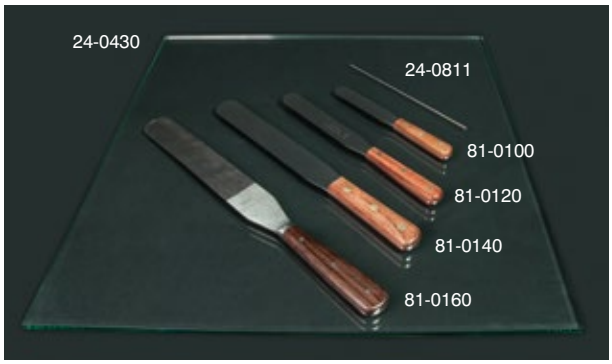
Product Code	Product
78-1250/01	225 ltr Drying Oven
78-1245	Dial Thermometer 0 to 300˚C
78-5456/01	Electronic Balance 4600 x 0.01 g
78-5527/01	Electronic Balance 32 kg x 1 g
81-0220	Aluminium Scoop
81-2979	Unnumbered 90 g Moisture Content Tin 10 required
81-3000	0.5 ltr Sample Container 10 required
81-4020	Sample Tray 306 x 306 x 38 mm 10 required

Soil Index Properties

Soil index properties are used extensively by engineers to discriminate between the different kinds of soil within a broad category, e.g. clay will exhibit a wide range of engineering properties depending on its composition.

Determination of Plastic Limit

The plastic limit is defined as the lowest moisture content of a soil that will permit a sample to be rolled into threads of 3 mm diameter without the threads breaking. The test procedure has remained, in principle, the same since 1932, when Casagrande proposed to define the various limits by relating the moisture content characteristics of soil under certain conditions. The apparatus required is simple yet effective.



Product Standards:

BS 1377-2, ASTM D4318, AASHTO T90

Required Equipment

Product Code	Product	
24-0430	Glass Plate 500 mm² (2 required)	
24-0811	Rod Comparator 3 mm dia to BS 1377	
81-0100	Spatula 100 mm	(2 required)
81-0120	Spatula 120 mm	
81-0140	Spatula 140 mm	
81-0160	Spatula 160 mm	

Determination of Liquid Limit

The condition of a soil can be altered by changing the moisture content. The liquid limit is the empirically established moisture content at which a soil passes from the plastic to the liquid state. A knowledge of the liquid limit allows the engineer to correlate several engineering properties with the soil. Two main types of test are used; the Casagrande type Cup and the cone penetrometer method, which is now the definitive method specified in BS 1377.

Casagrande Method ASTM

Particular design features of the instrument include a positive action horizontal lead screw, which is rapidly adjustable and rigidly fixes the height of cup in relation to the base during the test procedure. The cam mechanism and cup suspension assembly have been designed to withstand constant use with minimum readjustment.

BS Liquid Limit Device shown with motor

Liquid Limit Device BS (Motorised)

Product Code: 24-0417/01

Product Standards: BS 1377-2

Complete with revolution counter and motor.

Specifications

Power Supply	220-240 V AC, 50 Hz, 1 ph

Liquid Limit Device ASTM

Product Code: 24-0434

Product Standards: ASTM D4318, AASHTO T89

Complete with revolution counter.

- Rust resistant, brass construction.
- 10 mm gauge block located at end of handle.

Specifications

Weight (kg)	3

Accessories:

ASTM Metal Grooving Tool (24-0453)

Casagrande Grooving Tool AASHTO T89 (24-0461)
Used to control the width of the soil groove in the liquid limit cup.

Liquid Limit Device BS (Hand Operated)

Product Code: 24-0410

Product Standards: BS 1377, EN1997-2

Complete with revolution counter, metal grooving tool and test gauge.

Specifications

Weight (kg)	5

Accessories:

Glass Plate 500 mm² x 10 mm thick (24-0430)
Grooving Tool and Gauge (24-0425)

Cone Penetrometer Method

- Reduces operator error.
- Applicable to a wide range of soils.
- Gives reproducible test results.
- Provides direct measurement of penetration.

The method is fundamentally more satisfactory than the Casagrande method as it is essentially a static test depending on the soil shear strength. The test is based on the relationship between moisture content and the penetration of a cone into the soil sample under controlled conditions. Determines the moisture content at which clay soils pass from a plastic to a liquid state.

Cone Penetrometer (Manual)

Product Code: 24-0540

Product Standards:

BS 1377-2, EN 1997-2

Bench mounted apparatus to determine the liquid limit of soils to BS 1377. This method is applicable to a wide range of soils. The apparatus is fitted with a 150 mm diameter dial indicator for direct reading of penetration. Supplied complete with 30˚, 30 mm long test cone. Manufactured from Stainless Steel and includes adjustable levelling feet.

Specifications	
Dial Indicator	150 mm dia graduated in 400 x 0.1 mm divisions. Indicator point incorporates friction/ gear system.
Height Adjustment	Rapid, using integral clamping mechanism
Cone	1 x 30˚, 35 mm Test Cone
Base	Cast aluminium, adjustable levelling feet
Weight (kg)	7

Cone Penetrometer (Semi-Automatic)

Product Code: 24-0545/01

Product Standards:

BS 1377-2, EN 1997-2

Bench mounted apparatus to determine the liquid limit of soils to BS 1377. This method is applicable to a wide range of soils. The apparatus is fitted with a 150 mm diameter dial indicator for direct reading of penetration. Supplied complete with 30°, 30 mm long test cone. Manufactured from Stainless Steel and includes adjustable levelling feet. Incorporates Digital Automatic controller which releases the plunger head and ensures free falling of the penetration device during the test. The time set is displayed by a bright easy to read display.

Specifications	
Dial Indicator	150 mm dia graduated in 400 x 0.1 mm divisions. Indicator incorporates a friction/gear system.
Height	Adjustable using rapid integral clamping mechanism
Cone	1 x 30°, 35 mm Test Cone
Base	Cast aluminium with adjustable levelling feet
Power Supply	220-240 V AC, 50-60 Hz, 1 ph
Weight	Net 19 lbs (8.64 kg)

Soil Index Properties

Penetration Test Cup

Product Code: 24-0548

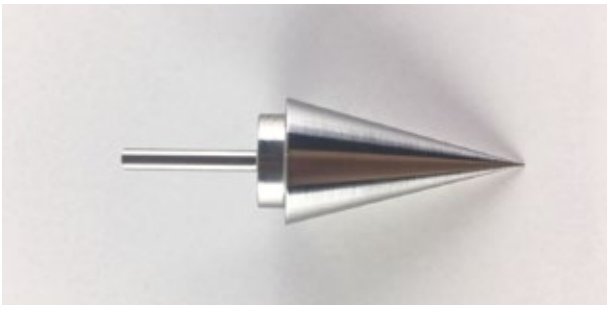
Product Standards:

BS 1377-2

Brass construction 55 mm diameter x 40 mm depth.

Penetration Test Cone

Product Code: 24-0544



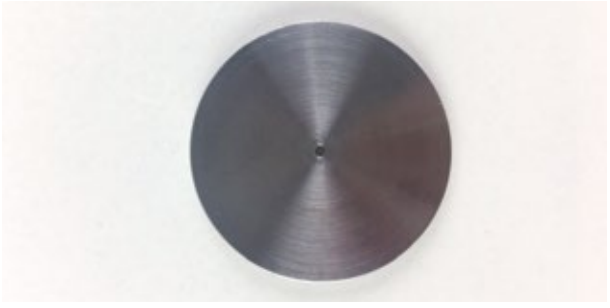
Product Standards:

BS 1377-2

Stainless Steel, 35 mm long with smooth surface at an angle of 30˚.

Penetration Test Gauge for Checking Condition of Cone Point

Product Code: 24-0546



Product Standards:

BS 1377-2

40 mm diameter with the rim parallel to the flat base.

Specifications	
Dimensions L x W x H (mm)	40 x 40 x 10

Determination of Shrinkage Characteristics

When the water content of a fine-grained soil is reduced below the plastic limit, shrinkage of the soil mass continues until the shrinkage limit is reached. Shrinkage can be significant in clays but less so in silts and sands. The equipment listed enables the engineer to determine a number of important parameters, including shrinkage ratio, volumetric shrinkage and linear shrinkage.

Volumetric Shrinkage

Product Standards:

BS 1377, ASTM D427, AASHTO T92

This method of test covers the determination of the shrinkage limit, shrinkage ratio, volumetric shrinkage and linear shrinkage.

Prong Plate

Product Code: 24-1500

Product Standards:

ASTM D427, AASHTO T92

Made of acrylic plastic fitted with three metal prongs.

Specifications	
Dimensions	78 mm dia x 6 mm thick
Weight	Net 1 oz (28 g)

Shrinkage Dish

Product Code: 24-1550

Specifications	
Dimensions (mm)	42 dia x 12 deep

Glass Cup

Product Code: 24-1600

Specifications	
Dimensions (mm)	70 dia x 50 deep
Weight (lbs)	0.388

Measuring Cylinder - Glass 100 ml

Product Code: 82-0380

Soda glass, spouted, BS EN 4788.

Evaporating Dish

Product Code: 82-2000

Product Standards:

ASTM D427, AASHTO T92

Shallow form with spout, porcelain.

Specifications	
Dimensions (mm)	150 dia x 45 deep

Linear Shrinkage

This test covers the determination of linear shrinkage of soils and indicates the plastic properties of soils with a low clay content.

Shrinkage Mould

Product Code: 24-1800

Product Standards:

BS 1377-2

To produce a specimen 140 mm long x 12.5 mm radius.

Specifications	
Weight (kg)	0.3

Vernier Calipers

Product Code: 81-0588

Range 0-200 x 0.002 mm. Graduated in mm and inches.

Determination of Density, Particle Density & Specific Gravity

Particle density or specific gravity is a measure of the actual particles which make up the soil mass and is defined as the ratio of the mass of the particles to the mass of the water they displace. A knowledge of the particle density is essential in relation to other soil tests. It is used when calculating porosity and voids ratio and is particularly important when compaction and consolidation properties are being investigated. The majority of apparatus used for the various tests is general laboratory equipment.

Gas Jar Method

This method is suitable for soils containing up to 10% of particles retained on a 37.5 mm BS sieve.

Gas Jar with Glass Cover & Rubber Bung

Product Code: 24-2830

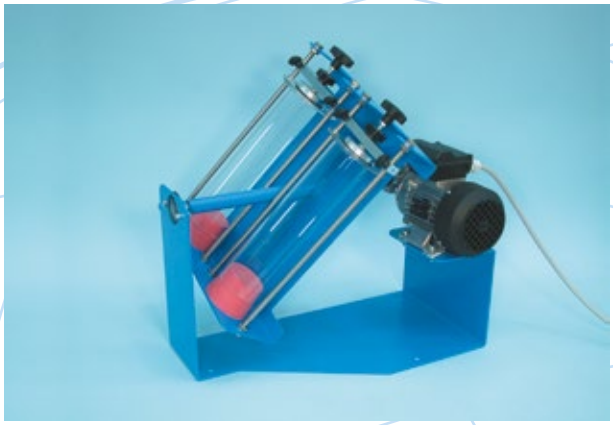
Product Standards:

BS-1377-2, EN 1997-2

Specifications	
Dimensions (mm)	75 dia x 300 deep
Capacity	1 ltr

Mechanical End-Over-End Shaker

Product Code: 24-2854/01



Product Standards: BS 1377-2

Fitted with friction safety device and control panel, capable of rotating two 24-2830 gas jars at approximately 50 rpm to satisfy BS 1377.

Specifications	
Power Supply	220-240 V AC, 50 Hz, 1 ph

Accessories:

37.5 mm Sieve 200 mm diameter (79-1640)

Soil Index Properties

Particle Density: Pyknometer Methods

These methods are generally suitable for fine-grained soils. The larger Pyknometers are not usually suitable for clay soils.

Density Bottles with Perforated Stoppers

Product Standards:

ISO 3507, EN 1097-7, ASTM D854, AASHTO T100

Supplied complete with capillary vent stopper. Gay-Lussac type.

Specifications

Product Code	Capacity (ml)
24-2890	25
24-2900	50
24-2950	100

Pyknometer

Product Code: 24-2885

Product Standards:

BS 812-2, BS 1377-2

Glass jar with non-corrodible cone and rubber seal. Capacity: 1 kg

Specifications

Gasket inside dia	2-1/4 inches (57.2 mm)
Gasket outside dia	2-7/8 inches (73 mm)

Accessories:

Pyknometer Gasket (24-2885/11)

Pyknometer Jar Only (24-2885/10)

Pyknometer Top (24-2885/12)

Particle Size Distribution & Sand Equivalent Value

The analysis of soils by particle size provides a useful engineering classification system from which a considerable amount of empirical data can be obtained. Two separate and different procedures are used. Sieving is used for gravel and sand size particles and sedimentation procedures are used for the finer soils. For soil containing a range of coarse and fine particles it is usual to employ a composite test of sieving and sedimentation procedures. The Sand Equivalent Test serves as a rapid field test to show the relative proportions of clay-like or plastic fines and dusts in granular soils and fine aggregates.

Constant Temperature Bath

Product Code: 24-4865/01

Product Standards:

ASTM D422, AASHTO T88

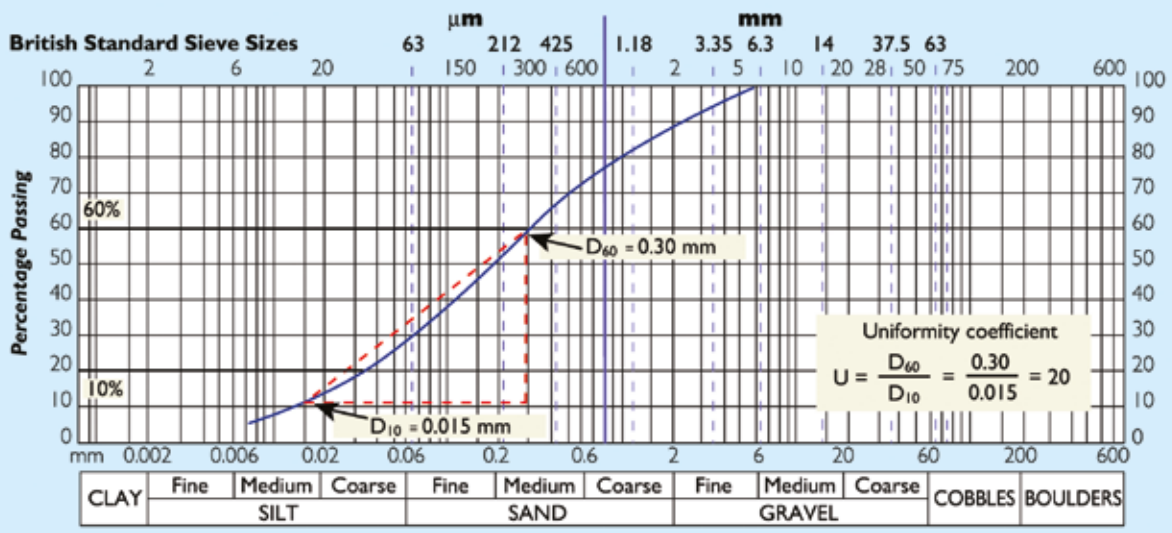
Constant Temperature Bath 5 to 99.9°C x 0.1°C with LED display and false base support.

Specially designed for the sedimentation testing of soils and other fine grained material, the bath is supplied with a false bottom to assist in circulation of the bath liquid. Will accommodate six sedimentation cylinders.

Specifications

External Dimensions L x W x H (mm)	535 x 210 x 610
Capacity	Holds up to 6 sedimentation cylinders
Construction	Stainless Steel with toughened glass front
Temperature Control	Heater/thermostat/circulation with digital controller unit 5 to 99.9°C x 0.1°C
Power (watts)	1500
Power Supply	220-240 V AC, 50-60 Hz, 1 ph
Weight (kg)	12

Particle Size Distribution & Sand Equivalent Value



Sedimentation by the Hydrometer Method

This method determines particle size distribution in a soil from the coarse sand size down to clay size (about 2 µm). The test does not require the weighing accuracy necessary for pipette sedimentation and is suitable for use in site laboratories.

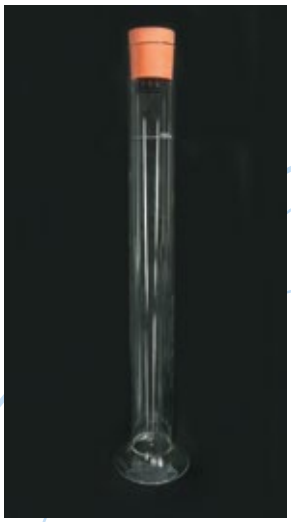
Hydrometer Sedimentation Cylinder

Product Code: 24-4700

Product Standards:

ASTM D422, AASHTO T88

Glass, 1000 ml capacity complete with rubber bung.



Specifications	
Graduations	1,000 ml at 20°C

Nomographic Chart for The Determination of Stoke's Law

Product Code: 24-4800

For the determination of Stoke's Law.

Mechanical Analysis Stirrer

Product Code: 24-4125/01

Product Standards:

ASTM D422, AASHTO T88

High Speed Compact Bench Top Stirrer used for dispersing soil samples in water. Supplied complete with Mixing Paddle and Dispersion Cup with Baffle. Beaker position maintained by column retainer.

Specifications	
Power Supply	220-240 V AC, 50-60 Hz, 1 ph
Weight (kg)	4

Spares/Consumables:

Mixing Paddle for 24-4125 series High Speed Stirrer (24-4125/10)

Soil Dispersion Cup and Baffle (24-4125/11)

Accessories:

Sodium Hexametaphosphate 500 g (24-4145)

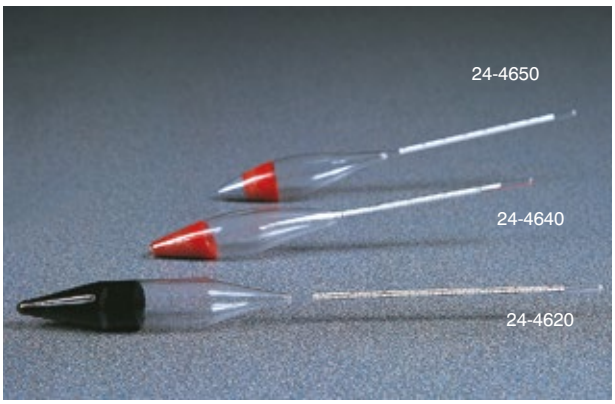
Particle Size Distribution & Sand Equivalent Value

Soil Hydrometers

Product Standards:

ASTM D422, AASHTO T88, ASTM E100

Product Code	Product Standards	Graduation
24-4620	BS/EN DD ENV	0.995 to 1.030 g/ml
24-4640	ASTM/AASHTO	-5 to +60 g/litre
24-4650	ASTM D422 (151H)	0.995 to 1.038 g/ml



Sand Equivalent Value

This test method assigns an empirical value to the relative amount, fineness and character of clay-like material present in the test specimen.

Sand Equivalent Apparatus

Product Code: 24-4919

Product Standards:

ASTM D2419, AASHTO T176, EN 933-8

Sand Equivalent Set Contents	Qty
Glass Measuring Cylinder	4
Rubber Stopper for Cylinder	2
Graduated Rule 500 mm	1
Funnel	1
Measuring Can 200 ml	1
Plastic Bottle	1
Irrigator Tube	1
Weighted Foot Assembly	1
Concentrated Stock Solution 1000 ml	1

Spares/Consumables:

Concentrated Solution (24-4919/10)

Accessories:

Syphon Assembly (24-4925)

Calcium Chloride (24-4930)

Formaldehyde (24-4932)

Glycerol Analar (24-4934)

Mechanical Sand Equivalent Shaker

Recommended for use in laboratories performing a large number of tests, motorised shakers provide a consistent and repeatable oscillation, minimising variation in test results.

Specifications

Product Code	Power Supply	Weight (kg)
24-4945/01	220-240 V AC, 50 Hz, 1 ph	3.2
24-4945/06	220-240 V AC, 60 Hz, 1 ph	4.2

Product standards:

ASTM D2419, AASHTO T176, EN 933-8

Compaction

Compaction tests typically enable the following criteria to be established:

- The relationship between dry density and moisture content for a given degree of compactive effort.
- The moisture content for the most efficient compaction; that is, at which the maximum dry density is achieved under that compactive effort.
- The value of the maximum dry density achieved. There are several different standard laboratory compaction tests, with the most appropriate in each case being based on the nature of the project, the type of soil and the availability of equipment on site.

Applications of Compaction

Soil used as fill

- To refill an excavation or void.
- To provide made-up ground to support a structure.
- As a sub-base for a road, railway or airfield runway.
- As a structure; e.g. an earth dam.

Improvement by compaction

- Higher stability.
- Higher CBR value.
- Lower compressibility.
- Lower permeability.
- Lower frost susceptibility.

Effect on mass of fill

- Greater stability.
- Less settlement.
- Less deformation.
- Less water absorption.
- Less risk of frost heave.

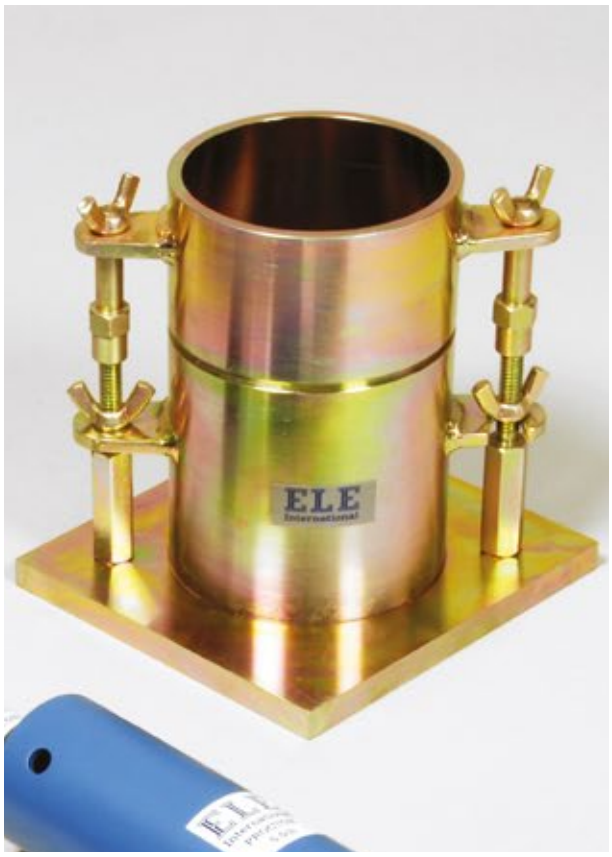
Compaction & CBR

BS/EN Compaction Test 2.5 kg

This test method utilises a 2.5 kg hand compaction rammer and a one litre capacity compaction mould. Often referred to as the 'Proctor' test it is suitable for soils containing particles no larger than 20 mm. The mould and rammer are manufactured from corrosion protected steel components to withstand the heavy usage involved in the test.

Compaction Mould BS Standard

Product Code: 24-9000



Product Standards:

BS 1377-4, BS 1924-2, EN 1997-2

Plated steel standard compaction mould, comprising a collar mould body and base plate with quick release wing nuts for easy dismantling.

Specifications	
Mould Volume	1 ltr
Dimensions (mm)	105 dia x 115.4 high
Construction	All steel, threaded studs with wing nuts, plated
Weight (kg)	5.5

Compaction Rammer 2.5 kg BS Standard

Product Code: 24-9002

Product Standards:

BS 1377-4, BS 1924-2, EN 1997-2

50 mm diameter with 300 mm drop, manufactured from corrosion protected steel.

Specifications	
Rammer Size	50 mm dia, 2.5 kg
Drop (mm)	300
Guide Sleeve	Machined steel tubing with air pressure release holes
Finish	Corrosion resistant
Total Weight (kg)	4.2

BS/EN Compaction Test 4.5 kg

This test method utilises a 4.5 kg hand rammer resulting in a heavier compactive effort than the 2.5 kg test method. Compactive energy some 4.5 times greater is applied to the sample using the heavier rammer. The method is often specified where higher levels of compaction are necessary in a structure, e.g. an airfield sub-base material. Manufactured from corrosion protected steel components the 4.5 kg rammer is designed to withstand heavy usage involved in the test method.

Compaction Rammer 4.5 kg BS Standard

Product Code: 24-9004

Product Standards:

BS 1377-4, BS 1924-2, EN 1997-2

Specifications	
Rammer Size	50 mm dia, 4.5 kg
Drop (mm)	450
Guide Sleeve	Machined steel tubing with air pressure release holes
Finish	Corrosion resistant
Total Weight (kg)	7.5

Proctor Compaction

Proctor Mould ASTM

Product Code: 24-9060

Product Standards:

ASTM D558, ASTM D698, ASTM D1557, AASHTO T99, AASHTO T134, AASHTO T180

Specifications	
Dimensions (mm)	101.6 dia x 116.4 high
Rammer Mould Volume	1/30 ft³
Construction	All steel, threaded studs with wing nuts, plated
Weight (kg)	5.4

Proctor Compaction Rammer 2.49 kg ASTM

Product Code: 24-9063

Product Standards:

ASTM D558, ASTM D698, ASTM D1557, AASHTO T99, AASHTO T134, AASHTO T180

Specifications	
Rammer Size	2 inches dia (50.8 mm) 5-1/2 lbs (2.49 kg)
Drop	12 inches (305 mm)
Guide Sleeve	Machined steel tubing with air pressure release holes
Finish	Corrosion resistant
Total Weight (kg)	2.5

Compaction Mould Modified ASTM

Product Code: 24-9066

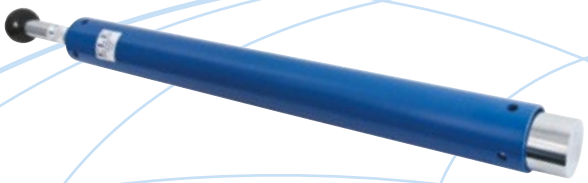
Product Standards:

ASTM D558, ASTM D698, ASTM D1557, AASHTO T99, AASHTO T134, AASHTO T180

Specifications	
Dimensions (mm)	152.4 dia x 116.4 high
Rammer Mould Volume	1/13.33 ft³
Construction	All steel, threaded studs with wing nuts, plated
Weight (kg)	8.3

Proctor Compaction Rammer 4.5 kg (Modified) ASTM

Product Code: 24-9070



Product Standards:

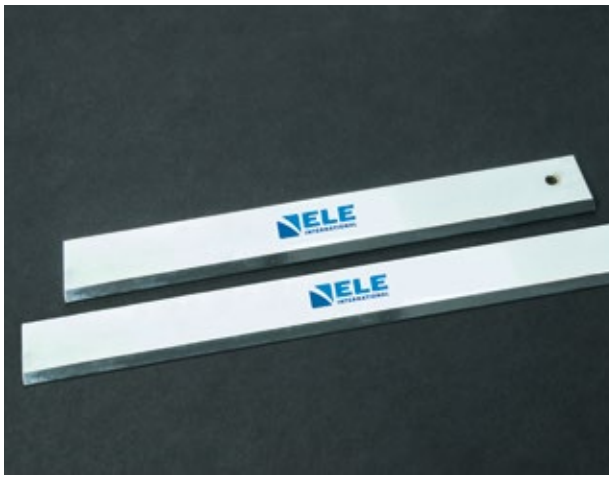
ASTM D558, ASTM D698, ASTM D1557, AASHTO T99, AASHTO T134, AASHTO T180

Specifications	
Rammer Size	2 inches dia. (50.8 mm); 10 lbs (4.5 kg)
Drop	18 inches (457.2 mm)
Guide Sleeve	Machined steel tubing with integrally spun end cap; air pressure release holes
Finish	Corrosion resistant
Total Weight (kg)	6.3

Compaction & CBR

Straight Edge 300 / 455 mm

Product Code: 24-9010, 81-0715



Specifications

Product Code	24-9010	81-0715
Dimensions L x W x D (mm)	300 x 40 x 1.5	455 x 40 x 1.5
Weight (g)	550	900

Automatic Compaction of Soils

The time and effort required to prepare specimens for compaction studies and other test methods can often be costly and time-consuming. The use of an automatic, mechanical compactor will show considerable cost benefits over hand compaction methods. Two models meeting the requirements of BS/EN and ASTM are available.

Automatic Compactors

- Pre-set blow pattern ensures even compaction.
- Solid state controls for reliability and ease of maintenance.
- Automatic re-setting of counter after completion of blow pattern.

These machines automatically compact specimens eliminating the laborious hand compaction method. The height and weight of the rammer are selectable to suit test requirements. An automatic blow pattern ensures optimum compaction for each layer of soil. The rammer travels across the mould and the table rotates the mould in equal steps on a base that is extremely stable. The number of blows per layer can be set at the beginning of the test.

Automatic Soil Compactor BS

Product Codes: 24-8080/01, 24-8080/06

Product Standards:

BS 1377-4, BS 1924-2, EN 13286-2, EN 13286-47

Pre-set blow pattern ensures an even compaction. Includes solid state controls for reliability and maintenance. An automatic digital counter resets to zero on completion of a test. A pre-set number of blows per layer can be set by thumb wheel control. A compaction rate of approximately 26 blows per minute. Accepts BS Standard Compaction and CBR moulds; also meets the requirements of BS 1377.

Specifications		
Dimensions L x W x H (mm)	430 x 240 x 1400	
Rammer BS/EN	Circular faced, 50 mm dia, selectable to 2.5 kg or 4.5 kg weight.	
Drop BS/EN (mm)	Adjustable to 300 or 450	
Weight (kg)	160	
Product Code	**24-8080/01**	**24-8080/06**
Power Supply	220-240 V AC, 50 Hz, 1 ph	220-240 V AC, 60 Hz, 1 ph

Automatic Soils Compactor ASTM

Product Codes: 24-8085/01, 24-8085/06

Product Standards:

ASTM D558, ASTM D698, ASTM D1557, AASHTO T99, AASHTO T134, AASHTO T180

Specifications		
Dimensions L x W x H	10 x 17 x 55 inches (250 x 430 x 1400 mm)	
Rammer	Circular faced, 2 inch (50.8 mm) dia foot; selectable to either 5.5 lb (2.5 kg) or 10 lb (4.5 kg) weight	
Drop	Adjustable to either 12 inches (305 mm) or 18 inches (457 mm)	
Controls	Digital counter system, selector switch for either standard Proctor test or modified Proctor/CBR testing	
Weight (kg)	160	
Product Code:	**24-8085/01**	**24-8085/06**
Power Supply	220-240 V AC, 50 Hz, 1 ph	220-240 V AC, 60 Hz, 1 ph

Compaction & CBR

Compaction BS & CBR Accessories

Grouped Product Standards:

BS 1377-4, BS 1924-2, EN 13286-4

Product Code	Product
24-9200	CBR Extension Collar
24-9204	BS CBR Solid Base
24-9198	CBR Mould Body
24-9000	Standard Compaction Mould

Compaction ASTM Accessories

Grouped Product Standards:

ASTM D558, ASTM D698, ASTM D1557, AASHTO T99, AASHTO T134, AASHTO T180

Product Code	Product
24-9060	Proctor Mould
24-9066	ASTM/Modified Proctor Compaction Mould
24-9228	ASTM CBR Mould

Automatic Soils Compactor Spares Kit BS

Product Code: 24-9090/K1

Spares Kit Includes	Qty
Tongue	1
Compression Spring	1
Tension Spring	2
Guide Pin	1
External Circlip	1
Microswitch Roller	2
Thrust Washer	1
Oilite Bush	1
Compression Spring	2
Tension Spring	1
Clamp Nut	2
Torsion Spring	1
Tension Spring	1
Anti Surge Fuse for Digital Console 240 V	5
A/S Fuse	5
Rammer BS	1
Knockout BS	1

Automatic Soils Compactor Spares Kit ASTM

Product Code: 24-9095/K1

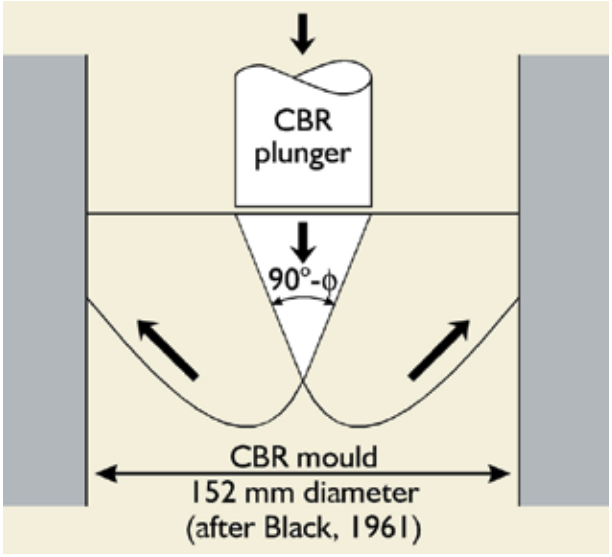
Spares Kit Includes	Qty
Tongue	1
Compression Spring	1
Tension Spring	2
Guide Pin	1
External Circlip	1
Microswitch Roller Lever Short	2
Thrust Washer	1
Oilite Bush	1
Compression Spring	2
Tension Spring	1
Clamp Nut	2
Torsion Spring	1
Tension Spring	1
Anti Surge Fuse for Digital Console 240 V	5
A/S Fuse	5
Rammer ASTM	1
Knockout ASTM	1

California Bearing Ratio

This test can be performed in the laboratory on prepared samples or on location in the field. It is important to appreciate that this test, being of an empirical nature, is valid only for the application for which it was developed.

A number of options are available to collect and analyse data with the ELE CBR-Test 50 or the MultiPlex 50 machines:

- Mechanical, using standard Load Rings and Penetration Dial Gauges.
- Electronic, Load Transducers and Displacement Transducers in conjunction with the ELE DSU Data Logger.
- Electronic, using Electronic measuring devices as above in conjunction with the ELE DS7.2 software that provides full analysis of CBR Test data.



CBR-Test 50 Machine 50 kN capacity BS & ASTM supplied with Stabilising Bar

Product Codes: 24-9150/01, 24-9150/02, 24-9150/06

Product Standards:

EN 13286-47, BS 1377-4, ASTM D1883, AASHTO T193

Designed for performing laboratory CBR tests to BS 1377, EN13286-47 and ASTM D1883, this bench mounting machine comprises a twin column frame incorporating a motorised drive system. Rapid adjustment of the platen is provided, which enables daylight to be taken up quickly and also close control of application of a seating load.

- Single speed machine (BS/EN and ASTM).
- Rapid platen adjustment.
- Complete with stabilising bar.
- Compact, bench-mounting design.
- Options for mechanical or electronic measurement.

Specifications	
CBR Penetration	Yes
Dimensions L x W x H (mm)	550 x 400 x 1220
Max Vertical Clearance (mm)	800
Horizontal Clearance (mm)	255
Platen dia (mm)	133
Platen Travel (mm)	105
Weight (kg)	80
Product Code	**Power Supply**
24-9150/01	220 V AC, 50 Hz, 1 ph
24-9150/02	110-120 V AC, 60 Hz, 1 ph
24-9150/06	220-240 V AC, 60 Hz, 1 ph

Spares/Consumables:

Stabilising Bar (24-9170)

Compaction & CBR

MultiPlex 50 Load Frame

Product Code: 25-3700/01

Product Standards:

Marshall

EN 12697-34, EN 12697-12, EN 12697-23, BS 598-107, ASTM D6927, ASTM D6931

CBR

EN 13286-47, BS 1377-4, ASTM D1883, AASHTO T193

Triaxial

BS 1377-7, BS 1377-8, ASTM D2166/D2166M, ASTM D2850, ASTM D4767, ASTM D7181, AASHTO T208, AASHTO T296, AASHTO T297

Specifications	
CBR Penetration	Yes
Unconfined Compression	Yes
Consolidated Undrained	No
Consolidated Drained	No
Marshall Stability and Flow	Yes
Power Supply	220-240 V AC, 50-60 Hz, 1 ph
Dimensions (mm)	550 x 400 x 1470
Max Vertical Clearance (mm)	800
Horizontal Clearance (mm)	265
Platen dia (mm)	133
Platen Travel (mm)	100
Platen Speed Range	0.5 to 50.8 mm/min
Rapid Approach Speed	40 mm/min
Weight (kg)	100 (shipping 113)

Manual Accessories:

Clamped Boss Load Ring - 2 kN (78-0060)

Clamped Boss Load Ring - 3 kN (78-0160)

Clamped Boss Load Ring - 4.5 kN (78-0260)

Clamped Boss Load Ring - 10 kN (78-0460)

Clamped Boss Load Ring - 28 kN (78-0760)

Clamped Boss Load Ring - 50 kN (78-0860)

Penetration Dial Gauge BS (24-9186)

Penetration/Swell Dial Gauge ASTM (24-9184)

Electronic Accessories:

50 kN S-Type Load Cell (27-1559)

CBR Penetration Transducer 50 mm travel fitted with 5-pin DIN plug (27-1705)

DSU 27-1300/01 and 27-1300/02

Alternative frame to product: 24-9150/01

Compact bench mounting load frame designed for performing laboratory CBR, unconfined compression, Quick Undrained Triaxial and Marshall Stability Tests. Has a variable speed of 0.5 to 50.8 mm per minute and features rapid approach of platen.

Penetration Measurement

Penetration Piston

Product Code: 24-9182

1935 mm² (3 inches²) area foot of case hardened steel. Designed to fit all ELE load rings.

Specifications	
Weight (kg)	3.8

CBR Penetration Piston (Adjustable)

Product Code 24-9183

Product Standards:

EN 13286-47, BS 1377-4, ASTM D1883, AASHTO T193

As 24-9182 but with a coarse stem adjustment. This piston is particularly useful for in-situ testing.

Penetration/Swell Dial Gauge ASTM

Product Code: 24-9184

Product Standards:

ASTM D1883, AASHTO T193

1 inch travel x 0.0005 in divisions. Complete with rack extensions and chisel edge anvil.

Penetration Dial Gauge BS

Product Code: 24-9186

Product Standards:

BS 1377, BS 1924, ASTM D4429

25 mm travel x 0.01 mm divisions. Complete with rack extensions and chisel edge anvil.

CBR Penetration Gauge Dual Purpose Mounting Bracket & Adaptor

Product Code: 24-9188

Product Standards:

BS 1377, BS 1924, ASTM D4429

Dual purpose mounting bracket for CBR penetration dial gauges 24-9184/24-9186. Allows gauge to be fixed to penetration piston or load ring.

CBR Penetration Transducer 50 mm Travel fitted with 5-pin DIN Plug

Product Code: 27-1705

Displacement Transducers are used in consolidation, shear, CBR and triaxial test applications for accurate displacement measurements. They are supplied complete with a 5-pin DIN type connector for direct connection to the DSU.

- Ideally suited for use with DSU for accurate displacement measurements.
- Models available for use in consolidation, shear, CBR and triaxial test applications.
- Supplied complete with mounting hardware for specified products.
- Supplied with calibration certificate.

Specifications	
Construction	Fully encapsulated electronics, sealed in a Stainless Steel case
Excitation	14 V DC
Connector	5-pin DIN type
Mounting Bracket	Included as standard
Weight (kg)	0.45

Compaction & CBR

Force Measurement

A range of load rings will be required depending upon the type of material being tested. Detailed below is a selected range of load rings and transducers that are suitable for differing values of CBR.

Clamped Boss Load Rings

ELE Clamped Boss Load Rings are available in the range 1 kN to 50 kN.

The available capacities and performance of ELE load rings satisfy the requirements for accurate load measurement for a wide range of testing applications.

The repeatability and accuracy of all clamped boss rings comply with the requirements of NIS 0415 Accreditation for the Calibration of Force Measuring Rings and Load Cells used in Soil Testing.

The repeatability of all load rings is within 0.2% of indicated load and accuracy is ±1% of indicated load over the upper 80% of the working range, at the calibration loads.

All clamped boss load rings are calibrated in kN and supplied with a calibration chart.

Complete with a detachable nipple, all rings are supplied in a protective foam moulding.

- Repeatability within 0.2% of indicated load.
- Accuracy within ±1% of indicated load.
- Works calibrated.

Product Code	Capacity			Typical Design Sensitivity			Overall Height (mm)	Approx Weight (kg)	Value of CBR
	kN	kgf	lbf	N/div	kgf/div	lbf/div			
78-0060	2.0	200	450	1.3	0.13	0.30	248	3.2	Up to 8%
78-0160	3.0	300	650	2.0	0.20	0.43	248	3.3	N/A
78-0260	4.5	450	1000	3.0	0.30	0.66	248	3.5	N/A
78-0460	10.0	1000	2250	7.7	0.77	1.73	248	4.6	8% - 40%
78-0760	28.0	2800	6000	25.5	2.54	5.45	248	5.4	Average range of CBR
78-0860	50.0	5000	11200	45.5	4.54	10.18	248	7.9	Above 40%

S-type Load Cell 50 kN

Product Code: 27-1559

Product Standards:

EN 12697-34

Maximum working capacity of 50 kN and extension 10 V AC/DC with an output of 2.7 mV/V nominal. Aluminium alloy and Stainless Steel construction with IP65 environmental protection.

Supplied with calibration certificate.

Specifications	
Value of CBR %	ALL
Environmental Protection	IP65
Force Capacity (kN)	50

Automatic Data Acquisition - CBR

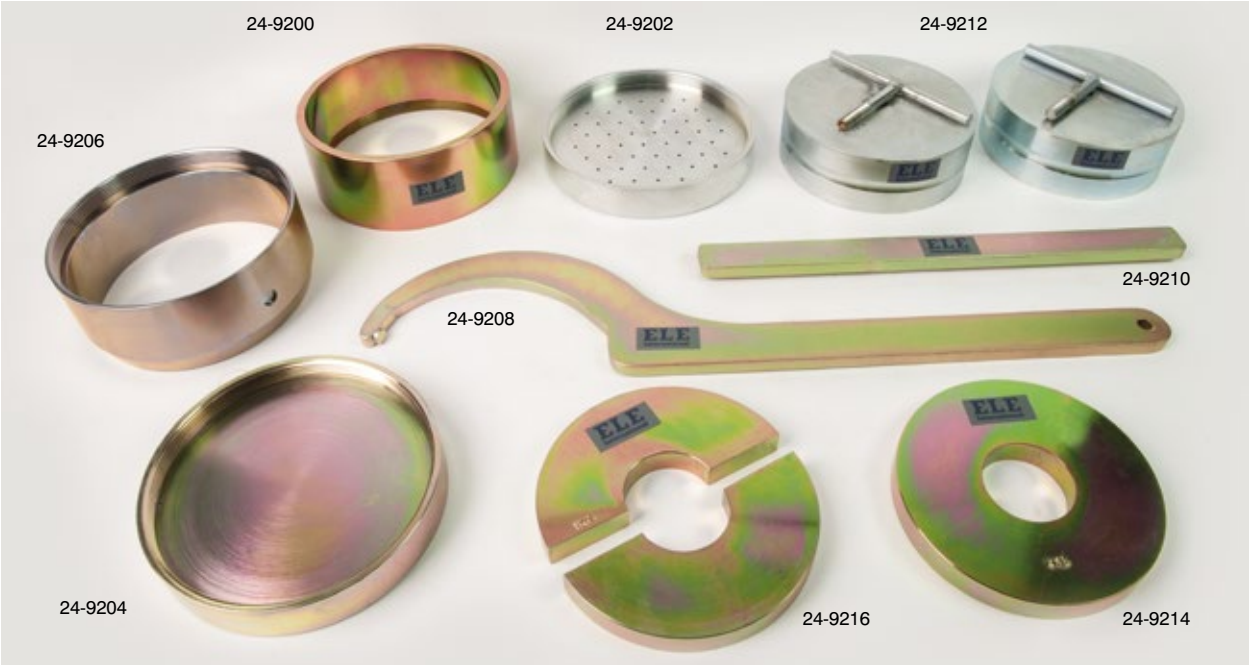
For full details see Data Logging on pages 72-77

Product Code	Product
27-2798 (DS7.2: 27-1798)	DS7.3 California Bearing Ratio (CBR) Penetration Program
27-1500/01	GDU 8 channel data acquisition unit 220-240 V AC, 50-60 Hz, 1 ph
27-1500/02	GDU 8 channel data acquisition unit 110-120 V AC, 50-60 Hz, 1 ph
27-1300/01	DSU 4 channel data acquisition unit 220-240 V AC, 50-60 Hz, 1 ph
27-1300/02	DSU 4 channel data acquisition unit 110-120 V AC, 50-60 Hz, 1 ph

CBR Moulds & Accessories

A range of moulds and accessories designed to meet relevant Standards. The equipment is manufactured from high quality materials and, with regular maintenance, will give years of satisfactory performance.

CBR Mould BS EN



CBR Mould Body BS EN

Product Code: 24-9198

Product Standards:
BS 1377-4, BS 1924-2

Specifications	
Mould (mm)	152 x 127 (inside dia x height)
Collar (mm)	51 height, fits both ends of mould
Base Plate	Solid, fits both ends of mould
Construction	All steel, plated
Weight (kg)	7.3

CBR Mould Accessories BS EN

Product Standards: ASTM D1883, AASHTO T193

Product Code	Product	Weight (kg)
24-9200	CBR Extension Collar To fit to mould body	1.85
24-9204	BS CBR Solid Base To fit to mould body	2.5
24-9202	Perforated Base Plate To fit to mould body for swell tests	1.8
24-9206	CBR Cutting Collar. To fit mould body, with a cutting edge to enable undisturbed samples to be taken from the field	1.4
24-9208	C-spanner for CBR Mould To fit mould body and collars	1.7
24-9210	Base Plate Tool. To fit into base plate to assist removal from mould body	0.7
24-9212	Static Compaction Plug Steel, 150 mm dia x 51 mm depth. Complete with removable handle	7.3
24-9214	Annular Surcharge Weight	2
24-9216	Split Surcharge Weight (4 required)	2
24-9237	Space Disc	7
24-9220	Filter Paper - 150 mm dia Box of 100	0.2

Compaction & CBR

CBR Mould ASTM/AASHTO

CBR Mould ASTM complete with Collar & Perforated Base Plate

Product Code: 24-9228

Product Standards:

ASTM D1883, AASHTO T193

Specifications	
Mould (mm)	152.4 x 177.8 (inside dia x height)
Collar (mm)	50.8 height, fits both ends of mould
Base Plate	Perforated
Construction	All steel, plated
Weight (kg)	9

CBR Mould Accessories ASTM/AASHTO

Grouped Product Standards:

ASTM D1883, AASHTO T193

Product Code	Product	Weight (kg)
24-9234	Solid Base Plate	2.9
24-9236	CBR Cutting Collar To fit mould body, with a cutting edge to enable undisturbed samples to be taken from the field	1.5
24-9238	CBR Spacing Disc 150.8 mm dia x 61.4 mm deep	6.8
24-9240	Filter Screen 150mm dia with 150 μm mesh. Box of 100	0.1
24-9243	10 lb annular Surcharge Weight	4.5
24-9244	5 lb split Surcharge Weight (4 required)	-
24-9245	5 lb annular Surcharge Weight	-
24-9250	Filter Papers Equivalent to Whatman No.5 - 150 mm dia Box of 100	0.2

Swell Expansion Test Equipment

Swell Plate

Product Code: 24-9260

Product Standards:

ASTM D1883, AASHTO T193

With adjustable stem.

Specifications	
Base Plate	5 15/16 inches dia (150.8 mm); perforated.
Contact Head	Adjustable; locks on stem with knurled nut
Construction	Aluminium
Weight (kg)	0.5

Swell Stand (Tripod)

Product Code: 24-9262

Product Standards:

ASTM D1883, AASHTO T193

For mounting Swell Dial Gauge in position on CBR Mould Collar.

Further Information:

Requires dial indicator; not included, order separately.

Specifications	
Construction	Machined, one-piece cast aluminium
Clamp	Integral part of assembly; holds dial indicator
Contact Head	Integral part of assembly; holds dial indicator
Dimensions L x W x H (mm)	190 x 190 x 170
Weight (kg)	0.9

Accessories:

Mechanical Dial Indicator - 25 mm Range Clockwise Movement (88-4110).

Small Curing Tank for Small Cubes

Product Code: 34-6755/01

Small cube curing tank can hold 16 x 150 mm cubes or 105 x 70.7 mm cubes. Comes complete with stand, internal tray, immersion heater designed to maintain the temperature at 20°C, +/- 2°C and thermostat.

Curing Tank Heater Unit to be used with Small Curing Tank

Product Code: 34-6755/10

Alternative Large Curing Tank (34-6575/01) please see page 126.

Penetration/Swell Dial Gauge BS & ASTM

Dial Gauge Back Bracket Mount Positions

Specifications				
Product Code	Application	Travel (mm)	Divisions (mm)	Standard
24-9184	Penetration/Swell	25	0.01	ASTM
24-9186	Penetration	25	0.01	BS
24-9275	Penetration/Swell	25	0.01	BS

Compaction & CBR

In-situ CBR

The use of in-situ CBR apparatus on road construction contracts enables the bearing capacity of soils to be determined quickly and efficiently with minimum delay. The BS 1377, BS 1924 and ASTM D4429 standards describe in-situ test procedures.

In-situ/CBR Mechanical Jack 45 kN (10000 lb) Capacity

Product Code: 24-9290

Product Standards:

BS 1377-9, BS 1924-2, ASTM D4429

The body is corrosion protected and houses an enclosed worm and wheel gear. The gear ratio has been carefully selected to provide a handwheel speed that can be comfortably maintained, particularly with soils of high CBR value. A quick-release device in the screwjack allows the plunger to be rapidly adjusted prior to the test.

Specifications	
Weight (kg)	8.2

In-situ Land Rover Bracket to attach 29-200 Jack. For Land Rover Models 90 & 110 from 1983 onwards

Product Code: 24-9298

Product Standards:

BS 1377-9, BS 1924-2, ASTM D4429

Fits all models in Land Rover series 90 and 110.

Ball Seating for 45 kN Jack 24-9290

Product Code: 24-9300

Product Standards:

BS 1377-9, BS 1924-2, ASTM D4429

For fitting between the mechanical jack and reaction point. The ball seating is used when testing on undulating ground to ensure that the jack, load measuring ring and penetration piston are truly vertical. Non-axial loading of the load ring will give false results and will eventually damage the ring itself.

Specifications	
Weight (kg)	1.8

In-situ Set of Extension Rods

Product Code: 24-9308

Product Standards:

BS 1377-9, BS 1924-2, ASTM D4429

Made from high quality steel with large section thread for quick assembly.

Spares/Consumables:

Adaptor for Extension Rod Set (24-9308/10)

In-situ Datum Bar Assembly

Product Code: 24-9312

Product Standards:

BS 1377-9, BS 1924-2, ASTM D4429

Comprising 2 tripod stands and a datum bar.

CBR Annular Surcharge Weight

Product Code: 24-9320

Product Standards:

BS 1377-9, BS 1924-2

Specifications	
Weight lb / kg	10 / 4.5

CBR Slotted Surcharge Weight

Product Code: 24-9322

Product Standards:

ASTM D4429

Specifications	
Weight lb / kg	10 / 4.5

CBR Slotted Surcharge Weight

Product Code: 24-9248

Product Standards:

ASTM D4429

Specifications	
Weight lb / kg	20 / 9.1
Construction	Machined steel
Finish	Plated

Accessories:

5 lb (2.27 kg) Annular Surcharge Weight ASTM (24-9245)

5 lb (2.27 kg) Split Surcharge Weight ASTM (24-9244)

CBR Penetration Piston (Adjustable)

Product Code: 24-9183

Product Standards:

BS 1377-9, BS 1924-2, ASTM D4429

As 24-9182 but with a coarse stem adjustment. This piston is particularly useful for in-situ testing.

For full specification see page 37

Penetration Gauge Bracket & Adaptor. Dual Purpose Mounting Bracket for CBR Penetration Gauges 24-9184/24-9186

Product Code: 24-9188

For full specification details see page 37

Penetration/Swell Dial Gauge BS & ASTM

Dial Gauge Back Bracket Mount Positions

Specifications				
Product Code	Application	Travel (mm)	Divisions (mm)	Standard
24-9184	Penetration/Swell	25	0.01	ASTM
24-9186	Penetration	25	0.01	BS
24-9275	Penetration/Swell	25	0.01	BS

Clamped Boss Load Rings

Product Code	Capacity			Overall Height (mm)	Approx Weight (kg)
	kN	kgf	lbf		
78-0460	10.0	1000	2250	248	4.6
78-0760	28.0	2800	6000	248	5.4

For full specifications on the above Load Rings see page 38

Compaction & CBR

In-situ Conversion to Laboratory CBR

The in-situ CBR jack assembly can be mounted in a simple conversion frame to measure CBR values in the laboratory. The frame is used with the jack, a suitable load ring, CBR mould and penetration piston.

CBR Conversion Frame

Product Code: 24-9341

Product Standards:

BS 1377-9, BS 1924-2, ASTM D4429

50 kN conversion frame to adapt to mechanical jack for laboratory CBR tests. The frame is of a two-column construction with an overhead beam to accept the mechanical jack 24-9290 and is supplied complete with stabilising bar.

Specifications	
Weight (kg)	25

In-situ/CBR Mechanical Jack 45 kN (10000 lb) Capacity

Product Code: 24-9290

Product Standards:

BS 1377, BS 1924, ASTM D4429

Clamped Boss Load Ring 28.0 kN

Product Code: 78-0760

Repeatability shall be within 0.2% of indicated load. Accuracy will be +/- 1% of indicated load over the upper 80% of the working range at the calibration loads.

Penetration Piston (Adjustable) for CBR

Product Code: 24-9183

As 24-9182 but with a coarse stem adjustment. This piston is particularly useful for in-situ testing.

For full specification see page 37

Penetration Gauge Bracket & Adaptor. Dual Purpose Mounting for CBR Penetration Gauges

Product Code: 24-9188

Product Standards:

BS 1377, BS 1924, ASTM D4429

Dual purpose mounting bracket for CBR penetration dial gauges 24-9184/24-9186. Allows gauge to be fixed to penetration piston or load ring.

Penetration/Swell Dial Gauge ASTM

Product Code: 24-9184

For full specification see page 37

Penetration Dial Gauge BS

Product Code: 24-9186

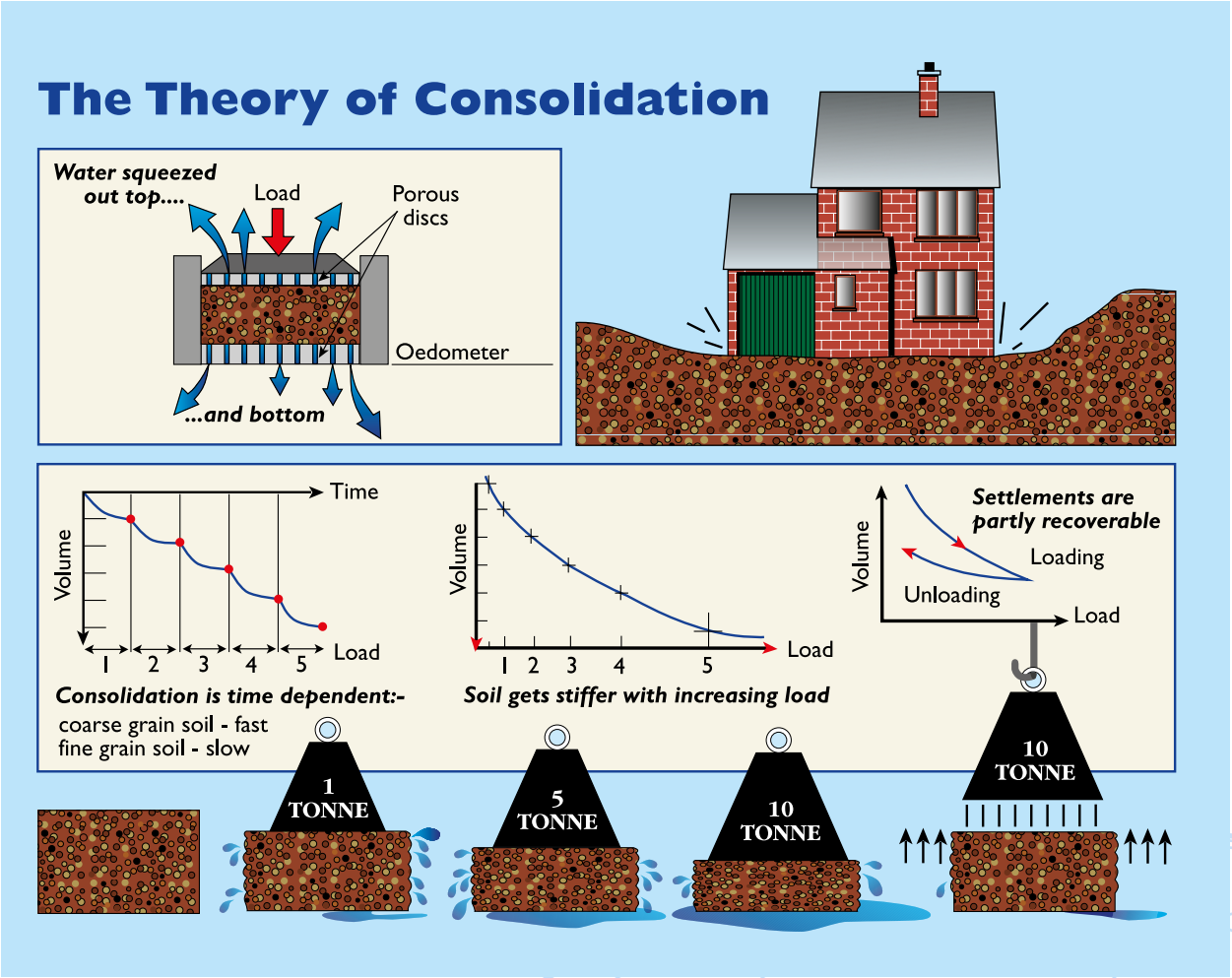
For full specification see page 37

Consolidation

It is generally understood that clays and other compressible soils can be subject to long-term consolidation under the loads imposed by foundations and above ground structures, also that settlement may occur even if the applied pressure is within the safe bearing capacity of the soil.

One-Dimensional Consolidation

The One-dimensional Consolidation test is used to determine the consolidation characteristics of soils of low permeability. Tests are carried out on specimens prepared from undisturbed samples. Data obtained from these tests, together with classification data and a knowledge of the soils loading history, enables estimates to be made of the behaviour of foundations under load.



Consolidation

Consolidation/Oedometer Apparatus

Consolidation Frame

Product Code: 25-0402

Product Standards:

ISO 17892-5, BS 1377-5, ASTM D2435, ASTM D3877, ASTM D4546, AASHTO T216

The ELE Oedometer is rigidly constructed to ensure minimum frame distortion. The frame is designed to load the specimen through a yoke assembly and one of three alternative beam ratios. The beam is fitted with a counterbalance weight and beam support jack. The cell platform will accept the complete range of ELE consolidation cells and is fitted with a central spigot to ensure accurate centring of the cell under the loading yoke.

- High capacity - 8800 kPa on 50 mm diameter specimens using 11:1 beam ratio.
- Triple beam ratio, 9:1, 10:1, 11:1.
- Compact unit ensures maximum space saving.

Further Information:

Supplied without dial gauge and weights.

Spares/Consumables:

Weight hanging spindle assembly (1563B0010)

Specifications	
Load Capacity	48 tons/ft^2 (5,14 8 kPa) on 2.5 inches (63 mm) dia samples
Loading Beam	Cast aluminium; counterbalanced; 9:1,10:1 and 11:1 ratios
Frame	Cast aluminium; integral beam support jack; plated steel and platform
Dimensions L x W x H	711 x 203 x 508 mm (28 x 8 x 20 inches) excluding weight hanger
Weight	(Net 30 lbs) 13.6 kg; Shipping 40 lbs (18.1 kg)

Consolidation Weight Sets 100 kg / 50 kg

Product Code: 25-0408, 26-2132

Specifications	Set A	Set B
Product Code	25-0408	26-2132
Weight Set (kg)	100 Total	50 Total
Set Includes	9 x 10 kg 1 x 5 kg 2 x 2 kg 1 x 1 kg	4 x 10 kg 1 x 5 kg 2 x 2 kg 1 x 1 kg

Consolidation Floor Mounting Stand

Product Code: 25-0429

A versatile modular steel stand. Holes in the shelf are provided for securing up to three 25-0402 Consolidation Frames. Dimensions 610 x 915 x 865 mm (L x W x H).

Specifications	
Table Dimensions (mm)	980 x 950

Consolidation Cells & Accessories

High Pressure Application Consolidation Cells & Accessories

Grouped Product Standards:

ISO 17892-5, BS 1377-5, ASTM D2435, ASTM D3877, ASTM D4546, AASHTO T216

Product Code	Product	Sample Dia (mm)
25-0455	Consolidation Cell 50 mm	50
25-0458	Cutting Ring	50
25-0461	Calibration Disc	50
25-0455/13	Upper and lower Porous Stones	50

Spares/Consumables:

Top cap for 50 mm Consolidation Cell (1037A0006)

BS EN Consolidation Cells & Accessories

Grouped Product Standards:

ISO 17892-5, BS 1377-5

Product Code	Product	Sample Dia (mm)
25-0503	Consolidation Cell 75 mm	75
25-0506	Cutting Ring	75
25-0509	Calibration Disc	75
25-0503/13	Upper and lower Porous Stones	75

ASTM/AASHTO Consolidation Cells & Accessories

Grouped Product Standards:

AASHTO T216, ASTM D2435, ASTM D3877, ASTM D4546

Product Code	Product	Sample Dia (inches)
25-0479	Consolidation Cell	2.5
25-0482	Cutting Ring	2.5
25-0485	Calibration Disc	2.5
25-0479/13	Upper and lower Porous Stones	2.5

Vertical Settlement Measurement

Various methods of measuring vertical settlement can be supplied. These range from dial gauges to displacement transducers. All devices comply with the accuracy specified in BS 1377, ASTM D2435 and D4546. Displacement transducers are supplied with a calibration certificate. The table below shows the range of devices available for fitting to the 25-0402 Consolidation Frame. Transducers are supplied complete with mounting brackets as required.

Product Code	Product
25-0440	Dial Gauge 10 mm travel x 0.002 mm divisions
27-1649	Consolidation Transducer 15 mm travel

Automatic Data Acquisition - Consolidation

Geotechnical laboratories make extensive use of computers and automated testing, and we offer specially written software packages designed to record and analyse test data. Presentation of results is in test report format, giving geotechnical engineers total control over all areas of analysis where an engineering judgement is required.

Product Code	Product
27-2773 (DS7.2: 27-1773)	DS7.3 One-Dimensional Consolidation Software
27-1300/01	DSU

For full details see Data Logging on page 72-77.

Consolidation

Permeability

Knowledge of the permeability characteristics of soil is essential for construction projects where drainage is an important element. In particular, permeability is a key parameter for the design and assessment of landfill sites, the investigation of contaminated ground, the design of earth dams and sheet pile walls, and in assessing the potential for lowering groundwater levels.

Combination Permeameter, 2.5 inches (63.4 mm); Constant & Falling Head Methods

Product Code: 25-0623

This combination permeameter has a transparent plastic chamber for soil specimens of either fine-grained or coarse-grained soils. Generally, soils containing 10% or more particles passing a 75 μm sieve are tested using the falling head assembly. More granular soils, containing 90% or more particles retained on the 75 μm sieve, are tested using the constant head assembly. The cell is sealed at the top so that a vacuum may be used to saturate the specimen. Porous stones located at the top and bottom of the cell prevent sample flaking or washout. For constant head tests, a plastic funnel reservoir is mounted on an upright attached to the cell, providing a maximum head of 550 mm. Falling head tests are performed using the graduated pipette falling head reservoir, which gives a maximum head of 1000 mm and is graduated 0.2 ml.

- Plated steel chamber head assembly.
- Corrosion-resistant cast aluminium base assembly.
- Includes accessories for conducting both constant and falling head permeability studies.

Specifications	
Chamber	Transparent plastic, single section
Base	Cast aluminium
Top Seal	Plated steel with gaskets
Constant Head	Plastic, funnel reservoir, 550 mm max head
Falling Head	Graduated pipette, 100 ml x 0.2 ml, 1000 mm max head
Specimen Size (dia x length max)	63.5 x 63.5 mm when using lower chamber only 63.5 x 140 mm when using both lower and extension chambers
Capacity	Clear lucite; 1/4 inch (6.3 mm) wall; single section
Porous Stones (dia x thickness)	Mounts at top and bottom; 62.7 x 12 .7 mm; 105-120 permeability rating; 300 micron, average pore size
Weight	Net 11 lbs (5 kg)

Spares/Consumables:

Porous Stone 62.7 x 12.7 mm (T-308)

Products Standards:

BS 1377-5

Permeameters

These Permeameters are designed for performing either constant head or falling head permeability tests on undisturbed, remoulded or compacted soils.

Compaction Permeameter

Product Code: 25-0607

Product Standards:

ASTM D5856

Specifications	
Mould	Machined seamless steel tubing, plated
Capacity (mm)	101.6 x 116.4 (inside dia x h) 1/30 ft³
Collar (mm)	50.8 high, machined
Top	Overflow valve assembly and water connection
Base	Cast aluminium, with inlet/outlet fitting
Porous Stone	(4 inches) 101.6 x 12.7 mm (dia x thickness)
Weights (kg)	7.9

Standpipe Panel

Product Code: 25-0609

Complete with three glass tubes of 1.5, 3 and 5 mm diameter bore, approximately 1.4 metres long. Supplied with metre scale and thick-walled flexible tubing. The glass tubes are fitted to a panel for wall mounting and connected to a 3-way outlet valve.

De-Airing Tank

Product Code: 25-0611

Manufactured from transparent plastic with de-airing jet inlet and a flow outlet connection with flexible tubing. The tank is manufactured to withstand a reduced pressure and is suitable for direct wall mounting.

Specifications	
Weight (kg)	6

Soaking Tank

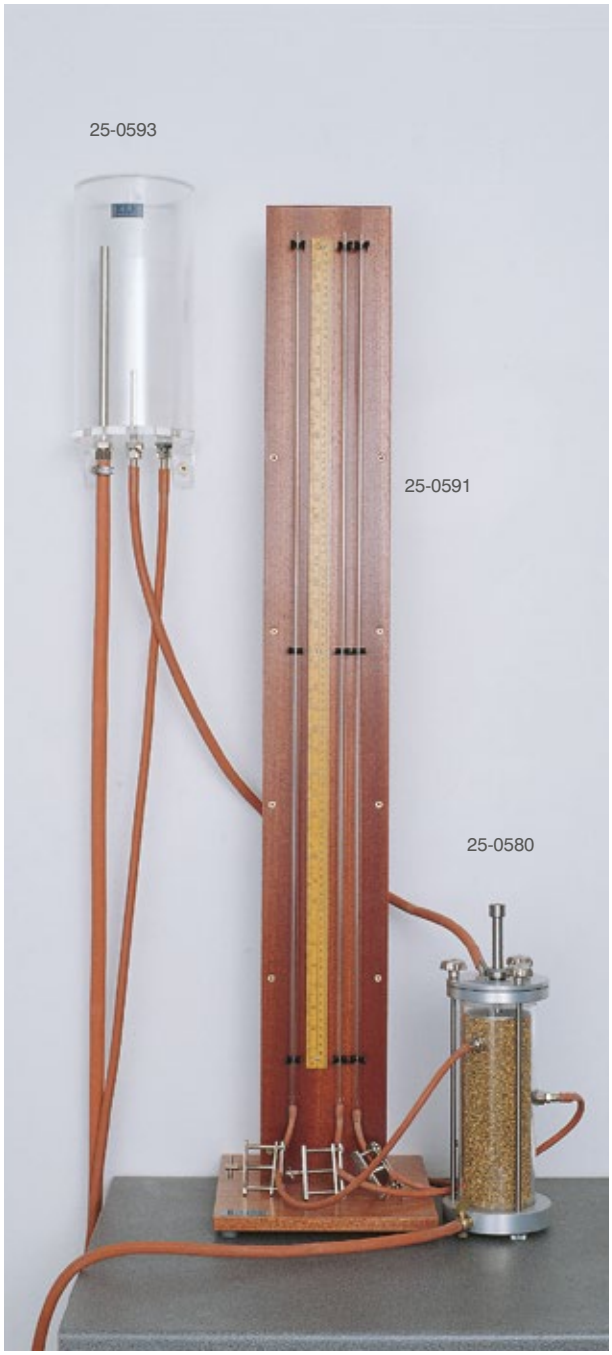
Product Code: 25-0613

With fixed overflow. Used for containing permeability cell during test.

Specifications	
Weight (kg)	4

Permeability

Constant Head Apparatus



This equipment is used for testing the permeability of granular soils (sands and gravels). The specimen is formed in a permeability cell and water is passed through it from a constant level tank. Take-off points located along the sides of the permeability cell are connected to three manometer tubes mounted on a panel complete with a metre scale. Water passing through the specimen is collected and measured, either for a specific quantity or over a period of time. The reduction of head is noted from the variation of water level in the manometer tubes.

Constant Head Permeability Cell

Product Standards:

BS 1377-5

Specifications		
Product Code	25-0580	25-0585
Nominal Cell inside dia (mm)	75	114
Cell Wall	Transparent plastic	Transparent plastic
Take-off Points	3	3
End Plates	Anodised aluminium	Anodised aluminium
Weight (kg)	4.5	8

Manometer Tubes & Stand

Product Code: 25-0591

Product Standards:

BS 1377-5

Comprising three glass tubes of constant bore, metre scale and connecting tubing for cell pressure take-off points, all mounted on a free-standing panel.

Permeability Cell Requirements:

75 mm Permeability Cell: 1 x set of tubes, 1 x stand

114 mm Permeability Cell: 2 x sets of tubes, 2 x stands

Specifications	
Weight (kg)	9.5

Constant Level Tank

Product Code: 25-0593

Product Standards:

BS 1377-5

Manufactured from transparent plastic with attachment for wall mounting. The inlet, outlet and overflow pipes are fitted to the base of the tank and can be adjusted for height within the tank. Supplied complete with connecting tubing.

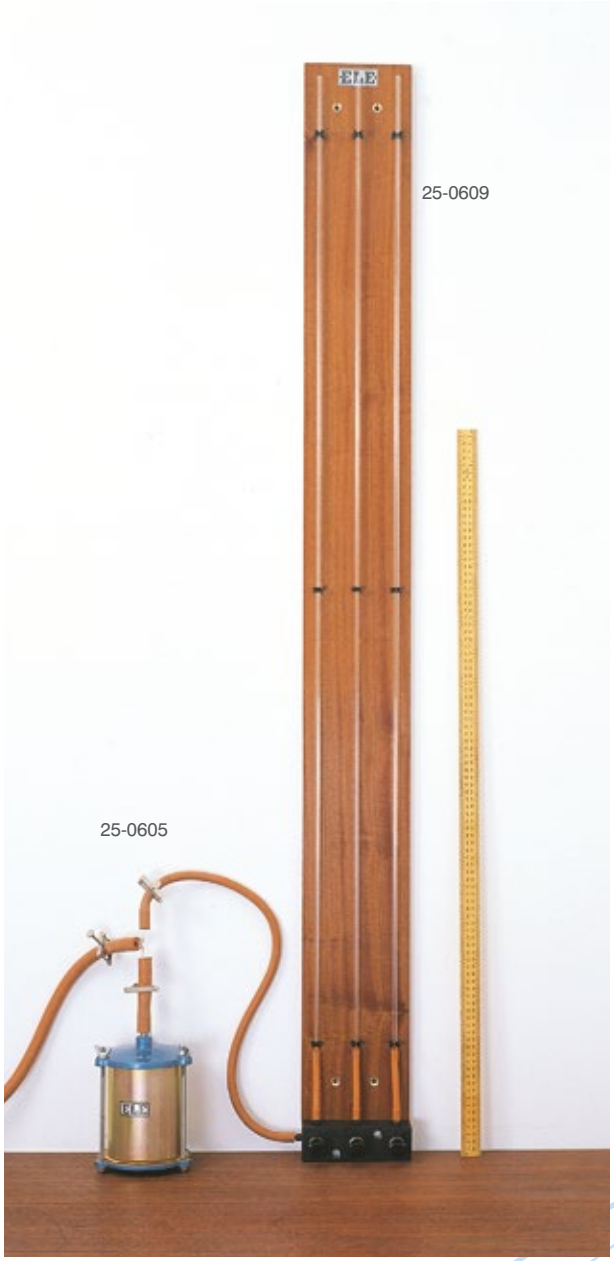
Specifications	
Weight (kg)	2.4

Spares/Consumables:

75 mm Gauze Disc - 0339A0016

114 mm Gauze Disc - 0342A0016

Falling Head Apparatus



Clays and silts are tested using the falling head technique. Flow of water through the specimen is observed by monitoring the rate of fall of water in the tube. It is essential that soils of very low permeability are sealed inside the cylinder to prevent seepage along the sides of the specimen. Before testing, the specimen must be completely saturated with water as the presence of air will restrict the flow of water.

Falling Head Permeability Cell

Product Code: 25-0605

Specifications	
Cell (mm)	Plated seamless tube 100 dia x 130 height
Base	Porous plate with three tie rods
Top Plate	Machined to accept smaller tubes
Weight (kg)	3.4

Spares/Consumables:

Standpipe 1.5 mm (0345A0002)

Standpipe 3.0 mm (0345A0003)

Standpipe 5.0 mm (0345A0004)

Standpipe Panel

Product Code: 25-0609

Complete with three glass tubes of 1.5, 3 and 5 mm diameter bore, approximately 1.4 metres long. Supplied with metre scale and thick-walled flexible tubing. The glass tubes are fitted to a panel for wall mounting and connected to a 3-way outlet valve.

De-Airing Tank

Product Code: 25-0611

Manufactured from transparent plastic with de-airing jet inlet and a flow outlet connection with flexible tubing. The tank is manufactured to withstand a reduced pressure and is suitable for direct wall mounting.

Specifications	
Weight (kg)	6

Soaking Tank

Product Code: 25-0613

With fixed overflow. Used for containing permeability cell during test.

Specifications	
Weight (kg)	4

Accessories:

Measuring Cylinder 100 ml (82-0380)

Permeability

Guelph Permeameter

The Guelph Permeameter is used to obtain accurate measurements of hydraulic conductivity, soil sorptivity and soil matrix flux potential. These three factors govern how liquids will move through an unsaturated soil profile.

Guelph Permeameter supplied complete with Extension Kit

Product Code: 25-0650

Product Standards:

ASTM D5126

Recent significant advances in both the theoretical and practical techniques of measuring soil hydraulic conductivity have been made by the University of Guelph, Canada. This has resulted in the development of the Guelph Permeameter, utilising the Constant Head Well principle.

- Lightweight and portable.
- Robust construction.
- Requires only 2.5 litres of water.
- Results usually within 2 hours.

Further Information:

Guelph Permeameter Set Includes:-

- 1 Field Tripod.
- 1 Well Auger.
- 1 Well Tripod.
- 1 Preparation Tool.
- 1 Hand Pump.
- 1 Extension Kit (extends depth by 800 mm).
- 1 Collapsible Water Container.
- 1 Set of Instructions and Carrying Case.

Specifications	
Cell (mm)	Plated seamless tube 100 dia x 130 height
Capacity (ltrs)	3.18
Base	Porous plate with three tie rods
Top Plate	Machined to accept smaller tubes
Overall Weight (kg)	111
Permeameter	High impact polycarbonate, molded elastomers
Auger	2 inches (50.8 mm) dia; machined steel
Carrying Case	Die-cut foam for parts storage
Test Time	1/2 - 2 hours
Test Depth	150 to 750 mm (0.5 to 2.5 ft)
Hydraulic Conductivity Range	10-4 to 10-8 m/sec (10-2 to 10-6 cm/sec)
Weight	Net 30 lbs (13.6 kg)

Spares/Consumables:

Permeameter Extension Kit (25-0655)

Vacuum Hand Pump with Gauge (25-0650/10)

Guelph Permeameter (25-0650/80)

1) Auger and prepare hole

2) Install Permeameter and fill with water

3) Record changing water level and calculate results

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Soil Strength (Triaxial)

The measurement of total stress or effective stress requires different procedures and therefore different equipment.

Total stresses are normally measured in a triaxial cell where the sample is subject to an all round confining pressure (σ_3). A load is applied (σ_1) through a piston onto a pressure pad, with the sample being confined within a rubber membrane so that no drainage in or out of the specimen is allowed. Pore water pressures are not normally measured and the undrained test is often referred to as the QU-TXL test.

By comparison, effective stresses when measured in a triaxial cell are more complex in their nature, as numerous parameters can be measured. These include back pressure, pore water pressure and volume change; all of which can be used to calculate the required engineering properties.

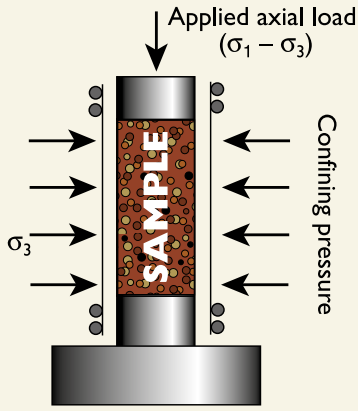
Effective stress tests are usually referred to as consolidated drained (CD) or consolidated undrained (CU). Generally the CD test is applicable to sands, while both the CU or CD test can be used with clays. There are many special test variations within these basic test groupings.

Our range of triaxial cells and accessories, used in conjunction with other equipment such as load frames, pressure sources and measurement devices, have been specifically designed to meet the wide ranging requirements of modern soil mechanics laboratories. Each system is easy to set up and use, providing accurate and repeatable measurements.

Types of Test

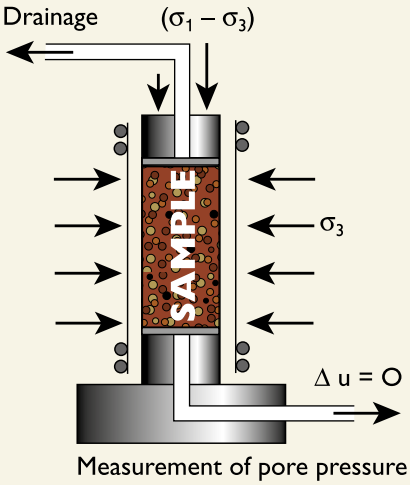
Total Stress Measurement

Quick undrained (QU) and Unconsolidated Undrained (UU)



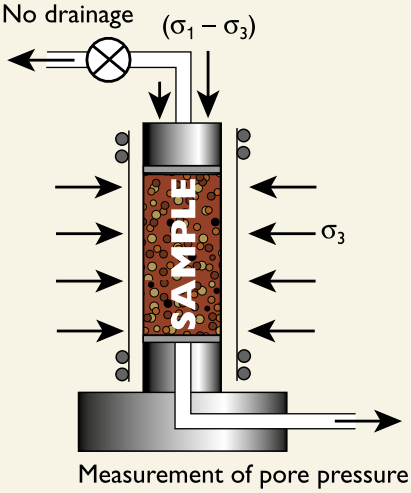
Effective Stress Measurement

Consolidated Drained (CD)



Measurement of pore pressure

Consolidated Undrained (CU)



Measurement of pore pressure

Soil Strength (Triaxial)

Triaxial Requirement Guide

There are various Triaxial tests that can be carried out ranging from the Total Stress to the more complex Effective Stress.

We ask the following simple questions to determine accurately your requirements when you are looking for a full system.

Once you determine your requirements from the questions on the right we can determine the exact set of equipment required.

See below example sets for Triaxial requests created using the Triaxial Sets Buyers Guide Chart.

Example Sets

ES	38	AU	PN	03
PE	70	AU	OW	01
TS	100	MA	OW	01
UNCONFINED		50	MA	
UNCONFINED		70	AU	

Triaxial Sets Buyers Guide — Please choose from the following:

	What type of test?		Choose
A)	1	Effective Stress CU/CD	ES
	2	Permeability	PE
	3	Total Stress QU/UU	TS
	4	Unconfined Compression	UNCONFINED

	What sample size?		Choose
B)	1	38 mm	38
	2	50 mm	50
	3	70 mm	70
	4	100 mm	100

	What type of system?		Choose
C)	1	Manual – Dial Gauges	MA
	2	Automatic – Transducers, Data Logging and Software	AU

	What pressure system?		Choose
D)	1	Oil and Water	OW
	2	Pneumatic	PN

	How many cells?		Choose
E)	1	1 cell	01
	2	2 cells	02
	3	3 cells	03

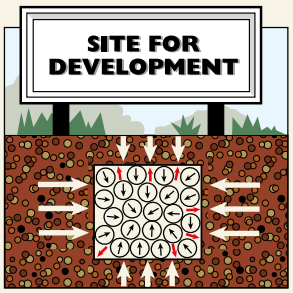
Effective Stress

Effective Stress = Total Stress - Pore Water Pressure

Effective Stress is drainage dependent (time and permeability dependent)

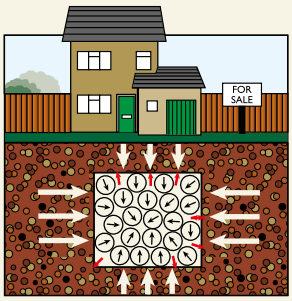
TIME = 0

Total Stress	= 100
Pore Water Pressure	= 40
Effective Stress	**= 60**



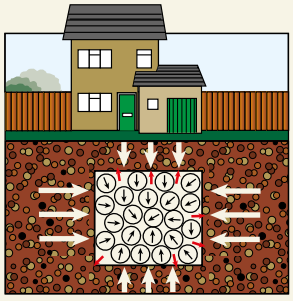
TIME = 8 Months

Total Stress	= 200
Pore Water Pressure	= 140
Effective Stress	**= 60**



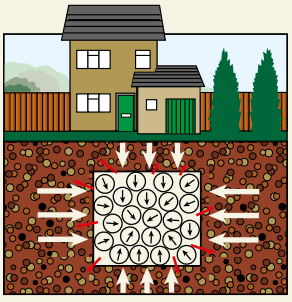
TIME = 12 Months

Total Stress	= 200
Pore Water Pressure	= 90
Effective Stress	**= 110**



TIME = 20 Months

Total Stress	= 200
Pore Water Pressure	= 40
Effective Stress	**= 160**



Strength depends on Effective Stress NOT Total Stress

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Triaxial Load Frames

The range of ELE designed and manufactured load frames is the most modern of its kind available to the discerning test laboratory. The range comprises capacities of 50 kN incorporating the latest microprocessor control systems, clear on-board screen displays and a range of other high quality features.

Digital Tritest 50 Load Frame

Product Code: 25-3518/01, 25-3518/02

Product Standards:

BS 1377-7, BS 1377-8, ASTM D2166/D2166M, ASTM D2850, ASTM D4767, ASTM D7181, AASHTO T208, AASHTO T296, AASHTO T297

This 50 kN capacity machine, designed primarily for triaxial testing of soil specimens up to 100 mm diameter x 200 mm long, comprises a rigid twin column construction with an integral fully variable microprocessor controlled drive unit and LCD display with a touch sensitive keyboard. The machine is normally bench mounted for ease of installation and operation. The use of a microprocessor controlled drive system and keyboard entry provides the Digital Tritest 50 with a wide variety of features which include pause and speed reset during test, RS 232C, operator programming of speed and control functions, self test diagnostics and many other features. A robustly constructed steel case houses the motor drive system with careful attention being given to the prevention of ingress of water or grit. All operating controls are mounted on the front panel of the machine, which is angled and recessed to prevent physical and environmental damage.

- Microprocessor control.
- Large on-board LED screen display.
- Direct entry via a touch sensitive keyboard.
- Rapid approach and return to datum of platen.
- Fully variable speed, 0.00001 to 9.99999 mm/min.
- Samples up to 100 mm diameter.

Further Information:

Complete with RS 232C interface.

Specifications	
CBR Penetration	Yes
Unconfined Compression	Yes
Consolidated Undrained	Yes
Consolidated Drained	Yes
Capacity	50 kN (11,200 lbf)
Speed Range	English mode: 0.000001 to 0.399999 in/min. Metric mode: 0.00001 to 9.99999 mm/min
Rapid Approach Speed	1.0 inch/min (25 mm/min)
Platen Travel	100 mm (3.9 inches); limit switch protection
Platen dia	133 mm (5.2 inches)
Vertical Clearance	910 mm (36.8 inches) max; 305 mm (12 inches) min
Horizontal Clearance	364 mm (15.3 inches)
Serial Interface	RS 232C; programmable baud rate and protocol
Overall Dimensions W x D x H	500 x 500 x 1470 mm (19.7 x 19.7 x 57.8 inches)
Weight	100 kg (220 lbs)
Product Code	**Power Supply**
25-3518/01	220-240 V AC, 50-60 Hz, 1 ph
25-3518/02	110-120 V AC, 50-60 Hz, 1 ph

Accessories:

Adaptor Kit to perform CBR on the Tritest 50 load frame (25-3518/10)

Frame and Drive Assembly (1884B0043)

PCB Stepper Control and Spring (1884B0036)

Tritest Motor Assembly (1884A0038)

Tritest Input Filter (6012X0351)

Tritest Transformer (6012X0351)

Keyboard Assembly (1884B0032)

LCD (1895A0063)

Spares/Consumables:

220 V Spares Kit (25-3518/K1)

110 V Spares Kit (25-3518/K2)

Soil Strength (Triaxial)

MultiPlex 50 Load Frame

Product Code: 25-3700/01

Product Standards:

BS 1377-7, BS 1377-8, ASTM D2166/D2166M, ASTM D2850, ASTM D4767, ASTM D7181, AASHTO T208, AASHTO T296, AASHTO T297

Compact bench mounting load frame designed for performing laboratory CBR, unconfined compression, Quick Undrained Triaxial and Marshall Stability Tests. Has a variable speed of 0.5 to 50.8 mm per minute and features rapid approach of platen.

Specifications	
CBR Penetration	Yes
Unconfined Compression	Yes
Consolidated Undrained	No
Consolidated Drained	No
Marshall Stability and Flow	Yes
Dimensions L x W x H (mm)	550 x 400 x 1470
Max Vertical Clearance (mm)	800
Horizontal Clearance (mm)	265
Platen dia (mm)	133
Platen Travel (mm)	100
Platen Speed Range	0.5 to 50.8 mm/min
Rapid Approach Speed	40 mm/min
Power Supply	220-240 V AC, 50-60 Hz, 1 ph
Weight (kg)	100 (shipping 113)

Accessories For Unconfined Compression Test:

Unconfined Compression Platens (25-3650)

4.5 kN Clamped Boss Load Ring, complete with dial gauge and calibration certificate (78-0260)

2-Part Split Mould - 100 mm (25-7655)

2-Part Split Mould - 70 mm (25-6530)

2-Part Split Mould - 50 mm (25-5530)

2-Part Split Mould - 38 mm (25-5130)

2-Way Split Former - 100 mm diameter (25-7650)

2-Way Split Former - 70 mm diameter (25-6500)

2-Way Split Former - 50 mm diameter (25-5500)

2-Way Split Former - 38 mm diameter (25-5120)

Spares/Consumables:

Tacho Assembly (1895A0048)

Belt (8447X0645)

Micro PCB Assembly (1873PL0038)

DC Drive 508 (6023X0025)

DC Motor (6018A0054)

Triaxial Cells

Grouped Product Standards:

BS 1377-7, BS 1377-8, ASTM D2850, ASTM D4767, ASTM D7181, AASHTO T208, AASHTO T296, AASHTO T297

This range of precision made triaxial cells has been designed to meet the requirements of the modern soils laboratory. The cells have been treated to minimise corrosion. Particular attention has been paid to the quality of finish between the piston and the head. Final assembly includes the fitting of an O-ring seal and the use of special lubricant to reduce friction to a minimum and eliminate water leakage. The piston load capacity is designed to accept high horizontal forces which may be present during the final stages of a test. Each cell has five take-off positions drilled in the base for top drainage/back pressure, pore water pressure and bottom drainage.

Two no-volume change valves and an anvil for strain gauge/transducer datum are supplied for fitting to the cell. A feature of these cells is that they all accept a single diameter piston. The internal height is such that a range of submersible load transducers can be fitted without any modification. Each cell will accept a range of base adaptors and various accessories for testing a wide range of specimens.

- Working pressure up to 1700 kPa.
- All round visibility.
- Sample sizes 38 to 100 mm diameter.
- Rapid assembly and dismantling.
- Accepts a range of interchangeable submersible load transducers.
- Maximum piston load 45 kN.

Product Code	Cell Size (mm)	Weight (kg)	Max Specimen Size (mm)	Vertical Clearance (mm)	Horizontal Clearance (mm)
25-4157	100	14.3	100 x 200	515	255
25-4117	70	7.3	70 x 140	430	180
25-4047	50	4	50 x 100	380	155

Note: 38 mm samples are tested in the 50 mm cell.

Soil Strength (Triaxial)

Accessories for Triaxial Cells

Aggressive Materials

Although all products are treated to inhibit corrosion, certain aggressive materials may attack the metal components. Examples of this are samples obtained from the seabed or containing high concentrations of sulphates or chlorides. Where aggressive materials are to be tested, ELE will be pleased to offer advice on any special requirements.

Triaxial Cell Specimen Base Adaptors

Grouped Product Standards:

BS 1377-7, BS 1377-8, ASTM D2850, ASTM D4767, ASTM D7181, AASHTO T208, AASHTO T296, AASHTO T297

Each cell will require the correct size of specimen base adaptor relative to the diameter of the sample tested. All base adaptors are double perforated for bottom drainage/pore pressure measurement. They are supplied complete with a solid disc for use in tests where no drainage is required.

Specifications

	Cell Model Product Code		
	25-4047	25-4117	25-4157
Specimen Size	Max Specimen Dia		
	50 mm	70 mm	100 mm
38	25-4166	-	-
50	25-4168	25-4174	-
70	-	25-4176	-
100	-	-	25-4186

Load Measurement

Various methods of axial displacement and load can be supplied. All devices comply with the accuracy specified in BS 1377, ASTM D2850, D4767. All transducers are supplied with a calibration certificate.

Product Code	Type	Capacity (kN)
78-0260	Load Ring	4.5
78-0760	Load Ring	28
78-0860	Load Ring	50
27-1553	S-Type Load Cell	10
27-1555	S-Type Load Cell	25
27-1573	Submersible Load Cell	5
27-1575	Submersible Load Cell	10
27-1551	S-Type Load Cell	5
27-1293	Stainless Steel distance piece for use with submersible Load Cells	-

Piston Restraint Clamp for Triaxial Cells

Product Code: 25-4200

Product Standards:

BS 1377-7, BS 1377-8, ASTM D2850, ASTM D4767, ASTM D7181, AASHTO T208, AASHTO T296, AASHTO T297

For ELE Triaxial Cells manufactured from July 1996.

Holds the piston or submersible load cell away from the sample whilst loading and unloading the cell.

Specifications

Weight (lbs)	1.075

Silicon Grease Lubricant

Product Code: 25-8090

Product Standards:

BS 1377-7, BS 1377-8, ASTM D2850, ASTM D4767, ASTM D7181, AASHTO T208, AASHTO T296, AASHTO T297

Silicon Grease Lubricant (Tube).

Automatic Data Acquisition - Triaxial

Product Code	Product
27-2753 (DS7.2: 27-1753)	DS7.3 Undrained Traxial Shear Strength Software
27-2763 (DS7.2: 27-1763)	DS7.3 CU/CD Triaxial Shear Strength Software
27-2768 (DS7.2: 27-1768)	DS7.3 Permeability in a Triaxial Cell Software
S2160 (DS7.2: S1160)	DS7.3 Full Software Suite - All Triaxial, CBR, Direct Shear, Consolidation
27-1500/01	GDU 8 Channel Data Acquisition Unit
27-1505	GDU 8 Channel Expansion Card

For full specification see page 72-77

Axial Displacement

Various methods of axial displacement and load can be supplied. All devices comply with the accuracy specified in BS 1377, ASTM D2850, D4767. All transducers are supplied with a calibration certificate.

Axial Dial Gauge 25 mm Travel x 0.01 mm Divisions

Product Code: 25-4210

25 mm travel x 0.01 mm divisions.

Specifications	
Dial Indicator	25 mm range

Axial Strain Transducer

Product Code: 27-1617

Axial Strain Transducer Assembly 50 mm travel fitted with 5-pin DIN Plug.

Soil Strength (Triaxial)

Sample Preparation

Various methods of measuring load can be supplied, these include load rings, S-type and submersible load transducers. The capacity of the load measurement device will invariably be selected with reference to the type of specimen and its size.

As a general guide, suggested load measurement capacities are as follows:

Type of Soil	Capacity (kN)
Clays	4.5
Frictional Materials	20
Soft Rocks, frictional soils at high cell pressures	50

	Sample Dia Size			
Product	38 mm	50 mm	70 mm	100 mm
Membrane Placing Tool	25-4290	25-5470	25-6470	25-7610
Suction Membrane Device	25-5100	25-5480	25-6480	25-7640
Two-part Split Former (non-cohesive soils)	25-5120	25-5500	25-6500	25-7650
Two-part Split Mould (cohesive soils)	25-5130	25-5530	25-6530	25-7655
BSP Valve complete with 6 mm Connector and integral Sealing Ring	25-4520	25-4520	25-4520	25-4520
10 ml single-tube Drainage Burette	25-4540	25-4540	25-4540	–

Accessories for Consolidated Drained & Undrained Tests

Grouped Standards:

BS 1377-7, BS 1377-8, ASTM D2850, ASTM D4767, ASTM D7181, AASHTO T208, AASHTO T296, AASHTO T297

Filter Paper Drain

Specifications

Product Code	Dia (mm)	Qty
25-5200	38	Supplied in packs of 50
25-5580	50	
25-6580	70	
25-7670	100	

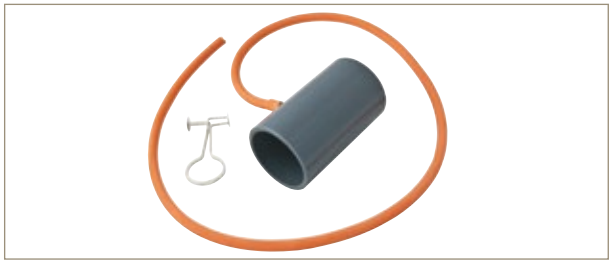
Porous Disc

Specifications

Product Code	Dia (mm)	Qty
25-5181	38	Supplied in packs of 2
25-5561	50	
25-6561	70	
25-7661	100	

Membrane Placing Tools

Suction Membrane Devices



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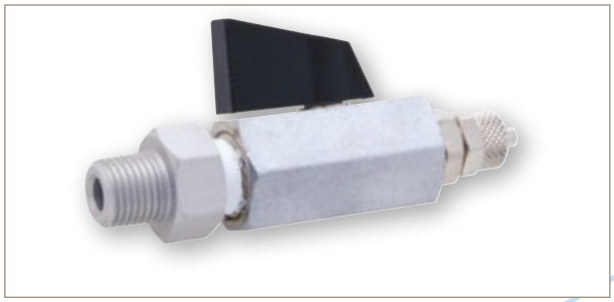
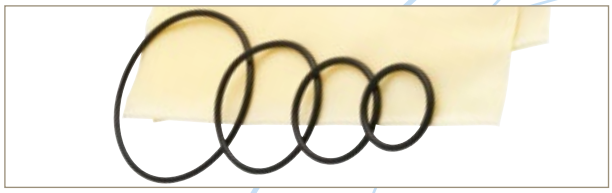
Two-part Split Formers

Two-part Split Moulds

BSP Valve complete with 6 mm Connector



Membrane Sealing Rings



Specifications

Product Code	Dia (mm)	Qty
25-5081	38	Supplied in packs of 10
25-5461	50	
25-6461	70	
25-7631	100	

Rubber Membranes

Specifications

Product Code	Dia (mm)	Qty
25-5061	38	Supplied in packs of 10
25-5441	50	
25-6441	70	
25-7621	100	

Pressure Pads & Internal Tubing

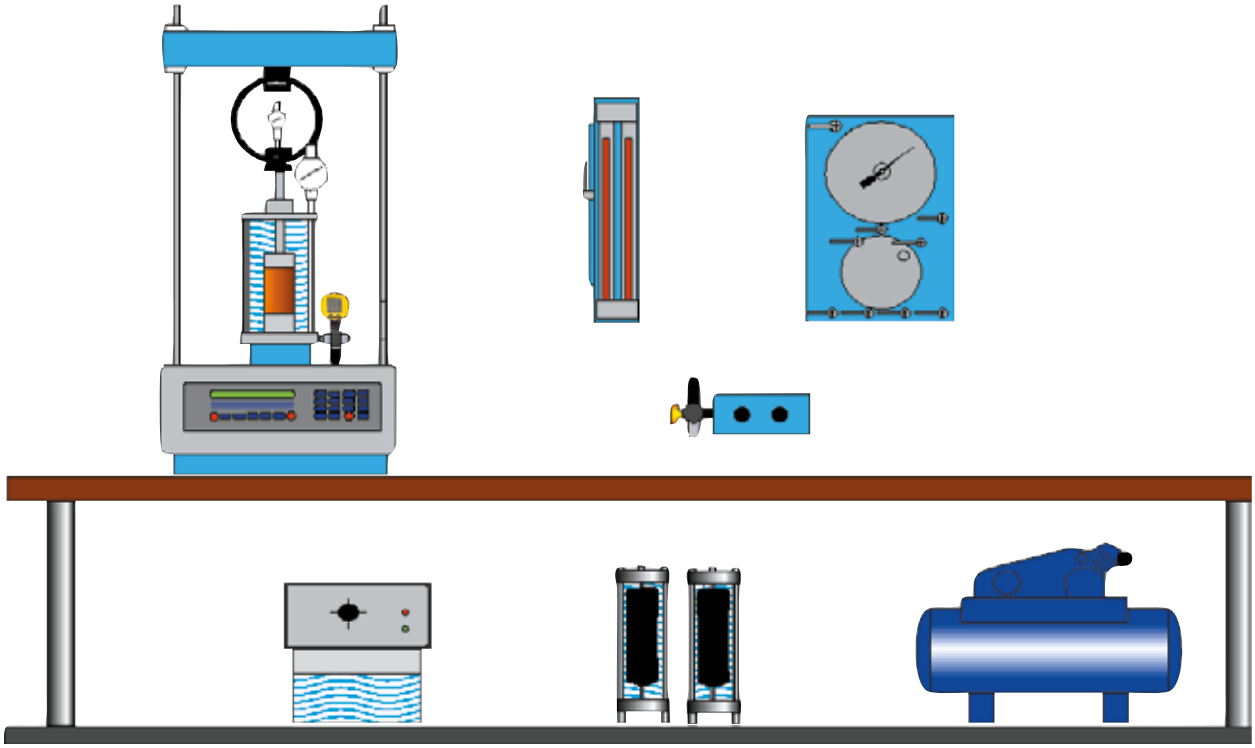
Specifications

Product Code	Product	Dia (mm)
25-5050	Pad	38
25-5050/10	Tubing	-
25-5430	Pad	50
25-5430/10	Tubing	-
25-6430	Pad	70
25-6430/10	Tubing	-
25-7590	Pad	100
25-7590/10	Tubing	-

Soil Strength (Triaxial)

De-Aired Water

It is particularly important that water from which dissolved air has been removed is used in the pore pressure measurement system and saturation procedures. Any dissolved air in the water will lead to errors in the measurement of pore pressure, particularly at low pressures, and also give slow or incorrect saturation results.



De-Aired Water Apparatus

Product Code: 25-1833/01

This compact self-contained unit will de-air water quickly and efficiently down to levels of dissolved oxygen acceptable for geotechnical test methods. Air is removed from the water by a vacuum system, which continuously circulates the water in the tank. The unit is supplied with a clear water container, which will hold a maximum of 15 litres of water. Input and output lines are formed using standard 6 mm tube connectors.

Specifications	
Self-Contained	Yes
Capacity (ltrs)	15
Dimensions L x W x H (mm)	380 x 356 x 470
Power Supply	220-240 V AC, 50-60 Hz, 1 ph
Weight (kg)	13

Spares/Consumables:

Pump (5020X0073)

Tank (9004A0073)

Gasket (1617B0012)

Pressure Systems

We offer a range of products designed to supply and monitor all those parameters necessary for the successful testing of geotechnical materials. Two types of constant pressure systems are available:

- Air/water system operated by a pneumatic compressor.
- A motorised oil/water system.

Air/Water Pressure Systems

Where a laboratory requires a number of constant but independent and variable pressure sources, the use of a pneumatic compressor is recommended. Depending on the capacity and volume of the unit, a series of pressure sources can be provided to various test stations around the laboratory. Compressed air must be delivered to a system designed to transfer the controlled pressure to the fluid (usually water), which applies the various test pressures, e.g. a confining pressure in a triaxial test. The pressure reducing panel is used in conjunction with a bladder-type air/water interface assembly. Each individual pressure take off from the reducing panel will require a bladder interface assembly. Connection of the reducing panels to the compressor/water trap outlet and to other reducing panels requires the use of nylon tubing.

Air/Water Bladder-Type Pressure Assembly

Product Code: 26-1746

With transparent plastic chamber for operating continuously at pressures up to 1000 kPa. A length of tubing is provided for connecting the air/water cylinder outlet to a pressure measuring system.

- Used to supply hydraulic pressure from a pneumatic pressure source.
- Prevents air entering the hydraulic pressure system.
- Maximum working pressure 1000 kPa.
- Supplied with connectors and tubing for fitting to pressure measuring systems.

Specifications	
Weight (kg)	5.6

Spares/Consumables:

Plastic Hose Clip (8412X0260)

'O' rings for upper + lower 5 inch cell (8447X1143)

Replacement Bladder (38 mm internal dia) (26-1746/10)

Air Compressor Unit 1000 kPa

Product Code: 83-1735/01

Specifications	
Dimensions L x W x H (mm)	1321 x 457 x 914
Free Air Delivery	6.0 cfm
Receiver Capacity (ltrs)	116
Max Pressure	1380 kPa
Continuous Working Pressure	1000 kPa
Power Supply	220-240 V AC, 50 Hz, 1 ph
Water Trap	Yes
Weight (kg)	149

Soil Strength (Triaxial)

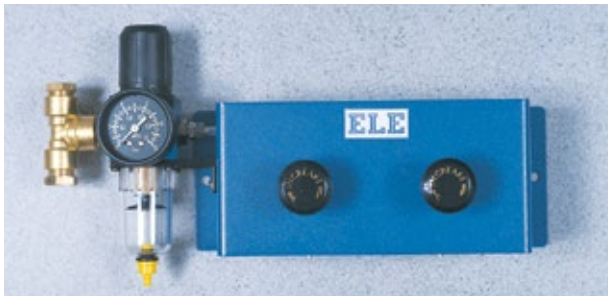
Air Compressor Unit 700 kPa

Product Code: 83-1730/01

Specifications	
Dimensions L x W x H (mm)	483 x 457 x 864
Free Air Delivery	2.0 cfm
Receiver Capacity (ltrs)	50
Max Pressure	1000 kPa
Continuous Working Pressure	700 kPa
Power Supply	220-240 V AC, 50 Hz, 1 ph
Water Trap	No
Weight (kg)	57

Pneumatic Pressure Reducing Panel. Provides Two Independent Pressure Outlets 1000 kPa Maximum.

Product Code: 26-1760

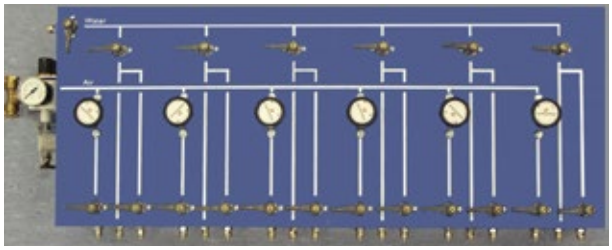


Comprising two constant pressure reducing valves with inlet water trap and pressure indicator. The unit allows a maximum output pressure of 1000 kPa. Maximum input pressure should not exceed 1400 kPa. The panel has an inlet connector to accept nylon tubing from the air compressor and two 6 mm outlets for connecting Bladder type Air/Water Pressure Assemblies. An outlet connector is fitted for the connection of an additional panel using nylon tubing to increase the total capacity of the system. This outlet is blanked off when not required.

Specifications	
Weight (kg)	4

Six-Way Pneumatic Pressure Control Panel

Product Code: 26-1872



The six-way pressure control systems have been designed specifically for the monitoring of up to six independent pressures. They are particularly useful for setting up and controlling a 3-cell effective stress system using three independent back pressures. The panel is used in conjunction with the Universal Pump and Pressure Indicating Panel which provides pressure monitoring and facilities for filling and de-airing the system. Comprising six pneumatic control valves mounted in a housing for controlling six independent outlets. Supplied with connection ports for coupling panel to 26-1880. Maximum inlet pressure 1400 kPa, maximum outlet pressure 1000 kPa.

Nylon Tubing 1700 kPa (30 m)

Product Code: 26-1769

30 metre length. For pressures up to 1700 kPa. Used for connecting Air Compressors to Pneumatic Pressure Reducing Panels, or for connecting two Pressure Reducing Panels together.

Further Information:

Nylon tubing 30 metres with pressure fittings.

Specifications	
Pressure (kPa)	1700
Weight (kg)	2
Dia	1/2 inch

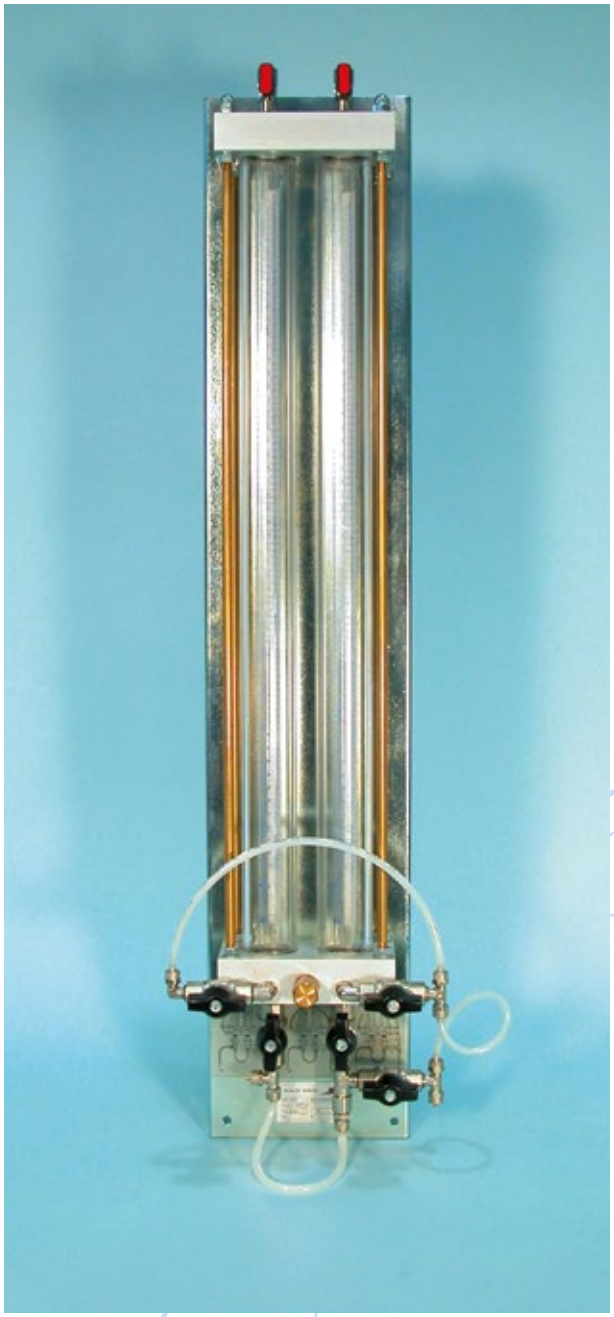
Measurement Instrumentation

Various methods of measuring axial displacement, load, pressure and volume change can be supplied. All devices comply with the accuracy specified in BS 1377; ASTM D2850, D4767. All transducers are supplied with a calibration certificate.

Volume Change Measurement

Twin Burette Volume Change Unit

Product Code: 26-1892



Fitted with reversing valve and by-pass valve. The unit is fitted with burettes graduated 0 to 100 ml x 0.2 ml and is mounted on a solid panel for wall or bench mounting.

Connector 1/4 BSP (6 mm)

Product Code: 26-1922

With sealing washer.

Nylon Tubing 3500 Kpa

Product Code: 26-1926

Specifications	
Pressure (kPa)	3500
Outside dia (mm)	6
Inside dia (mm)	4

For use up to a pressure of 3500 kPa. Priced per metre.

Elbow Connector (6 mm)

Product Code: 26-1928

T Connector (6 mm)

Product Code: 26-1930

Soil Strength (Triaxial)

Oil/Water Constant Pressure System

The ELE oil/water constant pressure system, PressureTest 1700, is extremely versatile and can be used in conjunction with a wide range of test equipment. The unit provides continuous variable pressure up to 1700 kPa. Pressure is increased or decreased simply by turning a control wheel. The apparatus is supplied without a gauge for those customers who have suitable pressure monitoring equipment. A digital pressure gauge is offered as an accessory. The machine features a clear hydraulic/water interface reservoir and up to one litre capacity of water is available under pressure.

Pressure Test 1700 Oil/Water Constant Pressure System 0 to 1700 kPa

Product Code: 26-1800/01

- 0 to 1700 kPa (250 lbf/in²) fully variable.
- Continuous constant pressure control.
- One litre capacity.

Specifications	
Dimensions L x W x H (mm)	240 x 400 x 500 (without gauge)
Power Supply	220-240 V AC, 50-60 Hz, 1 ph
Weight (kg)	17

Digital Pressure Gauge 1700 kPa for ELE Triaxial Cells

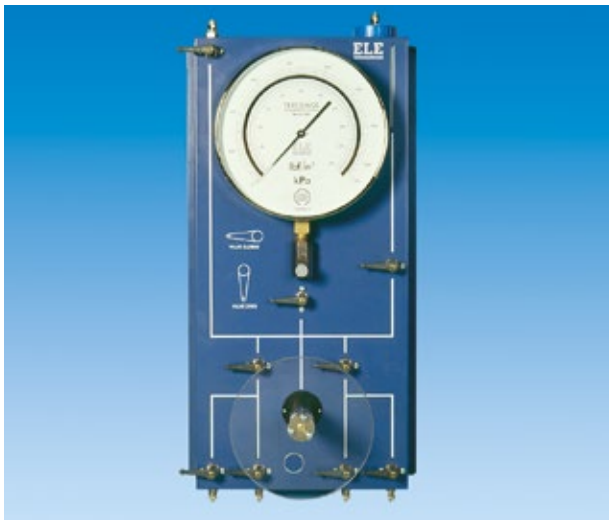
Product Code: 26-1820

Oil 2 Litres T46

Product Code: 26-1800/10

Universal Pump & Pressure Indicating Panel 1700 kPa

Product Code: 26-1880



This is the main pressure display in the system for monitoring various pressures and also provides fine control of the pressure within the system using the rotary hand pump. The unit is fitted with a dual calibrated 250 mm diameter pressure gauge, four inlet/outlet no-volume change valves, screw controlled rotary hand pump, water reservoir and isolating valves. The unit is housed in a hinged case for wall or bench mounting. By using an isolating valve the panel may be used to monitor cell or back pressure. 1700 kPa and 250 lbf/in².

Specifications	
Weight (kg)	12

- Modular system for flexibility.
- Wall mounting.
- Four outlets.
- 6 mm diameter pipework for quick filling and draining.
- Standard type valves on all units - on/off with no volume change.
- Ideal system for geotechnical laboratories.

This modular system provides flexibility and cost saving by enabling only those units that are relevant to the particular testing requirements to be selected. It is simple to update the system with the addition of other units, which can be quickly connected together. The units may be used with a variety of pressure systems, such as pneumatic and oil/water and are designed to accept pressures of up to 1700 kPa where appropriate.

Volume Change Transducer Assembly 80 cm^3 Maximum Working Pressure 1700 kPa

Product Code: 27-1641

The Volume Change Transducer provides continuous measurements of volume change during the triaxial test. The assembly includes a valve to reverse the flow through the unit, providing increased capacity.

- Reversing valves to increase capacity.
- Steel case for wall mounting and access to piping.
- Supplied complete with calibration certificate.

Specifications	
Max Pressure	250 psi (1700 kPa)
Excitation	10 V DC
Output	1.25 Volts full range
Capacity	80 cc x 0.1 cc sensitivity
Case	Steel; hinged for access to piping
Connector	5-pin DIN type
Overall Dimensions W x D x H	9 x 7 x 14 -1/2 inches (229 x 178 x 368 mm)
Weight	Net 11 lbs (5 kg)

Submersible Load Transducers

Product Code: 27-1573

Axial Strain Transducer

Product Code: 27-1617

Axial Strain Transducer Assembly 50 mm travel fitted with 5-pin DIN Plug.

Direct Shear & Vane Tests

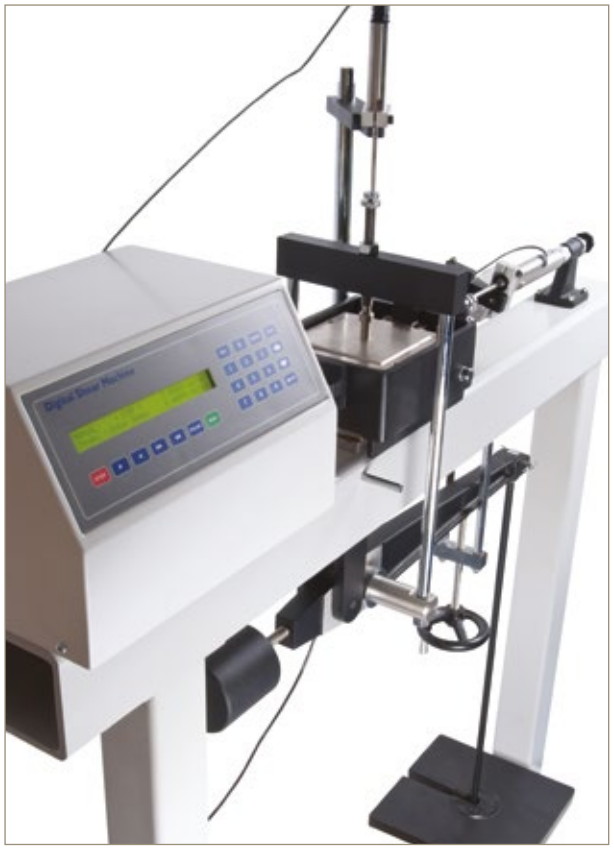
Direct Shear & Vane Tests

Every building or structure that is built in or on the earth imposes loads on the soil supporting the foundations. The stresses set up in the soil cause deformation of the soil with stress failure being caused by slippage of soil particles, which may lead to sliding of one body of soil relative to the surrounding mass.

Direct/Residual Shear Apparatus

Digital Direct/Residual Shear Apparatus complete with Lever Loading Assembly

Product Codes: 26-2114/01, 26-2114/02



The ELE Direct Shear Apparatus accepts specimens up to 100 mm² or 63 mm diameter. The use of a microprocessor controlled drive system and keyboard entry gives the apparatus a wide range of features that include pause and speed reset during test, RS 232C interface, operator programming of speed and control functions, self test diagnostics and many other features. A return to start datum provides a positive means of reversing the shearbox when either preparing for a new test or continuing with residual testing procedures. Safety forward/reverse travel limit switches are fitted as standard and monitored through the electronics system control. The electronics are housed in a modern moulded shroud, which includes a large LCD display and keyboard entry. The apparatus is enclosed in a robustly constructed case, has been designed for floor mounting and is supplied complete with carriage, loading hanger and 10:1 lever loading device.

Product Standards:

ASTM D3080, AASHTO T236, BS 1377, EN 1997-2

- Microprocessor control.
- Large on-board LCD screen display.
- Direct entry via touch sensitive keyboard.
- Rapid approach and return to start datum.
- Fully variable speed, 0.00001 to 9.99999 mm/minute.
- Accepts specimens up to 100 mm² or 63 mm diameter.

Specifications	
Sample Size	Accepts up to 100 mm² or 63 mm dia samples using accessory shear box assemblies, not included
Speed Range	Variable in either English or Metric units between 0.000001 inches (0.00001 mm) to 0.399999 inches (9.99999 mm) per minute
Shear Force	1,100 lbf (5.0 kN) max
Vertical Load	2,200 lbf (10.0 kN) using 10:1 lever ratio
Dimensions L x W x H	44.7 x 12.6 x 49.6 inches (1135 x 320 x 1260 mm)
Weight	Net 181 lbs (82 kg)
Product Code	**Power Supply**
26-2114/01	220-240 V AC, 50-60 Hz, 1 ph
26-2114/02	110-120 V AC, 50-60 Hz, 1 ph

Spares/Consumables:

Digital Head (1885PL0044)
Membrane Keyboard (1885B0031)
Stepping Motor Assembly (1885A0038)
Gear Box Assembly (1885B0037)
LCD Display (1895A0063)
Swan Neck (1627C0018)
Stepper Motor (6018X0110)

Direct Shear & Vane Tests

Shear Box Assemblies

All shearbox assemblies are designed to fit the carriage of the Direct/Residual Shear Apparatus. They are supplied complete with three porous plates, one retaining plate and a loading pad. The three sizes supplied comply with the relevant requirements of BS 1377 and ASTM D3080. All assemblies can be used for quick shear tests or drained/residual shear tests. Optional accessories are available including specimen cutters and extrusion tools. The table shows the complete range of shearbox assemblies and accessories.

Shear Box Assembly 100 mm²

Product Code: 26-2197

Product Standards:

BS 1377-7, ASTM D3080/D3080M, AASHTO T236

- Manufactured from corrosion resistant materials.
- Sample size 100 x 100 x 25 mm high meeting BS 1377.
- Incorporates PTFE faced box separation screws to reduce friction.
- Supplied complete with upper and lower porous plates and loading pad.
- Suitable for quick undrained or drained/residual tests.

Specifications	
Specimen Area/Size (mm)	100 x 100
Specimen Thickness (mm)	25
Weight (kg)	5.22

Spares/Consumables:

Porous Plate 100 mm² (26-2197/10)

Specimen Cutter 100 mm² (26-2201)

Specimen Extrusion Tool 100 mm² (26-2205)

Bottom Pad or Grooved Plates 100 mm (1627A0097)

Shear Box Assembly 60 mm²

Product Codes: 26-2181

Product Standards:

BS 1377-7, ASTM D3080/D3080M, AASHTO T236

- Manufactured from corrosion resistant materials.
- Sample size 60 x 60 x 25 mm high meeting BS 1377.
- Incorporates PTFE faced box separation screws to reduce friction.
- Supplied complete with upper and lower porous plates and loading pad.
- Suitable for quick undrained or drained/residual tests.

Specifications	
Specimen Area/Size (mm)	60 x 60
Specimen Thickness (mm)	25
Weight (kg)	2

Spares/Consumables:

Porous Plate 60 mm² (26-2181/10)

Specimen Cutter 60 mm² (26-2185)

Specimen Extrusion Tool 60 mm² (26-2189)

Bottom Pad or Grooved Plates 60 mm (1627A0094)

Shear Box Assembly 2.5 inch Diameter

Product Code: 26-2213

Product Standards:

ASTM D3080/D3080M, AASHTO T236

- Manufactured from corrosion resistant materials.
- Sample size 2.5 inch diameter x 1 inch high meeting ASTM D3080.
- Incorporates PTFE faced box separation screws to reduce friction.
- Supplied complete with upper and lower porous plates and loading pad.
- Suitable for quick undrained or drained/residual tests.

Specifications	
Specimen Area/Size (inches)	2.5 dia
Specimen Thickness (inches)	1
Weight (kg)	2.8

Spares/Consumables:

Porous Plate 2.5 inch diameter (26-2213/10)

Specimen Cutter 2.5 inch diameter (26-2217)

Specimen Extrusion Tool 2.5 inch diameter (26-2221)

Bottom Pad or Grooved Plates 2.5 inch diameter (1627A0099)

Direct Shear & Vane Tests

Measurement of Horizontal & Vertical Movement

Vertical Dial Gauge
10 mm Travel x 0.002 mm Divisions

Product Code: 25-0440

Horizontal Dial Gauge
10 mm Travel x 0.01 mm Divisions

Product Code: 83-5456

Measurement of Load (Shear Stress)

Product Code	Product	Capacity (kN)
78-0060	Load Ring - 2 kN	2
78-0160	Load Ring - 3 kN	3
78-0260	Load Ring - 4.5 kN	4.5
27-1561	S-Type Load Cell	5

For full specification see page 38

Application of Normal Stress

Product Code	Product	Weight (kg)
26-2132	Set of weights - 4 x 10 kg, 1 x 5 kg, 2 x 2 kg, 1 x 1 kg	50
26-2137	Slotted surcharge weight	10
26-2139	Slotted surcharge weight	5
26-2141	Slotted surcharge weight	2
26-2143	Slotted surcharge weight	1
26-2145	Slotted surcharge weight	0.5
26-2147	Slotted surcharge weight	0.25

Horizontal Displacement Transducer Assembly 15 mm Travel 5-pin DIN Plug Mounting Pillar

Product Code: 27-1697

Vertical Displacement Transducer Assembly 15 mm Travel with 5-pin DIN Plug Bracket for Shear Box

Product Code: 27-1689

Software & Data Logging

Product Code	Product
27-2793 (DS7.2: 27-1793)	DS7.3 Direct and Residual Shear Strength Software
27-1300/01	DSU Electrical Data Acquisition and Control System

For full specification see page 72-77

DSU Electrical Data Acquisition & Control System

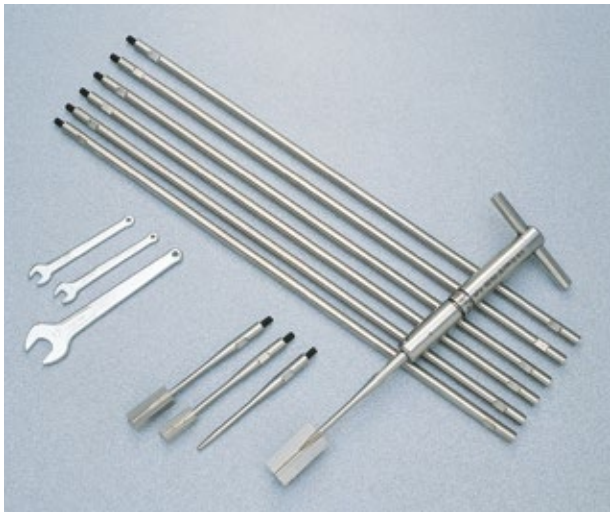
Product Code: 27-1300/01

For full specification see page 72

Inspection Vane

Inspection Vane

Product Code: 26-3335



Product Standards:

BS 1377-7, ASTM D4648/D4648M

This instrument is an essential tool for civil engineers involved in site investigation work. The unit is supplied in kit form with a carrying case incorporating the measuring head, extension rods, vanes, etc. The measuring head comprises a T-handle that is spring-loaded against the extension rod adaptor. Weight 3 kg. Range 0-260 kPa.

Spares/Consumables:

H605 Extension Rod (26-3335/11)

Laboratory Vane Apparatus

Product Code: 26-2270, 26-2275/01

Product Standards:

BS 1377-7,
ASTM D4648/D4648M

The equipment is based on a design by the Transport Research Laboratory, England, and is available in hand or motorised versions. Stress is applied through the 12.7 x 12.7 mm vane by means of any one of four calibrated springs. The motorised version produces a shearing rate of 10° per minute.

Product Code	Product
26-2270	Hand Operated Vane Apparatus
26-2275/01	Motorised Vane Apparatus

Spares/Consumables:

Set of 4 Calibrated Springs for Laboratory Vane Apparatus (26-2275/10)

Drive Belt (26-2275/11)

Accessories:

Vane 12.7 mm diameter x 12.7 mm long (26-2279)

Vane 12.7 mm diameter x 19 mm long (26-2281)

Vane 12.7 mm diameter x 25.4 mm long (26-2283)

Attachment Clamp for 38 mm and 100 mm sample tubes (26-2289)

Pocket Shearmeter

Pocket Shearmeter with 3 Vanes 0 to 1 kgf/cm² x 0.5 kgf/cm²

Product Code: 26-2261

The Shearmeter can be used on tube samples, on the sides of pits, cuttings etc. It is an invaluable tool for initial site investigation work.

Further Information:

Complete with sensitive vane, standard vane and high-capacity vane. Range 0 to 1 x 0.05 kgf/cm².

Specifications	
Vane Driver	1.6 inch (41 mm) dia x 3.2 inches (81 mm) long with vane attached
Dial Scale	1 kg/cm² (tons/ft²) x 0.05 sub-divisions
Carrying Case W x D x H	Plastic; 6 x 4 x 2 inches (152 x 102 x 51 mm)
Weight	Net 10.5 oz (300 g)

Spares/Consumables:

Sensitive Vane 0 to 0.2 kg/cm² (26-2261/10)

Standard Vane 0 to 1 kg/cm² (26-2261/12)

High-Capacity Vane 0 to 2.5 kg/cm² (26-2261/14)

Data Logging, Software & Electronic Instrumentation

At ELE we have long specialised in the development of intelligent processing and recording systems. Over the years, our knowledge, skills and resources have enabled us to help customers move from the early stages of simple digital readout units, through dedicated computer control, to the latest intelligent stand-alone data acquisition systems. In each case our expertise in both hardware and software allows us to deliver dedicated condition monitoring and software solutions that meet the exact needs of our customers, while retaining optimum system performance, functionality and reliability.

- Multi-tasking.
- Stand-alone systems.
- Digital readout units.
- Total solutions.
- Systems consultancy service.
- Wide range of PC compatibility.

DSU Electronic Readout & Control System

The Data System Unit (DSU) is a versatile instrument designed to accommodate the general logging requirements of geotechnical and materials testing engineers. Its intelligent interface allows the user to work with a range of different sensors.

- 4 channel automatic control and data-logging unit.
- Automatic, dual-frame control.
- Performs CBR, Marshall, Unconfined Compression, Direct and Residual Shear, One-Dimensional Consolidation and Unconsolidated Undrained tests.
- LAN connection - software can be running anywhere on your server.
- Never lose data from power failures.
- 2 GB of non-volatile memory.
- 2 year warranty.

The DSU has two distinct modes of operation. The first is referred to as DS mode (DataSystem) for operation with ELE International's established DS7 geotechnical testing software.

- DS Mode.
- Up to four one-dimensional Consolidation tests.
- Up to two CBR tests.
- One Direct/Residual Shear test.
- One triaxial quick Undrained test.
- DU Mode.
- Up to two Marshall tests.
- Up to two Unconfined Compression tests.
- Automatic frame control.

Overview:

- Touch Screen data entry for stand-alone operation, Marshall/CBR/Quick Undrained.
- Automatic single and dual frame control (with Multiplex 50 frame).
- Log memory of 2 GB.
- Non-volatile memory.
- Ethernet TCP/IP link and serial comms support.
- Market leading signal stability.
- Certificate and manual calibration features.
- Easy update firmware RS 232 connection.

Specifications

Product Code	Power Supply
27-1300/01	220-240 V AC, 50-60 Hz, 1 ph
27-1300/02	110-120 V AC, 50-60 Hz, 1 ph

Dual Frame Comms Cable

Product Code: 27-1300/10

This item is required if you wish to control two Multiplex-50 load frames for CBR and Marshall tests.

Cable, Safety/ID

Product Code: 27-1300/11

This is required for every CBR Test 50, Marshall Test 50 and Multplex 50 load frame that you wish to control.

Please note, one of these is included with the DSU as standard. An additional cable will be required if you wish to connect to a second frame.

PC Cable

Product Code: 27-1300/12

This item is required to connect the Multiplex frame or a link to the PC when using the DSU with DS7 Software.

GDU 8 Channel Data Acquisition Unit

Product Code: 27-1500

The GDU is a stand-alone, multi-tasking, multi-channel data logger that is reliable and powerful, enabling it to co-ordinate test data from the range of ELE transducers required for various test methods. The ELE Geotechnical software packages (DS7), in conjunction with the GDU and a range of transducers, are the two central components required to create a modern turnkey soil testing system. Being fully modular it can be adapted to a wide range of soil testing laboratory configurations.

- For performing CBR, Consolidation, Direct/Residual Shear and Total and Effective Stress Triaxial tests.
- 8 Channels expandable to 32 for performing multiple, concurrent tests for cost savings.
- Independent signal conditioning on each channel to maintain data accuracy.
- Field-upgradeable software, meaning no downtime for future software and functionality upgrades.
- 2 year warranty.

Specifications

Case	Aluminium, free standing; houses power supply, analogue to digital conversion module and an 8-channel analogue input module with transducer energization
Sockets	Standard 5-pin DIN type
Input Range	± 5 volts to ± 10 mV full scale
Transducer Supply	10 V DC
Dimensions W x D x H	12.8 x 14.3 x 6.1 inches (325 x 363 x 155 mm)
Weight	Net 14.08 lbs (6.4 kg)
Product Code	**Power Supply**
27-1500/01	220-240 V AC, 50-60 Hz, 1 ph
27-1500/02	100-120 V AC, 60 Hz, 1 ph

Accessories:

8-Channel Expansion Analog Input Module (27-1505)

USB to Serial Adaptor (27-1701)

RS 232 to USB Cable for GDU (27-1510)

S-Type Load Cell for Triaxial Testing

S-Type Load Cell for Triaxial Tests. Fitted with 5-pin DIN Plug.

Ideally suited for a wide range of applications, ELE S-type load cells provide high accuracy and minimum deformation. Various models are available, with the necessary adaptors, for use with ELE Triaxial Load Frames, Multiplex 50/Marshall Test 50/CBR Test 50 and Direct Shear machines.

- Repeatability better than ± 0.02% of rated output.
- Non-linearity better than ± 0.03% of rated output.
- Supplied complete with 5-pin DIN type connector for connection to DSU and GDU.

Specifications

Load Device Type		S-Type
Environmental Protection		IP65
Product Code	**Force Capacity**	**Test Type**
27-1562	1 kN	Triaxial
27-1563	3 kN	Triaxial
27-1551	5 kN	Triaxial
27-1553	10 kN	Triaxial
27-1555	25 kN	Triaxial
27-1559	50 kN	CBR and Marshall
27-1561	5 kN	Direct Shear

Spares/Consumables:

Ball Nipple 1/2 bsf (0117A0007)

Ball Nipple M16 (1274A0152)

Calibration Adaptor (1274A0153)

Load Cell Adaptor (1274A0164)

Data Logging, Software & Electronic Instrumentation

Submersible Load Transducer Assembly Capacity in Compression

Submersible Load Transducers are used to measure accurately the axial loads applied to triaxial test specimens. Consisting of a load cell and piston assembly these units replace the standard triaxial cell loading piston.
A major advantage is that these transducers measure loads directly on top of the specimen. All transducers are supplied complete with a 5-pin DIN type connector and calibration certificate.

- Eliminates effects of piston friction on readings.
- Unaffected by cell confining pressures.
- Easily installed in triaxial cell.
- Supplied complete with calibration certificate and 5-pin DIN type connector for use with GDU or DSU.

Specifications

Load Device Type	Submersible	
Overload Capacity	150%	
Non-linearity	0.1% max	
Hysteresis Deflection	0.1% max 0.05 mm at full load	
Side Force	50% full scale max without effect	
Connector	5-pin DIN plug	
Weight (g)	850	
Product Code	**27-1573**	**27-1575**
Force Capacity (kN)	5	10
Dimensions Dia x H (mm)	75 x 50	75 x 50
	Excluding piston and adaptor	
Output	26 mv full range	
Excitation	10 V DC (15 V DC max)	
Compensated Temperature Range	0 to 50°C	1 to 50°C

Accessories:

Distance Piece required for Submersible Transducer (27-1293)

Displacement Transducers

Displacement Transducers are used in Consolidation, Shear, CBR and Triaxial test applications for accurate displacement measurements. They are supplied complete with a 5-pin DIN type connector for direct connection to the DSU and GDU.

- Ideally suited for use with GDU or DSU for accurate displacement measurements.
- Models available for use in consolidation, shear, CBR and triaxial test applications.
- Supplied complete with mounting hardware for specified products.
- All supplied with calibration certificate.

Specifications

Construction	Fully encapsulated electronics sealed in a Stainless Steel case
Excitation	10 V DC
Connector	5-pin DIN type
Weight (kg)	0.45

Specifications

Product Code	Product	Range (mm)	For Use With
27-1617	Axial Strain Transducer	0 to 50	Triaxial Cells
27-1649	Consolidation Displacement Transducer	0 to 10	One-dimensional Consolidation Apparatus
27-1689	Vertical Displacement Transducer	0 to 10	Direct/Residual Shear Machines
27-1697	Horizontal Displacement Transducer	0 to 10	Direct/Residual Shear Machines
27-1705	CBR Displacement Transducer	0 to 50	CBR Tritest and Multiple Series Load Frames

Accessories for Transducers

Extension Cables

Wired with a 5-pin DIN plug at one end and 5-pin DIN type socket at the other, these extension cables are used to increase the length of any DSU and GDU transducer cable.

Transducer Extension Cable

Specifications	
Product Code	Length (m)
27-1715	1.5
27-1717	3.0
27-1719	4.5
27-1710/10	10

Pressure Measurement

Digital Pressure Gauge 1700 kPa for ELE Triaxial Cells

Product Code: 26-1620

The Digital Pressure Gauge offers highly accurate pressure measurement and digital readout for ELE triaxial cells.

Specifications	
Capacity	250 psi (1700 kPa)
Display	LCD
Display Units	Psi, kPa, mPa
Accuracy	Better than 1% of indicated pressure
Read Rate	Two samples per second
Power Supply	3 volt battery, CR 2340 type
Battery Life	1400 hours continuous operation
Dimensions W x D x H	2.30 x 1.25 x 3.75 inches (59 x 32 x 95 mm)
Weight	Net 1/4 lb (125 g)

Pressure Transducer Assembly 1700 kPa Fitted with 5-pin DIN Plug

Product Code: 27-1633

Pressure Transducers are used to measure the cell, pore and back pressures during triaxial testing. Assemblies are supplied complete with a de-airing block, valve, 5-pin DIN plug connector and calibration certificate.

Specifications	
Construction	Stainless Steel
Excitation	10 V DC
Output	143 mV full range
Thread	1/4 inch BSP

De-Airing Block for Pressure Transducer

Product Code: 27-1625/10

Data Logging, Software & Electronic Instrumentation

Geotechnical Testing Software

DS7 Software

ELE International is pleased to present a NEW version of its geotechnical data acquisition and analysis testing software, DS7 (DataSystem 7). The software currently has two versions, DS7.2 and the new DS7.3.

DS7.2 supports Windows 7 and Windows XP Service Pack 3.

DS7.3 supports Windows 10 and Office 2016/Office 365.

- Now supports Ethernet communications in conjunction with the DSU.
- Programs available for Triaxial, Permeability Consolidation, Direct/Residual Shear and CBR tests.
- Accurate and repeatable test procedures.
- 72 hour unsupervised logging.
- Eliminate the possibility of errors while taking manual readings.
- Tests are run with step-by-step instructions selectable between BS and ASTM/AASHTO standards.
- Automatic report generation in accordance with the above standards.
- Real-time graphical outputs to both screen and printer as required.

DS7.3 Software-UU/CU/CD Triaxial, Permeability, Consolidation, Direct/Residual Shear, CBR

Product Code: S2160 (DS7.2 Windows 7, XP: S1160)

- Programs available for Triaxial, Permeability Consolidation, Direct/Residual Shear and CBR tests.

DS7.3 Undrained Triaxial Shear Strength Program for Windows 10, 32/64 bit

Product Code: 27-2753 (DS7.2 Windows 7, XP: 27-1753)

Options are available for a single test on one sample, standard three-sample procedure with linking of the results, or for a multi-stage test on one sample. Load and strain are monitored through transducers. Various printouts and graphical plots are available including basic sample data, moisture content and density. The program tabulates shearing data and plots stress against strain. Mohr circles are produced for graphical analyses.

- Options for single or multi-stage testing on a sample.
- Mohr circles produced for graphical analysis.

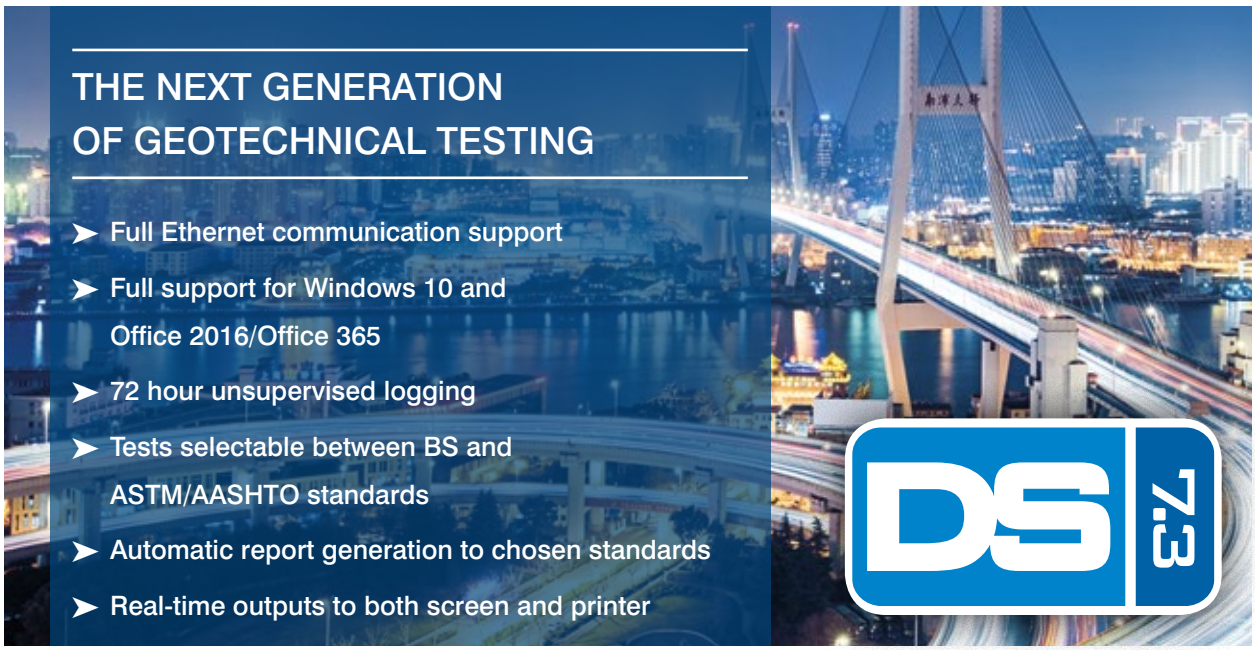
Specifications	
GDU Compatibility	Yes
DSU Compatibility	Yes

DS7.3 Direct & Residual Shear Strength Program for Windows 10, 32/64 bit

Product Code: 27-2793 (DS7.2 Windows 7, XP: 27-1793)

This unique package provides test options for quick undrained or drained shear tests with the user selectable option of residual testing. Individual test results can be linked together to produce the Coulomb Envelope. Printouts and plots are available for sample description and basic test data such as moisture content, etc. Realtime plots of settlement, shear versus displacement and vertical displacement during shearing is readily available via the PC screen or printer.

Specifications	
GDU Compatibility	Yes
DSU Compatibility	Yes



DS7.3 CU/CD Triaxial Shear Strength Program for Windows 10, 32/64 bit

Product Code: 27-2763 (DS7.2 Windows 7, XP: 27-1763)

This advanced package includes procedures for consolidated drained and consolidated undrained tests. Standard options are available for saturation, consolidation and shearing with automatic monitoring of the various parameters through transducers linked to the system. Load, strain, volume-change, pore-pressure, cell pressure and back pressure can all be monitored. Various prints and graphical plots are available to the engineer and include saturation data such as pore pressure build-up and B values, consolidation, volume change against time, shearing load versus strain with pore pressure monitoring.

- Complete package for consolidated drained and consolidated undrained triaxial tests.

Specifications	
GDU Compatibility	Yes
DSU Compatibility	No

DS7.3 One-Dimensional Consolidation Program for Windows 10, 32/64 bit

Product Code: 27-2773 (DS7.2 Windows 7, XP: 27-1773)

DS7.3 Consolidation Software provides all basic functions needed to record and analyse consolidation test data. Options are available for monitoring settlement on a log time or square-root time basis. Printouts and graphical plots are available for all stages including MV and CV moisture content, voids ratio plots, and initial sample conditions.

Specifications	
GDU Compatibility	Yes
DSU Compatibility	Yes

DS7.3 California Bearing Ratio (CBR) Penetration Program for Windows 10, 32/64 bit

Product Code: 27-2798 (DS7.2 Windows 7, XP: 27-1798)

This program provides the classical data for the CBR test. Load and penetration are monitored simultaneously. The program tabulates the results and provides a graphical presentation report.

Specifications	
GDU Compatibility	Yes
DSU Compatibility	Yes

DS7.3 Permeability in a Triaxial Cell Program for Windows 10, 32/64 bit

Product Code: 27-2768 (DS7.2 Windows 7, XP: 27-1768)

This program provides data for the determination of permeability of soil specimens using a triaxial cell and two volume change units in accordance with BS 1377.

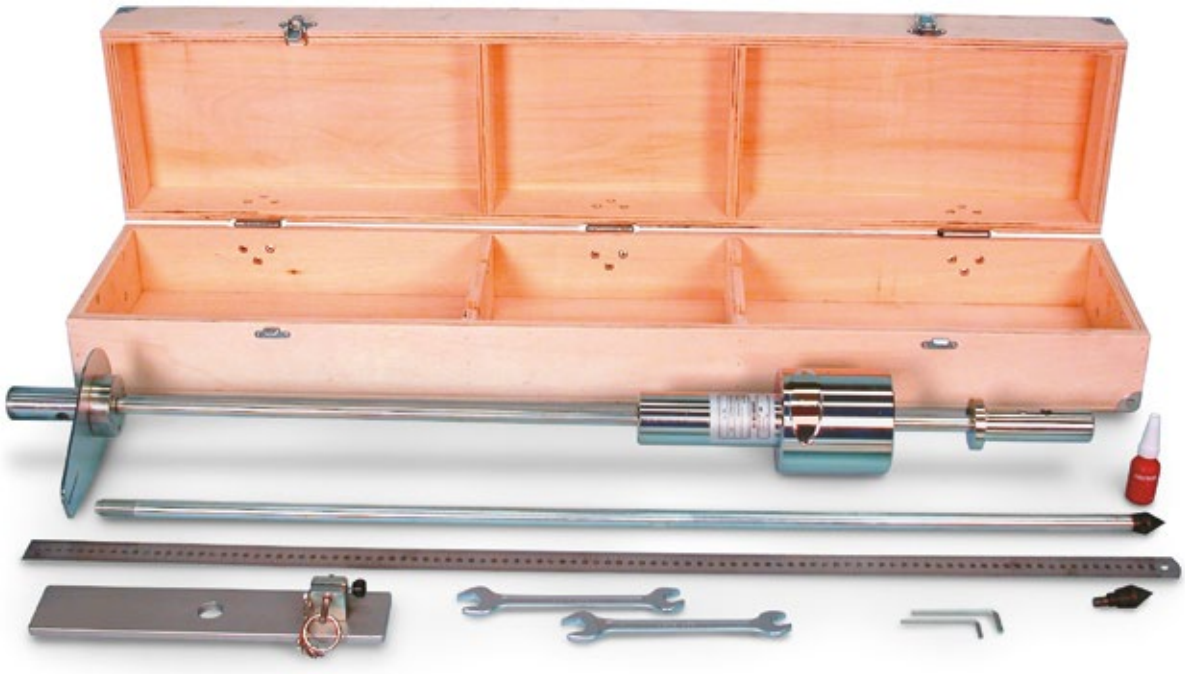
Specifications	
GDU Compatibility	Yes
DSU Compatibility	No

The design of foundations is a prerequisite of economic design and construction. In order to guard against shear failure and unacceptable ground movements due to loading, it is often necessary to determine the ground bearing capacity.

In-situ Testing

Dynamic Cone Penetrometer 8 kg Hammer (TRL Design)

Product Code: 29-3720



Product Standards:

ASTM D6951/D6951M

The TRL (Transport Research Laboratory) Dynamic Cone Penetrometer (DCP) is used for rapid in-situ measurement of the structural properties of existing pavements constructed with unbound materials. The unit incorporates an 8 kg weight with a drop of 575 mm, and a 20 mm diameter cone fitted to the end of the shaft, allowing measurements to be made to a depth of approximately 850 mm. Readings are usually taken after a set number of blows, changing the number according to the strength of the layer being penetrated. For good granular bases, readings every five to ten blows are satisfactory, but for weaker sub-base layers and subgrades, readings every one to two blows may be appropriate.

The DCP requires three operators, one to hold the instrument in a vertical position, one to raise the hammer and let it fall and one to record the results. A typical test takes only a few minutes, providing a very efficient method of obtaining information which would otherwise require the excavation of test pits. Where pavement layers have different strengths, boundaries can be identified and layer thickness determined.

Further Information:

Supplied complete with all necessary tools, assembly and operating instructions.

Specifications	
Weight (kg)	25

Spares/Consumables:

Spare Cone for Dynamic Cone Penetrometer (29-3720/10)

Hammer Shaft 815 mm (29-3720/11

Extension Rod 400 mm (29-3720/12)

Penetration Rod 900 mm (29-3720/13)

Base Plate (29-3720/14)

Pocket Penetrometer

Product Code: 29-3729

The Pocket Penetrometer was originally developed for use by field personnel in checking visual classification of soils. Data was compiled on several thousand unconfined compressive strength tests of silty clays and clay soils against the penetrometer readings to develop the scale.

- Direct-reading scale in tons/ft² and kg/cm².
- Ground and polished Stainless Steel loading piston.
- Calibrated spring and penetrometer body plated for rust resistance and long life.
- Convenient belt-loop style carrying case.
- Optional Adaptor Foot for testing very soft materials.

Specifications	
Range	0.25 to 4.5 tons/ft² (kg/cm²)
Scale Divisions	0.25 tons/ft² (kg/cm²)
Load Piston	1/4 inch (6 mm) dia; Stainless Steel
Carrying Case	Canvas; belt-loop style
Dimensions	3/4 inch dia x 6-3/8 inches long (19 x 162 mm)
Weight (g)	216

Accessories:

Adaptor Foot increases surface area x 16 (29-3729/10)

Further Information:

IMPORTANT: The readings obtained from the Pocket Penetrometer do not replace laboratory test results due to the fact that a small area penetration test is inherently liable to give misleading results. The instrument should not be used for obtaining foundation design data.

Plate Bearing Apparatus Complete, 500 kN Capacity

Product Code: 29-3800

Product Standards:

ASTM D1194, ASTM D1195/D1195M, ASTM D1196/D1196M, BS1377, EN1997-3

Applications include the determination of bearing capacity of the soil in-situ, designing for static loads on spread footings, and repetitive and non-repetitive plate loading tests of soils and flexible pavements. Manufactured from machined steel plate with a finished thickness exceeding 25 mm. The plate has concentric markings on one face. All plates are supplied with two lifting eyes except for the 150 mm diameter plate. NOTE: to successfully perform the test, a reaction load is required. IMPORTANT: The equipment is used in conjunction with a reaction beam. This is not supplied with the equipment.

Plate Bearing Apparatus Comprises of:

- Hydraulic Jack 500 kN capacity.
- Pressure system.
- Datum bar.
- 4 x Dial Gauges 50 mm travel x 0.01 mm divisions.
- 4 x Bearing Plates: 150 mm, 305 mm, 455 mm and 760 mm diameter.

Specifications	
Loading Jack	500 kN capacity with integral ball seating
Pump	Hand operated, single speed with integral oil reservoir
Hose	3 m long. Max pressure 70 mPa with quick release couplings
Gauge	100 mm dia with quick release couplings and graphs to convert readings to kN, kgf and lbf
Weights	Loading jack 24 kg Pressure system 12.5 kg

Spares/Consumables:

Hand Operated Pressure System for 500 kN Jack (29-3808)

500 kN/700 Bar Pressure Gauge (29-3808/10)

Datum Bar Assembly (29-3818)

Dial Gauge 50 mm Travel x 0.01 mm Divisions complete with Adjustable Clamp Assembly (29-3822)

Adjustable Clamp Assembly for Dial Gauge 29-3822 (29-3822/10)

Bearing Plates:

150 mm diameter (29-3826) 305 mm diameter (29-3834)

455 mm diameter (29-3838) 760 mm diameter (29-3846)

In-situ Density

In-situ Density

Many civil engineering projects require the use of fill material. Whenever soil is placed as an engineering fill, it is usually compacted to a dense state to obtain satisfactory engineering properties. Compaction on site is usually effected by mechanical means such as rolling, ramming or vibrating. Control of compaction is necessary to achieve a satisfactory result at a reasonable cost. Laboratory compaction tests provide the basis for control procedures used on site.

Proctor Penetrometer

This spring-type penetrometer can be used in the field to control soil compaction. The stem is calibrated to 150 lbf x 2 lbf divisions, and a sliding collar indicates the applied load. A rapid estimate of the moisture content of soil can be obtained by comparing the amount of penetration of the needle for a corresponding load, with a laboratory determined moisture/density curve for a similar soil.

Proctor Penetrometer (Spring Type) with Adaptor Stem

Product Code: 29-3925

Product Standards:

ASTM D1558

Supplied without needle points.

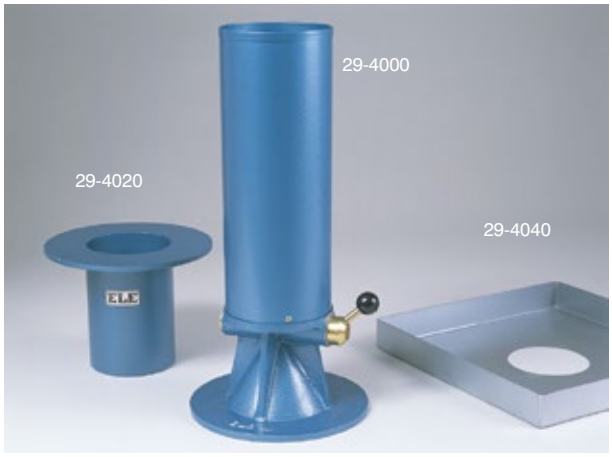
Specifications	
Weight (kg)	2

Accessories:

Case for Proctor Penetrometer (29-3933)

Set of Needle Points (34-0810)
1, 3/4, 1/2, 1/3, 1/5, 1/10, 1/20, 1/30, 1/40 square inch area.

Sand Replacement



This equipment is used to determine the dry density of in-situ soils. Apparatus is included which satisfies BS, ASTM and AASHTO specifications.

Sand Pouring Cylinder (100 mm)

Product Code: 29-4000

Product Standards:

BS 1377-9, EN 1924-2

Specifications	
Dia (mm)	100
Weight (kg)	3.2

Calibrating Container (100 mm)

Product Code: 29-4020

Product Standards:

BS 1377-9, EN 1924-2

Specifications	
Internal dia (mm)	100
Depth (mm)	150
Rim dia (mm)	200
Weight (kg)	2.75

Sand Pouring Cylinder (150 mm)

Product Code: 29-4100

Product Standards:

BS 1377-9, EN 1924-2

Specifications	
Dia (mm)	150
Weight (kg)	8.7

Calibrating Container (150 mm)

Product Code: 29-4120

Product Standards:

BS 1377-9, EN 1924-2

Specifications	
Internal dia (mm)	150
Depth (mm)	150
Rim dia (mm)	250
Weight (kg)	4.4

Sand Pouring Cylinder (200 mm)

Product Code: 29-4200

Product Standards:

BS 1377-9, EN 1924-2

Specifications	
Dia (mm)	200
Weight (kg)	14

Calibrating Container (200 mm)

Product Code: 29-4220

Product Standards:

BS 1377-9, EN 1924-2

Specifications	
Internal dia (mm)	200
Depth (mm)	250
Rim dia (mm)	350
Weight (kg)	8.2

Metal Tray 300 mm² x 40 mm deep with a 100 mm diameter hole

Product Code: 29-4040

Product Standards:

BS 1377-9, EN 1924-2

Metal Tray 300 mm² x 40 mm deep with a 150 mm diameter hole

Product Code: 29-4140

Metal Tray 500 mm² x 50 mm deep with a 200 mm diameter hole

Product Code: 29-4240

Sand Cone 6 inches

Grouped Product Standards:

ASTM D1556/D1556M, AASHTO T191

Product Code	Product
29-4300	6 inch (152 mm) Sand Cone
29-4320	Plastic Container for Sand Cone
29-4340	Density Plate
82-7401	Standard Sand - 600/300 μm

In-situ Density

Core Cutter Apparatus

In this method of determining the dry density of in-situ soil, a Core Cutter of known volume is driven into the soil by a rammer. The Core Cutter is removed, trimmed and the soil obtained is weighed and dried for a moisture/ density check.

Core Cutter

Product Code: 29-5300

Product Standards:
BS 1377

Specifications	
Internal dia x length (mm)	100 x 130

Driving Dolly for 29-5300

Product Code: 29-5320

Product Standards:
BS 1377-9, EN 1924-2

Specifications	
Weight (kg)	0.34

Driving Rammer for 29-5320

Product Code: 29-5340

Product Standards:
BS 1377-9, EN 1924-2

Specifications	
Weight (kg)	13

Field Density Tools

Density Spoon

Product Code: 29-5000

For removing soil from the hole.

Specifications	
Weight (kg)	0.11

Soft Headed Mallet

Product Code: 29-5020

Specifications	
Weight (kg)	0.62

Density Chisel

Product Code: 29-5060

With hardened tip.

Specifications	
Weight (kg)	0.75

Metal Dibber Tool

Product Code: 29-5080

For excaturating hole.

Specifications	
Weight (kg)	0.27

Density Hand Pick

Product Code: 29-5120

For excavating in difficult ground.

Specifications	
Weight (kg)	0.76

Steel Pointed Rod

Product Code: 29-5140

Steel pointed rod with plastic handle.

Specifications	
Weight (kg)	0.25

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Sieving, Wet & Dry Method

Sieve method is applicable to soils with less than 10% fines.

Standard(s)	EN 17892-4	
Product Code	**Product**	**Qty**
24-4145	Sodium Hexametaphosphate 500 g	1
79-0010	200 mm dia Lid	1
79-0020	200 mm dia Receiver	1
79-0070	200 mm dia BS Sieve 63 Mic Stainless Steel Mesh	1
79-0120	200 mm dia BS Sieve 150 Mic Stainless Steel Mesh	1
79-0140	200 mm dia BS Sieve 212 Mic Stainless Steel Mesh	1
79-0160	200 mm dia BS Sieve 300 Mic Stainless Steel Mesh	1
79-0180	200 mm dia BS Sieve 425 Mic Stainless Steel Mesh	1
79-0200	200 mm dia BS Sieve 600 Mic Stainless Steel Mesh	1
79-0240	200 mm dia BS Sieve 1.18 mm Stainless Steel Mesh	1
79-0270	200 mm dia BS Sieve 2 mm Stainless Steel Mesh	1
79-0280	200 mm dia BS Sieve 2.36 mm Stainless Steel Mesh	1
79-2010	300 mm dia Lid	1
79-2020	300 mm dia Receiver	1
79-2300	300 mm dia BS Sieve 3.35 mm Stainless Steel Mesh	1
79-2515	300 mm dia BS Sieve 5 mm Perforated Plate	1
79-2525	300 mm dia BS Sieve 6.3 mm Perforated Plate	1
79-2555	300 mm dia BS Sieve 10 mm Perforated Plate	1
79-2575	300 mm dia BS Sieve 14 mm Perforated Plate	1
79-2595	300 mm dia BS Sieve 20 mm Perforated Plate	1
79-2615	300 mm dia BS Sieve 28 mm Perforated Plate	1
79-2640	300 mm dia BS Sieve 37.5 mm Perforated Plate	1
79-2655	300 mm dia BS Sieve 50 mm Perforated Plate	1
79-2670	300 mm dia BS Sieve 63 mm Perforated Plate	1
79-2680	300 mm dia BS Sieve 75 mm Perforated Plate	1
79-7200	Sieve Brush Double Ended Brass and Nylon Bristle	1
79-7210	Sieve Brush Double Ended Nylon	1
81-0220	Aluminium Scoop Large	2
81-0375	Red Rubber Tubing 6.5 mm Bore x 5 mm Wall thickness price per metre	2
81-3545	22 ltr Transport/Storage Container complete with Snap-on Lid and Handle	3
81-4080	Sample Tray 610 x 610 x 63 mm	2
81-4700	Stainless Steel Tray 305 mm dia	6
82-0220	Glass Beaker 1000 ml capacity Squat Form with Spout	3
82-2000	Evaporating Dish 150 mm dia x 45 mm depth	6

Continued on page 84

Continued: Sieving, Wet & Dry Method

Product Code	Product	Qty
23-3000	Riffle Box 7 mm slot width complete with 3 Containers	1
23-3070	Riffle Box 15 mm slot width complete with 3 Containers	1
23-3170	Riffle Box 30 mm slot width complete with 3 Containers	1
23-3300	Riffle Box 50 mm slot width complete with 3 Containers	1
78-1215/01	Drying Oven 50 ltr capacity 1 Year Warranty 220-240 V AC, 50-60 Hz, 1 ph	1
78-6020/01	Electronic Top Loading Balance 6 kg x 0.1 g with below balance hanger	1
78-6050/01	Upright Loading Balance 50 kg x 10 g	1
80-0200/01	ELE Sieve Shaker complete with separate Control Panel 220-240 V AC, 50 Hz, 1 ph	1
82-2110	Desiccator Cabinet Non-Vacuum	1
82-7091	Silica Gel 2.5 to 6 mm Self Indicating 500 g	1

Sedimentation by Hydrometer Method

This method is applicable to soils with more than 10% fines.

Standard(s) EN 17892-4

Product Code	Product	Qty
24-2854/01	Mechanical End-Over-End Shaker complete with Friction Safety Device and Control Panel 220-240 V AC, 50 Hz, 1 ph	1
24-4145	Sodium Hexametaphosphate 500 g	1
24-4620	Long Stem Soil Hydrometer	1
24-4700	1000 ml Glass Cylinder with Rubber Bung	2
24-4865/01	Constant Temperature Bath 0 to 99.9°C x 0.1°C with LED Display and False Base Support	1
34-0140	300 mm Stainless Steel Rule	1
81-0375	Red Rubber Tubing 6.5 mm Bore x 5 mm Wall thickness price per metre	2
81-0518	Timer Clock	1
82-0200	Glass Beaker 600 ml Squat Form with Spout	1
82-0260	Beaker Cover 100 mm dia	
82-0380	Measuring Cylinder 100 ml	1
82-1300	Bulb Pipette 50 ml capacity	1
82-2000	Evaporating Dish 150 mm dia x 45 mm depth	5
82-2100	Non-Vacuum Desiccator 200 mm internal dia	1
82-2200	Buchner Funnel No. 5	1
82-2350	1000 ml Filter Flask Polypropylene with Side Arm	1
82-2500	Wash Bottle Polythene 500 ml	1
82-4005	Glass Rods 7 mm dia x 200 mm. Pack of 10	1
82-5420	Digital Pocket Thermometer -49.9˚C to +199.9˚C	1
82-7091	Silica Gel 2.5 to 6 mm Self Indicating 500 g	1
82-7700	Filter Pump	1
82-7931	Filter Paper No. 95 equivalent to Whatman No. 50. 110 mm dia. Box of 100	1

Continued: Sedimentation by Hydrometer Method

Product Code	Product	Qty
78-1215/01	Drying Oven 50 ltr capacity 1 Year Warranty 220-240 V AC, 50-60 Hz, 1 ph	1
78-6020/01	Electronic Top Loading Balance 6 kg x 0.1 g with below balance hanger	1
79-0020	200 mm dia Receiver	1
79-0070	200 mm dia BS Sieve 63 Mic Stainless Steel Mesh	1
79-0140	200 mm dia BS Sieve 212 Mic Stainless Steel Mesh	1
79-0200	200 mm dia BS Sieve 600 Mic Stainless Steel Mesh	1
79-0270	200 mm dia BS Sieve 2 mm Stainless Steel Mesh	1

Incremental Loading Oedometer Test — Manual Recording

The Oedometer Consolidation test method determines the compression, swelling and consolidation properties of soils. Available sample sizes: 50 mm and 75 mm consolidation cells. Options for manual or automatic recording/analysis of results.

One-Dimensional Consolidation

Standard(s): EN 17892-5

Product Code	Product	Qty
24-0430	Glass Plate	1
24-9010	Straight Edge 300 mm	1
25-0402	Consolidation Frame One-Dimensional Consolidation Incremental Loading Device	1
25-0408	Set of Weights 100 kg total weight	1
25-0429	Floor Mounting Stand	1
25-0440	Dial Gauge 10 mm Travel x 0.002 mm Divisions	1
78-6010/01	Electronic Top Loading Balance 1200 g at 0.01 g	1
81-0100	Spatula 100 mm Blade	1
81-0518	Timer Clock	1
81-0590	Vernier Caliper (LCD) Range 0 to 200 mm x 0.01 mm	1
81-0710	Trimming Knife	1
81-0805	Engineer's Steel Rule 300 mm	1
82-5310	Max-Min Thermometer (Mercury Free) Range -40˚C to +50˚C	1

50 mm Sample

25-0455	Consolidation Cell complete 50 mm dia Sample	1
25-0461	Calibration Disc 50 mm Cell	1

75 mm Sample

25-0503	Consolidation Cell complete 75 mm dia Sample	1
25-0509	Calibration Disc 75 mm Cell	1

Also required Part 1 Moisture Content Determination Oven Method - Page 112.
Also required Part 2 Determination of Density of Fine Grained Soil - Page 113.

Incremental Loading Oedometer Test | Automatic Recording

The Oedometer Consolidation test method determines the compression, swelling and consolidation properties of soils. Available sample sizes: 50 mm and 75 mm consolidation cells. Options for manual or automatic recording/analysis of results.

One-Dimensional Consolidation

Standard(s)	EN 17892-5	
Product Code	**Product**	**Qty**
24-0430	Glass Plate	1
24-9010	Straight Edge 300 mm	1
25-0402	Consolidation Frame One-Dimensional Consolidation Incremental Loading Device	1
25-0408	Set of Weights 100 kg total weight	1
25-0429	Floor Mounting Stand	1
78-6010/01	Electronic Top Loading Balance 1200 g at 0.01 g	1
81-0100	Spatula 100 mm Blade	1
81-0518	Timer Clock	1
81-0590	Vernier Caliper (LCD) Range 0 to 200 mm x 0.01 mm	1
81-0710	Trimming Knife	1
81-0805	Engineer's Steel Rule 300 mm	1
82-5310	Max-Min Thermometer (Mercury Free) Range -40˚C to +50˚C	1
27-1500/01	GDU 8 Channel Data Acquisition Unit	1
27-1649	Consolidation Transducer Assembly 15 mm Travel fitted with 5-pin DIN plug	1

50 mm Sample

25-0455	Consolidation Cell complete 50 mm dia Sample	1
25-0461	Calibration Disc 50 mm Cell	1

75 mm Sample

25-0503	Consolidation Cell complete 75 mm dia Sample	1
25-0509	Calibration Disc 75 mm Cell	1

Also required Part 1 Moisture Content Determination Oven Method - Page 112.

Also required Part 2 Determination of Density of Fine Grained Soil - Page 113.

Determination of Unconfined Compressive Strength. 38 mm Dia Samples.

The unconfined test is useful to derive the undrained shear strength of soil.
This test provides an approximate value of the unconfined compressive strength of a water saturated homogenous specimen of undisturbed or remoulded cohesive soil.

Standard(s)	EN 17892-7	
Product Code	**Product**	**Qty**
23-4090	38 mm Hand Operated Hydraulic Sample Extruder with Trimming Knife 38 mm Split Former and Cutting Tool	1
23-4120	38 mm Split Former	1
23-4140	Cutting Tool for end preparation of 38 mm samples	1
24-9010	Straight Edge 300 mm	1
25-3650	Unconfined Compression Platens complete with Dial Gauge	1
34-0140	300 mm Stainless Steel Rule	1
78-0260	4.5 kN Clamped Boss Load Ring	1
81-0140	Spatula 200 mm	1
81-0518	Timer Clock	1
81-0588	Vernier Caliper Range 0 to 200 mm x 0.02 mm	1
81-0708	Wire Saw	1
81-0710	Trimming Knife	1
Load Frame also required.		
24-9150/01	CBR-Test 50 Machine 50 kN capacity Two Speeds BS and ASTM supplied with Stabilising Bar	1

Alternative(s)

25-3700/01	Multiplex 50 Machine 50 kN capacity supplied with Stabilising Bar	1
25-3518/01	Digital Tritest 50 Triaxial Load Frame for use on 220-240 V AC, 50-60 Hz, 1 ph	1

Also recommended, but not mandatory
Part 1 Moisture Content Determination Oven Method - Page 112.
Part 2 Determination of Density of Fine Grained Soil - Page 113.

Determination of Compressive Strength. Undrained Triaxial. Oil/Water Pressure System. 38 mm Samples.

Manual Recording

Available sample sizes: 38 mm, 50 mm, 70 mm and 100 mm dia. Options for Oil/Water or Pneumatic pressure systems and choice of Manual or Automatic recording/analysis of test results.

This test determines the compressive strength of a water saturated cylindrical specimen of undisturbed or remoulded cohesive soil without allowing any drainage from the specimen.

Standard(s)	EN 17892-8	
Product Code	**Product**	**Qty**
25-3518/01	Digital Tritest 50 Triaxial Load Frame for use on 220-240 V AC, 50-60 Hz, 1 ph	1
25-4047	50 mm Triaxial Cell 1700 kPa with 5 Pressure/Drainage Ports, supplied with 2 Valves	1
25-4166	38 mm/1.5 inch Base Adaptor with Twin Pore Pressure Ports for 50 mm Cells	1
25-4210	Dial Gauge 25 mm Travel x 0.01 mm Divisions	1
25-4290	Membrane Placing Tool for 35 mm and 38 mm samples	1
25-5050	Pressure Pad 38 mm/1.5 inch dia	1
25-5061	Rubber Membrane 38 mm/1.5 inch dia. Pack of 10	1
25-5081	Membrane Sealing Ring 38 mm/1.5 inch dia. Pack of 10	1
25-5100	Suction Membrane Device 38 mm/1.5 inch dia	1
25-5120	Two-Way Split Former 38 mm/1.5 inch dia	1
26-1800/01	Pressure Test 1700 Oil/Water Constant Pressure System 0 to 1700 kPa 220-240 V AC, 50-60 Hz, 1 ph	1
26-1820	Digital Pressure Gauge 1700 kPa for use with 26-1800 Series Oil/Water Constant Pressure System	1
26-1926	Nylon Tubing 6 mm outside dia, 3500 kPa	10
78-0260	4.5 kN Clamped Boss Load Ring	1
Also required option		
25-1833/01	De-Aired Water Apparatus 15 ltr capacity 220-240 V AC, 50-60 Hz, 1 ph	1

Also required:
Part 1 Moisture Content Determination Oven Method - Page 112.
Part 2 Determination of Density of Fine Grained Soil - Page 113.
Part 3 Determination of Particle Density, Pyknometer Method - Page 114.

Determination of Compressive Strength. Undrained Triaxial. Pneumatic Pressure System & DataSystem 7. 38 mm Samples. — Automatic Recording

This test determines the compressive strength of a water saturated cylindrical specimen of undisturbed or remoulded cohesive soil without allowing any drainage from the specimen.

Standard(S)	EN 17892-8	
Product Code	**Product**	**Qty**
25-3518/01	Digital Tritest 50 Triaxial Load Frame for use on 220-240 V AC, 50-60 Hz, 1 ph	1
25-4047	50 mm Triaxial Cell 1700 kPa with 5 Pressure/Drainage Ports supplied with 2 Valves	1
25-4166	38 mm/1.5 inch Base Adaptor with Twin Pore Pressure Ports for 50 mm Cells	1
25-4290	Membrane Placing Tool for 35 mm and 38 mm samples	1
25-5050	Pressure Pad 38 mm/1.5 inch dia	1
25-5061	Rubber Membrane 38 mm/1.5 inch dia. Pack of 10	1
25-5081	Membrane Sealing Ring 38 mm/1.5 inch dia. Pack of 10	1
25-5100	Suction Membrane Device 38 mm/1.5 inch dia	1
25-5120	Two-Way Split Former 38 mm/1.5 inch dia	1
26-1746	Bladder-Type Air/Water Pressure Assembly 1000 kPa Max Working Pressure	2
26-1760	Pneumatic Pressure Reducing Panel provides 2 independent pressure outlets 1000 kPa max	1
26-1769	Nylon Tubing 30 m length	1
26-1880	Universal Pump and Pressure Indicating Panel 1700 kPa	1
26-1926	Nylon Tubing 6 mm outside dia 3500 kPa price per metre	4
27-1293	Distance Piece Stainless Steel for use with Submersible Load Cells and Axial Strain Transducers	1
27-1500/01	GDU 8 Channel Data Acquisition Unit	1
27-1551	S-Type Load Cell 5 kN for Triaxial Tests fitted with 5-pin DIN plug	1
27-1617	Axial Strain Transducer Assembly 50 mm Travel fitted with 5-pin DIN plug	1
27-1633	Pressure Transducer Assembly 1700 kPa fitted with 5-pin DIN plug	1
27-1753	DS7.3 Undrained Triaxial Shear Strength Program	1
83-1730/01	Air Compressor Unit 700 kPa Working Pressure 220-240 V AC, 50 Hz, 1 ph	1
Also required option		
25-1833/01	De-Aired Water Apparatus 15 ltr capacity 220-240 V AC, 50-60 Hz, 1 ph	1

Also required:
Part 1 Moisture Content Determination Oven Method - Page 112.
Part 2 Determination of Density of Fine Grained Soil - Page 113.
Part 3 Determination of Particle Density, Pyknometer Method - Page 114.

Part 8: Determination of Compressive Strength. CU/CD Effective Stress Triaxial. 38 mm Samples.

Manual Recording

Available sample sizes: 38 mm, 50 mm, 70 mm and 100 mm dia. Options for Oil/Water or Pneumatic pressure systems and choice of Manual or Automatic recording/analysis of test results.

This test determines the stress-strain relationship and effective stress paths of a water saturated specimen of undisturbed, remoulded or reconstituted soil when subjected to an isotropic or anisotropic stress under undrained or drained conditions.

Standard(s)	BS 1377	
Product Code	**Product**	**Qty**
25-1833/01	De-Aired Water Apparatus 15 ltr capacity 220-240 V AC, 50-60 Hz, 1 ph	1
25-3518/01	Digital Tritest 50 Triaxial Load Frame for use on 220-240 V AC, 50-60 Hz, 1 ph	1
25-4047	50 mm Triaxial Cell 1700 kPa with 5 Pressure/Drainage Ports supplied with 2 Valves	1
25-4166	38 mm/1.5 inch Base Adaptor with Twin Pore Pressure Ports for 50 mm Cells	1
25-4200	Piston Restraint Clamp for ELE Triaxial Cells manufactured from July 1996	1
25-4210	Dial Gauge 25 mm Travel x 0.01 mm Divisions	1
25-4290	Membrane Placing Tool for 35 mm and 38 mm samples	1
25-4520	Valve No Volume Change 1/4 inch BSP fitted with 6 mm Connector and Integral Sealing Ring	2
25-5050	Pressure Pad 38 mm/1.5 inch dia	1
25-5061	Rubber Membrane 38 mm/1.5 inch dia. Pack of 10	1
25-5081	Membrane Sealing Ring 38 mm/1.5 inch dia. Pack of 10	1
25-5100	Suction Membrane Device 38 mm/1.5 inch dia	1
25-5120	Two-Way Split Former 38 mm/1.5 inch dia	1
25-5181	Porous Disc 38 mm/1.5 inch dia. Pack of 2	1
25-5200	Filter Paper Drain 38 mm/1.5 inch dia. Pack of 50	1
26-1800/01	Pressure Test 1700 Oil/Water Constant Pressure System 0 to 1700 kPa 220-240 V AC, 50-60 Hz, 1 ph	2
26-1820	Digital Pressure Gauge 1700 kPa for use with 26-1800 Series Oil/Water Constant Pressure System	1
26-1880	Universal Pump and Pressure Indicating Panel 1700 kPa	1
26-1892	Twin Burette Volume Change Unit	1
26-1900	Red Dye Kerosene Soluble 10 g Phial for colouring Kerosene	1
26-1926	Nylon Tubing 6 mm outside dia 3500 kPa price per metre	10
27-1620	Digital Pressure Gauge 1700 kPa for ELE Triaxial Cells	1
78-0260	4.5 kN Clamped Boss Load Ring	1

Part 8: Determination of Compressive Strength. CU/CD Effective Stress Triaxial. 38 mm Samples.

Automatic Recording

This test determines the stress-strain relationship and effective stress paths of a water saturated specimen of undisturbed, remoulded or reconstituted soil when subjected to an isotropic or anisotropic stress under undrained or drained conditions.

Standard(s)	BS 1377	
Product Code	**Product**	**Qty**
25-1833/01	De-Aired Water Apparatus 15 ltr capacity 220-240 V AC, 50-60 Hz, 1 ph	1
25-3518/01	Digital Tritest 50 Triaxial Load Frame for use on 220-240 V AC, 50-60 Hz, 1 ph	1
25-4047	50 mm Triaxial Cell 1700 kPa with 5 Pressure/Drainage Ports supplied with 2 Valves	1
25-4166	38 mm/1.5 inch Base Adaptor with Twin Pore Pressure Ports for 50 mm Cells	1
25-4200	Piston Restraint Clamp for ELE Triaxial Cells manufactured from July 1996	1
25-4290	Membrane Placing Tool for 35 mm and 38 mm samples	1
25-4520	Valve No Volume Change 1/4 inch BSP fitted with 6 mm Connector and Integral Sealing Ring	2
25-5050	Pressure Pad 38 mm/1.5 inch dia	1
25-5061	Rubber Membrane 38 mm/1.5 inch dia. Pack of 10	1
25-5081	Membrane Sealing Ring 38 mm/1.5 inch dia. Pack of 10	1
25-5100	Suction Membrane Device 38 mm/1.5 inch dia	1
25-5120	Two-Way Split Former 38 mm/1.5 inch dia	1
25-5181	Porous Disc 38 mm/1.5 inch dia. Pack of 2	1
25-5200	Filter Paper Drain 38 mm/1.5 inch dia. Pack of 50	1
26-1800/01	Pressure Test 1700 Oil/Water Constant Pressure System 0 to 1700 kPa 220-240 V AC, 50-60 Hz, 1 ph	2
26-1880	Universal Pump and Pressure Indicating Panel 1700 kPa	1
26-1926	Nylon Tubing 6 mm outside dia 3500 kPa price per metre	10
27-1293	Distance Piece Stainless Steel for use with Submersible Load Cells and Axial Strain Transducers	1
27-1500/01	GDU 8 Channel Data Acquisition Unit	1
27-1573	Submersible Load Transducer Assembly 5 kN capacity in Compression	1
27-1617	Axial Strain Transducer Assembly 50 mm Travel fitted with 5-pin DIN plug	1
27-1633	Pressure Transducer Assembly 1700 kPa fitted with 5-pin DIN plug	3
27-1641	Volume Change Transducer Assembly 80 cm^3 capacity Max Working Pressure 1700 kPa	1
27-2753	DS7.3 Undrained Triaxial Shear Program (DS7.2: 27-1753)	1
27-2763	DS7.3 CU/CD Triaxial Shear Strength Program (DS7.2: 27-1763)	1

Direct/Residual Shear Test — Manual Recording

Available sample sizes: 60 mm² and 100 mm² samples and 63.5 mm round samples. Options for Manual or Automatic recording/analysis of results.

Direct shear tests are used in earthworks and foundation engineering.
This test determines the effective shear strength parameter for soils.

Standard(s)	EN 17892-10	
Product Code	**Product**	**Qty**
25-0440	Dial Gauge 10 mm Travel x 0.002 mm Divisions	1
26-2114/01	Digital Direct/Residual Shear Apparatus complete with Lever Loading Assembly. 220-240 V AC, 50-60 Hz, 1 ph	1
26-2132	Set of Weights 50 kg Slotted	1
26-2181	Shear Box Assembly 60 mm²	1
26-2185	Specimen Cutter 60 mm²	1
26-2189	Specimen Extrusion Tool 60 mm²	1
78-0260	4.5 kN Clamped Boss Load Ring	1
83-5456	Dial Gauge 10 mm Travel x 0.01 mm Divisions	1

Also required Part 1 Moisture Content Determination Oven Method - Page 112.

Direct/Residual Shear Test with DataSystem 7. 60 mm² Specimen. — Automatic Recording

This test determines the effective shear strength parameter for soils.

Standard(s)	EN 17892-10	
Product Code	**Product**	**Qty**
26-2114/01	Digital Direct/Residual Shear Apparatus complete with Lever Loading Assembly 220-240 V AC, 50-60 Hz, 1 ph	1
26-2132	Set of Weights 50 kg slotted	1
26-2181	Shear Box Assembly 60 mm²	1
26-2185	Specimen Cutter 60 mm²	1
26-2189	Specimen Extrusion Tool 60 mm²	1
27-1500/01	GDU 8 Channel Data Acquisition Unit	1
27-1561	S-Type Load Cell 5 kN for use with Direct/Residual Shear Machine fitted with 5-pin DIN plug	1
27-1689	Vertical Displacement Transducer Assembly 10 mm Travel with 5-pin DIN plug and Bracket for Shear Box	1
27-1697	Horizontal Displacement Transducer Assembly 10 mm Travel 5-pin DIN plug Mounting Pillar	1
27-2793	DS7.3 Direct and Residual Shear Strength Program (DS7.2: 27-1793)	1

Also required Part 1 Moisture Content Determination Oven Method - Page 112.

Permeability of Soil Constant Head Permeameter

Permeability tests in this standard are intended for use in earthworks and foundation engineering.
This test determines the coefficient of permeability through water saturated soils.

Standard(s)	EN 17892-11	
Product Code	**Product**	**Qty**
25-0580	Constant Head Permeability Cell 75 mm dia Specimen	1
25-0591	Manometer Tubes and Stand	1
25-0593	Constant Level Tank	1
42-4580	Tamping Rod 8 mm dia x 300 mm long	1
81-0200	Aluminium Scoop Small	1
81-0375	Red Rubber Tubing 6.5 mm Bore x 5 mm Wall thickness price per metre	1
81-0518	Timer Clock	1
82-0380	Measuring Cylinder 100 ml	1
82-0460	Measuring Cylinder 500 x 5 ml Soda Glass Spouted BS 604	1
82-1060	Volumetric Flask 1000 ml capacity with Stopper	1
82-2660	Polythene Funnel 200 mm dia	1
82-7720/01	Vacuum Pump 220-240 V AC, 50-60 Hz, 1 ph	1
82-7720/12	Water Trap Filtering Kit	1

Part 6: Permeability in a Triaxial Cell. 100 mm Sample.

Manual Recording

Available sample sizes: 38 mm, 50 mm, 70 mm and 100 mm dia. Options for Oil/Water or Pneumatic pressure systems and choice of Manual or Automatic recording/analysis of test results.

This test determines the coefficient of permeability through water saturated soils.

Standard(s)	BS 1377

Product Code	Product	Qty
25-1833/01	De-aired Water Apparatus 15 ltr capacity 220-240 V AC, 50-60 Hz, 1 ph	1
25-4157	100 mm Triaxial Cell 1700 kPa with 5 Pressure/Drainage Ports supplied with 2 Valves	1
25-4186	100 mm Base Adaptor with Twin Pore Pressure Ports for 100 mm Triaxial Cell	1
25-4200	Piston Restraint Clamp for ELE Triaxial Cells manufactured from July 1996	1
25-4520	Valve No Volume Change 1/4 inch BSP fitted with 6 mm Connector and Integral Sealing Ring	2
25-7590	Pressure Pad 100 mm dia	1
25-7610	Membrane Placing Tool 100 mm/4 inch dia	1
25-7621	Rubber Membrane 100 mm/4 inch dia. Pack of 10	1
25-7631	Membrane Sealing Ring 100 mm dia. Pack of 10	1
25-7640	Suction Membrane Device 100 mm/4 inch dia	1
25-7650	Two-Way Split Former 100 mm dia	1
25-7661	Porous Disc 100 mm dia. Pack of 2	1
25-7670	Filter Paper Drain, 100 mm/4 inch dia. Pack of 50	1
26-1746	Bladder-Type Air/Water Pressure Assembly 1000 kPa Max Working Pressure	3
26-1769	Nylon Tubing 30 m length	1
26-1872	Six-Way Pneumatic Pressure Control Panel	1
26-1880	Universal Pump and Pressure Indicating Panel 1700 kPa	1
26-1892	Twin Burette Volume Change Unit	2
26-1900	Red Dye Kerosene Soluble 10 g Phial for colouring Kerosene	1
26-1926	Nylon Tubing 6 mm outside dia 3500 kPa price per metre	20
27-1620	Digital Pressure Gauge 1700 kPa for ELE Triaxial Cells	1
83-1730/01	Air Compressor Unit 700 kPa Working Pressure 220-240 V AC, 50 Hz, 1 ph	1

Part 6: Permeability in a Triaxial Cell. 100 mm Sample.

Automatic Recording

This test determines the coefficient of permeability through water saturated soils.

Standard(s)	BS 1377

Product Code	Product	Qty
25-1833/01	De-Aired Water Apparatus 15 ltr capacity 220-240 V AC, 50-60 Hz, 1 ph	1
25-4157	100 mm Triaxial Cell 1700 kPa with 5 Pressure/Drainage Ports supplied with 2 Valves	1
25-4186	100 mm Base Adaptor with Twin Pore Pressure Ports for 100 mm Triaxial Cell	1
25-4200	Piston Restraint Clamp for ELE Triaxial Cells manufactured from July 1996	1
25-4520	Valve No Volume Change 1/4 inch BSP fitted with 6 mm Connector and Integral Sealing Ring	2
25-7590	Pressure Pad 100 mm dia	1
25-7610	Membrane Placing Tool 100 mm/4 inch dia	1
25-7621	Rubber Membrane 100 mm/4 inch dia. Pack of 10	1
25-7631	Membrane Sealing Ring 100 mm dia. Pack of 10	1
25-7640	Suction Membrane Device 100 mm/4 inch dia	1
25-7650	Two-Way Split Former 100 mm dia	1
25-7661	Porous Disc 100 mm dia. Pack of 2.	1
25-7670	Filter Paper Drain, 100 mm/4 inch dia. Pack of 50	1
26-1746	Bladder-type Air/Water Pressure Assembly 1000 kPa Max Working Pressure	3
26-1769	Nylon Tubing 30 m length	1
26-1872	Six-way Pneumatic Pressure Control Panel	1
26-1880	Universal Pump and Pressure Indicating Panel 1700 kPa	1
26-1926	Nylon Tubing 6 mm outside dia 3500 kPa price per metre	20
27-1300/01	DSU Electronic Data Acquisition and Control System	1
27-1633	Pressure Transducer Assembly 1700 kPa fitted with 5-pin DIN plug	1
27-1641	Volume Change Transducer Assembly 80 cm^3 capacity Max Working Pressure 1700 kPa	2
27-2768	DS7.3 Permeability in a Triaxial Cell (DS7.2: 27-1768)	1
83-1730/01	Air Compressor Unit 700 kPa Working Pressure 220-240 V AC, 50 Hz, 1 ph	1

Determination of Liquid & Plastic Limit

"Atterberg" limits of soil comprise the Liquid Limit and Plastic Limit test methods. These limits are also known as the Consistency Limits.

The liquid limit is the water content at which soil changes from a liquid to a plastic state. The plastic limit of soil is the lowest water content at which it is plastic.

Standard(s)	EN 17892-12	
Product Code	**Product**	**Qty**
23-3500	Rubber Headed Pestle	1
23-3505	Mortar and Pestle Porcelain	1
24-0430	Glass Plate	1
24-0540	Cone Penetrometer complete with Stainless Steel Test Cone	1
24-0546	Test Gauge for Checking Condition of Cone Point	1
24-0548	Penetration Test Cup	1
24-0811	Rod Comparator	1
79-0175	200 mm dia ISO: 565 3310/1 Sieve 400 Mic Stainless Steel Mesh	1
79-0270	200 mm dia BS Sieve 2 mm Stainless Steel Mesh	1
81-0140	Spatula 200 mm	2
81-0518	Timer Clock	1
81-3500	Plastic Sample Container 1 dm^3 capacity complete with Lid	10
82-2000	Evaporating Dish 150 mm dia x 45 mm depth	1
82-2500	Wash Bottle Polythene 500 ml	1
78-6010/01	Electronic Top Loading Balance 1200 g at 0.01 g	1

Also required Part 1 Moisture Content Determination Oven Method - Page 112.

Hand Boring & Sampling Kit for In-situ Sampling

Product Code	Product	Qty
23-1501	100 mm dia Soil Auger Head	1
23-1517	150 mm dia Gravel Auger Head	1
23-1504	150 mm dia Soil Auger Head	2
23-1577	38 mm dia Sample Tube 230 mm long complete with End Caps	5
23-1525	50 mm dia Dutch Soil Auger Head	2
23-1579	Adaptor for 23-1577 to fit Extension Rods	1
23-1541	Extension Rod 27 mm dia x 1 m long for use with Auger Heads	10
23-1547	Handle and T Piece for use with 23-1541	1
23-1587	Jarring Link for driving Sample Tubes	1
23-1617	Spiral Auger 40 mm dia. One Piece Model	1
23-1543	Stillson Wrench Size 14	2

Riffle Boxes (Sample Dividers) Set

Product Code	Product	Qty
23-3050	Riffle Box 13 mm slot width complete with 3 Containers	1
23-3070	Riffle Box 15 mm slot width complete with 3 Containers	1
23-3100	Riffle Box 19 mm slot width complete with 3 Containers	1
23-3150	Riffle Box 25 mm slot width complete with 3 Containers	1
23-3170	Riffle Box 30 mm slot width complete with 3 Containers	1
23-3200	Riffle Box 38 mm slot width complete with 3 Containers	1
23-3300	Riffle Box 50 mm slot width complete with 3 Containers	1
23-3350	Riffle Box 64 mm slot width complete with 3 Containers	1
23-3000	Riffle Box 7 mm slot width complete with 3 Containers	1

Part 2: Determination of Shrinkage Limit — Volumetric Method

Shrinkage due to drying is significant in clays but less so in silts and sands.
This test enables the shrinkage limit of clays to be determined.

Standard(s) BS1377

Product Code	Product	Qty
24-1500	Prong Plate	1
79-7210	Sieve Brush Double-Ended Nylon	1
81-0100	Spatula 100 mm Blade	2
81-4700	Stainless Steel Tray 305 mm dia	1
24-1550	Shrinkage Dish	1
39-1100/10	Glass Plate for 3 Gang Prism Moulds	1
24-1600	Glass Cup	1
82-0380	Measuring Cylinder 100 ml	1
82-2000	Evaporating Dish 150 mm dia x 45 mm depth	2
78-6010/01	Electronic Top Loading Balance 1200 g at 0.01 g	1

Also required Part 1 Moisture Content Determination Oven Method - Page 112.

Also requires Mercury not supplied by ELE.

Part 2: Determination of Linear Shrinkage

This test determines the linear shrinkage of the fraction of a soil passing a 425 μm test sieve. The filtered soil is put into a mould and then into the drying oven for determination of shrinkage.

Standard(s)	BS 1377

Product Code	Product	Qty
24-1800	Shrinkage Mould to BS 1377	2
81-0100	Spatula 100 mm Blade	2
81-0588	Vernier Caliper Range 0 to 200 mm x 0.02 mm	1
24-0430	Glass Plate	1
25-8090	Silicon Grease Lubricant 100 g	1
78-1215/01	Drying Oven 50 ltr capacity	1

Part 4: Determination of Dry/Density Moisture Content Relationship

Compaction of soil is the process by which the solid particles are packed more closely together thereby increasing the dry density of the soil.

Standard(s)	BS 1377

Part 4: Dry Density/Moisture Relationship (for up to Medium Gravel Size) — 2.5 kg Rammer Method

This test is for the determination of the dry density of soil passing a 20 mm sieve when it is compacted in a specified manner over a range of moisture contents.

Standard(s)	BS 1377

Product Code	Product	Qty
24-9000	BS Standard Compaction 1000 mm capacity	1
24-9002	Standard Compaction Rammer 2.5 kg	1
79-0020	200 mm dia Receiver	1
79-1595	200 mm dia BS Sieve 20 mm Perforated Plate	1
79-1640	200 mm dia BS Sieve 37.5 mm Perforated Plate	1
81-0100	Spatula 100 mm Blade	1
24-9010	Straight Edge 300 mm	1
81-0590	Vernier Caliper (LCD) Range 0 to 200 mm x 0.01 mm	1
81-4160	Sample Tray 910 x 910 x 76 mm	1
78-6040/01	Electronic Top Loading Balance 30 kg x 1.0 g	1
23-4200	Proctor/Core Cutter Extruder Frame and Hydraulic Jack extrudes 100 mm/4 inch dia Specimens	1

Also required Part 1 Moisture Content Determination Oven Method - Page 112.

Part 4: Dry Density/Moisture Relationship (for Soils with some Coarse Gravel) — 2.5 kg Rammer Method

This test is for the determination of the dry density of soils containing no more than 30% by mass of material retained on a 20 mm sieve when it is compacted in a specified manner over a range of moisture contents.

Standard(s): BS 1377

Product Code	Product	Qty
24-9002	Standard Compaction Rammer 2.5 kg	1
24-9198	BS CBR Mould Body	1
24-9200	BS Extension Collar	1
24-9204	BS Solid Base or Top Plate	2
24-9208	C-Spanner for BS CBR Mould. 2 Required	2
24-9210	Base Plate Tool for BS Mould	1
79-0020	200 mm dia Receiver	1
79-1595	200 mm dia BS Sieve 20 mm Perforated Plate	1
79-1640	200 mm dia BS Sieve 37.5 mm Perforated Plate	1
81-0100	Spatula 100 mm Blade	1
24-9010	Straight Edge 300 mm	1
81-0590	Vernier Caliper (LCD) Range 0 to 200 mm x 0.01 mm	1
81-4160	Sample Tray 910 x 910 x 76 mm	1
81-0220	Aluminium Scoop Large	1
78-6040/01	Electronic Top Loading Balance 30 kg x 1.0 g	1
23-4250	CBR/Core Cutter Extruder Frame and Hydraulic Jack extrudes 150 mm/6 inch dia Specimens	1

Part 4: Dry Density/Moisture Relationship (for up to Medium Gravel Size) — 4.5 kg Rammer Method

This test is for the determination of the dry density of soil passing a 20 mm sieve when it is compacted in a specified manner over a range of moisture contents.

Standard(s): BS 1377

Product Code	Product	Qty
24-9000	BS Standard Compaction Mould 1 ltr capacity	1
24-9004	BS Compaction Rammer 4.5 kg	1
79-0020	200 mm dia Receiver	1
79-1595	200 mm dia BS Sieve 20 mm Perforated Plate	1
79-1640	200 mm dia BS Sieve 37.5 mm Perforated Plate	1
81-0100	Spatula 100 mm Blade	1
24-9010	Straight Edge 300 mm	1
81-0590	Vernier Caliper (LCD) Range 0 to 200 mm x 0.01 mm	1
81-4160	Sample Tray 910 x 910 x 76 mm	1
81-0220	Aluminium Scoop Large	1
78-6040/01	Electronic Top Loading Balance 30 kg x 1.0 g	1
23-4200	Proctor/Core Cutter Extruder Frame and Hydraulic Jack extrudes 100 mm/4 inch dia Specimens	1

Also required Part 1 Moisture Content Determination Oven Method - Page 112.

Part 4: Dry Density/Moisture Relationship (for Soils with some Coarse Gravel) — 4.5 kg Rammer Method

This test is for the determination of the dry density of soils containing no more than 30% by mass of material retained on a 20 mm sieve when it is compacted in a specified manner over a range of moisture contents.

Standard(s)	BS 1377	
Product Code	**Product**	**Qty**
24-9004	BS Compaction Rammer 4.5 kg	1
24-9198	BS CBR Mould Body	1
24-9200	BS Extension Collar	1
24-9204	BS Solid Base or Top Plate	2
24-9208	C-Spanner for BS CBR Mould. 2 Required	2
24-9210	Base Plate Tool for BS Mould	1
79-0020	200 mm dia Receiver	1
79-1595	200 mm dia BS Sieve 20 mm Perforated Plate	1
79-1640	200 mm dia BS Sieve 37.5 mm Perforated Plate	1
81-0100	Spatula 100 mm Blade	1
24-9010	Straight Edge 300 mm	1
81-0590	Vernier Caliper (LCD) Range 0 to 200 mm x 0.01 mm	1
81-4160	Sample Tray 910 x 910 x 76 mm	1
81-0220	Aluminium Scoop Large	1
78-6040/01	Electronic Top Loading Balance 30 kg x 1.0 g	1
23-4200	Proctor/Core Cutter Extruder Frame and Hydraulic Jack extrudes 100 mm/4 inch dia Specimens	1

Also required Part 1 Moisture Content Determination Oven Method - Page 112.

Part 4: Determination of Minimum Density of Gravelly Soils

This test determines the minimum density at which a gravel or sandy gravel can be placed. The method is suitable for gravelly soils passing the 37.5 mm sieve and containing no more than 10% of fine material passing the 63 μm sieve.

Standard(s)	BS 1377	
Product Code	**Product**	**Qty**
24-9198	BS CBR Mould Body	1
24-9200	BS Extension Collar	1
24-9204	BS Solid Base or Top Plate	1
79-0020	200 mm dia Receiver	1
79-1640	200 mm dia BS Sieve 37.5 mm Perforated Plate	1
81-0220	Aluminium Scoop Large	1
24-9010	Straight Edge 300 mm	1
81-0590	Vernier Caliper (LCD) Range 0 to 200 mm x 0.01 mm	1
81-4160	Sample Tray 910 x 910 x 76 mm	1
81-3540	Plastic Sample Container 10 dm^3 capacity complete with Lid	10
81-5100	Rubber Bucket 9 ltrs (3 gallons) capacity	1
78-1250/01	Drying Oven 225 ltrs capacity Fan-Circulated. Supplied with 3 Shelves	1
78-6040/01	Electronic Top Loading Balance 30 kg x 1.0 g	1

Part 4: Determination of the California Bearing Ratio (CBR)

Sample preparation for CBR by static compression.

The following laboratory test methods are used to determine the California Bearing Ratio (CBR) of compacted or undisturbed samples of soil. The test methods are suitable for soils having a max particle size of 20 mm.

Standard(s)	BS 1377	
Product Code	**Product**	**Qty**
24-9198	BS CBR Mould Body	1
24-9200	BS Extension Collar	1
24-9202	BS Perforated Base Plate	1
24-9204	BS Solid Base or Top Plate	2
24-9208	C-Spanner for BS CBR Mould. 2 Required	2
24-9210	Base Plate Tool for BS Mould	1
24-9212	Static Compaction Plug	3
34-0130	Tamping Rod 16 mm dia x 600 mm long Hemispherical at Both Ends	1
79-2020	300 mm dia Receiver	1
79-2515	300 mm dia BS Sieve 5 mm Perforated Plate	1
79-2595	300 mm dia BS Sieve 20 mm Perforated Plate	1
81-0140	Spatula 200 mm Blade	1
24-9010	Straight Edge 300 mm	1
81-0590	Vernier Caliper (LCD) Range 0 to 200 mm x 0.01 mm	1
81-3540	Plastic Sample Container 10 dm^3 capacity complete with Lid	10
24-9220	Filter Papers 150 mm dia equivalent to Whatman No 1. Box of 100	1
24-9150	CBR Test Machine 50 kN complete with stabilising bar 220-240 V AC, 50 Hz, 1 ph	1
78-6040/01	Electronic Top Loading Balance 30 kg x 1.0 g	1

Part 4: Sample Preparation for CBR by Dynamic Compaction	2.5 kg Rammer Method

Standard(s)	BS 1377	
Product Code	**Product**	**Qty**
24-9002	Standard Compaction Rammer 2.5 kg	1
24-9198	BS CBR Mould Body	1
24-9200	BS Extension Collar	1
24-9204	BS Solid Base or Top Plate	2
24-9208	C-Spanner for BS CBR Mould. 2 Required	2
24-9210	Base Plate Tool for BS Mould	1
79-0020	200 mm dia Receiver	1
79-1595	200 mm dia BS Sieve 20 mm Perforated Plate	1
79-1640	200 mm dia BS Sieve 37.5 mm Perforated Plate	1
81-0100	Spatula 100 mm Blade	1
24-9010	Straight Edge 300 mm	1
81-0590	Vernier Caliper (LCD) Range 0 to 200 mm x 0.01 mm	1
81-4160	Sample Tray 910 x 910 x 76 mm	1
81-3540	Plastic Sample Container 10 dm^3 capacity complete with Lid	10
78-6040/01	Electronic Top Loading Balance 30 kg x 1.0 g	1
23-4250	CBR/Core Cutter Extruder Frame and Hydraulic Jack extrudes 150 mm/6 inch dia Specimens	1

Part 4: Sample Preparation for CBR by Dynamic Compaction	4.5 kg Rammer Method

Standard(s)	BS 1377	
Product Code	**Product**	**Qty**
24-9004	BS Compaction Rammer 4.5 kg	1
24-9198	BS CBR Mould Body	1
24-9200	BS Extension Collar	1
24-9204	BS Solid Base or Top Plate	2
24-9208	C-Spanner for BS CBR Mould. 2 Required	2
24-9210	Base Plate Tool for BS Mould	1
79-0020	200 mm dia Receiver	1
79-1595	200 mm dia BS Sieve 20 mm Perforated Plate	1
79-1640	200 mm dia BS Sieve 37.5 mm Perforated Plate	1
81-0100	Spatula 100 mm Blade	1
24-9010	Straight Edge 300 mm	1
81-0590	Vernier Caliper (LCD) Range 0 to 200 mm x 0.01 mm	1
81-4160	Sample Tray 910 x 910 x 76 mm	1
81-3540	Plastic Sample Container 10 dm^3 capacity complete with Lid	10
78-6040/01	Electronic Top Loading Balance 30 kg x 1.0 g	1
23-4250	CBR/Core Cutter Extruder Frame and Hydraulic Jack extrudes 150 mm/6 inch dia Specimens	1

Part 4: Sample Preparation for CBR by obtaining an Undisturbed Sample

Standard(s)	BS 1377	
Product Code	**Product**	**Qty**
24-9198	BS CBR Mould Body	1
24-9200	BS Extension Collar	2
24-9202	BS Perforated Base Plate	1
24-9204	BS Solid Base or Top Plate	2
24-9206	CBR Cutting Collar	1
24-9208	C-Spanner for BS CBR Mould. 2 Required	2
24-9210	Base Plate Tool for BS Mould	1
24-9010	Straight Edge 300 mm	1
81-0590	Vernier Caliper (LCD) Range 0 to 200 mm x 0.01 mm	1
81-3540	Plastic Sample Container 10 dm^3 capacity complete with Lid	10
78-6040/01	Electronic Top Loading Balance 30 kg x 1.0 g	1
23-4250	CBR/Core Cutter Extruder Frame and Hydraulic Jack extrudes 150 mm/6 inch dia Specimens	1

Also required Part 1 Moisture Content Determination Oven Method - Page 112.

Part 4: Soaking (Swell) Test

Standard(s)	BS 1377	
Product Code	**Product**	**Qty**
24-9275	Dial Gauge 25 mm Travel x 0.01 mm Divisions	1
24-9198	BS CBR Mould Body	1
24-9200	BS Extension Collar	1
24-9202	BS Perforated Base Plate	1
24-9260	Swell Plate	1
24-9262	Swell Tripod	1
24-9216	2 kg Split Surcharge Weight	4
81-3540	Plastic Sample Container 10 dm^3 capacity complete with Lid	1
34-6575/01	Large Curing Tank complete with Circulating Pump Heater/Thermostat Unit and Lower Rack	1

Part 4: Determination of the CBR Laboratory Method Penetration Test.	Manual Recording
Standard(s)	BS 1377

Product Code	Product	Qty
24-9150/01	CBR-Test 50 Machine 50 kN capacity 2 Speeds BS and ASTM supplied with Stabilising Bar	1
24-9182	Penetration Piston	1
24-9186	Penetration Dial Gauge BS	1
24-9188	Bracket and Adaptor	1
24-9198	BS CBR Mould Body	1
24-9200	BS Extension Collar	1
24-9204	BS Solid Base or Top Plate	1
24-9214	2 kg Annular Surcharge Weight	1
24-9216	2 kg Split Surcharge Weight	4
78-0860	50 kN Clamped Boss Load Ring complete with Dial Gauge	1
81-0521	Stop Watch	1

Part 4: Determination of the CBR Laboratory Method Penetration Test.	Automatic Recording
Standard(s)	BS 1377

Product Code	Product	Qty
24-9150/01	CBR-Test 50 Machine 50 kN capacity 2 Speeds BS and ASTM supplied with Stabilising Bar	1
24-9182	Penetration Piston	1
24-9188	Bracket and Adaptor	1
24-9198	BS CBR Mould Body	1
24-9200	BS Extension Collar	1
24-9204	BS Solid Base or Top Plate	1
24-9214	2 kg Annular Surcharge Weight	1
24-9216	2 kg Split Surcharge Weight	4
27-1300/01	DSU Electronic Data Acquisition and Control System	1
27-1559	S-Type Load Cell 50 kN for CBR or Marshall Tests fitted with 5-pin DIN plug	1
27-1705	CBR Penetration Transducer 50 mm Travel fitted with 5-pin DIN plug	1
81-0521	Stop Watch	1

Part 4: Determination of the CBR Laboratory Method, Multiplex 50.	Manual Recording
Standard(s)	BS 1377

Product Code	Product	Qty
24-9182	Penetration Piston	1
24-9186	Penetration Dial Gauge BS	1
24-9188	Bracket and Adaptor	1
24-9198	BS CBR Mould Body	1
24-9200	BS Extension Collar	1
24-9204	BS Solid Base or Top Plate	1
24-9214	2 kg Annular Surcharge Weight	1
24-9216	2 kg Split Surcharge Weight	4
25-3700/01	Multiplex 50 Machine 50 kN capacity supplied with Stabilising Bar	1
78-0760	28 kN Clamped Boss Load Ring complete with Dial Gauge and Calibration Certificate, height 248 mm	1
81-0521	Stop Watch	1

Part 4: Determination of the CBR Laboratory Method, Multiplex 50.	Automatic Recording
Standard(s)	BS 1377

Product Code	Product	Qty
24-9182	Penetration Piston	1
24-9188	Bracket and Adaptor	1
24-9198	BS CBR Mould Body	1
24-9200	BS Extension Collar	1
24-9204	BS Solid Base or Top Plate	1
24-9214	2 kg Annular Surcharge Weight	1
24-9216	2 kg Split Surcharge Weight	4
25-3700/01	Multiplex 50 Machine 50 kN capacity supplied with Stabilising Bar	1
27-1300/01	DSU Electronic Data Acquisition and Control System	1
27-1559	S-Type Load Cell 50 kN for CBR or Marshall Tests fitted with 5-pin DIN plug	1
27-1705	CBR Penetration Transducer 50 mm Travel Fitted with 5-pin DIN plug	1
81-0521	Stop Watch	1

Part 9: Determination of the CBR In-Situ

The in-situ CBR test is generally concerned only with pavement design and the control of subgrade construction.
The test method is suitable for soils not exceeding 20 mm particle size.

Standard(s)	BS 1377	
Product Code	**Product**	**Qty**
24-9183	CBR Penetration Piston (adjustable)	1
24-9186	Penetration Dial Gauge BS	1
24-9188	Bracket and Adaptor	1
24-9290	45 kN (10000 lb) capacity Mechanical Jack	1
24-9298	Land Rover Bracket to attach 29-200 Jack	1
24-9300	Ball Seating for 24-9290 45 kN Jack	1
24-9308	Set of Extension Rods	1
24-9312	Datum Bar Assembly	1
24-9320	10 lb (4.5 kg) Annular Surcharge Weight	1
24-9322	10 lb (4.5 kg) Slotted Surcharge Weight	3
78-0760	28 kN Clamped Boss Load Ring complete with Dial Gauge and Calibration Certificate, height 248 mm	1
81-0521	Stop Watch	1
81-3540	Plastic Sample Container 10 dm^3 capacity complete with Lid	10

Part 9: In-situ Density Tests

Sand replacement method suitable for fine and medium grained soils. BS 1377: Part 9.

This test determines the in-situ density of natural or compacted fine and medium grained soils.
The method is applicable to layers not exceeding 150 mm.

Standard(s)	BS 1377	
Product Code	**Product**	**Qty**
24-0430	Glass Plate	1
29-4000	100 mm Sand Pouring Cylinder	1
29-4020	100 mm Calibrating Container 100 mm inside dia x 150 mm deep with 200 mm dia rim	1
29-4040	Metal Tray L x W x D 300 x 300 x 40 mm with a 100 mm dia hole	1
29-5000	Density Spoon	1
29-5080	Metal Dibber Tool	1
29-5140	Steel Pointed Rod	1
81-4700	Stainless Steel Tray 305 mm dia	1
82-7401	Standard Sand 600-300 Mic	1
Also required for fine grained cohesionless soils.		
29-5300	Core Cutter 100 mm inside dia x 130 mm long	1
Also required Part 1 Moisture Content Determination Oven Method - Page 112.		

Part 9: Sand Replacement Method Suitable for Fine & Medium Grained Soils

This test determines the in-situ density of natural or compacted soil containing coarse grained particles. The method is applicable to layers exceeding 150 mm but not exceeding 250 mm.

Standard(s)	BS 1377	
Product Code	**Product**	**Qty**
24-0430	Glass Plate	1
29-4200	200 mm Sand Pouring Cylinder	1
29-4220	200 mm Calibrating Container 200 mm inside dia x 250 mm deep with a 350 mm dia rim	1
29-4240	Metal Tray L x W x D 500 x 500 x 50 mm with a 200 mm dia hole	1
29-5000	Density Spoon	1
29-5080	Metal Dibber Tool	1
29-5140	Steel Pointed Rod	1
81-4160	Sample Tray 910 x 910 x 76 mm	1
82-7401	Standard Sand 600-300 Mic	1

Also required Part 1 Moisture Content Determination Oven Method - Page 112.

Part 9: Core Cutter Method for Cohesive Soils Free from Coarse-Grained Material

This test determines the density of natural or compacted soil in-situ.

Standard(s)	BS 1377	
Product Code	**Product**	**Qty**
29-5300	Core Cutter 100 mm inside dia by 130 mm long	3
29-5320	Driving Dolly for 29-5300	1
29-5340	Driving Rammer for 29-5320	1
34-0140	300 mm Stainless Steel Rule	1
81-0140	Spatula 200 mm Blade	1
24-9010	Straight Edge 300 mm	1
78-6040/01	Electronic Top Loading Balance 30 kg x 1.0 g	1
23-4200	Proctor/Core Cutter Extruder Frame and Hydraulic Jack extrudes 100 mm/4 inch dia Specimens	1

Also required Part 1 Moisture Content Determination Oven Method - Page 112.

50 mm Triaxial Cell with 38 mm Accessories

Standard(s)	EN 17892-8	
Product Code	**Product**	**Qty**
25-4047	50 mm Triaxial Cell 1700 kPa with 5 Pressure/Drainage Ports supplied with 2 Valves	1
25-4166	38 mm/1.5 inch Base Adaptor with Twin Pore Pressure Ports for 50 mm Cells	1
25-4200	Piston Restraint Clamp for ELE Triaxial Cells manufactured from July 1996	1
25-4290	Membrane Placing Tool for 35 mm and 38 mm samples	1
25-4520	Valve No Volume Change 1/4 inch BSP fitted with 6 mm Connector and Integral Sealing Ring	2
25-5050	Pressure Pad 38 mm/1.5 inch dia	1
25-5061	Rubber Membrane 38 mm/1.5 inch dia. Pack of 10	1
25-5081	Membrane Sealing Ring 38 mm/1.5 inch dia. Pack of 10	1
25-5100	Suction Membrane Device 38 mm/1.5 inch dia	1
25-5120	Two-Way Split Former 38 mm/1.5 inch dia	1
25-5130	Two Part Split Mould 38 mm	1
25-5181	Porous Disc 38 mm/1.5 inch dia. Pack of 2	1
25-5200	Filter Paper Drain 38 mm/1.5 inch dia. Pack of 50	1

50 mm Triaxial Cell with 50 mm Accessories

Standard(s)	EN 17892-8	
Product Code	**Product**	**Qty**
25-4047	50 mm Triaxial Cell 1700 kPa with 5 Pressure/Drainage Ports supplied with 2 Valves	1
25-4168	50 mm Base Adaptor with Twin Pore Pressure Ports for 50 mm Cells	1
25-4200	Piston Restraint Clamp for ELE Triaxial Cells manufactured from July 1996	1
25-4520	Valve No Volume Change 1/4 inch BSP fitted with 6 mm Connector and Integral Sealing Ring	2
25-5430	Pressure Pad 50 mm dia	1
25-5441	Rubber Membrane 50 mm dia. Pack of 10	1
25-5461	Membrane Sealing Ring 50 mm dia. Pack of 10	1
25-5470	Membrane Placing Tool 50 mm dia	1
25-5480	Suction Membrane Device 50 mm dia	1
25-5500	Two-Way Split Former 50 mm dia	1
25-5530	Two Part Split Mould 50 mm	1
25-5561	Porous Disc 50 mm Pack of 2	1
25-5580	Filter Paper Drain 50 mm dia. Pack of 50	1

70 mm Triaxial Cell with 50 mm Accessories

Standard(s)	EN 17892-8	
Product Code	**Product**	**Qty**
25-4117	70 mm Triaxial Cell 1700 kPa with 5 Pressure/Drainage Ports supplied with 2 Valves	1
25-4174	50 mm Base Adaptor with Twin Pore Pressure Ports for 70 mm Cells	1
25-4200	Piston Restraint Clamp for ELE Triaxial Cells manufactured from July 1996	1
25-4520	Valve No Volume Change 1/4 inch BSP fitted with 6 mm Connector and Integral Sealing Ring	2
25-5430	Pressure Pad 50 mm dia	1
25-5441	Rubber Membrane 50 mm dia. Pack of 10	1
25-5461	Membrane Sealing Ring 50 mm dia. Pack of 10	1
25-5470	Membrane Placing Tool 50 mm dia	1
25-5480	Suction Membrane Device 50 mm dia	1
25-5500	Two-Way Split Former 50 mm dia	1
25-5530	Two Part Split Mould 50 mm	1
25-5561	Porous Disc 50 mm. Pack of 2	1
25-5580	Filter Paper Drain 50 mm dia. Pack of 50	1

70 mm Triaxial Cell with 70 mm Accessories

Standard(s)	EN 17892-8	
Product Code	**Product**	**Qty**
25-4117	70 mm Triaxial Cell 1700 kPa with 5 Pressure/Drainage Ports supplied with 2 Valves	1
25-4176	70 mm Base Adaptor with Twin Pore Pressure Ports for 70 mm Cells	1
25-4200	Piston Restraint Clamp for ELE Triaxial Cells manufactured from July 1996	1
25-4520	Valve No Volume Change 1/4 inch BSP fitted with 6 mm Connector and Integral Sealing Ring	2
25-6430	Pressure Pad 70 mm dia	1
25-6441	Rubber Membrane 70 mm/2.8 inch dia. Pack of 10	1
25-6461	Membrane Sealing Ring 70 mm dia. Pack of 10	1
25-6470	Membrane Placing Tool 70 mm/2.8 inch dia	1
25-6480	Suction Membrane Device 70 mm dia	1
25-6500	Two-Way Split Former 70 mm dia	1
25-6530	Two Part Split Mould 70 mm	1
25-6561	Porous Disc 70 mm dia. Pack of 2	1
25-6580	Filter Paper Drain 70 mm/2.8 inch dia. Pack of 50	1

100 mm Triaxial Cell with 100 mm Accessories

Standard(s)	EN 17892-8	
Product Code	**Product**	**Qty**
25-4157	100 mm Triaxial Cell 1700 kPa with 5 Pressure/Drainage Ports supplied with 2 Valves	1
25-4186	100 mm Base Adaptor with Twin Pore Pressure Ports for 100 mm Triaxial Cell	1
25-4200	Piston Restraint Clamp for ELE Triaxial Cells manufactured from July 1996	1
25-4520	Valve No Volume Change 1/4 inch BSP fitted with 6 mm Connector and Integral Sealing Ring	2
25-7590	Pressure Pad 100 mm dia	1
25-7610	Membrane Placing Tool 100 mm/4 inch dia	1
25-7621	Rubber Membrane 100 mm/4 inch dia. Pack of 10	1
25-7631	Membrane Sealing Ring 100 mm dia. Pack of 10	1
25-7640	Suction Membrane Device 100 mm/4 inch dia	1
25-7650	Two-Way Split Former 100 mm dia	1
25-7661	Porous Disc 100 mm dia. Pack of 2	1
25-7670	Filter Paper Drain 100 mm/4 inch dia. Pack of 50	1

This List of Equipment is Suitable when Specifying Principal Items Required for Strength Testing of Soils

Part 7: Soil Strength Testing Comprising One-Dimensional Consolidation, Triaxial & Direct Shear.

Automatic Recording

The items below enable One-Dimensional Consolidation tests on 75 mm dia samples, CU/CD Triaxial tests on 50 mm dia samples and Direct Shear tests on 60 mm^2 samples to be carried out.

Standard(s)	EN 17892-5, BS 1377	
Product Code	**Product**	**Qty**
25-0402	Consolidation Frame One-Dimensional Consolidation Incremental Loading Device	1
25-0408	Set of Weights 100 kg	1
25-0503	Consolidation Cell complete 75 mm dia Sample	1
25-1833/01	De-Aired Water Apparatus 15 ltr capacity 220-240 V AC, 50-60 Hz, 1 ph	1
25-3518/01	Digital Tritest 50 Triaxial Load Frame for use on 220-240 V AC, 50-60 Hz, 1 ph	1
25-4047	50 mm Triaxial Cell 1700 kPa with 5 Pressure/Drainage Ports supplied with 2 Valves	1
25-4168	50 mm Base Adaptor with Twin Pore Pressure Ports for 50 mm Cells	1
25-4200	Piston Restraint Clamp for ELE Triaxial Cells manufactured from July 1996	1
25-4520	Valve No Volume Change 1/4 inch BSP fitted with 6 mm Connector and Integral Sealing Ring	2
25-4540	10 ml Burette Single Tube Drainage	1
25-5430	Pressure Pad 50 mm dia	1
25-5441	Rubber Membrane 50 mm dia. Pack of 10	1
25-5461	Membrane Sealing Ring 50 mm dia. Pack of 10	1
25-5470	Membrane Placing Tool 50 mm dia	1
25-5480	Suction Membrane Device 50 mm dia	1
25-5500	Two-Way Split Former 50 mm dia	1

Product Code	Product	Qty
25-5530	Two Part Split Mould 50 mm	1
25-5561	Porous Disc 50 mm. Pack of 2	1
25-5580	Filter Paper Drain 50 mm dia. Pack of 50	1
26-1800/01	Pressure Test 1700 Oil/Water Constant Pressure System 0 to 1700 kPa 220-240 V AC, 50-60 Hz, 1 ph	2
26-1820	Digital Pressure Gauge 1700 kPa for use with 26-1800 Series Oil/Water Constant Pressure System	2
26-1880	Universal Pump and Pressure Indicating Panel 1700 kPa	1
26-2114/01	Digital Direct/Residual Shear Apparatus complete with Lever Loading Assembly 220-240 V AC, 50-60 Hz, 1 ph	1
26-2132	Set of Weights 50 kg Slotted	1
26-2181	Shear Box Assembly 60 mm^2	1
27-1500/01	GDU 8 Channel Data Acquisition Unit	1
27-1505	GDU 8 Channel Expansion Analogue Input Module	1
27-1561	S-Type Load Cell 5 kN for use with Direct/Residual Shear Machine fitted with 5-pin DIN plug	1
27-1617	Axial Strain Transducer Assembly 50 mm Travel fitted with 5-pin DIN plug	1
27-1633	Pressure Transducer Assembly 1700 kPa fitted with 5-pin DIN plug	3
27-1641	Volume Change Transducer Assembly 80 cm^3 capacity Max Working Pressure 1700 kPa	1
27-1649	Consolidation Transducer Assembly 10 mm Travel fitted with 5-pin DIN plug	1
27-1689	Vertical Displacement Transducer Assembly 10 mm Travel with 5-pin DIN plug Bracket for Shear Box	1
27-1697	Horizontal Displacement Transducer Assembly 10 mm Travel 5-pin DIN plug Mounting Pillar	1
27-2753	DS7.3 Undrained and Triaxial Shear Strength Program (DS7.2: 27-1753)	1
27-2763	DS7.3 CU/CD (DS7.2: 27-1763)	1
27-2773	DS7.3 One-Dimensional Consolidation (DS7.2: 27-1773)	1
27-2793	DS7.3 Direct and Residual Shear Strength Program (DS7.2: 27-1793)	1

Water Content Determination — Oven Method

The water content is required as a guide to the classification of natural soils and as a control for re-compacted soils. The water content is measured on samples used for most field and laboratory tests.

The definitive method for the determination of water (moisture) content of soils is the oven dry method.

Standard(s): EN 17892-1

Product Code	Product	Qty
78-1250	225 ltr Drying Oven	1
78-6000/01	Electronic Top Loading Balance 200 g x 0.001 g	1
78-6010/01	Electronic Top Loading Balance 1200 g at 0.01 g	1
78-6040/01	Electronic Top Loading Balance 30 kg x 1.0 g	1
81-0220	Aluminium Scoop Large	1
81-2979	Unnumbered Moisture Content Tin 90 g capacity	10
81-3000	Sample Container. 0.5 ltr capacity	10
81-3060	Sample Container. 10 ltr capacity	10
81-4020	Sample Tray 306 x 306 x 38 mm	10
82-1540	Weighing Bottle Nominal Size 30 mm dia x 50 mm high	5
82-2110	Desiccator Cabinet Non-Vacuum	1

Annex A — Methods Suitable for Field Control of Earthworks

Sand Bath Method

Note: Results from this test method should be checked using the 'Oven Method'.

Standard(s): EN 17892-1

Product Code	Product	Qty
78-3104/01	Hotplate Digital Temperature Indication 0 to 300°C, 300 x 500 mm Heating Area 220-240 V AC, 50 Hz, 1 ph	1
78-6020/01	Electronic Top Loading Balance 6 kg x 0.1 g with below balance hanger	1
81-0100	Spatula 100 mm Blade	1
81-0220	Aluminium Scoop Large	1
81-2979	Unnumbered Moisture Content Tin 90 g capacity	10
81-4700	Stainless Steel Tray 305 mm dia	4

Alternative

Rapid Method by Speedy Tester

Note: Results from this test method should be checked using the 'Oven Method'.

Standard(s): EN 17892-1

Product Code	Product	Qty
23-7452	Speedy Moisture Tester D2 Large 0 to 20% Moisture Range supplied without Calcium Carbide	1
23-7702	Calcium Carbide Reagent for Speedy Moisture Testers. Pack of 12 Cans 500 g each	1

Determination of Density of Fine Grained Soil — Linear Measurement Method

This method is suitable for cohesive specimens of regular shape, normally rectangular prisms or straight cylinders.

Standard(s): EN 17892-2

Product Code	Product	Qty
23-4090	38 mm Hand Operated Hydraulic Sample Extruder with Trimming Knife 38 mm Split Former and Cutting Tool	1
23-4120	38 mm Split Former	1
23-4140	Cutting Tool for end preparation of 38 mm Samples	1
24-9010	Straight Edge 300 mm	1
34-0140	300 mm Stainless Steel Rule	1
78-6010/01	Electronic Top Loading Balance 1200 g at 0.01 g	1
81-0140	Spatula 200 mm Blade	1
81-0200	Aluminium Scoop Small	1
81-0588	Vernier Caliper Range 0 to 200 mm x 0.02 mm	1
81-0708	Wire Saw	1
81-0710	Trimming Knife	1
81-0805	Engineers' Steel Rule 300 mm	1

Also required Part 1 Moisture Content Determination Oven Method - Page 112.

Determination of Particle Density — Pyknometer Method

This test method applies to soil types with particles less than 4 mm.

Standard(s): EN 17892-3

Product Code	Product	Qty
23-3000	Riffle Box 7 mm slot width complete with 3 Containers	1
24-2900	50 ml Density Bottle with Perforated Stopper	2
78-1300/01	Drying Oven 50 ltrs capacity 220-240 V AC, 50-60 Hz, 1 ph	1
78-6000/01	Electronic Top Loading Balance 200 g x 0.001 g	1
81-0375	Red Rubber Tubing 6.5 mm Bore x 5 mm Wall thickness price per metre	2
82-1000	Volumetric Flask 100 ml capacity with Stopper	1
82-2170	Vacuum Desiccator 250 mm internal dia	1
82-2180	Safety Cage for Desiccator	1
82-2500	Wash Bottle Polythene 500 ml	1
82-4005	Glass Rods 7 mm dia x 200 mm. Pack of 10	1
82-5270	Thermometer -1 to +51°C x 0.1°C	1
82-7091	Silica Gel 2.5 to 6 mm Self Indicating 500 g	1
82-7700	Filter Pump	1
82-8500/01	12 ltr Water Bath with Digital Controller LED Display 0 to 99.9°C x 0.1°C	1

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