This test is used to determine the shear strength of a soil sample subjected to orthogonal stress with respect to the failure plane. The sample is enclosed within a robust metal box horizontally split into two halves and provided with a vertical plunger. The shearing stress is created by imposing a movement of the lower half of the shear box, whilst applying a static load to the load plunger. In the more refined machines, called “controlled displacement equipment”, the variables that may be measured during the test are as follows: vertical strain, horizontal strain, shearing stress whilst the vertical force and displacement speed are kept absolutely constant.
Accurate, noiseless and reliable: this apparatus is of robust construction, made to last, as the most widely-used instrument in a soils testing laboratory should be. It is equipped with an advanced, electromechanical operating device comprising a stepper motor, a precision made reduction unit and final worm screw with reduced play. These devices are designed to obtain linear, micrometrical movements at constant speed and, independently from force developed, fast reverse drive. Noise levels are virtually imperceptible and no maintenance is required. Continual drive speed in either direction can be varied via the electronic control unit from 0.00001 to 12 mm/minute. RS232 Interface for PC. Graphic display. The number of cycles, forward/reverse speeds and displacement for the measurement of residual shear may also be programmed.

Instructions for use are provided in sequence on the display unit and data are input directly via the alphanumeric keypad. Also provided are separate buttons for rapid approach and standard test speeds, as well as buttons to stop and reset the unit. Safety alarm lights are also provided (to signal piston overtravel and dynamometer overload). Accommodates shear boxes measuring up to 100 x 100 mm.

Bench, horizontal displacement of shear box mechanism, counter-balanced leverage system and vertical weight hanger have all been made in either non-rust forming or chromium-plated metals so as to eliminate all the painted surfaces most subject to wear.

**Specifications:**

- Max. force forward/reverse: 6 kN
- Speed range: 0.00001 – 12 mm/minute
- Different speeds may be selected for forward and reverse drive
- Speed/load limitations: none
- Displacement movements: 0.03 µm
- Rapid approach speed (unloaded): 12 mm/min.
- Forward/reverse cycles: programmable up to 20 mm
- Number of cycles: no limit to number which may be programmed
- Microswitches prevent piston overtravel and dynamometer overload
- Leverage system allows applied weights to be amplified by 10, 9, 7.92 and 6.125
- A small handwheel serves to sustain/release the vertical load
- Supports are provided for transducers, dial gauges and dynamometers.

Dimensions (without packing): 1016 x 572 x 1548 mm (h)
Weight (without packing): 100 kg

Dimensions (packed): 1100 x 700 x 1250 mm (h)
Weight (packed): 140 kg.

**Models:**

- **T 665/N** 220-240 V, 50 Hz, SINGLE PHASE, 325 W
- **T 665/N1** 110 V, 60 Hz, SINGLE PHASE, 325 W

**N.B.** The standard equipment supplied with the shear testing apparatus does not include the following essential components:

- load and shear measurement instruments,
- shear box or calibrated weights.

These instruments are to be ordered separately and may be chosen from the items listed on the following pages.
6.2 "DIRECT SHEAR" TEST

**ANALOG MEASURING INSTRUMENTS**

**Load**
Classic load rings with mechanical measurement of deflection and made of special treated steel, supplied complete with microswitches to prevent overloading/ tension, millesimal dial gauge and official calibration certificate. Linearity is within ± 1% in the upper 80% of full scale and repeatability is better than 0.5%.

**BA 003**
LOAD RING WITH 3 kN FULL SCALE
for 60 x 60 mm, 70 x 70 mm, 63.5 and 67.7 mm diameter samples (BS 1377)

**BA 006**
LOAD RING WITH 6 kN FULL SCALE
for 100 x 100 mm samples

Each proving ring (with relevant dial gauge) is calibrated by an Accredited Laboratory which issues a CALIBRATION CERTIFICATE.

The same proving rings, supplied with Tecnotest certificate are also available.

**BB 003**
LOAD RING WITH 3 kN FULL SCALE

**BB 006**
LOAD RING WITH 6 kN FULL SCALE

**Deformation:**
vertical: 10 mm - horizontal: 30 mm

**DV 922/C**
ANALOG DIAL GAUGE 10 mm TRAVEL, 0.01 divisions (Rambold)

**DV 922**
ANALOG DIAL GAUGE 30 mm TRAVEL, 0.01 divisions (Rambold)

Low cost alternative:

**T 628/E1**
ANALOG DIAL GAUGE 10 mm TRAVEL, 0.01 divisions

**T 628/E**
ANALOG DIAL GAUGE 30 mm TRAVEL, 0.01 divisions

As an alternative we offer digital dial gauges (without data acquisition):

**DV 923/10**
DIGITAL DIAL GAUGE: 10 mm TRAVEL, ACCURACY 0.01 mm

**DV 923/30**
DIGITAL DIAL GAUGE: 30 mm TRAVEL, ACCURACY 0.01 mm

**DIGITAL MEASURING INSTRUMENTS**

**Load**
Instead of the load ring, an extensometric type load cell may be fitted which, combined with a special Geotronic readout unit, enables measurements to be taken in digital form or for data to be acquired automatically.

**AP 032/003**
LOAD CELL - 3.5 kN CAPACITY

**AP 032/005**
LOAD CELL - 5 kN CAPACITY

Linearity - hysteresis ± 0.03% F.S.

**Specifications of the cell**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repeatability (%)</td>
<td>≤± 0.01 F.S.</td>
</tr>
<tr>
<td>Nominal sensitivity (mV/V)</td>
<td>2</td>
</tr>
<tr>
<td>Recommended supply voltage (V)</td>
<td>10</td>
</tr>
<tr>
<td>Nominal supply voltage range</td>
<td>1 - 15</td>
</tr>
<tr>
<td>Maximum supply voltage (V)</td>
<td>18</td>
</tr>
<tr>
<td>Mechanical limit values referred to nominal load:</td>
<td></td>
</tr>
<tr>
<td>a) service load (%)</td>
<td>120</td>
</tr>
<tr>
<td>b) max permissible load (%)</td>
<td>150</td>
</tr>
<tr>
<td>c) breaking load (%)</td>
<td>&gt; 300</td>
</tr>
<tr>
<td>d) max transverse load (%)</td>
<td>50</td>
</tr>
<tr>
<td>e) max permissible dynamic load (%)</td>
<td>50</td>
</tr>
<tr>
<td>Displacement at nominal load (%)</td>
<td>~ 0.3</td>
</tr>
<tr>
<td>Reference temperature (°C)</td>
<td>+23</td>
</tr>
<tr>
<td>Temperature nominal range (°C)</td>
<td>-10+40</td>
</tr>
<tr>
<td>Service temperature range (°C)</td>
<td>-10+70</td>
</tr>
<tr>
<td>Storage temperature range (°C)</td>
<td>-20+80</td>
</tr>
<tr>
<td>Protection class (EN 60529)</td>
<td>IP67</td>
</tr>
<tr>
<td>Execution material</td>
<td>Stainless steel</td>
</tr>
</tbody>
</table>

**Deformation:**
vertical: 10 mm - horizontal: 30 mm

**AD 100/011**
LINEAR EXTENSOMETRIC BRIDGE TRANSUCER 10 mm TRAVEL, accuracy 0.001 mm

**AD 113/011**
LINEAR EXTENSOMETRIC BRIDGE TRANSUCER 10 mm TRAVEL, accuracy 0.002 mm

**AD 115/011**
POTENTIOMETRIC TRANSDUCER, 10 mm TRAVEL, accuracy 0.01 mm

**AD 100/026**
LINEAR EXTENSOMETRIC BRIDGE TRANSUCER 25 mm TRAVEL, accuracy 0.001 mm

**AD 113/026**
LINEAR EXTENSOMETRIC BRIDGE TRANSUCER 25 mm TRAVEL, accuracy 0.002 mm

**AD 115/026**
POTENTIOMETRIC TRANSDUCER, 25 mm TRAVEL, accuracy 0.01 mm

All the above-mentioned instruments are used in combination with the single channel Geotronic unit. They are supplied with Tecnotest individual calibration certificate.

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6.2 “DIRECT SHEAR” TEST

AD 002
GEOTRONIC DIGITAL CONTROL UNIT
MICROPROCESSOR-BASED

30,000 (±) divisions. 5 digit graphic display.
Current loop interface.
Internal storage of up to 100 data items. Tare function.
Power supply: 220-110-240 V, 50-60 Hz, single phase
- 10 Watts, 12 Vdc.

AD 225/005
“CASAGRANDE DIRECT SHEAR” PROGRAM

AD 225/006
AD 225/005 EXPANSION
FORMEASURING
“RESIDUAL SHEAR STRENGTH”

Beam loading device 10:1 ratio supplied as standard
6.2 “DIRECT SHEAR” TEST

**SHEAR BOXES**

Machine-finished, consisting of:

- lower element with fixed base and lifting lugs
- upper element with loading pad and handles for displacement from the cutter mold to the box
- two perforated retaining plates
- two non-perforated retaining plates
- connection pins
- two porous discs

Four standard models are available in brass:

<table>
<thead>
<tr>
<th>Model</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>T 666</td>
<td>FOR 60 x 60 x 20 mm SPECIMENS</td>
</tr>
<tr>
<td>T 666/1</td>
<td>FOR 100 x 100 x 20 mm SPECIMENS</td>
</tr>
<tr>
<td>T 666/2</td>
<td>FOR 63.5 dia. x 20 mm SPECIMENS</td>
</tr>
<tr>
<td>T 666/4</td>
<td>FOR 67.7 dia. x 20 mm SPECIMENS</td>
</tr>
</tbody>
</table>

**N.B.**
The 100 x 100 mm shear box requires a large housing which is supplied at no extra cost if purchased together with the direct shear apparatus; to fit shear boxes measuring 60 x 60 mm and 63.5 mm dia. into this housing, a special adaptor T 666/12 must be ordered.

Upon request boxes can be supplied in stainless steel or aluminium; the latter, although offering a significant saving in cost, does not guarantee long-term dimensional rigidity.

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>T 666/P</td>
<td>PISTON GUIDE ACCESSORY</td>
</tr>
<tr>
<td></td>
<td>TO UNICEN ISO/TS 17892-10</td>
</tr>
</tbody>
</table>
The succession of pressure multiples of 0.125 kgf/cm² is obtained by positioning the weight hanger at position (x9) for 60 x 60 mm specimens, (x7.92) for 2.5” diameter specimens and (x6.125) for 70 x 70 mm specimens.

**CALIBRATED WEIGHTS**

Each shear box is supplied with a special calibrated weight calculated to generate an initial pressure on the sample of: 0.125 kgf/cm².

To obtain pressure multiples of 0.125 kgf/cm² (that is 0.250, 0.500, 1.25, 2, 4 and 8 kgf/cm²), two sets of calibrated weights are available, in particular:

**T 660/6**

**SET OF CALIBRATED WEIGHTS**

for specimens measuring 60 x 60 mm, 70 x 70 mm and 2.5” dia. (63.5 mm)

Consisting of:

- **N° 1 T 660/B** 0.5 kg calibrated weight
- **N° 1 T 660/C** 1 kg calibrated weight
- **N° 1 T 660/D** 2 kg calibrated weight
- **N° 1 T 660/E** 4 kg calibrated weight
- **N° 1 T 660/F** 8 kg calibrated weight
- **N° 1 T 660/G** 16 kg calibrated weight

**T 660/7**

**SET OF CALIBRATED WEIGHTS**

for 100 x 100 mm specimens

Consisting of:

- **N° 1 T 660/A** 0.25 kg calibrated weight
- **N° 1 T 660/B** 0.50 kg calibrated weight
- **N° 1 T 660/C** 1 kg calibrated weight
- **N° 1 T 660/D** 2 kg calibrated weight
- **N° 1 T 660/L** 5 kg calibrated weight
- **N° 1 T 660/M** 10 kg calibrated weight
- **N° 7 T 660/M** 10 kg calibrated weight

The succession of pressure multiples of 0.125 kgf/cm² is obtained by placing the weight hanger at position (x10) of the lever arm.

**Precision ± 0.1%**
The consolidation phase of soil of low permeability can be very lengthy, thus it is convenient to consolidate specimens simultaneously out of the direct shear machine itself. The consolidation bench fulfills this purpose. It is only available in single place form thus allowing complete flexibility of the number of benches to buy and their rational positioning within the laboratory.

**Specifications:**

- Single place bench
- Rust-proof shear box container
- Weight hanger and leverage system supplied as standard
- Dial gauge transducer support

Dimensions: 900 x 200 x 1350 (l x w x h) mm  
Weight: 77 kg  
Packed dimensions: 1200 x 600 x 500 (h)mm  
Packed weight 113 kg

**N.B.**  
The following items, necessary for tests, are not included and should be ordered separately:

- shear box  
- calibrated weights  
- instrument for strain measurement

To complete the equipment refer to the information provided on the previous pages.

The load piston is used for extruding the sample from the mould.

**Spare parts and accessories:**

<table>
<thead>
<tr>
<th>T 666/12</th>
<th>ADAPTOR FOR SHEAR BOXES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>measuring 60 x 60 mm, 63.5 and 67.7 mm dia.</td>
</tr>
</tbody>
</table>

**Accessories for performing anisotropic consolidation on T 667 bench:**

- T 667/D  Load hanger for direct weights (triaxial cell)  
- T 667/P  Triaxial cell housing platen
SAMPLE CUTTERS
Made of corrosion-resistant metal, they fit into a special housing on the relative shear box so as to allow the extrusion of the sample directly onto the shear box.

- **T 666/A**: CUTTER FOR SAMPLES 60 x 60 x 20 mm
- **T 666/5**: CUTTER FOR SAMPLES 63.5 dia. x 20 mm
- **T 666/B**: CUTTER FOR SAMPLES 100 x 100 x 20 mm
- **T 666/D**: CUTTER FOR SAMPLES 67.7 dia. x 20 mm

POROUS DISCS & PLATES
Made of silicon carbide, supplied in sets of 2 pieces.

- **T 666/6**: SET FOR SAMPLES 60 x 60 mm
- **T 666/8**: SET FOR SAMPLES DIA. 63.5
- **T 666/7**: SET FOR SAMPLES 100 x 100 mm

Made of sintered bronze, supplied in sets of 2 pieces.

- **T 666/10**: SET FOR SAMPLES DIA. 67.7 mm

**AD 160** PROFESSIONAL MICROMETRIC INSTRUMENT
Support with micrometric head, 0.001 mm divisions. Measurement range from 0 to 25 mm. A support bracket holds instruments having diameters measuring 8 and 17.5 mm. Dimensions: 200 x 140 x 340 (h) mm. Weight: 7 kg.

**AD 162** SLIP GAUGES
In special steel, of known and calibrated thickness, they are normally used for checking and calibrating displacement transducers. Housed in a small case, complete with calibration certificate. Assortment of 32 pieces.

**AD 163/D** DIGITAL MICROMETER
Travel 50 mm (0.001) complete with frame for transducers and dial gauges.

**AD 161** MICROMETER
Economically priced with essential equipment only. Supporting frame and micrometric head, 25 mm travel (0.001).

**INSTRUMENTS FOR TRANSDUCER AND DIAL GAUGE CALIBRATION**

<table>
<thead>
<tr>
<th>Composition</th>
<th>Size range (mm)</th>
<th>Progression (mm)</th>
<th>Tolerance (micrometers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.005</td>
<td>-</td>
<td>± 0.20</td>
</tr>
<tr>
<td>9</td>
<td>1.01 ~ 1.9</td>
<td>0.01</td>
<td>± 0.20</td>
</tr>
<tr>
<td>9</td>
<td>1 ~ 9</td>
<td>0.1</td>
<td>± 0.20</td>
</tr>
<tr>
<td>3</td>
<td>10 ~ 30</td>
<td>10</td>
<td>± 0.40</td>
</tr>
<tr>
<td>1</td>
<td>60</td>
<td>-</td>
<td>± 0.80</td>
</tr>
</tbody>
</table>

**AD 161 with transducer and readout unit during calibration**

**Porous Discs & Plates**
Made of silicon carbide, supplied in sets of 2 pieces.