

Compacted road base and subbase soils

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When highway or railway earthworks, bases, subbases and dams are constructed and subgrades are prepared, it is necessary to compact the material mechanically, to confer a high degree of density. This procedure increases the shear strength, reduces the permeability and water absorption, and reduces the tendency to settle under repeated loading. Compaction is therefore defined as the process of increasing the density of a material by mechanical means. To simulate the procedure adopted in the earthworks to obtain a defined level of compaction in the field, several laboratory tests have been developed over the years; they only differ for the different level of energy applied to the soil sample.

The equipment proposed in section 33 concern mainly Proctor moulds and compactors.

Section 34 refers mainly to the CBR equipment and various models of loading presses.

The equipment shown in section 35 concerns mainly all devices for determining the in situ density and various models of plate bearing test apparatus.

Section 38 propose various apparatus for determining the permeability of soil.

33 Moisture/Density relationship

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34 CBR California Bearing Ratio

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38 Soil permeability

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Proctor moulds and rammers

Proctor moulds and rammers conforming to EN

Standards EN 13286-2

Moulds

Code	Internal diameter (mm)	Body height (mm)	Approx. weight (kg)
33-T0070/EN	100 ± 1	120 ± 1	5.0
33-T0070/ENS*	100 ± 1	120 ± 1	5.0
33-T0071/EN	150 ± 1	120 ± 1	8.9
33-T0071/ENS*	150 ± 1	120 ± 1	8.9
33-T0074/E	250 ± 1	200 ± 1	32

*Split version

Steel plates

Code	Diameter (mm)	Thickness (mm)	Approx. weight
33-T0070/E1	99.5	10	0.6
33-T0071/E1	149.5	10	1.3
33-T0074/E1	249.5	20	7.6

Rammers

Code	Rammer diameter (mm)	Free fall height (mm)	Rammer weight (kg)	Approx. Weight (kg)
33-T0075/E	50 ± 0.5	305 ± 3	2.49	3.0
33-T0076/E	50 ± 0.5	457 ± 3	4.54	5.3
33-T0077/E*	125 ± 0.5	600 ± 3	15.0	23

*A semi-automatic high energy compactor is available on request.

Used for determining the relationship between the moisture content and density of compacted soil. The moulds include collar, mould body and base plate.

The rammer construction includes a guide sleeve with vent holes. Different versions are available that conform to the various commonly used standards. They are all made of plated steel and are identical in shape, only differing slightly in diameter and capacity. For the extrusion of soil specimens from the mould, the Universal specimen extruder may be used. See Accessories.

An alternative (and preferable) method of compacting is to use an automatic compactor. For more information, see AUTO-PROCTOR, the automatic Proctor-CBR compactor, pages 136-138.

Proctor moulds and rammers conforming to ASTM, AASHTO and CNR

Standards

ASTM D558, D698, D1557 | AASHTO T99, T134, T180 | CNR N°69

Moulds

Code	Volume (cm³)	Internal diameter (mm)	Body height (mm)	Approx. weight (kg)
33-T0070/A	944	101.6	116.4	7.0
33-T0071/A	2124	152.4	116.4	9.0
33-T0072/A	944	101.6	116.4	7.5
33-T0073/A	2124	152.4	116.4	9.5

Rammers

Code	Rammer diameter	Free fall height (mm)	Rammer weight (kg)	Approx. weight (kg)
33-T0075	50.8	305.0	2.49	3.0
33-T0076	50.8	457.2	4.54	5.3

Accessories (for all moulds)

16-T0080

Universal extruder

Used to remove 4" (101.6 mm), 6" (152.4 mm), 100 mm and 150 mm diameter specimens from Proctor, CBR and Marshall moulds. Constructed of steel, with adapters that correspond to the diameter of the moulds and can easily be fitted. Capacity: 50 kN, Ram travel: 197 mm (ram) + 68 mm (screw), Weight: 25 kg (approx.)

Proctor moulds and rammers conforming to BS

Standards BS 1377:4, 1924:2

Moulds

Code	Volume (cm³)	Internal diameter (mm)	Body height (mm)	Approx. weight (kg)
33-T0070/BS	1000	105.0	115.5	7.0

Rammer

Code	Rammer diameter (mm)	Free fall height (mm)	Rammer weight (kg)	Weight (kg)
33-T0075/B	50	300	2.5	3.0
33-T0076/B	50	450	4.5	5.3



Proctor moulds and rammers conforming to NF

Standards NF P94-078, P94-93, P98-231-1

Moulds

Code	Volume (cm ³)	Internal diameter (mm)	Body height (mm)	Approx. Weight (kg)
33-T0070/NF	944	101.6	116.4	7.0
33-T0072/NF*	944	101.6	116.4	7.5
33-T0089/NF	2758	152.0	152.0	9.0
33-T0089/NFS*	2758	152.0	152.0	10.0

*Split versions

Rammer

Code	Rammer diameter (mm)	Free fall height (mm)	Rammer weight (kg)	Weight (kg)
33-T0075	50.8	305	2.49	3.0
33-T0076	50.8	457	4.535	5.3

Proctor moulds and rammers conforming to NLT and UNE

Standards NLT-108/91, UNE 103-500

Moulds

Code	Volume (cm ³)	Internal diameter (mm)	Body height (mm)	Approx. Weight (kg)
33-T0070/C	1000	102.0	122.4	7.0
33-T0070/C3*	1000	102.0	122.4	7.0
33-T0071/C	2320	152.4	127.0	10.0
33-T0071/C3*	2320	152.4	127.0	10.0

*Split versions

Rammer

Code	Rammer diameter (mm)	Free fall height (mm)	Rammer weight (kg)	Weight (kg)
33-T0075	50.8	305	2.49	3.0
33-T0076	50.8	457	4.535	5.3



EN compaction equipment



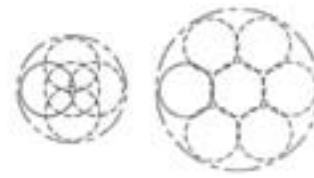
Compaction equipment

Universal Proctor/CBR automatic compactors | T3500 series

Standards

EN 13286-2 | EN 13286-47 | ASTM D698 | ASTM D1557 | ASTM D1883 | AASHTO T99 | AASHTO T180 | AASHTO T193 | BS 1377:4 | NF P94-093 | NF P94-066 | UNE 103-500

Mould Ø 100/4" Mould Ø 150/6"



Model 33-T3512 Detail of blow distribution, evidencing the central blow on 150-152 mm dia. specimens

- One model only to satisfy all Standard requirements (ASTM/AASHTO/EN/NF/BS/UNE etc.), including the central blow
- User friendly selection of Standards
- Possibility to program up to 15 user defined compaction cycles and sequences



main features

- > Universal application: one model only to satisfy all Standard requirements, including central blow
- > Fully automatic programmable micro-processor controlled
- > User friendly selection of Standards
- > The rammer is included. The face dia. and weight can be easily set conforming to the selected Standards
- > User defined compaction sequences, ideal for research purposes
- > Lateral transparent panel to follow the compaction evolution and to make easier the removal of the mould at the test end
- > Protection guards for operator safety
- > Noise reduction cabinet available
- > Unique hammer lifting device to guarantee correct drop height

Ordering information

33-T3512

Universal Fully Automatic Programmable, Proctor/CBR automatic compactor for specimens from 100 to 152.4 mm dia, conforming to EN, ASTM, AASHTO, BS, NF, UNE and major international Standards. Rammer kit included. 230V, 50 Hz, 1 ph [33-T3513](#)
Same as above but 220V, 60 Hz, 1 ph [33-T3514](#)
Same as above but 110V, 60 Hz, 1 ph

Conforming to all the above Standards, designed for moulds 100 to 102 and 150 to 152.4mm diameter, this programmable,microprocessor-controlled model is particularly suitable for research purposes as it is possible to program a user-defined compaction sequence and a sequence conforming to standards. A sophisticated compaction technique permits the central blow required for the 150-152.4 mm diameter moulds. The end of each layer compaction is indicated by a visual and acoustic signal. The machine is supplied complete with compaction hammer which can be easily set conforming to the Standard in use as specified in the table.

All models can be supplied complete with noise reduction cabinet. See page 139.

Models	33-T3512, 33-T3513, 33-T3514
Mould/specimen dia.	100 to 152.4 mm (4" and 6")
Rammer face dia. (interchangeable conforming to Standards, see table below)	50 and 50.8 mm.
Rammer weight (interchangeable conforming to Standards, see table below)	2.49-2.50-4.50-4.53 kg
Rammer drop (interchangeable conforming to Standards, see table below)	300, 305, 450, 457 mm
Blow rate	25 blows/min, approx.
CE protection	Included
Power rating	650 W approx.
Overall dimensions (wxdxh)	460 x 460 x 1390 mm
Weight approx.:	140 kg

Rammer application guide.

The Universal Automatic Compaction Hammer series 33-T3500 as specified, can be easily set with the different rammer face diameter, rammer and drop weight.

The following table summarizes all the Standard requirements. This model can surely satisfy other National Standards too.

Standards	Rammer face dia.	Rammer weight	Rammer drop height
ASTM 698	50.8 mm	2.49 kg	305 mm 457 mm
ASTM D1557	50.8 mm	4.53 kg	305 mm 457 mm
ASTM D1883	50.8 mm	2.49 kg 4.53 kg	305 mm 457 mm
AASHTO T99 AASHTO T180 AASHTO T193	50.8 mm	2.49 kg 4.53 kg	305 mm 457 mm
EN 13286-2 EN 13286-47	50 mm	2.50 kg 4.50 kg	305 mm 457 mm
BS 1377:4	50 mm	2.50 kg 4.50 kg	300 mm 450 mm
NF P94-093 NF P94-066	50 mm	2.49 kg 4.53 kg	305 mm 457 mm
UNE 103-500	50.8 mm	2.49 kg 4.53 kg	305 mm 457 mm



33-T3512 Detail of lifting mechanism. The system feature a unique device which automatically compensates the backlash and the mechanical wear for long durability and maintaining constant the rammer drop



User defined video

33-T3512 View with open doors. The transparent right panel permit the visual control of the compaction and, at the end, the easy removal of the mould.

Proctor/CBR ASTM automatic compactors | T3600 series



The automatic compactor provides a fully automatic and uniform compaction of specified effort, thus ensuring repeatable test results and eliminating any operator fatigue during the tests.

main features

- > Automatic programmable compactor to Standards ASTM and AASHTO
- > Graphic display showing test progress in real time
- > Possibility to program up to 3 user defined compaction cycles and sequences
- > Rammer with both head and weights included
- > Unique rammer lifting device to guarantee correct and longlife drop height
- > All safety features as protection guards and emergency button included as standard
- > Lateral transparent panel ensures free view on the compaction evolution
- > Double doors for free access to wide test area
- > Noise reduction cabinet is available (see accessories)

Ordering information

33-T3612

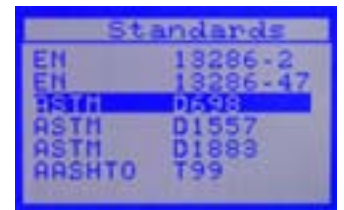
Automatic Proctor/CBR compactor for 4 and 6" dia. moulds, conforming to ASTM/AASHTO Standards. Rammer kit included. 230 V, 50 Hz, 1 ph

33-T3613

Same as above but 220 V, 60 Hz, 1 ph

33-T3614

Same as above but 110 V, 60 Hz, 1 ph



Standards

ASTM D698 | ASTM D1863 | ASTM D1557 | AASHTO T99 | AASHTO T180 | AASHTO T193

Conforming to ASTM and AASHTO Standards, this microprocessor-controlled soil compaction tester is designed for 4" and 6" moulds. The end of each layer compaction is indicated by a visual and acoustic signal. The machine is supplied complete with all relevant accessories as: 50.8 mm circular face for 4" diameter specimen and interchangeable sector face for 6" diameter specimens, and a rammer weights (2495/4353 g) that are easily interchangeable according to the reference standard.

The wide control display and panel are connected with a shock absorber system and can be tilted according to user comfort.

The software gives the possibility to program customized sequences allowing the user to set the rotation angle from 5° to 90° with 5° steps between two subsequent blows, granting a precise and uniform blows distribution.

The rotating base has screw clamping system for the moulds locking.

Two doors, one blind frontal and one transparent lateral, ensure comfortable access to a wide test area and gives free view during test running.

The soil automatic compactor can be supplied with noise reduction cabinet (see accessories).

See page 139.

Models	33-T3612, 33-T3613, 33-T3614
Standards	ASTM AASHTO
Mould/specimen dia.	4" and 6" (101.6 to 152.4 mm)
Rammer (s)	Included: circular 4"(50.8 mm) head and sector face for 6" specim.
Rammer weight	Adjustable: 2495/4353 g
Rammer drop (adjustable)	305 and 457 mm
Blow rate	25 blows/min approx.
CE protection	Included
Power rating	650 W approx.
Overall dimensions (wxdxh)	457 x 455 x 1390 mm
Weight approx.:	130 kg

NOTE ASTM/AASHTO compactor can be easily converted to compact 100 mm dia. specimens conforming to EN using a 50 mm dia. tamping face available on request and adjusting the weight and the drop height of the hammer.



33-T3612 ASTM/AASHTO automatic compactor. Detail of the rammer sector face with the interchangeable sector face to compact 6" dia. specimens.

33-T3000/CB

Noise reduction cabinet for CBR-Proctor automatic compactors

The cabinet is manufactured from sheet steel and lined internally with soundproofing material to considerably reduce the noise.

This cabinet is essential for use in laboratories that adhere to CE safety standards. The control panel of the automatic compactor can be easily removed from the machine and placed externally on the cabinet wall as shown.

The cabinet is designed to make the operator access very easy as the compactor front protection door can be completely opened for filling and moulds removal.

-Overall dimensions: (wxdxh). 850 x 672 x 1562 mm

-Weight (cabinet only): 90 kg approx



33-T3512 installed inside the Noise reduction cabinet 33-T3500/CB. Double access door and top door to make easy all load and unload operations.

main features

- > Large lateral space permitting the total opening of the compactor door and consequent easy filling and removal of moulds
- > The top of the cabinet can be opened for easy removal of the rammer in case of routine maintenance
- > Possibility to fit the control panel to the external wall without electrical disconnection

Vibrating compaction hammer

Standards

EN 12697-9 | EN 12697-10 |
EN 12697-32 | EN 13266-4 | BS 1377:4 |
BS 1924:2

Vibrating hammer.

230 V, 50 Hz, 1 ph.

Used for compacting asphalt in the percentage refusal density test and for the compaction of Proctor and CBR soil specimens (for more information see page 443). Using the appropriate tamping foot it can also be used for compacting concrete cube or beam specimens.

The hammer is supplied without support frame and tamper which have to be ordered separately



- Power: 950 W
- Length: 433 mm
- Weight approx.: 6.4 kg

Ordering information

- 33-T8702**
Vibrating hammer. 240 V, 50 Hz, 1 ph
- 33-T8703**
As above but. 220 V, 60 Hz, 1 ph
- 33-T8704**
As above but. 110 V, 60 Hz, 1 ph

33-T8702 with Supporting frame 33-T0087/B, Large tamping foot 33-T0087/7 and Shank 33-T0087/8A

Accessories

- 33-T0087/B**
Supporting frame for vibrating hammer, weight 70 kg (approx.).
- 33-T0087/6**
Small tamping foot, 102 mm diameter, head only.
- 33-T0087/7**
Large tamping foot, 146 mm diameter, head only.
- 33-T0087/8A**
Shank, 300 mm long.

Compaction penetrometers

Standards

ASTM D1558

33-T0165

Proctor penetrometer

Used for establishing the moisture content/penetration resistance relationship of fine-grained soils. It consists of a special spring dynamometer with a pressure-indicating scale on the stem of the handle. A sliding ring on the stem indicates the maximum pressure obtained in the test.

Supplied in a carrying case.

Specifications

- Load scale: 0 to 55 kg, 1 kg subdivisions with maximum load indicator
- Diameter of interchangeable needles: 28.55, 24.79, 20.22, 16.54, 12.83, 9.07, 6.40, 5.23 and 4.52 mm
- Weight: 3.5 kg (approx.)

33-T0166

Load ring penetrometer

Used for measuring the bearing strength and degree of compaction of soils. The apparatus consists of a T-shaped handle connected to a 1 kN (100 kgf) capacity load ring with a maximum load pointer, and an extension rod with five 100 mm graduations. The 30° end cone has an area of 645 mm² (1in²). Supplied complete with calibration chart.

Weight: 4 kg (approx.)



Compressive strength of Unbound and Hydraulically bound mixtures

Standards

EN 12390-4 | EN 13286-41

This Multipurpose compression tester can be suitable used for applying static compaction to CBR samples or for 10% Fines/ACV on aggregates.

For more information see page 366

Ordering information

50-C92C02

PILOT Automatic COMPACT-Line compression tester, 600 kN capacity, load measurement by pressure transducer. 230 V, 50-60 Hz, 1 ph.

50-C92C04

As above but 110 V, 60 Hz, 1 ph.



Determination of compactability

Moisture Condition Value (MCV) and Chalk Crushing Value (CCV)

Standards

EN 13286-46, BS 1377:4,
Manufactured under license from TRL-UK

33-T0064 Moisture condition apparatus

Used in the assessment of earthworks for construction by comparing compaction characteristics at various moisture contents in order to determine the "Moisture Condition Value" and "Chalk Crushing Value". This robust apparatus is designed for use in the construction laboratory and incorporates a rammer, scale, counter, and mould.

Weight: 55 kg (approx.)



Accessories

- 33-T0064/1**
Moisture condition mould
- 33-T0064/2**
Fibre discs, pack of 6.

Relative density of cohesionless soil

Standards

EN 13286-5 | ASTM D4253 |
ASTM D4254

This method, in the EN standard, covers the determination of the maximum dry density and water content of cohesionless materials when compacted using a vibrating table. Materials for which this method is applicable may contain up to 12% fines (<0.063 mm) by mass. The maximum particle size of the material to be tested is 80 mm. This method applies to mixtures to be used in road construction.

The ASTM also specifies that the method is used for the determination of the relative density of cohesionless soil for which impact compaction will not produce a well-defined moisture/density relationship curve and where the maximum density of the impact method will generally be less than by the vibratory method.

Two versions of test set are available: 33-T0063/A conforming to EN and 33-T0063 conforming to ASTM. They are practically identical except for the 0.1 ft³ mould which is included with 33-T0063.



Specifications

Both 33-T0063/A (EN) and 33-T0063 (ASTM) test sets include:

- **33-T0063/3:**
14200 cm³ (0.5 ft³) mould set
- **33-T0064/4:**
Relative density gauge set
- **33-T0063/1:** Vibrating table (33-T0063/1 Y for 220 V, 60 Hz or 33-T0063/1 Z for 110 V, 60 Hz) with the following specifications:
 - Vibration frequency: 3600 r.p.m.
 - Amplitude range: 0.05 to 0.64 mm
 - Vibrator type: electromagnetic
 - Separate amplitude control panel
 - Table dimensions: 762 x 762 mm
 - Table capacity: 250 kg

The 33-T0063 (ASTM) version also includes:

- **33-T0063/2:**
0.1 ft³ relative density mould set.
- Overall weight: 33-T0063/A, 289 kg; 33-T0063, 310 kg (approx.)

Note Each part can be ordered individually.

Ordering information

33-T0063/A
EN Relative density test set. 230 V, 50 Hz, 1 ph.

33-T0063
ASTM Relative density test set. 230 V, 50 Hz, 1 ph.
33-T0063/Y
As above but 220 V, 60 Hz, 1 ph.
33-T0063/Z
As above but 110 V, 60 Hz, 1 ph.

Accessories

33-T0063/7
12.5 and 25 mm diameter pouring devices.



33-T0063/7

CBR (California Bearing Ratio), IBI (Immediate Bearing Index)

This method is used for the laboratory evaluation of subgrade and subbase coarse materials in road construction. The apparatus comprises moulds with accessories, compaction rammers (the automatic models are the same as those used for the compaction of Proctor moulds - see pages 136-138), load testing machines with accessories, etc. Different models are available that conform to the various relevant specifications. Please note that very frequently, some of the items (e.g. Swell plate, Tripod etc.) are common to more than one standard test set.

ASTM, AASHTO, UNE, UNI CBR equipment

Standards ASTM D1883 | AASHTO T193 | UNE 103-502 | CNR UNI 10009

Ordering information and specifications

Code	Description	Specifications	Approx. weight, kg
34-T0090/A	CBR mould	With collar and perforated base plate - Plated steel. 6" (152.4 mm) diameter, - 7" (177.8 mm) body height	7.8
34-T0090/A1	Split CBR mould	Same as T0090/A, split longitudinally on one side	8.5
34-T0090/3	Filter screen	Stainless steel woven mesh, No.100 (150 µm), 144 mm diameter	0.05
33-T0076	Compaction rammer	2" (50.8 mm) diameter rammer face, 457.2 mm fall, 4.54 kg weight	5.3
33-T0096	Sliding weight rammer (as alternative to 33-T0076)	2" (50.8 mm) diameter rammer face, 457.2 mm fall, 4.54 kg weight	8
34-T0091	Spacer disc with "T" handle	5 ¹⁵ / ₁₆ " (150.8 mm) diameter x 2.416" (61.4 mm) high. Plated steel	7.5
34-T0091/1	UNE Spacer disc	Plated steel	7.5
34-T0094	Annular surcharge	Plated steel, 2.27 kg	2.27
34-T0095	Slotted surcharge	Plated steel, 2.27 kg	2.27
34-T0098	Cutting edge	Plated steel	0.5
34-T0099	Straight edge	3 x 30 x 300 mm	0.3
34-T0097/A	Solid CBR base	Plated steel	1.0
86-D1800	Filter paper	No. 1 x 150 mm diameter. Pack of 100	0.3
34-T0092	Swell plate	With adjustable stem	1.0
34-T0093	Gauge tripod	Non-corrodible alloy	0.3
82-D1255	Dial gauge	10 mm travel, 0.01 mm divisions	0.1
16-T0080	Universal extruder	For 100 to 152.4 mm diameter samples	25
34-T0100/B	Soaking tank	Plastic, 680 x 490 x 540 mm (internal dimensions)	9.1



ASTM, AASHTO, UNE, CNR test set (partial)



BS CBR equipment

Standards BS 1377:4 | BS 1924:2

Ordering information and specifications

Code	Description	Specifications	Approx. weight, kg
34-T0090/BS1	CBR mould body	Plated steel with both ends threaded to fit the base or collar. 152 mm internal diameter x 127 mm high	3.0
34-T0090/BS2	Extension collar	152 mm internal diameter x 50 mm high	1.0
34-T0090/BS3	Perforated base plate	Plated steel	1.8
34-T0090/BS4	Solid base/top plate	Plated steel	1.8
34-T0090/BS5	Cutting collar	Plated steel	1.0
34-T0090/B6	"C" spanner	To tighten / loosen the collar from the mould body. Two required	1.0
34-T0090/B7	Tool for base plate	To tighten / loosen the solid or perforated base plate from the mould	1.0
34-T0091/B	Compaction plug with handle	150 mm diameter x 50 mm high	7.2
33-T0076/B	Compaction rammer	50 mm diameter rammer face, 450 mm fall, 4.5 kg weight	5.3
34-T0094/B	Annular weight	Plated steel, 2 kg	2.0
34-T0095/B	Split weight	Plated steel, 2 kg	2.0
34-T0095/C	Tamping bar	12.7 mm dia. x 380 mm long	
34-T0099	Straight edge	3 x 30 x 300 mm	0.3
82-D1694	Steel rule	500 mm long	0.1
86-D1800	Filter paper	No.1 x 150 mm diameter. Pack of 100	0.3
34-T0092	Swell plate	With adjustable stem	1.0
34-T0093	Gauge tripod	Non-corrodible alloy	0.3
82-D1257	Dial gauge	25 mm travel, 0.01 mm divisions	0.1
16-T0080	Universal extruder	For 100 to 152.4 mm diameter samples	25
34-T0100/B	Soaking tank	Plastic, 680 x 490 x 540 mm (internal dimensions)	9.1



BS test set (partial)

NF CBR equipment

Standards NF P94-078 | NF P94-093 | NF P98-231-1

Ordering information and specifications

Code	Description	Specifications	Approx. weight, kg
34-T0089/NF	NF CBR mould	Complete with collar and perforated base plate. Plated steel. 152 mm diameter x 152 mm body height	9.0
34-T0089/NFS	Split NF CBR mould	Same as T0089/NF, split longitudinally on one side	9.0
34-T0076/F	Modified compaction hammer	51 mm diameter rammer face, 457.2 mm fall, 4.54 kg weight	5.3
86-D1800	Filter paper	No.1 x 150 mm diameter. Pack of 100	0.3
34-T0091/F	Spacer disc	Plated steel, 25.4 mm high	3.8
34-T0091/1	Spacer disc	Plated steel, 36 mm high	4.5
34-T0094/F	Annular surcharge weight	Plated steel, 2.3 kg	2.3
34-T0095/F	Split surcharge weight	Plated steel, 2.3 kg	2.3
34-T0098	Cutting edge	Plated steel	0.5
34-T0099	Straightedge	3 x 30 x 300 mm	0.3
34-T0092/F	Swell plate	Plastic with 3 mm diameter holes	0.3
82-D1257	Dial gauge	30 mm travel, 0.01 mm divisions	0.1
34-T0093	Gauge tripod	Non-corrodible alloy	0.3
34-T0100/B	Soaking tank	Plastic, 680 x 490 x 540 mm (internal dimensions)	9.1
16-T0080	Universal extruder	For 100 to 152.4 mm diameter samples	25



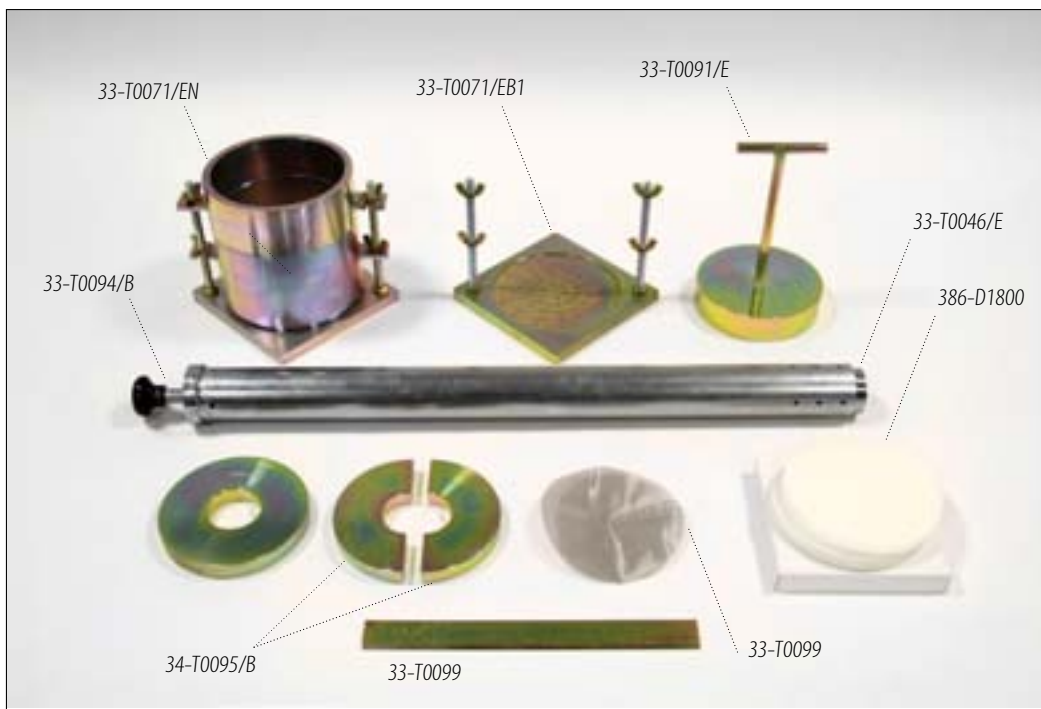
NF test set (partial)

EN CBR equipment

Standards EN 13286-47

Ordering information and specifications

Code	Description	Specifications	Approx.weight, kg
33-T0071/EN	Proctor/CBR mould	With collar and solid base plate. Plated steel. 150 mm diameter, 120 mm height	8.9
33-T0071/ENS	Proctor/CBR mould split version	With collar and solid base plate. Plated steel. 150 mm diameter, 120 mm height	8.9
33-T071/EB1	Perforated base plate	Plated steel	1.0
34-T0090/3	Filter screen	Stainless steel woven mesh, No.100 (150 µm), 144 mm diameter	0.05
33-T0076/E	Compaction rammer	50 mm diameter rammer face, 457 mm fall, 4.50 kg weight	5.3
34-T0091/E	Spacer disc with "T" handle	149.5 mm diameter, 36 mm high. Plated steel	5.0
34-T0094/B	Annular surcharge	Plated steel, 2 kg	2.0
34-T0095/B	Split surcharge	Plated steel, 2 kg	2.0
34-T0099	Straight edge	3 x 30 x 300 mm	0.3
86-D1800	Filter paper	No.1 x 150 mm diameter. Pack of 100	0.3
34-T0092/E	Swell plate	Aluminium perforated with adjustable stem	1.0
34-T0093	Gauge tripod	Non-corrodible alloy	0.3
82-D1257	Dial gauge	30 mm travel, 0.01 mm divisions	0.1
16-T0080	Universal extruder	For 100 to 152.4 mm diameter samples	25
34-T0100/B	Soaking tank	Plastic, 680 x 490 x 540 mm (internal dimensions)	9.1



Expansion (Swell) test apparatus

34-T0093

Dial gauge tripod

Used to support the dial gauge for monitoring the swelling of CBR samples. Made from a special non-corrodible alloy. Weight: 0.3 kg (approx.)

82-D1255

Dial gauge, 10 x 0.01 mm as alternative:

82-D1257

Dial gauge, 30 x 0.01 mm

34-T0092 (T0092/E) with Tripod 34-T0093 and Dial gauge 82-D1257



34-T0092

ASTM Perforated plate with adjustable stem (Swell plate) . Plated steel. -Weight: 1 kg approx.

34-T0092/F

NF Perforated plate with adjustable stem (Swell plate). Plastic. -Weight: 0.3 kg approx.



34-T0092/F

34-T0092/E

EN Perforated plate with adjustable stem (Swell plate) . Aluminium. -Weight: 0.3 kg approx.

34-T0100/B

Large soaking tank

The CBR moulds are immersed in this plastic water tank during the swelling test. Supplied complete with supporting base, which allows free water circulation. Capacity: 6 CBR moulds
Dimensions:
External: 800 x 600 x 550 mm;
Internal: 680 x 490 x 540mm;
Weight: 9.1 kg (approx.)



Extruder 16-T0080. Detailed information on page 31



34-T0100/B with CBR moulds

Field CBR apparatus

Standards

ASTM D4429 | BS 1377:7 | BS 1924:2 | UNI 10009

34-T0115/A

Field CBR test set

Description

Used for the in-situ determination of the bearing capacity of soils used in road construction. The complete set is housed in a strong carrying case and includes:

34-T0112*

50 kN capacity mechanical jack. Weight 8.5 kg.

34-T0112/1*

Ball seating for 34-T0112. Weight 1 kg.

82-T1008*

40 kN capacity load ring. Weight 4 kg.

34-T0103/1*

Adjustable CBR penetration piston. Weight 2.2 kg.

34-T0104/7*

Adjustable dial gauge holder.

34-T0115/3

Set of 3 extension rods and adapters. Weight 33 kg.

34-T0115/41

Datum bar assembly including two tripod stands and a 1220 mm long aluminium bar. Weight 7 kg.

82-D1257*

Penetration dial gauge, 30 mm travel, 0.01 mm divisions.

34-T0115/5

9 kg slotted surcharge weight.

34-T0115/6

4.5 kg slotted surcharge weight.



34-T0114 with items*

34-T0115/7

4.5 kg annular surcharge weight.

*Items for use with the 34-T0114 to create a hand operated CBR laboratory loading press.

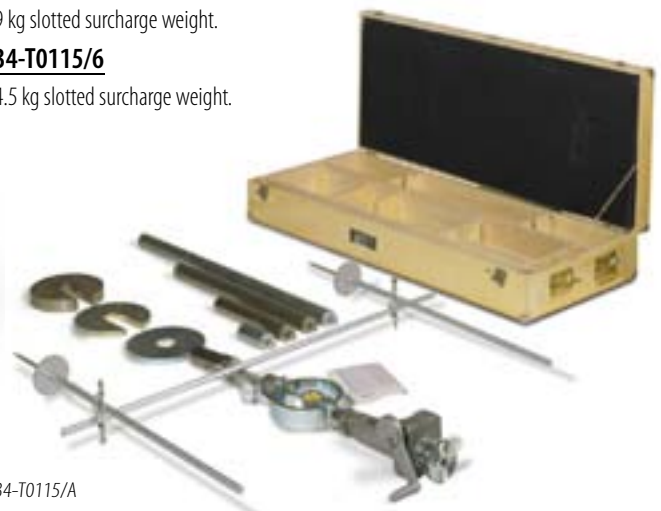
Total weight: 70 kg (approx.)

Note: all above items can also be purchased individually.

Accessories

34-T0114

Conversion frame to convert the 34-T0115/A test set into a hand operated CBR loading press for laboratory use. Total weight (including parts identified with the *in the 34-T0115/A set): 55 kg (approx.)



34-T0115/A

CBR (California Bearing Ratio), Penetration test

CBR Loading frames and presses

Standards EN 13286-47 | ASTM D1883 | AASHTO T193 | BS 1377:4 | NF P94-078 | UNI CNR 10009

The CBR penetration test can be performed with a number of loading presses, some of them specifically designed for CBR tests, and others with multiple applications (Universal models), at different levels of sophistication. A concise presentation is given below to expedite your selection.

34-T0106 and 34-T0102 series 50 kN capacity

main features

- > Adjustable penetration piston
- > Load ring fitted with 0.001 mm div. gauge to fulfill the Standard requirements

Ordering information

34-T0106/A

CBR motorized loading press, 50 kN capacity, complete with 50 kN load ring, adjustable penetration piston and dial gauge. 230 V, 50 Hz, 1 ph.

34-T0106/AY

As above but 220 V, 60 Hz, 1 ph.

34-T0106/AZ

As above but 110 V, 60 Hz, 1 ph.

34-T0102/A

CBR mechanical loading press, 50 kN capacity, manually/hand operated, complete with CBR accessories.

CBR Specific loading presses

34-T0106/A

Motor operated

This machine features a rigid two-column frame with an upper crossbeam which can be adjusted in height and locked in position with locknuts. The drive force is provided by a mechanical jack housed in the base cabinet which also houses the motor and the electric panel. The machine includes a precision 50kN capacity load ring, an adjustable penetration piston and a dial gauge.

A version without accessories is also available: model 34-T0106, which can be completed with other accessories (e.g. digital configuration). See Accessories.

Note: 82-T1009/C load ring 50 kN cap. fitted with gauge 0.01 mm resolution available on request.



34-T0106/A with mould



34-T0102/A

Hand operated

This machine features a rigid two-column frame with an upper crossbeam which can be adjusted in height and locked in position with locknuts. The drive force is provided by a mechanical jack housed in the base cabinet. The machine includes a precision 50kN capacity load ring, penetration piston and dial gauge.

Models	34-T0106/A	34-T0102/A
Maximum load	50 kN	50 kN
Test speed	1.27 mm/min	Manually Controlled
Maximum ram travel	120 mm	120 mm
Horizontal span	270 mm	270 mm
Load ring capacity	50 kN, 0,001 mm div. incl.	50 kN, 0,001 mm div. incl.
Dial gauge	30 x 0.01 mm, included	30 x 0.01 mm, included
Penetration piston	Adjustable, included	Included
Power rating	300W	-
Overall dimensions	392 x 495 x 1194 mm	300 x 410 x 1140 mm
Weight (approx.)	78 kg	75 kg

34-T0106

CBR motorized loading press. Frame only.
230 V, 50 Hz, 1 ph.

34-T0106/Y

As above but 220 V, 60 Hz, 1 ph.

34-T0106/Z

As above but 110 V, 60 Hz, 1 ph.

34-T0102

CBR Hand operated press. Frame only.

CBR parts for 34-T0106 and 34-T0102. Frames only

The above frame can be completed with the standard parts mounted in the 34-T0106/A version (34-T0103/3 and 82-T1009).

Accessories

34-T0103/3

Adjustable penetration piston complete with dial holder and dial gauge 30 x 0.01 mm div.

82-T1009

Load ring 50 kN cap., fitted with dial gauge 0.001 mm div.

Note: As alternative, with the 34-T0103/3C assembly and the 82-T1009/C load ring



34-T0106 with 34-V0107/CBR and 82-P60R02 with mould

CBR Accessories for performing the test in digital mode

The 34-T0106 frame can be equipped in digital mode, as shown, with the following accessories.

34-V0107/CBR

Test set to perform the CBR test in digital mode, including:

82-P0375

Load cell, 50 kN capacity

82-P0375/C

Adapter to fit load cell (two pieces)

82-P0322

Displacement transducer, 25 mm travel

34-T0104/81

Adjustable transducer holder

34-T0103/1

Adjustable CBR penetration piston

Also required:

82-P60R02

DIGIMAX TS, Touchscreen, 4-channel readout and processing unit for load and displacement sensors. Suitable for CBR, Marshall, Indirect tensile and general purpose tests.
110-240 V, 50-60 Hz, 1 ph.

82-SW/CMU

PC software for CBR, Marshall, Indirect tensile and general purpose tests.

Note: for more details and information on the DIGIMAX TS and Software, see page 154

Spare parts

34-T0103/1

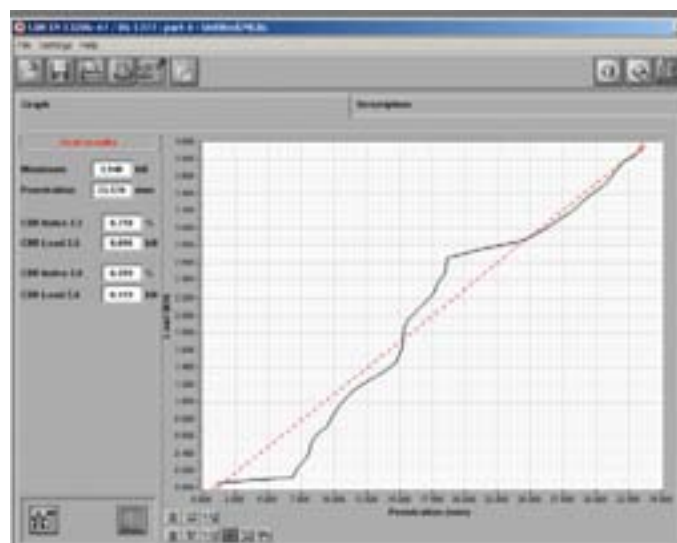
Adjustable penetration piston.

82-D1257

Dial gauge 30 mm travel, 0.01 mm divisions.

34-T0104/7

Dial gauge holder.

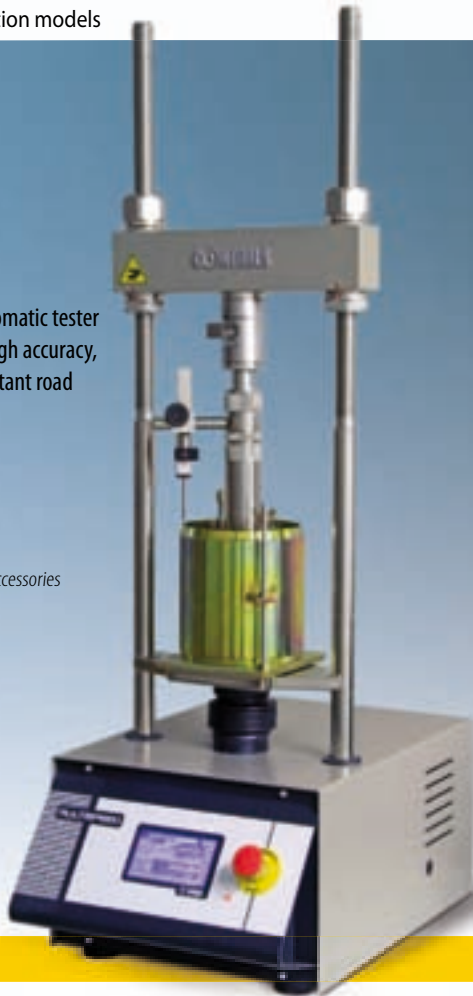


MULTISPEED

Multiple application models

A unique fully automatic tester to perform with high accuracy, all the most important road strength tests

34-V1172 with CBR accessories

**main features****MULTISPEED Automatic 34-V1172**

- > Closed-loop speed control
- > CBR and MARSHALL test speed can be selected by default
- > Other testing speeds (custom) between 0.05 and 51mm/min, can be easily set
- > Selection of maximum platen displacement with automatic stop
- > Rapid approach and return function, to reduce the testing time
- > Speed calibration function by firmware.
- > CE Emergency stop button
- > Stand-alone automatic digital load frame
- > Four channel on board data acquisition
- > Integrated transducer calibration facility
- > Infinitely variable speed from 0.05 to 51 mm/min
- > Large touchscreen display for viewing real-time graph and test data

Application of MULTISPEED and MULTISPEED Automatic testers

These models represent the ideal solution for major laboratories performing tests requiring displacement control, such as **CBR, Marshall, Indirect tensile, Unconfined compression, Quick triaxial** etc. The MULTISPEED standard version 34-V1072 (see page 150) is usually equipped with analogue measurement system but could also accept digital accessories, while MULTISPEED Automatic 34-V1172 is fitted with digital system only, as required by all EN Standards. The various test accessories and relevant Standards, are shown and listed on page 152,153.

34-V1172 with Marshall accessories



MULTISPEED 34-V1172 Automatic series

The MULTISPEED Automatic, features automatic control of the test speed/ travel by microprocessor. Prior to the test, the operator can set travel limits for automatically ending the test. No external transducer is required for displacement measurement. The firmware allows transducer calibrations and setting of up to 10 test profiles, saving data onboard. A real-time test graph and transducer data are displayed on the user interface touchscreen which is supplied complete with a stylus pen.

The machine has built-in data acquisition with four channels: two dedicated to strain gauge load cells and two for potentiometric linear transducers - one of each can be used during the test. An important feature is provided by the processing unit that manages the speed through closed-loop control, avoiding speed calibrations and voltage fluctuation effects. The front panel is fitted with an emergency button for prompt stopping of the machine. Test data can be stored on a USB pen drive or downloaded through a LAN communication port in Controls, txt or ASCII format. All the accessories have to be ordered separately.

Data acquisition and processing system

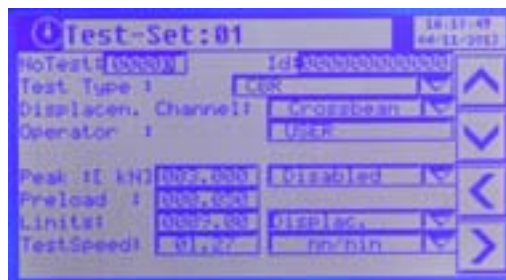
Example of screenshots



Main menu



Saving data screenshot



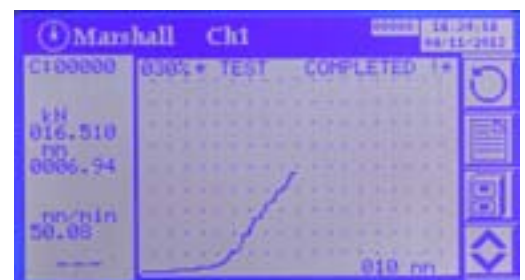
Test set parameters



Test set parameters



CBR graph



Marshall graph



34-V1172 Multispeed Automatic. Detail of the connection socket panel: Power, USB port, LAN port for PC connection and four connectors for Load cells and displacement transducers.

Technical specifications

Models	34-V1172 34-V1173 34-V1174
Maximum capacity	50 kN
Testing speed, adjustable from	0.05 to 51 mm/min
Power rating	DC motor 750 W
Data download	By LAN port, ASCII,
USB port	For USB memory stick data storage
Resolution	132000 divisions
Display	Touchscreen graphic 240 x128 pixel
Sampling frequency	50 Hz
Horizontal clearance	270 mm
Maximum vertical clearance (without accessories)	730 mm
Overall dimensions (lwxhxh)	392 x 495 x 1213 mm
Weight (approx.)	65 kg

Ordering information

MULTISPEED AUTOMATIC 34-V1172

34-V1172

MULTISPEED Automatic, automatic compression tester, 50 kN capacity, 4-channel built-in data acquisition and variable speed from 0.05 to 51 mm/min. 230 V, 50 Hz, 1 ph.

34-V1173

As above but 220 V, 60 Hz, 1 ph.

34-V1174

As above but 110 V, 60 Hz, 1 ph.

Test accessories

See pages 152, 153

MULTISPEED

Multiple application models



34-V1072 with CBR accessories (analogic)



34-V1072 with Marshall accessories (analogic)

General descriptions

MULTISPEED 34-V1072 series

The MULTISPEED tester features a rigid two-column structure with an upper cross beam which can be set at various heights. The load jack, DC motor and controls are housed in a specially designed base cabinet.

When fitted in digital mode, test data are acquired and processed by a Digimax or other similar device.

One of the main features of the new MULTISPEED is the control of test speed which is easily set and then shown on the display. Furthermore, the test stroke can be set at the beginning of the test with an automatic stop, avoiding overloading the machine and the specimen, thus assuring operator safety. This important feature also permits a calibration of machine speed to be performed, with micrometric manual adjustments made by the operator.

The display shows the travel direction of the lower platen and the front panel is fitted with an emergency button and two operating LEDs indicating machine on/off and travel direction.

This model is normally equipped in the analogical mode, but, using the Digimax TS Data acquisition system and relevant PC software (see page 154), can also be equipped in the digital mode (see accessories)

Ordering information

MULTISPEED 34-V1072

34-V1072

MULTISPEED, digital compression tester, 50 kN capacity, testing speed steplessly adjustable from 0.2 to 51 mm/min. 230 V, 50 Hz, 1 ph.

34-V1073

As above but 220 V, 60 Hz, 1 ph.

34-V1074

As above but 110 V, 60 Hz, 1 ph.

Accessories for performing CBR and Marshall tests in analogue mode

(For use with the Multispeed 34-V1072 series only)

CBR Accessories

Standards

EN 13286-47 | ASTM D1883 | AASHTO T193 | BS 1377:4 | NF P94-078 | UNI CNR 10009

34-T0103/3

Adjustable penetration piston complete with dial holder and dial gauge 30 x 0.01 mm div.

82-T1009

Load ring 50 kN cap., fitted with dial gauge 0.001 mm div.

Marshall accessories

Standards

EN 12697-34* | ASTM D1559 | ASTM D5581 | ASTM 6927-06 | AASHTO T245 | BS 598-107 | NF P98-0251-2 | DIN 1996 | CNR 30

Note: The EN Standard specifies that Marshall Testers must be used in digital mode with a recording unit.

82-T1009/F

Load ring, 50 kN capacity, with stembrake Or as alternative:

82-T1007/F

Load ring, 30 kN capacity, with stembrake

34-T0104/10

Compression device.

76-B0034

Flow meter.

76-B0033

Stability mould.



CBR accessories (analogic mode)



Marshall accessories (analogic mode)

Note: to perform the above tests in the digital mode see page 152

main features

MULTISPEED 34-V1072 series

- > Closed-loop speed control
- > CBR and MARSHALL test speed can be selected by default
- > Other testing speeds (custom) between 0.2 and 51mm/min, can be easily set
- > Selection of maximum platen displacement with automatic stop
- > Rapid approach and return function, to reduce the testing time
- > Speed calibration function by firmware.
- > CE Emergency stop button



34-V1072 with Marshall accessories to test 6" up to dia. samples in the digital mode and Digimax TS 82-P60R02 touch screen data acquisition system. See page 154



Technical specifications

Models	34-V1072 34-V1073 34-V1074
Maximum capacity	50 kN
Testing speed, adjustable from	0.2 to 51 mm/min
Power rating	DC motor 750 W
Display	Alphanumeric 2 x16 characters
Horizontal clearance	270 mm
Maximum vertical clearance (without accessories)	730 mm
Overall dimensions (lxwxh)	392 x 495 x 1213 mm
Weight (approx.)	65 kg

MULTISPEED

Multiple application models

Accessories for 34-V1072 and 34-V1172 models

All the above MULTISPEED and MULTISPEED Automatic testers, with the appropriate accessories, are frequently used for road testing (CBR, Marshall, and Indirect tensile etc.) which are illustrated on this page.

For all other applications, see page 153

**Accessories to perform the CBR and Marshall test in digital mode*

CBR, conforming to:

Standards

EN 13286-47 | ASTM D1883 | AASHTO T193 | BS 1377:4 | NF P94-078 | UNI CNR 10009



34-V0107/CBR Test set with CBR mould

34-V0107/CBR

Test set for performing CBR tests in digital mode, including:

82-P0375

Load cell, 50 kN capacity

82-P0375/C

Adapter to fit load cell (two pieces)

82-P0322

Displacement transducer, 25 mm travel

34-T0104/81

Adjustable transducer holder

34-T0103/1

Adjustable CBR penetration piston

All above items can be ordered individually.

Note: The MULTISPEED 34-V1072 Series also require data acquisition system. See DIGIMAX TS 82-P60R02 on page 154

Marshall, conforming to:

Standards

EN 12697-34* | ASTM D1559 | ASTM D5581 | ASTM 6927-06 | AASHTO T245 | BS 598-107 | NF P98-0251-2 | DIN 1996 | CNR 30



34-V0107/MAR Test set

34-V0107/MAR

Test set for performing Marshall tests in digital mode, including:

82-P0375

Load cell, 50 kN capacity

82-P0375/C

Adapter to fit load cell (two pieces)

82-P0322

Displacement transducer, 25 mm travel

34-T0104/81

Adjustable transducer holder

34-T0104/13

Compression device extension

34-T0104/10, Compression device

76-B0033, Stability mould 4"

** The EN Standard specifies that Marshall Testers must be used in digital mode with a recording unit.*

CBR and Marshall, conforming to the standards specified above

(To avoid duplications when both test have to be performed)

34-V0107/CM

Test set for performing CBR and Marshall tests in digital mode, including:

82-P0375

Load cell, 50 kN capacity

82-P0375/C

Adapter to fit load cell (two pieces)

82-P0322

Displacement transducer, 25 mm travel

34-T0104/81

Adjustable transducer holder

34-T0103/1

Adjustable CBR penetration piston

34-T0104/13

Compression device extension

34-T0104/10

Compression device

76-B0033

Stability mould 4"

Note: Stability mould for 6" specimen available on request-see 76-B0033/C

Other tests can be performed with the MULTISPEED and MULTISPEED AUTOMATIC testers, using the following accessories:

Indirect tensile on bituminous mixtures

Standards

EN 12697-12 | EN 12697-23 | ASTM D4123 | CNR 34



Machine fitted with accessories for IDT

Unconfined compression (soil)

Standards

EN 12697-12 | EN 12697-23 | ASTM D4123 | CNR 34



Machine fitted with accessories

Quick triaxial (soil)

Standards

ASTM D2850 | BS 1377:7

Accessories

82-P0375

Load cell, 50 kN capacity

82-P0375/C

Adapter to fit load cell (two pieces). For triaxial cells and related accessories see page 75, 79



Universal models

UNIFRAME

For performing tests under speed/displacement and load control, including all road tests (CBR, Marshall, Indirect tensile etc.), concrete, cement and natural building stone flexural testing under load control, triaxial testing etc. See page 388, 392

Accessories

82-P0375

Load cell, 50kN capacity

82-P0375/C

Adapter to fit load cell (two pieces)

82-P0322

Displacement transducer, 25mm travel

34-T0104/81

Adjustable transducer holder

34-T0104/13

Compression device extension

34-T0104/10

Compression device

76-B0078/B

Tensile splitting device or, alternatively,

76-B0078/C

82-P60R02*

DIGIMAX TS Data acquisition system

*For use with Multispeed 34-V1072 series only

Accessories

82-P0370

Load cell, 2.5kN capacity

82-P0375/C

Adapter to fit load cell (two pieces)

82-P0322

Displacement transducer, 25mm travel

34-T0104/81

Adjustable transducer holder

70-T0108/5

Load cell extension

34-T0104/4

Platens for unconfined compression

82-P60R02*

DIGIMAX TS Data acquisition system

*For use with Multispeed 34-V1072 series only

Punching test on clay block for flooring

(see page...)



UNIFRAME 70-T1082 with CBR accessories. Other versions also available: 70-T1182 with increased testing space and 70-T1092, 100 kN cap. For complete information see page 388

main features

- > Stand-alone automatic digital load frame
- > Automatic failure detection
- > Universal machine suitable for a wide range of tests
- > Closed-loop speed/load control
- > Four channel onboard data acquisition
- > CBR and Marshall test automatic control facility
- > Integrated transducer calibration facility
- > Infinitely variable speed from 0.05 to 51 mm/min
- > Large touchscreen display for viewing real-time graph and test data
- > Rapid approach and return functions ensure test time savings
- > CE emergency stop button

DIGIMAX TS, Touch Screen data acquisition system



main features

- > Large size touchscreen display
- > Very easy to use menus with intuitive selections, self-explanatory icons, optimized test procedures
- > PC connection via LAN port allowing faster communication, better stability and longer cable lengths compared to an RS232 serial connection
- > Advanced calibration menus with linearization functions, firmware-driven procedures, secure file storage
- > Unlimited data storage on USB pen drives

Note: For Multispeed 34-V1072 series only.

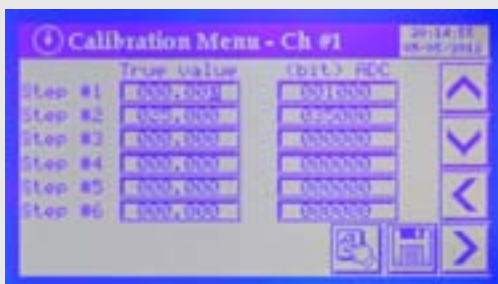
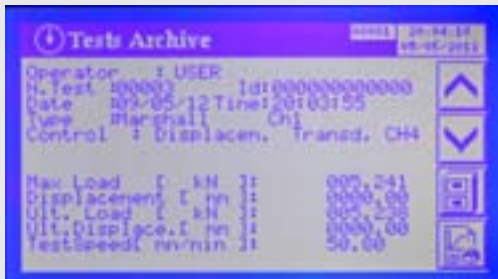
The Multispeed Automatic 34-V1172 Series incorporates a data acquisition system.

Based on the latest electronic technology, this modern readout unit offers advanced performance and outstanding electronic features, including excellent effective resolution, sampling rate, accuracy and stability of readings, superb calibration functions, touchscreen sensitivity and reaction times, and fast network communication.

Our long-standing experience and tradition in the production and design of testing systems, and in particular digital units, has enabled us to create an extraordinarily optimized user interface with efficient working procedures, resulting in a unit that is faster and easier to use, combined, as always, with Class 1 accuracy and total reliability.

82-P60R02

DIGIMAX TS, Touchscreen four-channel readout and processing unit for load and displacement sensors. Suitable for CBR, Marshall, Indirect tensile and general purpose tests. 110-240 V, 50-60 Hz, 1 ph.



DIGIMAX TS
82-P60R02.
Few examples of test
menu

Technical specifications

- 240 x 128 pixel touchscreen graphic display showing numerical and graphical data
- Total of four channels: two dedicated to load sensors and two for displacement transducers. A maximum of two channels (one load and one displacement, selected by the user) can be used simultaneously
- Effective sampling rate up to 50/sec
- Effective resolution 17 bit
- Data storage on USB pen drive (included)
- Connection to PC via LAN port (basic communication software is included)
- Multiple selection of language and units
- Real-time clock and date
- Overall dimensions (w x d x h): 290 x 220 x 130 mm
- Weight: 3.4 kg (approx.)

is designed specifically to be used with new Digimax 82-P60 R02 and with 76-B3812, 34-V1172, 70-T1082, 70-T1182 and 70-T1192 testing machines.

Minimum PC requirements

- Pentium 4® CPU 3 GHz
- 1 GB of free hard disk space
- Microsoft Windows® XP or higher operating system
- RAM memory:
 - for Windows XP or Vista: minimum 1 GB; recommended 2 GB
 - for Windows 7: minimum 2 GB; recommended 4 GB
- CD-ROM drive
- One free RJ45 network port
- Screen resolution of 1024 x 768 pixels with color quality set to 32 bit
- MS Excel 2003 or higher (optional)

Ordering information

82-SW/CMU

PC software for CBR, Marshall, Indirect tensile and universal tests.

PC software for CBR, Marshall, Indirect tensile and general purpose tests

Standards

EN 12697-34 | ASTM D1559 | ASTM D1883 | ASTM D5581 | ASTM D6927 | AASHTO T245 | EN 12697-12 | EN 12697-23 | BS 1377:4 | NF P94-078 | AASHTO T193 | EN 13286-47 | UNI 10009

This program is written to run in MS Windows® for data acquisition and processing of CBR, Marshall, Indirect tensile and general load/displacement tests. The software

82-SW/CMU test data screenshot



Impact soil tester

34-T0168/B

Used to obtain an indication of the degree of compaction of soil in road construction. Results can be directly correlated to the CBR test. The unique microprocessor system automatically checks all readings throughout the test and displays the fourth reading as the Impact Value. An essential trench control tool for all cable and pipe laying service contractors.

Specifications

Dimensions: 140 x 140 x 700 mm (approx.)
Weight: 6.5 kg (approx.)



34-T0168/B

main features

- > Results can be directly correlated to the CBR test
- > An essential trench control tool for all cable and pipe laying service contractors

Strength of stabilized soil

Standards

EN 13286-53 | BS 1924:2 | NF P 94-100
| NF P98-230-2

These tests are performed to determine the unconfined compressive strength of fine and medium grained soils.

Two versions with different sizes are available that conform to:
– EN 13286-53 and BS 1924:2
– NF P 94-100

EN 13286-53 and BS 1924:2 test sets

34-T0123/A

EN/BS stabilized soil set for fine and medium grained soils – specimen size Ø 50 x 50 mm (diameter x height) – EN 13286-53 and BS 1924:2

34-T0123/B

EN/BS stabilized soil set for fine and medium grained soils – specimen size Ø 50 x 100 mm (diameter x height) – EN 13286-53 and BS 1924:2

34-T0124/A

EN/BS stabilized soil set for fine and medium grained soils – specimen size Ø 100 x 100 mm (diameter x height) – EN 13286-53 and BS 1924:2

34-T0124/B

EN/BS stabilized soil set for fine and medium grained soils – specimen size Ø 100 x 200 mm (diameter x height) – EN 13286-53 and BS 1924:2

All above sets include a mould, set of 2 end plugs, set of 2 plug displacing collars with 3 different heights, one demoulding plunger and specimen collector.

All components can be purchased separately.
Approx. weight: 10 kg (34-T0123/A), 12 kg (34-T0123/B), 20 kg (34-T0124/A) and 53 kg (34-T0124/B)

NF P 94-100 test set

34-T0123/S

NF stabilized soil set for fine and medium grained soils – specimen size Ø 50 x 50 mm (diameter x height) – according to NF P94-100

This set includes a mould, 5 stainless steel casing, 2 compaction plugs, set of plug displacing collars, one demoulding plunger and a specimen collector.

Spares

34-T0123/S1

Set of 5 stainless steel casing for specimen size Ø 50 x 50 mm (diameter x height)



34-T0123/A



34-T0124/B

FIELD DENSITY

Sand replacement method

The verification of the degree of compaction can be determined on site with a simple procedure that essentially involves removing and weighing a section of compacted soil and then refilling the hole with sand. A simple apparatus is used to record the volume of sand, and then the density of the removed soil can be calculated.

ASTM/AASHTO/NF Sand density cone apparatus

Standards

ASTM D1556 | AASHTO T191 | NF P94-061-3 | UNE 7371 | CNR N° 22

We produce three versions of this apparatus, each suitable for soils of different grain sizes. The sets all include a double cone, a metal base plate and two plastic sand jars, except the 35-T0133 model which is supplied with one acrylic sand container.

The 35-T0129 6.5" (165.1 mm) diameter model can be completed with a calibrating container. See Accessories.

Ordering information

35-T0128

4" (101.6 mm) diameter sand density cone apparatus.

35-T0129

6.5" (165.1 mm) diameter sand density cone apparatus.

35-T0133

12" (304.8 mm) diameter sand density cone apparatus.

Accessories

35-T0130/8

Calibrating container for 35-T0129
Weight: 5 kg (approx.)

35-T0127

Standard sand, 0.3 to 0.6 mm grain size, conforming to ASTM/AASHTO/BS. 50kg sack.

35-T0127/1

Standard sand, 0.4 to 2.0 mm grain size, conforming to CNR 22. 50 kg sack.

Sand replacement set parts (ASTM)

Part description*	35-T0128 4" diameter	35-T0129 6.5" diameter	35-T0133 12" diameter
Double cone	35-T0128/1	35-T0129/1	-
Plastic sand jar (2 pieces)	35-T0130/2	35-T0130/2	-
Metal base plate with flanged (rimmed) hole	35-T0128/2	35-T0129/2	-
Weight of complete set (approx.)	3 kg	3 kg	20 kg

*all parts can also be purchased individually



35-T0128, 35-T0129, 35-T0133

BS Sand replacement apparatus

Standards BS 1377:9 | BS 1924:2

The operating principle is identical to the ASTM/AASHTO method. Three sizes of apparatus are available, each comprising a pouring cylinder, calibration can and density tray made of plated sheet steel. The apparatus have a similar design to the ASTM/AASHTO models but the pouring cylinders and calibration can are made from precision-machined cast aluminium.

Ordering information

35-T0125

100 mm diameter sand replacement apparatus.

35-T0125/A

150 mm diameter sand replacement apparatus.

35-T0126

200 mm diameter sand replacement apparatus.

Accessories

35-T0127

Standard sand, 0.3 to 0.6 mm grain size, conforming to BS/ASTM/AASHTO. 50 kg sack.

Sand replacement set parts (BS)

Part description*	35-T0125 100 mm diameter	35-T0125/A 150 mm diameter	35-T0126 200 mm diameter
Sand pouring cylinder	35-T0125/1	35-T0125/A1	35-T0126/1
Calibration can	35-T0125/2	35-T0125/A2	35-T0126/2
Density tray	35-T0125/3	35-T0125/A3	35-T0126/3
Weight of complete set (approx.)	7.7 kg	13 kg	27.5 kg

*all parts can also be purchased individually

Field Density tools

Used to dig, level and remove soil during various field density tests.

35-T0140

Metal dibber, weight 300 g.

35-T0141

Scraper, weight 600 g.

35-T0142

Pointed steel rod, weight 100 g.

35-T0143

Density spoon, weight 150 g.

35-T0144

Rubber mallet, 50 mm diameter, weight 1 kg.

35-T0145

Hammer, weight 300 g.

35-T0145/G

Club hammer, weight 2 kg.

35-T0146

Density pick, weight 1 kg.

35-T0147

Chisel, 300mm long, weight 1 kg.

86-D1348

Tin lid lever, 5 litre capacity, weight 100 g.



35-T0126, 35-T0125/A, 35-T0125



Balloon method

The principle of operation is similar to the sand replacement method but the hole is filled with a rubber balloon into which water is pumped. The amount of water can be easily determined by reading the graduations marked on the cylinder or piston stress. Two versions are available: the ASTM/AASHTO/CNR model, with 1.6 litre capacity (35-T0131), and the NF version, with 3 or 6 litre capacity (35-T0134 and 35-T0134/A).

35-T0131

ASTM/AASHTO Balloon density apparatus

Standards

ASTM D2167 | AASHTO T205 | CNR N° 22

This test set consists of a graduated cylinder with 1596 ml capacity housed inside an aluminium guard, a reversible rubber aspirator pump, a 9" square density plate and 12 rubber balloons.

- Capacity: 1596 ml.
- Weight: 6 kg (approx.)

Accessories and spares

35-T0131/4

Rubber balloons, pack of 12.



35-T0131

NF Balloon apparatus

Standards

NF P94-061-2

This apparatus is used for determining the in-situ density of well-bonded soil according to NF specifications. A metal cylinder is filled with water which is then pumped into a rubber membrane mounted on the base of the cylinder, which fills a hole previously made in the soil. The water pressure is controlled by a pressure gauge and the volume of the balloon is measured on the graduated piston stem. Two versions are available: 3000 and 6000 ml capacity. The apparatus are supplied complete with base plate, 3 locking clamps and 6 reinforced balloons.

- Weight:
35-T0134, 9.5 kg (approx.)
35-T0134/A, 11.5 kg (approx.)



35-T0134/A



35-T0134

Ordering information

35-T0134

Balloon density apparatus, 3000 ml capacity.

35-T0134/A

Balloon density apparatus, 6000 ml capacity.

Accessories and spares

35-T0134/2

Spare reinforced 3000 ml membranes for 35-T0134. Pack of 6.

35-T0134/A2

Spare reinforced 6000 ml membranes for 35-T0134/A. Pack of 6.

Surface soil samplers

In this method a sampling tube is driven into the ground to take a standard core sample, which is then removed, trimmed, and weighed in order to establish the in-situ density of the soil. Two different versions are available, one conforming to ASTM/CNR and one to BS.

ASTM/CNR Surface soil sampler

Standards

ASTM D2937 | CNR N° 22

This apparatus is made from corrosion-resistant steel and consists of a 5 kg sliding-weight drop-hammer which falls freely onto the driving head situated above the sampling tube.

- Weight: 10 kg (approx.).
- Sampling tube: 73 mm internal diameter, 66 mm long.

Ordering information

35-T0135

ASTM/CNR Surface soil sampler.

Accessories and spares

35-T0135/1

Spare thin wall sampling tube, 73 mm internal diameter, 66 mm long.



BS Surface soil samplers (Core cutters)

Standards

BS 1377:9

This version of the soil sampler includes a core cutter, driving dolly and driving rammer. Two sizes are available: 100 and 150 mm internal diameter, both made of steel.

Ordering information

35-T0137

100 mm diameter core cutter set.

35-T0138

150 mm diameter core cutter set.



Field density of undisturbed soil

35-T0164

Piston volumeter, 30 cm³ capacity.

This is an easy to use pocket device; very useful for determining the in-situ density of undisturbed soil. A stainless steel tube is driven into the soil and the volume is read off the stem which is marked from 0 to 30cm³.

- Weight: 0.5kg (approx.).



Soil samplers parts

Description	35-T0137 100 mm diameter	35-T0138 150 mm diameter
Core cutter (weight)	35-T0137/1 (1 kg)	35-T0138/1 (4.5 kg)
Driving dolly (weight)	35-T0137/2 (1 kg)	35-T0138/2 (4 kg)
Driving rammer (weight)	35-T0137/3 (13.5 kg)	35-T0138/3 (16 kg)
Total weight (approx.)	15.5 kg	24.5 kg

Note: all parts can also be purchased individually

Bearing capacity

Plate bearing test apparatus 100, 200 and 500kN capacity

Standards

ASTM D1194 | ASTM D1195 | ASTM D1196 | BS 1377:9 | UNE 739 | UNE 7391 | DIN 18134 | CNR N° 92 | CNR N° 146

These test methods are used for estimating the bearing capacity of a soil under field loading conditions for a specific loading plate and depth of embedment (ASTM D1194). They also cover load tests on soil and flexible pavement components, for use in evaluation and design of airport and highway pavements (ASTM D1195, D1196 - BS 1377 - CNR No. 92 and No. 146 - DIN 18134).

Models available

Our new models have been designed primarily with the operator's site requirements in mind. These considerations are summarized in the following points:

- Light and easy to handle
- Easy load reading options, either by high-resolution digital manometer or with a pressure transducer and data logger
- We produce an extensive range of models which offer different levels of sophistication and load capacities and satisfy the requirements of all the relevant standards.

There are two basic versions:

- 100 / 200kN capacity, 300 mm plate diameter. 35-T1170 to 35-T1172/EL models.
- 200 kN capacity, 300, 450, 600 and 760 mm plate diameters. 35-T1173/D and 35-T1173/EL models

Each one of the above versions is available in the following configurations:

- Analogue measuring system with manometer and dial gauges
- Digital measuring system with digital manometer and analogue dial gauges
- Electronic measuring system with a pressure transducer for load measurement, three linear displacement transducers for deflection measurements and a datalogger for data acquisition, processing and display

Technical Specifications

All above versions are listed and detailed in the table on page 162 and in the ordering information

500 kN ASTM loading system

A 500 kN loading system, conforming to ASTM D1194 and ASTM D1195, is also available and can be completed with the suitable accessories (datum bar, load plates and dial gauges). See page 163.



35-T1171



35-T1171/D



Detail of the digital gauge fitted in the 35-T1170/D, 35-T1171/D, 35-T1172/D and 35-T1173/D models.

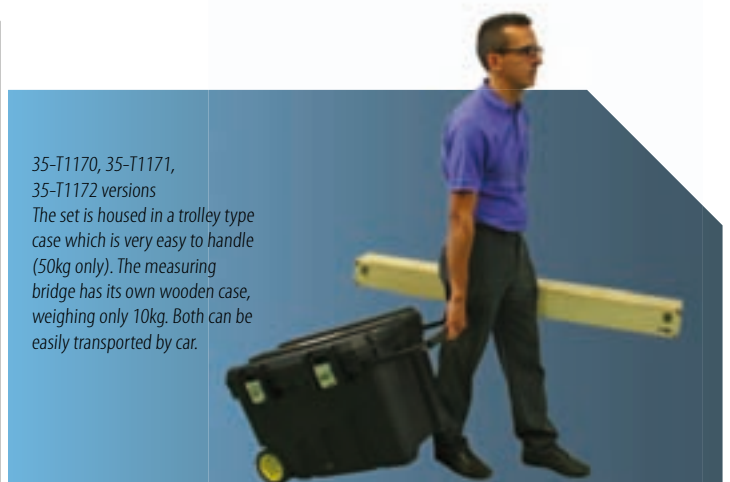
Very high resolution (65,000 divisions), 0-100 kN range, 10N minimum reading. LCD display, display height 16 mm with high visibility. Battery operated, 1 year battery life.



35-T1173/D

main features

- > 180/200mm piston travel, to meet easily the reaction loading system
- > Double-delivery hand pump for fast approach to the reaction loading system
- > Three measuring system options: Analogue, Digital with analogue dial gauges and Electronic with load and displacement transducers and a datalogger
- > Light and extremely rigid aluminium alloy measuring bridges
- > Load and measuring system housed in a practical, very easy to handle-trolley case.
- > Light and easily transportable: Analogue and Digital versions (35-T1170 to 35-T1172 series) weigh only 60kg in total, including cases
- > Supplied complete with calibration and conformity certificates



35-T1170, 35-T1171, 35-T1172 versions
The set is housed in a trolley type case which is very easy to handle (50kg only). The measuring bridge has its own wooden case, weighing only 10kg. Both can be easily transported by car.



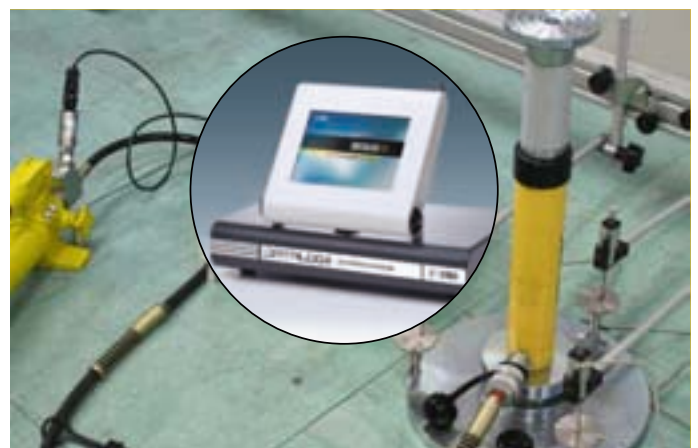
35-T1170, 35-T1170/D, Detail of dial gauge housing conforming to CNR N° 146 method A standard



35-T1173/D detail of plate set, hydraulic cylinder, dial gauges with supports, hand pump and high resolution digital gauge: 0-200kN range, 10N resolution.



Internal view of carrying cases



35-T1170/E/L Electronic version. Detail of platen assembly with pressure transducer connected to the pump, three displacement transducers and DATALOG8, data acquisition system.

Plate bearing test apparatus

Technical specifications

Models 35-	T1170	T1170/D	T1170/EL	T1171	T1171/D	T1171/EL	T1172/D	T1172/EL	T1173/D	T1173/EL
Standards	CNR 146-A	CNR 146-A	CNR 146-A	BS 1377:9 CNR 146-B	BS 1377:9 CNR 146-B	BS 1377:9 CNR 146-B	BS 1377:9 CNR 146-B	BS 1377:9 CNR 146-B	ASTM D1194 ASTM D1195 ASTM D1196 BS 1377:9 CNR 146-B	ASTM D1194 ASTM D1195 ASTM D1196 BS 1377:9 CNR 146-B
Capacity, kN	100	100	100	100	100	100	200	200	200	200
Plate diameter(s), mm	300	300	300	300	300	300	300	300	300 450 600 760	300 450 600 760
Deflection measurement method	30 x 0.01mm dial gauge	30 x 0.01mm dial gauge	One electronic transducer	Three 30 x 0.01mm dial gauges	Three 30 x 0.01mm dial gauges	Three electronic transducers	Three 30 x 0.01mm dial gauges	Three electronic transducers	Three 30 x 0.01mm dial gauges	Three electronic transducers
Load measurement method (scale and divisions/resolution)	Manometer 200mm diameter 0-50 kN scale 250 N div.	Digital pressure gauge 0-100 kN 10 N res.	Pressure transducer and data logger	Manometer 200mm diameter 0-50 kN scale 250 N div.	Digital pressure gauge 0-100 kN 10 N res.	Pressure transducer and data logger	Digital Pressure gauge 0-200 kN 10 N res.	Pressure transducer and data logger	Digital pressure gauge 0-200 kN 10 N res.	Pressure transducer and data logger
Data acquisition	-	-	Datalog8* with 82-P9008/1 Inverter and case	-	-	Datalog8* with 82-P9008/1 Inverter and case	-	Datalog8* with 82-P9008/1 Inverter and case	-	Datalog8* with 82-P9008/1 Inverter and case
Case dimensions, cm and approximate weights	Trolley 80 x 48 x 50 50 kg Wooden case 137 x 15 x 12 10 kg	Trolley 80 x 48 x 50 50 kg Wooden case 137 x 15 x 12 10 kg	Trolley 80 x 48 x 50 50 kg Wooden case 137 x 15 x 12 10 kg	Trolley 80 x 48 x 50 50 kg Wooden case 137 x 15 x 12 10 kg	Trolley 80 x 48 x 50 50 kg Wooden case 137 x 15 x 12 10 kg	Trolley 80 x 48 x 50 50 kg Wooden case 137 x 15 x 12 10 kg	Trolley 80 x 48 x 50 50 kg Wooden case 137 x 15 x 12 10 kg	Trolley 80 x 48 x 50 50 kg Wooden case 137 x 15 x 12 10 kg	Trolley 80 x 48 x 50 50 kg Wooden case 162 x 31 x 12 27 kg Wooden pallet 96 x 95 x 20 200 kg	Trolley 80 x 48 x 50 50 kg Wooden case 162 x 31 x 12 27 kg Wooden pallet 96 x 95 x 20 200 kg
Total weight, kg (approx.) (including cases)	60	60	60	60	60	60	60	60	277	277

* Complete with plastic carrying case. For detailed information see page 552

Ordering information

Analogue models

35-T1170

Plate bearing test apparatus, 100 kN capacity, 300 mm diameter plate, pressure gauge 0-50 kN range, 250 N divisions, conforming to CNR No. 146 method "A", one dial gauge.

35-T1171

Plate bearing test apparatus, 100 kN capacity, 300 mm diameter plate, pressure gauge 0-50 kN range, 250 N divisions, conforming to BS 1377:9 and CNR No. 146 method "B", three dial gauges.

Digital models

35-T1170/D

Plate bearing test apparatus, 100 kN capacity, 300 mm diameter plate, digital

pressure gauge 0-100 kN range, 10 N resolution, conforming to CNR No. 146 method "A", one dial gauge.

35-T1171/D

Plate bearing test apparatus, 100 kN capacity, 300 mm diameter plate, pressure gauge 0-100 kN range, 10 N resolution, conforming to BS 1377:9 and CNR No. 146 method "B", three dial gauges.

35-T1172/D

Plate bearing test apparatus, 200 kN capacity, 300 mm diameter plate, pressure gauge 0-200 kN range, 10 N resolution, conforming to BS 1377:9 and CNR No. 146 method "B", three dial gauges.

35-T1173/D

Plate bearing test apparatus, 200 kN capacity, 300, 450, 600 and 760 mm diameter plates, pressure gauge 0-200 kN range,

10 N resolution, conforming to ASTM D1194-D1195-D1196, BS 1377:9 and CNR No. 146 method "B", three dial gauges.

Electronic models

35-T1170/EL

Plate bearing test apparatus, 100 kN capacity, 300 mm diameter plate, complete with pressure transducer, one displacement transducer and Datalog8 data acquisition and display unit. Battery operated with adaptor for 110-230 V. Conforming to CNR No. 146 method "A".

35-T1171/EL

Plate bearing test apparatus, 100 kN capacity, 300 mm diameter plate, complete with pressure transducer, three linear displacement transducers and Datalog8 data acquisition and display unit. Battery operated with adaptor for 110-230 V.

Conforming to BS 1377:9 and CNR No. 146 method "B".

35-T1172/EL

Plate bearing test apparatus, 200 kN capacity, 300 mm diameter plate, complete with pressure transducer, three linear displacement transducers and Datalog8 data acquisition and display unit. Battery operated with adaptor for 110-230 V. Conforming to BS 1377:9 and CNR No. 146 method "B".

35-T1173/EL

Plate bearing test apparatus, 200 kN capacity, 300, 450, 600 and 760 mm diameter plates, complete with pressure transducer, three linear displacement transducers and Datalog8 data acquisition and display unit. Battery operated with adaptor for 110-230 V. Conforming to ASTM D1194-D1195-D1196, BS 1377:9 and CNR No. 146 method "B".

Electronic components of the Plate bearing test apparatus, models 35-T1170/EL | 35-T1171/EL | 35-T1172/EL and 35-T1173/EL

The Electronic Plate bearing apparatus models listed above include a pressure transducer to be fitted to the hand pump, three linear displacement transducers to measure the deflection and a datalogger for data acquisition and display. These components can also be purchased individually to convert an analogue to an electronic model and to create a loading system using the other available accessories.

82-P0324

Linear displacement potentiometric transducer, 50 mm travel.

Specifications

- Input voltage: 10V DC
- Output: from 0 to 10V DC
- Repeatability: better than 0.002 mm
- Accuracy: better than 0.002 mm
- Weight: 100 g (approx.)

82-P0700

Pressure transducer, range 0-700 bar.

Specifications:

- Accuracy: $\pm 0.5\%$
- Resolution: infinite
- Weight: 150 g (approx.)



82-P0324



82-P0700

Datalog8 82-P9008, 8-channel multipurpose datalogger



82-P9008

35-T0116/33

500 kN capacity loading system

Standards

ASTM D1194 | ASTM D1195

This apparatus consists of a 500 kN capacity hydraulic jack, spherical seat, hand pump and pressure gauge and is supplied complete with a wooden carrying case. The set can be completed with a datum bar, dial gauges and load plates to make a complete Plate bearing test apparatus that suits your requirements. See Accessories.

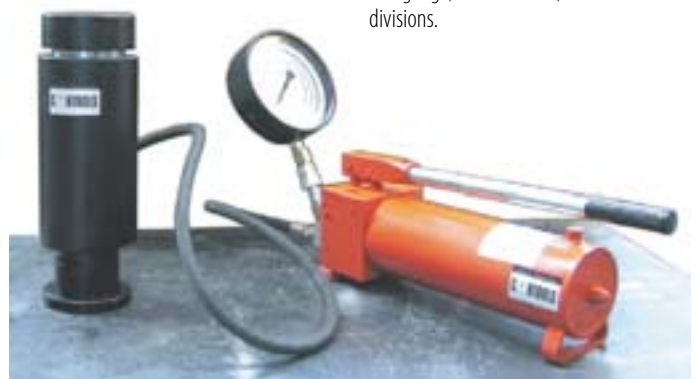
Weight: 40 kg (approx.)

Accessories

Datum bars (measuring bridges)

35-T1171/10

Datum bar, 2.5 m long, complete with three dial gauge supports.



35-T0116/33

35-T1173/10

As above but 5.5 m long.

Load plates

35-T0116/27

Load plate, 300 mm diameter. Weight 14 kg (approx.).

35-T0116/23

Load plate, 450 mm diameter. Weight 28 kg (approx.).

35-T0116/24

Load plate, 600 mm diameter. Weight 55 kg (approx.).

35-T0116/25

Load plate, 760 mm diameter. Weight 80 kg (approx.).

Dial gauges

82-D1259/B

Dial gauge, 50 mm travel, 0.01 mm divisions.

82-D1257

Dial gauge, 30 mm travel, 0.01 mm divisions.

82-D1255

Dial gauge, 10 mm travel, 0.01 mm divisions.



Set of load plates, dial gauges, dial gauge supports and datum bar (partial view).

Bearing capacity and deflection

Aluminium bearing plate 600mm diameter

Standards

NF P94-117-1

This bearing plate is normally used, together with a hydraulic jack, hand pump with manometer and the 80-B0180 Benkelman beam apparatus, for determining the bearing capacity and deflection of road pavements as fully described on page 472

It can also be conveniently used in plate load testing as an alternative to the standard 300 to 760 mm diameter steel plates. The aluminium bearing plate should be completed with the accessories specified below.

Ordering information

80-B0180/B1

Aluminium bearing plate, 600 mm diameter, with reinforcing ribs. Weight 30 kg (approx.).

Accessories

80-B0180/B2

Hydraulic jack, 200 kN capacity. Weight 10 kg (approx.).

80-B0180/B3

Three interchangeable extensions with spherical seated foot. Weight 12 kg (approx.).

80-B0180/B4

Hand pump with 200 mm diameter high-precision manometer. Calibrated in bar (0 to 3.5) and in daN (0 to 10000). Complete with connecting hose. Weight 11 kg (approx.).

80-B0180/B5

Carrying case for the above items except for the 80-B0180/B1. Weight 10 kg.

80-B0180*

Benkelman beam apparatus. Weight 10 kg

80-B0181*

Wooden carrying case for 80-B0180



80-B0180/B1

* For more informations see page 472



80-B0180/B1, 80-B0180/B2, 80-B0180/B3, 80-B0180/B4

Plate bearing test - Swiss method

Standards

SNV 70312

This method is used to estimate the bearing capacity of a soil under field loading conditions on flexible pavement components.

The relatively low weight (68 kg in total) and small dimensions of this apparatus make it very easy to use and to move from one place to another. The measuring bridge, made from aluminium alloy, is very light and has telescopic extensions so it can be positioned in a few minutes with minimum effort. The remote load control and gauge are mounted on the pump so it is not necessary to go near the plate for recording the load. The deformations are measured with three dial indicators.

Specifications

- Loading ram capacity: 100 kN
- Gauge range: 0 to 0.8 MN/m²
- Dial indicators: 3 no., 30 mm travel, 0.01 mm divisions
- Carrying case dimensions:
 - 1) 1080 x 360 x 200 mm
 - 2) 920 x 360 x 200 mm
- Total weight: 68 kg (approx.)

Ordering information

35-T0121

Plate bearing test apparatus, 100 kN capacity, 300 mm plate diameter.



35-T0121

Dynamic deformation modulus of soil

35-T0120

Lightweight deflectometer

Standards ASTM E2835-11* | TP-BF**-StB part 8.3/2012 | ZTV E-StB 09 | ZTV T-StB 95 | ZTV A- StB 97 | RVS 8 (Austrian regulations) | RIL 836

*Standard test method for measuring deflections using a portable impulse plate load test device

**German technical test standard for soil and rock in road construction

The dynamic plate load test performed with the Lightweight deflectometer is used to determine the soil bearing capacity and compaction quality of soils and non-cohesive subbases, as well as for soil improvement applications. Built-in soil layers can easily be tested without load abutment, facilitating quick assessments of test lots even under limited space conditions. The test method is suited to coarse-grain and mixed grain soils with a maximum grain size of 63mm and can be used to determine the dynamic modulus of deformation of soil in the range $E_{vd} = 15$ to 70 MN/m^2 .



35-T0120 during operation

Applications

- Road and railway construction, earth moving
- Quality assurance in canal construction
- Compaction monitoring in pipe trenches and cable ducts
- Testing of pavement bedding
- Testing of foundation backfill
- Quality inspection in boreholes
- Testing of modulus of deformation in line with soil exploration

Intra-company monitoring saves costs!

Being easy to handle and providing immediate measuring results, the Lightweight deflectometer is especially suited for monitoring intra-company operations. It facilitates quick decisions for continu-

ing construction at the site. The documentation can be printed directly at the site via the thermal printer or as a protocol printout after transferring and processing the data on a PC.

Advantages of the Dynamic Plate Load Testing.

- Fast and cost-saving
 - Time-saving (maximum 2 minutes per measuring point)
 - No vehicle required
 - Immediate on-site evaluation of test results
- Easy to handle
 - Low tester weight, few components, human-engineered
 - Easy for one person to operate and carry

- Testing can be achieved in difficult-to-reach locations
- Reliable and precise
 - Calibrated by an approved calibration institute
 - Complies with the latest state of the art technology
 - Field tested and used successfully throughout the world
 - Calibrated according to ASTM E2835-11 by authorization of the Federal Highway Research Institute

Specifications

Loading mechanism

Total weight: 15 kg
 Drop weight: 10 kg
 Maximum impact force: 7.07 kN
 Duration of impact: 17 ms
 Material: zinc coated/hard-chrome plated steel

Load plate

Diameter: 300 x 20 mm
 Total weight: 15 kg
 Material: zinc coated steel

Electronic settlement measuring instrument

Interfaces: USB, Thermal-Printer, GPS
 Power supply: 4 x R6 batteries
 Dimensions: 210 x 100 x 45 mm
 Settlement measuring range: 0.1 to 2.0 mm \pm 0.02 mm
 Measuring range: $E_{vd} < 225 \text{ MN/m}^2$
 Temperature range: 0 to 40°C
 Storage capacity of measured data: 500 series

Accessories

35-T0120/1

Transport cart for easier on-site transport of the Lightweight deflectometer between the measuring points.

35-T0120/2

Magnetic base plate for proper positioning of loading unit.

35-T0120/3

Thermal printer, small and quick, with light resistant paper, for documenting the test results within seconds at any time and any place.

35-T0120/4

Protocol software for user-friendly evaluation and processing of measurement series.

35-T0120/5

Transport box for secure transport of the Lightweight deflectometer to the site and between measuring points.



35-T0120/2



35-T0120/5



35-T0120/1

SOIL PERMEABILITY

Constant and Falling head apparatus

The permeability of soil is a very important factor in the study of the natural behaviour of soil with respect to water flow.

Two different methods of testing are proposed:

Constant head apparatus (models 38-T0184/A1 to 38-T0184/A11). Particularly suitable for relatively coarse-grained soil such as sands and gravel.

Falling head apparatus (models 38-T0185/1 to 38-T0185/4). More appropriate for fine-grained soils such as clay-like or silty soils.

Constant head apparatus

Standards

ASTM D2434 | AASHTO T215 | BS 1377:5

This test set includes a transparent plastic permeability cell (available in two sizes: 75 and 114 mm diameter), a stand with 3 manometer tubes (38-T0184/A2) and a constant level tank (38-T0184/A3).

Ordering information

38-T0184/A1

Constant head permeability cell, 75mm internal diameter, 3 take-off points.

38-T0184/B1

Constant head permeability cell, 114mm internal diameter, 6+6 (blanked) take-off points.

38-T0184/A2

Manometer stand with 3 manometer tubes.

The metal stand comprises 3 constant bore tubes, a metre scale, nipples and connecting tubing.

Dimensions: 1150 x 200 x 50 mm.

Weight: 3 kg (approx.)

38-T0184/A3

Constant level tank. Manufactured from acrylic glass. Complete with inlet, outlet, overflow, connecting tubing for the cell and attachment for wall mounting.

Dimensions: 250 x 155 x 160 mm.

Weight: 2.6 kg (approx.)

38-T0184/A11

Tamping rod, 8 mm diameter x 300 mm height.

Falling head apparatus

This apparatus is particularly suitable for fine-grained soils such as clay-like or silty soils with a permeability in the range of 1×10^{-2} to 1×10^{-6} cm/s. The test is performed with a permeability cell (38-T0185/1), which has to be connected to a manometer stand (38-T0185/2). During the test the cell is placed in a soaking tank fitted with an overflow tube (38-T0185/3). A vacuum pump can be connected to the cell to saturate the sample before testing. See Accessories.

As an option, the apparatus can be used with a suitable de-airing system such as the De-airing apparatus (28-WF4202) with De-airing tank (28-WF4220/A or 28-WF4221/A), Vacuum pump (86-D2001), Air drying unit (86-D2005) and Vacuum control panel (38-T085/4). See Accessories and general layout next page.

Ordering information

38-T0185/1

Falling head permeability cell, 100 mm internal diameter.

Complete with 75 micron gauze and 2 m of tubing

38-T0185/2

Manometer stand, with 4 glass manometer tubes, 1500 mm long, of 21, 12, 5 and 3.5 mm internal diameter.

Back panel dimensions: 1680x 280 mm.

Weight: 3.6 kg (approx.)

38-T0185/3

Soaking reservoir, made from plated steel, complete with overflow tube.

Dimensions: 230 mm diameter x 230 mm height.

Weight: 2.3 kg (approx.)



38-T0184/A3,
38-T0184/A2,
38-T0184/A1



38-T0185/1
with 38-T0185/3 and
38-T0185/2

Permeability cell specifications

Cell model	38-T0184/A1	38-T0184/B1
Nominal internal diameter	75 mm	114 mm
Cell body	Transparent plastic	Transparent plastic
Take-off points	3	12 (6 blanked off)
Upper and lower plates	Anodised aluminium	Anodised aluminium
Weight (approx.)	2.7 kg	6.5 kg

Note: to use the 38-T0184/B1 cell, two manometer stands (38-T0184/A2) are required.

Accessories for falling head apparatus

De-airing and vacuum system

De-airing tanks

Used in conjunction with a vacuum source and related accessories, this item provides a very efficient and therefore quick means of removing the air from water. The de-airing tank consists of a transparent plastic cylinder fitted with a water spray inlet, an air outlet and a water outlet. A suitable vacuum supply is connected to the air outlet and water is sucked into the cylinder in a fine spray via the water inlet.

The tanks are supplied complete with a metal stand and have to be mounted at a high level so that the tank can fill the testing system by gravity.

Two models are available:

28-WF4220/A

7 litre capacity de-airing tank.
Overall dimensions: 579 x 200 x 209 mm.
Weight: 6.4 kg (approx.).

28-WF4221/A

23 litre capacity de-airing tank.
Overall dimensions: 619 x 320 x 311 mm.
Weight: 12 kg (approx.).



28-WF4220/A

Vacuum pump

86-D2001

Portable vacuum pump.
Free air displacement: 75 l/min.
Ultimate vacuum: 0.1 mbar.
230 V, 50-60 Hz, 1 ph.

86-D2001/Z

As above but 110 V, 60 Hz, 1 ph.

86-D2064

Rubber tube for vacuum pump.
ID 6.5 mm, OD 16.5 mm.



86-D2001

Air drying unit

86-D2005

Air drying unit

This item is installed between the vacuum pump and the de-airing tank to prevent / limit water vapour mixing with the oil of the vacuum pump, which, in significant quantities, may cause serious damage to the pump. It has to be filled with a suitable desiccant (e.g. Silica gel desiccant 86-D0819). For more details about complete de-airing systems see page 570

Specifications

Plastic frame with acrylic cylinder.

Desiccant capacity:
500 g (approx.).

Overall dimensions:
185 x 300 mm (d x h) (approx.).

Weight when empty:
1 kg (approx.)

86-D0819

Silica gel desiccant with indicator,
1000 g bottle.



86-D0819, 86-D2005

Vacuum control panel

38-T0185/4

Vacuum control panel.
Used for saturating samples. Includes adjustable vacuum valve and vacuum gauge.
Two manifolds of 3 and 6 lines.
Weight: 3 kg (approx.).



38-T0185/4

Hydraulic conductivity by compaction mould permeameters

Standards

ASTM D5856

This test method covers laboratory measurement of the hydraulic conductivity (also referred to as the coefficient of permeability) of laboratory-compacted materials in compaction-mould permeameters conforming to ASTM D5856: Constant head method A and Falling head method B-C-D. The testing system includes a compaction-mould permeameter (available in two sizes: 4" and 6" diameter) and a permeability stand (38-T0179/B) which is suitable for either constant or falling head permeability determination.

Compaction-mould permeameters

The 4" (101.6 mm) diameter model (38-T0180) is based on a standard Proctor mould and the 6" (152.4 mm) diameter (38-T0181) on a CBR mould. Both comprise mould and collar, valve, water inlet or outlet, perforated base plates and filter screens. The moulds are designed to prevent swelling of the test specimen.

Weight:

38-T0180: 8 kg (approx.)

38-T0181: 16 kg (approx.).



38-T0180, 38-T0181

Ordering information

38-T0180

Compaction-mould permeameter, 4" (101.6 mm) diameter.

38-T0181

Compaction-mould permeameter, 6" (152.4 mm) diameter.

38-T0179/B

Constant and Falling head permeameter stand four cell capacity

This apparatus is used to control the water supply in the constant or falling head permeability tests on compacted soils.

The stand consists of two wall-mounted aluminium panels. The larger one is for falling head permeability tests, with four transparent plastic tubes and graduated scales, the other is for constant head permeability tests and has a height-adjustable water reservoir and comes complete with tubing and valves.

Specifications

- Max adjustable height of constant head tank: 3850 mm
- Cell capacity: four cells
- Overall dimensions of panels:
 - Falling head panel: 800 x 1100 x 130 mm (with four transparent tubes)
 - Constant head panel: 240 x 1920 x 300 mm (with water reservoir)
- Weight: 70 kg (approx.)



38-T0179/B. The wall mounted panels can be conveniently positioned at an appropriate height. The water reservoir can be easily adjusted in height up to the maximum height of 3850 mm for the selected constant head value.

Determination of dispersibility

38-T0186

Combined constant or falling head apparatus

Standards

ASTM D2434

This apparatus can be used for either the constant or falling head method, to determine the soil permeability. It consists of a two-section plastic chamber, a plated steel top with gaskets, a plastic funnel reservoir (with a maximum head of 550 mm with the reservoir upright) and a 100 cc pipette. Also included are two porous stones, 63.5 mm diameter by 12.7 mm thick, with an average pore size of 300 microns.

Weight: 4.5 kg (approx.)

Spare parts

38-T0186/1

Spare porous stone 63.5 mm dia x 12.7 mm thick. Pack of 5.



38-T0186

38-T0189/A

Pinhole test apparatus

Standards

ASTM D4647 | BS 1377:5

Certain fine-grained soils with a high sodium content are highly susceptible to erosion by the water flowing through them. During the dispersibility test the flow of water through a cavity in the soil under a high hydraulic gradient is reproduced. The test apparatus consists of a cylindrical metal container fitted with a water inlet at one end and an outlet connection at the other, a standpipe tube with scale, and a stand to support the pinhole apparatus.

Weight: 3.5 kg (approx.)

Accessories

38-T0184/A3

Constant level tank.

38-T0184/A5

PVC tubing, 10 mm OD, 8 mm ID, 10 m coil.



38-T0189/A