

Tensile Properties - Force-Ductilometer Method - DDA 3 (automatic)

ASTM D 113, ASTM D 5892, ASTM D 6084, ASTM P 226 (obs.), EN 13398, EN 13589, EN 13703, IP 32 (obs.), IP 515, IP 516, IP 520, JIS K2207, NF T66-006 (obs.), AASHTO T51, AASHTO T300, AASHTO T301

Product group(s): Bitumen

User group(s): Asphalt, Bitumen, Polymers, Road Research

Scope: The Ductility or Elongation:
is measured by the distance to which a sample will elongate before breaking when two ends of a specimen briquette are pulled apart at a specified speed and at a specified temperature. It may be used for quality specifications.

The Force-Ductility:
measures tensile properties on the basis of the performed force and the specimen strain. A specimen briquette is pulled apart at a specified speed and at a specified temperature until the briquette ruptures or a specified strain is achieved.

The Elastic Recovery:
is measured by the recoverable strain determined after a specified time after severing an elongated briquette specimen. The specimens are pulled to a specified distance at a specified speed and at a specified temperature, cut apart and after a specified time of recovering the reduction in relation to the total distance is measured. This is useful in confirming that a material has been added to the asphalt to provide a significant elastomeric characteristic.

The Deformation Energy:
is a significant characteristic for the adhesive power of polymer-modified bitumen.

With the ductility machines of the DDA 3 series the afore mentioned procedures can be performed automatically. Except for recovery tests, 3 tests can be performed simultaneously.

The drive is microprocessor controlled and uses a stepping motor and a feed rod. Both are located outside the tempering bath and therefore are not affected by corroding influences of the bath liquid.

The tempering bath itself is double-walled with an outer water circulation system. The tractor cradle is made of stainless steel as well as the bath walls.

If extremely thin threads are measured, the built-in circulation pump for the inner bath can be switched off.

A very even and exact temperature can be obtained in the bath by the connection of a good coolant circulator and due to several temperature probes plus the transparent bath cover.

Traction speed, elongation and pauses can be pre-set on the control unit. During the whole test run the tensile force on each line is permanently measured. The maximum tensile force may be up to 300 Newton's per line. With the DDA 3 a minimum tensile force margin can be set.

When a bitumen briquette ruptures and the tensile falls below this setting, the pertinent elongation will be stored and the machine will be stopped automatically after all three briquettes have broken.

There is a special program for recovery tests of polymer-modified bitumen. The bitumen briquette will be expanded to a pre-set elongation, then the tractor (after a pause) returns to a position where no more stress is in the material, equivalent to the cut-up state of the specimen.

If due to any recovery of the material a tension should occur, the tractor will move until there is a stress-free condition again.

- 3 simultaneous tests
- 4 different molds

The control unit is equipped with two RS232 interface. This allows to connect a serial printer and a PC to record all test parameters, the final values on each test line as well as peaks with their pertinent elongation. Further, the DDA 3 has analog output sockets so that force/elongation curves can be drawn.

The ductility meters are also available as DD 3 in a basic version without force measurement. These models have a digital indication of the elongation only.

DDACon Software

A program for recording, saving and graphic presentation of DDA values.

Replacing analog line recorder or serial data-printer, allows to control the DDA by PC, the data-transfer to MS EXCEL® or LIMS and simplifies the download of firmware-upgrades.

The sample status of up to 3 samples will be displayed simultaneously, indicating the traction distance or for Recovery-tests the percentage of relief and the total energy.

Significant points like the local minimum, maximum, turn-points of in- & decreasing flanks and tangent-points can be determined automatically and displayed as diagram or chart.

The numerical display of force or distance for a single point on the curve is possible, too.

Individual diagram areas can be increased, curves can be hidden or indicated numerically.

Since every sample will be saved under an individual filename, it is possible to compare 3 samples of different tests with each other.

The evaluated data can be exported as ASCII-files. They include information like the sample name, file name, user ID, date & time, duration, program, speed, temperature at start & end, status and distance & force.

- 2 elongation & 2 recovery programs
- force & rupture detection
- high constancy of speed & temperature
- different lengths available

Printing of numerical or graphic evaluations, including relevant point like maxima and fracture are possible on a usual printer.



Ductilometer Test Equipment

to be composed of:

- Automatic **Force-Ductilometer** - DDA 3
- **Circulator** for external & internal heating & cooling
- **Hose-Set** for circulator

Technical Data

DDA 3 / 100 - for test length up to 100 cm

Technical Data:

Working Range: approx. -10 to +60 °C (depending on the cooler)

Travel Length: 100 cm (maximum)

Test Positions: 3 (in a 30 l bath)

Traction Standard: 50 mm/min.

Speed: Variable: 2.5 to 140 mm/min.

Tension Force: 300 N / test position (maximum)

Connections for: line-recorder, serial printer, PC (RS232), cooler (Ø 8 mm)

Dimensions:

Bath: 170 x 40 x 50 cm (WxDxH), weight: 70 kg

Controller: 35 x 25 x 15 cm (WxDxH), weight: 6 kg

Printer: 37 x 28 x 16 cm (WxDxH), weight: 5 kg

DDA 3 / 150 - for test length up to 150 cm

Technical Data:

Working Range: approx. -10 to +60 °C (depending on the cooler)

Travel Length: 150 cm (maximum)

Test Positions: 3 (in a 45 l bath)

Traction Standard: 50 mm/min.

Speed: Variable: 2.5 to 140 mm/min.

Tension Force: 300 N / test position (maximum)

Connections for: line-recorder, serial printer, PC (RS232), cooler (Ø 8 mm)

Dimensions:

Bath: 220 x 40 x 50 cm (WxDxH), weight: 92 kg

Controller: 35 x 25 x 15 cm (WxDxH), weight: 6 kg

Printer: 37 x 28 x 16 cm (WxDxH), weight: 5 kg

Main Unit

10-0360

DDA 3 / 100 - Automatic Force-Ductilometer
(test length up to 100 cm)

Elongation-Tests:

ASTM D 113 - AASHTO T51 - JIS K2207
(DIN 52013, IP 32, NF T66-006)

With further accessories suitable for:

Recovery-Tests:

ASTM D 5892 (ASTM P 226) & ASTM D 6084 -
AASHTO T301 - IP 516 - EN 13 398 (DIN V 52021-1)

Force-Tests:

EN 13 589 - IP 520 & EN 13 703 - IP 515 - AASHTO T300

Features:

- variable traction speed up to 140 mm/min.
- force detection by high resolution (10 mN) 300 N-sensors
- automatic rupture detection above 20 mN is possible
- constancy of speed and temperature at minor bath motion is better than demanded by the standards
- without cooling coils, therefore easy to clean

Bath: for 3 simultaneous tests, made of stainless steel, double-walled and full insulated, closed cycle cooling system, circulation pump to be switched off, temperature probe, bath illumination and acrylic bath cover.

Control Unit: with microprocessor, membrane keypad, digital display (LCD) of program, traction speed, distance, tensile force and temperature; analog output for 3 force-channel line-recorder, RS 232-interfaces for printer & PC

4 Programs:

- Semi-Automatic Elongation for rupture forces below 20 mN
- Automatic Elongation for rupture forces of 20 mN to 300 N
- Semi-Automatic Elastic Recovery for polymer modified bitumen (in accordance with ASTM D 6084, EN 13398 and other methods)
- Automatic Elastic Recovery for polymer modified bitumen (similar to ASTM D 6084 and other methods)

Serial Impact Printer: for single sheet & continuous paper (incl. data transmission cable) for printouts of 3 test points with following parameters: program, traction speed, distance, tensile forces, temperatures, percentage of elastic recovery, energy (the result of integral) (not suitable for DDACon-Software printouts)

Supplied with:

3 molds (acc. ASTM D 113, if not ordered otherwise),
3 mold-holders,
2 corrosion protection specimen,
2 contrast inlays and distance pieces

Note: External cooling device for filling the bath-jacket is required. Windows® PC-Software DDACon is available.

Power supply: 220/240 V, 50/60 Hz, EU-plug

10-0361

**DDA 3 / 100 - Automatic Force-Ductilometer
(test length up to 100 cm)**

Like 10-0360 but:

Power supply: 115 V, 60 Hz, US-plug

10-0364

**DDA 3 / 150 - Automatic Force-Ductilometer
(test length up to 150 cm)**

Elongation-Tests:

ASTM D 113 - AASHTO T51 - JIS K2207
(DIN 52013, IP 32, NF T66-006)

With further accessories suitable for:

Recovery-Tests:

ASTM D 5892 (ASTM P 226) & ASTM D 6084 -

AASHTO T301 - IP 516 - EN 13 398 (DIN V 52021-1)

Force-Tests:

EN 13 589 - IP 520 & EN 13 703 - IP 515 - AASHTO T300

Like 10-0360 but:

with 3 contrast inlays and distance pieces and variable technical data. (mentioned in the "Technical Data" section)

Power supply: 220/240 V, 50/60 Hz, EU-plug

10-0365 DDA 3 / 150 - Automatic Force-Ductilometer (test length up to 150 cm)

Like 10-0364 but:

Power supply: 115 V, 60 Hz, US-plug

10-0380 Circulator (external & internal heating & cooling) with accessories



For heating & cooling of instruments without circulation pump (e.g. bath jacket filling device) and / or for tempering applications directly in the bath.

Consisting of:

Cooler with stainless steel bath. Thermostat with digital display, splash-proof keypad, heater, pump, RS232/RS485-interface, Pt-100-socket, programmer, over/under-temperature & low-level protection, adjustable pump-pressure, proportional cooling control.

Supplied with: 1 bath cover, 1 drain tap, 1 junction line for temperature probe (10-0382)

Note: Insulated hose-set is recommended.

Technical Data:

Working range: -40 to +200 °C (at +5 to +40 °C ambient temp.)

Display / Resolution: VFD & LCD / 0.01 °C

Control: ICC / Integrated Programmer

Heater capacity: 2000 W

Cooling capacity: 680 W at +20 °C

Pump-Pressure capacity: 22-26 l/min, 700 mbar

Pump-Suction capacity: 22-26 l/min, 400 mbar

Bath opening: 23 x 14 x 20 cm (WxDxH)

Safety class / Bath fluid: 3 / FL (Flammable Liquids possible)

Volume: 16 l

Sockets for: Pt-100, solenoid valve

Dimensions / Weight: 37 x 46 x 71 cm (WxDxH), 49 kg

Power supply: 230 V, 50 Hz

10-0381 Circulator (external & internal heating & cooling) with accessories

Like 10-0380 but:

Power supply: 230 V, 60 Hz (115 V not available)

25-0228 Hose-Set, insulated (Ø 8 mm, 2 x 2 m, incl. fittings)

Options & Accessories

10-0404 PC Software - DDACon (Windows®)

A program for recording, saving and graphic presentation of DDA values.

Replacing analog line recorder or serial serial printer, allows to control the DDA by PC, the data-transfer to MS EXCEL® or LIMS and simplifies the download of firmware-upgrades.

Supplied with: 1 PC-data-cable, 1 USB/RS232-converter

10-0332 Mold (4-piece), brass



EN 13 398 - IP 516
for bitumen briquettes preparation

10-0334

Mold (4-piece), brass
former: DIN 52 013 - NF T 66-006 - IP 32
for bitumen briquettes preparation



10-0335

Mold (4-piece), brass
ASTM D 113 - AASHTO T 51
for bitumen briquettes preparation



10-0336

Mold (4-piece), brass
ASTM D 5892 - ASTM D 6084 - AASHTO T 300 -
AASHTO T 301 - EN 13 589 - EN 13 703 - IP 515 - IP 520
(former ASTM P 226)
for bitumen briquettes preparation



10-0333

Mold Holder (fits 10-0332, 10-0334, 10-0335 and 10-0336)

10-0379

Calibration Set - DDA/DD



Consisting of:
1 set of precision resistor plugs,
3 weights with steel-rope,
1 pulley,
1 certified thermometer (0 to +50 : 0.1°C),
1 thermometer holder,
1 digital stop watch,
1 tape-measure with mm-division

10-0383

Thermometer DIN 12775 - E0,1/0/50
Range: 0 to +50 : 0.1 °C
Length: 220 mm, Immersion: --, Ø 8 mm

10-0384

Thermometer DIN 12775 - E0,1/0/50
Range: 0 to +50 : 0.1 °C (officially certified)

10-0403

Rack, 80 x 25 x 42 cm (L x W x H)
to place controller and printer behind the Ductilometer

18-0403

Circulator-Bath (internal & external heating)
with cooling-coil & intermediate bottom



For tempering applications directly in the bath (e.g. sample pre-tempering) and / or for heating of instruments without circulation pump (e.g. PNR-tempering dish).

Consisting of:

Stainless steel bath with adjustable intermediate bottom and cooling-coil.
Thermostat with digital display, splash-proof keypad, heater, pump, RS232-interface, over-temperature- & low-level-protection.

Supplied with:

1 bath cover Ø 5 cm, 1 bath cover 20 x 20 cm, 1 thermometer (-2 to +105 : 0.5 °C)

Note:

Requires counter-cooling for applications near ambient temperatures. Hose not included. Insulated hose-set is recommended.

Technical Data:

Working range: +20 to +150 °C (at +5 to +40 °C ambient temp.)

Display / Resolution: LED / 0.01 °C

Control: PID

Heater capacity: 2000 W

Pump-Pressure capacity: 15 l/min, 320 mbar

Bath opening: 20 x 20 x 25 cm (WxDxH)

Safety class / Bath fluid: 3 / FL (Flammable Liquids possible)

Volume: 20 l

Dimensions / Weight: 37.5 x 45 x 47.5 cm (WxDxH), 3.4 kg

Power supply: 230 V, 50 Hz, EU-plug

18-0402 **Circulator-Bath (internal & external heating)**
with cooling-coil & intermediate bottom

Like 18-0403 but:
Heater capacity: 1000 W
Power supply: 115 V, 60 Hz

11-0181 **Hose, silicon (Ø 8 mm, 8 m)**

Spare Parts

10-0377 **Contrast Inlay (6 x 170 x 550 mm) pack of 1**

10-0406 **Corrosion Protection Specimen (200 x 100 mm) pack of 2**

11-0599 **USB/RS232-Converter (verified for petrotest®-units)**
with 2 m cable connecting 1 serial port with the USB-port of a PC or Hub



25-0262 **PC-Data-Cable (0-modem), 2 m, serial, RS232**

Order Guideline

Minimum equipment:	1 each of DDA 3, 10-0380, 10-0404
Spares (approx. 1 year):	3x molds, 1x 10-0406
Additional requirements:	PC