

4PB B210 STAND-ALONE SERVO-PNEUMATIC FOUR POINT BENDING (4PB) SYSTEM B210-01 SERVO-PNEUMATIC 4PB APPARATUS

Standard: AASHTO T321, AST 03, EN12697-24 Annex D, EN12697-26 Annex B and ASTM-D7460

The Pavetest Servo-pneumatic Four Point Bending (4PB) System is a servo-pneumatic testing machine utilizing digital control of a high performance servo valve to provide accurate loading wave shapes up to 60Hz. The 4PB system can be operated in haversine or sinusoidal, controlled strain or sinusoidal controlled stress mode to determine the flexural stiffness/modulus and resistance to fatigue of asphalt beams of various sizes.

The 4PB System is underpinned by Pavetest's leading edge CDAS digital controller, TestLab software and a full complement of accessories... hardware and software in perfect unison.



CDAS Digital Controller: Pavetest's compact Control and Data Acquisition System (CDAS) delivers unparalleled performance, real time control and ultimate versatility in acquisition. The CDAS provides excellent waveform fidelity from integrated acquisition and control functions, with low level sampling at speeds of up to 200,000 samples per second simultaneously on all channels (using up to 64x oversampling) gives superior low noise performance and resolution of 20 bit over the full dynamic input signal range (no auto ranging required).

TestLab Software: Developed with ultimate flexibility in mind, TestLab test and control software caters to all levels of operator experience. By use of pre-programmed "Method files", an inexperienced operator can run a range of international test methods without the need for any programming. Moreover, a test "Wizard", available with popular tests can guide the operator step by step based on a "recipe book" approach. Most importantly, the experienced engineer and/or researcher need not be constrained by the functions and analysis in the method files provided. The operator may, clone, modify and/or generate his/her own method file to suit their specific requirements. The Excel based data analysis offers the operator the flexibility to implement alternative analysis and customized reporting facilities.

TestLab allows for real time graphing of results and configurable real time transducer levels display with unprecedented clarity of results and analytical power.



MAIN FEATURES

- Robust four point loading frame.
- Backlash free rotation and translation on all load and reaction points.
- Fully configurable to suit a large range of testing applications.
- High performance servo-valve.
- Long life pneumatic actuator.
- Digital Servo-pneumatic control.
- 2 axis control and 8 channel data acquisition.

B210_B210-01

B210_STAND-ALONE SERVO-PNEUMATIC FOUR POINT BENDING (4PB) SYSTEM

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The specimen is securely clamped using servo-motor driven ball screws **to maintain the prescribed clamping force**, to accommodate any compliance of the specimen between the clamping surfaces, during the test. The clamping force is controlled by regulating the motor current. Two switches located on the front of the device are used to activate and release the inner and outer specimen clamps.

The four specimen yokes provide **backlash free rotation and translation** at all load and reaction points. The clamping surfaces are 25 mm wide, so as to distribute the stress between the clamps during loading.

A specially designed tool is provided to accurately set the spacing of the four loading points according to the two most commonly used spans.

Markings on the top clamp pads assist the operator to centre the beam laterally prior to clamping.

It's important for the centre line (neutral axis) of the specimen to be in line with the pivot points.

For this reason, the system includes a set of (10 mm) thick clamp pad spacers... to be used in conjunction with 50 mm high specimens or set aside when testing 70 mm high specimens.

The servo-pneumatic system uses **a bottom loading pneumatic actuator coupled to a high performance servo valve**, with PID closed-loop control and run time adaptive control to achieve/maintain the requested strain/stress for the duration of the test.

The test control system is computer based, using three sensors on the machine for control and/or data acquisition. A low profile, high performance

stainless **steel ring torsion load cell** is used **to measure and control the load** and a **co-axially mounted (LVDT) displacement transducer**, on the actuator is used **to position the centre cradle**. An **on-specimen (LVDT) displacement transducer** is used **to measure and control the deflection** at the centre of the beam with respect to the outer load/reaction points, as prescribed in the relevant standards.

The Windows based, TestLab software provides a user interface that is as simple and efficient as possible and application software according to the following international standards: **AASHTO T321, AST O3, EN12697-24 Annex D, EN12697-26 Annex B and ASTM-D7460.**



Accessories: A range of testing accessories is available for the 4PB system including, climatic chambers, temperature measurement kits reference/dummy specimens and air compressor:

B212:
Four Point Bending
(4PB)



This device is used for four point bending/flexure testing of asphalt beams.

AASHTO T 321-07 (2011) Standard Method of Test for Determining the Fatigue Life of Compacted Hot-Mix Asphalt (HMA) Subjected to Repeated Flexural Bending

AST 03: 2000 Fatigue life of compacted bituminous mixes subject to repeated flexural bending

ASTM D7460-10 Standard Test Method for Determining Fatigue Failure of Compacted Asphalt Concrete Subjected to Repeated Flexural Bending

AB-P1/T233 Fatigue life of compacted bituminous mixes subject to repeated flexural bending

EN 12697-26:2004 (E) Test methods for hot mix asphalt – Part 26: Stiffness, Annex B – Four point bending test on prismatic specimens (4PB-PR)

EN 12697-24:2004 (E) Test method for hot mix asphalt – Part 24: Resistance to fatigue, Annex D – Four point bending test on prismatic shaped specimens

B210-02 4PB PVC Beam

B210-03 4PB Reference beam

Technical Specifications

Load frame

Outer clamp span	355.5 mm (14") and 420 mm
Nominal beam size(s)	50 mm (h) X 50 mm (w) 50 mm X 63.5 mm 70 mm X 70 mm

Servo actuator

Capacity	±5kN
Frequency	Up to 60Hz
Stroke	10 mm

On-specimen transducer

Range	±1 mm
Resolution	0.002 µm
Accuracy	Better than 5 µm

CDAS Controller

Acquisition	8 CH, 20 bit resolution
Sampling rate	Up to 200kHz (all channels)
Smoothing	Up to 64 times over-sampling
Calibration	On power up
Control Axis	2
Communication	USB or Ethernet
Dimensions	100H x 310D x 250W mm
Mains Power	90–264V 50/60Hz