

TSRST-MULTI

MULTI STATION THERMAL ASPHALT SYSTEM

STANDARDS:

AASHTO TP10-1993 Standard test method for Thermal Stress Restrained Specimen Tensile strength

EN 12697-46:2012 Test methods for hot mix asphalt Part 46: Low temperature cracking and properties by uniaxial tension tests

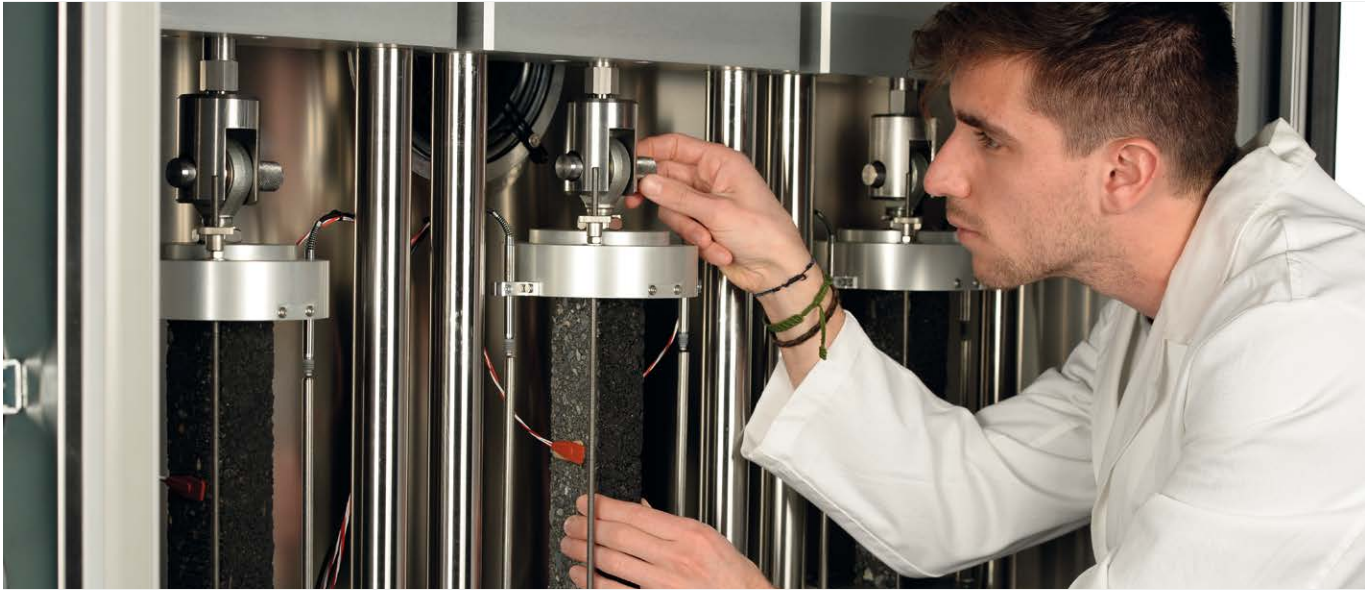
FIRST STAND ALONE SERVO-HYDRAULIC TSRST

MAIN FEATURES

- Up to three working stations (electromechanical and/or servo-hydraulic stations).
- Servo-hydraulic actuator: 30 kN static, 25 kN dynamic, double acting, fatigue rated and equal area type with long life Labyrinth bearings & seals.
- Dynaflo™ Hydraulic Power Supply: Variable Frequency Drive 2.2 kW pump motor; Silent operation.
- Ability to clone, modify and/or generate user's own method file(s) to suit their specific requirements.
- Programmable test Wizard to guide the operator step by step based on a recipe book approach.
- Temperature controller programmed via PC software.



TSRST-MULTI STATION



PAVETEST TSRST-MULTI: THE NEXT GENERATION OF MULTI-STATION THERMAL ASPHALT SYSTEM

The **Thermal Stress Restrained Specimen Test (TSRST)** is used to determine the low temperature cracking susceptibility of asphalt concrete. In the early 1990s the TSRST was developed by Oregon State University (OSU) as part of the Strategic Highway Research Program. The test method became AASHTO TP10.

1

FIRST STAND-ALONE SERVO-HYDRAULIC TSRST ON THE MARKET

With up to three servo-hydraulic testing station in one unit, Pavetest TSRST-Multi is **the first stand-alone servo-hydraulic low temperature** cracking asphalt testing system **on the market** able to test up to three different specimens simultaneously, under the same temperature conditions.

FLEXIBLE

Designed with flexibility in mind, **Pavetest** TSRST-multi can use different combinations of servo-hydraulic and/or electro-mechanical testing stations with **no need for a compressed air supply**.



VERSATILE

Pavetest versatile TSRST-Multi can be used to evaluate:

- Uniaxial tension stress test (UTST)
- Thermal stress restrained specimen test (TSRST)
- Relaxation time, using the relaxation test (RT)
- Tensile creep tests (TCT)
- Uniaxial cyclic tension stress test (UCTST)
- Uniaxial thermal stress & strain test (UTSST) it requires additional hardware



POWERFUL

Equipped with Pavetest's leading edge Control and Data Acquisition System (CDAS) and TestLab software, the user can control up to 3 testing stations in one unit, with unparalleled performance and ultimate versatility.





EASY TO OPERATE

Pavetest TestLab software makes it easy to operate the system because it enables the operator to program the temperature controller with ease.



SAFE

Pavetest TSRST-Multi employs a reliable refrigeration system, capable of cooling at a rate of 10° per hour. **Mechanical refrigeration eliminates the need for liquid nitrogen**, offering a completely safe working environment for the operator.



QUIET

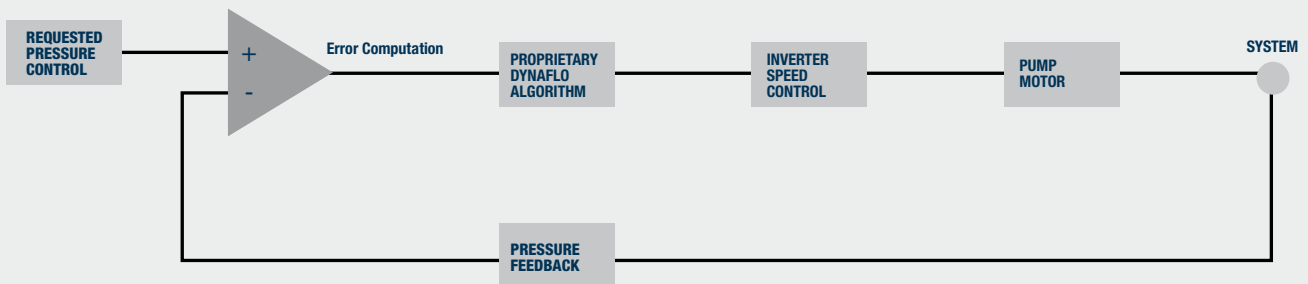
The **Electro-mechanical and/or dynamically controlled hydraulic power supply are almost silent during testing.**



DYNAFLO™

The servo-hydraulic station(s) are powered by the Dynaflo Hydraulic Power Supply (HPS). The **Dynaflo HPS is an innovative concept based on “inverter” technology**: An inverter is used to control the speed of the pump motor to control hydraulic oil flow based on the requirements; **reducing noise and heat generation**, rendering the HPS silent in most applications. It also **improves the longevity of the pump** because it only works as hard as it needs making it quiet, cool and long lasting.

THE DYNAFLO™ CONCEPT



The **environmental chamber** is constructed from **top quality stainless steel**; stylish, durable and easy to clean.

Mechanical refrigeration capable of cooling at $-10\text{ }^{\circ}\text{C}$ per hour down to $-40\text{ }^{\circ}\text{C}$; no need for liquid nitrogen.

The **modular concept** allows the system to be configured in any combination of, **up to three electro-mechanical and/or servo-hydraulic stations**, without the need for compressed air supply.

The **high performance digital temperature controller** can be programmed through the software; eliminating the arduous task of setting the controller using the tiny buttons on the controller.

Triple glazed, low-e glass door offers excellent insulation without compromising visibility.

Internal lighting ensures good visibility under all conditions.

Uniquely **low coefficient of thermal expansion invar rods** offer accurate measurement and control over the full temperature spectrum.

Axial alignment is achieved using self-aligning couplings.

Small footprint makes best use of precious laboratory space.

Only requires **electrical power** for easy installation.

Fully integrated digital control and data acquisition system (CDAS).



CONTROL AND DATA ACQUISITION SYSTEM (CDAS)



B206 16 CHANNEL CDAS

CONTROL:

- High speed, (18 bit) digital servo-control, 4/6 axis.
- Digital closed loop update sampling rate of 2.5 kHz.
- Computer programmable, Proportional, Integral and Derivative (PID) control algorithm.
- Adaptive Level Control (ALC) algorithm for best dynamic peak accuracy.
- 3 feedback control modes. E.g. force, position and on-specimen strain.
- “Bumpless transfer” between control modes.

ACQUISITION:

- Analog inputs are automatically calibrated on power up.
- Simultaneous sampling of all channels.
- 16 Analog (± 10 Volt) input channels.
- Up to 64 times over sampling (set to 8 by default).
- 20 bit digital resolution (no auto ranging required).
- Sampling rate up to 192,000 samples/sec.

COMMUNICATION:

- USB or Ethernet

ENVIRONMENTAL CHAMBER

- REFRIGERATION RANGE: -40 °C to + 40 °C, capable of cooling at a rate of 10 °C per hour.
- Optional: -50 °C to + 40 °C version.

Real Time Dashboard display shows transducer levels, computed data and charted data before, during and after the test has completed.

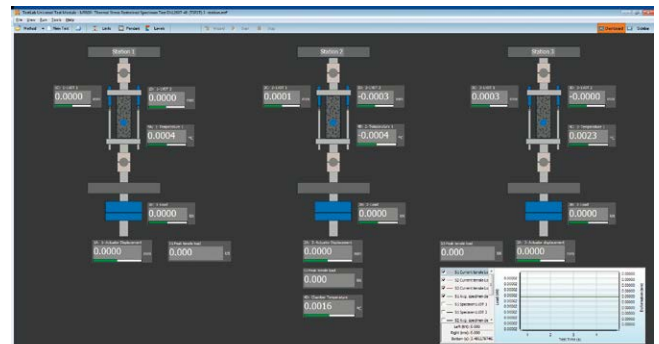
Dynamic image update feature shows visual image representation of specimen failure Multi- axes representation for clear visual presentation of test status for each axes.

Very user friendly presentation simplifies specimen setup in the machine.

The dashboard display feature of Testlab provides the user with an intuitive visual representation of the current status of both the machine and test method. The dashboard shows live transducer level measurements along with nominated key test data information and real time chart updates. This feature is individually customisable for each method file. Pavetest has already available dashboard designs for the more sophisticated tests including multi station TSRST.



TestLab Universal Test Module



TSRST-Multi Dashboard

TECHNICAL SPECIFICATIONS

External dimensions load frame (including environmental chamber):

1853(h) x 1020(d) x 1230(w) mm

Hydraulic Power Supply (for Servo-hydraulic station(s)):

700(h) x 520(d) x 570(w) mm

Weight load frame: 200 kg approx. without the selected stations configuration

Electrical requirement for:

Servo-hydraulic station (each): 230V 50-60Hz 1ph 2.2kW

Electro-mechanical station (each):

100-230V 50-60Hz 1ph 0.75kW

Refrigeration unit: 380-420V 50Hz 3ph 2.5kW

Loading frame(s)

- Rigid two column frame
- Width of work space: 240 mm
- Height of work space (between the two platens): 285 mm

Electro-mechanical actuator(s)

- 25kN static with ± 50 mm stroke (100 mm)
- Internal displacement transducer

Servo-hydraulic actuator

- 30kN static, 25kN dynamic, double acting, fatigue rated, servo hydraulic actuator, equal area type with long life seals & bearings
- ± 50 mm stroke (100 mm)
- Internal displacement transducer
- Close coupling of servo valve to actuator for best servo performance
- 10 μ m pressure line filter at actuator for ultimate contamination control
- 0.5 lt hydraulic accumulator with 40 Bar pre-charge for best pressure line regulation at servo-valve.
- High response, VCD direct drive, servo-valve: -3 db @ 350 Hz, $\pm 5\%$ amplitude (performance curves available on request)

Load cell(s)

- Low profile Precision Transducers load cell, ± 30 kN, 0.1%. Normalized output with in-line signal conditioning

Hydraulic power supply

- Working pressure of up to 160 Bar (low pressure adjustable)
- High/Low pressure selectable from control pendant
- Variable flow rate up to 7.5 liter/min
- Variable Frequency Drive (VFD) 2.2kW pump motor; speed based on demand
- 3 μ m return line filtration
- Low oil, over temperature and dirty filter displayed
- Remote starting
- Pressure gauge
- Air cooling (Electric fan)

**B282-08** TSRST specimen gluing jig (needed accessory)

Simple and easy to use gluing jig for preparing TSRST specimens. The jig provides for perfect alignment and adjustment for different sized specimens. The clamping force is easily set and ensures the end plates are glued perpendicular to the specimen.

ORDERING INFORMATION

The basic MULTI TSRST includes the main frame, the CDAS, the climatic chamber, the refrigeration unit and at least one between the electro-mechanical or servo-hydraulic station. All available configurations are summarized in the following table:

	ELECTROMECHANICAL STATION	SERVO-HYDRAULIC STATION
B282-10	1	-
B282-11	2	-
B282-12	3	-
B282-13	-	1
B282-14	1	1
B282-15	2	1

Note:

Multiple stations configuration (b282-11, b282-12, b282-14, b282-15) allow to run tsrst tests with all stations simultaneously. In this configurations, utst, rt, tct, utsst and utcst tests are performed on one station at a time. With combined configuration (electromechanical and servo-hydraulic) utcst must be performed with servo-hydraulic station.

TO PERFORM

- Uniaxial tension stress test (UTST)
- Thermal stress restrained specimen test (TSRST)
- Relaxation time, using the relaxation test (RT)
- Tensile creep tests (TCT)
- Uniaxial cyclic tension stress tests (UCTST)**
- Uniaxial thermal stress & strain test (UTSST)***

** Only applicable to servo-hydraulic work station(s)

*** Additional hardware required

ACCESSORIES

- B282-08** TSRST specimen gluing jig (**needed**)
- B282-18** TSRST proof test assembly (optional)

Disk Shaped Compact Tension test:

B284-01 Disk-shaped compact tension test jig

B282-02 Rod ends (2 pieces **needed**)

B290-07 SCB deformation gauge (**needed**)

or

B290-12 Epsilon (model 3541) clip-on gauge cmod transducer +1/-7 mm (Alternative to B290-07)

C090-18 Knife edge (pack of 24) only for B290-12