*Your supplier of high pressure laboratory instruments and advanced geotechnical testing equipment*

PRODUCT BROCHURE | ROCK MECHANICS TESTERS | TRUE TRIAXIAL SYSTEMS

# TRUTEST-C

## True Triaxial Rock Testing System with Confining Pressure Control

| σx ≠ σy ≠ σz | 70 MPa | 150 °C | 100³ mm |
|---|---|---|---|
| independent principal stresses | stress & confining pressure | optional heating system | cubic specimen |


*Complete TRUTEST-C system — true triaxial load frame, three-pump assembly and computerised control station*

***A complete turnkey system — cell, actuators, pumps, control cabinet and acquisition station***

# OVERVIEW

*Polyaxial characterisation of cubic rock specimens under fully independent principal stresses*

*TRUTEST-C true triaxial load frame — four servo-controlled hydraulic actuators around the confining pressure cell*

## SYSTEM DESCRIPTION

- Mechanical characterisation of large cubic rock specimens, 100 × 100 × 100 mm
- Fully independent stress control along the three orthogonal principal axes (σx, σy, σz)
- Four servo-controlled hydraulic actuators in two opposing pairs along X and Y; σz applied directly by the confining pressure
- Cubic flexible sleeve fully isolates and seals the specimen, allowing confining pressurisation up to 70 MPa
- Three independent high-pressure syringe pumps for closed-loop pressure regulation and fine stress-path control
- Six high-precision LVDT transducers, two per axis, for redundancy and measurement accuracy
- Rigorous reproduction of complex anisotropic in-situ stress conditions and true triaxial loading paths
- Optional modules: heating, acoustic velocity, acoustic emission and hydraulic fracturing

## KEY BENEFITS

### True independent stress control

σx ≠ σy ≠ σz along the three orthogonal axes — realistic in-situ stress states that conventional triaxial cells cannot reproduce.

### High-precision load & deformation

Servo-controlled hydraulic actuation with high-resolution LVDTs for accurate stress and strain in all three directions.

### Confining pressure up to 70 MPa

The sealed cubic sleeve keeps the specimen isolated while reproducing deep reservoir conditions under true triaxial stress.

### Thermo-mechanical testing to 150 °C

Optional heating simulates reservoir temperatures for coupled stress–temperature experiments.

### Real-time acoustic monitoring

P- and S-wave velocities give early crack detection, elastic properties and stress-induced anisotropy on every axis.

### Acoustic emission localisation

Real-time 2D/3D mapping of fracture initiation and propagation with high spatial accuracy.

# WORKING PRINCIPLE

*Four hydraulic actuators on X and Y — confining pressure on Z*

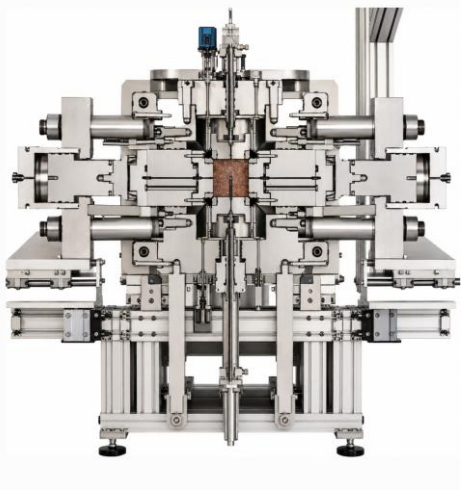
The TRUTEST-C is a true triaxial testing system with four hydraulic actuators arranged in two opposing pairs along the X and Y axes. Each pair independently applies and controls the stress in its direction.

The third principal stress, σz, is applied by the confining pressure acting on two opposite loading platens along the Z axis. These platens transfer the pressure directly to the specimen.

This configuration provides true triaxial loading with three independently controlled principal stresses, reproducing the real three-dimensional stress conditions found in geological formations.

**Force = Hydraulic pressure × Piston area**

**σx ≠ σy ≠ σz — three independently controlled principal stresses**



*Cross-section of the cell and the four opposed hydraulic actuators*

## TRUE TRIAXIAL CELL

The true triaxial cell incorporates a high-pressure confining chamber that houses the cubic specimen. Before installation, a flexible cubic sleeve is moulded around the specimen to isolate it from the confining fluid and ensure sealing. The sleeved specimen is then loaded on its six faces through six rigid hardened platens.

- Along X and Y, four platens are driven by the four hydraulic actuators; along Z, the two platens are loaded directly by the confining pressure
- Top-opening design — unscrewing the top cap gives direct access to the specimen
- Actuators mounted on sliding tables, retracted for easy specimen installation and removal
- Dedicated lifting device for safe handling of the heavy end plug
- Opposed actuator configuration ensures symmetric loading and minimises bending

*Cubic specimen sealed in its flexible moulded sleeve, ready for installation between the six platens*

## OPTIONAL INSTRUMENTATION OF THE PLATENS

**Integrated heating**
Cartridge heaters and insulation mantle for thermo-mechanical testing

**Acoustic sensors**
Platens can host P/S-wave and acoustic emission transducers

**Fluid injection**
Bottom platen can incorporate a borehole injection port for fracturing

# SYSTEM COMPONENTS

*Actuators, pump assembly, chassis table, control cabinet and acquisition station*

## FOUR HYDRAULIC ACTUATORS

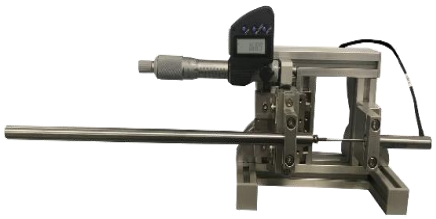
- Four actuators in opposing pairs along the X and Y axes, applying symmetric controlled stress on opposite specimen faces
- Both actuators on the same axis operate simultaneously and in coordination
- Forces transferred through rigid loading platens to the specimen faces
- Independent hydraulic circuits allow precise regulation of the three principal stresses
- One LVDT per actuator measures deformation in real time; combined with the Z-axis measurement the system resolves the full 3D strain field

## THREE SYRINGE PUMPS

Two pumps drive the hydraulic actuators along X and Y; the third controls the confining pressure and therefore the stress along Z. Control modes: pressure (stress), axial displacement and flow.

| PUMP FEATURES | |
|---|---|
| Working pressure | **70 MPa** |
| Volume | **250 cc** |
| Max flow rate | **0.0001 to 60 cc/min** |
| Wetted parts | **Stainless steel** |
| Weight | **40 kg** |
| Power | **110–220 V AC, 50 / 60 Hz** |


*Three-pump assembly and computerised control & acquisition station*



*Axial LVDT calibrator — resolution 0.001 mm, absolute or relative displacement, supplied as standard*

## CONTROL CABINET & DATA ACQUISITION

- Signal conditioning module linking the six LVDTs, all additional transducers and the safety devices
- Sensor excitation, amplification, filtering and conversion into standardised voltage outputs
- Icon-based control station recording X, Y and Z deformations continuously
- Full control of the three syringe pumps for precise regulation of loading conditions
- Real-time visualisation, graphical plots and full recording for post-processing
- Manages the optional acoustic velocity, acoustic emission and fracturing pump modules

## SCOPE OF SUPPLY & SERVICES

- True triaxial cell with high-pressure confining chamber, six hardened platens and sleeve mould
- Four servo-controlled hydraulic actuators, rigid chassis and support table
- Three syringe pumps, control cabinet, DAQ station and LVDT calibrator
- On-site installation, start-up and commissioning by Floxlab engineers
- Two days of operation and maintenance training
- Two-year spare parts kit and 12-month warranty from delivery

# OPTIONAL MODULES

*Extend the TRUTEST-C with heating, acoustic monitoring and hydraulic fracturing*

## HEATING SYSTEM — up to 150 °C

- Electrical cartridge heaters inserted directly into the cell body
- External insulation mantle for thermal stability and homogeneous distribution
- Digital controller and embedded probe regulating cell temperature
- Coupled thermo-mechanical testing under true triaxial stress and pore pressure

## ACOUSTIC VELOCITY — P & S waves

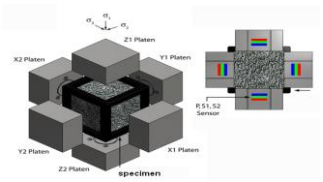
- Six transducers on opposite faces: one P-wave and two orthogonally polarised S-wave sensors
- Centre frequency 1 MHz — operating up to 120 °C
- Pulser–receiver with integrated multiplexer and Floxlab acquisition software
- Elastic moduli, microcrack initiation, stress-induced anisotropy and damage progression

## ACOUSTIC EMISSION — 2D / 3D localisation

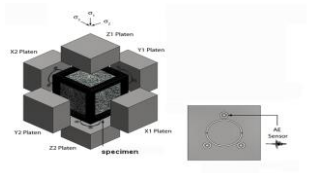
- Six broadband AE transducers on the flat platens along X and Y — 125 to 750 kHz
- 40 dB low-noise preamplifiers, 32–1000 kHz filtering
- Eight-channel acquisition, 16-bit resolution, 10 MHz sampling rate
- Hypocentre accuracy ≈ 2 mm; hit counts, amplitude, energy

## HYDRAULIC FRACTURING — CF-12 unit

- Bottom platen injects fluid into a pre-drilled borehole for wellbore stability testing
- Dual-cylinder CF-12 pump — 70 MPa, 2 × 15 cc, 0.0001 to 30 cc/min
- Floating-piston accumulator — 2000 ml, Viton seals
- Breakdown pressure and propagation tracked by the AE system




*Six P / S-wave transducers on the platen faces*




*AE sensor layout for 2D / 3D event localisation*

*CF-12 dual-cylinder fracturing fluid injection pump*

## TECHNICAL SPECIFICATIONS

| PARAMETER | VALUE |
|---|---|
| Specimen dimensions | **100 × 100 × 100 mm (cubic)** |
| Maximum stress capacity (σx, σy, σz) | **70 MPa** |
| Confining pressure | **up to 70 MPa** |
| Pore pressure | **up to 70 MPa** |
| Temperature range | **Ambient up to 150 °C (optional heating system)** |
| Loading actuators | **4 servo-controlled hydraulic actuators (X and Y axes)** |
| Z-axis loading | **Generated by the confining pressure through two rigid platens** |
| Displacement measurement | **6 LVDT transducers — 2 per axis** |
| LVDT resolution | **0.5 µm** |
| Pressure generation | **3 independent high-pressure syringe pumps** |
| Wetted parts | **Stainless steel** |
| Power supply | **230 V AC, 2-phase, 50 / 60 Hz** |

# APPLICATIONS

*Advanced rock mechanics and geomechanical investigations*

### Reservoir geomechanics

Rock behaviour under realistic anisotropic in-situ stress states for compaction, subsidence and depletion studies.

### Wellbore stability

Assessment of borehole failure and breakout mechanisms under independently controlled principal stresses.

### Hydraulic fracturing

Breakdown pressure, fracture initiation and propagation under true triaxial conditions.

### Failure criteria & modelling

High-resolution determination of principal stresses, directional strains and polyaxial failure envelopes.

### Anisotropy & damage mechanics

Quantification of stress-induced anisotropy and progressive microstructural damage from acoustic velocity and AE data.

### Underground storage & excavation

Coupled thermo-hydro-mechanical testing for $CO_2$ and $H_2$ storage, tunnelling and deep geological repositories.

## CONTACT US

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