



High Pressure Static Triaxial Systems

Overview:

GDS Static High Load frame is actuated from the base by a hydraulic actuator at loads of either 1000kN or 2000kN. To increase efficiency and to reduce life costs the actuator is powered by a 200cc / 64MPa GDS advanced pressure controller.

Key Features of Static Load Frame:

Benefits to the User:

To increase efficiency and to reduce whole life costs the actuator is powered by a 200cc / 64MPa GDS Advanced pressure controller:	This efficiency means that the full load of the frame can be achieved by drawing less than 1000 Watts (1kW) from mains electricity in place of a hydraulic power pack which can draw up to 50kW. Control is carried out by a GDS advanced pressure controller and as such is very stable and accurate. No special requirements are needed to host or service a powerpack or to protect system users from noise generated by a powerpack.
The static frame uses low pressure compressed air on the reverse side of the actuator to raise the actuator post compression:	This allows a simple manual regulator to be set with a small pressure in the upper chamber of the actuator. This innovation allows lower stress testing to be carried out more efficiently and more accurately without the cost implications of using a second pressure controller for the upper chamber of the actuator. Once the regulator is set it can then be left unattended for all tests, so long as a supply of clean, dry compressed air is available at a pressure greater than 0.5MPa (5 Bar).
Ideal for creep and relaxation testing:	Ideal for use where displacements are very small and loads needs to be very stable and well controlled.
Infinite Volume Controller option:	For tests where continuous displacement is required to amplitudes greater than 5mm. See diagram of set-up on the following page.

Upgrade Options:

Additional 64MPa controller and Infinite Volume Controller for tests where continuous displacement is required, additional data acquisition channels, an extensive range of Traixial and Hoek cells are available to a complete triaxial testing solution for rocks, temperature control (up to 100°C).

Technical Specification:

Computer Interface:	USB
Load Range (kN):	1MN or 2MN
Dimensions:	Frame footprint 700mm x 600mm. Height 1850mm
Weight Approx (kg):	1725

Typical 1MN Proposed Specification Using a Static Load Frame:

The typical example system is based on a GDS 1MN Static (compression only) Load frame based solution with 1 off 64MPa pressure controller.

GDSLAB Software:

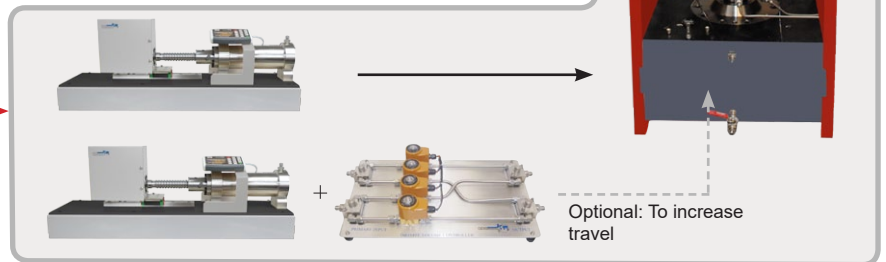
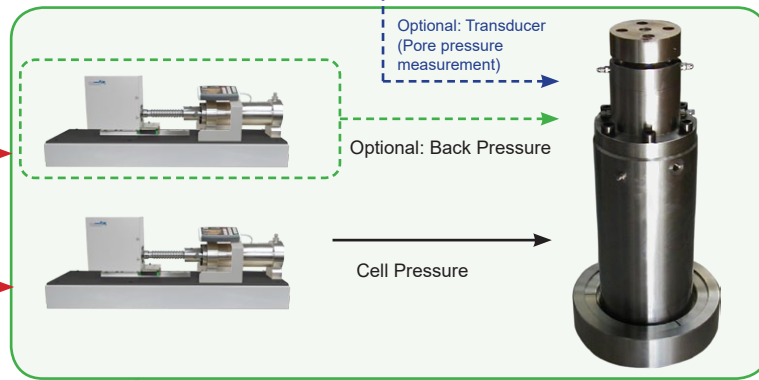
The GDSLAB control and acquisition software is a highly developed, yet extremely flexible software platform. Starting with the Kernel module and the ability to perform data acquisition only, additional modules may be chosen for your testing requirements.

Data Logger & Transducers:

- Standard GDS 16 bit 8-Channel data logger.
- Load cell: 1000kN External load cell (removable and can be replaced by other ranges 5, 10, 16, 32, 64, 128, 250, 400 or 500kN are all optionally available).
- Load cell accuracy: Better than 0.25% FRO.
- Temperature compensated to: 100°C (note: load cell is sited outside heated chamber).
- Total axial displacement: 50mm range recti-linear potentiometer.
- Accuracy: 0.25% of Full Range Output.
- Pore pressure transducer: 16MPa
- Accuracy: 0.15% of Full Range Output.
- Temperature control sensor: Type k Thermocouple -30 - 100°C
- Temperature measurement: Type k Thermocouple -30 - 100°C



Note: Connection via USB interface to PC.



Triaxial Cells & Pressure Control System:

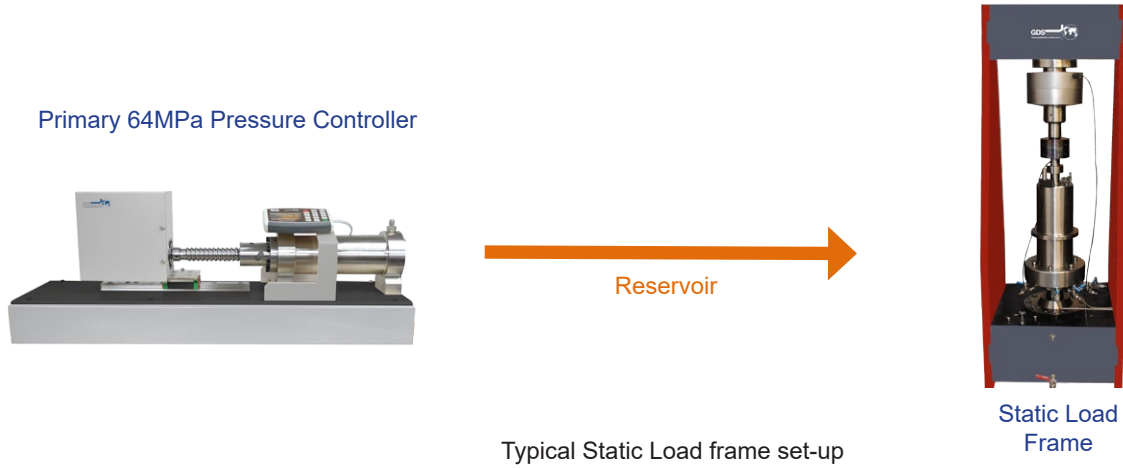
- Triaxial cell: 64TC100 (With balanced ram).
- Sample size: up to 100mm.
- Maximum cell & back pressure: 64MPa.
- Proposed cell pressure medium: Silicone / Hydraulic oil.
- Seal type: Low friction, high temperature.
- Maximum operating temperature: 100°C.
- Envisaged cell materials of construction.
- Main cell body: Austenitic 303, 304 and 316 Grades Stainless Steel, 17-4PH.
- Pedestal: 17-4PH grade Stainless steel with drainage.
- Topcap: 17-4PH grade Stainless steel with Aluminium-Bronze Spherical seat.
- Cell pressure actuation: 64MPa GDS ADVDP.
- Optional back pressure system: 1 x 64MPa GDS ADVDP.

Load Frame

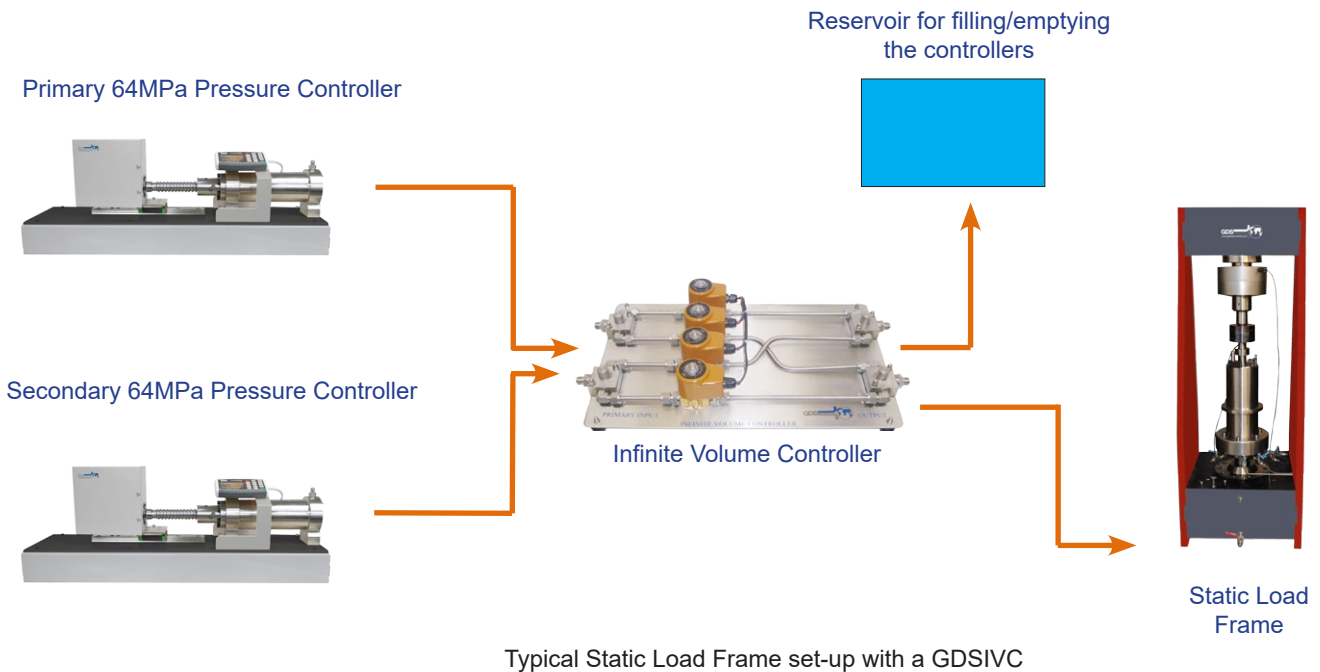
- 1MN Static.
- 64MPa GDS pressure controller for ram compression.
- Low pressure compressed air for ram return.

How does the Static Load Frame apply load?

A typical arrangement for the axial load system for a creep test set-up is shown below. In this setup a single 64MPa controller is used to provide pressure for the axial loading ram. This limits the axial displacement to 5mm between refills of the controller which are carried out manually, see below.



For tests where continuous displacement is required to amplitudes greater than 5mm the optional Infinite Volume Controller apparatus can be added. The infinite volume control option relies on a second 64MPa pressure controller which is used automatically when the primary controller requires refilling. Test accuracy is maintained during changeover between the two controllers as the secondary controller is kept pressurised to the same pressure as the primary unit ready for transfer.



Upgrade Option: Temperature Control Systems

The basic temperature control system is a heating only system. Cooling to temperatures of -30°C Centigrade can be added as an option.

The basic system relies on heating elements directly attached to the triaxial cell. This method removes the need for a heat exchanger which demands cooling and high power consumption. The maximum power consumption for this method of heating is 1800-2000 Watts at full power. However, this will only be required where large changes of temperature are requested in short periods of time. Control of the heating elements is by a closed-loop PID controller linked to the PC via RS232 under the control of GDSLAB control software.

The cell is surrounded by an environmental isolation chamber. For safety, the closure to the chamber is temperature interlocked to prevent access while the system is at high temperatures. The isolation chamber is constructed from stainless steel and lined with material with high thermal insulation properties to reduce losses. System estimated thermal efficiency is 70%.

Specification:

Heating & Cooling Options:

- 30°C to +65°C
- 20°C to +80°C
- 10°C to +65°C

Heating Only Options:

- Ambient to 60°C
- Ambient to 100°C



20MPa high pressure cell with the temperature control.

Hoek vs Triaxial Cells

Increasingly triaxial testing is becoming more common in rock mechanics. Traditional Hoek cells are slowly being replaced by more flexible triaxial cells. The addition of a triaxial cell to replace a Hoek cell can open a testing system to more types of test and greater accuracy of results. Some of the major benefits to using a triaxial cell in place of a Hoek cell include;

- The use of internal submersible load cells. This allows load applied to the sample to be measured directly with no errors included from seal friction. Seal friction in high pressure cells can be significant due to high sealing forces required at elevated pressures.
- The space inside the cell to allow the use of on sample transducers, such as LVDT, Seismic or Acoustic emissions.
- Hoek cells are often used in load frames designed for concrete testing. These often, only allow the peak load to be determined at the point of failure, the use of a triaxial testing system can allow significantly more information to be determined for each sample. This can include small strain stiffness, stress path information and permeability.



High pressure triaxial cell

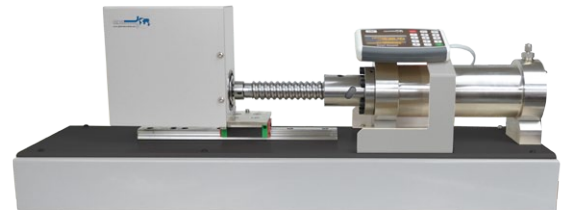
Common Triaxial Cell Pressure Ranges Supplied by GDS:

- 4MPa, 14MPa, 20MPa, 32MPa, 64MPa and 100MPa
- Standard sample sizes vary for different pressure cells between 20mm and 150mm in diameter.

Note: All GDS triaxial cells are designed to accommodate samples with a 2:1 height to diameter ratio or smaller.

Pressure Control Systems

Cell pressure and optional back pressure systems. The cell pressure will be controlled by a GDS, 32MPa, 64MPa, 100MPa or 150MPa Advanced Pressure Controller. The GDS Pressure controllers provide stable and accurate sources of pressure and volume change measurement with 0.1% FRO pressure accuracy as standard.



High pressure controller

Also Available: Dynamic Servo-Hydraulic Load Frame (HLF) for Compression and Tension

The GDS Hydraulic Loading Frame (ELCTS) is a load frame with a hydraulic dynamic actuator mounted on the cross beam for axial stress/strain cyclic dynamic loading.

The system is capable of dynamically controlling axial displacement or axial force and can be synchronised with an optional dynamic cell pressure actuator (radial stress), to give an advanced capability of dynamic stress path testing.

Technical Specification:

Frequency:	10Hz
Load Range (kN):	100kN, 250kN, 1.5MN
Weight Approx (kg):	100kN - 670kg, 250kN - 1280kg, 1.5MN - 7000kg



Dynamic Hydraulic Load Frame