Static Load Frame

Dynamic Load Frame

High Pressure Triaxial Testing Systems

Overview: GDS manufacture two high load (above 1MN) testing systems. The GDS Static Load frame which, 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.

The second type of system is a Dynamic Servo-Hydraulic Load Frame (HLF), which is used where higher displacement rates or cyclic testing are required. This actuator is designed for bi-directional actuation (i.e compression and tension).

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.

Key Features of Dynamic Hydraulic Load Frame:	Benefits to the User:
The HLF1000-H has closed loop-feedback control of force and position as standard:	This allows the frame to be used for many different test types from soil to rock mechanics and other material test applications where precise control of axial force and displacement are required in a very stiff reaction frame.
Compact design:	Reduces the laboratory floor space required, only 2430 x 750 x 700mm.
Hydraulic power:	Hydraulic power is derived from a separate powerpack that can be sited up to 15m from the loadframe.
Frequency Options:	The dynamic load frame is available as either 5 or 10Hz.

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 Fig 1 below.

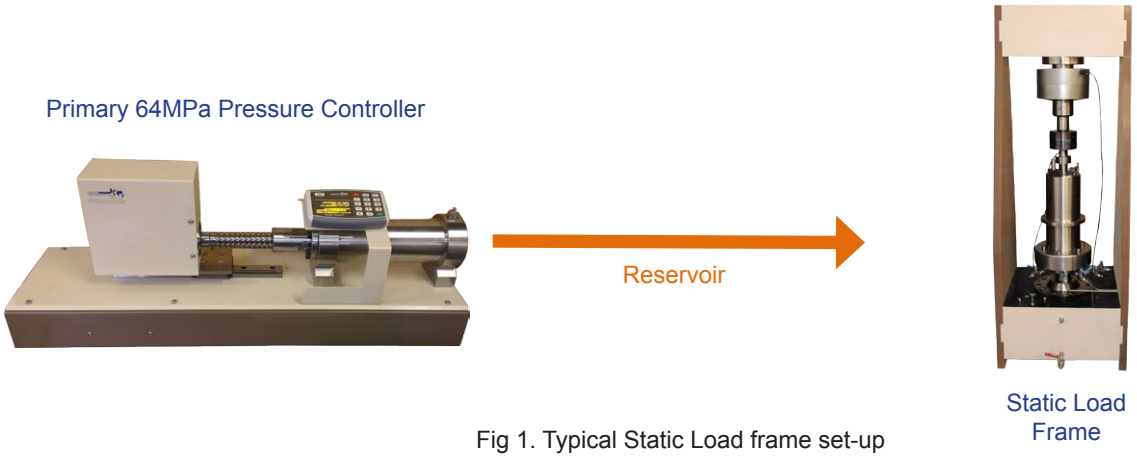


Fig 1. Typical Static Load frame set-up

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.

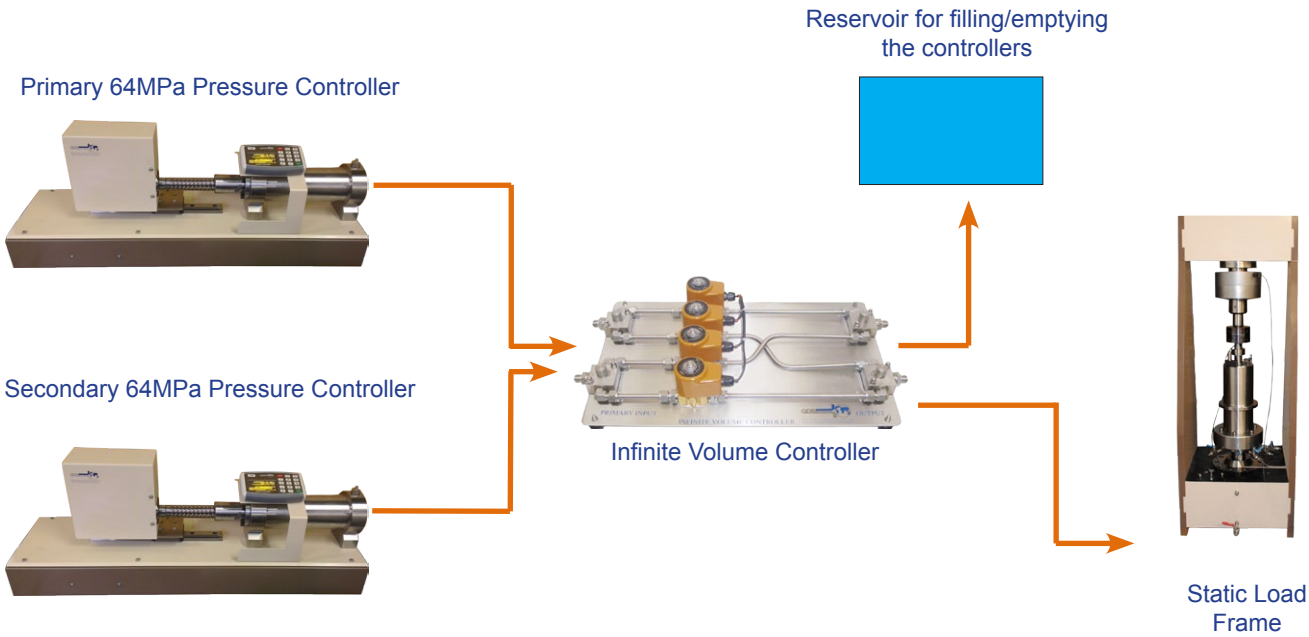


Fig 2. Typical Static Load Frame set-up with a GDSIVC

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

Servo-Hydraulic load frames are used where higher displacement rates or cyclic testing are required. As the GDSHLF actuator is designed for bi-directional actuation it is ideally suited for these tests.

Options available for HLF Load frames

- Fixed cross beam (standard for 1MN Load frame) / moveable cross beam (standard for 100kN, 250kN, 400kN and 500kN Load frames).
- Manual or motorised cross beam movement (which requires moveable crossbeam upgrade).
- Automatic beam locks.
- Extended height & width.
- Air or water cooled Power packs

Fig 3. Dynamic Servo Hydraulic Load Frame

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.

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.

Fig 4. High pressure triaxial cell

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.

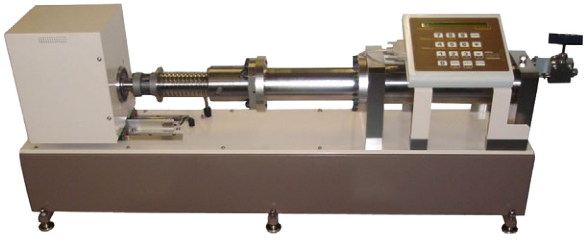


Fig 5. High pressure controller

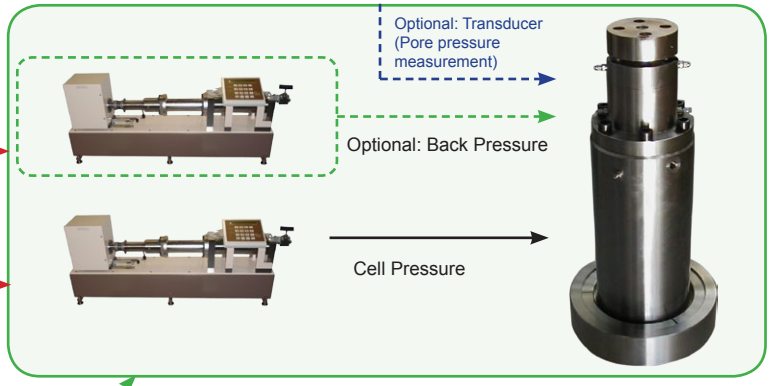
Fig 6. Typical 1MN Proposed Specification Using a Static Load Frame:

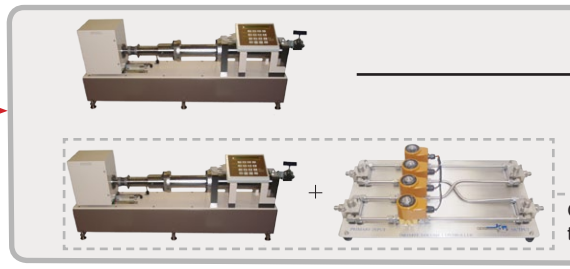
The typical example system is based on a GDS 1MN Static (compression only) Load frame based solution with 1 off 64MPa pressure controller.

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 0-200°C
- Temperature measurement: Type k Thermocouple 0-200°C.

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.





Note: Connection via USB, RS232 multiplexer (mux) or PC resident IEEE card (depending on device type chosen)

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: 150˚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 ADVDPC.
- Optional back pressure system: 1 x 64MPa GDS ADVDPC.

Load Frame

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

Fig 7. A Typical 1MN Proposed Specification Using a Dynamic Servo-hydraulic Load frame:

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).
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- Accuracy: 0.25% of Full Range Output.
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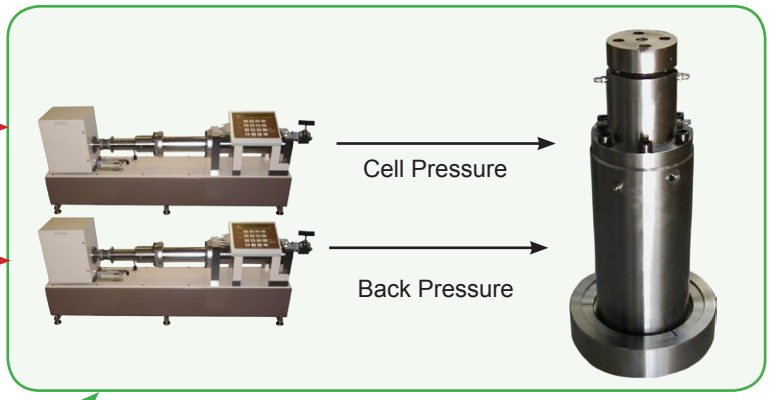

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- Optional Back pressure system: 1 x 64MPa GDS ADVDPC.

Load Frame

- 1MN dynamic servo hydraulic controlled frame.
- Double acting actuator.
- Hydraulic power pack.
- Available in either 5 or 10Hz

Upgrade Option: Temperature Control Systems

The basic temperature control system is a heating only system. Cooling to temperatures of -20˚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:

Range: Ambient temperature → 65, 85,100 or 150˚C
Control Accuracy: ± 1˚C
Measurement resolution: 0.1˚C

Fig 8. 20MPa high pressure cell with the temperature control.

Why Buy GDS?

Technical Support:

GDS provide comprehensive on-site product training and installation. GDS understand the need for ongoing after sales support, so much so that they have their own dedicated customer support centre. The support centre allows the user to log queries, download helpsheets and get the latest information on product updates. The site is fully searchable and provides a great resource to customers.

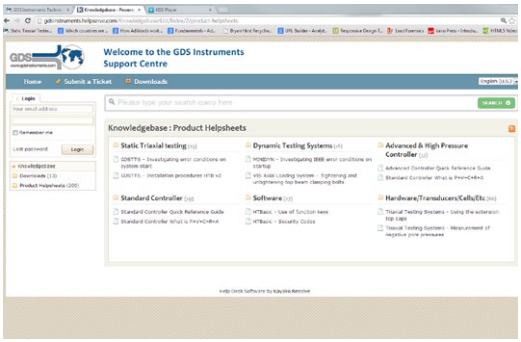

Fig 9. GDS online customer support centre.

Alongside their support centre GDS use a variety of additional support methods including...

- **Remote PC Support**: Remote PC support works by GDS providing a secure link to a customers PC, thereby allowing GDS to take control. Once in control of the PC, GDS can help with any problems associated to software, installation, testing etc.
- **Product Helpsheets:** The helpsheets are the GDS FAQ documents. They cover a multitude of hardware and software questions and are free to download from our online support centre.
- **YouTube Channel:** GDS YouTube channel holds both software and hardware video's aimed to give you better understanding of how the products work.
- **Email & Telephone Support:** If you prefer you can email requests to support@gdsinstruments.com where they will be automatically added to the support system and then allocated to a support engineer.

GDS Awarded Queens Award for Enterprise in International Trade:

GDS have been presented with the most prestigious corporate award made in the UK – The Queen's Award for Enterprise in the International Trade category. GDS are delighted to have won the award which has been given to GDS for increasing overseas trade by 190% over six years of continuous sustained growth, and for selling over 85% of their production overseas. GDS have achieved this through a combination of continuous product development, understanding customer's requirements and a company wide dedication to customer support.

THE QUEEN'S AWARDS
FOR ENTERPRISE:
INTERNATIONAL TRADE

Made in the UK:

All GDS products are designed, manufactured and assembled in the UK at our offices in Hook. Quality assurance is taken of all products before they are dispatched.

ISO 9001 REGISTERED FIRM | INTERNATIONAL ACCREDITATION BOARD

GDS are an ISO9001:2000 accredited company. The scope of this certificate applies to the approved quality administration systems relating to the "Manufacture of Laboratory and Field Testing Equipment".

Due to continued development, specifications may change without notice. See the GDS website for the full product range & to visit our Geotechnical Learning Zone.