ROCK MECHANICS

GDS HAS MANUFACTURED HIGH PRESSURE AUTOMATED TRIAXIAL TESTING SYSTEMS FOR ROCK FOR OVER 20 YEARS, WITH SYSTEMS INSTALLED AT LEADING RESEARCH AND COMMERCIAL INSTITUTES AROUND THE WORLD.

To assess the deformation and failure characteristics of rocks in the laboratory, test equipment must be stiff to avoid tremendous backlash and spring effects at failure, as well as sufficiently designed and manufactured to ensure consistent results year on year. The GDS rock mechanics range is therefore built to meet these requirements, providing high load and pressure test systems with options to include advanced transducers, such as Acoustic Velocity and Acoustic Emission.

KEY FEATURES

- Systems are configured to the customers’ test specifications and budgets
- Automated system control and data acquisition via GDSLAB software
- Stiff load frames to avoid backlash and spring effects
- Triaxial and Hoek cells available for specimen confinement
- Options to install Acoustic Velocity and Acoustic Emission transducers
- Load frames with electro-mechanical or hydraulic actuation available

VIEW ALL PRODUCTS

www.gdsinstruments.com/rockmechanics

INSTRUMENTED HOEK CELLS (GDSHC)
The GDS Instrumented Hoek Cell brings together the classic high pressure Hoek cell, with the advanced testing capabilities for Acoustic Emission and Acoustic Velocity testing.

LARGE AUTOMATED DIRECT SHEAR SYSTEM (GDSLADS)
is an electro-mechanical direct shear testing system designed for specimens up to 300mm square or circular. GDS also offers a rock mechanics specimen set to enable solid rock testing within the device.

TEMPERATURE CONTROLLED SYSTEMS
GDS have a large range of temperature controlled load frame rock testing systems. Our temperature systems offer two variables; heating & cooling or heating only.

STATIC TRIAXIAL ROCK TESTING SYSTEM (ST-RTS) is a triaxial system which enables load application from 100kN to 2MN using a passive triaxial cell and stiff load frame, or alternatively a 2MN active triaxial cell which applies load via its own hydraulic piston. Triaxial confining pressures of up to 100MPa are common when using this system.

DYNAMIC TRIAXIAL ROCK TESTING SYSTEM (DT-RTS) is a cyclic triaxial system designed to apply loads from 50kN to 1500kN, at loading frequencies of up to 5Hz, 10Hz, or 20Hz. Triaxial confining pressures of up to 75MPa may be reached with this system, due to use of a dynamic pressure intensifier to ensure cell pressures are accurately and consistently controlled.

ACOUSTIC VELOCITY (AV) AND ACOUSTIC EMISSION (AE) transducers may be included with the Instrumented Hoek Cell, or GDS’ high pressure triaxial cells.

ROCK TESTING

PREFER TO VIEW THE PRODUCTS ONLINE?
visit www.gdsinstruments.com
TEMPERATURE CONTROLLED SYSTEMS

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

PRESSURE OPTIONS:
- Up to 100MPa

Temperature Controlled Testing
GDS have a large range of temperature controlled rock testing systems. Our temperature systems offer two variables; heating & cooling or heating only. Combined heating and cooling systems use coiled tube sections inside the cell; this is connected through the standard ports within the cell base to a temperature control unit allowing temperature transfer close to the specimen.

The cooling system provides ideal conditions for frozen soil testing. Its high pressure testing capability (up to 100MPa) along with low temperature provides the ideal environment for Gas Hydrate Testing. The heating only systems have options from ambient up to either 60°C or 100°C.

Product Applications:-
- Frozen Soil Testing
- Gas Hydrate Testing
- High Pressure Testing
- High & Low Temperature Testing

SYSTEM COMPONENTS

High Pressure Cells
High pressure cells are available up to 100MPa, with up to 100mm diameter specimens. All GDS high pressure cells are made from stainless steel.

Data Acquisition
Up to 12 channels are available depending on the system selected.

Advanced Pressure Controller
Available from 8MPa to 100MPa with a volumetric capacity of 200cm³. The controller can be manually controlled via the keypad, or connected to the PC via USB.

PREFER TO VIEW THE PRODUCTS ONLINE?
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The GDS Instrumented Hoek Cell brings together the traditional high pressure Hoek Cell, with the functionality of advanced testing capabilities for Acoustic Emission (AE) and Acoustic Velocity (AV) testing. Below are some features and benefits of the cell.

- **Max pressure**: 70MPa.
- **Upgrades available**: Acoustic Emission & Acoustic Velocity (both horizontal and vertical).
- **Sizes available**: 38.1mm and 50.8mm diameter.
- **The confining pressure of up to 70MPa is applied using the GDS high pressure controllers which allow for accurate control and acquisition of both the pressure and volume change.**
- **Special membranes allow for the AE and AV transducers to quick connect via push fit connections.**
- **AV transducers are mounted in the topcap and pedestal.**
- **Up to 12 AE transducers, 1 set of vertical AV transducer, up to 2 sets of horizontal AV transducers can be installed in each cell.**
- **Access to the inner chamber and membrane is done with a screw threaded top section and a specially designed top plate that allows the entire internals of the cell to be removed for easy maintenance.**
- **Dimensions**: 381mm diameter x 305mm high. Weight = 180kg.

### INSTRUMENTED HOEK CELLS

### LARGE SHEARBOX

GDS Large Automated Direct Shear System (GDSLADS) is an electro-mechanical direct shear testing device for large samples, up to 300mm square or round. Different sample sets can be used to achieve the following types of testing in one system.

- **Standard Direct Shear up to 300x300mm.**
- **Geomembrane Shear test.**
- **Rock Mechanics sample set.**

**Electro-mechanical actuators on both shear and vertical axis.** Only mains electricity required (no hydraulics, pneumatics or hanging weights) therefore a reduction in the space required and providing a more accurate system.

**Built in load cells (up to 100kN, other ranges can be provided):** Interchangeable load cells allow for lower range load cells to be used for more accurate low stress testing.

**Supplied with hydraulic (manual) lifting frame for ease of sample set up.**

**Cylindrical or square sample sets can be supplied, as well as multiple sample boxes.**

**Automated data logging (multiple stage tests):** Testing can run unattended overnight and at weekends to increase productivity and reduce staffing costs. Multiple stage tests can be pre-programmed and saved in GDSLAB.

**Automated test control and a greater throughput of samples:** After setting of shear gap no further user intervention is required until tests has completed.

**Embankments & Dams Testing**

**Mining**

**Oil exploration**

**Creep testing**

**Tunnelling Testing**
ACOUSTIC VELOCITY

Acoustic Velocity Transducers (AV):

Systems to measure the P- and S-Wave velocity within a sample. AV sensors are generally used where pressures and load exceed those where bender elements can be used.

AV sensors are based on the same principle as bender elements but the piezo ceramic elements are not exposed to the environment so they can be used at pressures up to 100MPa and an axial force up to 2MN. Sensors are mounted in the pedestal and topcap or to the sides of the sample in some cases. Each sensor package contains a Compressional wave (P-Wave) element and two shear wave (S-Wave) elements.

The Shear wave elements are set in orthogonal directions to allow two shear waves to be generated with different polarisation, which is important where samples may be cross-anisotropic or fully anisotropic.

ACOUSTIC EMISSION

Acoustic Emission Transducers (AE):

The AE transducers enable micro-fractures occurring within a rock specimen during testing to be recorded and analysed. Analysis of rock micro fractures can give information as to the failure mechanisms of a sample under test as well as determining the onset of failure.

The AE system may be specified as a triggered type system or a continuous acquisition system. The triggered “hit counter” system yields less but more simple data to process, whereas, the continuous system never misses a beat. The system can be configured to use both triggered and continuous data acquisition.

Screenshots from the AV software

Single transducer without casing

Screenshots from the AE software
ROCK MECHANICS

STATIC TRIAXIAL ROCK TESTING SYSTEM

PRODUCT CODE: ST-RTS

The Static Triaxial Rock Testing System enables axial load application up to 2MN, with triaxial cells rated up to 100MPa used to confine test specimens of maximum 200mm diameter.

KEY FEATURES
Axial loads generated by a GDS 64MPa pressure volume controller, or electro-mechanical load frame.

Silent frame construction that exceeds ISRM recommendations, reducing equipment compliance and increasing measurement accuracy.

Clean and quiet system operation, designed for long term tests. Very low power consumption and no system cooling requirements.

TRIAXIAL (ACTIVE CELL) ROCK TESTING SYSTEM

PRODUCT CODE: AT-RTS

The Active Triaxial Rock Testing System allows axial load application up to 2MN via a hydraulically-actuated triaxial cell. Confining pressures up to 64MPa are available for a maximum 150mm test specimen diameter.

KEY FEATURES
Axial loads generated by a GDS 64MPa pressure volume controller, with stress directly applied to the test specimen.

Options to include Acoustic Emissions and Acoustic Velocity transducer measurement systems.

Upgrades available to provide local strain measurement, along with temperature control systems for specimen heating and cooling.

DYNAMIC TRIAXIAL ROCK TESTING SYSTEM

PRODUCT CODE: DT-RTS

The Dynamic Triaxial Rock Testing System can apply axial loads of up to 1.5MN at dynamic frequencies of 20Hz and below. Dynamic loading is achieved using a servo-hydraulic actuator system.

KEY FEATURES
Different load, pressure and specimen sizes available to enable system configuration to specific user requirements.

Can be supplied with a cell top lifting system to provide ease of use when confining test specimens in a high pressure triaxial cell.

Options to include Acoustic Emissions and Acoustic Velocity transducer measurement systems.

ACOUSTIC VELOCITY

PRODUCT CODE: GDSAVE

The Acoustic Emission transducers enable micro-fractures occurring within a rock specimen during testing to be recorded. The submersible transducers may monitor fractures continuously, or only when triggered.

KEY FEATURES
High speed data acquisition systems (10MHz – 50MHz) available up to 16-bit for high resolution measurements.

Transducer ranges from simple fracture counters through to complete systems that locate the fracture origin within the specimen.

Option to include velocity tomographic surveys to map acoustic velocity variations within a rock specimen.

INSTRUMENTED HOEK CELL

PRODUCT CODE: GDSCHC

The Instrumented Hoek Cell is a highly sophisticated version of the traditional Hoek cell, which can be fully instrumented with acoustic velocity and/or acoustic emission transducers.

KEY FEATURES
Option to include up to 12 channels of Acoustic Emission transducers for monitoring micro-fractures.

Can be supplied as a standalone cell for use in an existing system or as a complete system with loadframe and pressure control.

LARGE AUTOMATED DIRECT SHEAR SYSTEM (300mm)

PRODUCT CODE: GDSDLADS

The Large Automated Direct Shear system is an electro-mechanical direct shear testing device for specimens of up to 300mm square in size.

KEY FEATURES
Only mains electricity required to run the system (no hydraulics or pneumatics), reducing space required and additional equipment requirements.

Flexibility to test different shaped specimens, including sets for testing rock cores.

Stiff shearbox construction reduces system compliance and increases accuracy of strain measurements.

BACK PRESSURE SHEARBOX - HIGH PRESSURE

PRODUCT CODE: HPBPS

The High Pressure Back Pressured Shearbox is a high pressure version of the GDSDLADS. Normal and shear loads of up to 10kN may be applied to the test specimen, with a back pressure of up to 10MPa available.

KEY FEATURES
Accurate application of loading conditions through electro-mechanical control of normal and shear forces.

Precise displacement measurements enable long-term creep tests to be performed.

Back pressure applied using GDS Advanced Pressure Volume Controller.