

GDS Triaxial Compression/Extension Cells



Overview: GDS produce an extensive range of triaxial cells in order to satisfy the complex range of tests required by today's modern geotechnical laboratories. In summary, the cells are grouped into the following categories:-

1. Low Pressure Passive Triaxial Cells ($\leq 4\text{MPa}$).
2. High Pressure Passive Triaxial Cells with Balanced Ram ($>4\text{MPa}$).
3. High Pressure Passive Triaxial Cells without Balanced Ram ($>4\text{MPa}$).
4. Active Triaxial Cells (includes a hydraulically actuated ram i.e. a Bishop and Wesley type).

What are they?

GDS produce an extensive range of triaxial cells in order to satisfy the complex range of tests required by today's modern geotechnical laboratories (see Fig. 1 for a typical triaxial cell schematic). Traditional passive triaxial cells (known as passive due to the fact that they are used with an external actuator such as a load frame to apply axial loads), large diameter triaxial cells (up to 300mm sample diameter), active triaxial cells (based on Bishops and Wesley's original hydraulic stress path apparatus and include an actuator 'built in'), as well as cells specifically designed for dynamic triaxial testing with low friction bearings and seals are available from GDS. In addition, there are a number of features such as balanced ram triaxial cells, access ports and access rings for internal transducers that are offered.

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2. High Pressure Passive Triaxial Cells with Balanced Ram ($>4\text{MPa}$)
3. High Pressure Passive Triaxial Cells without Balanced Ram ($>4\text{MPa}$)
4. Active Triaxial Cells (includes a Hydraulically Actuated Ram i.e. a Bishop and Wesley type).

All GDS cells are capable of performing extension testing using the GDS extension top cap system, supplied as standard in most cells.

Technical Specification:

1) Low Pressure ($\leq 4\text{MPa}$) Passive cells; max sample size/pressure range:	50mm/2MPa, 70mm/2MPa, 76mm/3.5MPa, 100mm/2MPa, 100mm/4MPa, 150mm/2MPa, 200mm/1MPa, 300mm/1MPa.
2) High Pressure ($>4\text{MPa}$) Passive cells with balanced ram; max sample size/pressure range:	54mm/32MPa, 100mm/64MPa.
3) High Pressure ($>4\text{MPa}$) Passive cells without balanced ram; max sample size/pressure range:	50mm/100MPa, 54mm/32MPa, 70mm/70MPa, 76mm/14MPa, 100mm/14MPa, 100mm/20MPa, 150mm/14MPa.
4) Hydraulically Actuated cells; max sample size/pressure range:	50mm/2MPa, 55mm/10MPa, 100mm/2MPa, 150mm/64MPa.

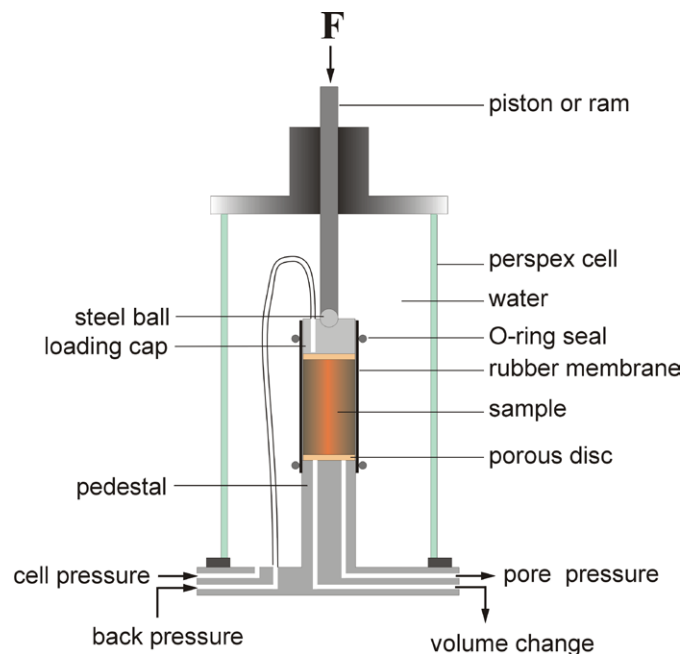


Fig 1. Typical triaxial cell arrangement.



Low Pressure Passive Triaxial Cells (Low pressure $\leq 4\text{MPa}$)

Overview: The Traditional Passive Triaxial Cells range in sample size from 50mm through to 300mm (as used in our Large Diameter Cyclic Triaxial Testing System). All passive triaxial cells have ports to enable the measurement of cell, back and pore pressure, specimen volume change and a top entry ram for application of axial stress and strain. All passive cells can be upgraded with the addition of an access ring to allow additional transducers to be fed into the cell (i.e. local strain, on-sample pore pressure measurement or temperature measurement).



Traditional passive triaxial cell in 50kN load frame (100TC2)



Traditional passive triaxial cell with heating elements (100TC4)



Traditional passive triaxial cell in 250kN load frame (300TC/1)

Product Code	Max Sample Diameter	Max Sample Height	Max Pressure Rating	Cell Height	Outer Cell Diameter	Load Ram Diameter	Max Axial Load	Max Sample size with HE**	Max Sample size with LVDT***
50TCEL*	50mm	100mm	2MPa	528mm	190mm	25mm	50kN****	-	-
70TCEL2	70mm	140mm	2MPa	610mm	270mm	25mm	50kN****	up to 50mm	up to 50mm
76TC35*	76mm	152mm	3.5MPa	530mm	230mm	25mm	50kN****	up to 50mm	up to 50mm
100TC2*	100mm	200mm	2MPa	610mm	270mm	25mm	50kN****	up to 83mm	up to 76mm
100TC4*	100mm	200mm	4MPa	528mm	279mm	25mm	50kN****	up to 83mm	up to 76mm
150TC2*	150mm	300mm	2MPa	725mm	330mm	25mm	50kN****	up to 100mm	up to 100mm
200TC1*	200mm	400mm	1MPa	910mm	410mm	25mm	50kN****	up to 150mm	up to 150mm
200TC2*	200mm	500mm	1MPa	910mm	500mm	25mm	50kN****	up to 150mm	up to 200mm
300TC1*	300mm	600mm	1MPa	1200mm	575mm	30mm	100kN	up to 150mm	up to 300mm
300TC/1*	300mm	1000mm	1MPa	1500mm	750mm	50mm	250kN	up to 150mm	up to 300mm

* Can be modified to a Dynamic Triaxial Cell. These cells have low friction seals and linear ball bearing for dynamic testing.

** (HE) Hall Effect Local Strain Transducers.

*** (LVDT) Local Strain Transducers.

**** Load Rating can be increased from 50kN to 100kN (high tensile, high load ram specified at time of order).



High Pressure Passive Triaxial Cells with Balanced Ram (>4MPa)

Overview: The balanced ram ensures that there is no load exerted by the cell pressure on the ram in either direction, no matter what cell pressure is being applied. The main advantage being that the full capacity of the load frame can be used to apply load to the sample.

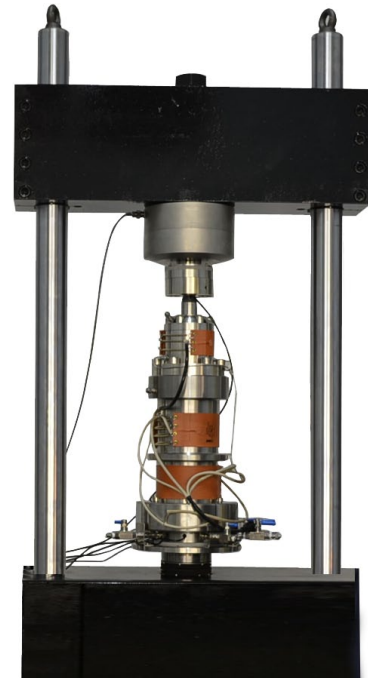
All high pressure triaxial cells have the following common functions:

- Temperature versions available.
- 5 x feed through ports (Cell, back & pore pressure).
- Made from Stainless Steel.

What is a Balanced Ram?

The balanced ram is a system that compensates for the up thrust on the ram exerted by the cell pressure. A secondary chamber around the ram balances the pressure in the cell against a second piston seal such that the cell pressure force is not exerted onto the load frame (i.e. the ram is “balanced” no matter what pressure is inside the cell).

This means that a smaller range loadframe can be used to achieve the same deviator loadings on the sample. For example if a cell has a 50mm diameter ram and a cell pressure of 32MPa the up thrust would be approximately 63kN which would have to be overcome by the load frame before any sample loading can be applied. With a balanced ram, the full capacity of the frame can be used to apply axial force on the sample. In addition, a balanced ram by its nature eliminates disturbance to constant cell pressure during axial loading, because as the ram enters the cell, the cell pressure remains constant because it is a fixed volume system.



32MPa Balanced Ram Cell with heating elements in GDS Virtual Infinite Stiffness load frame (HP32BR)

Product Code	Max Sample Diameter	Max Sample Height	Max Pressure Rating	Cell Height	Outer Cell Diameter	Max Axial Load	Load Ram Diameter	Load Cell Type	Weight (Approx)
HP32BR	54mm	100mm	32MPa	925mm	305mm	250kN	50mm	10 or 12*	180kg
HP64CL	100mm	200mm	64MPa	1048mm	382mm	250kN	50mm	10 or 12*	300kg
HP64CL/ GA40	100mm	200mm	64MPa	1015mm	385mm	400kN	50mm	10 or 12*	300kg
HP64HL	100mm	200mm	64MPa	1035mm	385mm	1000kN	70mm	10 or 12*	325kg

*Use type 10 loadcell for 64kN or less, use type 12 loadcell for >64kN.



High Pressure Passive Triaxial Cells without Balanced Ram (>4MPa)

Overview: For triaxial cells that do not have balanced rams, accommodation needs to be made for the potential maximum ram upthrust (in particular for high pressure triaxial cells). The load frame that the cell is being used in must be capable of taking the maximum ram upthrust. If this is not the case, a balanced ram solution can be considered. Porting is provided for local instrumentation. All high pressure triaxial cells have the following common functions:

- Temperature versions available.
- 5 x feed through ports (Cell, back & pore pressure).
- Made from Stainless Steel.



14MPa Triaxial Cell with 150mm
max sample diameter
(14MPAC/GA1)



14MPa Triaxial Cell with 76mm
max sample diameter (HP14/76)



100MPa Triaxial
Cell with 50mm max sample
diameter (HP100MPA)

Product Code	Max Sample Diameter	Max Sample Height	Max Pressure Rating	Cell Height	Outer Cell Diameter	Max Axial Load	Ram Diameter	Load Cell Type
HP100MPA	50mm	100mm	100MPa	760mm	400mm	100kN / 400kN	25mm / 50mm	12*
HP32/CL50	54mm	100mm	32MPa	1048mm	375mm	400kN	50mm	12*
HP70CL/70	70mm	140mm	70MPa	690mm	310mm	400kN	50mm	12*
HP14/76	76mm	152mm	14MPa	600mm	270mm	100kN	25mm	9 or 10*
HP14CL	100mm	200mm	14MPa	560mm	266mm	100kN	25mm	9 or 10*
HP20CL	100mm	200mm	20MPa	750mm	290mm	100kN / 400kN	25mm / 50mm	9 or 10*
14MPAC/GA1	150mm	300mm	14MPa	735mm	480mm	400kN	50mm	9 or 10*

*Use type 9 or 10 loadcell for 64kN or less, use type 12 loadcell for >64kN.

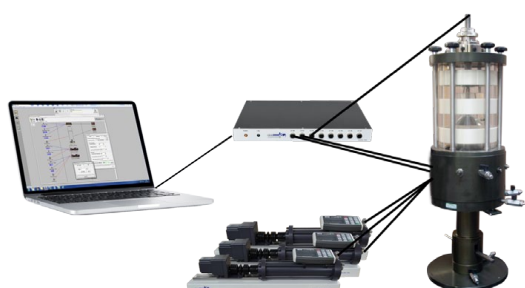


Active Triaxial Cells

(Includes a Hydraulically Actuated Ram)

Overview: The difference between active and passive triaxial cells is in the manner in which the axial load is applied. Active cells have a built in system (usually hydraulic or electro-mechanical) to apply the axial loads, passive cells derive their axial loads from being placed into load frames.

- Ram displacement may be calculated from the volume change applied to the ram.
- 5 hydraulic connectors (cell, 2 x back, 2 x pore)
- Specifically designed for stress path testing
- Designed to work with internal submersible load cells
- Made from hard anodised aluminium ($\leq 2\text{MPa}$ rating), or stainless steel ($>2\text{MPa}$)



2MPa Hydraulically Actuated Ram in a Bishop and Wesley type (BW038)



64MPa Active Triaxial Cell with Lifting Frame (HP64AC)

Product Code	Max Sample Diameter	Max Pressure Rating	Max Stroke	Max Axial Load	Max Sample Diameter with Hall Effects	Max Sample Diameter with LVDT	Cell Description
BW038	50mm	2MPa	25mm	7kN	up to 50mm	up to 50mm	Complete with four hydraulic ports and valves. Supplied complete with load ram and pillar for connection of displacement gauge.
10MPAC/GA1	55mm	10MPa	25mm	150kN*	up to 50mm	up to 50mm	* 150kN with 32MPa GDS pressure controller and 0kPa cell pressure. 105kN with 10MPa cell pressure.
BW7010	100mm	2MPa	50mm	20kN	up to 70mm	up to 76mm	Includes access ports for internal instrumentation as standard.
HP64AC	150mm	64MPa	100mm	2000kN	up to 150mm	up to 150mm	10 off electrical feed through's, accommodates 2000kN submersible load cell.