



### Hardin Oscillator (H-RCA)

**Overview:** Hardin Type Resonant Column Apparatus (H-RCA) is a system that allows samples to be tested in resonance while maintaining an anisotropic loading up to 2kN. This is achieved by a slender, thin walled loading column passing through the drive system to the topcap. The GDS Hardin Oscillator contains an electro-magnetic drive system incorporating precision wound coils and composite sintered neodymium iron boron (NdFeB) “rare-earth” magnets.

The GDS Hardin Oscillator can be mounted in a standalone system with an integral axial force actuator (shown opposite) for post resonance testing up to 5kN, or as a cell for integration into a standard loadframe up to 50kN.

#### Key Features:

#### Benefits to the User:

Hardin Type Oscillator:	The specific benefit of the Hardin Oscillator is the ability to perform torsional resonance anisotropically.
Hardin Oscillator can be loaded beyond its useable load:	The Hardin head is designed to be able to apply up to 2kN axial force whilst still being able to perform resonance tests. The GDS head is designed such that the Hardin cell can be loaded beyond this value to 5kN or 50kN (depending on which system is chosen), allowing a full suite of triaxial tests to be performed to shearing post resonance.
Post resonance maximum axial load of either 5kN (top actuator) or 50kN (load frame):	The 5kN max load system is neat because it has an actuator built into the top of the cell. The cell is a hybrid style cell that allows the cell wall to be lifted clear of the sample while the top-cap is supported in place for easy and accurate sample installation and alignment. The 50kN version (using a traditional load frame) has the obvious benefit of the additional load that can be achieved post resonance, however it does not have the advantage of a hybrid cell and has a traditional removable cell top instead.
Integrated reaction mass:	The reaction mass is integrated into the drive system so it is as close to the force generation as possible. This eliminates uncertainties due to transferal of forces.
Current driven using a transconductance power amplifier:	The impedance of magnet / coil devices change with frequency. At higher frequencies, using a constant voltage amplifier the current would be seen to reduce. As the torque is directly proportional to current, the torque will also reduce and a non-linear torque input would affect results. This effect is removed in the GDSRCA by using a current driven power amplifier.
Dedicated GDS RCA software is used for control and data acquisition:	Simple automated tests allow tests to be consistent.

**Tests that can be Performed:** Torsional resonance testing with Isotropic or Anisotropic Loading. Low stress torsional shear testing.

**Upgrade Options:** Sample shearing at 5kN or 50kN, high pressure systems up to 20MPa, temperature controlled systems, bender elements & unsaturated testing.

#### Technical Specification:

<b>Accuracy of Pressure Measurement:</b>	0.15% FRO
<b>Pressure Range:</b>	1MPa with optional upgrade to 20MPa
<b>Load Range for Resonance:</b>	2kN
<b>Load Range post Resonance:</b>	5kN (top actuator) or 50kN (load frame)
<b>Samples sizes:</b>	50mm, 70mm or 100mm
<b>Axial Stroke:</b>	50mm (2kN version)

## Why Buy GDS?

### GDS have supplied equipment to over 84% of the world's top 50 Universities:

GDS have supplied equipment to over 84% of the world's top 50 Universities who specialise in Civil & Structural Engineering, according to the "QS World University Ranking 2019" report.

GDS also work with many commercial laboratories including BGC Canada, Fugro, GEO, Geolabs, Geoteko, Golder Associates, Inpijn Blokpoel, Klonn Crippen, MEG Consulting, Multiconsult, Statens Vegvesen, NGI, Ramboll, Russell Geotechnical Innovations Ltd, SA Geolabs, SGS, Wiertsema and Partners to name a few.

**TOP  
50**

### Would you recommend GDS equipment to your colleague, friend or associate?

**100% of our customers answered "YES"**

Results from our post-delivery survey asked customers for feedback on their delivery, installation (if applicable), supporting documentation, apparatus and overall satisfaction with GDS. The survey ran for two years.



### Made in the UK:

All GDS products are designed, manufactured and assembled in the UK at our offices in Hook. All products are quality assured before they are dispatched.

GDS are an ISO9001:2015 accredited company. The scope of this certificate applies to the approved quality administration systems relating to the "Manufacture of Laboratory and Field Testing Equipment".

**40 YEARS OF  
BRITISH  
INNOVATION**



### Extended Warranties:

All GDS apparatus are covered by a 12 month manufacturers warranty. In addition to the standard warranty, GDS offer comprehensive extended warranties for 12, 24 and 36 months, for peace of mind against any repairs in the future. The extended warranties can be purchased at any time during the first 12 months of ownership.



### GDS Training & Installation:

All installations & training are carried out by qualified engineers. A GDS engineer is assigned to each order throughout the sales process. They will quality assure the apparatus prior to shipping, if installation has been purchased, install the apparatus on the customers site & provide the training.



### Technical Support:

GDS understand the need for ongoing after sales support, so much so that they have their own dedicated customer support centre. Alongside their support centre GDS use a variety of additional support methods including remote PC support, product helpsheets, video tutorials, email and telephone support.

