

BIAXIAL OVERBURDEN ROCK CORE CELLS

RATED UP TO 12,000 PSI, 150°C

Over the past seven years Daedalus Innovations has revolutionized the application of high pressure to high-field NMR spectroscopy research. This proven technology has now been applied to create the next generation of rock core analysis tools for wide-line NMR spectroscopy. A rugged design with high reliability at maximum rated conditions is a must-have for those concerned about sample throughput and minimization of hands-on assembly time.

The patent pending zirconia housing delivers increased strength and flexibility of design over other materials yielding a vessel that has both superior performance and ease of assembly. Its unique threaded end plug design provides for a fully self-contained core sample holder. Separate and isolated flow paths provide for confinement pressure of the core and fluid injection through the core. Zirconia is fully RF permeable and the metal components are non-magnetic. Units can be ordered to accommodate 2-9" length and cores of up to 1.5" diameter.

Core diameter	1.5"	1.0"
Housing outside diameter with maximum pressure	53 mm—6,000 psi 51.4 mm—5,000 psi	53 mm—12,000 psi 49 mm—10,000 psi 43 mm—5,000 psi
Core size	2.5" length maximum with standard configuration and up to 6" length without modification to the housing. Special version of the 49 mm OD for 1" core samples can accommodate 9" core lengths.	
Maximum temperature	150°C with standard components. Higher temperatures are possible with advanced seals and core mounts.	
Proof Pressure	1.5x rated pressure for 10 minutes minimum	



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53 mm OD x 41 mm ID
6,000 psi rating

51.4 mm OD x 41 mm ID
5,000 psi rating



53 mm OD x 32 mm ID
12,000 psi rating

49 mm OD x 32 mm ID
10,000 psi rating

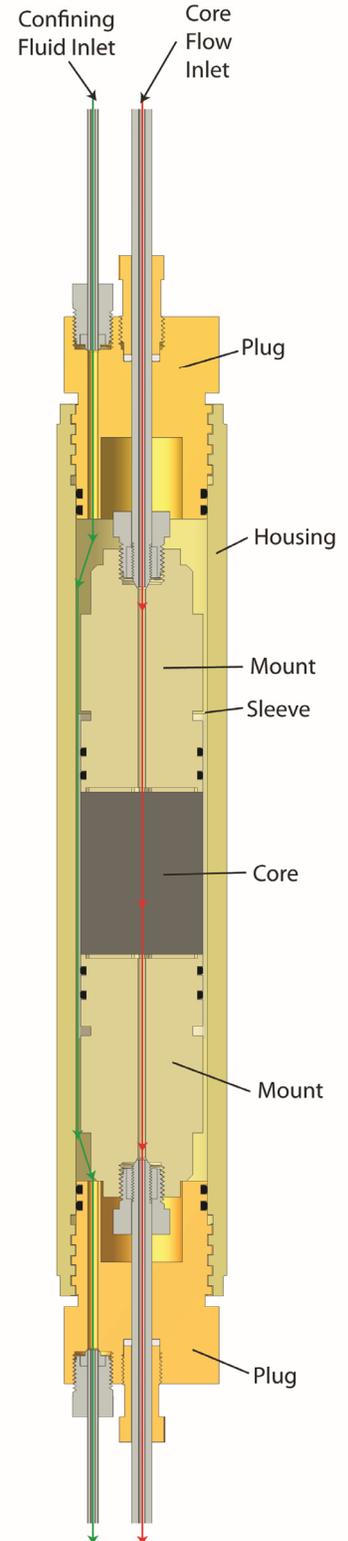
We have several other stock sizes available such as a dedicated 1" core sample holder in the same 53 mm OD size. Slightly smaller outer diameter cells are also available for use in other instruments.

The sample core is positioned between two mounts with high pressure connections through the plug and secured in place between mounts using a pressure-tight FEP sleeve. This entire assembly is then deposited through the top of the housing with the bottom high pressure tubing sliding through the bottom plug and sealed in place externally. The top mount acts as a piston when confinement pressure is applied to deliver axial pressure to the core while the sleeve delivers radial pressure for a biaxial pressure confinement of the core. The fluid flow paths are shown on the diagram to the right. The core confinement fluid is fully isolated from the fluid sent through the core.

The primary end plugs are threaded into the housing which creates a high pressure seal using elastomer seals. This threading action provides a simple mechanism to assure the high pressure seals are properly set so there is no leakage, but it also makes removal of the plugs easier than if they needed to be pulled out. Core samples can be pre-assembled on the bench using additional confining mounts and later inserted for rapid sample change out. Assembly of a mounted core in the housing takes just a few minutes. Even after prolonged exposure at high temperatures the disassembly is just as easy due to the threads leveraging extraction of the plugs.

Distance between plug faces (nominal)	192 mm
Metal free zone	165 mm (typical)
Housing material	Zirconia
End plug material	Bronze standard configuration
Wetted parts core injection fluid	PEEK, FEP and 316 stainless steel

The standard unit provides single phase fluid injection to the core. However, the top plug can be easily modified for bi-phasic or even tri-phasic fluid passage through the core sample mount and to the fluid distribution channels at the core face. This feature is currently only available for the 41 mm ID cells. However, the 41 mm cell configuration can accommodate 1.0" diameter core samples with optional mounts specific to that purpose.



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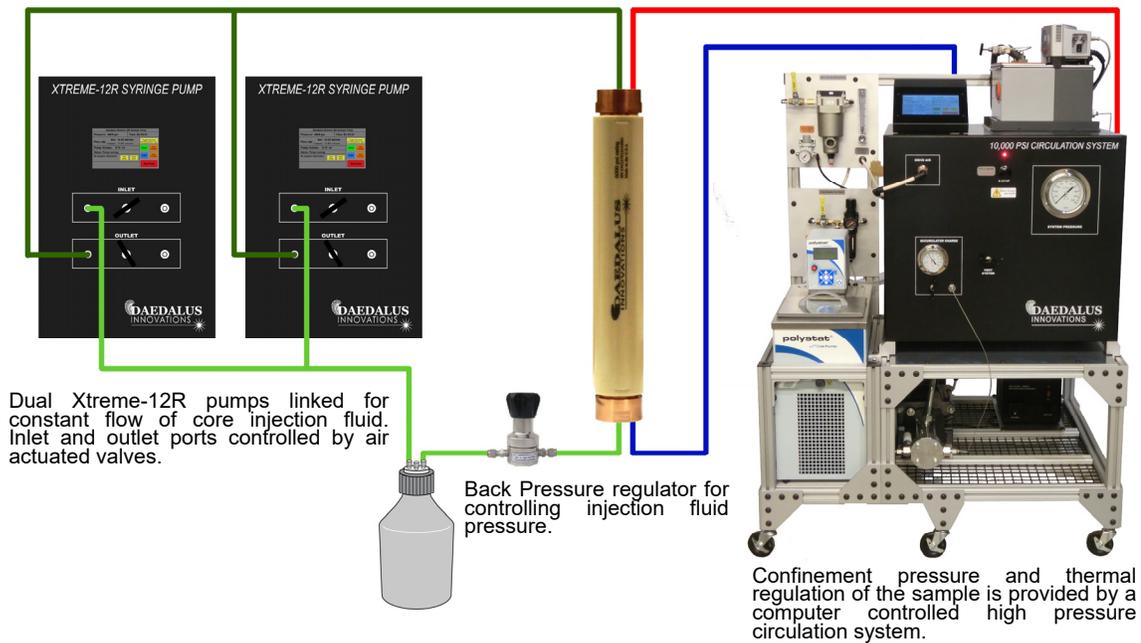


Z-axis translation mounts provides a stable platform to which the overburden cell can be fastened for placement inside the NMR instrument and optimal positioning of the core sample within the detection coils. Shown is the mount for the Oxford Instruments GeoSpec2/53 instrument.

Aging of core samples under pressure can be readily performed with the optional protective box that mounts directly to the assembly cradle (shown on the right). Dual polycarbonate layers provide a clear view of the cell to allow users to inspect the setup under pressure. Dual aluminum plates at the top allow for passage of the pressure lines outside the box for easy connection. The protective box is also useful for proof testing the setup prior to insertion into the magnet.



Daedalus Innovations also offers high pressure pumps and circulation units. We can provide basic, low-cost systems that use hand-crank pumps and manually adjustable circulation units. From this basic level the possible systems can be expanded all the way to fully automated tri-phasic fluid injection with fully automated thermally regulated circulation units with regulated pumping systems to control pulse damping. A pictorial block diagram of a fully automated single phase core fluid injection system with thermally regulated cell temperature is show below.



Daedalus Innovations can deliver flexible, fully automated but cost effective fluid management systems for a complete overburden rock core NMR system.

HIGH PRESSURE NMR

Daedalus Innovations has a proven track record of providing safe and reliable equipment for high pressure research with vessels for high-field NMR spectroscopy rated to 3.0 kbar (43,500 psi) in a 5 mm outside diameter NMR tube. Our efforts have led to a suite of instrumentation and pressure vessels that are easy to use even for those not yet familiar with high pressure research. Several systems are already in use for petrophysics applications. The first generation overburden cell is a dramatic departure from existing technology and promises to do for wide-line NMR research what we have been able to do for the high-field NMR research community.



The Xtreme and Xtreme R-Series Syringe Pumps provides precise computer-controlled pressure for high pressure applications.



Special flow cell with pressure connections available at the top and bottom. The cell is rated to 10,000 psi, 150°C. This might be used for live-oil experiments or packed with porous media for flow experiments. The outside dimension is 23 mm with a 5 mm inside diameter space for the sample. It is another example of the custom solutions developed by Daedalus.



Titanium manifold with 5 mm OD (2.8 mm ID) zirconia NMR tube. Versions rated to 3.0 kbar are currently available. Manifolds with integrated valves for self-contained confinement of high pressure samples are also available.

About Daedalus Innovations

Daedalus Innovations LLC was formed in 2005 by Joshua Wand, Ronald Peterson, and Brian Lefebvre. Founded to bring high-pressure capability to state-of-the-art solution NMR spectroscopy. An independent company, Daedalus Innovations is focused on the continuing development of new apparatus and products for the efficient and safe use of high pressure NMR in a variety of contexts.



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