EARTH PRESSURE CELLS

GEOKON®

MODEL 4800 SERIES



Model 4800 Earth Pressure Cell (front), Model 4820 Jackout Pressure Cell (center) and Model 4810 Contact Pressure Cell (rear).

APPLICATIONS

Earth Pressure Cells provide a direct means of measuring total pressures, i.e. the combination of effective soil stress and pore water pressure, in or on:

- Bridge abutments
- Diaphragm walls
- Fills and embankments
- Retaining walls surfaces
- Sheet piling
- Slurry walls
- Tunnel linings
- To measure earth bearing pressures on foundation slabs and footings and tips of piles

OPERATING PRINCIPLE

Earth Pressure Cells are constructed from two stainless steel plates welded together around their periphery and separated by a narrow gap filled with hydraulic fluid. External pressures squeeze the two plates together creating an equal pressure in the internal fluid. A length of stainless steel tubing connects the fluid filled cavity to a pressure transducer that converts the fluid pressure into an electrical signal transmitted by cable to the readout location.

ADVANTAGES & LIMITATIONS

The 4800 Series Earth Pressure Cells use vibrating wire pressure transducers and thus have the advantages of long term stability, reliable performance with long cables and insensitivity to moisture intrusion. All models also include a thermistor for temperature measurements and a gas discharge tube for lightning protection. Dynamic stress changes can be measured utilizing semiconductor type Pressure Cells, which are available on request.

Cell performance depends strongly on the surrounding soil properties. It would be prohibitively expensive to calibrate a cell in the soil type specific to the application being contemplated. However, studies have shown that the most consistent cell performance is achieved using cells of maximum stiffness with aspect ratios D/t >10 (D is the diameter of the cell, t the thickness). With GEOKON cells, maximum stiffness is achieved by using hydraulic oil with less than 2 ppm of dissolved gas and aspect ratios generally greater than 20 to 30. Tests on Geokon cells in various types of soil have shown that the cells over-register the soil pressure by less than 5 percent. This is probably no greater than the inherent variability of the soil pressure distribution in the ground.

Typical of all closed hydraulic systems, earth pressure cells are sensitive to temperature changes which cause the internal fluid to expand at a different rate than the surrounding soil giving rise to spurious fluid pressure changes. The magnitude of the effect depends to a greater extent on the elasticity of the surrounding soil, i.e., on the degree of compaction and confinement, and is difficult to predict and correct for. The built-in thermistor is helpful in separating these spurious effects from real earth pressure changes.

MODEL 4800, 4815 EARTH PRESSURE CELLS

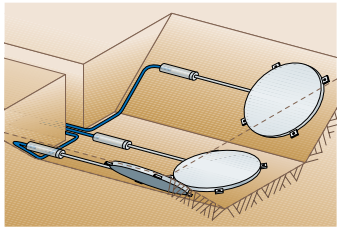


Model 4800 Earth Pressure Cell.

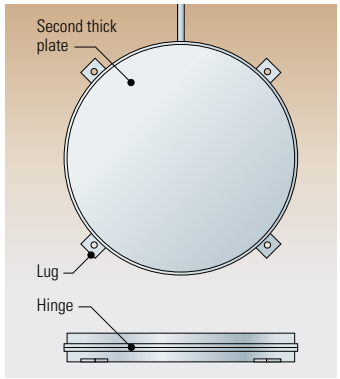
Model 4800 cells are constructed from two thin pressure sensitive plates. They can be positioned in the fill at different orientations so that soil pressures can be measured in two or three directions. Special armored cables are recommended in earth dam applications.

The Model 4815 is a special cell that effectively reduces the severity of point loading when used in granular materials. The modification uses two thick plates welded together at a flexible hinge that helps provide more uniform pressure distribution.

Models 4800, 4810 and 4815 are also available with a Bourdon Tube Pressure Gauge (2½" dial) in place of the vibrating wire pressure transducer. The pressure gauge is liquid-filled and features stainless steel wetted parts, a stainless steel case and crimp ring. Available in pressure ranges up to 15,000 psi (103 MPa) (1.5% span accuracy).



Model 4800 Earth Pressure Cells installed in fill for soil pressure measurement in three directions.



Model 4815 pressure cell, with two thick plates, for use in granular materials.



Model 4800 Earth Pressure Cell with a Bourdon Tube Pressure Gauge.

MODEL 4810 CONTACT PRESSURE CELLS

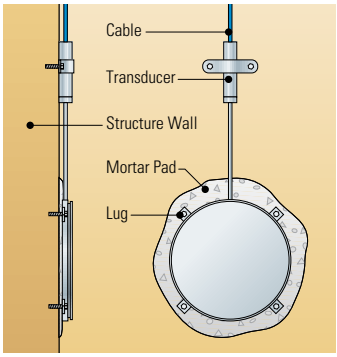


Model 4810 Contact Pressure Cell for attachment to existing concrete surfaces.

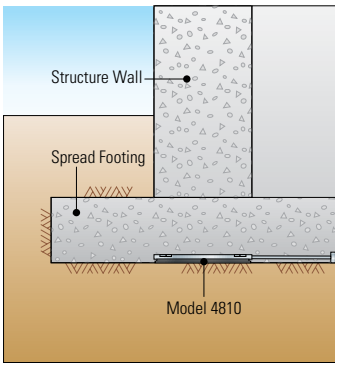
The Model 4810 Contact Pressure Cell is designed to measure soil pressures on structures. The backplate of the cell which bears against the external surface of the structure is thick enough to prevent the cell from warping. The other plate is thin and is welded to the backplate in a manner which creates a flexible hinge to provide maximum sensitivity to changing soil pressures.

Lugs on the side provide a means of mounting the cell to concrete forms or to steel or concrete surfaces. A mortar pad beneath the backplate ensures good contact with the structure surface. Cells are best installed flush with the surface to which they are attached. The fill material next to the cell should be screened to remove pieces larger than 10 mm.

Cells installed at the base of slabs and footings to measure bearing loads should always be positioned inside the concrete with the sensitive face pressed against the compacted fill. Cells placed in the fill below the concrete often become decoupled from the soil pressure due to the impossibility of adequately compacting the fill around the cell.



Side and frontal views of the Model 4810 installed on existing structure.



Model 4810 installation in a spread footing.

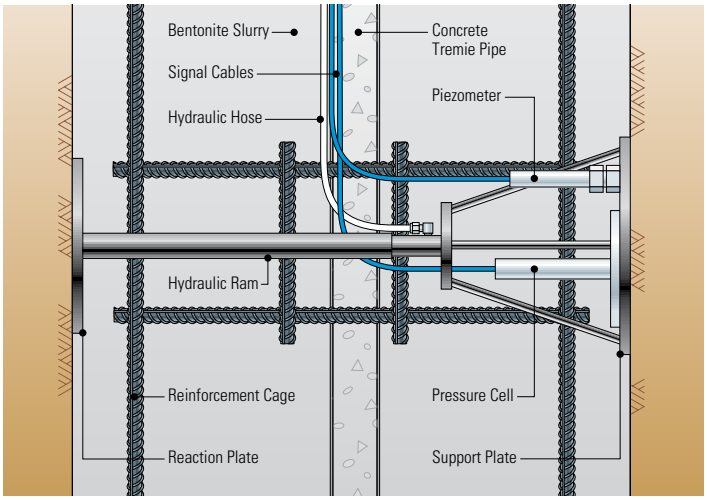
MODEL 4820 JACKOUT PRESSURE CELLS



Model 4820 shown in hydraulic ram assembly with piezometer and alone (inset).

The Jackout Pressure Cell is designed for installation in diaphragm walls (slurry walls) to monitor soil pressures on the walls as excavation proceeds. This allows the build-up of excessive pressures to be detected in time to take remedial measures.

The Jackout Pressure Cell assembly consists of the cell mounted on a support plate, a reaction plate and a hydraulic ram. This assembly is attached, in its retracted position, to the reinforcement cage and is lowered into the slurry trench along with the cage. When the cage is in position the hydraulic ram is extended by means of a hand pump situated at the top of the wall and connected to the ram by a hydraulic hose. Pressure is applied forcing the reaction plate and the cell against the walls of the trench. This pressure is maintained while the concrete is tremied into the trench and until the concrete cures. The cell may be supplemented by a piezometer attached to the support plate to measure pore water pressures.



Jackout Pressure Cell assembly installed in diaphragm wall.

MODEL 4830 PUSH-IN PRESSURE CELL



Model 4830 Push-In Pressure Cell.

The Model 4830 Push-In Pressure Cell is designed to be pushed in place for the measurement of total pressures in soils and earth fills. Where effective stress is required, the cell is fitted with an integral piezometer. A thread is provided on the end of the cell to allow for installation using lengths of pipe or drill rods.

MODEL 4855 PILE TIP PRESSURE CELL



Model 4855 Pile Tip Pressure Cell.

The Model 4855 Pile Tip Pressure Cell is used to measure pile-tip loads in cast-in-place concrete piles (caissons). Like the Model 4810, the Pile Tip Pressure Cell has a thick upper plate. The cell is manufactured to be close to the diameter of the pile and the back plate is supplied with hooks or sections of rebar to allow the cell to be connected to the bottom of the reinforcement cage. An added feature is a remote "crimping" mechanism to allow the cell to be inflated slightly so as to ensure good contact between the cell and the surrounding concrete. The Model 4855 is available on request.

CUSTOM PRESSURE CELLS



Custom Waterproof Pressure Cell.

Pressure Cells can be customized to meet your needs. Our staff will work with you throughout the process. Common customizations include temperature range, waterproof coating, remote repressurization, size, heavy duty housing, etc.

TECHNICAL SPECIFICATIONS

	4800*	4810*	4815*	4820*	4830*	4855*
Transducer Type	Vibrating Wire	Vibrating Wire	Vibrating Wire	Vibrating Wire	Vibrating Wire	Vibrating Wire
Output	2000–3000 Hz	2000–3000 Hz	2000–3000 Hz	2000–3000 Hz	2000–3000 Hz	2000–3000 Hz
Standard Ranges[1]	70, 170, 350, 700 kPa; 1, 2, 3, 5, 7.5, 10, 20 MPa	70, 170, 350, 700 kPa; 1, 2, 3, 5, 7.5, 10, 20 MPa	70, 170, 350, 700 kPa; 1, 2, 3, 5, 7.5, 10, 20 MPa	70, 170, 350, 700 kPa; 1, 2, 3, 5, 7.5, 10, 20 MPa	70, 170, 350, 700 kPa; 1, 2, 3, 5 MPa	2, 3, 5, 7.5, 10, 20 MPa
Over Range	1.5 × rated pressure	1.5 × rated pressure	1.5 × rated pressure	1.5 × rated pressure	1.5 × rated pressure	1.5 × rated pressure
Resolution	±0.025% F.S.	±0.025% F.S.	±0.025% F.S.	±0.025% F.S.	±0.025% F.S.	±0.025% F.S.
Accuracy[2]	±0.1% F.S.	±0.1% F.S.	±0.1% F.S.	±0.1% F.S.	±0.1% F.S.	±0.1% F.S.
Linearity	< 0.5% F.S.	< 0.5% F.S.	< 0.5% F.S.	< 0.5% F.S.	< 0.5% F.S.	< 0.5% F.S.
Typical Long-Term Drift	< 0.02% F.S./yr	< 0.02% F.S./yr	< 0.02% F.S./yr	< 0.02% F.S./yr	< 0.02% F.S./yr	< 0.02% F.S./yr
Cell Dimensions (H×D)[3]	7 × 230 mm	15 × 230 mm	26 × 230 mm	19 × 150 mm	10 × 203 mm	varies
Transducer Dimensions (L×D)	133 × 32 mm (≤ 170 kPa) 133 × 25 mm (≥ 350 kPa)	133 × 32 mm (≤ 170 kPa) 133 × 25 mm (≥ 350 kPa)	133 × 32 mm (≤ 170 kPa) 133 × 25 mm (≥ 350 kPa)	133 × 32 mm (≤ 170 kPa) 133 × 25 mm (≥ 350 kPa)	310 × 51 mm (≤ 170 kPa) 208 × 51 mm (≥ 350 kPa)	133 × 25 mm
Excitation Voltage	2.5–12 V swept square wave	2.5–12 V swept square wave	2.5–12 V swept square wave	2.5–12 V swept square wave	2.5–12 V swept square wave	2.5–12 V swept square wave
Excitation Frequency	1400–3500 Hz	1400–3500 Hz	1400–3500 Hz	1400–3500 Hz	1400–3500 Hz	1400–3500 Hz
Material	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
Temperature Range[1]	–20 °C to +80 °C	–20 °C to +80 °C	–20 °C to +80 °C	–20 °C to +80 °C	–20 °C to +80 °C	–20 °C to +80 °C

Note: PSI = kPa × 0.14503, or MPa × 145.03.
*Also available with mv/V, 0-5 V or 4-20 mA outputs Cell dimensions are the same. Transducer dimensions are 199 × 32 mm, except for the Model 4830 (please contact GEOKON for details).
[1]Other ranges available on request.
[2]Stated accuracy is for the pressure transducer alone. The total system accuracy (pressure transducer + pressure cell) is subject to site-specific variables.
[3]Other sizes available on request.



GeoNet Vibrating Wire Data Logger.

COMPATIBLE READOUTS AND DATA LOGGERS

GK-404: Handheld Readout
GK-406: Vibrating Wire Analyzer
8800 and 8900 Series: GeoNet Wireless Mesh Data Acquisition System
8910 Series: GeoNet Wireless LoRa® Data Acquisition System
8920 and 8921 Series: GeoNet Cellular Data Loggers
8930 Series: GeoNet Wi-Fi Data Loggers
8940 Series: GeoNet Local Data Loggers
8600 Series: Data Loggers

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