

# 4800 Series Earth Pressure Cell

## APPLICATIONS

- Bridge abutments and diaphragm walls
- Fills, embankments, and sheet pilings
- Tunnel linings and retaining wall surfaces

## FEATURES & ADVANTAGES

- Vibrating wire pressure transducer
- Reliable long-term performance



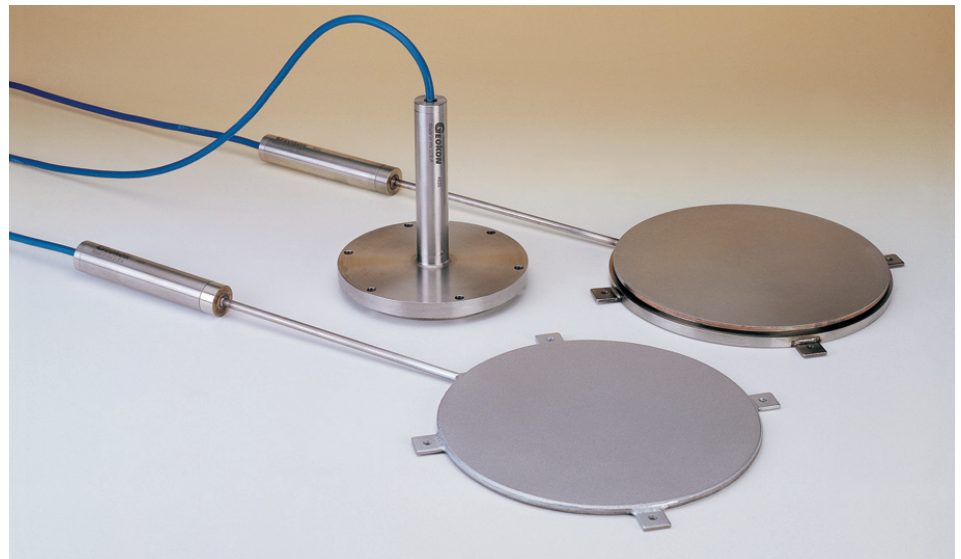
## OPERATING PRINCIPLE

4800 Series Earth Pressure Cells are constructed from two stainless steel plates welded together about 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 liquid filled cavity to a pressure transducer, which converts fluid pressures into an electrical signal transmitted to the readout location.

## ADVANTAGES & LIMITATIONS

Due to their use of vibrating wire transducers, 4800 Series Earth Pressure Cells provide long term stability and reliable signal performance over long cable lengths. 4800 Series pressure cells are also highly resistant to the effects of water intrusion. All models include an internal thermistor for temperature measurement and a gas discharge tube for lightning protection.

Cell performance depends strongly on the surrounding soil properties. Studies have shown that the most consistent cell performance is achieved using cells of maximum stiffness with a diameter (D) to thickness (t) aspect ratio of  $D/t > 10$ . With 4800 Series cells, maximum stiffness is achieved by using hydraulic oils with less than 2 ppm of dissolved gas. Cells generally have



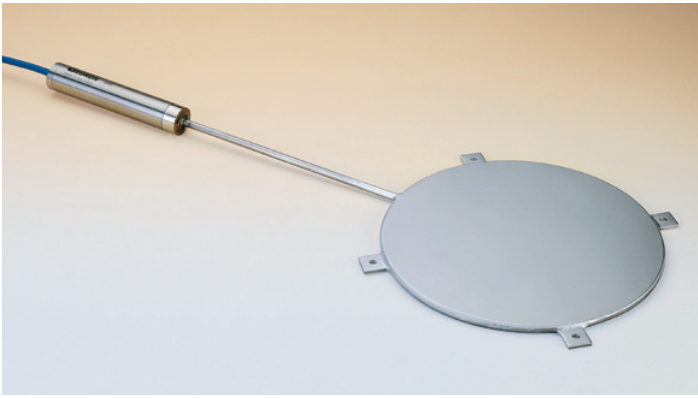
Model 4800 Earth Pressure Cell (front), Model 4820 Jackout Pressure Cell (center) and Model 4810 Contact Pressure Cell (rear).

aspect ratios greater than 20 or 30 D/t. Tests in various soil types have shown that 4800 Series 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 can cause internal fluids to expand at a

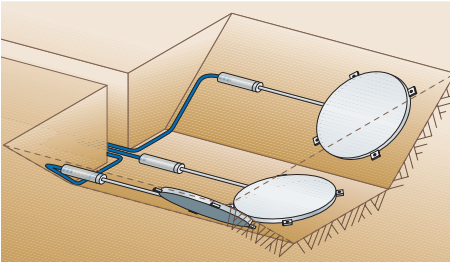
different rate than the surrounding soil. These changes often give rise to spurious fluid pressure changes. The magnitude of these effects are difficult to correct for, and depend largely on the elasticity of the surrounding soil and its degree of compaction or confinement. The built-in thermistors of the 4800 Series help compensate for this by separating these spurious effects from actual earth pressure changes.

## MODEL 4800, 4815 EARTH PRESSURE CELLS



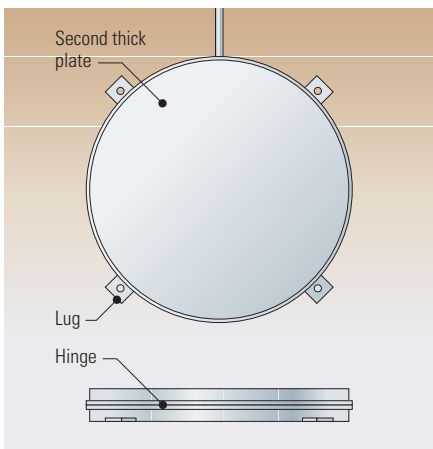
Model 4800 Earth Pressure Cell.

**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 for earth dam applications.



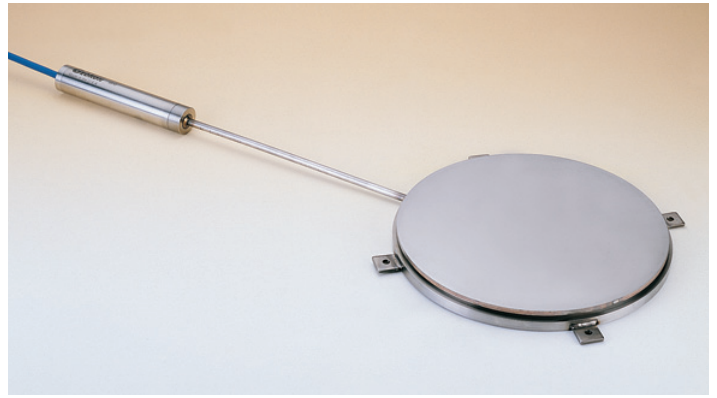
Model 4800 Earth Pressure Cells installed in fill for soil pressure measurement in three directions.

The **MODEL 4815** is a special cell that effectively reduces the severity of point loading when used in granular materials. This modified cell uses two thick plates welded together at a flexible hinge which provides more uniform pressure distribution.



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

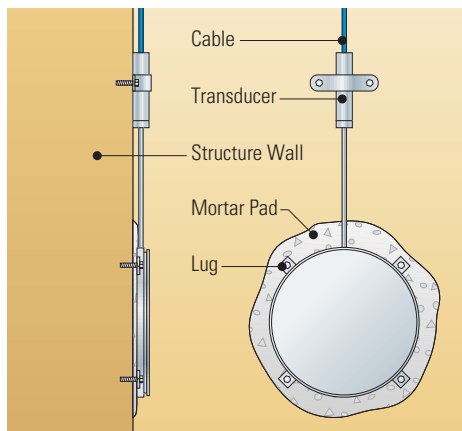
## MODEL 4810 CONTACT PRESSURE CELLS



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

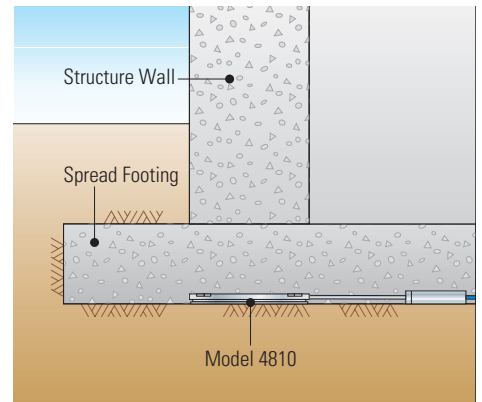
The **MODEL 4810** Contact Pressure Cell is designed to measure soil pressures on structures. The thick backplate of the cell bears against the external surface of the structure and prevents the cell from warping. The soil-facing side of the cell consists of a thin plate that is welded to the backplate to create a flexible hinge, providing maximum sensitivity to changing soil pressures.

Lugs on its side provide a means of mounting the cell to concrete or steel forms and surfaces. A mortar pad beneath 4810's backplate ensures good contact with the structural surface. Model 4810 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 particles larger than 10 mm.



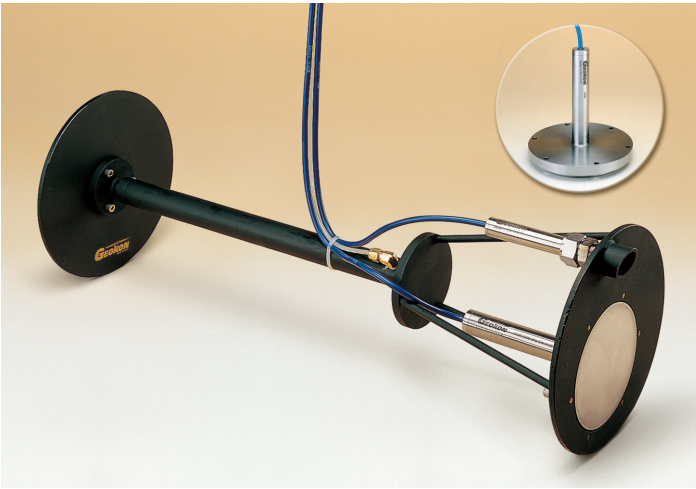
Side and frontal views of the Model 4810 installed on existing structure.

Cells installed at the base of slabs or footings, to measure bearing loads, should always be positioned within the concrete form with the sensitive face pressed against the compacted fill. Cells outside the concrete – placed in the fill beneath the concrete form – often become decoupled from soil pressures and, thus, do not properly engage the load bearing area.



Model 4810 installation in a spread footing.

## MODEL 4820 JACKOUT PRESSURE CELLS

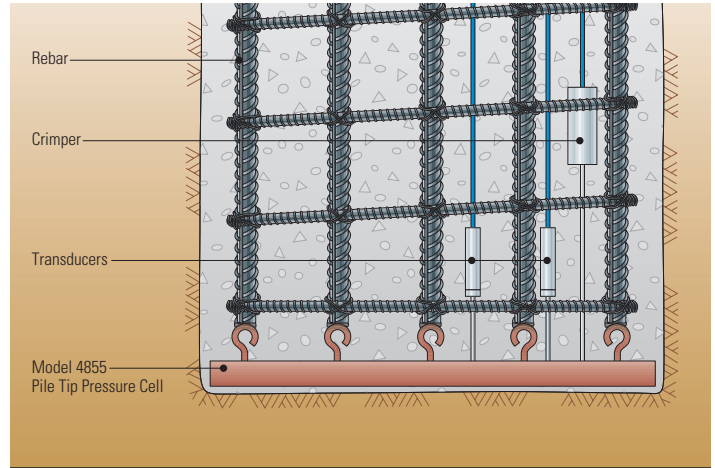


Model 4820 shown in hydraulic ram assembly with piezometer and alone (inset).

The **MODEL 4820** Jackout Pressure Cell is designed for installation in diaphragm walls (slurry walls) to monitor structure-affecting soil pressures during excavation procedures. This allows the build-up of excessive pressures to be detected in time to take remedial measures.

The Model 4820 assembly consists of a single pressure 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 lowered into the slurry trench. When the cage is in position, the hydraulic ram is extended by means of a hand pump, which is situated at the top of the wall and connected to the ram by a hydraulic hose. Applied pressure forces the reaction plate and the cell against the walls of the trench. Pressures from the hand pump must be maintained while the concrete is tremied into the trench and until the concrete cures. The Model 4820 pressure cell can also be used with an attached piezometer to measure pore water pressures.

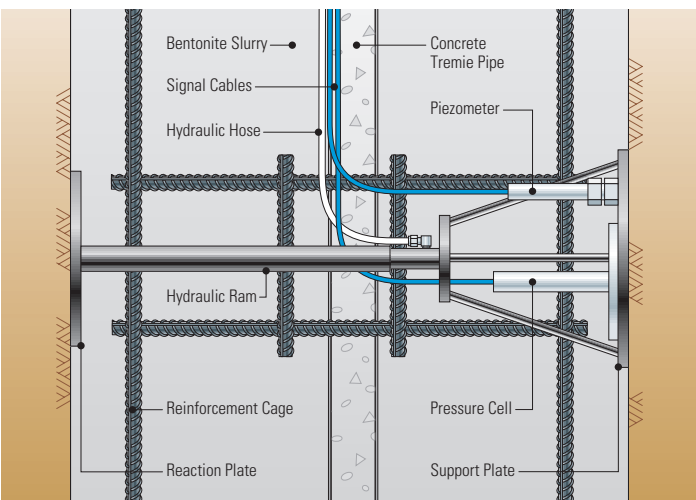
## MODEL 4855 PILE-TIP PRESSURE CELLS



Model 4855 Pile-Tip Pressure Cell installation

The **MODEL 4855** Pile-Tip Load Cell is used to measure pile-tip loads in cast-in-place concrete piles. Like the Model 4810, the Model 4855 has a thick upper plate which prevents cell warping. The cell is manufactured to be close to the diameter of the pile, and its backplate is supplied with hooks or sections of rebar to allow the cell to be connected to the bottom of the reinforcement cage. Two vibrating wire pressure transducers are connected to the cell to provide some redundancy in the event that one transducer is damaged during installation. The Model 4855 also features a remote "crimping" mechanism to allow the cell to be inflated slightly, ensuring good contact between the cell and the surrounding concrete.

## MODEL 4855 PILE-TIP PRESSURE CELLS



Jackout Pressure Cell assembly installed in diaphragm wall.

	4800	4810	4815	4820	4855
<b>Transducer Type</b>	Vibrating Wire	Vibrating Wire	Vibrating Wire	Vibrating Wire	Vibrating Wire
<b>Output</b>	2000-3000 Hz	2000-3000 Hz	2000-3000 Hz	2000-3000 Hz	2000-3000 Hz
<b>Standard Ranges<sup>1</sup></b>	70, 170, 350, 700 kPa; 1, 2, 3, 5, 7.5, 20 MPa	350, 700 kPa; 1, 2, 3, 5 MPa	350, 700 kPa 1, 2, 3, 5 MPa	350, 700 kPa; 1, 2, 3, 5 MPa	3, 5, 7, 10.5 MPa
<b>Over Range</b>	150% F.S. (maximum)	150% F.S. (maximum)	150% F.S. (maximum)	150% F.S. (maximum)	150% F.S. (maximum)
<b>Resolution</b>	±0.025% F.S.	±0.025% F.S.	±0.025% F.S.	±0.025% F.S.	±0.025% F.S.
<b>Accuracy<sup>2</sup></b>	±0.1% F.S.	±0.1% F.S.	±0.1% F.S.	±0.1% F.S.	±0.1% F.S.
<b>Linearity</b>	< 0.5% F.S.	< 0.5% F.S.	< 0.5% F.S.	< 0.5% F.S.	< 0.5% F.S.
<b>Thermal Effect on Zero</b>	< 0.05% F.S.	< 0.05% F.S.	< 0.05% F.S.	< 0.05% F.S.	< 0.05% F.S.
<b>Typical Long-Term Drift</b>	< 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
<b>Standard Cell Dimensions<sup>3</sup> (H × D)</b>	6 × 230 mm	12 × 230 mm	26 × 230 mm	12 × 150 mm	25 × varies
<b>Transducer Dimensions (L × D)</b>	150 × 25 mm	150 × 25 mm	150 × 25 mm	150 × 25 mm	150 × 25 mm
<b>Excitation Voltage</b>	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
<b>Material</b>	304 Stainless Steel	304 Stainless Steel	304 Stainless Steel	304 Stainless Steel	304 Stainless Steel
<b>Temperature Range<sup>1</sup></b>	-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

<sup>1</sup>Other ranges available on request.

<sup>2</sup>Calibrated accuracy of the pressure sensor.

<sup>3</sup>Other sizes available on request.

## APPLIED GEOMECHANICS

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