

# Hydraulic Borehole Pressure Cells

## Applications

The Model 3200 Hydraulic Borehole Pressure Cells are designed for the measurement of rock stress changes in...

- Coal mines
- Hard rock mines
- Support Pillars
- Roof and walls of underground openings
- Evaporite Deposits (salt, potash, trona etc.)



• Model 3200 Hydraulic Borehole Pressure Cells pictured with pressure transducer (front) and stainless steel pressure gage (rear).

## Operating Principle

The Borehole Pressure Cell, (BPC), is designed to monitor stress changes in rock. In use, the cell is grouted into a borehole drilled into the rock. When the grout has hardened the cell is connected to a hydraulic hand pump and pressurized to a pressure approximating the estimated in-situ stress level. (A check valve maintains the pressure inside the cell when the pump is removed). Stress changes within the rock are transmitted to the cell, causing proportionate changes in the hydraulic cell pressure, which are recorded by a pressure gage and/or pressure transducer.

## Advantages and Limitations

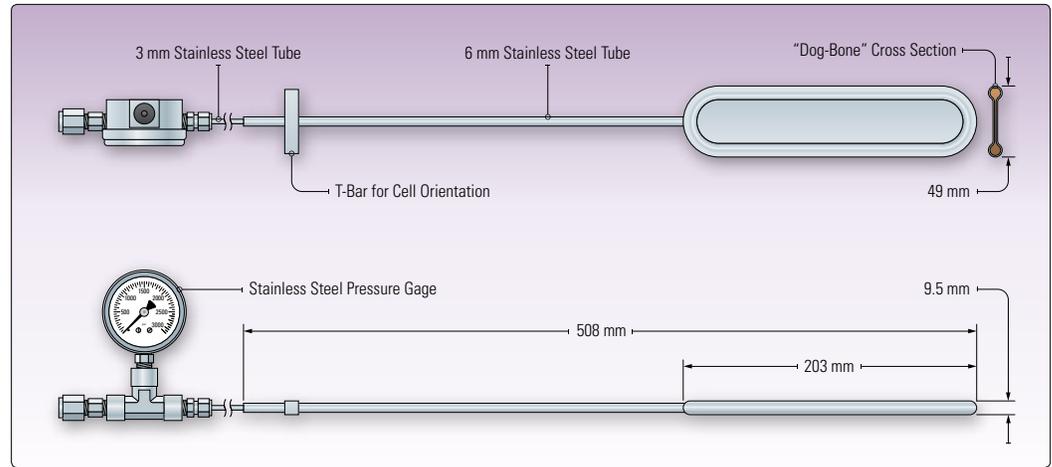
The BPC reacts mainly to stress changes in the direction perpendicular to the plane of the cell (the average sensitivity to stress changes in the plane of the cell is only about 6%). If biaxial stress changes are required then two or three BPCs can be installed at different orientations in the same borehole or in adjacent boreholes.

The conversion of cell pressure changes to equivalent rock stress changes requires knowledge of the rock modulus. Procedures do exist for obtaining an in-situ calibration but they are somewhat complicated.

In rocks, which exhibit plastic behavior, such as salt, potash, trona, etc., the rock squeezes down onto the BPC until pressure equilibrium is achieved. Under these circumstances it is not unusual for the BPCs to record the absolute value of the insitu rock stress and not merely stress changes.



● Model 3200 BPC shown pre-encapsulated in a cylinder of quick setting cement.



● Model 3200 components and dimensions.

### System Components

The BPC consists of a flatjack made from two steel plates welded together at their edges with the intervening space filled with hydraulic oil. The BPC has a “dog-bone” cross-section to allow it to expand and contract freely over a large range without splitting the welds. A length of high-pressure steel tubing is attached to the flatjack and leads to the outside of the borehole where a high-pressure Tee fitting allows the coupling of a pressure gage and a check valve through which the cell can be inflated. A pressure transducer, (models 4500H or 3400), can be used along with or instead of the pressure gage if remote or automatic reading capability is required.

BPC are installed using setting rods, which engage a T-Bar on the hydraulic tubing close to the cell, so that the cells can be oriented in the desired direction.

Where grouting cannot conveniently be performed, the BPC flatjack can be pre-encapsulated in a cylinder of quick setting cement. The encapsulated cell is pushed to the required depth and orientation and then inflated as before.

### Technical Specifications

|                                |  |
|--------------------------------|--|
| Standard Ranges <sup>1</sup>   | 20, 35, 75 MPa                                 |
| Resolution                     | 0.25% of range (approximately)                 |
| Accuracy <sup>2</sup>          | (Gage) 0.25% F.S.<br>(VW Transducer) 0.1% F.S. |
| Temperature Range <sup>3</sup> | -20°C to +80°C                                 |
| Borehole Size                  | 57 mm  |
| L × W × H                      | 210 × 51 × 6 mm                                |

<sup>1</sup>1 MPa = 145.04 psi.

<sup>2</sup>VW Transducer accuracy established under laboratory conditions.

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