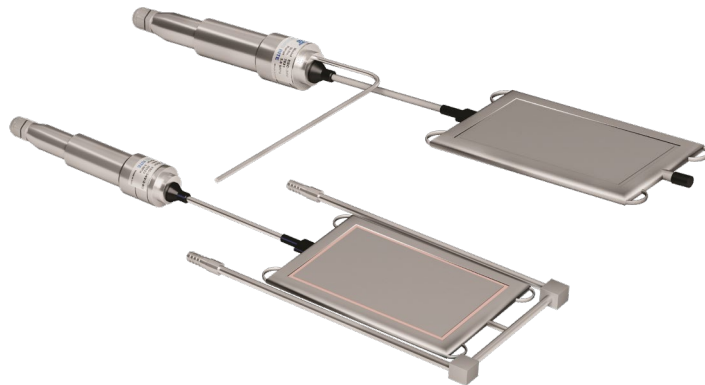


SHOTCRETE-CONCRETE PRESSURE CELL

MODEL ESC-30V



INTRODUCTION

The 'New Austrian Tunneling Method', or N.A.T.M., calls for the support of a tunnel by the rapid application of shotcrete to the freshly exposed ground. The theory behind this method of support, particularly useful in weaker grounds, is that if the inherent strength of the ground can be preserved, it will be almost self-supporting and will require much less artificial support in the form of concrete or steel. Proper evaluation of total stress may help in:

- The adequacy of the shotcrete lining, indicating the need for perhaps more or less shotcrete to maintain stability.
- Verifying design assumptions that will promote safer and more economical design and construction.

FEATURES

- Rugged, waterproof all stainless steel construction for high reliability.
- Remote filled for high rigidity, accurate and fast response.
- Vibrating wire sensor assures long term stability quick and easy readout.
- Pinch tube for re-inflation in concrete.
- Readily adaptable to data loggers.
- Thermistor available for temperature correction.

APPLICATION

- Radial and tangential stresses in shotcrete tunnel linings.
- Assess the adequacy of shotcrete lining.
- Mine backfill monitoring.
- Pressure on and within lining of underground excavations.
- Evaluating foundation bearing pressures.
- Stress in the rock walls of unlined caverns.



Shotcrete-concrete stress cells are designed for the measurement of radial and tangential stresses in shotcrete tunnel linings. They are often used in conjunction with borehole extensometer to measure:

- The performance of the lining
- To determine whether the lining is thick enough to maintain stability.

DESCRIPTION

The shotcrete-concrete stress cells basically consists of a flexible, flat rectangular capsule connected to a specially designed pressure sensor by a 6 mm ϕ x 170 mm long stainless steel tube.

Encardio-rite offers two variants of pressure cells:

- Model ESC-30V with pinching tube
- Model ESC-30V-R with re-groutable arrangement (instead of pinching tube).

The rigidity of the cell exceeds 50,000 MPa and ensures it will respond immediately and accurately to the onset of increasing concrete stresses.

Like any closed hydraulic system, pressure cell is sensitive to temperature effects. Any change in temperature of surrounding concrete can give an unauthentic reading, magnitude of which depends upon elasticity of surrounding concrete and relative coefficient of expansions of materials in contact & filled fluid inside the pressure cell. The sensor has an in-built thermistor to assist in separating these unauthentic temperature effects from actual pressure changes.

Fluid filled pressure capsule

The pressure capsule consists of two rectangular stainless steel plates welded around the edge. The narrow gap between plates is filled with de-aired fluid.

Vibrating wire pressure sensor

A stainless steel pressure sensor incorporates the latest vibrating wire technology and has inherently high sensitivity. Each pressure sensor is individually temperature compensated to 0.03%/°C.

Lugs

Lugs are provided at the corners of the rectangular plates to facilitate holding the cell in plane while the shotcrete is applied.

Pinch tube

During concrete lining, temperatures often rise and cause the capsule to expand in the still green concrete. On cooling, the capsule contracts, forming a gap between capsule and concrete. This prevents transmission of pressure from concrete to the cell. A 600 mm long pinch tube (filled with fluid) is provided to inflate the capsule after concrete around it has fully cured and has cooled off to the ambient temperature.

One end of pinch tube is welded to the pressure sensor while the other end is capped by welding. Using pliers, the tube is pinched at intervals, squeezing the fluid out of the tube into the capsule. This forces the capsule to expand until the gap is eliminated.

The re-groutable arrangement is for the same purpose.

OPERATING PRINCIPLE

Increase in stress in the concrete causes a corresponding rise in the fluid pressure as the steel plates are squeezed together. The change in fluid pressure is sensed by the pressure cell and is converted to an electrical signal in form of frequency. The pressure cell basically consists of a magnetic, high tensile strength stretched wire, one end of which is anchored and the other end fixed to a diaphragm which deflects in proportion to the applied pressure.

Any deflection of the diaphragm changes the tension in the wire, thus affecting the resonant frequency of the vibrating wire. The frequency output can be accurately measured by any vibrating wire readout unit. The data can also be automatically collected at desired frequency, stored and transmitted to remote server by a suitable datalogger.

SPECIFICATIONS

Sensor type	Vibrating wire
Range (MPa)	1.0, 2.0, 3.5, 5.0, 10.0, 20.0, 30.0 specify
Size (mm ²) (pressure pad)	100 x 200, 150 x 250, 200 x 300, 300 x 300
Accuracy of pressure sensor	± 0.5 % fs standard ± 0.1 % fs optional
Temperature limit operational	-20 to 80°C
Over range limit	150 % of range
Thermistor	YSI 44005 or equivalent (3 kOhms at 25°C)
Enclosure	Stainless steel

ORDERING INFORMATION

Model ESC-30V-(R)-Range-Pressure pad size- Cable housing type (cable ϕ 3.5-8 mm or 9-14 mm)