



# ENCARDIO RITE



## SHOTCRETE & CONCRETE PRESSURE METER

### 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.

#### SHOTCRETE-CONCRETE STRESS CELL

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 the EDS-80 Tape extensometer and EDS-64 Bore hole extensometer to measure:

- ◆ The performance of the lining and
- ◆ To determine whether the lining is thick enough to maintain stability.
- ◆ Suffix 'C': for use in concrete.

#### DESCRIPTION OF EQUIPMENT

The Encardio-rite N.A.T.M. style shotcrete concrete stress cells basically consists of a flat rectangular capsule and a pressure transducer connected to each other by a 6 mm  $\phi$  x 165 mm long stainless steel 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.

#### FEATURES

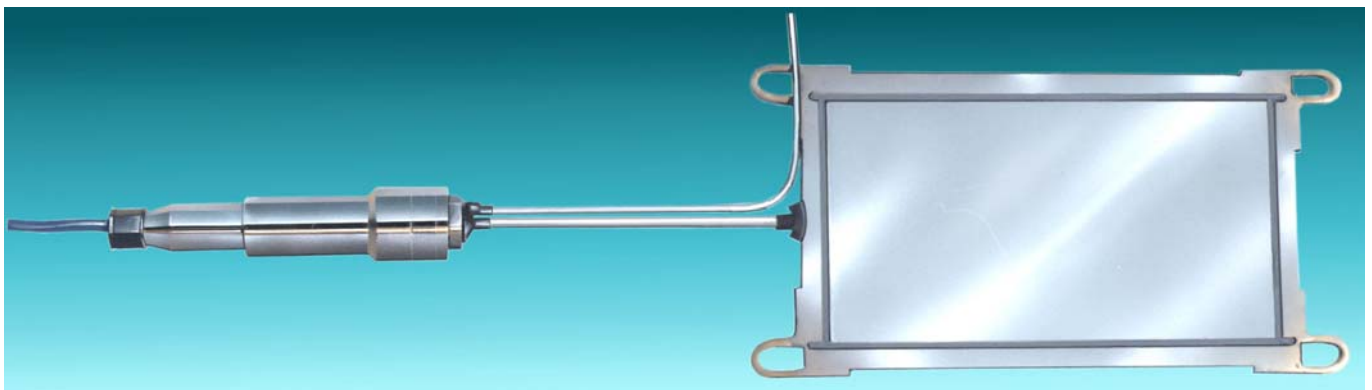
- ◆ Rugged, waterproof all stainless steel construction for high reliability.
- ◆ Remote filled for high rigidity, accurate and fast response.
- ◆ Vibrating wire sensor assures long term stability quick and easy readout.
- ◆ Pinch tube for re-inflation in concrete.
- ◆ Readily adaptable to data loggers.

#### APPLICATIONS

- ◆ 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 rockwalls of unlined caverns

#### Fluid filled pressure cells

The Encardio-rite model ESC-30V shotcrete-concrete cells comprises of two rectangular plates welded round the edge. The narrow gap between plates is filled with fluid using a special process which ensures that all the air is excluded.



### Vibrating wire transducer

The stainless steel pressure transducer is 42 mm  $\phi$  x 190 mm long. It incorporates the vibrating wire, the coil magnet assembly and the cable joint housing. Each pressure cell is individually temperature compensated to 0.03%/ $^{\circ}$ 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

One end of a 600 mm long pinch tube filled with fluid is welded to the pressure cell. The other end is capped by welding. During concrete lining, temperatures very often rises and causes the capsule to expand in the still green concrete. On cooling, the capsule contracts, which, if allowed to remain, would prevent the transmission of pressures from the concrete to the cell. The purpose of the pinch tube is to inflate the capsule after the concrete around it has fully cured and has cooled off to the ambient temperature. A set of pliers is used to squeeze the fluid in the pinch tube. The fluid is forced out of the tube into the capsule which expands until the gap is eliminated

### 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 specially built Encardio-rite vibrating wire pressure cell and is converted to an electrical signal which is transmitted as a frequency signal to read out unit. 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 some 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 resonant frequency with which the wire vibrates can be accurately measured by a conventional vibrating wire readout unit.

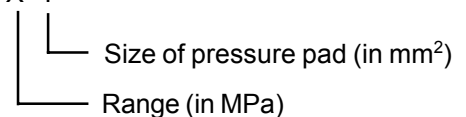
### SPECIFICATIONS

<b>Model</b>	ESC-30V-X
<b>Transducer type</b>	Vibrating wire
<b>Range (MPa)</b>	1.0, 2.0, 3.5, 5.0, 10.0, 20.0, specify
<b>Size (pressure pad)</b>	100 x 200 mm <sup>2</sup> , 150 x 250 mm <sup>2</sup> , 200 x 300 mm <sup>2</sup> , specify
<b>Accuracy<sup>1</sup></b>	$\pm 0.5$ % fs (standard) $\pm 0.1$ % fs (available on request)
<b>Temperature limit</b>	
<b>Operational</b>	-20 to 70 $^{\circ}$ C
<b>Compensated</b>	0 to 55 $^{\circ}$ C
<b>Over range limit</b>	150 % of range
<b>Over range effect</b>	$\pm 0.1$ % fsd upto 120%
<b>Read out</b>	Portable strain indicator
<b>Enclosure</b>	Stainless steel
<b>Thermistor</b>	YSI 44005 or equivalent ( 3 kOhms at 25 $^{\circ}$ C)

**Note<sup>1</sup>** Calibrated accuracy of pressure transducer, with our EDI-51V portable read-out unit.

### ORDERING CODE

Model ESC-30V-X-Y



All specifications subject to change without prior notice.

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