

# Piezo-cone penetrometer

## INTRODUCTION

The piezo-cone penetrometer is an electrical measuring instrument for Piezo-Cone Penetration Tests (PCPTs). The measurands are cone resistance ( $q_c$ ), sleeve friction ( $f_s$ ), pore pressure ( $u$ ). Figure 1 presents the layout of a 1,000 mm<sup>2</sup> (10 cm<sup>2</sup>) piezo-cone penetrometer with the filter positioned in the face of the cone.

Piezo-cone penetration tests involve the in-situ measurement of the resistance of ground to continuous penetration at a steady penetration of push rods having a cone at the base. The measurements permit high-quality interpretation of the ground conditions. A piezo-cone penetrometer also allows pore pressure dissipation testing.

## INSTRUMENT DETAILS

The common Fugro piezo-cone penetrometers have 1,000 mm<sup>2</sup> and 1,500 mm<sup>2</sup> cone base areas and a single filter position. The filter position is either in the face of the cone (face filter) or in the cylindrical extension above the base of the cone. Penetrometers with 100 mm<sup>2</sup> and 500 mm<sup>2</sup> cone base areas and penetrometers with double and triple filter positions are also available.

The cone and the friction sleeve consist of high-quality steel that is resistant to corrosion and abrasion. The filter consists of either porous HDPE or ceramic material.

The sensors for the cone and friction sleeve consist of load-cell type measuring transducers arranged in series. This arrangement permits a stiff penetrometer design. Penetrometer stiffness promotes the resistance to bending and relative movements of the various components, and hence the in-situ accuracy.

The pressure sensor is of the piezo-resistive type, requiring a very small volume change for the specified measuring range. The configuration of the filter, the internal connections and the pressure sensor facilitates practical and efficient saturation.

An internal amplifier unit enhances the analogue signal-to-noise ratios of the sensors. This promotes high-quality data transmission.

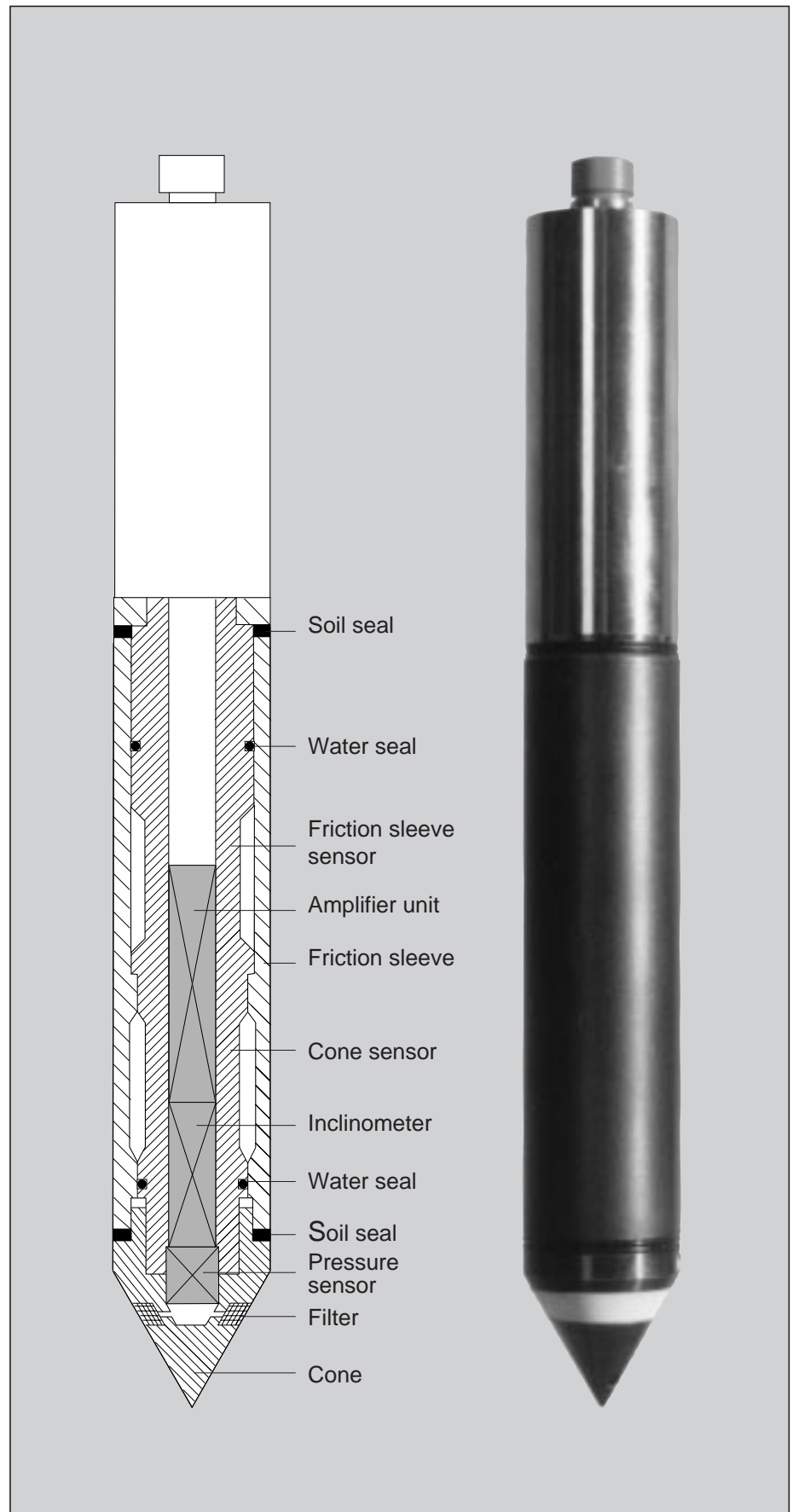


Fig. 1. Fugro Piezo-cone Penetrometer

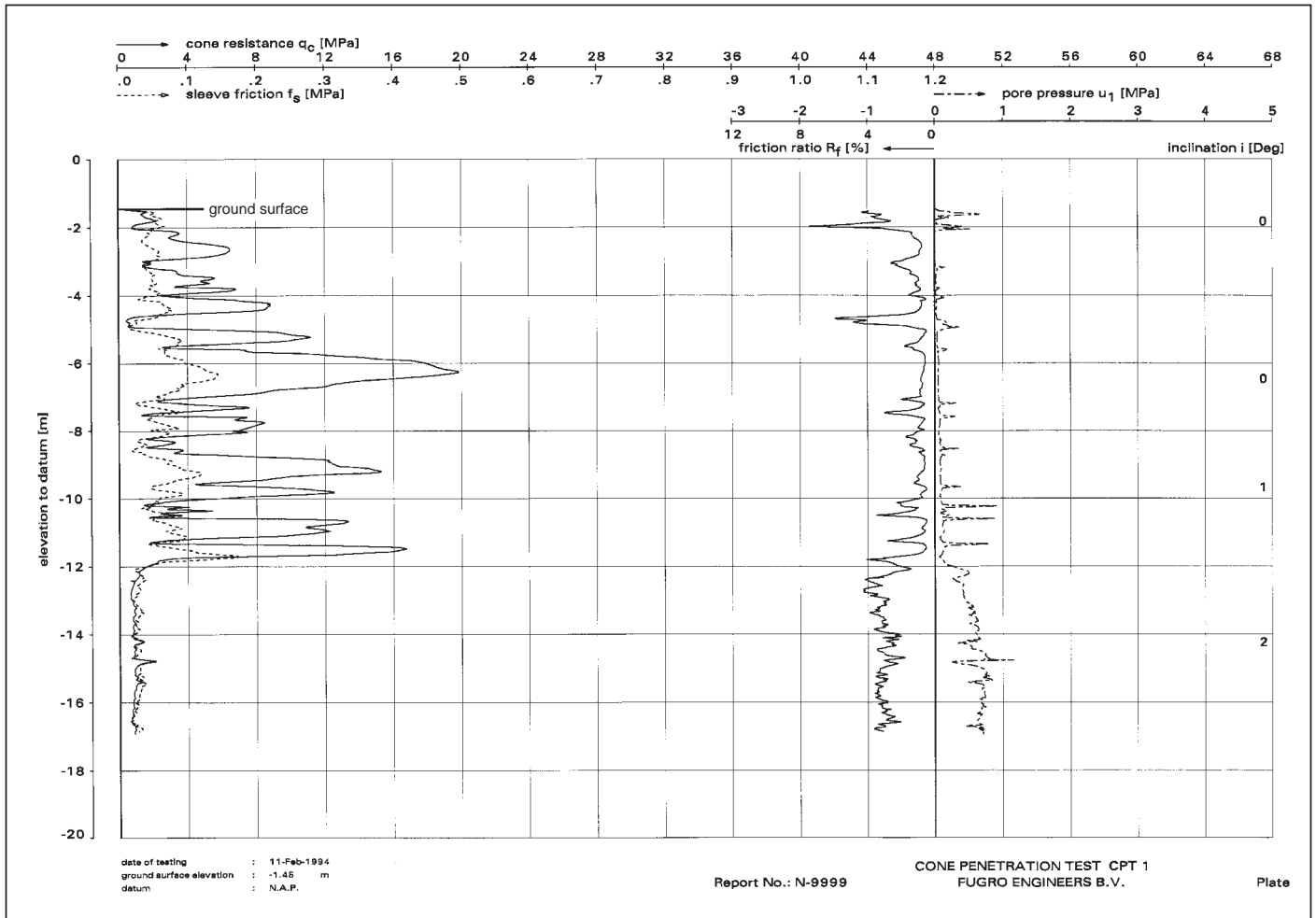


Fig. 2. Results obtained using the piezo-cone penetrometer at an onshore site

## MEASUREMENTS

A computer-based data acquisition system provides the link between the electrical output signals of the piezo-cone sensors and the digitally recorded data. Figure 2 presents typical results. The digital data allow rapid processing of the measurements and the derivation of PCPT parameters such as  $q_t$ ,  $q_{net}$  and  $B_q$ .

The piezo-cone penetrometer measures the transient pore pressure generated during penetration, as well as the hydrostatic pore pressure. The transient pore pressures can be significant for some low-permeability soils. Measurement of the dissipation of the transient pore pressure is feasible during a penetration interruption. The dissipation measurements permit the estimation of the in-situ coefficient of consolidation.

The specification of the equipment in this data sheet may be subject to modifications without prior notice.

## Fugro Engineers B.V.

10, Veurse Achterweg, P.O. Box 250, 2260 AG Leidschendam, The Netherlands.

Phone: 31-70-3111444 – Telefax: 31-70-3203640 – Telex: 31010 fugro nl.

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