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Laboratory equipment co.,limited

HEAVY DUTY POCKET PENETROMETER 16-T0163

PRODUCT MANUAL

C-TECH LABORATORY EQUIPMENT CO., LTD

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CONTENTS

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I. Description and features

The pocket penetrometer is a world-wide known instrument.

It is used by geotechnicians, geologists, agronomists, etc. to obtain quickly and easily an approximate measure of the shear resistance at failure of cohesive and semicohesive soils.

The body of the 16-T0163 pocket penetrometer consists of two telescopic cylinders containing a compression spring. A cylindrical tip, screwed at the lower part of the body, is pushed into the soil compressing the spring.

The 16-T0163 penetrometer is suitable for severe environmetal conditions. The complete instrument, including the spring, is made of stainless steel.

The 16-T0163 has been designed to allow relatively deep penetration of the soil for a pocket penetrometer (up to 6 cm max); this reduces mistakes and uncertainties typical of shallow measures which are often affected by remoulding, drying, etc. of the surface.

A value of the unconfined compressive strength (UCS) can be directly read from the scale on the instrument. This value (see appendix) has been derived from the so called "point resistance" which is the force needed to penetrate into the soil.

Measured strength values can assist the classification and description of cohesive soils and also give useful preliminary information about the shear strength.

The 16-T0163 can be used both in the field and in the laboratory with soils having UCS values (unconfined compressive strength) between zero and 2 MPa. For soft to medium soils the use of the largest tip is recommended to obtain a good resolution.

II. Specifications

The sensing part of the pocket 16-T0163 is a compression spring having a nominal stiffness of about 7 N/mm. 19 N of penetration force correspond to 2.72 mm of compression.

The standard tip of the penetrometer has a diameter of 6.35 mm. This gives a cross section equal to 31.65 sqmm. The largest tip has a diameter of 8.98 mm that it means a cross section of 63.335 sqmm.

The effective lengths of the standard probes is the same as the diameters which corresponds to the position of stop line for other pocket penetrometers in use.

With this point resistance values of up to 1 Mpa can be measured.

The instrument is supplied with another two interchange points, of which:

- the largest, diameter 8.98 mm, has a section twice that of the standard points and this measures resistance values of up to 0.5 Mpa; with this point, the values read on the scale must be divided by 2.
- the smallest, diameter 4.55 mm, has a section half that of the standard point and this measures resistance values of up to 2 Mpa; with this point, the values read on the scale must be multiplied by 2.

Numbers permanently etched on the left scale indicate UCS values (MPa) when the largest tip is used.

For cohesive saturated soils UCS is taken to be twice the undrained shear strength Cu.

The ratio qp/UCS, where qp is the point resistance, has been assumed equal to a mean value of 6 on the basis of both a number preliminary tests and the theoretical

considerations shown in the Appendix (R. Lancellotta, 1985). *

III. Instructions

1. Prepare the surface of the soil to be tested (sample, wall of a pit, etc.).
2. Screw the point onto the penetrometer, hand tighten or use the 6 to 14 mm spanner provided.
3. Verify that without any compression the PVC ring is at zero position, i.e. behind the step between the two telescopic cylinders.
4. Push the point slowly into the soil keeping a constant axis of penetration until the resistance value becomes pratically constant.
5. Pull out the probe and record the measured value; the reading is made from the low-load side of PVC ring (the handle side), on the proper scale (left or right scale) according to the used tip.

6. Also note the type of point used if different to the standard point.

7. Repeat the test nearly to the either confirm the measured value or obtain an average value.

8. Clean the instrument, unscrew the probe and replace both in the bag. The lower part of the penetrometer should be inserted into the leather leaving the upper half, which contains the scale and the PVC ring, free.

Note: The 16-T0163 penetrometer is designed and manufactured so as not to necessitate maintenance. It is however necessary to keep the instrument clean and not to let rest in water, mud etc. The spring inserted in the penetrometer is immersed in vaseline.

IV. Appendix * Considerations on the adopted ratio qp /Cu

1. The appropriate ratio for qp/Cu can be determined by considering the involved energy. For this the work necessary to penetrate the probe into the soil at a constant rate can be divided into three components (Baligh, 1984):

   a) work necessary to overcome the existing stress conditions (neglected in this situation);

   b) energy spent as plastic strains in the zone close to the tip;

   c) energy spent as elastic strains in the zone around the previously mentioned plastic zone.

The probe is tapered which results in a gap between the soil and probe behind its tip. Hence friction along the probe (or the work necessary to expand a cavity along the probe) can be neglected.

2. Which this assumption and the adoption of an hyperbolic behaviour model, the solution shown in figure is obtained. The figure indicates that the point resistance depends on both the undrained shear strength (Cu) and the yelding strain (defined by the ratio between the strength Cu and the shear modulus G). This last parameter controls the size of the plastic zone and the energy spent as plastic strains.

3. Because of the simplifications introduced into the analysis and taking into account the purposes of the test, the undrained shear strength determined should only be considered accurate to an order of magnitude. In other words either the deduced Cu parameter (or the UCS value directly read from the instrument) or the point resistance are only to be considered as an "index of strength".

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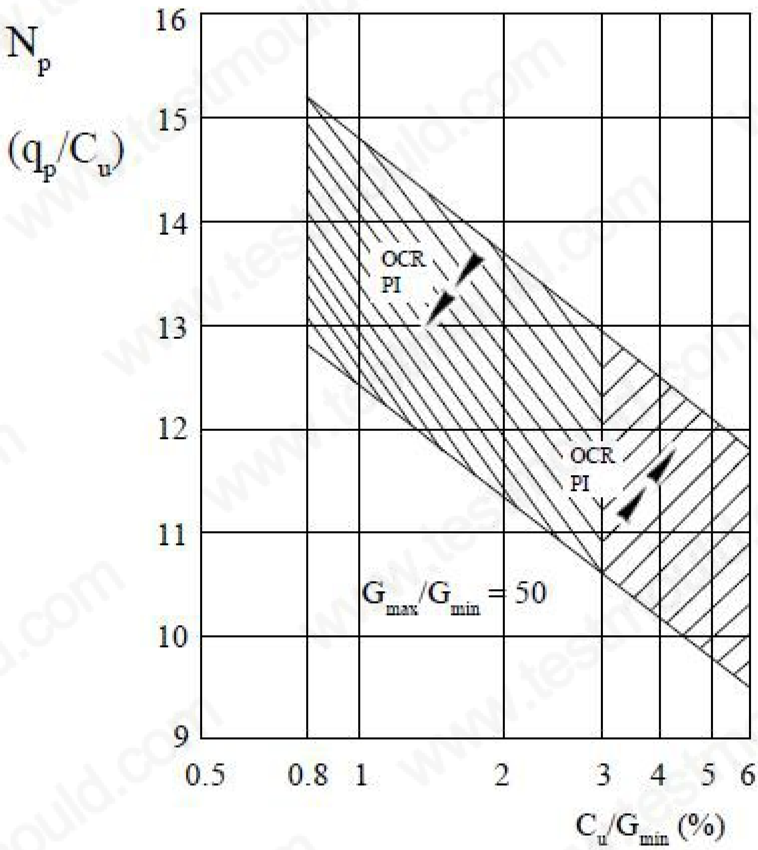
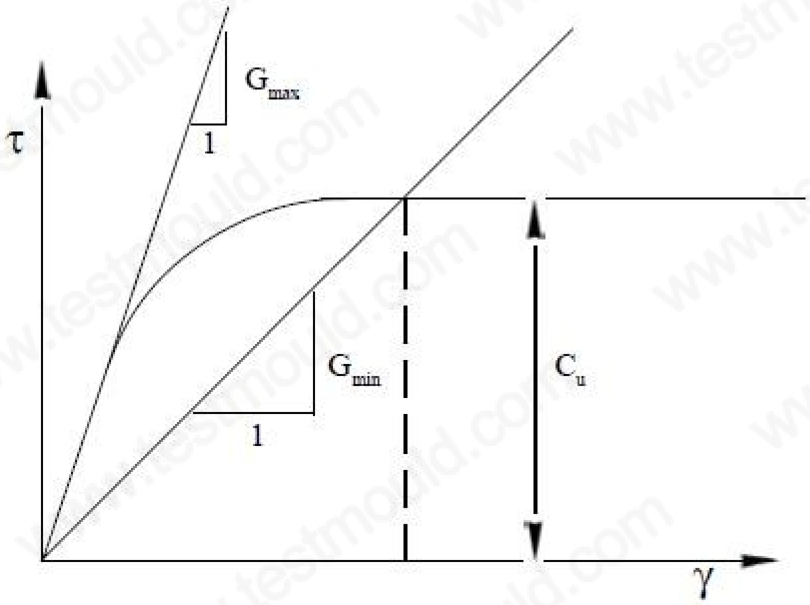
Please note that the penetrometer has one graduation only which correspond to the medium size probe. When using the small probe multiply by two result and when using the big one divide by two.





* Dr. Ing. Renato Lancellotta. Engineering Institute of Turin (Italy). 1985

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