

OPERATING INSTRUCTIONS

BS Liquid Limit Devices

24-0410, 24-0417

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<p><i>In the interests of improving and updating its equipment, ELE reserves the right to alter specifications to equipment at any time</i> ELE International 2004 ©</p>		

Contents

	Section	Page
1	Introduction	3
2	The Equipment	4
3	Operation	5
4	Maintenance	5

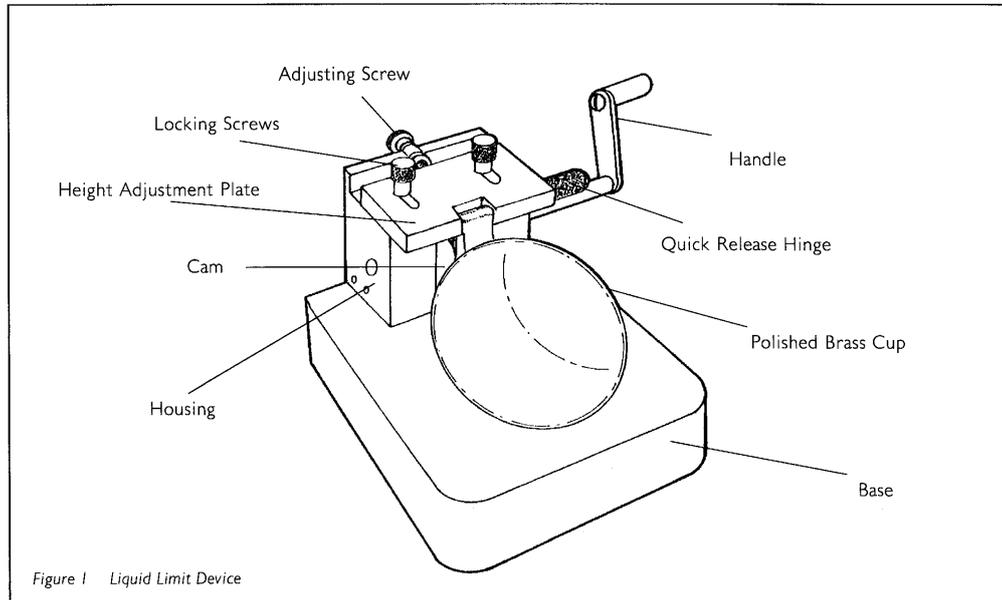
1 Introduction

1.1 The limit tests

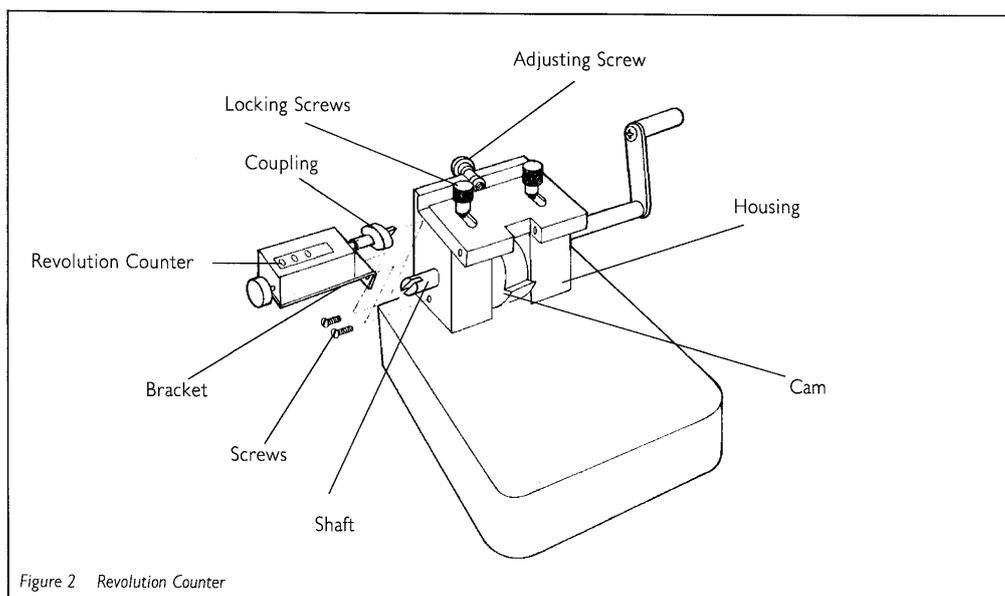
- 1.1.1 The liquid, plastic and shrinkage limits apply to fine grained soils in which the water content affects the physical properties, changing a clay soil from a solid to a liquid slurry. In 1911, A. Atterberg suggested the concept of boundaries to the four states in which a soil may exist, namely the liquid limit, the boundary between the liquid and plastic state; the plastic limit, the boundary between the plastic and semi-solid state and the shrinkage limit, the boundary between the semi-solid and solid state (Atterberg, A. 1911). These boundaries, like those between sand, silt and clay, are empirical, for the material grades imperceptibly from one state to the other and the boundaries have to be determined by a set procedure. The various tests have been standardized in this country in BS 1377. The test for plastic limit and for shrinkage limit have remained, in principle, the same since 1932 when Casagrande proposed to define the various limits by reference to the moisture content of the soil under certain conditions (Casagrande, A., 1932).
- 1.1.2 The shrinkage limit became the moisture content at which soil, on being dried, ceased to shrink. Above the shrinkage limit, as a fine grained (clayey) soil loses moisture it shrinks, this shrinkage is due to and is proportional to the moisture loss; for every cubic centimetre loss in volume the soil loses 1 gram of water. At the shrinkage limit, the water content is just sufficient to fill the voids and the soil sample is at its minimum volume obtainable by simple drying. The test consists of measuring the volume of a sample by displacement of mercury at different stages as it dries and shrinks, or measuring the linear shrinkage of a prepared specimen as it dries, calculating the moisture content from the weight of the sample, noting when the sample ceases to shrink and noting the corresponding moisture content.
- 1.1.3 The plastic limit was defined as the moisture content of a sample of soil such that when rolled out into threads of 2 mm diameter, the soil just crumbles as it reaches this diameter.
- 1.1.4 The liquid limit was originally considered as the moisture content at which 10 light jarring blows of the hand against a dish just closed the groove, previously made in the sample. The operator adjusted the moisture content by trial and error until the result was achieved (Wintermeyer, A.M., 1926). The liquid limit test as Casagrande proposed it, and similar to that now performed, is carried out by forming the groove in a pat of soil in a brass dish of certain dimensions, and by then repeatedly bumping the dish, by dropping it through a distance of one centimetre, onto a rubber base until the groove is just closed for a distance of 13 mm. The test is carried out by determining a series of moisture contents, each corresponding to a number of blows close to 25. A graph is then drawn on semi logarithmic paper relating blows and moisture content and the moisture content corresponding to 25 blows is read off.

2 The Equipment

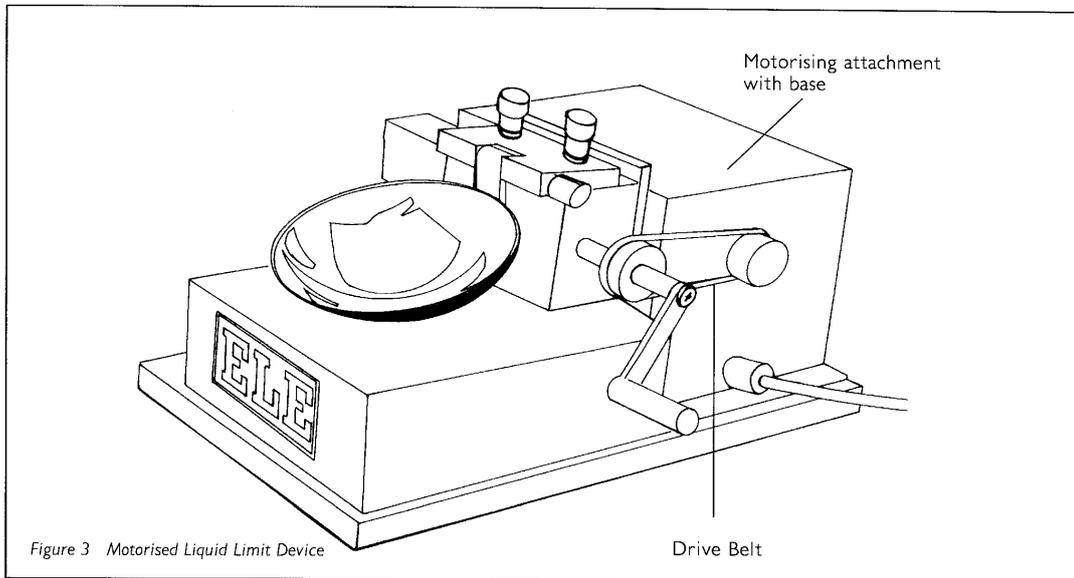
Basic hand operated apparatus (Figure 1).



- 2.1.1 The base in the form of a solid rubber block is manufactured according to the appropriate Standard.
- 2.1.2 Mounted on the base is a cam support bracket which includes the cam, and height adjustment plate, adjustment screws and lock nuts.
- 2.1.3 The polished brass cup is attached to the plate with a quick release hinge.
- 2.1.4 The cam is driven anti-clockwise by the handle fitted to the end of the cam shaft.



- 2.1.5 The counter is driven by a coupling fitted to the counter shaft and having a gear which engages with another gear on the end of the cam shaft.
- 2.2 Motorised unit (Figure 3).
- 2.2.1 A version of the apparatus is available that motorises the operation of the liquid limit device.



- 2.2.1 The liquid limit device incorporates a drive assembly with drive and follower pulleys, the latter fitted on the cam shaft of the liquid limit device. A blow counter is included in the motorised version.

Note: to use manual operation, slip the rubber belt off the follower pulley.

2.3 Electrical connections

Electrical safety

Warning: Before removing any covers or performing maintenance repair and service, isolate from electrical supply by removing mains plug. Where mains supply is required during these activities, only competent persons should perform the work.

Check that the power supply is compatible with the requirements stated on the label and connect in accordance with IEE regulations or to local requirements.

It is advised that this machine be connected via a residual current device (not supplied), and it should operate if earth leakage current exceeds 0.03 amps.

The power cable is coded as follows:

Brown wire	L	Live or Power
Blue wire	N	Neutral
Green/Yellow wire	E	Earth or Ground

Note: exercise extreme caution when using the machine with wet hands. Dry hands before operating machine.

Portable Appliance Tests (PAT)

All ELE designed products are tested for electrical safety prior to sale.

An electrical safety test label is fitted, (usually adjacent to the mains input socket).

Should no label be found, please contact ELE Service Department quoting the serial number of the equipment.

Organisations have an obligation to ensure equipment is maintained and is safe for use. Regular PAT testing is one means of ensuring equipment continues to be electrically safe.

Important: do not connect PAT leads to sensitive components such as PCBs, control switches and the like.

DO NOT FLASH TEST ELECTRONIC EQUIPMENT.

If in doubt as to the most suitable connection point (which will usually be an earth stud or an external earth connection) contact ELE Service Department for assistance.

3 Operation

3.1 General

3.1.1 This operating manual is not designed to detail precisely the individual techniques as described in various National Standards.

4 Maintenance

4.1. Lubrication of moving parts

4.1.1 Using a light oil regularly lubricate the following parts:

- Cam surface
- Cam shaft
- Cup hinge