

Apparatus

1. Liquid limit device, meeting essential features and dimensions of Figure 1?..... _____
2. Flat grooving tool, meeting essential features and dimensions of Figure 2?..... _____
3. Gage, for adjusting the height of drop of the cup, having dimensions shown in Figure 3?... _____
4. Containers, corrosion resistant with snug-fitting lids for water content specimens?..... _____
5. Balance, conforming to Specification D 4753, Class GP-1 (**readable to 0.01g**)..... _____
6. Storage container, large enough to store the prepared soil specimen and prevent water loss?_____
7. Ground glass plate, 30 cm square and 1 cm thick, for rolling plastic limit threads _____
(Plastic Limit Rolling Device - optional)?..... _____
8. Spatula, with a blade about 2 cm wide and 10 to 13 cm long?..... _____
9. Sieve, 203 mm dia., 425 µm E-11 specification, with a rim at least 5 cm above the mesh? . _____
 A 2 mm sieve may be needed also?..... _____
10. Wash bottle, for adding controlled amounts of **distilled / demineralized** water to soil?..... _____
11. Drying oven, capable of continuously maintaining a temperature of 110 ± 5°C? _____
12. Laboratory control soil established? **Supplied by MTO?**..... _____

Sampling

1. Samples may be taken from any location that satisfies testing needs and meeting the requirements of Method C 702, and Practices D 75 and D 420?..... _____

Calibration of Apparatus

1. Inspection for wear of liquid limit device:
 - a) Wear of base, the contact spot shall not exceed 10 mm dia.? _____
 - b) Wear of cup, cup replaced when grooving tool has worn a depression of 0.1 mm? _____
Or when rim of cup has been reduced to half its original thickness?..... _____
 - c) Wear of cup hanger, does not bind or permit 3 mm of side to side movement? _____
 - d) Wear of cam, shall not be worn so that the cup drops before cam follower loses contact with the cam? _____
2. Grooving tools, tip meets the dimensional requirements of Figure 2?..... _____
3. Adjustment of height of drop of cup, point of contact is adjusted to 10 ± 0.2 mm in height? _____

Preparation of Test Specimens

1. Wet preparation, following section 10.1 used? _____
- Or** Dry preparation, following section 10.2 used? _____
2. Water content of soil adjusted so to require from:
 - 25 to 35 blows to close the groove, if Multipoint Liquid Limit – Method A is used? _____
 - Or 20 to 30 blows if One-Point Liquid Limit – Method B is used? _____

Procedure – Multipoint Liquid Limit – Method A

1. Prepared soil placed in cup approx. 10 mm at deepest point and surface approx. horizontal? _____
2. Form groove in soil pat from highest point to lowest, tool bevel edge forward? _____
3. Record number of drops, *N*, required to close groove?..... _____
4. **Drop rate is 1.9 to 2.1 per second?** _____
5. **Groove closed 13mm (1/2 inch)?**..... _____
6. Remove slice of soil, at right angle to groove, including portion that flowed together, put in weighed, covered container?..... _____
7. Remaining soil returned to storage container, and cup and grooving tool cleaned and dried?_____
8. Remix soil specimen, adding distilled water to decrease the number of blows?..... _____
9. Repeat for at least two trials producing successively lower numbers of blows?..... _____
10. One of trials shall be for closure requiring 25 to 35 blows, and? _____
11. One of trials shall be for closure requiring 20 to 30 blows, and? _____
12. One of trials shall be for closure requiring 15 to 20 blows?..... _____
13. Water contents *W_n*, determined according to Method D 2216?..... _____
14. Plotted on semilogarithmic graph , best straight line through 3 or more points?..... _____

15. Water content at intersection of line to 25 blow abscissa is liquid limit of soil?

PLASTIC LIMIT AND PLASTICITY OF SOILS

LS-704

D-4318

Procedure – One-point Liquid Limit – Method B

1. Proceed as in Method A, #1 to #4, except that the number of blows to close the groove shall 20 to 30?
2. If less than 20 or more than 30, adjust water content and repeat?
3. Immediately after removing water content specimen, add small amount of soil and repeat?
4. If number of blows is the same or within two, take second water content specimen?
5. If not, repeat entire process?
6. Water contents, W_n , determined according to Method D 2216?
7. Determine the liquid limit for each water content specimen using one of the following:

Or

$$LL = (N) 0.121$$

$$LL = W^n \left(\frac{25}{N} \right)^{0.121}$$
~~$$LL = KW^n$$~~

Where:

- N = number of blows causing closure of the groove at water content
- W_n = water content, and
- K = factor given in Table 1.

8. Liquid limit is average of the two trial liquid limit values?

Plastic Limit

1. Select a 20 g portion of the soil prepared for the liquid limit test and reduce the water content to a consistency at which it can be rolled without sticking?
2. From 20 g mass, select a 1.5 to 2.0 g portion and roll on glass plate with fingers or palm to form a thread of uniform diameter throughout its length?
3. Thread further deformed on each stroke until its diameter is 3.2 mm, in no more than 2 min?
4. Thread broken into pieces, kneaded together, and re-rolled to 3.2 mm diameter?
5. Process continues until thread crumbles before reaching 3.2 mm diameter?
6. Gather portions of crumbled thread and place in weighed container and cover?
7. Select another 2.0 g portion and repeat until at least 6 g in container?
8. Repeat process for another container holding at least 6 g?
9. Determine water contents of soil according to Method D 2216?
10. Compute average of the two water contents and use as plastic limit?
11. Repeat if the difference between the two water contents exceeds limits in Table 2?
12. Calculate plasticity index:

$$PI = LL - PL$$

Use of Laboratory Control Aggregate

- 1. Laboratory has a supply of control aggregate? (***Supplied by MTO Soils and Aggregate Section***)
..... _____
- 2. Control sample tested every 10 samples or at least every week when samples tested?..... _____
- 3. Control chart showing data for last 20 samples of reference material?..... _____
 - Mean for last 20 samples..... _____
 - Low for last 20 samples _____
 - High for last 20 samples _____

Laboratory Control Soil:	Mean	LCL	UCL
Liquid Limit:	_____	_____	_____
Plastic Limit:	_____	_____	_____
Plasticity Index:	_____	_____	_____

Comments: