Check Procedure for Liquid Limit Devices

for

AASHTO Test Method T 89

and

ASTM Test Method D4318

Procedure Designation: IHP-3

Equipment required to perform the check:

1. 6-inch calipers readable to 0.01 mm
2. Balance with a capacity of at least 500 g and readable to the nearest 0.01 g
3. 10.00 ± 0.05 mm height gauge
4. Screwdriver
5. Water
6. Paper towels
7. Resilience Tester as described in Figure A1.1 of D4318.
8. ***Optional:*** Resilience Tester as described in Figure X1.1 and Table X1.1 of T 89.

Procedure:

1. Clean the device using water and paper towels, and record a confirmation that this has been performed.
2. Determine by visual inspection the largest diameter of the wear spot on the top of the base where the cup and base meet, measure this diameter using the calipers to confirm that it is less than 10.00 mm, and record this measurement. ***Note:*** If the wear spot is greater than this, the base can be machined to remove the worn spot provided the resurfacing does not make the base thinner than that specified in Step 12 down below, and the other dimensional relationships are maintained.
3. Determine by visual inspection the largest diameter of the wear spot on the bottom of the cup where the cup and base meet, and measure this diameter using the calipers to confirm that it is less than 13.00 mm, and record this measurement.
4. Measure the thickness of the rim around the back of the cup to confirm an original thickness of 1.90 to 2.10 mm, and record this measurement (A). Next, measure the edge of the rim at the front of the cup where the grooving tool pulls through, and record this measurement (B). Use the following equation to compare these two measurements to ensure that the wear is less than 50% and record the answer: (A-B)/A*100.
5. Confirm by visual inspection that nothing more than a slight groove (0.10 mm [0.0040 in.] deep) is noticeable in the middle of the cup where the grooving tool pulls through. Record a confirmation of this check.
6. Weigh the cup with hanger attached to confirm a combined mass of 185.00 to 215.00 grams. Record this mass.

7. Verify that the screws connecting the cup to the hanger arm are tight, and tighten using a screwdriver, as needed.
8. Lock the calipers at 3.00 mm and place them on the base of the liquid limit device so that the opened jaws are visible to the front of the cup. Push the cup to the left until it stops moving and align the left jaw of the calipers with the center-point of the front of the cup by repositioning the calipers. After alignment, push the cup to the right until it stops moving, and ensure that the center-point of the front of the cup does not pass beyond the right jaw of the calipers. Record an estimate of the amount of movement to the nearest whole mm, and a confirmation that the side-to-side movement is less than 3.00 mm.
9. Check for excessive wear of the hanger by turning the crank and making the determination that the cup does not begin to fall before the follower loses contact with the cam. This check requires that the liquid limit device be at eye-level, and that the crank be turned at a slow rate as the follower approaches the point where it will lose contact with the cam. Record a confirmation that the cup does not begin to fall before the follower loses contact with the cam.
10. Use the calipers to measure the length of the base at third-points along its width, and record both measurements to confirm that they are both within 148.00 to 152.00 mm.
11. Use the calipers to measure the width of the base at third points along its length, and record both measurements to confirm that they are both within 123.00 to 127.00 mm.
12. Use the calipers to measure the height of the base at the center-point of all four sides, and record the measurements to confirm that they are all within 48.00 to 52.00 mm.
13. Check the physical condition of the rubber feet to ensure that they have not become hard, cracked, or brittle from age, and record a confirmation of this check.
14. Use the calipers to take two measurements of the height of the gauge block at the point where the gauge block will come into contact with the cup, and record the measurements to confirm that the average height is within 10.00 ± 0.05 mm.
15. Adjust the height-of-drop of the cup so that the point on the cup that comes in contact with the base rises to a height of 10.00 ± 0.20 mm by performing the following steps:
    a. Place a piece of masking tape across the outside bottom of the cup parallel with the axis of the cup hanger pivot. The edge of the tape away from the cup hanger shall bisect the spot on the cup that contacts the base. For new cups, placing a piece of carbon paper on the base and allowing the cup to drop several times will mark the contact spot.
    b. Attach the cup to the device and turn the crank until the cup is raised to its maximum height.
    c. Slide the height gauge under the cup from the front, and observe whether the gauge contacts the cup or the tape. If the tape and cup are both simultaneously contacted, the height-of-drop is ready to be checked. If not, adjust the cup until simultaneous contact is made.
    d. Check adjustment by turning the crank at 2 revolutions per second while holding the gauge in position against the tape and cup. If a faint ringing or clicking sound is heard without the cup rising from the gauge, the adjustment is correct. If no ringing is heard or if the cup rises from the gauge, readjust the height-of-drop.

e. If the cup rocks on the gauge during this checking operation, the cam follower pivot is excessively worn and the worn parts should be replaced.
f. Record a confirmation that the height has been successfully adjusted.
g. ***Note:*** Always remove tape after completion of adjustment operation.

16. Resilience Testing:
    a. ***Optional:*** For T 89, follow Appendix X1 of T 89 to check the resilience of liquid limit device base, and record a confirmation that the base has a resilience rebound of at least 80 % but no more than 90 %.
    b. ***Mandatory:*** For D4318, follow Annex A1 of D4318 to check the resilience of liquid limit device base, and record a confirmation that the base has a resilience rebound of at least 77 % but no more than 90 %.