

## Measurement of Scuff Damage Produced by an Impact

## 1 Scope

This method is intended primarily for use with shoe upper leathers but it can be used with any light leather.

## 2 Principle of the method

The leather specimen is stretched across a steel anvil and is struck a glancing blow by a striker attached to a pendulum. The damaged specimen is put into a viewing box where it is illuminated in the specified way and the scuff damage is compared with the spots of a standard scuff scale.

## 3 Specimens

Cut the specimens from the sampling position described in SLP 2 as rectangles 125 mm by 25 mm, with their long sides parallel to the backbone. Mark the neck end of the specimen unless otherwise specified; condition them in accordance with the method of conditioning given in SLP 3 (see 6.1).

## 4 The impact pendulum and the anvil (see 6.2)

The pendulum is constructed from light metal castings as a rigid girder. It is suspended from a heavy, rigid frame by a steel axle of 12.7 mm diameter and 110 mm length, which is rigidly attached to the pendulum, and is supported horizontally in ball races let into the frame (see Fig 1). A steel striker is rigidly attached to the pendulum at a position vertically below the mid-point of the axle. The striker consists of a cylinder made of tool steel with a diameter of 12.7 mm and one edge bevelled as shown. It is hardened by a technique appropriate to the grade of steel used. The flat end surface is ground to a finish equivalent to a centre-line-average not exceeding 1.2 micro-millimetres and the bevelled surface to a centre-line-average not exceeding 2.4 micro-millimetres. The flat face at the bottom of the striker is situated at a distance of  $238 \pm 1$  mm from the axis of the steel axle. The pendulum (including the attached axle and striker) has the following characteristics:

mass,  $m = 1000 \pm 100$  g

centre of gravity, distant  $a = 160 \pm 16$  mm from the axis of the axle; the values of  $m$  and  $a$  are so chosen (within these limits) that their product is  $ma = 160,000 \pm 2000$  g mm.

If the pendulum is displaced through  $90^\circ$  and released, friction at the bearings is such that it swings for at least 40 seconds before its amplitude becomes reduced to  $40^\circ$ ; if the pendulum is displaced through  $40^\circ$  and released, the time for the first 40 swings is  $40 \pm 1$  seconds (ie, the period is  $1.00 \pm 0.025$ ) (see 6.3).



by estimation to 0.005 mm. That part of the anvil which lies below the striker is rounded in the plane of swing of the pendulum with a radius of curvature of 101.5 mm. After it has been raised or lowered by the micrometer screw, the bar which supports the anvil can be locked in position by use of a locking screw. It carries also a clamp for clamping one end of the specimen. The other end of the specimen is clamped between a pair of bars attached to a wire and a hook. The specimen is tensioned and pulled down flush on the anvil by passing the wire over a pulley and supporting a 5 kg weight from the hook.

The frame of the pendulum carries a quadrant with a quick release catch. The pendulum can be raised to an angle of  $75^\circ$  from its vertical position of rest and held by the catch until it is desired to release it.

## 5 Procedure

- 5.1 With the pendulum freely suspended, place a feeler gauge 0.500 mm thick between the anvil and the flat lower surface of the striker. Raise the anvil until the feeler gauge is in contact with the anvil and striker. Note the reading  $r_1$  of the micrometer, lower the anvil to its full extent, and remove the feeler gauge (see 6.4).
- 5.2 Draw the pendulum to one side and clamp it with the quick release catch.
- 5.3 Attach the marked end of the specimen to the anvil with its sides parallel to the plane of swing of the pendulum and its grain surface uppermost. Clamp the wire and hook to the other end. Pass the wire over the pulley and attach the 5 kg weight to tension the leather. Press the leather down by hand and ensure that it makes good contact with the anvil.
- 5.4 Lower the pendulum until it hangs above the leather. Place a lamp covered with a translucent screen (such as a sheet of paper) on one side of the pendulum and view the screen through the gap between the leather and the flat face of the striker. Raise the anvil and leather slowly until some part of the gap disappears. If the whole length of the gap disappears at the same instant, note the reading  $r_1$  of the micrometer. If, because of irregularities of the surface of the leather or of irregularities of its thickness, the whole length of the gap does not disappear at the same instant, continue to raise the anvil until half the length of the gap has disappeared, and take  $r_1$  as the reading of the micrometer when this occurs.
- 5.5 Lower the anvil to allow the pendulum to be moved. Raise the pendulum until it makes an angle of  $75^\circ$  with its vertical rest position and clamp it there with the quick release catch. With the aid of the micrometer raise the anvil to such a point that the flat face of the striker will penetrate a fraction three-tenths of the leather thickness when the pendulum is released (see 6.5 and 6.6). Clamp the anvil with the aid of the locking screw.
- 5.6 Release the pendulum by use of the quick release catch and allow it to strike the leather. Catch the pendulum by hand if it passes on after striking the specimen, so as to prevent it making a second (return)

strike. If the pendulum does so, the specimen is to be discarded and another taken in its place (see 6.7).

- 5.7 Release the locking screw, lower the anvil, raise the pendulum and clamp it, remove the 5 kg weight and remove the specimen from the apparatus.
- 5.8 Using the method of assessing scuff damage given in SLP 15, allot the appropriate scores.

## 6 Notes

- 6.1 For some purposes it may be informative to make scuff tests on wetted specimens. If this is done, the precise method of wetting the specimens should be reported. They should be dried and re-conditioned before they are assessed for scuff damage.
- 6.2 A pendulum type apparatus of the kind described can be purchased from Satra, Satra House, Rockingham Road, Kettering, Northamptonshire, England.
- 6.3 A pendulum having the characteristics described has its centre of percussion close to the flat face of the striker.
- 6.4 To avoid accidental damage to the striker and anvil, a safety stop prevents the anvil being raised sufficiently to make contact with the striker itself.
- 6.5 Suppose  $r_1$  and  $r_2$  are in millimetres. The anvil would make contact with the striker when the micrometer reads  $(r_1 + 0.5)$  mm and makes contact with the leather when the reading is  $r_2$ , so that the thickness of the leather is  $(r_1 + 0.5 - r_2)$  mm. To set the anvil for the pendulum strike, raise it until the micrometer reads  $r_2 + 3/10(r_1 + 0.5 - r_2)$ .
- 6.6 By this method of setting the anvil the effects of differences of leather thicknesses are practically eliminated. Grain splits of any thickness between 0.8 mm and 3.0 mm from the same leather give nearly the same results.
- 6.7 It is usually easy to catch the pendulum by hand if it passes on after striking the specimen. In most tests, the pendulum is brought to rest by the first impact with the specimen.