

Resistance of Air Dry Upper Leathers to Heat with Special Reference to the Direct Moulded and the Injection Moulded Process of Footwear Construction

1 Scope

- 1.1 The method is intended for testing whether upper leathers are damaged by heat under conditions similar to those they encounter in the Direct Moulded and Injection Moulded Sole process of footwear construction, but it may be suitable for testing other leathers as well.
- 1.2 In the method three alternative pairs of temperature settings are specified corresponding to those of:
 - 1.2.1 Unheated lasts (as used with solid rubber, whether the rubber is heated or not).
 - 1.2.2 Heated lasts (used with microcellular rubber).
 - 1.2.3 Injection moulding.

2 Principles of the method

The upper flat platen of a press is heated to a specified temperature.

On the lower platen is laid a ridge plate device heated to another temperature by conduction from the lower platen.

The separation of the top of the ridge and the under surface of the top platen is pre-determined by setting the pointer against an appropriate point on the scale on the ridge plate device.

With the press open, the leather specimen is laid, grain down, on the ridge in the position indicated on the plan and the press is closed until limited by the lugs of the ridge plate; in this way the heated ridge is pressed into the leather for a chosen fraction of the leather thickness and the compression is maintained for a fixed time.

To assess the damage caused by the specimen, it is removed, re-conditioned (SLP 3 (IUP/3)) and tested by the Ball Burst Test (SLP 9 (IUP/9)). The distension at grain crack is compared with that of an untreated specimen from the same leather.

3 Apparatus required

3.1 The Ridge Plate Device (Fig 1)

This consists of the two parts, a circular steel base plate and a steel height adjustment ring. The base plate is of outside diameter 140 mm, thickness 41 mm, and has a male buttress thread of pitch 5 mm. On its upper surface a ridge of truncated wedge section 100 mm long, 4 mm wide at its base, 4 mm high and 1 mm wide on top is formed by milling. Both edges of the ridge have a radius of 0.25 mm. The base

is bored with a radial hole extending to the centre of the base to accept a thermometer, thermocouple or thermistor.

The under surface of the base is to be flat within ± 0.005 mm, and the top surface of the ridge to be surface ground so that it is parallel to the under surface of the base within ± 0.005 mm.

The buttress thread to be accurately machined and devoid of 'drunkenness'.

The height adjustment ring has an outside diameter of 140 mm, height 30 mm and thickness at the root of the threads 10 mm. It has an internal buttress thread which mates with that of the base freely but with minimal clearance or backlash. The thread is lubricated with high temperature silicone grease. The top of the ring is milled away to form 3 lugs, to minimise heat transference to or from the top platen.

After the height adjustment ring has been screwed on to the base, the tops of the lugs are to be surface ground plane parallel with the under surface of the base.

A pointer is fitted to the base and a scale engraved on the height adjustment ring, calibrated in 0.1 mm, indicating the depth of the top edge of the ridge below the plane of the tops of the lugs.

- 3.2 The press has flat, surface ground, plane parallel platens which can be heated independently, and which have lengths and breadths not less than 150 mm. The heating and temperature control of the lower platen are such that when the ridge plate is placed, ridge up, at the middle of the platen, the ridge plate can be maintained at any temperature up to 200°C with an error not exceeding $\pm 3^{\circ}\text{C}$, as measured by a thermometer inserted in the hole of the ridge plate. The upper platen has a hardened steel face and can be maintained at any temperature up to 120°C with an error not exceeding $\pm 3^{\circ}\text{C}$, except for a brief period when the surface of the platen is cooled by the specimen itself (see 8.1).

4 Preparation of specimens

- 4.1 From the leather to be tested cut six adjacent specimens as squares of side 50 mm. Mark three specimens C_1, C_2, C_3 . These are controls which will not be heated and compressed. Mark the others T_1, T_2, T_3 . These T specimens will be heated and compressed unless they are discarded for the reason given below.
- 4.2 Condition all six specimens in accordance with method SLP 3 (IUP/3).
- 4.3 Mark a line on the grain surface of T_1 , mid-way between two of its parallel edges. Measure the thickness of T_1 in accordance with method SLP 4 (IUP/4) at the mid-point of this line, and at two other points on the line distant 15 mm from the mid-point. If the greatest thickness so measured is not more than 3% greater than the least, the specimen can be used for heating and compression, and its thickness t ,

is taken as the mean of the three measurements. If its greatest thickness is more than 3% greater than its least, take another specimen in its place. (The discarded specimen can be used as a control, and one of the controls used in its stead, the numbering of the two specimens being interchanged.)

- 4.4 In the same way, measure the mean thickness t_1 and t_2 of two other T specimens.

5 Procedure for heating and pressing the specimens

- 5.1 Place the ridge plate at the middle of the lower platen. Heat the platens and maintain the temperatures of the ridge plate and upper platen at the specified values during the test. For measurements that simulate the unheated last process, these temperatures will normally be:

upper platen $65 \pm 3^\circ\text{C}$; ridge plate $160 \pm 3^\circ\text{C}$;
and to simulate heated lasting they will normally be:
upper platen $105 \pm 3^\circ\text{C}$; ridge plate $185 \pm 3^\circ\text{C}$;
and to simulate the conditions of injection moulding:
upper platen $50 \pm 3^\circ\text{C}$; ridge plate $150 \pm 3^\circ\text{C}$.

Other temperatures may be specified, however (see 8.2).

- 5.2 Set the division of the scale on the height adjustment ring corresponding to $0.45t$ over the pointer in the base plate (where t is the thickness of the specimen of leather being tested) (see 8.3).

- 5.3 Place specimen T_1 on the ridge plate in the position shown by the dotted lines, with the marked line on its grain surface along the ridge. Immediately close the press and raise the pressure until the load applied is being borne by the lugs. Maintain the lugs in contact with the upper platen for 3 minutes (see 8.4).

- 5.4 At the end of 3 minutes, open the press and remove the specimen (see 8.5).

- 5.5 Heat and compress specimens T_2 and T_3 in the same way. Recondition specimens T_1 , T_2 and T_3 in accordance with method SLP 3 (IUP/3).

6 Tests of damage

- 6.1 Examine specimens T_1 , T_2 and T_3 . If any of them show grain cracks on or near the nip line, the leather has failed the test and need not be examined further.

- 6.2 If no grain cracks have occurred, cut a specimen from each of them for the Ball Burst Test (SLP 9 (IUP/9)). The circular specimen for this test is cut from the middle of the square, so that the nip line lies along a diameter.

- 6.3 Taking care that the specimens are correctly clamped, with the ball directly below the nip line, measure the distensions at grain crack of specimens T_1 , T_2 and T_3 . Cut a specimen for the Ball Burst Test from

each of the specimens C_1 , C_2 and C_3 and measure their distensions at grain crack. Calculate the sum of the distensions at grain crack of specimens T_1 , T_2 and T_3 as a percentage of the sum of those of specimens C_1 , C_2 and C_3 . The leather is considered to have failed the test if this percentage is less than 70 (see 8.6).

7 Test report

State the temperatures of the ridge plate and upper platen during the test. State whether the leather passed or failed the test, whether it developed grain cracks merely as a result of the heating and pressure, and (if it did not) the residual distension at grain crack as a percentage of the initial distension at grain crack.

8 Notes

- 8.1 A temporary fall of temperature due to contact of the cold leather with the hot platen and ridge is unimportant.
- 8.2 The temperatures used in the Direct Moulded Sole process are different for different machines and are subject to change. The temperatures given in the method are typical of conditions in many countries at the time of drafting this method.
- 8.3 By use of the height adjustment ring, the specimen thickness between the ridge and upper platen is reduced to 45% of its initial value. This is suitable for testing whether a leather is likely to fail in the shoe factory. Tests with the specimen thickness reduced to 40% and to 50% of their initial value are often informative.
- 8.4 If the upper platen and ridge plate are maintained at the specified temperatures by manual control of the power supplied to each, adjustments are likely to be needed when the press is closed because of increased conduction of heat from one to the other. Preliminary tests may be needed to find what adjustments are appropriate.
- 8.5 The time of 3 minutes is not that normally used in factories but is adequate to assess damage which will occur in footwear production.
- 8.6 The fact that the percentage is less than 100 does not necessarily indicate that damage was caused by the heating and pressing, because neighbouring specimens differ in their distensions at grain crack, and because compression (without damage to the leather fibres) also reduces distension at grain crack.

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