

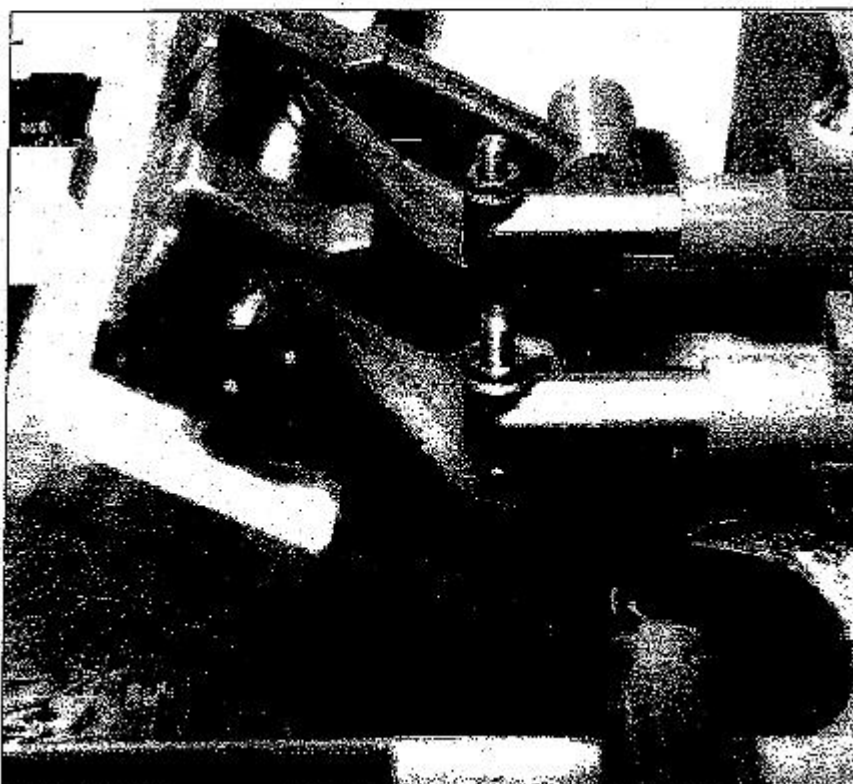
SATRA



TEST METHOD: SATRA TM77 (formerly PM77)

FLEXING MACHINE – WATER PENETRATION TEST

APRIL 1992



This method is intended to assess the resistance to water penetration of completed footwear during flexing. The method is applicable to all types of footwear.

1. SCOPE

This method is intended to assess the resistance to water penetration of completed footwear during flexing. The method is applicable to all types of footwear.

2. PRINCIPLE

The footwear specimen is placed in a trough of water, which may contain a dye solution, and is flexed through a specified angle about its natural flexing line. After a predetermined time or number of flexes the footwear is subjectively assessed for signs of water penetration. The level of the water in the trough, the number of flexes or the time between assessments, and the angle through which the footwear is flexed, are all determined by the type of footwear being tested.

3. REFERENCES

Test method SATRA TM 92: 1992 - Resistance of footwear to flexing.

4. APPARATUS AND MATERIALS

4.1 A flexing machine with:

4.1.1 A means of firmly clamping any type of footwear at the heel and toe.

4.1.2 A device such as a trough for maintaining a constant amount of water around the footwear.

4.1.3 A method of flexing the footwear, about its flex line, so that the forepart of the footwear is constantly in the water and the backpart is lifted in and out of the water at a rate of 140 ± 10 cycles per minute. The flexing angle should be adjustable to suit the type of footwear, see Table 2.

4.1.4 A means of recording, either the number of flexes, or the duration of the test providing the speed of the machine is constant and known.

A suitable machine is available from SATRA reference STM 184. This machine can also be used for Test method SATRA TM92: 1992 - Resistance of footwear to flexing.

4.2 A magenta dye prepared as described in section 8.2.

4.3 A small mirror on a long thin handle, and a low voltage, low temperature light source may be useful for inspecting the inside of the footwear.

5. TEST SPECIMENS

5.1 One or both of a pair of completed whole footwear.

6. PROCEDURE

6.1 This test can be conducted on either one or both of a pair of footwear. The footwear should be completely dry before the test is started. As accurately as possible, draw a line down the length of the insole of the footwear from the centre of the heel towards the centre of the toecap.

6.2 Mark on the insole of the footwear, to the nearest millimetre, the point which corresponds with the typical position, of the ball joint, of a wearer's foot. This should be done by measuring along the line, drawn in 6.1, the appropriate distance given in Table 1, from the heel end of the line and marking a point.

6.3 Mark a second point on the line drawn in section 6.1 which is 5 ± 1 mm closer to the heel. Draw a line across the width of the insole board, which passes through this second point and is at 90° to the line drawn in Section 6.1. This is regarded as the flexing line of the footwear, see Figure 1.

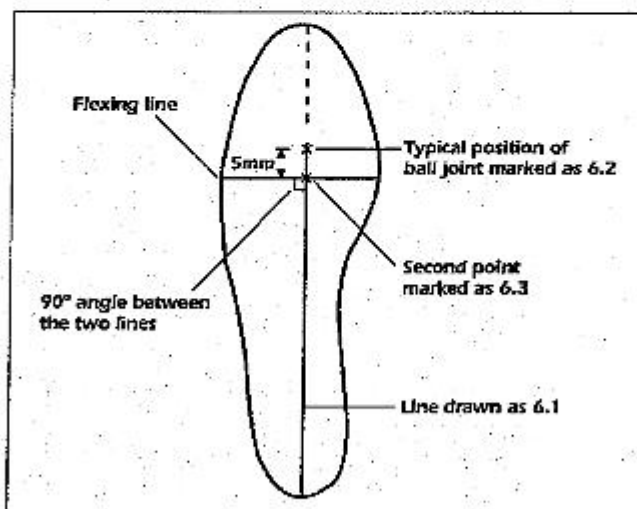


Figure 1 Marked insole

6.4 Set the flexing machine (4.1) to flex the footwear through the angle specified in Table 2.

6.5 Secure the footwear into the flexing machine so that they are flexed about the line drawn in section 6.3.

6.6 Set the water level so that its height relative to the footwear is as specified in Table 3, when the footwear is in the flexed position, see Section 8.3. If required the magenta dye (4.2) can be added to the water to help identify the point of water penetration. It should be noted that the magenta dye will permanently mark the footwear.

6.7 Operate the flexing machine for the required time or number of flexes, see section 8.1.

6.8 Remove the footwear from the machine and assess the inside of the footwear visually and by touch for signs of water penetration. Use the mirror and lamp (4.3) if required. If any penetration has occurred record the extent and position on report diagrams as shown in Figure 2.

Date _____	Sample reference _____
No. of flexes _____	
Time of test _____	
Total penetration _____	mm ²
Construction _____	
Depth of water _____	

Area of initial penetration
 Boundary of final penetration
 Seams

Figure 2 Typical report sheet

6.9 Repeat sections 6.5 to 6.8 until the total area of penetration in each item of footwear being tested has exceeded 300 mm².

7. TEST REPORT

Include in the test report:

7.1 Reference to this test method SATRA TM77: 1992

7.2 The constructional details of the footwear tested, including sole thickness and if applicable details of any previous wear.

7.3 The results of the water penetration test such as the number of flexing cycles or the test time, and the position and extent of penetration.

7.4 Any deviations from this standard test method.

SATRA can help members to interpret results from this method.

8. ADDITIONAL NOTES

8.1 Guide to number of flexes between assessments

It is usual to stop the test and assess the footwear after every 5 minutes or 700 flexes, but as time progresses without evidence of penetration the time interval between assessments may be extended to a maximum of 15 minutes or 2100 flexes. However, with some types of footwear it may be necessary to make more frequent assessments.

8.2 Preparation of magenta dye

Reagents: Magenta dye – powder
Industrial methylated spirits
Distilled water

Method of preparation:

1. Paste 1.5g of dye with 5cm³ of alcohol.
2. Add to the paste 20cm³ of distilled water.
3. Decant one dye liquor and the residue is again pasted as in (1) and (2).
4. Repeat until collected approx. 100cm³ ie paste four times.
5. Filter the liquor using a fast filter paper (for example No 541) into a 1000 cm³ volumetric flask.
6. Wash apparatus through filter paper using distilled water.
7. Rinse filter.
8. Make up to 1,000cm³ with distilled water.

Note: Greater dye stability is obtained by addition of 1cm³ glacial acetic acid to each litre of solution.

8.3 Water resistance of the upper construction

The test may be extended to determine the water resistance of the upper construction by placing the footwear in water at an appropriate height, for example in a waterproof bag which is slightly larger than the footwear under test.

8.4 Related tests

BS 5131 Section 5.5 Resistance of finished footwear to water penetration (trough test).

Test method SATRA TM81 - Trough - water penetration test.

Table 1 Average distance from the heel end of the insole to the ball joint position of the foot

Children's		Men's and women's	
Size	Heel/ball length on insole (mm)	Size	Heel/ball length on insole (mm)
4	85	1	143
5	91	2	149
6	97	3	155
7	102	4	160
8	108	5	166
9	114	6	172
10	120	7	178
11	126	8	184
12	131	9	189
13	137	10	195
		11	201
		12	207

Table 2 Suggested flexing angles for different styles of footwear

	Suggested flexing angle
Ladies'	
Platform styles	
Clogs (mules)	10°
Slingbacks, sandals, boots	15°
Courts	20°
Lace-up casuals	25-30°
Non-platform styles	
Courts, slingbacks, casuals and sandals	35°
Men's and boys	
Platform styles	
Slip-on casuals	25°
Lace-up shoes, and boots	30°
Non-platform styles	
Lace-up shoes, slip-on shoes and boots	45°

Table 3 Suggested level of water for different types of footwear

Footwear type	Water depth
Marked waterproof and specialist footwear	5mm above featherline
Everyday/normal footwear	Up to top of sole
Fashion footwear with leather soles	Wet surface of tray bottom