TEST METHOD: SATRA TM181 (formerly TM181)

STRENGTH OF BUCKLE AND STRAP ATTACHMENT

AUGUST 1996

This method is intended to determine the strength of buckle and strap attachment in completed footwear. The method is applicable to all footwear containing buckle fastenings.
1. SCOPE

This method is intended to determine the strength of buckle and strap attachment in completed footwear. The method is applicable to all footwear containing buckle fastenings.

2. PRINCIPLE

A test specimen containing a buckle and/or strap is gradually stretched by a tensile machine until failure occurs. The breaking force and the type and position of failure are determined. Depending on the cutting and clamping positions the method can be used to determine the strength of buckle attachment or the strength of the strap in the closed buckle; the strength of the strap attachment; or the strength of the strap, see section 8.1.

3. REFERENCES

BS EN 10002-2: 1992 – Verification of the force measuring system of the tensile testing machine.

4. APPARATUS AND MATERIALS

4.1 A tensile testing machine with:

4.1.1 A jaw separation rate of 100 ± 10 mm/min.

4.1.2 A force range appropriate to the specimen under test. This will usually be up to 2 kN.

4.1.3 The capability of measuring the force to the nearest better than 2% as specified by class 2 in BS EN 10002-2.

A suitable machine is available from SATRA reference STM 466.

5. PREPARATION OF TEST SPECIMENS

5.1 Where possible, for each type of shoe to be tested, prepare at least two test specimens using one of the following procedures.

5.2 Samples where the part of the upper to which the buckle is attached is large enough to be gripped in the jaws of the tensile testing machine.

5.2.1 Mark a line on each side of the shoe upper, from the top line to the feather edge, approximately corresponding to the longitudinal axis of the buckle prong and the strap at the point of attachment. Mark two further lines parallel to and 25 ± 2 mm from each of the initial lines, see Figures 1a and 1b.

5.2.2 Cut through the upper, including any stiffener and lining materials, along each of the outer lines. Finally cut through the upper along the feather edge to remove panels to which the buckle and strap are attached, see Figures 1a and 1b.

5.2.3 Insert the fastening strap in the buckle with the prong through the second hole. Flatten the cut out test assembly and mark the longitudinal axis lines (5.2.1) more accurately.
Figure 1a: Cutting of test assembly – buckle attached directly to quarter

Figure 1b: Cutting of test assembly – buckle attached to quarter via separate buckle loop
5.2.4 Draw further lines across the cut out panels, perpendicular to the longitudinal axis and 15 mm behind the rear point of attachment of the buckle and strap, see Figures 2a and 2b. These are the clamping lines which are aligned with the front edge of the jaw during tensile testing. If a clamping line passes over an underlay it should be redrawn immediately behind the end of the underlay.

5.2.5 Cut along the parallel lines (5.2.1) marked on each panel, then follow the procedure in section 5.4.

5.3 Samples where the buckle is attached to a narrow main strap, for example a sling-back strap, which is not large enough to be gripped in the jaws of the tensile testing machine.

5.3.1 Cut through the main strap at the back of the heel and at the feather edge on each side of the shoe, see Figure 3. Insert the fastening strap in the buckle with the prong through the second hole.

5.3.2 Flatten the cut out test assembly.

5.3.3 For each test specimen, cut four strips of upper leather, for example side leather of thickness 1.75 ± 0.25 mm, dimensions 80 mm x 25 mm. Sew these to the main strap on each side of the buckle and strap, so that the edge of each strip is 7 mm from the edge of the buckle strap or fastening strap, see Figure 4. Draw a line across each strip 15 mm from the main strap, see Figure 4. These are the clamping lines which are aligned with the front edge of the jaw during tensile testing.

5.4 All samples.

Cut the fastening strap in two places about 30 mm behind the second fastening hole and 30 mm from the upper top-line, see Figures 2a, 2b or 4, to produce three test specimens:

- Upper containing buckle and section of fastening strap, forms test specimen for Method 1.
- Upper and section of fastening strap, forms test specimen for Method 2.
- Section of fastening strap, forms test specimen for Method 3.

Note: The length of the fastening strap may not be sufficient to allow test specimens of adequate dimensions to be cut for all three methods. If this is the case then the lengths of strap cut for the various methods may be reduced by adjusting the cut positions but strap lengths for all test specimens should be reduced similarly. If testing by all three methods is not required then this may assist the provision of test specimens of adequate lengths.

6. PROCEDURE

6.1 Store the test specimens in a standard controlled environment of 23 ± 2°C/50 ± 2% rh or 20 ± 2°C/65 ± 2% rh for at least 48 hours and carry out the tests in this atmosphere. Include details of the conditions used in the test report.

6.2 Adjust the tensile testing machine (4.1) so that the jaws are approximately 50 mm apart.

6.3 Method 1: strength of buckle attachment or strength of strap in closed buckle

6.3.1 Clamp the end of the test specimen containing the buckle centrally in one jaw such that the edge of the jaw aligns with the clamping line marked on the test specimen. Take care that the end of the strap is not clamped.
Figure 2a: Cutting of test specimens – buckle attached directly to quarter

Figure 2b: Cutting of test specimens – buckle attached to quarter via separate buckle loop
Figure 3: Cutting of test assembly – buckle strap attached to sling-back strap

Figure 4: Cutting of test specimens with sewn-on strips – buckle strap attached to sling-back strap
6.3.2 Insert the fastening strap into the other jaw and clamp such that the front edge of the jaw is approximately 10 mm from adjacent edge of the buckle frame.

6.3.3 Operate the tensile testing machine so that the jaws separate at a speed of 100 ± 10 mm/min until failure of some part of the buckle fastening assembly occurs.

6.3.4 Record the maximum force in newtons, to the nearest 0.1 N, at which failure occurs. If tearing propagates from the buckle prong hole along the fastening strap, then allow the tear to continue to the first hole before stopping the test.

6.3.5 Record the type of failure which occurs, see section 8.2, as:

- Failure of the buckle attachment.
- Failure of any part of the buckle.
- Breaking of the fastening strap across its width.
- Tearing of the fastening strap along the line of the buckle holes.

6.3.6 Repeat the procedure in sections 6.3.1 to 6.3.5 for the remaining test specimen(s).

6.4 Method 2: strength of strap attachment

6.4.1 Clamp the end of the test specimen containing the strap attachment centrally in one jaw such that the edge of the jaw aligns with the clamping line marked on the test specimen.

6.4.2 Insert the fastening strap into the other jaw and clamp such that the front edge of the jaw is approximately 10 mm from adjacent edge of the strap attachment.

6.4.3 Operate the tensile testing machine so that the jaws separate at a speed of 100 ± 10 mm/min.

6.4.4 Record the maximum force in newtons, to the nearest 0.1 N, at which failure occurs.

6.4.5 Record the type and position of failure which occurs, see section 8.2, as:

- Failure of strap attachment.
- Breaking of fastening strap across its width.

6.4.6 Repeat the procedure in sections 6.4.1 to 6.4.5 for the remaining test specimen(s).

6.5 Method 3: strength of strap

6.5.1 Insert one end of a test specimen in each of the jaws of the tensile testing machine and clamp so that a similar length of the test specimen is clamped in each jaw.

Note: If the length of test specimen is insufficient the initial jaw separation may be reduced, but should be kept as close to 50 mm as possible.

6.5.2 Operate the tensile testing machine so that the jaws separate at a speed of 100 ± 10 mm/min.

6.5.3 Record the maximum force in newtons, to the nearest 0.1 N, at which failure by breaking of the strap occurs.

6.5.4 Repeat the procedure in sections 6.5.1 to 6.5.3 for the remaining test specimen(s).
7. TEST REPORT

Include in the test report:

7.1 Reference to this test method SATRA TM181: 1996.

7.2 A description of the buckle fastening assembly, including the type of upper material.

7.3 For each method carried out, the force at failure for each test specimen as recorded in section 6.3.4, 6.4.4 or 6.5.3.

7.4 The type and position of failure for each test specimen as recorded in section 6.3.5 or 6.4.5.

7.5 Any deviations from this standard test method.

SATRA can help members to interpret the results from this test method.

8. ADDITIONAL NOTES

8.1 Selection of methods

Depending on the information required, all or part of the procedure – Methods 1, 2 and 3 – may be carried out.

8.2 Validity of failure types

Where a test on the standard 50 mm wide test specimen exhibits a failure which appears to be propagated from a cut edge and would not have occurred in wear, then tests should, where possible, be repeated on wider test specimens. Such wider test specimens should, however, be tapered away from the buckle or fastening strap attachment down to 50 mm at the clamping line.

If the test on the wider test specimen gives a failure considered to be valid, then these test results should be reported instead of those for the standard test specimen.

8.3 Related tests

BS 5131: Section 5.11 – Determination of the strength of buckle fastening assemblies.

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