adidas	Division **FW**	Test Method ID **PHM-FW-0306 (aka ST-06)**	Version **06**	Page: 1-10 Effective Date: **Dec. 06, 2018**
Adhesion an Cementation Test				Effective Until: **Further Notice**

Document Owner: Advanced Creation Testing – Lab Standards	
Document Author: Harald Schaefer Sen. Manager Lab Standards FW	**Document Approver:** Michael Otto Senior Manager Lab Standards
Applicability - Brand: Adidas, Reebok	**Division:** FW

1. Objective

To determine the adhesion strength between the layers of coated and laminated materials. This includes:

- Adhesion of dressing of leather in dry & wet condition.
- Adhesion of dressing of Foiled leather as initial test which can be done in warehouse
- Adhesion to textile backer on synthetic materials.
- Bond ability of materials (Cementation to rubber).

In 90 % of needed cases, the preparation is done at the production line or in the sample room of the factory

2. Scope

All materials, components, complete uppers, according to PDM/aTP

3. Referenced documents

- **DIN EN ISO 2411** - Rubber or plastics-coated fabrics - Determination of coating adhesion (2000-08)
- **DIN EN1392** - Adhesives for leather and footwear materials - Solvent-based and dispersion adhesives - Testing of bond strength under specific conditions
- **DIN EN ISO 7500-1** - Metallic materials -Calibration and verification of static uniaxial testing machines
- **ISO 18454** - Standard atmospheres for conditioning and testing of footwear and components for footwear

4. Terminology

- PHM-FW : Physical Test Material – Footwear
- ST- : Strength Test
- aTP : adidas Testing Portal
- PDM : Product Data Management

5. Equipment

5.1. Equipment

- Tensile machine, compliant with DIN EN ISO 7500-1 standard, with the ability to install a graph writer.
- Loadcell compliant with DIN EN ISO 7500-1 class 0,5
- Buffing machine
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5.2. Accessories

- Rubber faced clamps, preferably pneumatic, clamp width not less than specimen width.
- Rubber, acc to A-08 and a minimum thickness of 3 mm
- Cleaning solvent: depending on the cement system and the guidelines of the released cement suppliers.
- Primer, hardener, and PU adhesive: depending on the cement system and the guidelines of the released cement suppliers.
- Knife or cutter
- Ruler
- 3M adhesive Scotch Tape

6. Sample

6.1. Sample definition

- If only adhesion and cementation are tested, 4 Test specimens in total are needed
- If adhesion, cementation, and aging- or hydrolysis test are required, 6 Test specimens in total are needed
- If on leather dry-, wet adhesion and cementation is requested, 6 Test specimens in total are needed.

6.2. Sample treatment/Conditioning

- Refer to adidas test method PHM-FW0002.
- Conduct test under normal room temperature conditions (23 ± 2) °C, at a humidity of (50 ± 10) %.

7. Procedure

7.1. Adhesion test on Foil leather

- Mark on the leather an area with 70mm x 45mm which is used for checking.
- Stripe the finished surface of leather with a knife in two ways (see figure 1). The scratches made in both directions should be about 45° and at least 5mm of separation.

Note: The stripes should be superficial, cutting the finished layer

1. Take a piece of Scotch Tape and glue it in the middle line of specimen, in parallel direction to 70mm side (see figure 1)
2. Press the Scotch Tape by rolling a steel cylinder (weight 3.3kg) over it 10 times
3. Take with the hand, one extreme of the tape and tear it quickly, ungluing the tape from the leather instantly.

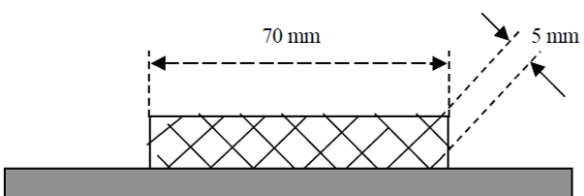


figure 1

Note: When cutting the surface layer by hand, make sure you don't cut too deep into the substrate material, just need to cut through the foil layer is enough (see also figure 2)

Correct

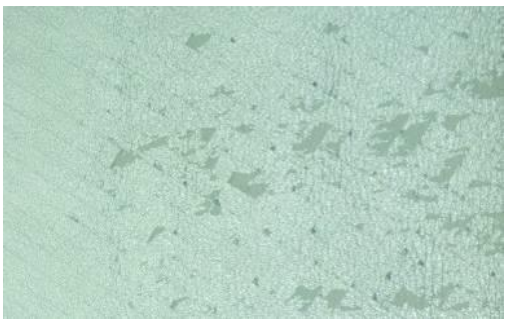
Wrong

figure 2

Evaluation

- When the tape is separated from the leather, and the top layer delaminates from the leather, the leather is considered as rejected.

- In this case, there is no need to do adhesion and cementation to rubber according to ST-06



Rejected

Released

figure 3

- If no delamination occurs, the leather is considered as released and specimens must be sent to the laboratory for additional ST-06 testing.

7.2. Adhesion and cementation test on most kinds of material

Note on "Adhesion on substrate"
Adhesion on substrate should be tested that way as the adhered layers are used at the shoe. That means if a TPU film is HF welded to the upper material it needs to be tested that way that the film is torn away from the upper material to which it was welded. The test shall be done with the tensile machine, too.
CT-09 is the most proper test method

Note on Adhesion and cementation when the material is used as bandage on slides
In case an upper material (mostly synthetic or textile) is used as bandage material on slides, the material must be tested on adhesion and cementation on front side, as well as cementation on back side. This is because on slides the upper material is cemented mostly from the backside to another material, but it can also happen that the material is bonded with its cover side to another material. Requirement level for both tests is on the same level and both layers have to pass.

2.1 Material Preparation

a) Laboratory preparation part

1. Cut pieces of material and testing rubber to a size of 150mm x 25,4mm.
2. Ensure leather specimen is taken from the backbone area acc. to A-02.

b) Production line preparation part

1. Rough the rubber with the buffing machine, ensuring that ALL buffing dust on the rubber surface is thoroughly removed afterwards.
2. After that :

2.1) Cementation on Leather

Rough the grain from the grain side off the leather so that the leather fibres can be seen on the specimen.

2.2) Adhesion of dressing

Clean the surface of the leather by brush or air-gun on white Anilines and Full grains

Prime the test specimen surface on metallic foiled leather

2.3) Synthetics, Rubber and Foam Materials

Prime the test specimen surface

3. Put the specimen into an oven at 55-60 °C for 2 minutes.

2.2 Attaching Process

Following procedure is the standard procedure for any kind of cement system. In order to optimise the process please refer to the guidelines of the released cement suppliers given for their products

1. Apply cement to both the test specimen and the rubber.
2. Allow both the specimen & rubber dry, putting it inside an oven for 5 minutes at 55-60 °C.
3. Directly stick the rubber and test specimen together

NOTE: surface temperature should be at min 40°C to get a good bonding result

4. Place the combined specimen into a press, and press it at a pressure of min 35 Kg/cm2 for at least 10-12 seconds
5. Keep specimens for a minimum of 4 hours at room temperature (**23°C**) before testing.
6. Cut out a test specimen size **150mm x 20mm** (cutting die for rubbing fastness) from the bonded specimen.

2.3 Additional Conditioning

a) Wet Adhesion On Leather

1. After specimen preparation, and 4 hours drying time at room temperature, place the specimen into distilled- or water of a pH value of 7 for 2 hours.
2. Remove the specimen from the water & wipe off the excess water before conducting the test.

b) Adhesion test after 'Hydrolysis'

1. Expose the material specimen at the defined hydrolysis conditions. See GE-08 for details on Hydrolysis Test.
2. Allow the specimen cool down to room temperature for 4 hours.
3. Prepare the specimen and the rubber as described above at 1b).
4. Let the combined specimen dry for another 4 hours before conducting the test.

c) Cementation test after 'Hydrolysis'

1. After specimen preparation, let the specimens 4 hrs. condition at room temp (23 +/-2 °C, 50 +/-10% RH) to allow the cross-linking of cement. Place the specimen into the hydrolysis chamber after the conditioning.

2. See GE-08 for details on 'Hydrolysis Test'.
3. Allow the specimens to cool down to room temperature for 24 hrs after hydrolysis test before conducting the test.

Test Procedure

1. Test must be conducted under normal room temperature conditions (23°C ±2°C, with a humidity of 50% ±10 %).
2. Set tensile machine to the required test start position (i.e. **25mm** clamp distance), see ***"figure 4"***.
3. Calibrate the load of the tensile machine to **zero (0)**.
4. Place test specimen between the clamps so that it is centrally located and that the long dimension is as parallel as possible to the force direction.
5. Allow the tensile machine to run at **100mm/min**.

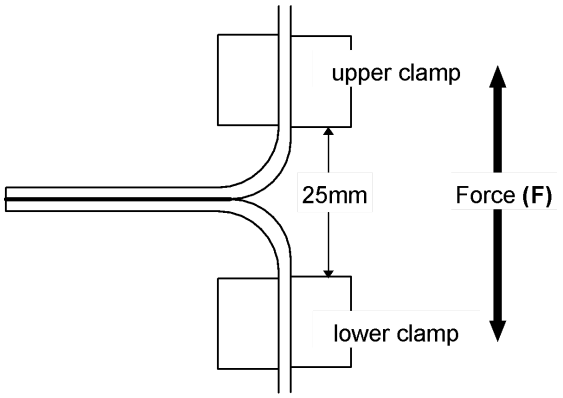


figure 4

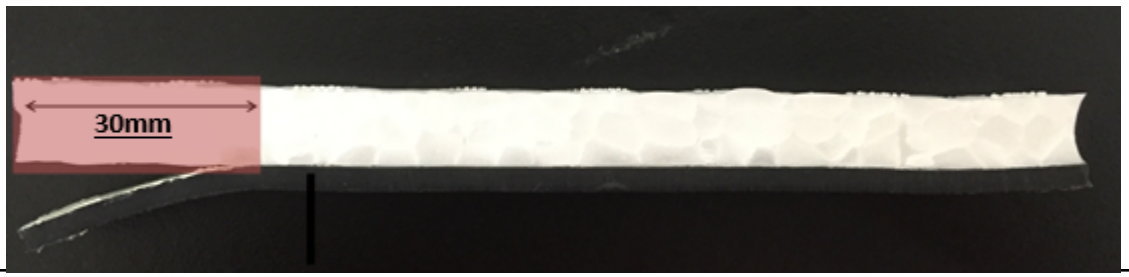
Note….In case the material does not separate, try to separate it carefully by cutting the surface of the testing material with a sharp knife (when testing adhesion strength), or the rubber surface (when testing cementation strength).

2. Adhesion and cementation test on Boost material

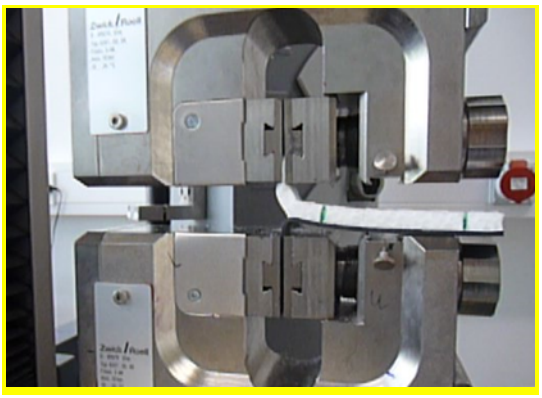
Conditioning time: at least 4 hours after preparation (23°C 2°C)

Test Procedure

1. Test must be conducted under normal room temperature conditions (23°C ±2°C, with a humidity of 50% ±10 %).
2. Mark the test area on the specimen and prepare it accurately as shown below.
   Red highlighted area: Boost isn´t cemented to the Rubber
   White area: Cemented for testing



3. Set tensile machine to the required test start position (clamp distance: min. 25mm).
4. Place test specimen between the clamps so that it is centrally located and that the long dimension is as parallel as possible to the force direction.
   Fix the Boost material in the upper clamp and rubber material in the lower clamp.



5. Calibrate the load of the tensile machine to zero (0).
6. Allow the tensile machine to run at 100mm/min.
7. Monitor the graph and the specimen during testing. Cutting only if Boost material starts to tear.

Evaluation

There are different ways to evaluate adhesion and cementation

Method (DIN 53357-A)

During the test, the graph must be observed carefully. It may happen that the value level of the test will not change, but the graph will turn down. If this is case something happens to the specimen and must be observed and recorded.

This evaluation method shall be used for all kinds material types except Synthetics. Cementation and adhesion test after hydrolysis are evaluated with this method, too

1. In calculating the parting force, the first and last quarters of the graph are not used in the evaluation. The remaining half (quarters 2 & 3) of the graph should be divided into **9** sections using **10** lines (see ***"figure 5"***).
2. The parting force measured and shown at points of intersection is used for evaluation.
3. The average of the 10 points of intersection is calculated & rounded off to 1 decimal place (e.g. 3.68459 = 3.7).
4. Adhesion Strength (**AS**) is calculated using the formula below. This calculation gives the Adhesion Strength figure as "Newton's per millimetre" (**N/mm**).

$$AS = \frac{\text{recorded force}}{\text{width of specimen}}$$

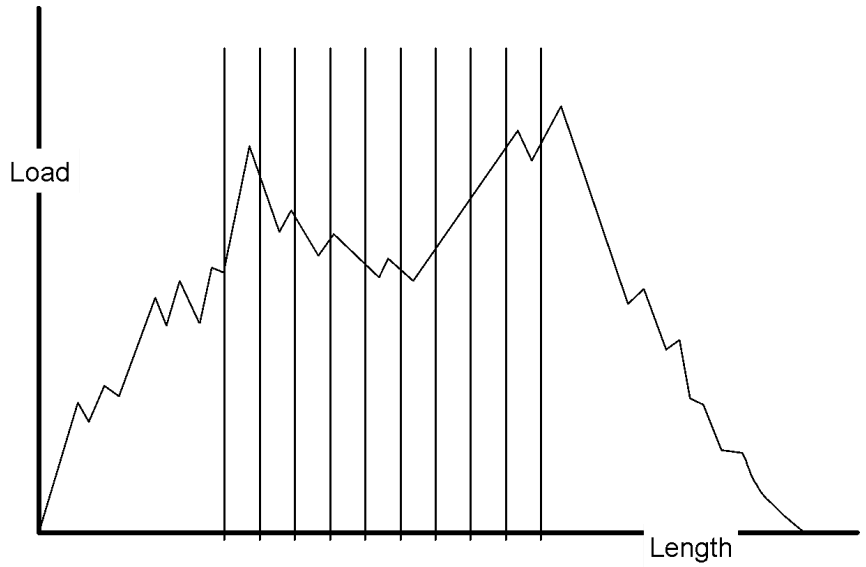


figure 5

In case materials fail on cementation test it is necessary to re-conduct the testing to see if the problem is a material- or a preparation problem.
In any case contact the cement supplier for additional support.

Evaluation 2

This evaluation method shall only be used for synthetic materials without additional conditioning

1. For calculating the **cementation strength**, take the highest peak in the beginning of the curve (see ***figure 6)***.

    - **Cementation Strength** (**CS**) is calculated using the formula below. This calculation gives the cementation strength figure as" "Newton's per millimetre" (**N/mm**). The average of the 2 specimen is written in the report.

$$CS = \frac{\text{recorded force}}{\text{width of specimen}}$$

2. For calculating the **adhesion strength to backer**, take the average of the peaks and valleys in the 2nd part of the curve (low) corresponding to the delamination (see ***figure 6)***.

    - **Adhesion Strength to backer** (**ASB**) is calculated using the formula below. This calculation gives the Adhesion Strength to backer figure as "Newton's per millimetre" (**N/mm**). The average of the 2 specimen is written in the report.

$$ASB = \frac{\text{recorded force}}{\text{width of specimen}}$$

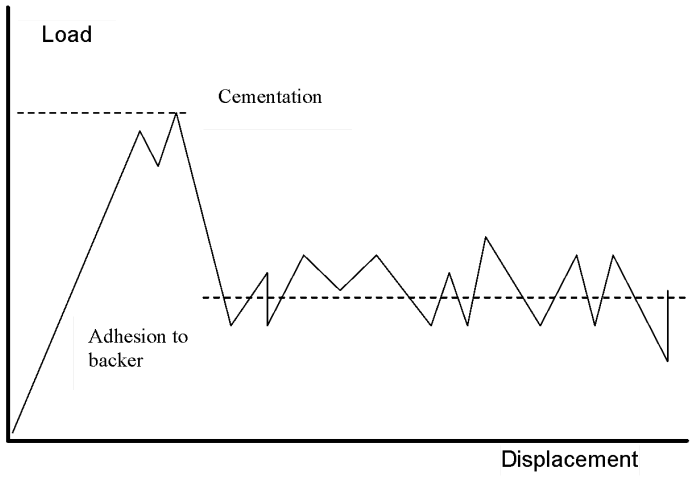
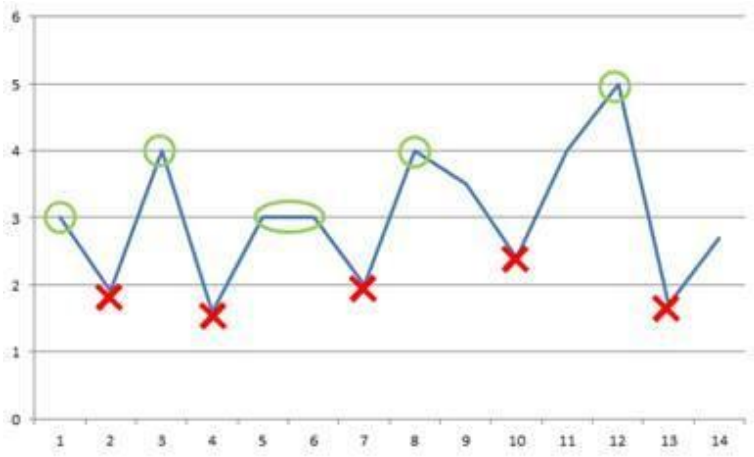


figure 6

Evaluation 3 (Boost):

1. Read the cementation value [in N/mm] from the computer monitor chart display and mark this point on the specimen.
   - Boost breakage: take the maximum value (as described and shown below)
   - All other breakages (for e.g. poor priming between rubber and boost): take the value at that point



2. List the lowest value of each specimen in the report.
3. All values need to be above requirement

9. Safety

Use of this test method may pose safety concerns and the user of the method is responsible to determine appropriate health and safety measures that should be taken, including any local health and safety regulatory limitations that may apply.

10. Quality Assurance

- Ensure tensile machine is in an air-conditioned room and is properly calibrated by the machine supplier
- For specimen preparation and cementing to the test rubber the use of water based PU cement systems is requested as first choice.
- Only in cases where this is impossible, it is allowed to use a solvent based system, provided it will be used in later production, too.

11. Requirements (*before aTP implementation*)

Test Method Code	Test Method Name	UOM/Report	Requirement
PHM-FW-0306-CTAD **PHM-FW0306-CTCEM**	Adhesion and Cementation Test - Adhesion Test Adhesion and Cementation Test - Cementation Test	N/mm	Depending on material

12. Document version history (*before aTP implementation*)

Version	Date	Author	Notes
04	17.07.2018	Harald Schaefer	Boost testing and evaluation added