BRITISH STANDARD

BS EN
1939 : 1997

Self adhesive tapes — Measurement of peel adhesion from stainless steel or from its own backing

The European Standard EN 1939 : 1996 has the status of a British Standard

ICS 83.180

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee PKW/3, Distribution packaging, transport packaging and unit loads, upon which the following bodies were represented:

British Adhesives and Sealants Association
British Apparel and Textile Confederation
British Coatings Federation Ltd.
British Fibreboard Packaging Association
British Glass Manufacturers' Confederation
British Industrial Truck Association
British Plastics Federation
British Retail Consortium
British Rubber Manufacturers' Association Ltd.
British Tensional Strapping Association Ltd.
British Timber Merchants' Association
British Wood Preserving and Damp-proofing Association
Chamber of Shipping
Chemical Industries Association
China Clay Association
Department of Transport
Engineering Equipment and Materials Users' Association
Federation of the Electronics Industry
Flexible Ibc Association
Food and Drink Federation
Independent Pallet Repair Committee
Institute of Grocery Distribution
Metal Packaging Manufacturers' Association
Ministry of Defence
National Association of Pallet Distributors
Power Fastenings Association
Pira International
Road Haulage Association Ltd.
Society of Occupational Medicine
Storage Equipment Manufacturers' Association
Timber Packaging and Pallet Confederation
Timber Research and Development Association
United Kingdom Softwood Sawmillers' Association

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

Adhesive Tape Manufacturers' Association
British Footwear Manufacturers' Federation
Packaging Distributors Association
Pressure Sensitive Manufacturers' Association

This British Standard, having been prepared under the direction of the Consumer Products and Services Sector Board, was published under the authority of the Standards Board and comes into effect on 15 April 1997

Amendments issued since publication

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The following BSI references relate to the work on this standard:
Committee reference PKW/3
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Contents

National foreword

This British Standard has been prepared by Technical Committee PKW/3 and is the English language version of EN 1939 : 1996 *Self adhesive tapes — Measurement of peel adhesion from stainless steel or from its own backing* published by the European Committee for Standardization (CEN).

Cross-reference

Publication referred to	Corresponding British Standard
EN 1942 : 1996	BS EN 1942 : 1996 *Self adhesive tapes — Measurement of thickness*

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 16, an inside back cover and a back cover.

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 1939

August 1996

ICS 83.180

Descriptors: Adhesive tapes, measurement, adhesive strength, adhesion tests, stainless steels

English version

Self adhesive tapes — Measurement of peel adhesion from stainless steel or from its own backing

Rubans auto-adhésifs — Mesure de pouvoir adhésif linéaire sur acier inoxydable ou sur son propre support

Klebebänder — Messung der Klebkraft auf nichtrostendem Stahl oder auf der eigenen Rückseite

This European Standard was approved by CEN on 1996-07-19. CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 253, Self adhesive tapes, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 1997, and conflicting national standards shall be withdrawn at the latest by February 1997.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

The European standard EN 1939 gives :

– the annex A (normative)	Self adhesive tapes — Measurement of peel adhesion from its own backing
– the annex B (normative)	Self adhesive tapes — Measurement of peel adhesion from stainless steel at low temperature
– the annex C (normative)	Self adhesive tapes — Measurement of peel adhesion from stainless steel of double sided adhesive tapes
– the annex D (normative)	Self adhesive tapes — Measurement of peel adhesion from stainless steel of an adhesive transfer tape
– the annex E (informative)	Bibliography — FEPA — *Standard for coated abrasive grains of fused alumina and silicon carbide 43-GB-1984*

Contents

1 Scope

This standard specifies the method to measure, under specified test conditions, the force required to remove an adhesive tape which has been applied to a standard metal surface.

This European Standard specifies the method of measurement, under specified test conditions, the force required to remove an adhesive tape which has been applied to:

– a standard metal surface;

– from its own backing;

– from stainless steel at low temperature;

– from stainless steel of double sided adhesive tapes; and

– from stainless steel of an adhesive transfer tape.

NOTE. For the purpose of facilitating the understanding of this standard, it has been divided into five separate test methods.

2 Definition

For the purposes of this standard the following definition applies.

peel adhesion

The force required to peel a strip of tape from a specified substrate at a specified angle and speed.

3 Principle

A length of adhesive tape is applied to a standard plate which is then fixed vertically in one clamp of a tensile testing machine. The other clamp of the machine pulls the free end of the adhesive tape at an angle of 180° to the plate.

The adhesive strength is measured by the force required to peel the adhesive tape continuously from the plate, the line of separation being perpendicular to the direction of the applied force.

4 Materials

4.1 Diacetone alcohol.

4.2 Lint free cotton wool or tissue.

4.3 One of the following solvents:

– methanol;

– methyl ethyl ketone;

– acetone;

– toluene.

Solvents shall be of general purpose chemical grade.

5 Apparatus

5.1 *Tensile testing machine*, with the following characteristics:

– the force shall be indicated with a maximum error of 2 %;

– the speed of the moveable clamp shall be 300 mm/min ± 30 mm/min;

– the scale shall be such that the readings obtained are between 15 % and 85 % of the complete scale;

– the clamps shall be serrated to prevent slipping or tearing of the tape;

– if a pendulum machine is used, ensure that the pendulum can swing freely.

5.2 Stainless steel plates[1)]

These shall be perfectly flat, 200 mm long × 50 mm wide and 2 mm thick. They shall be made from 'polishing' quality stainless steel of a Brinell hardness ranging from 130 to 200 (see ISO 6506) and comprising the following constituents:

–carbon <0,12 %;

–nickel >8 %;

–chromium >17 %.

The testing surface of the plate shall first be polished to a mirror finish. It shall then be roughened with abrasive grit[2)]. The abrasion lines shall be parallel to the long edge of the plate. The plate shall be graduated on the long edges with five short marks spaced 30 mm apart, the first being 50 mm from one end. (This is referred to as the starting end in **7.3.2.**)

Check that the surface conforms to the following conditions by five transverse measurements in the area between two imaginary lines 10 mm on each side of the longitudinal axis of the plate:

– mean range between 0,05 μm and 0,40 μm;

– maximum depth less than 4 μm. Sampling length (of abraded area of test plate) is 0,8 mm;

– the evaluation length of five transverse samples provides the abraded area required to cover all possible variables in surface rugosity.

NOTE. A full explanation of these terms will be found in ISO 468 and ISO 4287-1.

Between each test, the plates shall be kept in such a way as to avoid any accidental scratching which may modify the surface condition.

5.3 Polished cylindrical metal roller

This shall have a diameter of at least 50 mm and a mass corresponding to 2 kg/cm width of adhesive tape under test.

[1)] Potential suppliers of tools/materials may be published by other organisations like AFERA (Assocation des Fabricants Européens de Rubans auto-adhésifs) 60 rue Auber 94408 VITRY SUR SEINE CEDEX.

[2)] It is recommended to roughen the testing surface with Nr. 240 Type FEPA abrasive grit (see annex E). This information is given for the convenience of users of this standard and does not constitute an endorsement by CEN of this product type.

6 Test sample and test pieces

Condition the sample roll for 24 h at 23 °C ± 2 °C and 50 % ± 5 % relative humidity.

Discard the three outer turns of adhesive tape from the roll before taking test pieces.

Perform the test on test pieces 400 mm long and the same width as the adhesive tape. Take five or ten test pieces as required by the test.

For widths greater than 25 mm, a test piece 25 mm wide shall be cut longitudinally from the adhesive tape.

The cutting shall be carried out by means of a razor-blade or any other suitable instrument. It shall always be effected so that the adhesive surface never contacts other surfaces before application to the test plate. Cutting shall never be carried out with the adhesive tape already applied to the test plate, so as not to mark the plate for subsequent tests.

7 Procedure

7.1 Standard test conditions

The test shall be carried out at 23 °C ± 2 °C and 50 % ± 5 % relative humidity.

7.2 Preparation of plate

Wipe the test surface of the plate with a fresh piece of cotton wool or tissue saturated with diacetone alcohol. Dry the plate with fresh cotton wool, then wipe the test surface with a fresh piece of cotton wool saturated with one of the solvents given in **4.3**. Dry the plate with fresh cotton wool, then repeat for a total of three cleaning operations with this solvent. Maintain the plate at a temperature of 23 °C ± 2 °C for at least 5 min before proceeding.

In order to obtain consistent results, a new plate shall be cleaned at least 10 times before use.

7.3 Peel adhesion from stainless steel

7.3.1 *Application of the test piece to the plate*

Take five test pieces by unrolling the conditioned roll radially at a speed of approximately 300 mm/s and then apply them in the manner described below, within 15 s, in the standard test conditions.

Apply the test piece progressively by gentle longitudinal finger strokes in such a way that the formation of air bubbles between adhesive tape and plate is avoided, without, however, exerting appreciable pressure on the adhesive tape.

The test piece shall be centred on the plate such that the edge of the test piece is parallel to the long edge of the plate. Pass the roller over the surface of the adhesive tape, to and fro, twice in each direction, at a speed of approximately 10 mm/s. Leave the adhesive tape adhered to the plate for 10 min in the standard test conditions and then test as described below.

7.3.2 *Stripping the test piece from the test plate*

Peel off about 25 mm of the adhesive tape from the starting end of the plate, the line of separation being perpendicular to the axis of the test piece.

Fix the starting end of the plate in one clamp of the tensile testing machine.

Fold back the free end of the adhesive tape and fix it in the other clamp so that the non-adhesive surfaces are almost in contact and exactly aligned. Ensure that the two surfaces remain perfectly superimposed without rubbing.

At least 25 mm of the adhesive tape shall remain to be peeled before the first reference mark is reached.

If a pendulum machine is used, ensure that the pendulum swings freely. Set the speed at 300 mm/min ± 30 mm/min and start the tensile testing machine.

Take readings as the line of separation of adhesive tape from the plate passes each reference mark.

NOTE. In spite of its apparent simplicity, the use of this method is rather delicate and involves the observation of a certain number of precautions to give coherent and identical results between one laboratory and another as well as between one operator and another. Attention is drawn to the following points:

– the temperature at which the measurement is carried out is very important. The standard conditions of 23 °C ± 2 °C allow the test to take place between 21 °C and 25 °C. It has been found that the peel adhesions at 21 °C and 25 °C are different[3)];

– the tester should know that, by prolonged handling, heat is transmitted to the stainless steel plate. Therefore, during and after application of the adhesive tape to the plate, both should be handled as little as possible;

– care should be taken to roll horizontally over the adhesive tape which is in contact with the stainless steel plate, in order to exert a completely uniform pressure over the length and the width of the adhesive tape;

– it should be noted that the adhesive tape should be applied within 15 s following its removal from the roll.

8 Expression of results

For each test piece, arrange the five readings in ascending order and take the median value. Similarly, arrange these five median values in ascending order and take their median.

Take as the peel adhesion the value (median) so obtained and express in N/cm width of adhesive tape tested.

After each test, examine the test plate visually and note the appearance of the adhesive and, in particular, any deposit or transfer onto the plate.

Since the measurements made using different types of tensile testing machines (for example, electronic or pendulum) are not directly comparable, the type of tensile testing machine used shall be indicated in the report.

[3)] More accurate results may be obtained if the temperature is restricted to 23 °C ± 1 °C.

9 Test report

The test report shall include the following information:

a) a reference to this European Standard;

b) all information necessary to identify the test sample;

c) the type of tensile testing machine used;

d) the date of the test;

e) the results obtained;

f) any operation not specified in this European Standard, which may influence the results.

Annex A (normative)

Self adhesive tapes — Measurement of peel adhesion from its own backing

A.1 Scope

The annex A of this standard specifies the method to measure under specified test conditions the force required to remove an adhesive tape which has been applied to its own backing.

A.2 Definition

For the purposes of this annex the following definition applies.

peel adhesion

The force required to peel a strip of tape from a specified substrate at a specified angle and speed.

A.3 Principle

A length of adhesive tape is superimposed on a second length of adhesive tape which is already applied to a standard plate and is then fixed vertically in one clamp of a tensile testing machine. The other clamp of the machine pulls the free end of the adhesive tape at an angle of 180° to the plate.

The adhesive strength is measured by the force required to peel the adhesive tape continuously from its own backing, the line of separation being perpendicular to the direction of the applied force.

A.4 Materials

A.4.1 Diacetone alcohol.

A.4.2 Lint free cotton wool, or tissue.

A.4.3 One of the following solvents:

– methanol;

– methyl ethyl ketone;

– acetone;

– toluene.

Solvents shall be of general purpose chemical grade.

A.5 Apparatus

A.5.1 Tensile testing machine with the following characteristics:

– the force shall be indicated with a maximum error of 2 %;

– the speed of the moveable clamp shall be 300 mm/min ± 30 mm/min;

– the scale shall be such that the readings obtained are between 15 % and 85 % of the complete scale;

– the clamps shall be serrated to prevent slipping or tearing of the tape;

– if a pendulum machine is used, ensure that the pendulum can swing freely.

A.5.2 ***Stainless steel plates***[4)]

These shall be perfectly flat, 200 mm long × 50 mm wide and 2 mm thick. They shall be made from 'polishing' quality stainless steel of a Brinell hardness ranging from 130 to 200 (see ISO 6506) and comprising the following constituents:

– carbon <0,12 %;

– nickel >8 %;

– chromium >17 %.

The testing surface of the plate shall first be polished to a mirror finish. It shall then be roughened with abrasive grit[5)]. The abrasion lines shall be parallel to the long edge of the plate. The plate shall be graduated on the long edges with five short marks spaced 30 mm apart, the first being 50 mm from one end. (This is referred to as the starting end in **A.7.3.2**).

Check that the surface conforms to the following conditions by five transverse measurements in the area between two imaginary lines 10 mm on each side of the longitudinal axis of the plate:

– mean range between 0,05 μm and 0,40 μm;

– maximum depth less than 4 μm. Sampling length (of abraded area of test plate) is 0,8 mm;

– the evaluation length of five transverse samples provides the abraded area required to cover all possible variables in surface rugosity.

NOTE. A full explanation of these terms will be found in ISO 468 and ISO 4287-1.

Between each test, the plates must be kept in such a way to avoid any accidental scratching which may modify the surface condition.

A.5.3 ***Polished cylindrical metal roller***

This shall have a diameter of at least 50 mm and a mass corresponding to 2 kg/cm width of adhesive tape under test.

A.6 Test sample and test pieces

Condition the sample roll for 24 h at 23 °C ± 2 °C and 50 % ± 5 % relative humidity.

Discard the three outer turns of adhesive tape from the roll before taking test pieces.

Perform the test on test pieces 400 mm long and the same width as the adhesive tape. Take ten test pieces as required by the test.

For widths greater than 25 mm, a test piece 25 mm wide shall be cut longitudinally from the adhesive tape.

The cutting shall be carried out by means of a razor-blade or any other suitable instrument. It shall always be effected so that the adhesive surface never contacts other surfaces before application to the test plate. Cutting shall never be carried out with the adhesive tape already applied to the test plate, so as not to mark the plate for subsequent tests.

[4)] See **5.2**.

[5)] See **5.2**.

A.7 Procedure

A.7.1 *Standard test conditions*

The test shall be carried out at 23 °C ± 2 °C and 50 % ± 5 % relative humidity.

A.7.2 *Preparation of plate*

Wipe the test surface of the plate with a fresh piece of cotton wool or tissue saturated with diacetone alcohol. Dry the plate with fresh cotton wool, then wipe the test surface with a fresh piece of cotton wool saturated with one of the solvents given in **A.4.3**. Dry the plate with fresh cotton wool, then repeat for a total of three cleaning operations with this solvent. Maintain the plate at a temperature of 23 °C ± 2 °C for at least 5 min before proceeding.

In order to obtain consistent results, a new plate shall be cleaned at least 10 times before use.

A.7.3 *Peel adhesion from its own backing*

A.7.3.1 *Application of the test piece to the plate*

Take 10 test pieces by unrolling the conditioned roll radially at a speed of approximately 300 mm/s and then apply them in the manner described below, within 15 s in the standard test conditions.

Apply a first test piece progressively by gentle longitudinal finger strokes in such a way that the formation of air bubbles between adhesive tape and plate is avoided, without, however, exerting appreciable pressure on the adhesive tape. Cut off the excess at each end of the plate.

Apply a second test piece onto the test piece already applied to the plate, so that they are precisely coincident.

The test pieces shall be centred on the plate such that the edges of the test pieces are parallel to the long edge of the plate. Pass the roller over the surface of the adhesive tape, to and fro, twice in each direction, at a speed of approximately 10 mm/s. Leave the adhesive tape adhered to the plate for 10 min in the standard test conditions and then test as described below.

A.7.3.2 *Stripping the test piece from its own backing*

Peel off about 25 mm of the upper adhesive tape only from the starting end of the plate, the line of separation being perpendicular to the axis of the test piece.

Fix the starting end of the plate in one clamp of the tensile testing machine.

Fold back the free end of the adhesive tape and fix it in the other clamp so that the non-adhesive surfaces are almost in contact and exactly aligned. Ensure that the two surfaces remain perfectly superimposed without rubbing.

At least 25 mm of the adhesive tape shall remain to be peeled before the first reference mark is reached.

If a pendulum machine is used, ensure that the pendulum swings freely. Set the speed at 300 mm/min ± 30 mm/min and start the tensile testing machine.

Take readings as the line of separation of adhesive tape from its own backing passes each reference mark on the plate.

NOTE. In spite of its apparent simplicity, the use of this method is rather delicate and involves the observation of a certain number of precautions to give coherent and identical results between one laboratory and another as well as between one operator and another. Attention is drawn to the following points.

– The temperature at which the measurement is carried out is very important. The standard conditions of 23 °C ± 2 °C allow the test to take place between 21 °C and 25 °C. It has been found that the peel adhesions at 21 °C and 25 °C are different[6)].

– The tester should know that, by prolonged handling, heat is transmitted to the stainless steel plate. Therefore, during and after application of the adhesive tape to the plate, both should be handled as little as possible.

– Care should be taken to roll horizontally over the adhesive tape which is in contact with the stainless steel plate, in order to exert a completely uniform pressure over the length and the width of the adhesive tape.

– It should be noted that the adhesive tape should be applied within 15 s following its removal from the roll.

A.8 Expression of results

For each test piece, arrange the five readings in ascending order and take the median value. Similarly, arrange these five median values in ascending order and take their median.

Take as the peel adhesion the value (median) so obtained and express in N/cm width of adhesive tape tested.

After each test, examine the test plate visually and note the appearance of the adhesive and, in particular, any deposit or transfer onto the plate.

Since the measurements made using different types of tensile testing machines (for example, electronic or pendulum) are not directly comparable, the type of tensile testing machine used shall be indicated in the report.

A.9 Test report

The test report shall include the following information:

a) a reference to the annex A of this European Standard;

b) all information necessary to identify the test sample;

c) the type of tensile testing machine used;

d) the date of the test;

e) the results obtained;

f) any operation not specified in this European Standard, which may influence the results.

[6)] See **7.3.2**.

Annex B (normative)
Self adhesive tapes – Measurement of peel adhesion from stainless steel at low temperature

B.1 Scope

The annex B of this standard specifies the method to measure at low temperature the force required to remove an adhesive tape which has been applied to a standard metal surface at the same temperature.

B.2 Definition

For the purposes of this annex the following definition applies.

peel adhesion

The force required to peel a strip of tape from a specified substrate at a specified angle and speed.

B.3 Principle

A length of adhesive tape is applied to a standard plate which is then fixed vertically in one clamp of a tensile testing machine. The other clamp of the machine pulls the free end of the adhesive tape at an angle of 180° to the plate.

The adhesive strength is measured by the force required to peel the adhesive tape continuously from the plate, the line of separation being perpendicular to the direction of the applied force.

The entire test is carried out at low temperature.

B.4 Materials

B.4.1 Diacetone alcohol.

B.4.2 Lint free cotton wool, or tissue.

B.4.3 One of the following solvents:

– methanol;
– methyl ethyl ketone;
– acetone;
– toluene.

Solvents shall be of general purpose chemical grade.

B.5 Apparatus

B.5.1 ***Tensile testing machine***

With the following characteristics:

– the force shall be indicated with a maximum error of 2 %;
– the speed of the moveable clamp shall be 300 mm/min ± 30 mm/min;
– the scale shall be such that the readings obtained are between 15 % and 85 % of the complete scale;
– the clamps shall be serrated to prevent slipping or tearing of the tape;
– if a pendulum machine is used, ensure that the pendulum can swing freely.

B.5.2 ***Stainless steel plates***[7)]

These shall be perfectly flat, 200 mm long × 50 mm wide and 2 mm thick. They shall be made from 'polishing' quality stainless steel of a Brinell hardness ranging from 130 to 200 (see ISO 6506) and comprising the following constituents:

– carbon <0,12 %;
– nickel >8 %;
– chromium >17 %.

The testing surface of the plate shall first be polished to a mirror finish. It shall then be roughened with abrasive grit[8)]. The abrasion lines shall be parallel to the long edge of the plate. The plate shall be graduated on the long edges with five short marks spaced 30 mm apart, the first being 50 mm from one end. (This is referred to as the starting end in **B.7.3.2**).

Check that the surface conforms to the following conditions by five transverse measurements in the area between two imaginary lines 10 mm on each side of the longitudinal axis of the plate:

– mean range between 0,05 μm and 0,40 μm;
– maximum depth less than 4 μm. Sampling length (of abraded area of test plate) is 0,8 mm;
– the evaluation length of five transverse samples provides the abraded area required to cover all possible variables in surface rugosity.

NOTE. A full explanation of these terms will be found in ISO 468 and ISO 4287-1.

Between each test, the plates shall be kept in such a way as to avoid any accidental scratching which may modify the surface condition.

B.5.3 ***Polished cylindrical metal roller***

This shall have a diameter of at least 50 mm and a mass corresponding to 2 kg/cm width of adhesive tape under test.

B.5.4 An environment or environmental chamber appropriate to the chosen temperature.

B.6 Test sample and test pieces

Condition the sample roll for 2 h in an environment at the chosen low temperature.

Discard the three outer turns of adhesive tape from the roll before taking test pieces.

Perform the test on five test pieces 400 mm long and the same width as the adhesive tape.

For widths greater than 25 mm, a test piece 25 mm wide shall be cut longitudinally from the adhesive tape.

The cutting shall be carried out by means of a razor-blade or any other suitable instrument. It shall always be effected so that the adhesive surface never contacts other surfaces before application to the test plate. Cutting shall never be carried out with the adhesive tape already applied to the test plate, so as not to mark the plate for subsequent tests.

[7)] See **5.2**.

[8)] See **5.2**.

B.7 Procedure

B.7.1 *Standard test conditions*

The test shall be carried out at the chosen low temperature.

B.7.2 *Preparation of plate*

Wipe the test surface of the plate with a fresh piece of cotton wool or tissue saturated with diacetone alcohol. Dry the plate with fresh cotton wool, then wipe the test surface with a fresh piece of cotton wool saturated with one of the solvents given in **B.4.3**. Dry the plate with fresh cotton wool, then repeat for a total of three cleaning operations with this solvent. Condition the plate and the roller at the chosen low temperature for 2 h before proceeding.

In order to obtain consistent results, a new plate shall be cleaned at least 10 times before use.

B.7.3 *Peel adhesion from stainless steel at low temperature*

B.7.3.1 *Application of the test piece to the plate*

Take five test pieces by unrolling the conditioned roll radially at a speed of approximately 300 mm/s and then apply them in the manner described below, within 15 s at the chosen low temperature.

Apply the test piece progressively by gentle longitudinal finger strokes in such a way that the formation of air bubbles between adhesive tape and plate is avoided, without, however, exerting appreciable pressure on the adhesive tape.

The test piece shall be centred on the plate such that the edge of the test piece is parallel to the long edge of the plate. Pass the roller over the surface of the adhesive tape, to and fro, twice in each direction, at a speed of approximately 10 mm/s. Leave the adhesive tape adhered to the plate for 16 h to 24 h at the chosen low temperature and then test as described below.

B.7.3.2 *Stripping the test piece from the test plate*

Verify that the tensometer clamps and the space between are at the chosen low temperature.

Peel off about 25 mm of the adhesive tape from the starting end of the plate, the line of separation being perpendicular to the axis of the test piece.

Fix the starting end of the plate in one clamp of the tensile testing machine.

Fold back the free end of the adhesive tape and fix it in the other clamp so that the non-adhesive surfaces are almost in contact and exactly aligned. Ensure that the two surfaces remain perfectly superimposed without rubbing.

At least 25 mm of the adhesive tape shall remain to be peeled before the first reference mark is reached.

If a pendulum machine is used, ensure that the pendulum swings freely. Set the speed at 300 mm/min $\pm$ 30 mm/min and start the tensile testing machine.

Take readings as the line of separation of adhesive tape from the plate passes each reference mark.

NOTE. In spite of its apparent simplicity, the use of this method is rather delicate and involves the observation of a certain number of precautions to give coherent and identical results between one laboratory and another as well as between one operator and another. Attention is drawn to the following points.

– The tester should know that, by prolonged handling, heat is transmitted to the stainless steel plate. Therefore, during and after application of the adhesive tape to the plate, both should be handled as little as possible.

– Care should be taken to roll horizontally over the adhesive tape which is in contact with the stainless steel plate, in order to exert a completely uniform pressure over the length and the width of the adhesive tape.

– It should be noted that the adhesive tape should be applied within 15 s following its removal from the roll.

B.8 Expression of results

For each test piece, arrange the five readings in ascending order and take the median value. Similarly, arrange these five median values in ascending order and take their median.

Take as the peel adhesion the value (median) so obtained and express in N/cm width of adhesive tape tested.

After each test, examine the test plate visually and note the appearance of the adhesive and, in particular, any deposit or transfer onto the plate.

Since the measurements made using different types of tensile testing machines (for example, electronic or pendulum) are not directly comparable, the type of tensile testing machine used shall be indicated in the report.

B.9 Test report

The test report shall include the following information:

a) a reference to the annex B of this European Standard;

b) all information necessary to identify the test sample;

c) the type of tensile testing machine used;

d) the date of the test;

e) the results obtained;

f) the test temperature;

g) any operation not specified in this European Standard, which may influence the results.

Annex C (normative)
Self adhesive tapes — Measurement of peel adhesion from stainless steel of double sided adhesive tapes

C.1 Scope

The annex C of this standard specifies the method to measure under specified test conditions the force required to remove each side of a double sided tape which has been applied to a standard metal surface.

C.2 Definitions

For the purposes of this annex the following definitions apply.

peel adhesion

The force required to peel a strip of tape from a specified substrate at a specified angle and speed.

open side (adhesive)

That surface of the adhesive on a double sided tape which is exposed on normal unwinding or separation of the first liner.

closed side (adhesive)

That surface of the adhesive on a double sided tape which normally remains in contact with the release liner on normal unwinding or separation of the first liner.

C.3 Principle

A length of adhesive tape is applied to a standard plate which is then fixed vertically in one clamp of a tensile testing machine. The other clamp of the machine pulls the free end of the adhesive tape at an angle of 180° to the plate.

The adhesive strength is measured by the force required to peel either face of the double sided adhesive tape continuously from the plate, the line of separation being perpendicular to the direction of the applied force.

C.4 Materials

C.4.1 Diacetone alcohol.

C.4.2 Lint free cotton wool, or tissue.

C.4.3 One of the following solvents:

– methanol;

– methyl ethyl ketone;

– acetone;

– toluene.

Solvents shall be of general purpose chemical grade.

C.4.4 Polyester film 25 μm thick approximately 3 mm wider than the test piece (typically 28 mm).

C.5 Apparatus

C.5.1 *Tensile testing machine*

With the following characteristics:

– the force shall be indicated with a maximum error of 2 %;

– the speed of the moveable clamp shall be 300 mm/min ± 30 mm/min;

– the scale shall be such that the readings obtained are between 15 % and 85 % of the complete scale;

– the clamps shall be serrated to prevent slipping or tearing of the tape;

– if a pendulum machine is used, ensure that the pendulum can swing freely.

C.5.2 *Stainless steel plates*[9)]

These shall be perfectly flat, 200 mm long × 50 mm wide and 2 mm thick. They shall be made from 'polishing' quality stainless steel of a Brinell hardness ranging from 130 to 200 (see ISO 6506) and comprising the following constituents:

– carbon <0,12 %;

– nickel >8 %;

– chromium >17%.

The testing surface of the plate shall first be polished to a mirror finish. It shall then be roughened with abrasive grit[10)]. The abrasion lines shall be parallel to the long edge of the plate. The plate shall be graduated on the long edges with five short marks spaced 30 mm apart, the first being 50 mm from one end. (This is referred to as the starting end in **C.7.3.2** and **C.7.4.2**).

Check that the surface conforms to the following conditions by five transverse measurements in the area between two imaginary lines 10 mm on each side of the longitudinal axis of the plate:

– mean range between 0,05 μm and 0,40 μm;

– maximum depth less than 4 μm. Sampling length (of abraded area of test plate) is 0,8 mm;

– the traversing length of five transverse samples provides the abraded area required to cover all possible variables in surface rugosity.

NOTE. A full explanation of these terms will be found in ISO 468 and ISO 4287-1.

Between each test, the plates shall be kept in such a way as to avoid any accidental scratching which may modify the surface condition.

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9) See **5.2.**

10) See **5.2**.

C.5.3 ***Polished cylindrical metal roller***

This shall have a diameter of at least 50 mm and a mass corresponding to 2 kg/cm width of adhesive tape under test.

C.6 Test sample and test pieces

Condition the sample roll for 24 h at 23 °C ± 2 °C and 50 % ± 5 % relative humidity.

Discard the three outer turns of adhesive tape from the roll before taking test pieces.

Perform the test on five test pieces from each roll. Each test piece shall be 400 mm long and the same width as the adhesive tape.

For widths greater than 25 mm, a test piece 25 mm wide shall be cut longitudinally from the adhesive tape.

The cutting shall be carried out by means of a razor-blade or any other suitable instrument. It shall always be effected so that the adhesive surface never contacts other surfaces before application to the test plate. Cutting shall never be carried out with the adhesive tape already applied to the test plate, so as not to mark the plate for subsequent tests.

C.7 Procedure

C.7.1 ***Standard test conditions***

The test shall be carried out at 23 °C ± 2 °C and 50 % ± 5 % relative humidity.

C.7.2 ***Preparation of plate***

Wipe the test surface of the plate with a fresh piece of cotton wool or tissue saturated with diacetone alcohol. Dry the plate with fresh cotton wool, then wipe the test surface with a fresh piece of cotton wool saturated with one of the solvents given in **C.4.3**. Dry the plate with fresh cotton wool, then repeat for a total of three cleaning operations with this solvent. Maintain the plate at a temperature of 23 °C ± 2 °C for at least 5 min before proceeding.

In order to obtain consistent results, a new plate shall be cleaned at least 10 times before use.

C.7.3 ***Procedure for the open side of double sided adhesive tape***

C.7.3.1 *Application of the test piece to the plate*

Take five test pieces by unrolling the conditioned roll radially at a speed of approximately 300 mm/s and then apply them in the manner described below, within 15 s, and in the standard test conditions.

Apply the open side of the test piece progressively by gentle longitudinal finger strokes in such a way that the formation of air bubbles between adhesive tape and plate is avoided, without, however, exerting appreciable pressure on the adhesive tape.

The test piece shall be centred on the plate such that the edge of the test piece is parallel to the long edge of the plate. Do not roll the tape at this stage. Remove the interleaving material from the test piece. Lay a strip of 25 μm thick polyester cut to approximately 3 mm wider than the width of the test pieces on top of the test piece so that it overlaps both edges. Pass the roller over the surface of the polyester film, to and fro, twice in each direction, at a speed of approximately 10 mm/s. Leave the double sided adhesive tape adhered to the plate for 10 min in the standard test conditions and then test as described below.

C.7.3.2 *Stripping the test piece from the test plate*

Peel off about 25 mm of the polyester reinforced adhesive tape from the starting end of the plate, the line of separation being perpendicular to the axis of the test piece.

Fix the starting end of the plate in one clamp of the tensile testing machine.

Fold back the free end of the double sided adhesive tape and fix it in the other clamp so that the non-adhesive surfaces are almost in contact and exactly aligned. Ensure that the two surfaces remain perfectly superimposed without rubbing.

At least 25 mm of the double sided adhesive tape shall remain to be peeled before the first reference mark is reached.

If a pendulum machine is used, ensure that the pendulum swings freely. Set the speed at 300 mm/min ± 30 mm/min and start the tensile testing machine.

Take readings as the line of separation of double sided adhesive tape from the plate passes each reference mark.

NOTE. In spite of its apparent simplicity, the use of this method is rather delicate and involves the observation of a certain number of precautions to give coherent and identical results between one laboratory and another as well as between one operator and another. Attention is drawn to the following points.

– The temperature at which the measurement is carried out is very important. The standard conditions of 23 °C ± 2 °C allow the test to take place between 21 °C and 25 °C. It has been found that the peel adhesions at 21 °C and 25 °C are different[11)].

– The tester should know that, by prolonged handling, heat is transmitted to the stainless steel plate. Therefore, during and after application of the adhesive tape to the plate, both should be handled as little as possible.

– Care shall be taken to roll horizontally over the double sided adhesive tape which is in contact with the stainless steel plate, in order to exert a completely uniform pressure over the length and the width of the adhesive tape.

– It should be noted that the double sided adhesive tape should be applied within 15 s following its removal from the roll.

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11) See **7.3.2**.

C.7.4 *Procedure for the closed side of double sided adhesive tape*

C.7.4.1 *Application of the test piece to the plate*

Take five pieces by unrolling the conditioned roll radially at a speed of approximately 300 mm/s and then apply them in the manner described below, within 15 s, and in the standard test conditions.

Apply the open side of the test piece centrally onto a strip of 25 μm thick polyester film approximately 3 mm wider than the test piece such that the polyester film extends beyond the tape on both edges.

Remove the interleaving material from the test piece to expose the closed side and apply progressively to the plate with gentle finger strokes in such a way that the formation of air bubbles between adhesive tape and plate is avoided, without, however, exerting appreciable pressure on the adhesive tape.

The test piece shall be centred on the plate such that the edge of the test piece is parallel to the long edge of the plate. Pass the roller over the surface of the polyester film, to and fro, twice in each direction, at a speed of approximately 10 mm/s. Leave the adhesive tape adhered to the plate for 10 min in the standard test conditions and then test as described below.

C.7.4.2 *Stripping the test piece from the test plate*

Peel off about 25 mm of the polyester reinforced adhesive tape from the starting end of the plate, the line of separation being perpendicular to the axis of the test piece.

Fix the starting end of the plate in one clamp of the tensile testing machine.

Fold back the free end of the double sided adhesive tape and fix it in the other clamp so that the non-adhesive surfaces are almost in contact and exactly aligned. Ensure that the two surfaces remain perfectly superimposed without rubbing.

At least 25 mm of the double sided adhesive tape shall remain to be peeled before the first reference mark is reached.

If a pendulum machine is used, ensure that the pendulum swings freely. Set the speed at 300 mm/min ± 30 mm/min and start the tensile testing machine.

Take readings as the line of separation of the double sided adhesive tape from the plate passes each reference mark.

NOTE. In spite of its apparent simplicity, the use of this method is rather delicate and involves the observation of a certain number of precautions to give coherent and identical results between one laboratory and another as well as between one operator and another. Attention is drawn to the following points.

– The temperature at which the measurement is carried out is very important. The standard conditions of 23 °C ± 2 °C allow the test to take place between 21 °C and 25 °C. It has been found that the peel adhesions at 21 °C and 25 °C are different[12)].

– The tester should know that, by prolonged handling, heat is transmitted to the stainless steel plate. Therefore, during and after application of the adhesive tape to the plate, both should be handled as little as possible.

– Care should be taken to roll horizontally over the double sided adhesive tape which is in contact with the stainless steel plate, in order to exert a completely uniform pressure over the length and the width of the adhesive tape.

– It should be noted that the double sided adhesive tape should be applied within 15 s following its removal from the roll.

C.8 Expression of results

For each test piece, arrange the five readings in ascending order and take the median value. Similarly, arrange these five median values in ascending order and take their median.

Take as the peel adhesion the value (median) so obtained and express in N/cm width of adhesive tape tested.

After each test, examine the test plate visually and note the appearance of the adhesive and, in particular, any deposit or transfer onto the plate.

Since the measurements made using different types of tensile testing machines (for example, electronic or pendulum) are not directly comparable, the type of tensile testing machine used will be indicated in the report.

C.9 Test report

The test report shall include the following information:

a) a reference to the annex C of this European Standard;

b) all information necessary to identify the test sample;

c) the type of tensile testing machine used;

d) the date of the test;

e) the results obtained, indicating whether open or closed side;

f) any operation not specified in this European Standard, which may influence the results.

Annex D (normative)

Self adhesive tapes — Measurement of peel adhesion from stainless steel of an adhesive transfer tape

D.1 Scope

The annex D of this standard specifies the method to measure under specified test conditions the force required to remove each side of an adhesive transfer tape which has been applied to a standard metal surface.

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12) See **7.3.2**.

D.2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard. For undated references the latest edition of the publication referred to applies.

EN 1942 *Self adhesive tapes — Measurement of thickness*

D.3 Definitions

For the purposes of this annex the following definitions apply.

peel adhesion

The force required to peel a strip of tape from a specified substrate at a specified angle and speed.

transfer tape

A tape having two available pressure sensitive surfaces without the need for a carrier and with a release line separating the adhesive surfaces. The adhesive may contain reinforcing material.

open side (adhesive)

That surface of the adhesive on a double sided tape which is exposed on normal unwinding or separation of the first liner.

closed side (adhesive)

That surface of the adhesive on a double sided tape which normally remains in contact with the release liner on normal unwinding or separation of the first liner.

D.4 Principle

A length of adhesive tape is applied to a standard plate which is then fixed vertically in one clamp of a tensile testing machine. The other clamp of the machine pulls the free end of the adhesive tape at an angle of 180° to the plate.

The adhesive strength is measured by the force required to peel either face of the adhesive transfer tape continuously from the plate, the line of separation being perpendicular to the direction of the applied force.

D.5 Materials

D.5.1 Diacetone alcohol.

D.5.2 Lint free cotton wool, or tissue.

D.5.3 One of the following solvents:

– methanol;

– methyl ethyl ketone;

– acetone;

– toluene.

Solvents shall be of general purpose chemical grade.

D.5.4 A general purpose paper adhesive tape with a thickness of 0,15 mm to 0,20 mm when measured by EN 1942 and with a peel adhesion of 4 N/cm to 8 N/cm when measured as in **D.8.3**.

D.6 Apparatus

D.6.1 ***Tensile testing machine***

With the following characteristics:

– the force shall be indicated with a maximum error of 2 %;

– the speed of the moveable clamp shall be 300 mm/min ± 30 mm/min;

– the scale shall be such that the readings obtained are between 15 % and 85 % of the complete scale;

– the clamps shall be serrated to prevent slipping or tearing of the tape;

– if a pendulum machine is used, ensure that the pendulum can swing freely.

D.6.2 ***Stainless steel plates***[13)]

These shall be perfectly flat, 200 mm long × 50 mm wide and 2 mm thick. They shall be made from 'polishing' quality stainless steel of a Brinell hardness ranging from 130 to 200 (see ISO 6506) and comprising the following constituents:

– carbon <0,12 %;

– nickel >8 %;

– chromium >17 %.

The testing surface of the plate shall first be polished to a mirror finish. It shall then be roughened with abrasive grit[14)]. The abrasion lines shall be parallel to the long edge of the plate. The plate shall be graduated on the long edges with five short marks spaced 30 mm apart, the first being 50 mm from one end. (This is referred to as the starting end in **D.8.3.2** and **D.8.4.2**).

Check that the surface conforms to the following conditions by five transverse measurements in the area between two imaginary lines 10 mm on each side of the longitudinal axis of the plate:

– mean range between 0,05 μm and 0,40 μm;

– maximum depth less than 4 μm. Sampling length (of abraded area of test plate) is 0,8 mm;

[13)] See **5.2**.

[14)] See **5.2**.

– the traversing length of five transverse samples provides the abraded area required to cover all possible variables in surface rugosity.

NOTE. A full explanation of these terms will be found in ISO 468 and ISO 4287-1.

Between each test, the plates shall be kept in such a way as to avoid any accidental scratching which may modify the surface condition.

D.6.3 ***Polished cylindrical metal roller***

This shall have a diameter of at least 50 mm and a mass corresponding to 2 kg/cm width of adhesive tape under test.

D.7 Test sample and test pieces

Condition the sample roll for 24 h at 23 °C ± 2 °C and 50 % ± 5 % relative humidity.

Discard the three outer turns of adhesive tape from the roll before taking test pieces.

Perform the test on five test pieces from each roll. Each test piece shall be 400 mm long and the same width as the adhesive tape.

For widths greater than 25 mm, a test piece 25 mm wide shall be cut longitudinally from the adhesive tape.

The cutting shall be carried out by means of a razor-blade or any other suitable instrument. It shall always be effected so that the adhesive surface never contacts other surfaces before application to the test plate. Cutting shall never be carried out with the adhesive tape already applied to the test plate, so as not to mark the plate for subsequent tests.

D.8 Procedure

D.8.1 ***Standard test conditions***

The test shall be carried out at 23 °C ± 2 °C and 50 % ± 5 % relative humidity.

D.8.2 ***Preparation of plate***

Wipe the test surface of the plate with a fresh piece of cotton wool or tissue saturated with diacetone alcohol. Dry the plate with fresh cotton wool, then wipe the test surface with a fresh piece of cotton wool saturated with one of the solvents given in **D.5.3**. Dry the plate with fresh cotton wool, then repeat for a total of three cleaning operations with this solvent. Maintain the plate at a temperature of 23 °C ± 2 °C for at least 5 min before proceeding.

In order to obtain consistent results, a new plate shall be cleaned at least 10 times before use.

D.8.3 ***Procedure for the open side of an adhesive transfer tape***

D.8.3.1 *Application of the test piece to the plate*

Take five test pieces by unrolling the conditioned roll radially at a speed of approximately 300 mm/s and then apply them in the manner described below, within 15 s, and in the standard test conditions.

Apply the open side of the test piece progressively by gentle longitudinal finger strokes in such a way that the formation of air bubbles between adhesive tape and plate is avoided, without, however, exerting appreciable pressure on the adhesive tape.

The test piece shall be centred on the plate such that the edge of the test piece is parallel to the long edge of the plate. Do not roll the tape at this stage. Remove the interleaving material from the test piece. Lay a strip of general purpose paper adhesive tape cut to the same width of the test pieces on top of the test piece so that it is precisely coincident with the test piece. Pass the roller over the surface of the paper adhesive tape, to and fro, twice in each direction, at a speed of approximately 10 mm/s. Leave the adhesive tape adhered to the plate for 10 min in the standard test conditions and then test as described below.

D.8.3.2 *Stripping the test piece from the test plate*

Peel off about 25 mm of the paper reinforced adhesive transfer tape from the starting end of the plate, the line of separation being perpendicular to the axis of the test piece.

Fix the starting end of the plate in one clamp of the tensile testing machine.

Fold back the free end of the adhesive transfer tape and fix it in the other clamp so that the non-adhesive surfaces are almost in contact and exactly aligned. Ensure that the two surfaces remain perfectly superimposed without rubbing.

At least 25 mm of the adhesive transfer tape shall remain to be peeled before the first reference mark is reached.

If a pendulum machine is used, ensure that the pendulum swings freely. Set the speed at 300 mm/min ± 30 mm/min and start the tensile testing machine.

Take readings as the line of separation of adhesive transfer tape from the plate passes each reference mark.

NOTE. In spite of its apparent simplicity, the use of this method is rather delicate and involves the observation of a certain number of precautions to give coherent and identical results between one laboratory and another as well as between one operator and another. Attention is drawn to the following points.

– The temperature at which the measurement is carried out is very important. The standard conditions of 23 °C ± 2 °C allow the test to take place between 21 °C and 25 °C. It has been found that the peel adhesions at 21 °C and 25 °C are different[15)].

– The tester should know that, by prolonged handling, heat is transmitted to the stainless steel plate. Therefore, during and after application of the adhesive tape to the plate, both should be handled as little as possible.

– Care should be taken to roll horizontally over the adhesive transfer tape which is in contact with the stainless steel plate, in order to exert a completely uniform pressure over the length and the width of the adhesive tape.

– It should be noted that the adhesive transfer tape should be applied within 15 s following its removal from the roll.

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15) See **7.3.2**.

D.8.4 ***Procedure for the closed side of adhesive transfer tape***

D.8.4.1 *Application of the test piece to the plate*

Take five pieces by unrolling the conditioned roll radially at a speed of approximately 300 mm/s and then apply them in the manner described below, within 15 s, and in the standard test conditions.

Apply a strip of general purpose paper adhesive tape cut to the same width as the test piece onto the open side of the test piece so that the edges are precisely coincident.

Remove the interleaving material from the test piece to expose the closed side and apply progressively to the plate by gentle longitudinal finger strokes in such a way that the formation of air bubbles between the adhesive tape and the plate is avoided, without, however, exerting appreciable pressure on the adhesive tape.

The test piece shall be centred on the plate such that the edge of the test piece is parallel to the long edge of the plate.

Pass the roller over the surface of the general purpose paper adhesive tape, to and fro, twice in each direction, at a speed of approximately 10 mm/s.

Leave the test piece adhered to the plate for 10 min in the standard test conditions and then test as described below.

D.8.4.2 *Stripping the test piece from the test plate*

Peel off about 25 mm of paper reinforced adhesive tape from the starting end of the plate, the line of separation being perpendicular to the axis of the test piece.

Fix the starting end of the plate in one clamp of the tensile testing machine.

Fold back the free end of the adhesive transfer tape and fix it in the other clamp so that the non-adhesive surfaces are almost in contact and exactly aligned. Ensure that the two surfaces remain perfectly superimposed without rubbing.

At least 25 mm of the adhesive transfer tape shall remain to be peeled before the first reference mark is reached.

If a pendulum machine is used, ensure that the pendulum swings freely. Set the speed at 300 mm/min $\pm$ 30 mm/min and start the tensile testing machine.

Take readings as the line of separation of adhesive transfer tape from the plate passes each reference mark.

NOTE. In spite of its apparent simplicity, the use of this method is rather delicate and involves the observation of a certain number of precautions to give coherent and identical results between one laboratory and another as well as between one operator and another. Attention is drawn to the following points.

– The temperature at which the measurement is carried out is very important. The standard conditions of 23 °C $\pm$ 2 °C allow the test to take place between 21 °C and 25 °C. It has been found that the peel adhesions at 21 °C and 25 °C are different[16];

– The tester should know that, by prolonged handling, heat is transmitted to the stainless steel plate. Therefore, during and after application of the adhesive tape to the plate, both should be handled as little as possible.

– Care should be taken to roll horizontally over the adhesive transfer tape which is in contact with the stainless steel plate, in order to exert a completely uniform pressure over the length and the width of the adhesive tape.

– It should be noted that the adhesive transfer tape should be applied within 15 s following its removal from the roll.

D.9 Expression of results

For each test piece, arrange the five readings in ascending order and take the median value. Similarly, arrange these five median values in ascending order and take their median.

Take as the peel adhesion the value (median) so obtained and express in N/cm width of adhesive tape tested.

After each test, examine the test plate visually and note the appearance of the adhesive and, in particular, any deposit or transfer onto the plate.

Since the measurements made using different types of tensile testing machines (for example, electronic or pendulum) are not directly comparable, the type of tensile testing machine used shall be indicated in the report.

D.10 Test report

The test report shall include the following information:

a) a reference to the annex D of this European Standard;

b) all information necessary to identify the test sample;

c) the type of tensile testing machine used;

d) the date of the test;

e) the results obtained, indicating whether open or closed side;

f) any operation not specified in this European Standard, which may influence the results.

[16] See **7.3.2**.

Annex E (informative)
Bibliography

ISO 468 *Surface roughness — Parameters, their values and general rules for specifying requirements*

ISO 4287-1 *Surface roughness — Terminology — Part 1: Surface and its parameters*

ISO 6506 *Metallic materials — Hardness test — Brinell test*

FEPA — *Standard for coated abrasive grains of fused alumina and silicon carbide 43-GB-1984.*

List of references

See national foreword.

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