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Leather — Physical and mechanical tests — Determination of fogging characteristics

Cuir — Essais physiques et mécaniques — Détermination des caractéristiques de condensation

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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ISO 17071 was prepared by the Physical Test Commission of the International Union of Leather Technologists and Chemists Societies (IUP Commission, IULTCS) in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 289, *Leather*, the secretariat of which is held by UNI. It was published as EN 14288. It is based on DIN 75201 of Deutsches Institut für Normung and on IUP 46 published in *J. Soc. Leather Tech. Chem.*, **86** (7), p. 349, 2002, and declared an official method of the IULTCS in May 2003.

IULTCS, originally formed in 1897, is a world-wide organization of professional leather societies to further the advancement of leather science and technology. IULTCS has three Commissions, which are responsible for establishing international methods for the sampling and testing of leather. ISO recognizes IULTCS as an international standardizing body for the preparation of test methods for leather.

Leather — Physical and mechanical tests — Determination of fogging characteristics

1 Scope

This International Standard specifies two alternative methods for determining the fogging characteristics of leathers used in the passenger compartments of motor vehicles, namely Method A and Method B. These are two different test procedures to measure the volatile components and there is no mathematical correlation between the results obtained with Method A and those with Method B.

Method A determines by reflection the light scattering properties (or opaqueness) and the nature of the film or droplet formation from volatile components condensed on a cold glass surface. Method B measures gravimetrically the quantity of volatile components condensed on a cold aluminium foil surface. Annex A gives the results of inter-laboratory trial which show that Method B performs well, whereas Method A showed a large variation in the percentage reflection.

The test conditions allow the two tests to be carried out in succession.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2418, *Leather — Chemical, physical and mechanical and fastness tests — Sampling location*

ISO 2419, *Leather — Physical and mechanical tests — Sample preparation and conditioning*

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

3 Method A — Reflectometric method

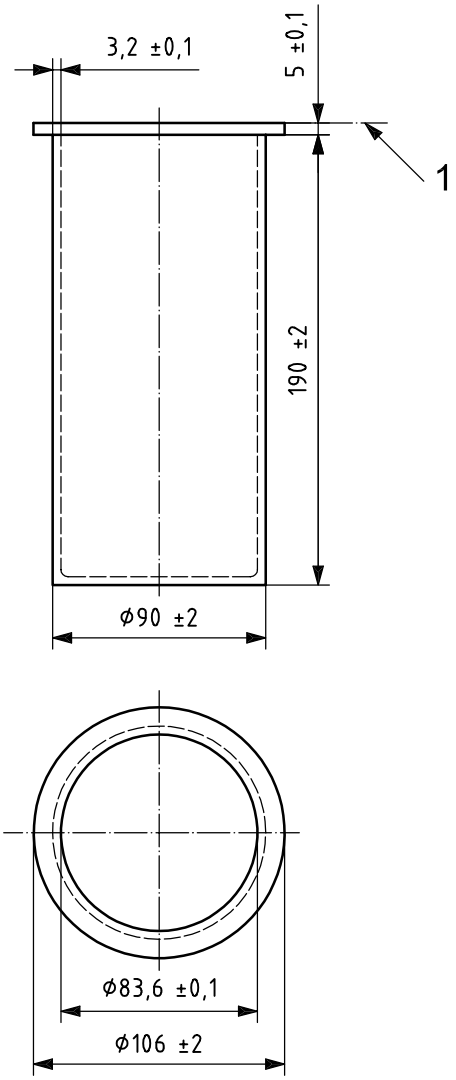
3.1 Principle

A test piece is heated in a glass beaker, any volatile ingredients are condensed onto a cooled glass plate and the reflectometric value of the glass plate with condensed fog is expressed as a percentage of the reflectometric value of the same plate without fogging condensate. The measurement by light reflection depends on the nature of the film/droplet formation and needs careful interpretation. An example is that a thick but clear film can give a good test result when, in actual fact, it is a bad result in terms of volatiles. The test should be stopped if a transparent oily film is formed on the glass. The reflection measurement result is only valid when an even opaque film (like a fogged windscreen) formed by small droplets is present. (See Annex A.)

3.2 Apparatus

3.2.1 Beaker, plane bottomed, of heat-resistant glass, with a flat ground rim at the top without a pouring spout, with an outside diameter of 90 mm ± 2 mm, height 190 mm ± 2 mm. (See Figure 1.) A beaker with a minimum mass of 450 g is needed to prevent floating in the thermostatic bath (3.2.2).

Dimensions in millimetres



Key
1 ground rim

Figure 1 — Beaker

3.2.2 Thermostatic bath, capable of operating at a uniform temperature of 100 °C ± 1 °C and of holding at least three beakers (3.2.1). The dimensions of the bath shall be such that the minimum distance between the beakers and the sides of the bath is 30 mm and the minimum distance between the base of the beaker and the base of the bath is 75 mm.

3.2.3 Thermal-transfer fluid, stable at 100 °C.

NOTE Water-soluble materials, such as a modified polyvalent dialiphatic alcohols, are preferred since they are water soluble and present fewer problems in cleaning.

3.2.4 Cooling system, with water at 21 °C ± 1 °C circulating through the complete interior of a corrosion-resistant metal plate. The surface used for cooling shall be flat and made from aluminium. The mass of the cooling plate shall be sufficient to suppress the buoyancy of the beaker in the thermostatic bath.

NOTE The mass of the cooling plate filled with water will normally be in excess of 1 kg.

3.2.5 Metal rings, external diameter 80 mm ± 1 mm, internal diameter 74 mm ± 1 mm, height 10 mm ± 1 mm and mass 55 g ± 1 g made from corrosion-protected steel.

3.2.6 Sealing rings, of silicone-rubber or fluororubber, inner diameter 95 mm ± 1 mm, thickness 4,0 mm ± 0,1 mm and hardness 65 IRHD ± 5 IRHD [1)].

3.2.7 Reflectometer, with a 60° incident beam and a 60° measuring beam.

3.2.8 Clock, reading to 1 min.

3.2.9 Desiccator, containing phosphorus pentoxide.

CAUTION — This product is corrosive and care should be taken in handling.

3.2.10 Float glass plates, of residential or windshield quality, thickness 3,0 mm ± 0,2 mm and minimum dimensions 110 mm × 110 mm, with a mark engraved on the upper surface. The plates shall be used a maximum of 10 times.

3.2.11 Spacer mount, with circular hole made of any suitable material of thickness 0,10 mm ± 0,02 mm, marked to allow positioning of the reflectometer to give four readings 25 mm ± 5 mm from the centre of the plate.

NOTE The spacer mount prevents contact between the condensate and the reflectometer. The actual size and geometry will depend on the dimensions of the reflectometer.

3.2.12 Matt black surface, minimum dimensions 200 mm × 200 mm.

3.2.13 Di-isodecyl phthalate, DIDP, analytical reagent grade or equivalent.

3.2.14 Dishwasher.

3.2.15 Glass cleaning detergent.

3.2.16 Distilled or deionized water, conforming to the requirements of grade 3 of ISO 3696.

3.2.17 Ethyl acetate.

3.2.18 Acetone.

3.2.19 Cotton wool, degreased with ethyl acetate.

3.2.20 Test ink, 1,0 g fuschine dissolved in a mixture of 27,1 ml methanol (analytical reagent grade or equivalent) and 72,9 ml distilled or deionized water.

NOTE This solution has a surface tension of 46 mN/m.

3.2.21 Brush, diameter about 8 mm.

1) IRHD = International Rubber Hardness Degrees.

3.2.22 Press knife, the inner wall of which is a right angled circular cylinder of diameter 80 mm ± 1 mm conforming to ISO 2419.

3.2.23 Polyethylene gloves, **or tweezers or forceps**.

3.2.24 Filter paper, qualitative type with nominal diameter 125 mm.

3.3 Sampling and sample preparation

3.3.1 Sample in accordance with ISO 2418. Cut four test pieces by applying the press knife (3.2.22) to the grain surface. Use two test pieces for two test sequences. If the agreement between the first two test pieces is satisfactory, the other two test pieces do not need to be tested.

NOTE If there is a requirement for more than two hides or skins to be tested in one batch, then only one sample need be taken from each hide or skin, provided that the overall total is not less than four test pieces.

3.3.2 Dry test pieces by storing in a desiccator (3.2.9) over phosphorus pentoxide for a minimum of two days.

If the test piece fails, then dry the test piece for seven days for the repeat test.

Wet leather test pieces need to be air dried before being put in the desiccator for conditioning.

NOTE Other desiccants, e.g. reusable silica gel, may be used if they can be shown to lead to the same results.

3.4 Cleaning

3.4.1 Wash beakers (3.2.1), metal rings (3.2.5) and sealing rings (3.2.6) twice manually or in a dishwasher using an appropriate glass cleaning detergent. Rinse with distilled or deionized water at room temperature and dry in an upright position.

3.4.2 Clean float glass plates (3.2.10) either in a dishwasher (3.4.2.1) or manually (3.4.2.2).

3.4.2.1 Wash the plates in a dishwasher at 80 °C ± 5 °C using an appropriate glass cleaning detergent, rinse with distilled or deionized water at room temperature and dry in an upright position.

3.4.2.2 Wash the plates manually using ethyl acetate and cotton wool then rinse the plates with acetone, soaking the plates in acetone for a minimum of 30 min. Dry the plates in an upright position.

3.4.3 Inspect the glass plates and reject any that are scratched.

3.4.4 Using the brush (3.2.21), apply a thin line of test ink (3.2.20) to an area of the glass plate where there will be no condensation. Observe the line of ink. If the edges contract within 2 s, repeat the cleaning procedure in 3.4.2.1 or 3.4.2.2. If the edges of the ink line contract after repeated cleaning, discard the glass plate.

NOTE If the fluid film contracts, then the adhesion tension of the glass is less than the surface tension of the test ink.

3.4.5 After cleaning, handle beakers only on the outer surface. Handle other cleaned apparatus with tongs or gloves (3.2.23).

3.4.6 Store cleaned apparatus in a dust-free environment at room temperature.

3.5 Procedure

IMPORTANT — Test pieces, cleaned surfaces and everything that goes into the beaker shall not be touched with bare hands. Wear polyethylene gloves, or use tweezers or forceps (3.2.23).

3.5.1 Pour sufficient thermal transfer fluid (3.2.3) into the thermostatic bath (3.2.2) so that the distance between the level of the fluid and the rim of the beaker is 57 mm ± 3 mm.

3.5.2 Switch on the bath and allow the fluid to equilibrate at 100 °C ± 1 °C.

3.5.3 Calibrate the reflectometer (3.2.7) according to the manufacturer's instructions.

3.5.4 Place the cleaned glass plate on the matt black surface (3.2.12). Place the spacer mount (3.2.11) on the glass plate. Position the reflectometer on the spacer mount with the edge of the reflectometer against the marking on this spacer mount. Record the reflectometric value.

3.5.5 Rotate the reflectometer through 90° and position against the second set of marks. Record the reflectometric value.

3.5.6 Repeat 3.5.5 twice to give a total of four reflectometric values. Determine the mean of the four values.

3.5.7 Place a test piece in a cleaned beaker (3.2.1) with the side facing the motor vehicle interior uppermost.

Place a metal ring (3.2.5) over the test piece to prevent it distorting during the test.

3.5.8 Place a sealing ring (3.2.6), glass plate and filter paper (3.2.24) on top of the beaker in that order.

3.5.9 Repeat 3.5.4 to 3.5.8 for the remaining test pieces.

3.5.10 Place the beakers in the thermostatic bath at 100 °C ± 1 °C and place the cooling plate (3.2.4) on top of the filter paper with the cooling surface downwards.

3.5.11 After 180 min ± 5 min, carefully remove the glass plate and place horizontally with the fogging condensate uppermost in a draft-free atmosphere at standard conditions out of direct sunlight.

The fogging condensate should be visually checked for droplets, transparent film, as well as evenness of distribution over the surface. These observations should be recorded in the test report.

3.5.12 After 50 min ± 5 min, remeasure the reflectometric values as in 3.5.4 to 3.5.6 and determine the mean value. If the individual results deviate by more than 20 % of the average for the two test pieces, repeat the test procedure using the second set of test pieces.

3.6 Reference test

IMPORTANT — Test pieces, cleaned surfaces and everything that goes into the beaker shall not be touched with bare hands. Wear polyethylene gloves, or use tweezers or forceps (3.2.23).

3.6.1 Carry out a reference test in parallel to the determination in 3.5.7 to 3.5.12.

3.6.2 Determine the reflectometric values at four points on a cleaned glass plate as in 3.5.4 to 3.5.6 and determine the mean value.

3.6.3 Weigh 10,0 g ± 0,1 g DIDP (3.2.13) into a cleaned beaker.

3.6.4 Place a sealing ring (3.2.6), glass plate (3.2.10) and filter paper (3.2.24) on top of the beaker in that order.

3.6.5 Place the beaker in the thermostatic bath at 100 °C ± 1 °C and place the cooling plate (3.2.4) on top of the filter paper with the cooling surface downwards.

3.6.6 After 180 min ± 5 min, carefully remove the glass plate and place horizontally with the fogging condensate uppermost in a draft-free atmosphere at standard conditions out of direct sunlight.

3.6.7 After 50 min ± 5 min, remeasure the reflectometric values as in 3.5.4 to 3.5.6 and determine the mean value.

3.6.8 Determine the fogging value of the glass plate with DIDP condensate using the equation given in 3.7.1. The fogging value should be 77 % ± 3 %. If the fogging value does not fall within this range, check the test conditions and repeat the determination.

3.7 Expression of results

3.7.1 Calculate the fogging value for the sample, F_v, and for DIDP, F_{DIDP}, expressed as a percentage (%), using the equations:

$$F_v = \frac{R_2 \times 100}{R_1}$$

$$F_{\text{DIDP}} = \frac{R_4 \times 100}{R_3}$$

where

R_1 is the mean initial reflectometric value of the glass plate determined as in 3.5.6;

R_2 is the mean reflectometric value of the glass plate in the presence of fogging condensate from the test piece determined as in 3.5.12;

R_3 is the mean initial reflectometric value of the glass plate in the reference test determined as in 3.6.2;

R_4 is the mean reflectometric value of the glass plate in the presence of fogging condensate from the reference test determined as in 3.6.7.

3.7.2 Calculate the mean fogging value for all the test pieces. Round F to the nearest integer.

4 Method B — Gravimetric method

4.1 Principle

A test piece is heated in a glass beaker, any volatile ingredients are condensed onto cooled aluminium foil and the mass of volatile material is determined. There is no mathematical correlation between the results of this method and those of Method A. (See Annex A.)

4.2 Apparatus

4.2.1 **Beaker**, plane bottomed, of heat-resistant glass, with a flat ground rim at the top without a pouring spout, with an outside diameter of 90 mm ± 2 mm, height 190 mm ± 2 mm. (See Figure 1.) A beaker with a minimum mass of 450 g is needed to prevent floating in the thermostatic bath (3.2.2).

4.2.2 **Thermostatic bath**, capable of operating at a uniform temperature of 100 °C ± 1 °C and of holding at least three beakers (4.2.1). The dimensions of the bath shall be such that the minimum distance between

beakers and the sides of the bath is 30 mm and the minimum distance between the base of the beaker and the base of the bath is 75 mm.

4.2.3 Thermal-transfer fluid, stable at 100 °C.

NOTE Water soluble materials such as modified polyvalent aliphatic alcohols are preferred since they are water soluble and present less problems in cleaning.

4.2.4 Cooling system, with water at 21 °C ± 1 °C circulating through the complete interior of a corrosion-resistant metal plate. The surface used for cooling shall be flat and made from aluminium. The mass of the cooling plate shall be sufficient to suppress the buoyancy of the beaker in the thermostatic bath.

NOTE The mass of the cooling plate filled with water will normally be in excess of 1 kg.

4.2.5 Metal rings, external diameter 80 mm ± 1 mm, internal diameter 74 mm ± 1 mm, height 10 mm ± 1 mm and mass 55 g ± 1 g made from corrosion-protected steel.

4.2.6 Sealing rings, of silicone-rubber or fluororubber**,** inner diameter 95 mm ± 1 mm, thickness 4,0 mm ± 0,1 mm and hardness 65 IRHD ± 5 IRHD.

4.2.7 Balance, reading to 0,01 mg.

4.2.8 Clock, reading to 1 min.

4.2.9 Desiccator, containing phosphorus pentoxide.

CAUTION — This product is corrosive and care should be taken in handling.

4.2.10 Float glass plates, of residential or windshield quality, thickness 3,0 mm ± 0,2 mm and minimum dimensions 110 mm × 110 mm, or alternatively round glass plates with a minimum diameter of 103 mm.

NOTE Glass plates that are no longer suitable for the reflectometric method may be used.

4.2.11 Aluminium foil, thickness 0,030 mm ± 0,005 mm, cut into circles of diameter 103 mm ± 1 mm.

4.2.12 Di-(2-ethyl-hexyl)phthalate (DOP), analytical reagent grade or equivalent.

CAUTION — This product is listed with a prenatal toxicity rating and should be used with care.

4.2.13 Dishwasher.

4.2.14 Glass cleaning detergent.

4.2.15 Distilled or deionized water, conforming to the requirements of grade 3 of ISO 3696.

4.2.16 Polyethylene gloves.

4.2.17 Press knife, the inner wall of which is a right angled circular cylinder of diameter 80 mm ± 1 mm conforming to ISO 2419.

4.2.18 Filter paper, qualitative type with nominal diameter 125 mm.

4.2.19 Desiccator, containing silica gel.

4.3 Sampling and sample preparation

4.3.1 Sample in accordance with ISO 2418. Cut two test pieces by applying the press knife (4.2.17) to the grain surface.

NOTE If there is a requirement for more than two hides or skins to be tested in one batch, then only one sample need be taken from each hide or skin, provided that the overall total is not less than two test pieces.

4.3.2 Dry test pieces by storing in a desiccator (4.2.9) over phosphorus pentoxide for a minimum of two days.

If the test piece fails, then dry the test piece for seven days for the repeat test.

Wet leather test pieces need to be air dried before being put in the desiccator for conditioning.

NOTE Other desiccants, e.g. reusable silica gel, may be used if they can be shown to lead to the same results.

4.4 Cleaning

4.4.1 Wash beakers (4.2.1), metal rings (4.2.5), sealing rings (4.2.6) and glass plates (4.2.10) twice manually or in a dishwasher using an appropriate glass cleaning detergent, rinse with distilled or deionized water at room temperature and dry in an upright position.

4.4.2 After cleaning, handle beakers only on the outer surface. Handle other cleaned apparatus with tongs or gloves (4.2.16).

4.4.3 Store cleaned apparatus in a dust-free environment at room temperature.

4.5 Procedure

IMPORTANT — Test pieces, cleaned surfaces and everything that goes into the beaker shall not be touched with bare hands. Wear polyethylene gloves, or use tweezers or forceps (3.2.23).

4.5.1 Pour sufficient thermal-transfer fluid (4.2.3) into the thermostatic bath (4.2.2) so that the distance between the level of the fluid and the rim of the beaker is 57 mm ± 3 mm.

4.5.2 Switch on the bath and allow the fluid to equilibrate at 100 °C ± 1 °C.

4.5.3 Weigh a disc of aluminium foil (4.2.11) and record the mass to the nearest 0,01 mg. The time between weighing the aluminium foil and the start of the test shall not exceed 10 min.

4.5.4 Place a test piece in a cleaned beaker (4.2.1) with the side facing the motor vehicle interior uppermost. Place a metal ring (4.2.5) over the test piece to prevent it distorting during the test.

4.5.5 Place a sealing ring (4.2.6), weighed disc of aluminium foil (bright side downwards), glass plate (4.2.10) and filter paper (4.2.18) on top of the beaker in that order.

4.5.6 Repeat 4.5.3 to 4.5.5 for the remaining test pieces.

4.5.7 Place the beakers in the thermostatic bath at 100 °C ± 1 °C and place the cooling plate (4.2.4) on top of the filter paper with the cooling surface downwards.

4.5.8 After a period of 16,0 h ± 0,2 h, carefully remove the aluminium foil disc from the top of the beaker and place in a desiccator (4.2.19) with the shiny (fogged) side upwards for 3,75 h ± 0,25 h.

4.5.9 Reweigh the aluminium foil discs to the nearest 0,01 mg and record the mass.

4.6 Reference test

IMPORTANT — Test pieces, cleaned surfaces and everything that goes into the beaker shall not be touched with bare hands. Wear polyethylene gloves, or use tweezers or forceps (3.2.23).

4.6.1 Carry out a reference test in parallel to the determination in 4.5.4 to 4.5.9.

4.6.2 Weigh a disc of aluminium foil (4.2.11) to the nearest 0,01 mg and record the mass. The time between weighing the aluminium foil and the start of the reference test shall not exceed 10 min.

4.6.3 Weigh 10,0 g ± 0,1 g DOP (4.2.12) into a cleaned beaker.

4.6.4 Place a sealing ring (4.2.6), weighed disc of aluminium foil (bright side downwards), glass plate (4.2.10) and filter paper (4.2.18) on top of the beaker in that order.

4.6.5 Place the beaker in the thermostatic bath at 100 °C ± 1 °C and place the cooling plate (4.2.4) on top of the filter paper with the cooling surface downwards.

4.6.6 After a period of 16,0 h ± 0,2 h, carefully remove the aluminium foil disc from the top of the beaker and place in a desiccator (4.2.19) with the shiny (fogged) side upwards for 3,75 h ± 0,25 h.

4.6.7 Reweigh the aluminium foil discs to the nearest 0,01 mg and record the mass.

4.6.8 Determine the mass of DOP condensed on the aluminium foil by subtracting the initial mass of the foil from the final mass. The mass condensed should be 4,90 mg ± 0,25 mg. If the mass does not fall within this range, check the test conditions and repeat the determination.

4.7 Expression of results

4.7.1 Calculate the mass of fogging material, m_F, and the reference mass of DOP condensed $m_{DOP,}$ in milligrams using the equations:

$$m_F = m_2 - m_1$$

$$m_{DOP} = m_4 - m_3$$

where

m_1 is the initial mass of the disc of aluminium foil in milligrams as determined in 4.5.3;

m_2 is the mass of the disc of aluminium foil in the presence of fogging condensed from the sample, in milligrams, as determined in 4.5.9;

m_3 is the initial mass of the disc of aluminium foil in the reference test, in milligrams, as determined in 4.6.2;

m_4 is the final mass of the disc of aluminium foil in the presence of fogging condensate from the reference test, in milligrams, as determined in 4.6.7.

4.7.2 Calculate the mean mass of fogging material in milligrams to the nearest 0,01 mg.

5 Test report

The test report shall include the following:

a) a reference to this International Standard; i.e. ISO 17071:2006. Indicate if Method A or Method B or both were used;

b) a description of the leather sample, the number of test pieces and the date of the test;

c) the mean fogging value, if determined;

d) the reference fogging value for DIDP, if determined;

e) the mean mass of fogging material in milligrams, if determined;

f) the reference mass for DOP in milligrams, if determined;

g) special observations in Method A on the nature of the condensate, e.g. transparent condensate, droplet size, film formation, evenness of droplets over the exposed surface (3.5.11);

h) any deviations from the method specified in this International Standard;

i) full details for identification of the sample and any deviations from ISO 2418 with respect to sampling.

Annex A
(informative)

Interlaboratory comparison of Method A (reflectometric) and Method B (gravimetric)

(Acknowledgements to *Leather International Journal*, August 2000)

A.1 General

The paper in the Leather International Journal summarizes an examination of DIN 75201, *Determination of the Fogging Behaviour of Materials for Car Interiors*, carried out by the VGCT-Commission/TEGEWA working team and concludes that fogging values should be determined using the gravimetric method.

There are generally two procedures carried out to determine fogging: gravimetric and reflectometric.

The results reported are based upon the following.

— Four samples of leather from the same skin were sent to each lab for testing.

— The test procedure was based on DIN 75201.

— Each test was carried out by up to eight labs (normally seven).

— Finished and crust leathers were tested.

A.2 Results

A summary of the results are set out in Table A.1. The standard deviations indicated in the table result from an analysis of variance, for which a significance level of 95 % was chosen. "S_w" stands for the standard deviation between the measurements in one laboratory. "S_v" indicates the standard deviation for measurements between different laboratories. The range of mean values is given for the between laboratory variance, but it is not possible to identify the range of data for each individual laboratory.

Table A.1 — Fogging test results

Tests	Crust leather		Finished leather	
	Mean	Mean	Mean	Mean
	(S_w)	(S_v)	(S_w)	(S_v)
Gravimetric fogging test		3,3 to 4,7		6,3 to 8,2
F_G (mg)	(0,40)	(0,95)	(0,95)	(1,28)
Reflectometric fogging test		27 to 57		58 to 94
F_R (%)	(9,1)	(16,6)	(16,4)	(25,1)
Reflectometric fogging test: sample drying with silica gel with indicator		34 to 62		48 to 80
F_R (%)	(3,5)	(16)	(17,3)	(23,1)
Reflectometric fogging test; 75 °C, 6 h		60 to 96		53 to 92
F_R (%)	(7,3)	(21,1)	(5,4)	(35,6)
	Standard glass plates		**Glass plates applied in the firm**	
	Mean	Mean	Mean	Mean
	(S_w)	(S_v)	(S_w)	(S_v)
Reflectometric fogging test: influence of the glass plates		25 to 49		22 to 50
F_R (%)	(14,1)	(33,3)	(18,6)	(42,6)

Annex B
(informative)

Source of apparatus

An example of a supplier of a suitable apparatus available commercially is given below.

Gebrüder HAKKE GmbH[2)], Dieselstr. 4, D-76227 Karlsruhe, Germany.

2) Gebrüder HAKKE GmbH is an example of a supplier of a suitable product available commercially. This information is given for the convenience of the users of this International Standard and does not constitute an endorsement by ISO of their product.

ICS 59.140.30

Price based on 13 pages