



## SURFACE STANDARD OF STEEL WHEELS

# E S 3.03

Page 1/6

*NORMES DE LA SURFACE DE ROUES EN ACIER*  
STANDARD DER OBERFLÄCHE FÜR STAHLRÄDER

### PART 'A' - SURFACE SPECIFICATION OF COATED WHEELS, ELECTROBASE COAT AND OVERSPRAY IF APPLICABLE

#### CHARACTERISTICS AND TEST SPECIFICATION

##### 1 - RE-COATABILITY

The paints shall be oversprayable by themselves or other paint finishes, specially nitrocellulose and alkyd resin enamels, without any surface modifications like swelling, softening and blistering or loss of adhesion.

##### 2 - COLOUR DEVIATIONS

For electrodeposition single-coat paints and paint finishes the maximum permissible colour deviation from the approved off-tool sample shall be less than 2 units for the cathoretic (and less than 1 unit for over-sprayed) wheels (VDA 621-409). No ranking is given by ISO 3668-1976.

Chalking shall also be subject to inspection. (Measurement according to ISO 3668-1976).

##### 3 - DEGREE OF GLOSS

The maximum permissible deviation in gloss from the approved off-tool sample of oversprayed wheels shall be 5 units; for cathoretic black gloss = 15 units. (Measurement by reflectometer according to ISO 2813-1978).

When using different measuring methods, evaluation will be made by comparison to approved off-tool samples. When the geometry of the wheel precludes the use of the a.m. technique a reference plate and/or a visual comparison with customer standards may be employed.

##### 4 - PROOF OF RESISTANCE

The following resistance tests shall be made and certified for all paints without exceptions.

##### 4.1 - BRAKE FLUID

The test for resistance to the reference brake fluid: ATE SuperDot 4 (Messrs. Teves) shall be made according to VDA = German Automotive Association guide-line 621-412 § 4.2.1. In case customer specify certain brake fluids these ones should be applied alternatively.

(Not applicable for air-drying paints applied for repair purposes)

Main changes compared to the last issue:

#### **4.2 - DEPRESERVATIVE AGENTS**

The test for resistance to the reference depreservative agent: P3 Kaltlin 7720 (Messrs. HENKEL) shall be made according to VDA guide-line 621-412 § 4.2.3. In case customers specify certain depreservative agents, these ones should be applied alternatively.

#### **4.3 - WHITE SPIRIT**

The test for resistance to white spirit according to DIN 51 604 part 1 shall be made according to VDA guide-line 621-412 § 4.2.1.  
(Not applicable for air drying paints applied for repair purposes)

#### **4.4 - HD MULTIPURPOSE MOTOR OIL**

The test for resistance to HD multipurpose motor oil shall be made according to VDA guide-line 621-412 § 4.2.4. In case customers specify certain motor oils, these ones should be applied alternatively.

#### **4.5 - PRESERVATIVE AGENTS**

The test for resistance to preservative agent 90 (Messrs. PFINDER NACHF. BÖBLINGEN) shall be made according to VDA guide-line 621-412 § 4.2.4. In case customers specify certain preservative agents, these ones should be applied alternatively.

### **5 - TESTS AND VERIFICATIONS**

#### **5.1 - ADHESION**

(Standard values as per table 1)

The adhesion of paints shall be tested by means of the cross-cut method according to ISO 2409:1972.

#### **5.2 - CORROSION RESISTANCE**

(Standard values as per table 1)

The primer shall be tested. All requirements shall apply to the same extent to any further coating.

##### **5.2.1 Salt spray test**

The salt spray test shall be made in the cycles listed in table1 in accordance with ISO 7253:1984.

##### **5.2.2 Degree of surface corrosion**

The evaluation of test 6.2.1 in view of the degree of surface corrosion shall be made according to ISO 4628-1:1982.

##### **5.2.3 Degree of edge corrosion**

The evaluation of test 6.2.1 in view of the degree of edge corrosion shall be made according to ISO 4628-1:1982.

##### **5.2.4 Blistering**

The evaluation of test 6.2.1 in view of the blistering shall be made according to DIN 53 209.

**5.2.5 Moisture infiltration (creep)**

The evaluation of test 6.2.1 in view of the moisture infiltration shall be made according to DIN 53 167 § 8.1.

**5.2.6 Adhesion**

The evaluation of test 6.2.1 in view of the adhesion shall be made according to DIN 53 151.

**5.3 - TROPICAL CLIMATE**

(Standard values as per table 1)

The corrosion test in tropical climate shall be made according to DIN 50 017 for the period stated in table 1.

**5.3.1 Blistering**

(Standard values as per table 1)

The evaluation of test 6.3 in view of blistering shall be made according to DIN 53 209.

**5.3.2 Adhesion**

The evaluation of test 6.3 in view of adhesion shall be made by means of the cross-cut method according to ISO 2409:1972.

**5.4 - ALTERNATING CORROSION TEST**

(Standard values as per table 1)

The alternating corrosion test shall be made on off-tool sample according to VDA guide-line 621-415. Refer to table 1 for number of test cycles.

**5.4.1 Degree of surface corrosion**

The evaluation of test 6.4 in view of the degree of surface corrosion shall be made according to ISO 4628-1:1982.

**5.4.2 Degree of edge corrosion**

The evaluation of test 6.4 in view of the degree of edge corrosion shall be made according to ISO 4628-1:1982.

**5.4.3 Blistering**

The evaluation of test 6.4 in view of the blistering shall be made according to DIN 53 209.

**5.4.4 Moisture infiltration**

The evaluation of test 6.4 in view of the moisture infiltration shall be made according to DIN 53 167 § 8.1.

**5.4.5 Adhesion**

The evaluation of test 6.4 in view of adhesion shall be made according to DIN 53 151.

**5.5 STONE CHIPPING TEST - CHIP RESISTANCE OF COATINGS**

ASTM D 3170-74 (re-approved 1980) (Standard values as per table 1)

The primer shall be subjected to testing. All requirements shall apply to the same extent to any further coating. The ASTM test is considered to be the reference test as long as OEM customers still refer to their very own requirements.

<b>T A B L E 1</b>
--------------------

**PERFORMANCE DATA OF RELEVANT DIPPING OPERATIONS**

Test according to point	Passenger car wheels	Truck and tractor wheels	Characteristics
5.1	GT0 – GT1	GT0 - GT1	Cross-cut
5.2.1	500	240	Test time in h
5.2.2	Ri 1	R i 1	Surface corrosion
5.2.3	K R 2	K R 2	Edge corrosion
5.2.4	M1 / g2	m2 / g2	Blistering
5.2.5	2	2	Infiltration in mm.
5.2.6	K 2	K 2	Adhesion
5.3	360		Test time in h
5.3.1	M1 / g1		Blistering
5.3.2	K 2		Adhesion
5.4	6		Cycles
5.4.1	Ri 2		Surface corrosion
5.4.2	KR 3 – front side		Edge corrosion
	KR 6 – rear side		" "
5.4.3	m2 / g2		Blistering
5.4.4	3		Infiltration in mm.
5.4.5	K 2		Adhesion
5.5	5 B or better		ASTM D 3170 (reapproved 1980)

**PART 'B' - COAT THICKNESS - MEASURING METHOD  
AND EVALUATION FOR STEEL WHEELS**

Coat thickness measuring method for non-ferromagnetic coats on ferromagnetic material. In this case the coat thickness on the base material for steel wheel production.

**TYPE OF PROBLEM**

Demonstration of the method to be applied, including calibration. Indication of the measuring principle.

**MEASURING METHOD**

For measuring of electrocoated as well as lacquered (covering lacquer) automotive wheels, exclusively a measuring method according to the magnetic-inductive principle is carried out. In this case, apart from others, the norm DIN 50 981 and the VDA-page 621-413 is valid.

## MEASURING EQUIPMENT

Measuring instruments to be used have to correspond to ISO 2178; the method is the one of magnetic induction, other ones are not permitted.

The equipment applied should be able to be calibrated on the extreme surface contours as far as the radius is concerned. The radius of the actually measured surface should be taken into account as corrective factor.

The measuring probe to be used therefore contains two contact point.

On the magnetic inductive measuring principle, the magnetic float dependance is used to determine the thickness, whereby the magnetism flows from the measuring probe through the non-ferromagnetic coat to the ferromagnetic base. The thicker the coat, the lower is the magnetic flux.

## MEASURING EQUIPMENT CALIBRATION

If nothing else has been agreed upon, calibration will be carried out by double-spot tuning, in order to cover the total measuring range of the expected coat thickness.

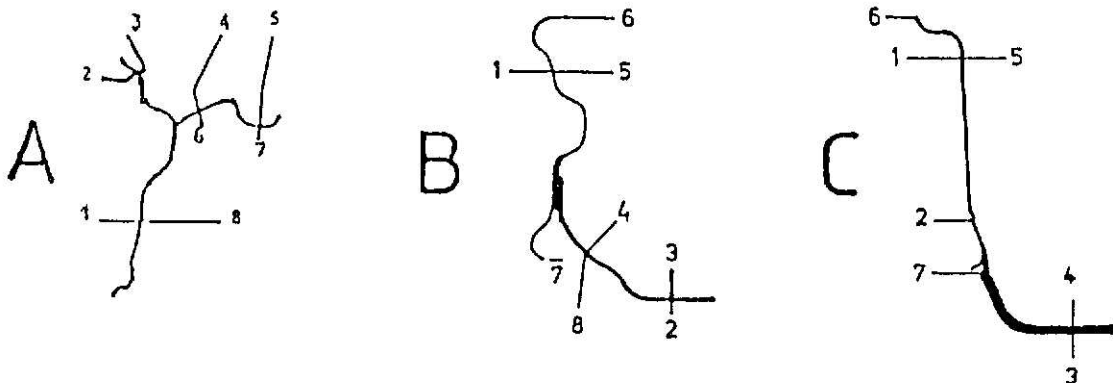
As a calibration sample, the base material is used which in its surface compositions comes closest to the practical conditions, whereby the chemical composition, the mechanical properties, the work hardening, the thickness and the shape of the wheel material and the one of the sample has to be comparable. The measuring instability, caused by surface roughness deviations is not considered.

For coat thickness simulating, unmagnetic (plastic) layers of known thickness are used.

The measuring equipment calibration is carried out before and after measuring.

## PROPOSAL OF REFERENCE POINTS

The points indicated in the drawing are determined as being possible reference points. It is to be considered, that reference points agreed upon have to have reference again to the calibration samples used and measuring data obtained is not to be corrected because of geometrical deviations. The number of reference points per wheels has to be established individually.



### **MEASURING FAULTS AND LIMITS**

Generally, the condition of DIN 50 981 and other applying are valid to avoid measuring faults. Deviations which result from the special geometry, concave and convex areas of the object are to be examined particularly.

If the radius of the part to be examined is  $r < 50$  mm, the calibration must be one with a standard of the same geometry, or the measured value must be corrected.

If the examined radius is  $r > 50$  mm, this correction is not necessary; a calibration on flat standards can be carried out.

### **INFLUENCE OF THE SURFACE ROUGHNESS ON THE COAT THICKNESS**

The surface roughness of the steel used or the surface geometric at the spot of measurement is of influence to the result obtained but not considered in this standard.

### **MEASURING THE COAT THICKNESS**

If not otherwise agreed upon, at each reference point as per the sketch a measurement is taken five times over the circumference of the wheel at approximately  $72^\circ$ . The arithmetic mean value  $\bar{x}$  hereby stands for the coat thickness at the reference point.

In order to determine the mean coat thickness at each wheel, the arithmetic mean values of all reference points form the total mean value  $\bar{\bar{x}}$ , the coat thickness.

The standard deviation  $\sigma$  for the individual reference point is calculated from the five measurements taken. If useful and of special interest, the total standard deviation  $s$  is calculated from all individual data again.

All measured values are evaluated with reference to the requested specification. Thus, the smallest single mean value  $\bar{x}$  of each reference point may not be below the specification limits and the highest single mean value  $\bar{x}$  of each reference point may not be above ( if there is such a request). The influence of the surface roughness of the starting material has to be taken into account at specifying the extreme requirements of the thickness and its tolerance.

The number of measurements for each production lot is to be agreed upon separately and laid down in inspection plans.