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Recommendation for the Quality Assessment of Paint Care Products for Motor Vehicles

Part 3: Paint Polish (Translation / Original: German)

Section Household Care in the German Cosmetic, Toiletry, Perfumery and Detergent Association (IKW)

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1. Foreword

German Cosmetic, Toiletry, Perfumery and Detergent Association (IKW) member companies make their expert knowledge of the products they manufacture available to the general public; this is done in the form of quality assessment recommendations.

The recommendations for the quality assessment are elaborated in working groups and are intended to enable a qualified testing of the relevant products by the manufacturers and test institutes. Quality characteristics are described that need to be fulfilled by the products concerned in order to achieve the effects expected by consumers and manufacturers.

The companies working within the framework of IKW want optimal quality standards for their products. Their aim is a consistent orientation to sustainability as a guiding principle, preparing to successfully face the future in a constantly changing world.

This commitment to sustainability as a guiding principle is built up on experiences expressed in numerous exemplary initiatives. Taking as starting points the declarations of Rio 1992, "92 plus 10" of Johannesburg and the Agenda 21, sustainability is understood as a balanced linking of economic, social and ecological aspects, with a view to meeting the needs of the present without compromising the ability of future generations to meet their own needs.

The member companies of the IKW have long been committed to sustainability under the umbrella of the association and sister federations. This commitment has already resulted in several established industry-specific initiatives, such as:

- Dialogue platform FORUM WASCHEN [1],
- IKW Report on sustainability in the detergents, maintenance and cleaning products industry [2],
- A.I.S.E. Charter for Sustainable Cleaning ("Charter 2020+") of the International Association for Soaps, Detergents and Maintenance Products (A.I.S.E.), Brussels [3],
- voluntary agreements [4].

Furthermore, the member companies are also committed within initiatives of raw material and supplier industries, for example:

- The "Responsible Care" initiative of the chemical-pharmaceutical industry and the chemicals trade in Germany [5],
- "Chemie³", the sustainability initiative of the German Chemical Industry Association (VCI), the Mining, Chemical and Energy Industrial Union (IG BCE) and the German Federation of Chemical Employers' Associations (BAVC) [6]

The constant further development of initiatives and products with sustainability as the guiding principle ensures the future viability of the detergents, maintenance and cleaning products industry in a constantly changing world. The social and societal benefits of these products in terms of hygiene and value-preservation are undisputed. The products make a significant contribution to today's standard of living and health and to the conservation of resources, for example by extending the service life of objects such as motor vehicles.

With this in mind, quality assessment recommendations encourage company staff to act responsibly toward humans and the environment in product development and manufacture. They also serve consumers who can expect efficient, safe and environmentally sound products.

The recommendations describe which qualities are relevant to a given product and how such qualities can be measured. It should be noted that every finished product has a certain efficacy spectrum in its intended use; this spectrum is largely determined by consumer expectations as to each individual quality characteristic – so that in each product some characteristics are deliberately emphasised while others will be less important. Moreover, the desired combination of product properties is subject to constant change, depending on the latest technical possibilities and new consumer habits.

Quality assessment recommendations must not impair such developments. Consequently, for each product only one overall result is valid to determine whether the product meets the quality recommendations or not. Emphasis on isolated test criteria is not admissible and may be misleading.

2. Rules, Standards and Voluntary Agreements

With regard to composition, packaging and labelling, inter alia, the following statutory requirements must be observed in their existing versions or to the extent that they still apply, respectively:

- German Code on Foodstuffs, Consumer Items and Animal Feed (Lebensmittel-, Bedarfsgegenstände- und Futtermittelgesetzbuch – LFGB)
- German Chemicals Act (Chemikaliengesetz – ChemG)
- German Dangerous Substances Ordinance (Gefahrstoffverordnung – GefStoffV)
- Chemicals Prohibition Ordinance [Chemikalienverbotsverordnung – ChemVerbotsV)
- German Detergents and Cleaning Products Act (Wasch- und Reinigungsmittelgesetz – WRMG)
- German Ordinance on Pre-packaged Products (Fertigverpackungsverordnung – FPV)
- German Ordinance on the Transport of Dangerous Goods by Road (Gefahrgutverordnung Straße – GGVS)
- German Ordinance on the Transport of Dangerous Goods by Rail (Gefahrgutverordnung Eisenbahn – GGVE)

as well as the following legislation by the European Union which serves as basis for the German ordinances or to which reference is made:

- Detergents Regulation (EC) No 648/2004
- REACH Regulation (EC) No 1907/2006
- Regulation on Classification, Labelling and Packaging (EC) No 1272/2008 ("CLP Regulation")
- Biocidal Products Regulation (EU) No 528/2012
- Regulation (EU) No 98/2013 on the Marketing and Use of Explosives Precursors

The following international standards were taken into account in respect of individual aspects:

- ASTM D3836-13 (USA): "Standard Practice for Evaluation of Automotive Polish"
- DIN 55660-1:2011-12:"Paints and varnishes – Wettability – Part 1: Terminology and general principles"
- DIN EN ISO 2813 (June 1999, updated 2015): "Paints and Varnishes – Determination of Gloss Value at 20°, 60° and 85°"

Moreover, the following voluntary agreements [4] apply, amongst others, to IKW member companies which can be relevant for paint care products:

- Ban of the Use of Alkylphenol Ethoxylates (APEO) (1986)
- Ban on Ethylenediaminetetraacetic Acid (EDTA) (1991)

3. Introduction

This Recommendation for the quality assessment includes test methods for the assessment of paint care products for motor vehicles. They are applied on larger, painted body components and can be classified in accordance with **Diagram 1** in respect of their polishing, paint conditioning and cleaning properties in a product group triangle. The considered product groups differ in terms of these properties. The boundaries between the product groups are fluid in accordance with the representation in **Diagram 1** and are partly only determined by the application concentration of certain ingredients.

According to **Table 1**, the following typical ingredients and assessment criteria can be assigned to the three properties or corners of the product group triangle in **Diagram 1**.

The paint surfaces are usually two-component paint systems which are used in the automotive industry. The products are applied as a rule with an application medium (e.g. sponge, cloth).

Diagram 1 Representation of the paint care product groups in a "product group triangle". The three product groups covered by this recommendation are shown in circles (*the product group of paint conditioners may also include hard waxes or sealants).

	Property	Typical Ingredient Groups	Assessment Criteria
"Polishing"	Polishing	Abrasives	Gloss
"Preserving"	Paint conditioning	Functional silicones and waxes, polydimethylsiloxanes	Gloss, hydrophobing
"Washing / Cleaning"	Cleaning	Surfactants	Cleaning performance

Tab. 1 Typical ingredient groups and assessment criteria for the properties of paint care products from **Diagram 1**.

The paint surfaces are heavily exposed to daily strains and soiling and are usually cleaned prior to the application of the above-mentioned three product groups (paint cleaner, paint conditioner, paint polish) e.g., by a car wash (car shampoo). The three product groups (paint cleaner, paint conditioner, paint polish) are as a rule used for value preservation and optical upgrading of the paint surfaces and differ in terms of composition of the ingredients and proper use. The products are commercially available in bottles, tubes or glass jars, tin cans or plastics boxes or other containers as well as in other presentations. They are available in a liquid, solid or pasty condition.

Paint cleaners for motor vehicles are used for older, already matt or scratched, pre-cleaned paint surfaces and prepare the paint for the subsequent application of paint conditioners or paint polish. Paint cleaners are products which contain a particularly high share of abrasives. They serve for the removal of weathered, loose pigment and paint particles as well as superficial scratches and scrapes on strongly affected already matt paint surfaces and paint layers. In accordance with their claim in conjunction with Article 2 of the Detergents Regulation (EC) No 648/2004, they are detergents and require labelling, inter alia, in accordance with Annex VII of the Detergents Regulation. In addition, a list of ingredients must be made available on the internet.

Paint conditioners for motor vehicles are usually abrasive-free and contain Gloss, water-repelling components such as waxes and silicones, for the conditioning and sealing of paint surfaces. After their application and subsequent polishing, they provide the paint with a high-gloss look. They protect and condition the paint. Paint conditioners are intended for the care of intact new paints as well as paints pre-cleaned with paint cleaner or paint polish and are, according to their intended use, not to be detached after the single cleaning with a detergent. Consequently, they come neither under the German Detergent and Cleaning Product Act (WRMG) nor under the Detergents Regulation (EC) No. 648/2004.

Paint conditioners, which are, however, mainly detached after a single cleaning with detergents and can then, based on experience, reach waters, come in accordance with § 2 Para 1 Sentence 2 No. 3 under WRMG. In this case, they do not need to be labelled in accordance with the Detergents Regulation, but manufacturers must publish no later than from the placing on the market a list of ingredients on the internet in accordance with Annex VII Section D of the Detergents Regulation. Additionally, it makes sense to print the internet address that leads to the list of ingredients on the packaging.

Paint polishes for motor vehicles are combination products of paint cleaners and paint conditioners and include abrasives as well as paint protecting components. They serve for the optical improvement of already affected paint surfaces. After polishing they provide the paint again with high gloss and protection. Water-repelling components, such as waxes and silicones, serve for the conditioning and sealing of paint surfaces. Paint polishes, which are also claimed for cleaning, are detergents within the meaning of Article 2 of the Detergents Regulation (EC) No 648/2004.

Without a cleaning claim they represent as a rule products in accordance with § 2 Para 1 Sentence 2 No. 3 WRMG which are intended to be applied to surfaces and are primarily detached after a single cleaning with detergents and according to experience can then reach waters. In this case, they do not need to be labelled in accordance with the Detergents Regulation, but manufacturers must publish no later than from the placing on the market a list of ingredients on the internet in accordance with Annex VII Section D of the Detergents Regulation. Additionally, it is recommended to print the internet address that leads to the list of ingredients on the packaging.

4. Aim

In 2014 the Working Group "EQ Paint Care Products" was mandated by the IKW Expert Committee on Cleaning and Care Products to revise the "IKW Recommendations on the Quality Assessment for Car Care and Cleaning Products" of 1992. The work within the working group involved both experts from industrial companies and also from a test institute. The updated recommendation represents a collection of methods which are to permit in their non-binding form a qualified testing of the relevant products for the application at private end consumers by the companies themselves, by the consumers and by the test institutes. The recommendation makes available three separate test methods for the following three products groups *(cf.* ***Diagram 1****)*:

1. **Paint cleaners** for motor vehicles (Part 1 of the Recommendation for the quality assessment of paint care products for motor vehicles)
2. **Paint conditioners** for motor vehicles (Part 2 of the Recommendation for the quality assessment of paint care products for motor vehicles)
3. **Paint polishes** for motor vehicles (Part 3 of the Recommendation for the quality assessment of paint care products for motor vehicles)

PLEASE NOTE:
Part 1 *("Paint cleaners for motor vehicles")* was already published in the SOFW Journal 11/18, volume 144:
https://www.ikw.org/fileadmin/IKW_Dateien/downloads/Haushaltspflege/1811_EQ_Lackreiniger_EN_final.pdf

Part 2 *("Paint conditioners for motor vehicles")* was published in the SOFW Journal 4/22, volume 148:
https://www.ikw.org/fileadmin/IKW_Dateien/downloads/Haushaltspflege/2022_EQ_Lackkonservierer_EN_final.pdf

The three test methods are to fulfil the following criteria:
✓ Practical relevance
✓ Precision and reproducibility
✓ Differentiability
✓ As simple conduct as possible

In order to fulfil these criteria, the tests are to be conducted in blind studies additionally with reference products in respect of which the testers do not know whether they test a reference or a test product. The reference products can be manufactured based on the information in the **Appendix** to the test methods. **Neither the reference products nor the individual chemicals or test specimens, equipment or auxiliary materials can be obtained from the IKW office.**

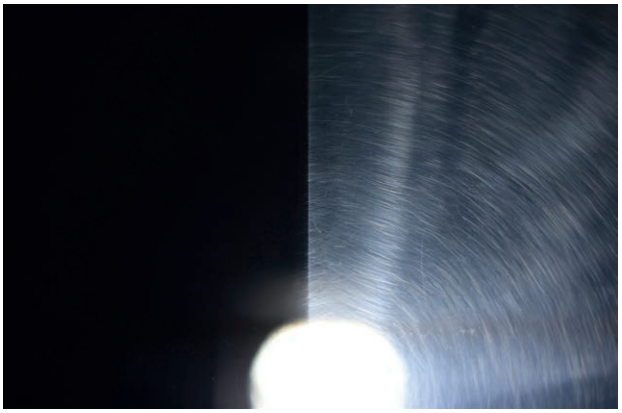


Fig. 1 Polishing effect: A weathered or scratched paint surface **(right)** compared with a paint surface polished with a paint polish **(left)**. *(Image source: SCHOLL Concepts GmbH)*

5. Paint Polish, Paint Surfaces a nd Application Method

After their application and subsequent polishing, paint polishes give the paint a high gloss look and protect it. To obtain reproducible measured values for a gloss increase, a slightly matted paint surface is therefore produced in the test method **(Figures 1** and **2)**.

Fig. 2 Roll-off effect: Paint surface treated with a paint polish on which water droplets roll off. (*Image source: Dr. O.K. Wack Chemie GmbH*)

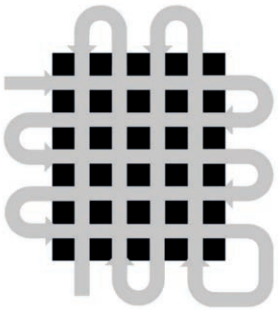


Diagram 2 Schematic representation of a full crosswise application **(grey)** with outline of the treatment surface **(black)**.

The working procedure stated in the test method for the application and/or polishing of the product is based on cross application. The application and/or polishing is carried out in accordance with **Diagram 2** with 50% overlapping of the wiping paths and beyond the edge of the surface to be treated [7].

A video with instructions for crosswise application is available at the following web address: https://www.youtube.com/watch?v=uyYTBKiJi9c&feature=youtu.be.

Note:
In the work procedure, however, it is essential to avoid material carry-over between the different test areas (cf. below **Diagrams 5** and **6**), as otherwise a falsification of the measurement results must be expected.

6. Test method for paint polishes for motor vehicles

One or several paint polishes (in the following "test paint polishes") are tested. For comparison and assessment of the test paint polishes, a specified reference paint polish with a defined formulation is used for certain test parameters (*cf.* ***Appendix***).

The setup (*cf. section 4.3.2 in the following table of the test method*) needed for determining the water run-off behaviour on glossy sheets is shown in the following schematic representation **(Diagram 3)**:

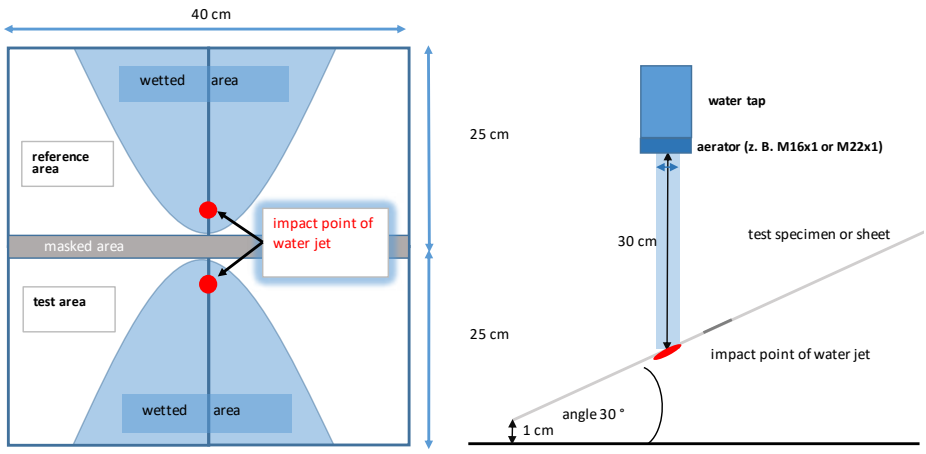


Diagram 3 Schematic representation of the water run-off method with a water jet (**left:** test specimen or test sheet with schematic representation of the parabolic course of the water jet with impact point on the reference or test side; **right:** schematic side view of the impact of a water jet on the test sheet with 1 cm distance from the washbasin or bottom of the water collection vessel for free run-off of the water).

Additionally, a video on the water run-off method using a water jet is available at the following web address: https://www.youtube.com/watch?v=6jiliU4NJ70

Further specifications and information on the test sheets, measuring instruments, equipment, setups, auxiliary materials, formulations, chemicals and supply sources are listed in the ***Appendix***.

Note:

The assessment of the tests is very demanding. Therefore, it should be carried out exclusively by persons who are familiar with the use of paint polishes and the performing of laboratory tests. At least a double determination of the test parameters is necessary to find outlier values among the test data.

In order to secure the results statistically, the tests should be performed ideally by three experienced persons independently from one another. The manufacture of the matted and glossy test sheets (5.1.1 and 5.2.1) should be done by the same person for a test series. The products to be tested should be made available to the testers in anonymised form.

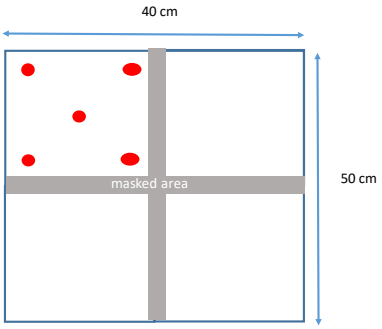
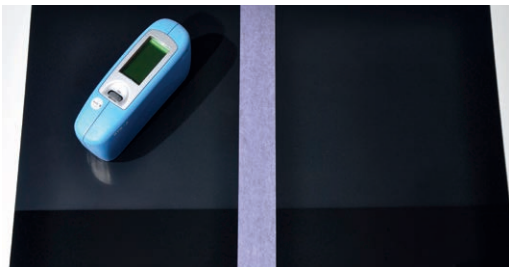
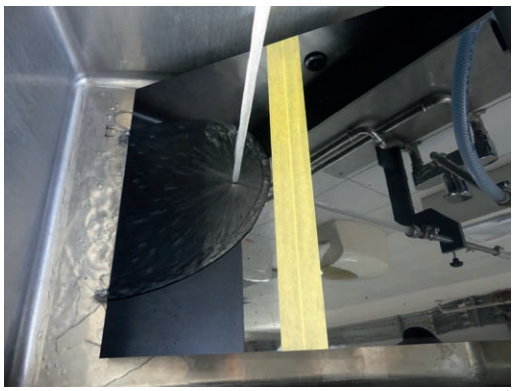
The tests are carried out at a temperature between 20 and 25 °C and a relative air humidity of 20 to 80%. The test conditions should be kept constant for all tests in a test series (same temperature and same air humidity).

Paint polishes are tested on two different types of sheets (matte and glossy). For the testing of different paint polishes, the pre-treatment of the test sheets must take place on the same day. The time interval between pre-treatment and application of the paint polish for subsequent testing must be the same for all products and within the same day. The sequence of tests of the two types of test sheet should be adhered to for efficient work!

In the work procedure, it is essential to avoid material carry-over between the different test areas on one test sheet, as otherwise a falsification of the measurement results must be expected!

As a rule, there are no uniform starting conditions for paints on vehicles. To level out such different conditions for the testing of paint polishes, the tests are carried out on uniformly pre-treated paint sheets. The test conditions are kept as close to practice as possible and are largely oriented to the average consumer behaviour. To facilitate matters and for automated evaluation, a table in Excel format in **Chapter 7** *can be used.*

Test Method for Paint Polish for Motor Vehicles		
1.	**General information on the test paint polish**	
1.1	Product designation (including brand name) of the test paint polish	
1.2	Manufacturer and/or distribution	
1.3	Scope of application	
2.	**Documentation of the test conditions (temperature, air humidity) during the subsequent performance of tests** … °C … % air humidity	
3.	**Properties of the test paint polish in the state as delivered**	
3.1	Form of presentation (e.g. solid, liquid, pasty)	
3.2	Container (e.g. bottle, tube, can)	
3.3	Intended form of application (e.g. using a cloth, a sponge or as spray)	
4.	**Reference formulation; test sheet and special setups for preparation**	
4.1	Reference paint polish	Reference paint polish with defined formulation *(cf.* ***Appendix*** *"Test sheets, measuring instruments, equipment, setups, auxiliary materials, formulations, chemicals and supply sources")*
4.2	Test sheets	In order to cover the paint qualities as they are found in practice, the test is carried out on absolutely flat [8], sufficiently stable and painted test sheets sized [9] 40 cm x 50 cm with original paint (OEM quality) [10] and paint colour „black uni" (no metallic paint, specification *cf.* ***Appendix****).* For each subsequent test, a sheet of the same batch and the same history [11] should be used to avoid deviations within the test series. Two different types of test sheet are needed for the following tests: – completely matted sheets: These are divided into four areas for parallel testing to assess the following test parameters for a maximum of 4 paint polishes *(cf. 5.1)*: • Measuring of gloss starting values • Assessment of ◦ distributability ◦ polishability ◦ dust formation 1. Assessment of the surface ◦ surface appearance ◦ paint refreshment ◦ change of gloss ◦ touchability and smear resistance 2. Assessment of surface after degreasing ◦ surface appearance ◦ colour refreshment ◦ change in gloss value – completely glossy sheets [9]: These are divided into two areas for parallel testing to assess the following test parameters for a maximum of 2 paint polishes (*cf. 5.2*): • Determination of water run-off behaviour before application • Water run-off behaviour after application • Wash resistance

4.3	Setups for determining the gloss value measurement and the water run-off behaviour	
4.3.1	Gloss value measurement	Gloss value measurements are carried out as single measurements on the maximum of four different areas evenly distributed in orientation to DIN EN ISO 2813, with a fixed measuring angle of 20 degrees at 5 measuring points (keeping a distance of at least 4 cm from the edge in each case). For each area, the mean value and the standard deviation [12] calculated from this are determined across all 5 measuring points (**Diagram 4**, **Figure 3**).  **Diagram 4** *Schematic representation of the test sheet with 5 measuring points in one area (side).* The gloss values before and after treatment with the paint polish and after removal of the product residues are entered in the Excel table *(cf. **Chapter 7**)*.  **Fig. 3** *Photo of two test areas of the test sheet with gloss meter. (Image source: Chemische Fabrik Dr. Stöcker GmbH & Co.KG).*
4.3.2	Setup to measure the water run-off behaviour	The water-repelling (hydrophobic) properties of a glossy sheet treated with a paint polish are assessed using the water run-off method where the following applies: The faster the water runs off, the better the hydrophobic properties of the paint polish. A jet of water (e.g., tap water) is directed onto one side each of the test sheet, which is divided by an adhesive strip, according to the setup in **Diagram 3** and the procedure shown in the video for **Diagram 3**. Measuring the average run-off time with 1/10-second accuracy is carried out by 5-fold measurement successively on the maximum two test areas of the test sheet. The measuring results are entered in an Excel table *(cf. **Chapter 7**)* and evaluated automatically. For the correct evaluation of the measuring results, it is essential to comply with the test conditions and to observe the test sheet size (40 cm x 50 cm). The 30° inclined sheet is placed on the shorter side (40 cm) in a holding device at a distance of 1 cm from the washbasin or the bottom of the water collection vessel for free water run-off, and the treated areas are exposed in the middle to a water jet from a tap with a flow rate of ca. 8 litres per minute *(cf. **Figure 4**)*. The volume flow should ideally be adjusted with a flow meter. The water temperature is ideally 20 °C. The distance between the water tap and the test sheet (impact surface) should be kept constant at ca. 30 cm; the diameter of the water jet should be kept constant at the aerator *(cf. **Appendix**)*. The water jet is positioned so that the wetted parabola begins exactly at the lower end of the adhesive strip. Here, it is to ensure that the water can run off freely at the end of the sheet. As soon as a parabolic, constantly wet water body has formed on the sheet, the water jet is turned off and the time required until the water has completely run off the sheet surface is measured in tenths of a second (run-off time). All set parameters of the water run-off method must be checked and kept constant throughout the entire test series!  **Fig. 4** *Photo of the setup of a 30° inclined test sheet in the holding device at 1 cm distance from the bottom of the washbasin. (Image source: SONAX GmbH)*

5. Pre-treatment of test sheets and test instruction

The sequence of tests on the two types of test sheet (1. matted, 2. glossy) should be adhered to for efficient work.

5.1 Testing on *matted* test sheet

5.1.1 Pre-treat the test sheet with matting agent

(The required chemicals, materials, equipment / *cf.* ***Appendix***: Basic car shampoo, demineralised water, isopropyl alcohol, matting agent, random orbit sander, PUR sponge, weight, gloss meter, if necessary: high-gloss polish, adhesive tape)

The test sheet is matted as follows:

- Clean with the basic car shampoo, rinse with demineralised water (DM water) and then treat with isopropyl alcohol (isopropanol) and dry. Drying is done, for example, by blowing off with oil-free compressed air or using a wiper with a degreased silicone lip.
- Shake the matting agent well before use!
- Work on the test sheet with matting agent, random orbit sander in combination with an excenter pad or by hand [13] in combination with a PUR sponge with the same pressure (1.5 kilogramme weight) in crosswise application *(cf.* ***Diagram 2*** */ video)*. For this, wet the excenter pad or the PUR sponge completely with the matting agent and matt in crosswise application with 50% overlapping:
  - Matting is done up to a gloss level of 70±2 units at a measuring angle of 20 degrees. [Note: If the matting process results in a gloss value < 68 units, the gloss value can be raised by treatment with a high-gloss polish *(cf. 5.2.1)*].
  - Before each measurement is taken, clean with a basic car shampoo. Then rinse with DM water, treat with isopropyl alcohol and dry. Drying is done e.g., by blowing with oil-free compressed air or with a wiper with a decreased silicone lip.
  - The matted test sheet is divided into a maximum of four equally sized areas using adhesive tape (e.g., 48 mm wide) (a maximum of four paint polishes can be tested on one matted test sheet, *(cf.* ***Diagram 5****)*. Additional test sheets for further test paint polishes can be prepared analogously.

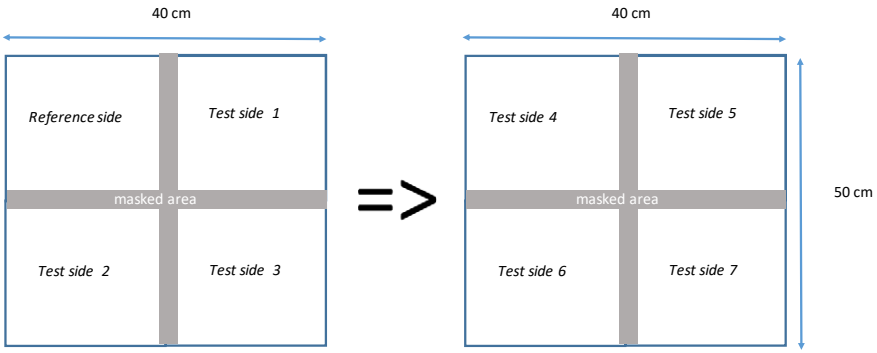


Diagram 5 *Schematic representation of two matted test sheets, each with four areas resp. sides to be tested.*

5.1.2 Measuring of initial gloss values

The initial gloss values are measured according to 4.3.1 on the maximum four matted areas of the test sheet before the paint polish is applied.

5.1.3 Assessment of workability

5.1.3.1 Applying the paint polish

Before applying the paint polish, the paint polish should be thoroughly homogenised by shaking.

For applying the reference paint polish and the test paint polish, in each case a different **unused, new straight from production and dry** PUR sponge should be used *(specification, cf.* ***Appendix****)*. If the manufacturer of the test paint polish recommends another application medium or has enclosed enough of it, this application medium should be used.

If the manufacturer of the test paint polish does not give any instructions regarding dosage and application medium, then **1 ± 0.1 gramme** (if necessary, the optimum quantity must be determined in a preliminary test) [14] of the paint polish is spread thinly and evenly over the entire area of the sponge.

Apply all paint polishes to be tested in a fivefold crosswise application *(cf.* ***Diagram 2* */ video)* with 50% overlapping of the wipe paths and the same pressure with 1.5 kg weight. The sponge must be moved over the test sheet with a weight without manual pressure (Figure 5).**

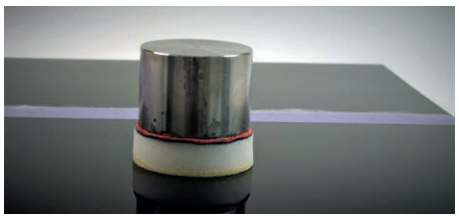
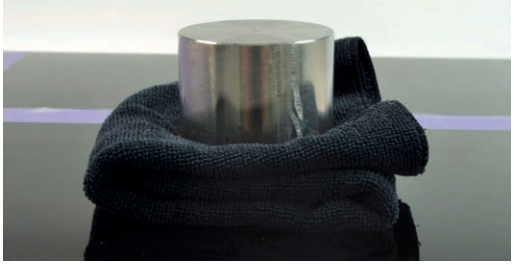
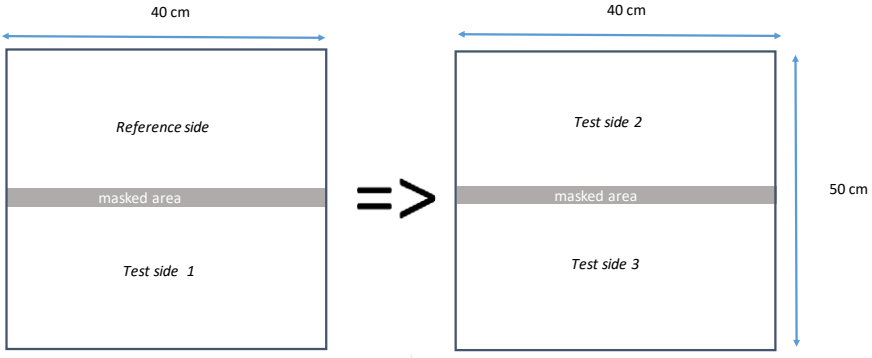


Fig. 5 *Photo of the test sheet with weight and sponge for applying the test polish. (Source: Wigo Chemie GmbH)*

5.1.3.2	Testing of distributability	It should be possible to distribute the test paint polish without effort and without using much force. Squeaky noises can occur which, however, are not considered in the assessment. Distributability is assessed by the amount of force that is needed to move the sponge with a weight according to 5.1.3.1, compared with the reference paint polish (RPP). The values are entered into the Excel table for automated evaluation *(cf. **Chapter 7**)*. 5 points = clearly less force required than with RPP 4 points = less force required than with RPP 3 points = comparable force required as with RPP 2 points = more force required than with RPP 1 point = clearly more force required than with RPP Intermediary marks in 0.5 increments are admissible (e.g., 1.5 points)
5.1.3.3	Drying time	Documentation of the timespan between application and polishability: Polishing out is done directly after the respective product no longer smears and appears to be dry. The testing of the drying of the respective product can be carried out by careful polishing at the edge of the sheet. Information possibly provided by the manufacturer on drying of the product must be considered. (Note: The paint polishes must no longer smear when polishing out. The drying time for the RPP is 10 minutes.)
5.1.3.4	Testing of polishability	Complete and residue-free polishing of the paint polish is carried out directly after the respective product no longer smears and appears to be dry, using a microfibre cloth *(specification, cf. **Appendix**)*. *(Information provided by the manufacturer on drying of the product has to be considered. The testing of the drying of the respective product can be carried out by careful polishing at the edge of the sheet. The drying time for the RPP is 10 minutes. The timespan between application and polishability is documented for the respective product.)* For polishing the different test paint polishes, in each case microfibre clothes of the same specification and the same pre-treatment (pre-washing of the microfibre clothes preferably with an aqueous liquid detergent of low viscosity, without fabric softener) must be used. If the manufacturer of the test paint polish recommends different materials for polishing or has enclosed enough of them, these should be used for polishing. For polishing, the microfibre cloth is moved in fivefold crosswise applications with the same pressure of 1.5 kg weight over the area *(cf. **Figure 6**)* and turned after threefold crosswise wiping paths *(cf. **Diagram 2** / video)*. **The number of crosswise applications up to the full removal of the product (no residues of the paint polish visible on the surface anymore) must be noted.** If the test paint polish can be completely polished with less than fivefold crosswise applications, the polishing should be finished up to the fifth crosswise application. The test paint polish should be polishable without effort. Polishability is assessed compared with the reference paint polish (RPP). The RPP needs threefold crosswise applications to full polishability. In comparison to the polishability to the RPP, only a maximum of two more or fewer crosswise applications are considered for the evaluation. The values are entered into the Excel table for automatic evaluation *(cf. **Chapter 7**)*: 5 points = two crosswise applications less required than with RPP 4 points = one crosswise application less required than with RPP 3 points = the same number of crosswise applications required as with RPP 2 points = one crosswise application more required than with RPP 1 point = two or more crosswise applications more required than with RPP  **Fig. 6** *Photo of a microfibre cloth with 1.5 kg weight. (Image source: Wigo Chemie GmbH)*

5.1.3.5	Colour refreshment (colour strength, intensification of the shade) (before product residue removal)	The test paint polish should hardly produce any dust during polishing. Dust residues on the sheet are assessed after polishing. Scoring scheme for dust formation compared with the reference paint polish (RPP): 5 points = clearly less than with RPP 4 points = less than with RPP 3 points = comparable with RPP 2 points = more than RPP 1 point = clearly more than RPP Intermediary marks in 0.5 increments are admissible (e.g., 1.5 points).
5.1.4	First assessment of the treated surface (before degreasing)	
5.1.4.1	Surface appearance (clouds, veils, streaks)	After the paint polishes were applied and polished out, the product residues (e.g., emulsifiers, auxiliaries) are removed after 24 hours: For removing the product residues, completely rinse the test sheet with DM water. Drying is done by blowing off with oil-free compressed air or using a wiper with a degreased silicone lip. The test paint polish is assessed regarding cloud, veil and streak formation immediately after drying. There should be a uniform surface appearance. The surface appearance is assessed visually, preferably in daylight or corresponding artificial light, and from different angles compared to the reference paint polish (RPP). The values are entered into the Excel table for automated evaluation *(cf.* ***Chapter 7****)*: 5 points = significantly better than RPP 4 points = better than RPP 3 points = comparable to RPP 2 points = worse than RPP 1 point = significantly worse than RPP Intermediary marks in 0.5 increments are admissible (e.g., 1.5 points).
5.1.4.2	Colour refreshment (colour strength, intensification of the colour shade)	The assessment is made preferably in artificial light corresponding to daylight from different angles. The test paint polishes should produce an intensification of the colour shade and the treated areas should thus appear darker. For better differentiation of the different areas, the adhesive tape should be removed before the assessment. The colour refreshment is assessed visually, compared to the reference paint polish (RPP). The values for each area are entered into the Excel table for automated evaluation *(cf.* ***Chapter 7****)*. 5 points = significantly better (darker) than RPP 4 points = better (darker) than RPP 3 points = comparable (darker) to RPP 2 points = worse (brighter) than RPP 1 point = significantly worse (brighter) than RPP Intermediary marks in 0.5 increments are admissible (e.g., 1.5 points)
5.1.4.3	Measuring of the change in gloss value	The assessment is made based on the average gloss value increase in gloss units (Δ GU), taking as initial values the gloss values determined in 5.1.2 for a maximum of four areas. The assessment is made in each case via the difference of the average gloss value changes to the determined initial values in gloss units (Δ GU) on the respective areas. The values for each area are entered into the Excel table for automated evaluation *(cf.* ***Chapter 7****)* and automatically evaluated with the help of the following linear equation: y = 0.357 * x (y: scoring points; x = gloss value increase in Δ GU) The assessment ranges are between 0 Δ GU and 14 Δ GU (scoring scheme: 0 to 5 points).
5.1.4.4	Touchability and smear resistance	Finally, cotton swabs are applied under strong pressure on the areas treated with the product and it is assessed whether traces can be seen on the areas. Touchability and smear resistance are assessed visually. The values are entered into the Excel table for automated evaluation *(cf.* ***Chapter 7****)*: 5 points = good (no traces to be seen) 3 points = satisfactory (weak traces to be seen) 1 point = bad (strong traces to be seen)

5.1.5	Degreasing	Degreasing is made as follows on the maximum of four areas *(specification cf.* ***Appendix****)*: – Degrease the test sheet with aromatics-free and paint resistant white spirit (boiling range 80–110°C) and isopropyl alcohol and then wash it with basic car shampoo; – then thoroughly rinse off the basic car shampoo for five minutes with tap water; – rinse off tap water residues with DM water, e.g., with spray bottle or beaker; – dry using a wiper with a degreased silicone lip or a microfibre cloth or by blowing off with oil-free compressed air. Full degreasing is reached at a constant gloss value. Gloss value measurements are carried out according to 4.3.1 to check constant gloss value. Degreasing is carried out to enable an assessment of an effective polishing effect (scratch removal, grey haze removal). Polishes might cause additional scratches on the paint surface.
5.1.6	Second assessment of the treated surface (after degreasing)	
5.1.6.1	Surface appearance (clouds, veils, streaks)	The test paint polish is assessed regarding cloud, veil and streak formation. There should be a uniform surface appearance. The surface appearance is assessed visually, preferably in daylight or corresponding artificial light, and from different angles compared to the reference paint polish (RPP). The values are entered into the Excel table for automated evaluation *(cf.* ***Chapter 7****)*: 5 points = significantly better than RPP 4 points = better than RPP 3 points = comparable to RPP 2 points = worse than RPP 1 point = significantly worse than RPP Intermediary marks in 0.5 increments are admissible (e.g., 1.5 points).
5.1.6.2	Colour refreshment (colour strength, intensification of the colour shade)	The assessment is made preferably in artificial light corresponding to daylight from different angles. The test paint polishes should produce an intensification of the colour shade and the treated areas should thus appear darker. For better differentiation of the different areas, the adhesive tape should be removed before the assessment. The colour refreshment is assessed visually, compared to the reference paint polish (RPP). The values for each area are entered into the Excel table for automated evaluation *(cf.* ***Chapter 7****)*. 5 points = significantly better (darker) than RPP 4 points = better (darker) than RPP 3 points = comparable (darker) to RPP 2 points = worse (brighter) than RPP 1 point = significantly worse (brighter) than RPP Intermediary marks in 0.5 increments are admissible (e.g., 1.5 points).
5.1.6.3	Measuring of the change in gloss value	The assessment is made in each case via the difference of the average gloss value changes to the determined initial values in gloss units (Δ GU). Initial values are the gloss values determined in 5.1.2 for a maximum of four areas. The values for each area are entered into the Excel table for automated evaluation *(cf.* ***Chapter 7****)* and automatically evaluated with the help of the following linear equation: y = 0.4167 * x (y: scoring points; x: gloss increase in Δ GU The assessment ranges are between 0 Δ GU and 14 Δ GU (scoring scheme: 0 to 5 points).
5.2	**Testing on *glossy* test sheet**	
5.2.1	Pre-treat the test sheet with high-gloss polish. (The required chemicals, materials, equipment / *cf.* ***Appendix***: Basic car shampoo, DM water, isopropyl alcohol, high-gloss polish, sponge, random orbit sander, microfibre cloth, tap water, water run-off setup, gloss value meter)	The test sheet is treated as follows: – Clean with the basic car shampoo, rinse with demineralised water (DM water) and then treat with isopropyl alcohol and dry. Drying is done, for example, by blowing off with oil-free compressed air or using a wiper with a degreased silicone lip. – Apply the high-gloss polish without waxes and silicones (e.g., SONAX Profiline Perfect Finish) with an excenter pad [e.g., SONAX Exzenter pad (medium)], polish with a random orbit sander (ca. 4,500 rotations per minute) in fivefold crosswise applications and let dry. – Then polish out the residues with a soft microfibre cloth without leaving any residues. – Degrease the test sheet with aromatics-free and paint-resistant white spirit (boiling range 80–110°C) and isopropyl alcohol and then wash it with basic car shampoo. – Then thoroughly rinse off the basic car shampoo for five minutes with tap water. – Rinse off tap water residues with DM water, e.g., with spray bottle or beaker. – In order to standardise the test sheets and to remove the basic water-repelling coating, the polishing process is repeated until the maximum gloss level on the dry test sheet according to 4.3.1 is at 86 ± 2 gloss units (GU) at a measuring angle of 20 degrees and the run-off time with the water run-off method according to 4.3.2 is 6 ± 1.5 seconds for all test areas (usually, 15 crosswise applications are sufficient to bring about the desired removal of the basic water-repelling coating). Further crosswise wiping does not result in a further increase of the gloss level.

		– Drying of the test sheet between the measurements and at the end of the pre-treatment is done with oil-free compressed air or using a wiper with a degreased silicone lip. – The glossy test sheet is divided in length (50 cm) with the help of an adhesive tape (48 mm wide) into a maximum of two equal-sized areas (a maximum of two paint polishes including the reference paint polish can then be tested on one glossy test sheet). Additional test sheets for further test paint polishes can be prepared analogously *(cf. **Diagram 6**)*. – **Note: The pre-treatment of the test sheets for the testing of different paint polishes must take place on the same day. The time interval between pre-treatment and the application of the paint polish for subsequent testing must be the same for all products and be on the same day.**  **Diagram 6** *Schematic representation of two glossy test sheets with two test areas resp. sides each.*
5.2.2		Assessment of the water run-off behaviour
5.2.2.1	Measuring of the initial value for the water run-off behaviour before applying the paint polish	The water run-off behaviour of the untreated areas is measured according to the setup described in 4.3.2. The run-off times are noted as target values for the wash resistance under 5.2.3.2.
5.2.2.2	Application, drying, polishing out and removal of product residues	**Before applying the paint polish, the paint polish should be thoroughly homogenised by shaking**. If the manufacturer of the test paint polish does not give any instructions regarding dosage and application medium, then **2 +/- 0.1 gramme** (if necessary, the optimum quantity must be determined in a preliminary test) [14] of the paint polish is spread thinly and evenly over the entire area of the **unused, new straight from production and dry** PUR sponge. Except for the application quantity, application is made according to 5.1.3.1. Drying (5.1.3.3), polishing (5.1.3.4) of the paint polish and removal of product residues (5.1.5) on a maximum of two areas follow the rules in 5.1 without assessment or documentation of the parameters. **The time interval between polishing and testing of the water run-off behaviour is at least 24 hours**.
5.2.2.3	Assessment of the water run-off behaviour	Next, the water run-off behaviour of the treated sheets is assessed according to the setup in 4.3.2. For the assessment of the run-off behaviour and automated scoring, a linear equation# according to the spreadsheet "Assessment of run-off time" in the Excel table *(cf. **Chapter 7**)* is used with the following scoring scheme:* 5.4 to 4 points: 0.1 to < 1,6 seconds 4 to 3 points: > 1.6 to < 2.7 seconds 3 to 2 points: ≥ 2.7 to < 3.8 seconds 2 to 1 points: ≥ 3.8 to < 4.9 seconds 1 to 0 points: ≥ 4.9 to < 5.9 seconds 0 points: ≥ 6 seconds The values of the run-off time are entered in the Excel table for automated evaluation. # *y = 0.909 * t + 5.4545 (y: points; t: run-off time in seconds)* * *Because of the y-axis intercept of the straight-line equation used in the Excel table, a maximum of 5.4 points can be achieved with a theoretical minimum run-off time of 0.1 seconds (accuracy of the stopwatch)!*
5.2.3	Wash resistance (paint preservation / long-term effect)	Wash resistance of the dried, polished and product residue-free test paint polish should be given over as many wash cycles as possible. One wash resistance cycle consists of washing according to 5.2.3.1 and the subsequent assessment of the water run-off behaviour according to 5.2.3.2. The wash on one test area is repeated until the initial value of the run-off time before treatment with the paint polish, as documented under 5.2.2.1, is reached or a maximum of 25 washes have been carried out. The assessment is made up to and including the fifth wash after each wash. From the fifth wash, assessments are made only after all five washes. When the initial values of the run-off time are reached, the assessments of the following washes carry zero points *(cf. **Chapter 7** "Excel assessment table")*.

5.2.3.1	Washing of the test specimen (test sheet)	The areas for the paint polishes on a test sheet need to be washed separately to avoid carry-over of the paint polishes. In addition, separate sponges and separate containers of basic car shampoo should be used *(cf. **Appendix**)*. Wash the test sheet with basic car shampoo: Completely soak the PUR sponge for treatment in fivefold crosswise applications *(cf. **Diagram 2** / video)* at the same pressure (ca. 1.5 kg) (corresponds to one wash). After each crosswise application, squeeze out the sponge and completely soak it anew with shampoo. Before the assessment, the test sheet is rinsed completely with DM water to remove the shampoo residues. Drying is done, for example, by blowing off with oil-free compressed air or using a wiper with a degreased silicone lip [before this, degrease the pull-off lip with aromatics-free and paint-resistant white spirit (boiling point 80 – 110°C) and isopropyl alcohol].
5.2.3.2	Assessment of the water run-off behaviour after the wash ("wash resistance")	The water run-off behaviour of the test paint polish is assessed each after 1, 2, 3, 4, 5, 10, 15, 20 and 25 washes or until complete removal of the paint polish (run-off time ≥ 6 seconds or until the initial value in 5.2.2.1 is reached) according to the setup in 4.3.2. The measurement of the run-off time is stated in tenths of a second and in each case separately, e.g., on the test and reference sides (areas). For the assessment of the run-off behaviour and automated scoring, a linear equation# according to the spreadsheet "Assessment of run-off time" in the Excel table *(cf. **Chapter 7**)* is used with the following scoring scheme: 5.4 to 4 points: 0.1 to < 1,6 seconds* 4 to 3 points: > 1.6 to < 2.7 seconds 3 to 2 points: ≥ 2.7 to < 3.8 seconds 2 to 1 points: ≥ 3.8 to < 4.9 seconds 1 to 0 points: ≥ 4.9 to < 5.9 seconds 0 points: ≥ 6 seconds The values of the run-off time are each entered in the Excel table for automated evaluation (if the paint polish has already been completely removed before the 25th wash and a water run-off time of ≥ 6 seconds has been achieved, no further wash cycles nor inputs in "run-off time after treatment" in the Excel table are required. The scoring of the subsequent wash cycles is automatically set to zero.) and a mean value between 0 and 5.4 points is determined for the entire test item "Wash resistance" *(cf. **Chapter 7**)*. # *y = -0.909 * t + 5.4545 (y: points; t: run-off time in seconds)* * *Because of the y-axis intercept of the straight-line equation used in the Excel table, a maximum of 5.4 points can be achieved with a theoretical minimum run-off time of 0.1 seconds (accuracy of the stopwatch)!*

7. Assessment of the test results

The assessment of the test results of the product group is carried out in a weighted point system **(Table 2)**. The total score can be calculated automatically using an Excel table. The assessment of the average wash resistance of the paint polishes is made by assessing the water run-off behaviour in each case after 1, 2, 3, 4, 5, 10, 15, 20 and 25 washes. The test procedure for wash resistance ends after a maximum of 25 washes. Evaluation and scoring for wash resistance are done using a linear equation provided in the spreadsheet "Assessment of run-off time" in the Excel table.

Under the following internet address an Excel table can be downloaded for the assessment of the test method for a paint polish (assessment scheme), including the following assessment table and calculation of the overall result:

https://www.ikw.org/fileadmin/IKW_Dateien/downloads/Haushaltspflege/2023_01_26_Assessment_scheme_Paint_Polish.xlsx

Test Criterion	Scoring points from the assessment scheme of the test method	Weighting (%)	Weighted Score
Matted test sheet			
Assessment of usability			
5.1.3.2 Distributability	1 to 5	2.5%	
5.1.3.4 Polishability	1 to 5	10%	
5.1.3.5 Dust formation	1 to 5	2.5%	
First assessment of the treated surface			
5.1.4.1 Surface appearance	1 to 5	5%	
5.1.4.2 Colour refreshment	1 to 5	5%	
5.1.4.3 Change in gloss value	0 to 5	15%	
5.1.4.4 Touchability and smear resistance	1 to 5	5%	
Second assessment of the treated surface			
5.1.6.1 Surface appearance	1 to 5	5%	
5.1.6.2 Colour refreshment	1 to 5	5%	
5.1.6.3 Change in gloss value	0 to 5	15%	
Glossy test sheet			
5.2.2.3 Water run-off behaviour before the wash	0 to 5.4	10%	
5.2.3.2 Wash resistance (water run-off behaviour after the wash)	0 to 5.4	20%	
Total score	**8 to 60.8**	**100%**	**0.4 to 5.12**

Tab. 2 Assessment table of the weighted test results of a paint polish for motor vehicles.

8. Members of the Working Group

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References

[1] https://www.forum-waschen.de/

[2] https://www.ikw.org/haushaltspflege/nachhaltigkeit/nachhaltigkeitsberichte

[3] https://www.charter2020.eu/

[4] https://www.ikw.org/haushaltspflege/wissen/freiwillige-vereinbarungen-und-selbstverpflichtungen-der-hersteller-von-wasch-pflege-und-reinigungsmitteln-im-ikw (called up: January 2023)

[5] https://www.vci.de/themen/nachhaltigkeit/responsible-care/uebersicht.jsp

[6] https://www.chemiehoch3.de/

[7] Applying / polishing beyond the edge of the area to be treated is intended to ensure an even treatment of the area.

[8] Measurement on curved vehicle surfaces does not make sense, as this does not provide correct measuring results in gloss value measuring.

[9] The size of the test sheets is crucial for the correct evaluation of the water run-off method on the glossy test sheets, using the Excel table in Chapter 7.

[10] Original Equipment Manufacturer – OEM.

[11] Unless no new sheets are used, the sheets should have a comparable condition regarding preparation and treatment. The history of the sheet can be noted down e.g., on its back.

[12] For a homogeneously matted area, the standard deviation should be < 1 gloss unit. DIN EN ISO 2813 (June 1999, updated in 2015) "Paints and varnishes – determination of the gloss value at 20°, 60° and 85°".

[13] When applying by hand, up to 20 crosswise applications might become necessary. Ideally, do not replace the sponge and add matting agent if needed. Too little matting agent can make matting more difficult.

[14] If necessary, the ideal application quantity should be determined in a pre-test. The application quantity should completely wet the test areas. It should be noted here that during the tests on the glossy test sheets, twice as large an area has to be wetted and therefor twice the amount of the paint polish should be needed as for the matted test sheets. If the application quantity is not sufficient for this, the areas must be completely cleaned with isopropyl alcohol and the process must be repeated.

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Appendix

Test specimens, equipment, auxiliary materials, formulations and supply sources

Test sheets (test specimens)

- For example, plain steel or aluminium sheet [8,11]
- Original paint layering in OEM quality (no repair and special paint) [10], base paint plain black, e.g. clear paint PPG APO 1.2 (e.g. Thierry GmbH, Motorstraße 30, 70499 Stuttgart, Germany)
- Size of the test sheet: [9] 500 mm x 400 mm x 1 mm
- Use of the test sheets three weeks after manufacturing at the earliest or expose test sheets to accelerated ageing: e.g., 16 hours in the drying cabinet at 60 °C including at least one day at ambient temperature for conditioning. The relative air humidity should amount to ca. 30 to 80%.

Measuring instruments, equipment and setups

- Gloss meter with measurement geometry and measurement conditions based on DIN EN ISO 2813 (e.g., company Byk-Gardner GmbH, Lausitzer Strasse 8, 82538 Geretsried, Germany, phone.: +49 (0)8171 3493-0, fax +49 (0)8171 3493-140, email: info.BYK.Gardner@altana.com, www.byk.com or ERICHSEN GmbH & Co. KG, Am Iserbach 14, 58675 Hemer, Germany, phone: +49 (0)2372 – 9683-0, fax: +49 (0)2372 – 6430, email: info@erichsen.de, https://www.erichsen.de/erichsen-de)
- Setup for the water run-off method with water jet according to **Diagram 3**:
  - Rack for 30 °C installation, so that the sheet at the underside is at least 10 mm above the bottom of the washbasin (free run-off)
  - Water tap
  - Aerator: e.g., Neoperl Strahlregler Perlator (TT, IG M16x1 V, Art. No.: 1562145 or M22x1 DL, Art. No.: 40460395, Neoperl GmbH, Klosterrunsstraße 9-11, 79379 Müllheim, Germany, phone: +49 (0)7631-188-0, fax: +49 (0)76 31-188-287, email: info@neoperl.de)
  - Flow meter 60 - 600 l/h: e.g., PVC-U flow indicator with 2fold bonded socket 20 mm (Art. No.: AA461; HT CONNECT GmbH & Co. KG, Norisstraße 4, 91257 Pegnitz, Germany; phone: 09241/9109100, email: info@ht-connect.de; https://www.pvc-welt.de/PVC-U-Durchflussmessgeraet-2fach-Klebemuffe)
  - Stopwatch for measuring the water run-off with a 1/10 second measuring accuracy
  - Thermostat
  - Washbasin or water collection vessel
- Balance for weighing the paint polish samples with 0.1 gramme measuring accuracy
- Random orbit sander: free-wheeling or forced rotation eccentric polisher for matting and polishing: e.g., ECCENTRIC POLISHER - BIGFOOT LHR15 MARK III (Rupes S.p.A. a socio unico, Via Marconi 3A loc. Vermezzo, 20071 Vermezzo con Zelo (MI) – Italy, phone: +39 02946941, fax: +39 0294941040, email: info_rupes@rupes.it, https://www.rupes.com)

Auxiliary materials

- Adhesive tape (residue-free): e.g. adhesive tape 5959, width 48 mm (3M Deutschland GmbH, Carl-Schurz-Str. 1, 41453 Neuss, Germany)
- Felt pad for matting (e.g. SONAX Felt Pad Art. No. 493 300, SONAX GmbH, Münchener Str. 75, 86633 Neuburg, Germany, phone:+49 (0)84 31 53-0, email: info@ sonax.de, www.sonax.de)
- Sponge for eccentric polisher for polishing and matting: e.g. Eccentric pad (medium) 143 (Art. No. 04933410), SONAX GmbH, Münchener Str. 75, 86633 Neuburg, Germany, phone: +49 (0)84 31 53-0, email: info@sonax.de, www.sonax.de)
- Wiper with silicon lip: e.g. Flexiblade (Art. No. 04174000, SONAX GmbH, Münchener Str. 75, 86633 Neuburg, Germany, phone: +49 (0)84 31 53-0, email: info@sonax.de, www.sonax.de)
- Polyuethane sponge (PUR sponge), round, for applying and matting; 7.5 cm diameter and 2 cm thick: e.g., T28065 (Oskar Pahlke GmbH, Linzer Straße 95, 53562 St Katharinen, Germany, phone: +49 (0)2645 9523-0, fax: +49 (0)2645 9523-40, info@pahlke-schaumstoffe.de, http://www.pahlke-schaumstoffe.de/)
- Microfibre cloth for polishing, e.g. microfibre cloth black (weight: 300 g/m², dimensions 40 x 40 cm, Art. No. 615.900.337, De Witte SA, Kluizenmeersen 7, B-9170 Sint-Gillis-Waas, Belgium, phone: +32 (0)3 766 46 83, fax: +32 (0)3 766 46 84, email: info@dewitte.biz, http://www.dewitte.biz /Dewitte /index.html)
- Cotton swabs: e.g., CLASSIQSwabs™ (Copan Flock Technologies Srl, Via Perotti 18, 25125 Brescia, Italy, phone +39 030 3666100, fax: +39 030 2659932, email: info@copanflock.com, www.copanflock.com)
- Metal weight to be placed on sponge and/or microfibre cloth: ca. 1.5 kg (cf. **Figures 5 and 6**)
- Containers with basic car shampoo for the testing of wash resistance

Formulations and chemicals

- Reference paint polish (RPP):
  - 10% by weight Mipri LK2 polishing grain (Mipri GmbH / 55543 Bad Kreuznach)
  - 8% by weight Korasilon NPF 60 silicone oil emulsion (Kurt Obermeier GmbH & Co. KG)
  - 5% by weight paraffin hydrocarbon (e.g., test white spirit 190-245 or Exxsol D80] / ExxonMobil)
  - 5% by weight paraffin wax emulsion (e.g., Hansa Care 4670 / CHT Germany GmbH)
  - 0.80% by weight xanthan gum (e.g., Hammonia Gum FG / Hammonia Oleochemicals GmbH, 20457 Hamburg, Germany)
  - 0.20% by weight preservative, at own choice
  - Ad 100% by weight water (DM)

- Matting agent (start with the liquid components and then stir in the abrasive):
  - 20% by weight abrasive (e.g., Silitin V 85 / HOFFMANN MINERAL GmbH, 86633 Neuburg, Gemany)
  - 15% by weight of 28% sodium lauryl ether sulphate (2.5 EO) solution (e.g., Emal 228D / KAO or Texapon® NSO / BASF SE)
  - 15% by weight complexing agent [e.g., Trilon® M liquid (40%) BASF SE]
  - 8% by weight glycerine
  - 0.2% by weight preservative, at own choice
  - Ad 100% by weight water (DM)

- Basic car shampoo:
  - 0.5% solution of 28% sodium lauryl ether sulphate (2.5 EO) solution (e.g. Emal 228D / KAO Chemicals Global or Texapon® NSO / BASF SE)
  - Ad 100% by weight water (DM)

- Demineralised water (DM water)
- Degreaser: Isopropyl alcohol (isopropanol alcohol), ≥99.8% purity
- White spirit: aromatics-free and paint-resistant (boiling range 80–110°C)
- Abrasive: e.g., Silitin V 85 (HOFFMANN MINERAL GmbH, Postfach 14 60, 86619 Neuburg, Germany, phone: +49 (0) 8431 53-0, fax: +49 (0) 8431 53-3 30, www.hoffmann-mineral.com, email: info@hoffmann-mineral.com)
- High-gloss polish without waxes and silicones (e.g. SONAX Profiline Perfect Finish (Art. No.: 224 141, SONAX GmbH, Münchener Str. 75, 86633 Neuburg, Germany, phone: +49 (0)84 31 53-0, email: info@sonax.de, www.sonax.de)