

# Joint Quality Management in the Supply Chain

## Marketing and customer service

- Car-washes

**Criteria for car-washes  
conforming to VDA specifications**

**2<sup>nd</sup> revised edition, September 2012**

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**Verband der Automobilindustrie e.V. (VDA)**

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**Berlin, September 2012**

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# 1 Introduction

This present publication: "Car-washes – criteria for car-washes conforming to VDA specifications" has been drawn up by a working group (the members are listed above), which was formed in January 2007 and re-convened in February 2012 for the 2<sup>nd</sup> edition in view of their coherent interests. The starting points were:

- a) the lack of sealing of vehicles, caused by water pressures and volumes, for which modern vehicles are not designed
- b) the increasing use of external decorative and functional vehicle components, the materials of which can be affected negatively in optical or functional terms by the wash chemicals normally used until now

Within the framework of the working group, guidelines were drawn up for:

- existing and upcoming car-washes
- the chemicals used in car-washes

in order to prevent these problems in future and to permit the better adaption of car-washes to the design of cars of the future. Advice is provided to car manufacturers regarding potentially critical vehicle geometries in car-washes.

While maintaining the importance of good cleaning results, the focus is aimed at the reduction of damage to vehicles.

Car-washes (whether gate-type, conveyor-type or self-operated) meeting the VDA specification in terms of chemical and technical requirements can apply for the use of the VDA seal. This seal indicates that there is less potential for damage provided the car-wash is operated in compliance with the specified parameters.



## **2 Purpose and area of application**

The purpose of this VDA publication is to prevent damage to vehicles in car-washes more effectively in future, by a direct balance between car-wash, vehicle and wash chemicals. To this end, guidelines have been developed, to which existing and future car-washes should conform, as well as the wash chemicals to be used. The quality of the water used is not touched on, nor is the water treatment system.

In addition a description is given of the procedure for obtaining a test seal, which will indicate to the customer that the car-wash conforms to the requirements of the VDA specification.

## **3 Validity / scope**

This VDA publication applies to:

- Gate-type car-washes
- Conveyor-type car-washes
- Manual, user-operated high-pressure washers
- Wash components

The requirements specified refer to:

- the chemical properties of the wash chemicals
- limit data for the layout of car-washes
- the maximum permitted mechanical stresses on vehicles in car-washes
- guidelines for the operation of car-washes

## **4 Chemical conditions for the wash chemicals**

### **4.1 Wash chemical classifications**

The processes applied in car-washes can be differentiated basically into manual and automatic systems. The products used for these are divided into two classes (A + B).

Depending on the maximum permitted concentration, an alkaline cleaner can be included in Class A or Class B. In practice this may appear as follows:

Alkaline pre-cleaner 'XYZ'

Class A (contact time = 5 min) → specified concentration of 4%

Class B (contact time = 1 min) → specified concentration of 10%

The labels on containers of products of this kind, or their brochures, can include both seals (see Appendix C) – however, this is permitted only if the appropriate instructions for use and details of the maximum permitted concentration are stated (see the above example).

There is no advantage in declaring cleaners automatically as Class B if they are not critical (even in concentrate form).

#### **4.1.1 Class A wash chemicals**

Products in Class A meet the test and approval criteria set out in Section 4.4.2.1.

Where these products are used as specified and the manufacturers' instructions are complied with in terms of concentration and contact time, there is no potential for damage to be caused. No matter what their pH value, care products can always be declared as Class A. Wash chemicals with a pH between 5 and 9 in the usage concentration can also be declared as Class A.

This includes:

- all cleaning products for which the manufacturer recommends a pH between 5 and 9 for the usage concentration, such as shampoo or wash powder (provided the pH of the wash solution is between 5 and 9).

- Drying products
- Waxes, etc.

Appropriate investigations leading to the release of the products for use are the responsibility of the manufacturer and details of these should be made available to the VDA in the course of manufacturer audits.

#### **4.1.2 Class B wash chemicals**

Products in Class B meet the test and approval criteria set out in Section 4.4.2.2. As a general principle, Class B wash chemicals have the potential to cause damage and must therefore be used on vehicles only in the concentration stipulated by the manufacturer, for the specified contact time.

### **4.2 Level of automation**

#### **4.2.1 Car-washes with automated & part-automated procedures**

In installations with automatically controlled operations, where both the dosing and application of the chemicals, as well as the sequences are controlled automatically by the movement of the vehicle and/or the machinery, both class A and class B chemicals can be used.

If the car-wash has an "automated pre-spray arch" which moves under its own power, Class B chemicals can be used as well as Class A products, provided the wash process ensures a defined contact time. The same applies to manual pre-spray hoses, provided they are used by trained personnel, the mix ratio is automatically controlled by dosing systems (Dosatron, Hydromin or similar) and provided there is a defined plan for emergencies, such as "drenching" if the maximum contact time is exceeded.

#### **4.2.2 Car-washes with manual procedures**

In areas of the car-wash where manually controlled operations, manual applications or manual dosing take place, only class A chemicals must be used, no matter what the application. This includes self-service car-washes and pre-spray systems operated by the customer – for example, coin-operated devices before the car-wash.

### **4.3 Chemical requirements**

The following procedure describes the essential investigations required for the approval of cleaning products such as, for example, pre-cleaners, shampoos, wheel-rim cleaners or insect removers, which are used on the exterior of the vehicle.

To eliminate the risk of corrosion damage to components (see Sections 4.4.2 and 4.5.2) and bodywork, cleaning products are assessed in terms of their aggressive qualities and corrosive effect on selected, sensitive types of surface protection at high temperatures. The resistance of cleaning media to ageing is not taken into account during the investigations.

It is essential to observe the safety regulations covering the use of cleaning products.

A surface is considered resistant to the effects of cleaning products if there is no optical deterioration or corrosion damage.

### **4.4 Aluminium decorative surfaces**

#### **4.4.1 Test items: description and quality requirements**

Where cleaning media have a pH value greater than 9 in the application concentration it is essential to use transparent anodized aluminium surfaces with a silk gloss quality. These finishes must meet the following requirements:

a) Material:

- Al99,5MgSi0,5 (DIN EN 573: alloy EN AW 6060 in gloss quality with 99.5% purity)

b) Surface protection:

- Silk gloss decorative transparent anodized plating, applied using the DC-sulphuric acid process with a thickness of 5-10 µm

c) Quality requirements:

- Colouring capability to DIN 12373-4.  
Requirement: characteristic  $\leq 1$

- Neutral salt spray test to DIN EN ISO 9227: no change in appearance after 480 hours test duration. Requirement: no optical change

- Resistance to alkalis

Test procedure for determining resistance to alkalis

- i) Test solution: the alkaline test solution is made up by adding a 0.0317 molecular solution of 1.27 g of sodium hydroxide, 4.64 g sodium phosphate-dodecahydrate (equivalent to 2 g of sodium phosphate) and 0.33 g of sodium chloride (equivalent to 200 g of chloride) to distilled water and then topping up to 1 litre. This solution has a calculated pH value of 12.5.

The chemicals required are available, for example, from Messrs. Merck in Germany under the following order reference numbers:

Sodium hydroxide:	1.06469.1000
Sodium phosphate-dodecahydrate:	1.06572.1000
Sodium chloride:	1.06404.1000

- ii) The samples are 50% immersed in these test solutions for 10 minutes at a temperature of 18-20°C (product and tank temperature). The surface of the sample is then rinsed with distilled (or fully de-ionized) water and dried in air. To remove any products of corrosion which may have developed, the surface can be cleaned with a mild paint care product (such as Sonax Autopolitur, order ref. 300 200) using a micro-fibre cloth. Each test must be carried out on a surface area in its original condition (not previously subjected to treatment of any kind). After the reference surface has been in contact with the cleaning media to be examined, the areas affected must not be used again in the tests.

⇒ Requirement: clearly visible changes at the area of immersion /at the line of immersion are not acceptable.

Test specimens are obtainable from:

Fa. Erbslöh AG, Abteilung F&E  
Siebeneicker Straße 235  
42553 Velbert, Germany

The test specimen must have a batch number in order to ensure the traceability of the test results.

#### **4.4.2 Method / test conditions**

Before the tests begin the samples must be cleaned for 3 minutes in an ultrasonic bath in a blended cleaner, made up of equal quantities of acetone, ethanol and petroleum benzine.

Photographs are then taken to record the initial condition of the samples.

The investigation of the resistance of surfaces and/or components is carried out by storing the items in contact with the relevant cleaning media in their maximum usage concentration as specified by the instructions for use/manufacturer's data. The wetting of the surface with the cleaning product takes place at raised temperatures.

A synthetic hard water (14° dH) to VW specification PV 1426 must be used to prepare the test solution to the usage concentration. This water is made up of:

- 148 mg/l sodium sulphate
- 165 mg/l sodium chloride
- 138 mg/l sodium hydrogen carbonate
- 275 mg/l calcium chloride
- (topped up with fully de-ionized water)

##### **4.4.2.1 Class A wash chemical**

A temperature of at least 50°C must be selected when wetting the surface with the cleaning product at the maximum usage concentration specified by the manufacturer. Once the sample and the cleaning fluid have been heated to the required temperature, contact between the surface and the medium must be maintained for 5 minutes in a circulating air test chamber. During this period the surface of the sample must be wetted with the test medium with a sufficient quantity to ensure that contact with the liquid is maintained for 5 minutes. To do so, the test surface may be immersed or wetted with droplets.

The test sample is then rinsed in running distilled water to remove any loosely adhering products of corrosion. It is then dried, using a drying cloth without any other polishing or other aids.



Visual assessment of the state of corrosion and photographic documentation of the resistance of the sample are carried out directly after the surface has been dried.

The car-wash operator requires clear recommendations for use from the manufacturer, for all products, no matter what their potential to cause damage. The manufacturer must therefore always provide the user with instructions regarding procedures and application, in particular regarding:

- dosing/final dilution on the vehicle
- the spraying method
- the time for subsequent washing / rinsing

This information should be clearly stated for the car-wash operator on the label – as a minimum it must be possible to obtain these details from the technical data sheet.

#### **4.4.2.2 Class B wash chemical**

The test is carried out in a similar way to that for Class A wash chemicals, with a minimum contact time of more than one minute between surface and medium in the circulating air test chamber. The chemicals supplier will provide procedural and application instructions for the products, based on current regulations and guidelines (e.g., REACH), covering:

- dosing / final dilution on the vehicle
- the method of spraying
- the time required for subsequent wetting and rinsing

This information should be clearly stated for the car-wash operator on the label – as a minimum it must be possible to obtain these details from the technical data sheet

If the operator of the car-wash uses a Class B wash chemical and a problem occurs in the operation of the car-wash, he must take appropriate action to ensure that he complies with the chemicals supplier's procedural and application instructions – for example, "drenching" the vehicle if the car-wash conveyor stops, in order to comply with the maximum application time specified by the manufacturer. At least by the end of the maximum contact time, the vehicle in the car-wash must be thoroughly washed or flushed with sufficiently clean water until no wash-chemical residues can be seen.

#### **4.4.3 Assessing changes to the surface of the sample**

Unless otherwise agreed the following conditions must be applied:

Visual assessment of the wetted surface, without using any optical aid, at a distance of 80 cm from the item, under normal daylight (northern aspect) or an equivalent lighting. Daylight (northern aspect) or an equivalent artificial lighting must be used to evaluate specific characteristics. In view of the need for reproducibility in critical cases the following artificial lighting is to be preferred:

In critical cases, artificial lighting with the following features should be used:

- Lighting level 1000 lux
- Colour temperature as from DL 65 fluorescent tubes

Any artificial lighting source must be positioned ca. 120 cm vertically above the item under examination.

Approval criteria: check for optical changes such as dulling, cloudiness, discoloration, material removal by corrosion or corrosion to the base metal, the coating, etc.

Only if none of the above changes can be detected the cleaning product can be approved for use.

The following example shows typical possible test results:



Fig. 1: Test results and examples of assessments

Photographic documentation used for approving the use of cleaners, taken after 5 minutes of contact time at 50°C, with the cleaner applied as drops on a transparent anodized surface.

Cleaners 3 & 5: NOK

Cleaner 4: No visual change = OK

## 4.5 Galvanized components

### 4.5.1 Test samples (galvanized components)

- Galvanized coating thickness > 15µm
- Passivation: transparent thin-coating passivation with nano-particles (as described in sampling documentation by the coater)
- Resistance to neutral salt spray exposure to DIN EN ISO 9227-NSS (with and without thermal conditioning of 24 hrs at 120°C): min. 240 hours before ferric oxide (red rust) appears.

Reference surfaces are obtainable from:

- Fa. KAMAX-Werke Rudolf Kellermann GmbH & Co. KG,  
Abt. F&E,  
Dr.-Rudolf-Kellermann-Str. 2,  
35315 Homberg/OHM  
Germany

#### **4.5.2 Method / test conditions (galvanized components)**

If the cleaning media have a pH value below 5 (acidic cleaners) at the maximum usage concentration specified by the manufacturer, it is essential for the reference surfaces to be electrolytically galvanized wheel bolts, as used as standard in the automotive industry, with transparent passivated surfaces (thin-coating passivation with nanoparticles), which have a defined surface quality in their "as new" condition.

To assess the suitability of the cleaning product the wheel bolts are stored for 10 minutes in the cleaner at the maximum usage concentration specified by the manufacturer at ambient temperature (20° to 23°C).

The surfaces are then rinsed with distilled water and dried in air.

#### **4.5.3 Assessing surface changes (galvanized components)**

The wheel bolts which have been exposed to the treatment are then subjected to an investigation in a neutral salt spray to DIN EN ISO 9227-NSS. At the same time, wheel bolts in an "as new" condition should be examined. At least 3 wheel bolts are required in each case.

Details of the salt spray test, such as the concentration of the salt spray or the positioning and direction of the test samples during the test, are set out in the standard quoted above and are stated here as "not deviating from DIN EN ISO 9227-NSS". The time between removing the test samples from the test medium and starting the salt spray test has no influence on the test result and is therefore not specified.

Requirement: Provided the wheel bolts subjected to the acidic cleaning medium demonstrate resistance to ferric oxide for at least 96 hours, the cleaner can be recommended and approved for use.

Products meeting these test and approval criteria can also be identified with the signet for Class A wash chemicals.

	<b>Alkaline cleaners pH &gt; 9 in max. usage concentration</b>	<b>Acidic cleaners pH &lt; 5 in max. usage concentration</b>
<b>Reference surface</b>	<ul style="list-style-type: none"> <li>Material: Al99,5MgSi0,5 (DIN EN 573: alloy to EN AW6060)</li> <li>Surface: Silk gloss decorative, transparent anodized plating, using the DC sulphuric acid process, plating thickness 5-10 µm</li> </ul>	<ul style="list-style-type: none"> <li>galvanized wheel bolts</li> </ul>
<b>Obtainable from</b>	see Section 4.4.1	see Section 4.5.1
<b>Characteristic quality features</b>	<ul style="list-style-type: none"> <li>Coloration to DIN 12373-4. Requirement: characteristic <math>\leq 1</math></li> <li>Neutral salt spray test to DIN EN ISO 9227, 480 hrs. Requirement: no visible change</li> <li>Alkali resistance: immersion test at 18-20°C (object and tank temperature, pH=12.5. Duration 10 minutes. Requirement: clearly visible changes in the immersion area/at the immersion line are not permitted. For details see 4.4.1</li> </ul>	<ul style="list-style-type: none"> <li>galvanizing, transparent passivation with nano-particles</li> <li>coating thickness: &gt; 15 µm</li> <li>Neutral sat spray test to DIN EN ISO 9227: no ferric oxide after 480 hours with / without prior thermal conditioning (120°C / 24 hrs)</li> </ul>
<b>Method</b>	<ol style="list-style-type: none"> <li>Cleaning in an ultrasonic bath with a mixed cleaner (equal quantities of acetone, ethanol and petroleum benzine</li> <li>Store the pre-heated sample in the fluid at 50°C (immersed; wetting) for min. 5 minutes (for Class A) or min. 1 minute (for Class B)</li> <li>Rinse and dry</li> <li>Visual assessment with defined lighting</li> </ol>	<ol style="list-style-type: none"> <li>Cleaning in an ultrasonic bath with a mixed cleaner (equal quantities of acetone, ethanol and petroleum benzine</li> <li>Store the sample at the maximum usage concentration at ambient temperature (20-23°C) for 10 minutes (immersed; wetting)</li> <li>Rinse and dry</li> <li>Corrosion check to DIN EN ISO 9227-NSS inc. visual assessment</li> </ol>
<b>Assessment</b>	Cleaner is suitable if there are no flecks, cloudiness, discoloration, attack or corrosion	Cleaner is suitable if there is resistance to ferric oxide on the head of the bolt after 96 hrs. neutral salt spray test to DIN EN ISO 9227

Table 1: Overview covering Sections 4.1. and 4.2

## **4.6 On-site test methods**

The crucial criterion for restricting the potential for damage is compliance with the dosing rates determined by the wash chemical manufacturer, at which VDA conformance is achieved.

The dosing (concentration) cannot be determined on site without an unacceptable degree of effort. Instead, therefore, the pH value and the conductivity of the on-site wash solution are compared with the figures provided by the manufacturer at the recommended usage concentration.

Because the water used on-site to dilute the cleaner concentrate has an influence on these measurements, it is essential to prepare a comparison dilution with the water used there, to the manufacturer's details.

Provided the pH value and conductivity of the collected wash delution are the same as or below those of the comparison delution, it may be assumed that compliance is achieved with the dosing (concentration) specified by the manufacturer and, therefore conformance with VDA requirements.

If the pH value of the wash delutions actually used is between 5 and 9 (the non-critical range) it will not be necessary to carry out the comparison check described above.

## **4.7 Convertible soft tops**

At present there are no specifications (reference materials and test methods) for preservatives and/or waxes in association with convertible soft tops. The information provided in the user manuals issued by the vehicle manufacturers apply.

## **5 Mechanical requirements**

A differentiation has been made between the following types of vehicle:

- Limousines: vehicles with a fixed roof and doors with frames for windows
- Convertibles and coupés: vehicles with a hard top, folding roof or soft top, as well as vehicles with doors having no frames for windows

### **5.1 Vehicle dimensions**

When defining vehicle dimensions it is important to ensure that the dimensions of vehicles and car-washes are suitable for each other. Within the framework of this definition, vehicles are passenger cars and car-washes are washing installations for passenger cars. Transport vehicles (i.e., vans, etc.) vary greatly in dimensions and can be accommodated in car-washes only to a limited extent. They are therefore excluded from this definition.

#### **5.1.1 Minimum dimensions for car-washes**

The following dimensions describe the minimum dimensions for car-washes, which must be achieved in order to wash current, popular vehicles. These minimum dimensions must be achieved by car-washes if they are to be registered as conforming to the VDA specification.

Dim.	Details of car-wash and vehicle	Car-wash without personnel	Car-wash with personnel
A	Min. drive-through height / overall bodywork height	2050 mm *1	Operator is responsible
B	Min. drive-through width / max. width of vehicle to outer edge of wing-mirrors (folded / not folded)	2250 mm *1	Operator is responsible
C	Min. width of wheel guides / max. track width of vehicle	1.950mm	Operator is responsible
D	Min. width of vehicle conveyor track / max. tyre width	330 mm	Operator is responsible
E	Max. interior height of guide rails / min. vehicle ground clearance (inc. area around wheels)	80 mm	80 mm
F	Min. side play between wheel washer and car-wash wheel guide / outer edge of wheel to outer edge of vehicle bodywork	100 mm *2 each side	Operator is responsible
G	Min. side play between car-wash frame to wheel guide / max. distance between outer edge of wheel and outer edge of wing-mirror	150 mm each side	Operator is responsible
H	Min. distance between inner edge of conveyor or guide rail to car-wash width restriction (right) / max. distance between inner edge of left wheel and outer edge of right-hand mirror	1850 mm	Operator is responsible

Table 2: Minimum dimensions for car-washes

\*1 These dimensions must be clearly displayed at the car-wash

\*2 This dimension reduced to 50 mm up to a height of 600 mm from the surface on which the wheels stand

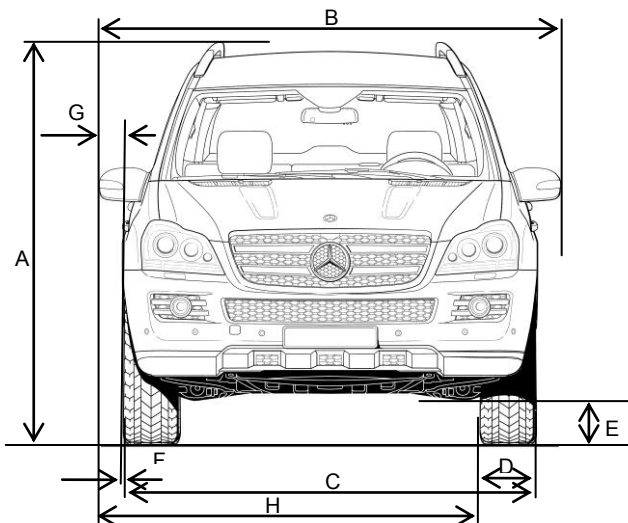


Fig. 2: Minimum dimensions for car-washes



### **5.1.2 Identification requirements / conditions for seal of approval**

The figures stated in Section 5.1.1 are minimum dimensions which apply to over 95% of present-day passenger cars and car-washes of recent years currently on the market.

To ensure that car drivers and people using the car-wash can recognize that the car-wash is suitable for their vehicle, the car-wash must have display plates showing clearly the most important dimensions (those identified by \*1 in Fig. 2). This is particularly important where passenger car-washes are also used by vans whose dimensions may be close to the limits.

In vehicle user manuals where a reference is made to the VDA seal of approval for car-washes, it is essential to give the most important dimensions (those identified by \*1 in Fig. 2).

For a certificate of conformance to be issued by the car-wash manufacturer and the right for the car-wash to bear the VDA seal, the car-wash must comply with the minimum dimensions for car-washes shown in Section 5.1.1 (with and without personnel) and the requirements regarding the display plates, described in Section 5.1.2. Both requirements are checked on a random sample basis as part of on-site inspections.

## **5.2 Vehicle shape**

Overhangs, under-cuts and projecting sections of bodywork can lead to problems in a car-wash and are therefore dealt with in the following section.

### **5.2.1 Overhangs and under-cuts**

The drying systems in modern car-washes which follow the contours of the vehicle bodywork must be able to detect unusual shapes such as overhangs and under-cuts, etc., using standard light-beam systems operating to the limits of the system. In the following section, definitions are given for dimensional limits which can be reliably detected.

### Horizontal "under-cut" of extension parts (such as a rear spoiler)

A horizontal gap ( $z$ ) greater than 50 mm in height must not exceed a depth ( $x$ ) of 150 mm.

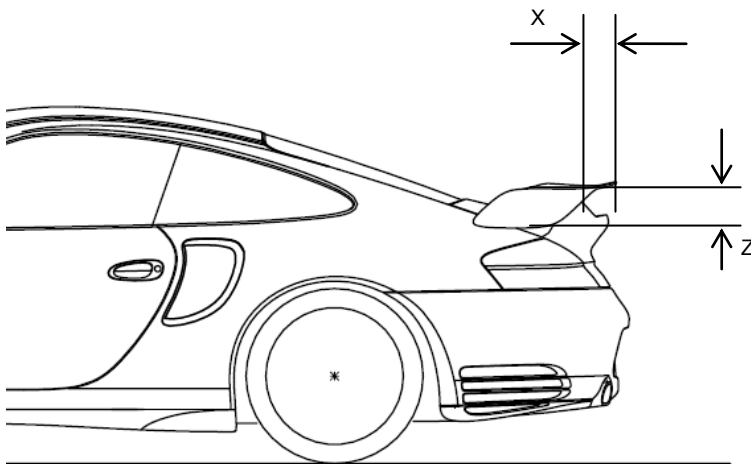


Fig. 3: Example of a spoiler

### Vertical overhang of extension parts (such as a spare wheel)

A vertical gap ( $x_1$ ) greater than 50 mm in width must not exceed a height ( $z$ ) of 150 mm, or the narrower part ( $x_2$ ) (in this example, the width of the wheel) must be greater than 250 mm in horizontal width.

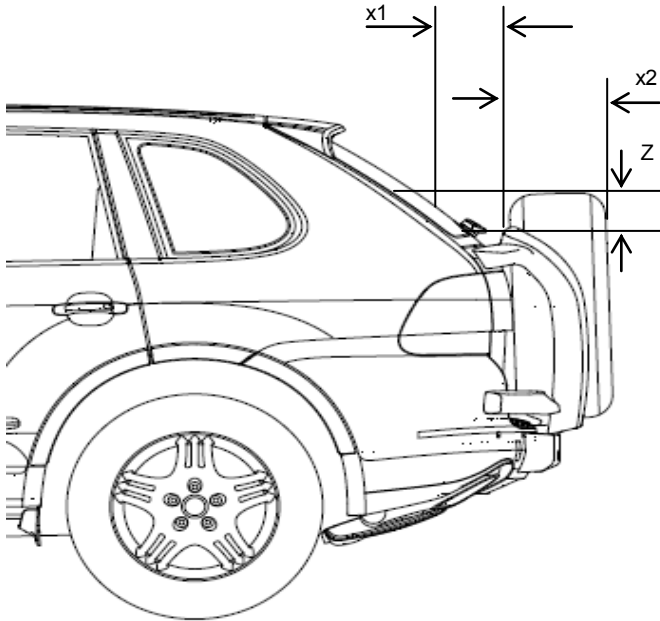


Fig. 4: A spare wheel on a SUV (sport utility vehicle)

Car-washes must have an appropriately designed light-beam system or equivalent or better technical means of detecting these dimensions for overhangs and under-cuts.

### 5.2.2 Projecting sections of bodywork

For the proper control of rotating washer elements (whether brushes, foam or textiles) it is essential to detect any salient elements of bodywork.

The washer elements (with the exception of washing equipment up to a height of 600 mm from the surface on which the wheels stand) must therefore be designed so that, with the maximum degree of extension, they can accommodate elements of bodywork projecting up to 150 mm upwards from the flat area of the bodywork (for example, roof racks; rigid antennae) and 200 mm to the sides (for example, wing mirrors). If these dimensions are exceeded, the vehicle components in question (antennae, mirrors, etc.) must be removed or folded away before the vehicle enters the car-wash.

### 5.3 Hydro-dynamic stresses

Hydro-dynamic stresses occur as a result of the quantity and pressure of the water which is used.

#### 5.3.1 Water volumes

The maximum permitted volume of water applies to an individual vehicle from above is 280 l/minute. This figure is based on an even distribution of water over the vehicle (from the moving gate or the spray arch) and a minimum travel of 7 metres/minute of the vehicle or aggregate. If the speed of movement is lower, the volumetric water flows must be adjusted accordingly, as shown in the following diagram.

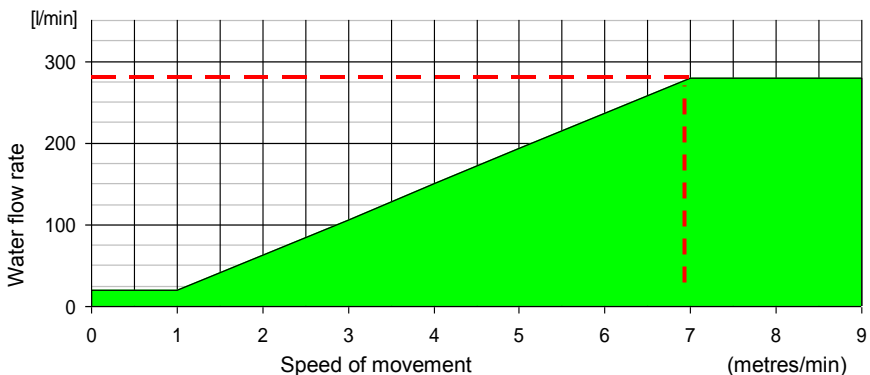


Fig. 5: Diagram showing max. permitted water flow rate by reference to speed of movement

### 5.3.1.1 On-site checking methods

Section 5.3.1 specifies the maximum instantaneous water flow rates permitted in a car wash / by the spraying system, an average flowrate of 280 l/min from above also represents the maximum figure which a vehicle is designed to withstand.

Within the on-site inspections, therefore, a reference container is positioned on top of a specific test vehicle to measure or calculate the volume of water which is actually projected onto the surface of the vehicle from above.

The opening to the container is  $470 \times 100 \text{ mm}^2$ . Upon completion of the wash process the water collected in the container is measured in litres and related to the vehicle surface using the rule of three. Taking account of the feed value of the vehicle (or wash system) and the length of the vehicle, it is then possible to calculate the volume of water (in l/min.) which has impacted on the vehicle over a specific time.

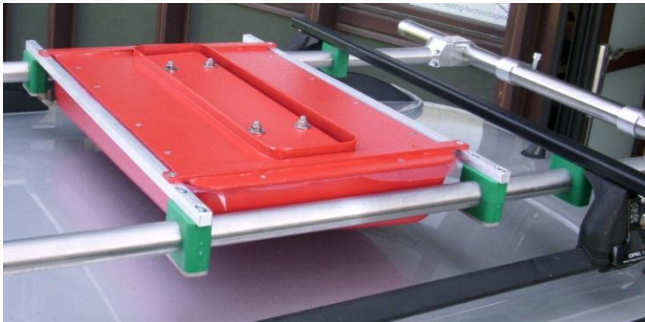


Fig. 6: Collection container to determine the volume of water

### 5.3.2 Water pressures

The jet pressure (i.e., the flow of water striking vertically on the surface) must not exceed the maximum static limits of:

**0.5 N/mm<sup>2</sup> on the general surface (risk of leaks)**  
**5 N on an area of 1 mm<sup>2</sup> (spot pressure - risk of damage)**  
**(peak pressures from the nozzle outlet, within the water jet)**

These figures apply to the whole of the vehicle bodywork.

NOTE: The spread of the spray and, therefore, the impacted surface, are influenced crucially by the incoming hydraulic flow conditions and the nozzle geometry.

#### 5.3.2.1 On-site checking methods

The surface loading is checked as part of the on-site inspection using a pressure-sensitive foil (FujiFilm PRESCALE LLLW R270 5M 1-E) and then evaluating the colour intensity with the aid of a scanner and evaluation software.

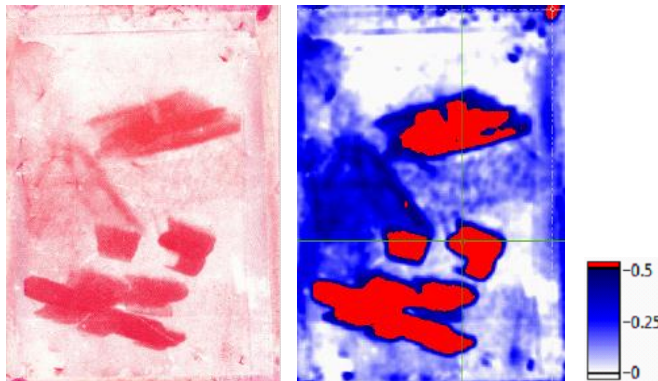


Fig. 7: Pressure-sensitive foil and evaluation result

The pressure sensitive foil must be applied to the vehicle with a suitable adhesive tape, with no air bubbles and with the sides sealed. It must be positioned:

- i. on the paint surface of the lower part of the driver's door, the wing of the vehicle or on the bumper (to the side).
- ii. With a convertibles and coupé the foil must also be applied to the "greenhouse" area (e.g., the side window to the driver's door)

In general the test vehicle should be in the middle of the car wash.

A pressure sensor is used to determine the peak pressure values. Test personnel have to position the pressure sensor in the flow of water at the same distance the vehicle surface has to the nozzle outlet in actual washing process. The person carrying out the check must "seek" the maximum value in the course of measurements. The value measured by the pressure sensor is transmitted to a data-acquisition system, which should be located close to the car wash but protected against water spray.

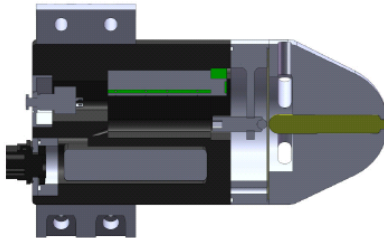


Fig. 8: Pressure sensor

### 5.3.3 Washing convertibles / coupés

The special features of a coupé or convertible, such as doors without window frames and the many seals for soft-tops and folding roofs mean that special requirements must be satisfied for these vehicles.

These special requirements apply to the section of the vehicle from the lower edge of the windows upwards – the so-called "greenhouse" area – see Fig. 9). This is the equivalent of a height of ca. 750 mm above the surface on which the wheels of the vehicle stand.



Fig. 9: Area from the lower edge of the windows upwards (the "greenhouse" area)

**There are 3 alternative for this area:**

**(1) Reduced pressure**

The car-wash has a special wash program for convertibles and coupés, where the maximum impact pressure (i.e., the flow of water striking vertically on the surface) is reduced in the critical area (the "greenhouse" area) to the maximum static figures of:

**0.25 N/mm<sup>2</sup> on the general surface (risk of leaks)**  
**5 N on an area of 1 mm<sup>2</sup> (spot pressure - risk of damage)**  
**(peak pressures from the nozzle outlet, within the water jet)**

**(2) Spray nozzle angles**

The impact pressure is maintained at max. 0.5 N/mm<sup>2</sup> on the general surface and the specified spray nozzle angles are maintained in the critical area.

- Adjusted angles on sides: 30°- 40° toward the rear and > 30° downwards (between the planes of the wheels)



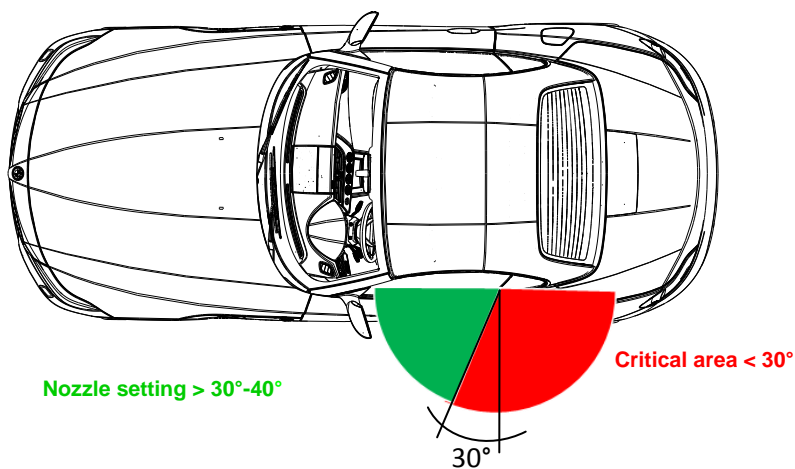


Fig. 10: Setting angle at sides (view from top / x-y plane)

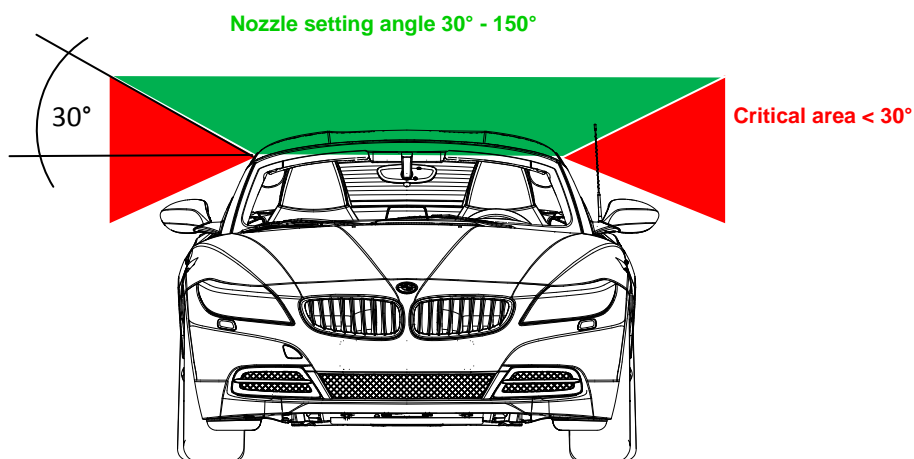


Fig. 11: Setting angle at front (side view / y-z plane) not less than 30°

### **(3) Control of the high-pressure water jet**

Many car wash manufacturers offer a so-called "Cabrio programme" in which the high-pressure water jet is disabled throughout or in the "greenhouse" zone.

## **5.4 Mechanical stresses**

### **5.4.1 Resistance of bodywork to denting**

The stresses occurring vertical to the surface of the vehicle during the wash process (forces on surfaces) on large surfaces (roof, bonnet, doors, etc.) must not exceed:

**Surface load of 400N/m<sup>2</sup>**

This figure applies to the whole vehicle bodywork.

#### **5.4.1.1 On-site checking methods**

It is not possible to check the surface loadings on horizontal surfaces of the vehicle as part of the on-site inspection without an unacceptable amount of effort. However, they can be determined with a degree of accuracy by the manufacturer using theoretical studies and are therefore verified as part of the manufacturer audits.

### **5.4.2 Firm retention of attached components**

The maximum forces on attached components occurring during the wash process must not exceed the values shown in Figs. 12 and 15 in technical machinery terms, applied quasi-statically on the reference item.

The point of application of the force is the point of the component in question furthest from the bodywork in a vertical direction.

### 5.4.2.1 Spoiler

The maximum permitted load on a spoiler as the force resulting at the outer point with a spoiler projection of 100 mm

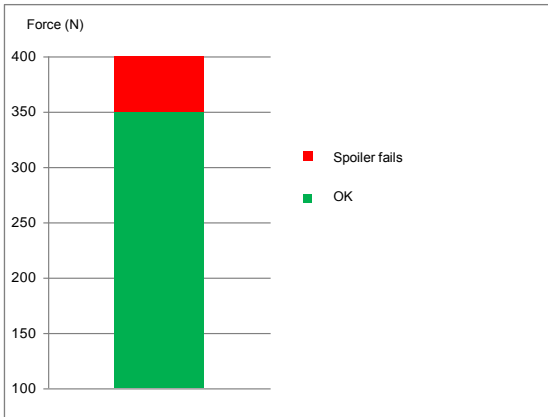


Fig. 12: Max. permitted load on a spoiler

#### 5.4.2.1.1 On-site checking methods

The task of the spoiler sensor is to measure the mechanical load on a spoiler during the wash process. The major load is the result of the horizontal brushes in the car wash and acts as a distributed surface load to the spoiler.

To eliminate the influence of the spoiler geometry on different vehicles, a test specimen of 1000 mm in width and 100 mm in length has been defined. As the critical dimension, measurements are made of the forces resulting from a projection of 100 mm from the edge of the bodywork.

The figures measured by the spoiler sensor are transferred to a data-acquisition system, which should be located close to the car wash but protected against water spray, or in the test vehicle.

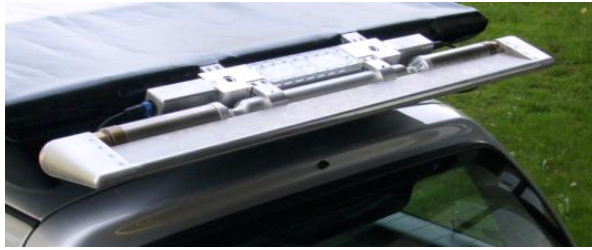


Fig. 13: Spoiler sensor / test device

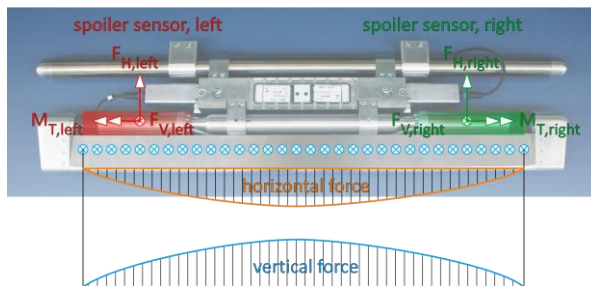


Fig. 14: Principle of measurement of the spoiler sensor

### 5.4.2.2 Wing-mirror

The maximum permitted load on a wing-mirror as the force resulting at the outer point with a mirror width of 280 mm



Fig. 15: Max. permitted load on a wing-mirror

#### 5.4.2.2.1 On-site checking methods

The task of the mirror sensor is to measure the force of the side wash-brushes. This force generates a distributed load on the mirror housing, which varies depending on the form and size of the mirror. To eliminate the influence of the mirror geometry on different vehicles, the mirror housing of the AUDI A6 was specified as the test specimen and the shear force acting on the mirror was chosen as the critical dimension. The distance between the outer edge of the test specimen and the fixing surface on the vehicle is ca. 280 mm.

The measurement principle was specified to ensure that the shear force can be measured independent of its point of impact. Because the mirror is fixed rigidly (a bolted attachment) it is possible to determine an shear force, a axial force, a bending torque and a torsion torque.

Because the shear force is the target dimension, the sensor was designed to ensure that measurement results are not influenced by axial force and torques. This is achieved by applying strain gages (SG) as shown in Fig. 17.

The mirror is attached in place of the original mirror, on the right-hand side of the test vehicle.



Fig. 16: Mirror sensor / test device

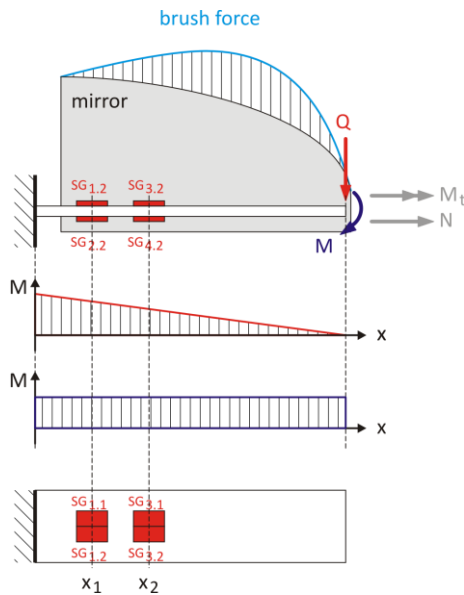


Fig. 17: Principle of measurement of the mirror sensor

### 5.4.3 Tensile forces in gaps

If the moving washing components / materials (e.g., brushes) become jammed in gaps at the vehicle, the tensile forces generated (static; tests under laboratory conditions) must not exceed the following limits.

Diagram showing relationship between tensile forces applied by moving washing materials on a cross-sectional surface area, based on current data.

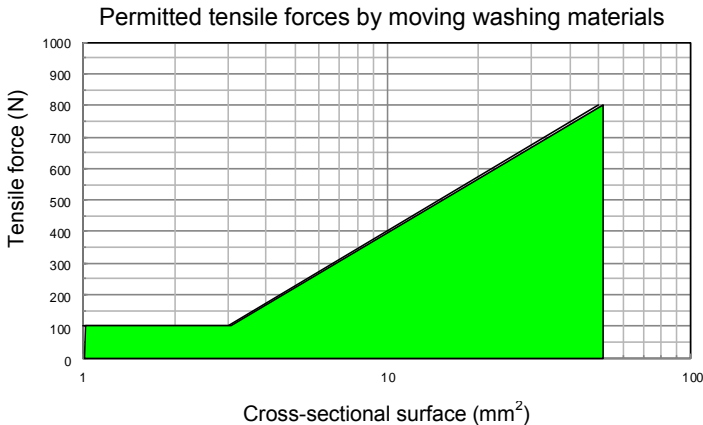


Fig. 18: Diagram showing relationship between tensile force and cross-sectional surface area, based on current data

The cross-section of the smallest possible element is crucial with regard to the potential for damage, because this represents the worst case. By their very design, wash materials with a larger cross-section ( $> 50 \text{ mm}^2$ ) cannot apply tension to a gap (with the exception of very thin, wide materials). The material must be checked by reference to the "worst case" of any possible operating conditions (humidity, period of use, etc.).

Manufacturers of car wash components (e.g., wash materials) are obliged to carry out appropriate approval investigations for representative car washes and combinations with car wash components. Evidence of these investigations must be provided to the VDA in the course of manufacturer audits. No breakage forces are determined in the course of on-site inspections.

## **6 Manual self-service & high-pressure washers**

This present VDA publication does not define specific requirements for car wash technologies used in the self-service sector.

The requirements set out in Section 4 for chemical products apply equally to manual self-service and high-pressure washers. Because customers may spray their vehicle with insect cleaner or wheel-trim cleaner before entering the car wash, it is generally not possible to predict the contact time of these wash chemicals. For this reason Class A wash chemicals only are permitted in the whole self-service sector.

Display panels must be provided, clearly visible and understandable for the customer, advising that:

- the cleaning fluid must not be allowed to dry out
- the nozzle must be at least 30 cm from the vehicle
- electrical components and seals must not be subjected to the direct application of high pressure water jets
- the high-pressure jet must be constantly in movement when washing the vehicle
- the cleaning process must be completed by flushing the vehicle with clean water (this applies only to self-service cubicles with no final machine wash)

Further information can be provided by the car-wash operator as required.

Confirmation that the specified display panels are actually present and that the wash chemicals are conform with the VDA specifications is essential for a self-service car wash to be registered as having VDA conformance.



## 7 VDA seal

The VDA seal certifies compliance with the specifications drawn up on behalf of the VDA (Verband der Automobilindustrie e.V.) by the "Car-washes" working group. These specifications, which result from specified parameters relating to the car-wash technologies and wash chemicals employed, lead to a reduction in potential for damage (Sections 4 + 5). This does not affect the current legal position.

The seal is issued afresh every 2 years and bears the date of expiry. The annual fees serve to cover the administration and personnel costs.



Fig. 19: VDA seal

### 7.1 The granting procedure

#### 7.1.2 Manufacturers

Granting of the VDA seal is based on the criteria set out in this VDA publication for wash chemicals and car-wash technologies. Compliance with these criteria is essential for granting and withdrawing of the seal.

Manufacturers of car-washes and chemical cleaning products certified to DIN EN ISO 9000ff or subsequent standards may provide the car wash operators with the certificate of conformance for their specific products, provided the relevant VDA criteria are met. Samples of certificates of conformance are shown in Appendix B.

Manufacturers of car wash technologies and chemical cleaning products may identify their products and equipment with a signet as shown in Appendix C.

Manufacturers of car wash materials, such as brushes, who are certified to DIN EN ISO 9000ff and whose measurement methods have also been audited by the VDA QMC may provide the car-wash operators with an additional certificate of conformance for their materials when used in association with the relevant type of machine / module, provided all relevant VDA criteria are met.

The following conditions apply to manufacturers who are not certified to DIN EN ISO 9000ff:

- The main emphasis of the evaluation is on the product development and approval processes. Because non-certified manufacturers cannot provide independent certification that these processes systematically ensure compliance of the manufactured products with the criteria of the VDA publication, an evaluation of the product-related development and approval processes must be carried out by VDA QMC qualified auditors.
- The objective of the evaluation is that non-certified manufacturers are also entitled to issue certificates of conformance to their customers.
- Evidence can be provided in a similar manner as with certified manufacturers. DIN EN ISO 9001 (development) includes a requirement for validation (product approval) before products are shipped to the customer. The criteria laid down in the VDA publication must have been taken into account as development requirements.
- In case of manufacturers of car washes or car wash components (wash materials), it is basically sufficient to obtain confirmation by the VDA auditor that the manufacturer has implemented appropriate development and approval processes and that the products and/or equipment in question satisfy the criteria of the VDA publication (conformance check and certification).
- Non-certified manufacturers of wash chemicals must present the concrete results obtained by approval investigations carried out by a laboratory accredited to DIN EN ISO/IEC 17025.
- In particular where car wash materials (brushes, for example) are sold, the supplier may not be the manufacturer of the materials but instead a dealer who has bought the material, processed it and is then selling it under his own trade name. In such cases the tests for VDA conformance can also be carried out by a competitor or

manufacturer (of other products) certified to DIN EN ISO 9000ff or subsequent standards.

Products which conform to the VDA specifications are registered by their manufacturers via the Internet. A special input template is provided by VDA QMC ([www.vda-carwash.de](http://www.vda-carwash.de)).

### **7.1.2 Operators**

Operators of car-washes can apply for the VDA seal via the Internet. A special input template is provided for this by VDA QMC ([www.vda-carwash.de](http://www.vda-carwash.de)). The form must be completed and a print-out sent to VDA QMC by post. In addition to the company's data - name, address, owner – the application form also contains details of the technology, wash components and chemicals to be used.

The completed application form must be accompanied by the manufacturer's certificates of conformance; where appropriate, certificates of VDA conformance issued by accredited laboratories and/or VDA auditors must also be provided.

Presentation of the certificates of conformance has two purposes. Firstly, in order to grant the seal, the VDA QMC requires concrete evidence that the individual parts of a car wash (the technology, the wash components and wash chemicals) meet the relevant VDA criteria. This declaration is already provided by the manufacturers to an adequate extent by the registration of their products in the data base. The manufacturers' data are verified by the VDA auditors within the framework of the manufacturer audits.

Secondly, in order to grant the seal, the operator must demonstrate that the overall car wash which has been registered is in fact made up of the parts which have been specified (the technology, the wash components and wash chemicals). Basically, this evidence is provided simply by the delivery note or an invoice (without prices). Precondition: All the parts stated in the registration can be selected from the data base.

If the operator of a car wash is not able to obtain the necessary certificates of conformance from the relevant manufacturers, as an alternative he can authorize a VDA inspector recognized by the VDA QMC to check the relevant parts of the car wash for conformance with this present VDA publication. The work involved and the costs must be agreed directly between the operator and the VDA inspector.

The seal will be sent to the car-wash operator following successful checks on the application by the VDA QMC. With the seal the operator also receives an official invoice covering the annual fee. As a general rule the invoice value is booked against the account which is stated with the registration.

## **7.2 Overall contractual conditions**

Granting of the VDA seal constitutes a contract between the applicant and the VDA. The precise wording of the contract is the current version which is available for inspection and/or downloads from the registration page ([www.vda-carwash.de](http://www.vda-carwash.de)). In submitting the registration data the operator accepts the contents of the contract.

### **7.2.1 Requirements and obligations**

The car-wash operator undertakes to comply with the VDA guideline. In addition he undertakes to maintain on site a complete record of all the chemical products used (including all safety data sheets and essential certificates of conformance) and the equipment / technologies employed (certificates of conformance).

Any modifications to the equipment / technologies and / or changes to the chemical products used must also be recorded immediately on site. In this connection it is emphasized that this is the responsibility of the operator. Self-authorized adjustment of parameters is unwanted. The settings to dosing pumps must be recorded in setting reports drawn up by the chemical manufacturer's service personnel. Conformance of the actual pump settings with the settings recorded in the setting reports is checked in the course of on-site inspections.

In the case of significant modifications (for example, complete components, wash materials, jets, etc.) associated with the parameters set out in this present publication, it may be necessary to carry out a

new evaluation of the conformance of the complete installation with the VDA specification.

Relevant changes are documented by filing the certificates of conformance in the daily work-record book or in the technical documentation file. These should be submitted to the VDA QMC and/or the VDA inspector on request. If VDA conformance can no longer be demonstrated following any such modification, this may lead to the immediate withdrawal of the seal.

Display panels must be provided at the car-wash, showing clearly the important dimensions indicated by (\*1) in Table 2 (see Section 5.1.1).

Operators of self-service car-washes further undertake to position in a prominent position the display panels required for self-service installations (see Section 6).

The VDA seal should be positioned at a point on the car-wash where it is very likely to be seen by the customer (for example, on the control panel of a gate-type installation).

## **7.2.2 Rights**

Following successful examination of an application, a self-adhesive seal (200 mm diameter) will be granted. This shows the month and year of the period of validity.

It is not permitted to use the seal itself for advertising purposes. The form, contents and statements in the seal must not be modified. However, the car-wash operator has the right to use the VDA seal as shown in Appendix C for customer advertising and information.

It is not permitted to combine the logos "VDA" or "VDA QMC" with the company's or other logos and products. In particular, no statements such as "VDA car-wash", "VDA-approved wash programs" or similar must be used.

## **7.2.3 Granting the seal**

The seal is granted by the VDA QMC.

#### **7.2.4 Validity of the seal**

The validity of the VDA seal and the associated contract is limited to 24 months. If no cancellation is received, the contract is automatically extended for a further 24 months. Subsequent claims are not affected.

#### **7.2.5 Cancellation period**

The contract can be cancelled at the expiry date of the contract period – but after 12 months at the earliest. The end of the contract period is identical to the date of validity of the seal which is granted.

If individual seals are issued to large customers at different times, the seals which have been granted remain valid for the validity period but are not renewed after cancellation of the contract.

In this case the contract period is identical to that of the last seal which is granted. If the validity of the last seal granted is more than 12 months from the date of cancellation, the annual fees will be payable despite the cancellation.

The period of cancellation is a minimum 3 months before the expiry of the contract period.

Following cancellation of the contract the seal must be returned without delay at the end of the contract period.

#### **7.2.6 Random checks**

To ensure compliance with the VDA criteria, the VDA QMC carries out on-site inspections at no cost to the car-wash operator.

If deficiencies are found, the operator will be invoiced for the costs involved in follow-up inspection and approval (travelling costs, hourly rates, test/inspection equipment) depending on the amount of work involved. However, this applies only if the deviations cannot be corrected immediately in the course of the inspection.

### **7.2.7 Withdrawal of the seal**

If the VDA criteria are not fulfilled, the operator will initially be given the opportunity to return the car wash, the wash materials or the wash chemicals used, immediately to VDA conformance in the presence of the VDA inspector. If this is not immediately possible, the operator will have one week to re-establish VDA conformance. As soon as he is ready for a new check for VDA conformance (this will be at the operator's cost) the operator will agree with the VDA inspector on a date for the re-examination.

If the operator is not prepared to re-establish conformance of the deficient parts of the overall installation, or if he exceeds the period of one week to do so, the seal will be removed immediately and taken from the car-wash by the inspector.

If this is not possible, the period for the return of the seal is 2 weeks maximum. Any annual fees already paid will not be reimbursed.

### **7.2.8 Handling complaints**

With the display of the VDA seal, the operator of a car wash conforming to VDA regulations accepts that he must meet the requirements of customers regarding the car washing processes. Because of this, a standard procedure for handling complaints is recommended.

Any damage to customers' vehicles should be logged, using the report form shown in Appendix A. As a minimum, data must include the type of damage, the type of vehicle, its mileage and its age.

Completed forms should be sent to the BTG in Minden for central logging.

## 8 Auditors, inspectors, experts and laboratories

Function	Object	QM evidence	Execution	Positive result	Monitoring	Damage assessment
Manufacturer	Technique	certified	Self-declaration	Gets signet and can declare conf.	VDA auditor	VDA inspector
Manufacturer	Technique	not certified	VDA auditor	Gets signet and can declare conf.	VDA auditor	VDA inspector
Manufacturer	Component	certified	Self-declaration	Gets signet and can declare conf.	VDA auditor	VDA inspector
Manufacturer	Component	not certified	VDA auditor	Gets signet and can declare conf.	VDA auditor	VDA inspector
Manufacturer	Chemicals	certified	Self-declaration	Gets signet and can declare conf.	VDA auditor	Accredited laboratory
Manufacturer	Chemicals	not certified	Accredited laboratory	Gets signet and can declare conf.	VDA auditor	Accredited laboratory
Operator	Car-wash	Confirmations exist	Self-declaration	Seal granted	VDA inspector	*A
Operator	Car-wash	No evidence of conf.	VDA inspector	Seal granted	VDA inspector	*A
Operator	Car-wash	No evidence of conf.	*A	Seal granted	VDA inspector	*A

Konf = Certificate of conformance

\*A = Officially appointed and sworn expert

Table 3: Matrix of responsibilities

Function	Object	QM evidence	Execution	Positive result	Monitoring
Accredited laboratory	Chemicals	Accredited	DAkkS	Accredited to DIN EN ISO/IEC 17025	DAkkS
VDA auditor	Technique Components Chemicals	Certified	VDA QMC	Qualified and authorized	VDA QMC
VDA inspector	Technique Components Car-wash	Certified	VDA QMC	Qualified and authorized	VDA QMC
*A	Car-wash	Requirements met	IHK	*A	IHK

DAkkS = Deutsche Akkreditierungsstelle GmbH  
(German accreditation department Ltd.)

IHK = Chamber of trade and industry

\*A = Officially appointed and sworn expert

Table 4: Qualifications matrix

### 8.1 Auditor qualifications

VDA auditors who are to be employed on behalf of the VDA QMC for the verification of manufacturers' data within the framework of audits of products conforming to the VDA specification must meet the following criteria:

- Qualifications based on DIN EN ISO 19011
- At least 6 years of practical experience in the automotive sector, with at least 2 of these years in the field of quality management
- Demonstrable knowledge of automotive-specific quality techniques
- Experience with internal system audits or supplier system audits in manufacturing organisations in the automotive industry, plant manufacture and the chemical industry.



VDA auditors must not be biased, nor may the auditor have a conflict of interests in regard to the organisation to be audited.

Any relationship representing a risk to a lack of bias and independence can be based on ownership conditions, company directors and /or management, work-force, mutually employed resources, finances, contracts, advertising, the payment of sales commission or other inducements for the recommendation of new customers.

## **8.2 VDA inspector qualifications**

VDA inspectors carrying out on-site inspection of VDA-approved car washes with the authority of the VDA QMC must meet the following criteria:

- Completed technical education or technical college studies
- At least 6 years practical experience in the automotive sector
- Participation in the VDA QMC 2-stage qualification training as VDA inspector
- Experience in organisations in the automotive industry, plant manufacture, the chemical industry or the car wash sector
- In the same way as described in Section 8.1, VDA inspectors must neither be biased nor have a conflict of interests in regard to the organisation to be audited

## **9 Standards quoted in this publication**

- DIN EN ISO 9001
- DIN EN ISO 19011
- DIN EN 573
- DIN 12373-4
- DIN EN ISO 9227

## **10 Appendix**

**Appendix A** Complaint report

**Appendix B** Certificates of conformance

**Appendix C** Signets

**Appendix D** Check-list for manufacturer audits

**Appendix E** Check-list for on-site inspections

## APPENDIX A

<b>Complaint report</b>	
<b>ID of the car wash in the VDA data base</b>	
E-mail of person reporting	
Date when damage occurred	
<b>Alternative obligatory fields</b>	
Car wash operator	
Post-code	
City	
Street	
Contact person	
E-mail of person reporting	
<b>Type of car wash</b>	
Manufacturer	
Type of car wash	
Type of wash materials	
<b>Vehicle marque</b>	
Vehicle model	
First registered	
Mileage	
Form of bodywork	
Damaged item	
Type / description of damage	
<b>Comments:</b>	
<b>Signature of the person making the report:</b>	

APPENDIX B



(Logo of the company displaying the declaration)

**Declaration of Conformance**

**Smith Chemicals Ltd  
17 Main Street  
00000 Smithville**

confirms that the chemical product

**(product name, type, etc.)**

conforms to the requirements of the

**VDA publication: "Car-washes ", 2<sup>nd</sup> edition**

The declaration is issued for

(Company)

(Date of conformance checks)

Authorised person

Smithville, dated:

(Logo of the company displaying the declaration)



## Declaration of Conformance

**Smith Car-wash Technics Ltd**  
**17 Main Street**  
**00000 Smithville**

confirms that the car-wash

**(title or description of the car-wash, product name, etc.)**

conforms to the requirements of the

**VDA publication: "Car-washes", 2nd edition**

The declaration is issued for

(Company)

(Date of conformance checks)

\_\_\_\_\_  
Authorised person

\_\_\_\_\_  
Smithville, dated:

## APPENDIX C



### Wash chemicals



### Car-wash technology

### Car-wash operators (advertisement and marketing)

The trademark “VDA”, VDA signets and VDA seal must not be combined with the company's or other logos.

## APPENDIX D

### Manufacturer audit check-list

The areas development, documentation, etc. have to be evaluated during the audit by checking the type and extent of approval tests which have been carried out, as well as the plausibility of these results

- To what extent were the criteria of the VDA publication taken into consideration during development of the registered products; including the definition phase of the specification?
- What tests were carried out to confirm that the products comply with the VDA publication?
- How have these tests and their results been documented? (traceability)
- What actions have been taken, if necessary, to achieve conformance with the VDA publication?
- Were conformance tests then carried out again (similar to the above)?
- How is the conformance of the registered products ensured and monitored during production and on site at the end-customer's premises?

The above points must be examined not only for the registered car wash technology but also for the registered wash chemicals and any other wash components.

In addition, with regard to car wash technology and wash components, the actual loads on the vehicle must be checked in at least one of the manufacturer's installations, with the aid of the VDA test vehicle.

## APPENDIX E

### On-site inspection check-list

Check for the presence in the documentation file of all the documents required for granting of the VDA seal:

- Certificate / declaration of conformance for chemicals
- Certificate / declaration of conformance for the technique
- Certificate of conformance for wash components (e.g., wash materials)
  - Pull-off forces (Section 5.4.3)
- Safety data sheets
- Compare documents with the materials and equipment used
- Check the pH values of the cleaners (including those used in the manual pre-cleaning processes)
- Check for any apparent structural changes (dosing equipment, nozzles, etc.). Check that the actual settings of equipment are consistent to the setting reports
- Visual check on the chemicals used (odour; colour)
  - In case of doubt, take samples and arrange analysis
- Check display panels showing permitted vehicle dimensions, particularly in unattended installations (Section 5.1.1.).
- Display panels in self-service car-washes
- If appropriate, measure geometric parameters
- If appropriate, measure the effect of the water jet (high pressure)
- Measure forces actually applied to attached components
- Check the convertible program if this is fitted
  - Setting angles and height of nozzles
- Check the operation of the car-wash for conformance





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Qualitäts Management Center im  
Verband der Automobilindustrie