



Rays of sunshine

Important information about paint in the classic car and automotive sector

The world of colours and thus of paintwork in the automotive sector is fascinating and covers many topics, which we would like to outline here.

One phenomenon and an almost daily topic is colour rendering and colour measurement, the painting of adjacent components, the angle of incidence of light and the associated problems and issues.

Why are butterflies so colourful? How are the colours created?

You can find some of the most colourful creatures on our planet among butterflies. Millions of tiny scales, arranged like roof tiles on both sides of the four butterfly wings, are responsible for the enormous variety of colours and drawings. Each individual tiny scale has formed from a single cell and corresponds to a hair. These microscopically small structures are responsible as carriers for the bright colours of the butterflies, their patterns are created according to the different arrangement. The wing colouring of butterflies can be produced either by pigment or also structural colours, and usually a combination of both is present.

Pigment colours

... are chemical compounds that are formed during metabolic processes and absorb light of very specific wavelengths. Many butterflies have a high black content in order to be able to store heat. Melanin, which produces this black or even brown colouration, is therefore a particularly common pigment.



Here you can see the pigmentation of a butterfly wing greatly enlarged.

Flavones are responsible for the cream and yellow colouration of some butterflies. Flavones are end products of plant substances that the butterfly takes in as food during the caterpillar stage and stores in its body. Green pigments in the caterpillars come from the pigment chlorophyll in plants. Other pigments provide white, orange, yellow and red tones. Very freshly hatched butterflies are the most intensively coloured, as the pigments can still develop their full power here. Sunlight bleaches them more and more during their life.

Structural colours

... in contrast to chemically produced pigment colours, are created by the physical properties of the butterfly scales. The most magnificent shades are created by light reflections on the surface structure of the scales. The scales do not have a smooth surface but are usually divided longitudinally into ribs.

These structures refract the light and determine the colour impression depending on the angle of incidence. The phenomenon of an iridescent butterfly, especially with blue or even green colours, is caused by these structural colours.

It is rare for a butterfly wing to appear colourful by structural colouring alone, usually it is a combination of both possibilities, with pigment colours often sitting below the structural colours.

So how do you determine the right colour?

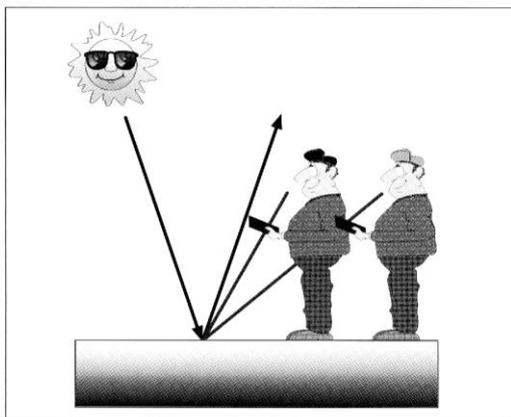
Solid colours, which appear the same from all directions, have no directional reflection except for gloss effects. It is different with metallic and pearlescent paints. These have pigments that reflect the incident light rays like a mirror: Angle of incidence equals angle of reflection - this is the physical law of directional reflection.

However, since the light is reflected in a concentrated way at an angle of reflection and no colour can be discerned, the colour is observed slightly away from this angle of reflection. This so-called difference angle can be, for example, 15°, 25° or even 70°.

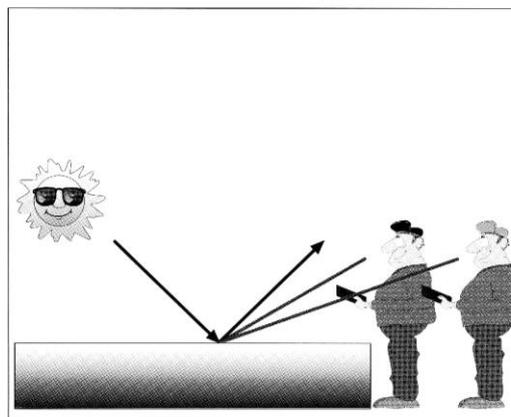
In the case of special-effect colours, these angles play an important role in that clear differences in colour can be observed.

The point of view of the observation is very important for the reasons mentioned. The correct assessment of a fabre on a vehicle depends on the geometries resulting from the lighting and the observation. If the vehicle is standing in the midday sun, the light rays are reflected directly upwards from the bonnet (diagram 1). Assuming a bonnet height of 90 cm above the ground, two test subjects of different heights would each observe a different colour at a distance of 50 cm.

Other location = other angle



Bei steiler Sonneneinstrahlung müssen sich unsere beiden Karosseriebauer über die Farbprobe beugen oder sich auf sie stellen, um die entsprechenden Differenzwinkel zu beobachten



Bei flacherer Einstrahlung müssen sich beide Karosseriebauer neben die Probe oder weiter von ihr entfernt aufstellen, um die gleichen Differenzwinkel wie in linker Grafik einzunehmen

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1 Types of lacquer

When a classic car is to be restored, modern lacquers are often used. The reasons for this are obvious: they are easily accessible, adapted to modern painting techniques, inexpensive, durable, and easy to apply. Even though restorers could fall back on old varnishes such as linseed oil, nitro, or alkyd resin varnishes for reasons of originality, this often does not happen because, on the one hand, their processing is very labour-intensive and requires a great deal of expertise, and on the other hand, the old varnishes fall under the Ordinance on the Limitation of Emissions of Volatile Organic Compounds (ChemVOCFarbV for short).

This rule is also confirmed by an exception: Under § 3, paragraph 3b, the ChemVOCFarbV permits the sale, purchase, preparation, and application of limited quantities of the old paints for vintage cars that are classified as being of special historical and cultural value. However, permission must be obtained from the competent authority for each individual case. Link to the site:

<http://www.gesetze-im-internet.de/bundesrecht/chemvocfarbv/gesamt.pdf>

Thus, nitrocellulose paints, for example, may still be used, even if they are only offered by very few manufacturers and in small quantities (cf. info box), in compliance with the 31st BimSchV (Ordinance on the Implementation of the Federal Immission Control Act). For paint shops, it is therefore important to involve the owner and a specialised expert in the decision whether to work with historically correct or modern paint materials for a vehicle of historical and cultural value - this can also be an early VW Beetle or an EMW 327 convertible, depending on the interpretation and the expertise of the authorities. Only a specialised expert can assess whether the use of modern paint materials results in a reduction in value.

1.1 Linseed oil copal paints until approx. 1910

Until about 1910, the body panels were still painted with linseed oil copal paints. The topcoat consisted of a binder, a mixture of linseed oil and natural resin, and pigments for colouring, mostly carbon black. Black was therefore the most used colour. All other colours were very expensive. Painting was done with a brush; the paint was thinned with alcohol. Impregnating agents for the wood did not yet exist. The addition of alcohol made the painter's work very dangerous because of the explosive vapours that were produced. The biggest problem, however, was the long drying times and the sensitivity of oil paints to dust. Thus, the curing of the paint coat took up to 8 weeks.

Properties:

- *Flash-off and drying time: at least 8 weeks.*
- *Application with brush stroke*

1.2 Shellac based on animal resins from 1910 to 1920

From 1910 to 1920, shellac based on animal resins was used. This required a drying time of four to eight weeks, which prevented series production on the assembly line. It was only later that the drying time for car bodies could be reduced to about half by using heated drying rooms and shellac mixed with methylated spirit.

Properties:

- *Flash-off and drying time: 4-8 weeks*

1.3 Nitrocellulose base from 1920

From 1920 onwards, the newly developed nitrocellulose-based lacquer, cellulose nitrate lacquer, or nitro lacquer for short, was used sporadically, and then increasingly from 1925 onwards.

In Germany, this lacquer was known as Protol from Farbwerke Zoellner, Berlin. From this, chemists developed a varnish that above all had the property of drying in 15 hours. On the other hand, nitro varnish was not weather-resistant. The binder of this lacquer quickly evaporated, and the lacquer surface became dull and unsightly. The old shine had to be restored by time-consuming polishing. However, it was the Americans who made the first move. In 1923, General Motors and Ford painted their cars with the new dye. The drying time could only be reduced considerably using drying ovens, which a car body ran through in 5 hours on rails at a temperature of 60-70 degrees Celsius.

From 1926 onwards, the rational nitrocellulose paint process became established at Opel. The paint was no longer laboriously applied with a brush, but with a spray gun - a huge technical advance. Chemically, the new car paint is based on a raw material that was used as gunpowder in the First World War - nitrocellulose. The spray gun evolved from a compressed air atomiser developed by an American country doctor for spraying the throat with antiseptic agents. And the solvent required for thinning paint was produced during experiments conducted by the chemist and later president of Israel, Chaim Weizmann, to ferment corn and sugar into acetone - butanol. Coincidence has played a major role in improving automotive painting technology.

Frequent polishing required.

In 1923, General Motors was the first car factory to use the new process. Ford and Chrysler follow at a short distance, and in 1926 Opel is among the first European manufacturers to use nitrocellulose paints. According to Frankfurt-based Hoechst AG, the new "NC" paints reduced the time needed to paint a car body from 336 to 15 hours, and the number of manual operations from 2400 to 600.

Around 1929, the structure of a car paint job looked like this (source Hoechst): "Primer with lead white paint based on linseed oil and wood oil, boiled down with Albertol; two coats of oil spray spackle; insulating intermediate coat of "Japan-Color"; two topcoats of "Nitrokombi enamel", consisting of 16% nitro wool, 8% plasticisers, 3% stand oil, 7% Albertol.

But for all the euphoria about the new technology, car manufacturers are also quick to recognise the specific problems that the nitro paint process entails without careful priming, nitro paint adheres very poorly to metal. Moreover, it is not weatherproof: nitro-painted car bodies must be carefully polished by hand at intervals of a few months - a time-consuming and laborious job. Cars that are not polished regularly soon look dull and sad.

Opel started using electric polishing machines in the paint department as early as 1926. At first, the workers only protect themselves from the spray mist with simple face masks. Extraction and respiratory protection devices are only introduced later. While the nitrocellulose paints initially dried in the air, from 1928 drying ovens accelerated the curing process. Also, from 1928 onwards, Opel primed the bodysHELLS in an immersion bath - a process that was still unprecedented in Germany.

Important preparation for the nitro painting was the preparation of the substrate, i.e., thoroughly cleaning and degreasing the body panels...A nitrocellulose primer was

sprayed as the first coat. Then, after drying ... with heat applied ... any necessary imperfections were smoothed out with nitrocellulose filler ... After the filler had dried and been sanded, at least three cross coats of nitrocellulose filler were applied. The whole body was then sanded manually with water and sandpaper. After thorough cleaning of the body... with appropriate intermediate drying or evaporation, three to three and a half cross coats of nitrocellulose topcoat... could be sprayed. After drying again, the topcoat was sanded with the finest sandpaper. After drying and cleaning, the body was sprayed again with very diluted nitro topcoat or with pure nitro thinner. By fogging, the surface of the paint was dissolved and smoothed to a certain extent. The rest of the smoothing work then had to be done laboriously by polishing with sanding paste and by hand with polishing water... Nitro paints were not weather-resistant. The binder quickly degraded, and the paints became dull. By polishing again, the paintwork (later by the car owner or his chauffeur, author's note) had to be brought back to shine." Excerpt from Chor, Klaus and Ledwoch, Klaus-Dietrich: Glänzende Partnerschaft- 100 Jahre Automobil u. Lack. Munich 1986. 1st edition. p.56 u.58

In the car industry, or more precisely: in car series painting, alkyd/melamine stove enamels dominated from 1954 onwards for initial painting; for touching up, there were the nitro enamels or nitro combination paints. The latter were also used in the car factory to repair minor damage to the painted body. The advantage was that they could be repaired locally in the factory and the repaired area could be polished after rapid drying in the air. As late as the 1960s, a litre of Nitro-Kombi paint in the colour of the car was provided with each new Mercedes for the buyer of the new car.

Nitro combination paints consisted essentially of nitrocellulose, air-drying and non-air-drying alkyd resins, plasticisers, pigments, and solvents.

Disadvantages were the low weather resistance of the nitrocellulose paints; the gloss quickly diminished over time. In many shades, e.g., those based on red pigments, the colours also faded.

Between about 1920 and 1960, there were only two production methods for the paint systems described: the three-roller, mainly for inorganic pigments, and the ball mill for carbon black and organic pigments. Additives for pigment wetting of organic pigments that were difficult to disperse were unknown; this required residence times of 48 to 72 hours on the ball mill. The first additives, simple ones such as zinc naphthenate or soya lecithin, were available from around 1960 for some of these difficult pigments.

Today, dispersing pigments with the help of special additives offered by several well-known manufacturers is a matter of course.

Properties:

- *Flash-off and drying time: 15 hours, this can even be reduced to 5 hours by using drying ovens at a temperature of 60- 70 degrees Celsius.*
- *Not weather resistant.*
- *Paint surface becomes dull and unsightly after "a short time"*
- *The lacquer is applied with a spray gun.*

1.4 Synthetic resin lacquers

1.4.1 One-coat - 2-component (2K) topcoat systems

With "1-layer", "2-component" or "direct gloss" systems, a cross-linking of the resin is initiated by adding hardener (usually in a ratio of 2:1, fast or slow) and thinner (to adjust the drying speed, fast or slow, usually approx. 10%), which then leads to a complete curing of the material as a chain reaction.

With one-coat systems, only solid colours can be produced, i.e., none of today's metallic or pearl-effect colours.

Single-coat paints offer useful protection against mechanical and chemical stress as well as against environmental influences but are clearly inferior to two-coat systems in terms of UV resistance and protection against chemical and mechanical influences. Modern clearcoats offer excellent protection against UV radiation, which is clearly visible when comparing single-coat paints, e.g., red Golf I from the 1970s with today's red colour shades. The old single-coat system also clearly comes out on top when comparing resistance to scratches, e.g., in car washes.

Paint level and depth cannot be compared with two-coat systems. Directly after painting, the gloss level will be the same, but the impression of depth or the rich paint level achieved with two-coat systems cannot be achieved with a topcoat system. The only solution: paint with topcoat and then overcoat with clearcoat (after intermediate sanding or before final cross-linking, i.e., after the first flash-off of the topcoat. However, caution and experience are necessary here, as boiling (due to solvent inclusions) may occur.

The polish ability is usually much worse than with two-coat systems, because when polishing the topcoat, colour pigments are also polished immediately. Often, these then discolour due to the heating, which leads to visible polishing marks.

Single-coat systems (2K paints) are used today almost exclusively for commercial vehicles, cheap buses, agricultural vehicles, etc. The use of 2K paints is not a problem. Since the beginning of the 1990s, only two-coat systems have been used for original equipment, and in the meantime almost exclusively two-coat systems are used for repairs, even for solid colours, because it is not worthwhile for the workshop to stock the entire system for a few repairs.

1.4.2 Two-coat basecoat systems

In the two-coat system, the colour coat (basecoat), which offers no protection, is applied first and then, after the carrier (organic solvent or water) has evaporated, a 2-component (2K) clearcoat is applied in HS (high solid, high solids content or low solvent content, thus more economical than MS) or MS (medium solid, higher solvent content, thus cheaper than HS).

The basecoat does not produce a glossy surface but becomes matt after evaporation ("flash-off") of the carrier (water, solvent). Depending on the system and temperature, this takes about 5 min. After applying the second basecoat layer and renewed flash-off and matting, the clearcoat can be applied.

Basecoat systems are available as water- or solvent-based paints (water since 1992 ICI or 1994).

Basecoat-clearcoat systems are now standard in original equipment. As a rule, water-soluble basecoats and high-solid clearcoats are used, and in some cases even powder clearcoats that no longer release any solvents.

For the repair of two-coat painted cars, two-coat systems should always be used, even for solid colours. With metallic, pearl effect, xiralllic or effect colours, there is no choice anyway, but even with solid colours, a one-coat repair of a two-coat painted car will always be visible. The basecoat systems of the major manufacturers are usually mixed with approx. 50% basecoat thinner to achieve the correct spray viscosity.

2 Paint colours

Our forefathers already used the trick of blackening the individual filler or paint coats. They used pine soot for this purpose, which clearly showed the depressions that were still present. After two coats of undercoat in the desired colour, two more coats of so-called half-paint followed, which were covered with sanding varnish after intermediate sanding. And on top of that, after a longer drying break of one to two weeks and preceded by fine sanding, the final coat was finally applied with rich topcoat. So, the total production time for this super finish took at least four weeks, often eight weeks.

Henry Ford initially painted his Model T in different colours, but then exclusively in black. Opinions differ as to the reason for this. On the one hand, a single colour shade is seen as a rationalisation measure, on the other hand, it was assumed that the pigments of the black colour shade would dry the fastest.

Factory-produced paints were not available until the beginning of the 20th century. Before that the painter had to make his own paints.

In the twenties, there was only a small choice of colours - red, blue or green. It was not until 1928, with the fashionable appearance of multi-coloured paints, the colour white was introduced.

2.1 Colour measurement

Before an original car paint can be added to or completely reapplied using the same technique, restorers must determine what type of paint was originally used. The first test is to check the non-polar solubility of the paint. Non-polar varnishes, such as nitrocellulose, amber or copal varnishes, are dissolved by petrol or turpentine. Polar paints, such as glue or plastic dispersion paint, are dissolved by water and alcohols and are therefore not used in vehicle construction. Once the result has been determined, the solvent of the paint and the elements contained in the paint (pigments, etc.) must be analysed by means of a chemical analysis in specialised laboratories. Of course, many paints can also be identified by the year of manufacture of the vehicle and thus by the paint systems used at that time, provided that the manufacturer's paint history is known. Nevertheless, there are often doubts, especially with exotic vehicles or those where new paints have been introduced. For the chemical analysis, we therefore work together with the paint laboratory of the Bavarian State Office of Criminal Investigation in Munich.

Colourimeters and spectrophotometers are the two types of colour measuring instruments used to record, analyse, and communicate colours. In almost every industry where colour accuracy is important, colour measurement is an essential part of the production process.

2.2 Colourimeter

A colorimeter is a tristimulus colour measurement device that provides an objective assessment of colour characteristics based on the light that passes through the primary filters for red, green, and blue. It simulates how the human eye perceives colour.

Device features

- *Compact size and high mobility*
- *Cost effective option for simple applications.*
- *Simpler functionality*

How it works:

1. *the sample is illuminated by an internal light source at an angle of 45°.*
2. *light passes through the tristimulus filters representing the amount of red, green, and blue light reflected from the sample.*
3. *the measurements of the filter are quantified into RGB values that simulate the light sensitivity of the human eye.*

Common applications

- *Simple colour recognition*
- *Comparison of similar colours and hues*
- *Measurement of colour strength*
- *Measurement of colour fastness*
- *Colour quality control*
- *Reference source for the determination of colour standards*
- *Assessment of non-metameric colour batches*

2.2.1 Spectrophotometer

A spectrophotometer is a more complex colour measurement device that considers light intensity as a function of colour. In contrast to the tristimulus method of a colorimeter, it performs a full-spectrum colour measurement and generates colour data that is not visible to the human eye.

Instrument features

- *Benchtop or portable models - compare our benchtop instruments.*
- *Higher quality solution for complex colour requirements*
- *More functionality*
- *Higher precision with full spectrum colour measurement*

How it works

1. *an internal light source hits the diffraction grating, which acts as a prism that splits the light into different wavelengths across the colour spectrum.*
2. *as the grating rotates, only one wavelength of light at a time reaches the exit slit and interacts with the sample.*

3. *The detector measures the light intensity, transmittance, and absorption of the sample.*
4. *the spectrophotometer displays this information digitally.*

Common applications

- *Colour measurement*
- *Colour formulation*
- *Monitoring colour accuracy throughout production*
- *Maintaining colour consistency throughout the supply chain*
- *Detection of metamerism*
- *Measurement of opacity and haze*
- *Colour quality control*
- *Detection of impurities*

3 Paint film thickness measurement

So why a paint film thickness measurement?

The paint film thickness gauge provides you with important information and can save you from making the wrong decision when buying a used car or used vehicle.

A coating thickness gauge is ideal for locating changes in the surface (e.g. paintwork) and helps you to detect indications of possible accident damage and re-treatment. The coating thickness gauge is ideal for quality monitoring during anodising, galvanising, electroplating, material testing in production, incoming and outgoing inspection as well as for measuring the paint layer / lacquer coating e.g. in the automotive sector. Localisation of substrate changes (filled holes/ filled dents) and repainting. Poorly filled and uncleanly painted surfaces can cause much more than just visual defects.

- *Rust pockets develop and lead to further damage.*
- *Filler mountains can indicate accident damage.*

3.1 Recognising initial paint and subsequent paint application

- *Rough guide value: up to 100µm the layer is too thin from 200µm onwards it could have been filled and repainted. (This varies from manufacturer to manufacturer)*
- *In addition, use a suitable paint thickness gauge (coating thickness gauge) and check the paint thickness every 30 centimetres around the vehicle. You can find information on the requirements for the device in our comparison or below.*
- *Visually inspect the paintwork for dull spots, colour differences, paint noses etc. These often indicate not only visual defects, but can also be signs of larger, non-obvious damage.*
- *If there are more stone chips and scratches on the side skirts on one side of the car than on the other. (This is normal damage caused by e.g., rolling grit).*
- *Check gap dimensions on doors for gross deviations.*

- *Check the last TÜV report. If rust spots and damage were noted, these spots can be checked. If these areas have changed or are no longer visible, caution is advised!*

A deviation of approx. 200µm (micrometres) from the original value is considered a repaired surface.

*For comparison: A hair has a thickness of 50µm (0.05 mm).
Here, a distinction is made between layer thicknesses:*

- *Target layer thickness: Specified layer thickness for individual coatings or the entire system to fulfil the protection periods.*
- *Minimum layer thickness: Must be adhered to on each of the components.*
- *Dry film thickness: This is the actual final film thickness after curing of the coating.*
- *Maximum Film Thickness: The highest film thickness allowed without affecting the properties of the individual film, or the entire coating system.*

3.2 Coating thickness measurement on metallic substrates

Non-destructive, tactile coating thickness measurement on metallic substrates can be roughly divided into two measurement methods:

- Measurement on ferromagnetic substrates, for example on iron or steel: The type of substrate and the associated measurement mode are usually referred to as Fe for short. Methods that make use of magnetic induction are used here. A magnetic field is generated by a permanent or electromagnet and measured with a Hall sensor (electro- or permanent magnet possible) or a secondary coil (electromagnet only).

- Measurement on non-ferromagnetic or non-ferrimagnetic but electrically conductive substrate; for example, on aluminium, zinc, copper, brass, and certain types of stainless steel: This type of substrate and the associated measurement mode are designated NFe. The eddy current method is used for these coatings.

On the one hand, coatings of non-magnetic but electrically conductive layers or metals such as chromium, zinc, or tin on magnetic base materials such as steel or iron (Fe) can be determined. In addition, users can also determine the layer thickness of electrically insulating layers of anodising or lacquer on non-ferromagnetic but electrically conductive base materials such as aluminium (NFe).

These include, for example:

- *Aluminium (for example in aircraft construction as well as in frame and body construction for motorbike and car manufacturers).*
- *stainless steel*
- *Copper (for example in pipe systems)*
- *magnesium*
- *Zinc (for example, the coating of a hot-dip galvanising line)*

3.3 Paint film thickness measurement on non-metallic substrates such as GRP and CFRP

The coating can be made of many different materials. We can measure the thickness of the following example surfaces non-destructively with our coating thickness gauges:

- Anodising (thickness between approx. 8 μm - 20 μm)
- Foils (approx. 260 μm)
- Electroplated coatings (5 μm - 30 μm)
- Anti-corrosion coatings (from 120 μm)
- Lacquers (between 100 μm - 200 μm thick)
- PTFE (for example known as Teflon coating in pans) (approx. 100 μm)
- Powder coatings (up to 150 μm)
- Enamel coatings (for example enamel) (from 500 μm)

3.4 Measurement procedure

Various common measuring methods are used:

- Magnetic induction with electromagnet and measurement with secondary coil (magnetic inductive measurement method) - DIN EN ISO 2178
- Magnetic induction with electromagnet and measurement with Hall sensor - DIN EN ISO 2178
- Magnetic induction with permanent magnet and measurement with Hall sensor - DIN EN ISO 2178
- Eddy current method - DIN EN ISO 2360

3.5 Correct use

Every coating thickness gauge is subject to many error influences that affect the accuracy of the measurement result. The most important influencing factors are.

- temperature changes,
- the material properties of the base substrate,
- the geometry of the measured object.
-

High-quality coating thickness gauges have very good temperature compensation. Nevertheless, users should always check the accuracy of the results when measuring the coating thickness in the case of strong temperature fluctuations. This can be done, for example, with an uncoated substrate (the reference plate) and a calibration standard (the calibration foil). If you as a user find unacceptable deviations in the measurement of the coating thickness, the measuring device should be adjusted.

In most cases, the material properties of the substrate can be compensated by an adjustment (often also called calibration). Common methods are:

- Zero-point adjustment: normalisation on the uncoated substrate
- Single-point adjustment: adjustment with a calibration standard of known thickness
- Multi-point adjustment: Adjustment with several calibration standards of known thickness.

Whether the geometry of the measured object - for example in the case of curvatures - has an influence on the measurement result can be checked in a first step by referring to the manufacturer's specifications in the data sheet. In borderline cases or if there is any doubt, the accuracy of the instrument must also be checked with calibration standards on the uncoated substrate and adjusted if necessary.

4 Coating repair process

Only a little damage, but a lot of work.

One should not underestimate the lacquer repair process and proceed carefully:

*Cleaning and assessing the damage.
Silicone remover (solvent-based/water-based)*

Prepare to measure the colour tone.

- *Clean and polish the measuring point near the damage.*
- *Clean the measuring point with mild detergent and then polish it up with a suitable polish and polishing machine*
- *Polishing by hand is not possible*
- *Clean again with silicone cleaner before measuring*
- *Heavily scratched and weathered surfaces should be sanded with P 3000 sandpaper (Trizact, Abralon 3000-4000) before polishing*

Sanding out damage:

*Sand out the damaged area
dry with P180 -P320
Dry large area of transition zone
Fine sand with P400*

Cleaning:

before trowel application

Filler application

Soft putty

Important:

After sanding, the filler should only be left on a bare substrate

Cleaning Silicone Remover

*Filler application only on bare substrate
When sanding, ensure that no 100 grit is skipped!*

Filler sanding

*Dry sand the filler with an eccentric and P180 - P320.
Dry fine sand transition zone over a large area with P400.*

Cleaning:

Before applying the primer.

Application of primer

Flash-off time (spray can) 10 -15 min. 20°C

Application of 1C Filler Primer in 1 -2 spray coats

Application Filler

Intermediate flash-off time 8 min. 20°C

Final flash-off time 10 min. 20°C

Application of filler in 1 -3 coats

Drying Filler

IR drying:

2 min. 50% and 8 min. 100%

Or

Oven drying

30 min. 60°C

Overnight drying

Filler sanding

Application of control black

Dry sanding with P400 and eccentric

Corners and edges: Use of soft back up and pads to avoid sanding through to avoid sanding through

Pre-treatment of the painting area

Treat the entire painting area carefully with a suitable abrasive, e.g. Scotch Brite grey/gold, Abralon 2000, Abranet 2500 or TrizactPrep 1000.

Tip:

An eccentric sanding leaves a fine and homogeneous surface.

Cleaning:

Clean again before masking.

Pre-treatment and cleaning

Blow out with compressed air with the aid of a dust-binding cloth.

Careful cleaning is necessary before applying the water-based paint

Basecoat application

Application in 1.5 spray coats (1 work step) Waterborne basecoat

Important:

The waterborne basecoat should be applied at a diagonal angle to avoid the undesirable light/dark effect (grey bar).

Final flash-off time: 15-25 min. 20°C

Application of clearcoat

Application of VOC

*Clearcoat in 1.5 coats (1 coat)
Level the overlap zone with Smart Blendplus.
Final flash-off time: 5 -10 min. 20°C
Oven drying: 30 min. 60°C object temperature*

Finish

Removal of dust particles, if necessary

Tip: The trolley should be washed before being handed over to the customer.

5 Paint defects

Typical paint damage in classic cars

5.1 Progressive disorders (orange peel skin)



5.1.1 Causes

- *Different spraying pressure, spraying viscosity, spraying technique or processing temperature*
- *Unsuitable solvent combination*
- *scarred substrate*
- *Unsuitable spray gun (nozzle)*
- *Temperature too high*
- *too high material application*

5.1.2 Avoidance

- *Follow the processing instructions in the technical data sheet*
- *Proper substrate preparation*
- *Use a suitable spray gun (nozzle)*
- *Use the prescribed thinner*
- *Avoid application at too high temperatures*

5.1.3 Solution

- *Sand and polish, worst case sand and paint again,*

5.2 Matting/Gloss

5.2.1 Causes

- *Excessive film thickness/air humidity*
- *Substrate can be dissolved*
- *Curing error or hardener had already reacted with moisture*
- *Incorrect dilution*
- *Insufficient fresh air supply*
- *Drying interrupted*
- *clear coat applied too quickly*
- *wrong polish applied too early*

5.2.2 Avoidance

- *Observe the processing instructions in the data sheet*
- *Close hardener containers*
- *Ensure sufficient fresh air supply during drying.*
- *Do not interrupt forced drying*

5.2.3 Solution

- *Sand, polish, grind, repaint*

5.3 Fading / colour change

5.3.1 Causes

- *Exposure of certain colour pigments in the paint to UV rays*
- *Low-quality varnishes with little or no UV protection*

5.3.2 Prevention

- *Protection by regular application of wax polish*

5.3.3 Solution

- *can be partially eliminated by machine polishing with fine abrasive paste*
- *Avoid excessive polishing; can be checked with a film thickness gauge.*
- *Repaint if necessary*

5.4 Bird droppings

5.4.1 Causes

- *Acid in bird droppings can penetrate the paint film and cause various types of damage ranging from light stains to effects on the zinc coating.*

5.4.2 Avoidance

- *Remove bird droppings as soon as possible*
- *Protect the paintwork regularly with a high-quality wax polish.*
- *Avoid parking under trees*

5.4.3 Solution

- *Cover with damp paper towel and allow to act for a few minutes*
- *Remove paper and wipe off bird droppings, allow to dry*
- *Stains can be removed by polishing the affected area; in the case of more severe damage to the paintwork, sand down and rebuild the paint structure*

5.5 Rust

5.5.1 Causes

- *Moisture ingress through cracks in the paint film*
- *Exposed bare metal*
- *Climate and time influence the extent of rust damage*

5.5.2 Avoidance

- *frequent washing and application of wax polish, especially in winter*
- *repaint broken paint surfaces immediately to avoid rust damage*

5.5.3 Solution

- *Sand affected paint areas, sandblast heavily affected areas*
- *Treat with neutralising acid*
- *Repaint with an approved paint system*

5.6 Damage caused by washing the car

5.6.1 Causes

- *damaged or dirty brushes in automatic car washes*

5.6.2 Avoidance

- *Avoid automatic car washes*

5.6.3 Solution

- *Scratches can be removed by machine polishing with fine abrasive paste.*
- *Avoid excessive polishing; can be checked with a film thickness gauge.*

5.7 Stone chip damage

5.7.1 Causes

- *Damage to the paintwork due to stones that have been thrown up*
- *can lead to rust damage in extreme cases*

5.7.2 Avoidance

- *Cover endangered areas with plastic foil*
- *Mud flaps can reduce damage in the area close to the ground*
- *Use paint systems recommended by the vehicle manufacturer (see Approval Systems)*

5.7.3 Solution

- *Very small areas can be repaired by light touch-up, but must be provided with clearcoat protection.*
- *Correct damage repair is only possible by supplementary painting or complete painting.*