FIVA Charter of Turin Handbook
Paint Supplement 2.0
February 2023

1 Paint on historic vehicles

The paintwork on a vehicle – the "clothing" in which it presents itself to the outside world – is by far the largest visible surface on any vehicle, and it has a huge impact on the first impressions we form. Paint on historic vehicles is, in all senses of the word, a "multilayered" topic.
Normally, cars are manufactured not for storage or for keeping in a garage, but to drive – with the exception of those few vehicles that manage to achieve cult status right from the start of production. The average lifespan of a modern vehicle is now around 15 years. In the run-up to the end of their useful lives, vehicles that remain on the road or that have not been scrapped, often go through a period of neglect. Generally, vehicles are not – and have except very few exceptions never been – designed for use over periods of 30 years or more, or to enjoy a revival as a collector's item decades into the future.
Over the course of a life of this length, vehicles are serviced, repaired and sometimes undergo a partial or complete respray before – in most cases –, they are finally scrapped. However, it is not uncommon for vehicles to be placed in storage or kept by enthusiasts even before they reach 30 years of age and achieve "vintage" status.

Vehicles that still have their untouched original paintwork intact are rare and highly coveted. Retaining the historical substance of a vehicle – particularly its original coating – has increased in importance and is increasingly affecting the value of vintage vehicles.

2 The value shift: Authenticity, originality, and patina

Starting in the beginning of the 1990s, painting vintage vehicles was all about achieving high-gloss, professional-level results ("better than new"). Vehicles with visible, unrepaired signs of aging and wear (patina) were considered unpresentable or deemed "unloved." This view has changed significantly or, more accurately, the spectrum of preference – which has always differed wildly between individuals – has widened.
Across the world, vehicle enthusiasts are now significantly more sensitive to the need to preserve historical surfaces, and this extends beyond the paintwork. Authenticity and originality are growing trends, and people are increasingly asking how old coatings can be preserved through conservation measures and, in some cases, how painting can be avoided altogether.

In the "standard" vintage vehicle market, too, the scene remains in a state of constant evolution. Today, designs that people previously turned their noses up at – such as Ford Capris with eye-catching spoilers and boxy, wide body kits – have now achieved cult status. The ostentatious car used in the German movie "Manta, Manta" is now on display in museums and, while it is still disliked by some, it has largely managed to shake off its bad reputation. The Citroën Ami 6 – the angular design of which was previously a target of ridicule – has increased in price in recent years, and the car is now considered one of the iconic designs by the creator of the Citroën DS, Flaminio Bertoni. In fact, the designer himself has said that he considers not the DS, but the Ami 6, to be his design masterpiece. The fox tail has a long way to go before it catches up with the nodding dog as a cult classic accessory, but it too has made its way back onto the shelves.
However, the reasons behind our desire for "originality" – even with more affordable classes of vehicle – go somewhat deeper. In an age of Industry 4.0, big data, cloud technology and digital tracking, an "analog over digital" trend is developing, fueling a preference for real, authentic, haptic, simple and comprehensible objects and experiences. This trend is also reflected in the world of classic cars.

Alongside the visually perfect vehicles restored to "better than new" condition, there have always been "imperfectly" restored and unrestored vehicles out there; it is how we view these vehicles that has changed. The Charter of Turin, which was approved by FIVA in 2012, served as a further boost to these viewpoints, setting out the first global framework for the preservation of historic vehicles. The concept of "preservation over replacement" might be the current trend, but there are still large numbers of car owners who value gloss above all else, meticulously polishing their vehicles to protect the new look. The effort put into restoring a collector's car often goes far beyond what would be expected for a car with "used" status; the collector's own ideas become part of the process.

From FIVA's perspective, the Charter of Turin is a set of recommendations or guidelines that offer plenty of scope for interpretation. It is not a law of nature, nor a binding set of strict and exclusive rules that must be complied with.

Where the boundary for "historical accuracy" lies is determined in part by personal preferences, budget, availability, legislation, and the desired level of quality. In any case, there is an overlapping of the real aging and condition of the vehicle and the owner’s idea of how to treat it.

From FIVA's point of view historical substance is valuable and should be preserved as far as possible. This trend is very visible in global auctions (Source: Classic Car Auction Yearbook by Historica Selecta).
With all of this in mind, it is clear that there is room for a variety of opinions, but there can be no single universal truth. The spectrum of paint services on offer has expanded accordingly, and now owners can opt for a completely flawless restoration ("better than old") or a restoration that is closer to how the vehicle would have looked when it was new (if this as-new condition is known and documented), or to retain some elements with "patina."

Briefly summarized: In the area of car restoration approaches we see mainly 3 approaches

1. The better-than-new Restauration
2. Restauration as close as possible to a look like a factory new
3. Preserving historical substance as far as possible
4. Modifying the vehicle based on the owner's ideas

The areas from 1-3 can be followed up as well in the article "Restoration Ethics Considerations by Dr. Marcel Schoch" on the FIVA website.

With their unique history, no two vintage vehicles are the same, and the condition and structure of the paint can tell you a great deal about a vehicle's past. With this in mind, it is crucial to look at each vehicle as an individual, unique piece; there is no "one size fits all" approach. The same is true of the wishes and requirements of the car owners; demands that seem irrational are often an expression of the vehicle owner's emotionally driven desires. Modifications compromise the originality of a vehicle and have an impact on the potential market for the finished car, in order not to devalue it.
From FIVA's point of view vehicle modifications are acceptable when the modifications are in-period.[1]

3 Aged paintwork

Like all parts of a vehicle, paint ages over time. Paint aging usually occurs when the resin/binder breaks down, causing pigments to be released. Pigments and other components can also change through exposure to intense sunlight. Paint manufacturers conduct extensive weathering tests to check the characteristics of their products. Paint is exposed to a long list of environmental influences. Not including accident damage, paint is exposed to:

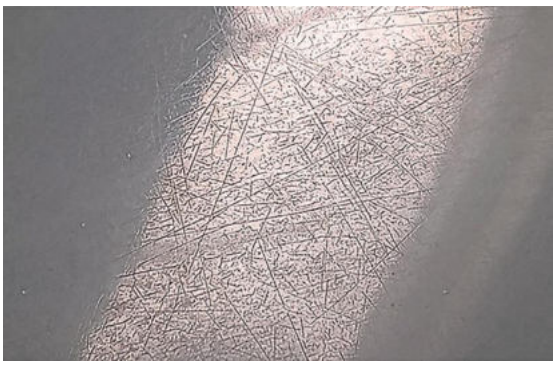
- External factors such as UV radiation, acid rain, gas, tree sap and bird droppings

[1] Today more and more we talk about so-called restomods. A restomod is a classic car that has been restored but modified with modern parts and technology. In a true restomod, you have classic styling – body lines and look appear to be classic. Then there are also customized restomod where there has been a fabrication to the original body lines.

- Mechanical influences such as minor scratches, washing, cleaning agents or rough covers placed over vintage vehicles. Stone chipping on panels can quickly lead to corrosion and infiltration.
- The structure of the resin, too, can degrade over time, causing the paint to become brittle and weak.
- The conditions in which the vehicle is stored. At a relative humidity of 70% or above, the risk of corrosion is significantly increased. Ideally, vehicles should be stored in areas with a relative humidity of 50% to 55%. Historic vehicles should be kept in controlled conditions (temperature and humidity) and in a dark location. However, in reality this storage setup can only be achieved to a limited extent in the vast majority of cases. Filiform corrosion often forms particularly under trim strips or originating from other covered areas.
- The aging of the vehicle and its paintwork is also directly connected to how it is treated and maintained during its useful life.

This takes us back to the idea of beauty being "in the eye of the beholder." The images below show some examples of paint that is damaged beyond repair from a technical point of view, but that may be worth retaining for "cultural" reasons. From a painter's technical point of view the technical expiry limit has been exceeded already but the surface tells the car's story.

Faded and weathered metallic paint on a Dodge Superbee, model year 1970 – supposedly the original coating. It is not possible to repair the paintwork in a way that imitates this visual effect. The violet metallic paint is virtually completely destroyed.



Cracked paint on a Panhard Dyna X, model year 1949 – probably the original coating. The paintwork still has a protective effect. The cultural aspect takes precedence over the need to repair this surface. If stored or conserved properly,
this vehicle can still enjoy a long life.

Paint on a Porsche 911 from the south-west of the U.S. The surface damage is easily highlighted using black control powder. In some areas, the paint is cracked and has been destroyed by sunlight and acid, and possibly also by insects and bird droppings. The technical and traditional approach would be to rub down the surface and repaint it. The cultural preservation approach would be to conserve it and retain the existing surface for as long as possible. The final decision will be made by the vehicle owner and the technical testing authorit

Recoated cracked old paintwork. This image shows a destroyed layer of paint with no patina. However, this kind of technical damage may also be worthy of preservation in the eyes of the vehicle owner.

When it comes to paint, documentation relating to the above points and any repairs carried out is often lacking crucial information or completely absent. This is why it is important to take far greater care with older paint layers than with new ones. Appropriate care and conservation measures should aim to ensure that the original look is maintained. These measures will extend the service life of the coating but will also mean that the vehicle requires more maintenance.

4 Preservation

We will not go into exhaustive detail on this topic in this chapter, but the question of which techniques can be used to conserve aged paint or partially corroded areas of aged paintwork, cannot always be answered with the same solution. The starting point of everything is the condition of the old paintwork.
What is left after many decades of use is always different and much more sensible than a new paintwork.

In general you need to follow these 3 basic rules
1 Treat gently
2 Begin with the mildest treatment
3 Take time

For example, oil-based rust sealing and conservation products manufactured by Owatrol or Ballistol, and maintenance waxes for aged or new paint from various manufacturers, all offer different results.
One example is an Alfa Romeo Giulietta SZ that was exhibited by Corrado Lopresto at the Concorso d'Eleganza at Villa d'Este in 2016.

This Italian collector has dedicated his life to the collection of rare cars and prototypes and has a reputation in the high-level automobile scene as an expert who likes to experiment with extreme and innovative techniques – to the benefit of all other collectors and enthusiasts. In Lopresto's view, the vehicle is "not perfect, but this is how I like it" – and this view was shared by the jury, who later awarded the car the title of "best-preserved car."

Half of the Alfa Romeo SZ from Lopresto's collection bears a mixture of aged and original white paint, while the other half is still covered in the years of dirt that have accumulated on the paintwork.
[21]

Half of the Alfa Romeo Giulietta SZ prototype from 1961 bears a mixture of aged and original white paint, while the other half is still covered in the years of dirt that have accumulated on the paintwork. The idea was to show the condition in which the car was found and how it can be preserved through conservation.
Work on the coating began on the dirty side of the car, with the fixing of the loose color residues using a special elastic adhesive. This half of the car was then covered with a transparent coat to preserve the condition in which the vehicle was found as effectively as possible.
The other half was carefully cleaned using gentle cleaning products. More stubborn dirt was removed with great care using mechanical methods. Where the paint was missing, the car was retouched with two-component paint in a precisely matched color. In areas requiring welding work, a special heat protection insulation paste was used to prevent the paint from being scorched.

The other systems and surfaces of the vehicle were also conserved, treated and prepared in a variety of different ways. The project was both expensive and time-intensive and used a combination of new and traditional methods. Details can be obtained from the collector and further information is available at loprestocollection.com
Reports like this are encouraging increasing numbers of vehicle owners to embrace the somewhat morbid charm of decay. Owners are increasingly demanding that damaged and cracked paintwork – which is no longer fit for purpose from a technical point of view – is retained, maintained and protected if it is still providing some level of protection; this kind of wear and aging is increasingly being viewed as part of the car's unique "patina."

4.1. Patina

We use the word “patina” for vehicles with visible, unrepaired signs of aging and wear. However, the boundary between a coating that is showing signs of use and aging and paintwork that is destroyed is a fluid one. This boundary between types of wear is often interpreted by the vehicle owner on the basis of how it looks and feels. But there are certain aspects, like incipient rust, blistering, or delamination, that make it necessary to perform a repair or restoration instead of conservation.

Aging always refers to surface abrasion caused by chemical or weather influences or mechanical damage to the finish. This is completely normal, because the coating ages together with the vehicle during use. Aging may include scratches caused by a car wash, as well as stone chipping or scrapes that happen in a car park. You could say that every coating has signs of aging after the first few times a new vehicle is used or washed, they are just more subtle than those of a coating that has been there for 30 years or more.

Preservation and conservation methods generally provide temporary protection but they cannot repair damage and are no replacement for a new paint coat. The techniques use materials based on oil, wax, and other chemicals to slow down any further damage to the paint and substrate, though without being able to stop it completely.
The amount of maintenance needed to protect a vehicle with a historical coating/original paintwork or an aged refinishing coat is much greater than for vehicles with an intact paint coat. This must be made clear to anyone who wants to protect their coating in this way. Ongoing care and maintenance with appropriate products is essential. And for many people who do this as a hobby, there is almost nothing more enjoyable than giving their classic vehicle the care and attention it deserves.
When performing maintenance, it is advisable to start with the gentlest agents and – if necessary – to work carefully towards using the more aggressive ones. One indicator is the possible abrasion found on the cloth or tool.
It can be assumed that old paintwork has very small damage that is not visible to the eye which should not be inadvertently made worse by using overly careful methods. For this reason, the first task should be to clean the vehicle thoroughly, for example with a cleaning clay.
Wax-based products are well suited to conservation. These products are also available in a mat look. Measurements taken for the first time with carnauba wax-based products have shown that a layer of 1 to 2 µm builds up per working process

with a machine – no more, but certainly no less. We found no significant difference when it was applied by hand.
A wax layer, therefore, needs to be continuously replaced. Wax is reversible, meaning it can be removed at any time. This means that other methods can be applied to the old coat afterward.
Products with linseed oil are generally not suitable for conservation. It leaves a rubber-like surface and ensures that dirt sticks to it. Penetrating oils can be used to preserve bare metal surfaces.
Historical coatings require careful, ongoing maintenance with suitable products. In particular, they must be compatible with the paint's capacity for swelling due to certain substances. This generally plays a lesser role when dealing with modern classic vehicles. However, when stored correctly and used carefully, the owner can enjoy the aged "patina" for a very long time.

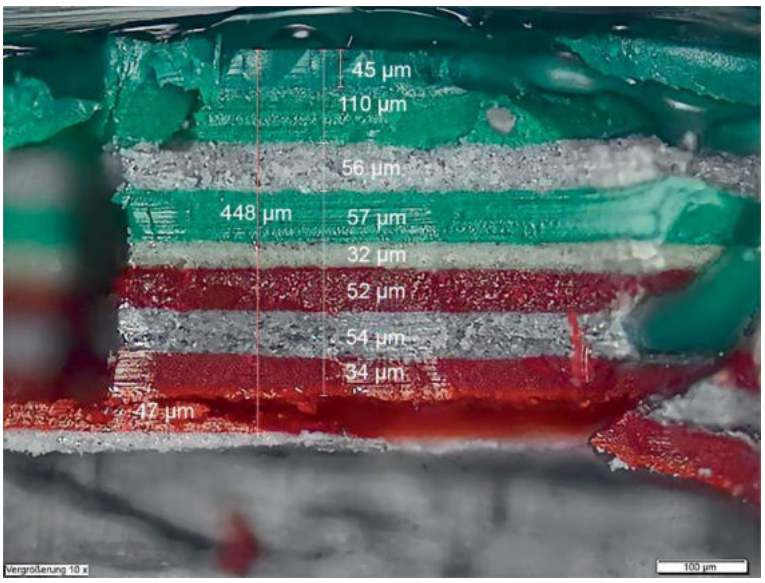
Paint conditioning methods follow the same pattern. Tools, methods and products for application on new vehicles are generally too coarse and abrasive and are too quick to abrade the old paint layers that are already weathered on the surface. This is then evidenced by worn-through areas, initially on corners and edges.

5 Paint systems on historic vehicles

A fundamental difference between the repair of old and new vehicles is the number of layers of paint that are very often present on an older vehicle. Like the age rings of a tree, the paint system can tell aspects of the story of the vehicle.
By taking the guidance and examples below into account, you can determine the measures required to complete a full restoration, repair, conservation or reconditioning work on a historic vehicle in a more targeted manner.

The figure below shows a cross-section of paint layers under a microscope: These kinds of paint systems are more a rule than an exception on vintage vehicles. The 1963 Porsche 356, which was originally Ruby Red, was a barn find. When it was made in 1963, the market launch of the 911 had already been announced. It was not uncommon to get these kinds of cars at a lower price in the 1960s and 70s and simply repaint them if the color was not to taste. If this car wasn’t a Porsche, it probably would have ended up on the scrap heap.
There was virtually no patina worthy of keeping and the history of the vehicle was only partially documented up to around 1967. The paint layers are indicators of the vehicle's story: It was painted multiple times, at least twice in red and two or three times in a shade of green. This 356 was clearly never considered a cultural asset and spent its service life in intensive use as an object of utility.

Expanding foam was used in the passenger door for noise insulation and repairs, while rust spots had been smoothed over across large areas.



Porsche 356: Image showing cross-section of paint layers under a microscope [20]

The 356 was repainted in authentic, high-gloss Ruby Red paint with smooth flow characteristics to mimic the original look. Reutter handed the vehicle over to Porsche polished to a high-gloss shine.
The owner wanted the vehicle to be completely reconstructed and ready to drive. To preserve the results of the restoration process, the internal surfaces of the car body were protected with a primer to produce a surface that was "better" than the original. In the case of this particular vehicle, the work undertaken on car body and paintwork had been exceptionally well documented, and a buyer will know exactly what they are looking at.

6 Original paint or not ?

We understand “original paint” as the paint applied in the production process before the vehicle has been sold.
A vehicle's paint says a lot but can often hide even more. With the combination of a trained eye, film thickness measurements and expert knowledge of the unique characteristics of the vehicle, many of the "surprises" that might come up can be uncovered in advance. Often, further investigations using techniques such as thermography may prove useful.

There are various simple visual clues that even non-experts can pick up on to quickly determine how "original" a paint job might be on a given vehicle. When assessing paintwork, it is essential to do so in good lighting conditions. Backlighting and reflective lamps are also important, so avoid looking at vehicles in partial darkness, at dusk or in poorly lit spaces. The vehicle must also be clean and dry.
The list below aims to give you an idea of some of the aspects to consider when evaluating the quality of a surface finish, but it is by no means exhaustive. If any of the considerations in the list give cause for concern, a more in-depth investigation is always worthwhile.

Significant differences in paint flow on the hood and front end of a recently restored Porsche 356

On opening the hood, it becomes clear that the paintwork on this Mercedes-Benz W 123 is not original

- Does the flow of the topcoat appear homogeneous or not?
- Are there any visible signs of overspray around seals or add-on parts?
- Have any rubber seals or piping been painted over?
- Are there any signs of tape application behind rubber seals?
- Are all the colors on all panels identical or at least not significantly different?
- Are there any visible dust inclusions or craters?
- Are there any traces of shrunken or irregular sanding scratches?
- Are there any visible edge markings around potential sand-through areas?
- Does the vehicle documentation contain any information about the paint and does this information match the known history of the vehicle?
- Are there any signs of running anywhere on the vehicle?
- Are there any vehicle-specific details still present, such as the bead rolled elements on the front of the wing of the Mercedes W113 Pagode, or the carbon fiber weave visible through the paint on the Ferrari F40?
- Have the vehicle's type plates been partially painted over or coated in overspray, or are they suspiciously clean and unnaturally new in appearance compared to the rest of the vehicle?

- Are there any areas of unevenness that cannot be attributed to defects during restoration, but that were caused by errors during production, e. g. traces from car body files left during the production of extreme body shapes such as the 1959 Buick LeSabre?

Important to know vehicle-specific details: What may look like paint defects could actually be authentic marks left behind by car body files. Extreme designs, like the jagged bodywork and tail fins seen in 1959, could not be achieved using the metal pressing technology of the era. These components were finished by hand, which left sanding marks behind.

Film thickness measurements should always be performed on the coating, as this information will provide an initial starting point to work from. At thicknesses of over 150 µm on horizontal surfaces and over 100 µm on vertical surfaces, the paint is unlikely to be an original coating. In such cases, you should obtain further advice (from a specialist). However, there are some skilled restorers who are able to achieve the film thicknesses of the original coating. Solvent tests should not be carried out in visible areas.
It is always a good idea to study the model in question in advance or to contact experts who are highly familiar with the relevant vehicles. Before the introduction of painting robots in extremely dust-free zones, vehicles were painted by hand during the production process in the factory. As a result, there may be some minor coating defects, which are typical of vehicles produced in this era.

Further information on paint and the clues that may be concealed in the coating of a vehicle can be found in Glasurit's advice on paint defects at https://www.glasurit.com/en-int/advice-on-paint-defects.

7 Modern materials and methods for historic vehicles

The photo below shows a typical refinish job from 1971. The image was captured for the launch of the 21 Line two-component PUR topcoat from Glasurit. The Ford “Knudsen-Taunus” in the photograph has since become a cult classic, but the environment in which it is pictured has seen some fundamental changes. Examples include safety considerations such as personal protective equipment for the spray painter and adequate ventilation in the working area. The spray gun in the image is now something that you would find in a museum and has been replaced by guns that

guarantee optimum atomization and little overspray. The solvents, pigments and other ingredients have also been adapted to comply with current regulations. Raw material changes due to legislation and economic reasons are frequently happening. For this reason, it would not be possible to perform a paint repair using exactly the same historical methods and materials.

A professional refinish job on a car body in 1971
[20]

Even back then, paint repairs were not always easy to carry out using contemporary methods and in-period refinishing processes. Examples include precisely color-matched repairs on direct-gloss metallic paints, which could only be carried out on very large areas, and repairs on thermo-plastic topcoats, which often resulted in edge markings, dissolving and cracking.
With this in mind, it is essential to use the latest painting technologies and refinishing processes to achieve long-lasting repairs that produce a visually consistent effect. There is no doubt that new technological solutions will play an increasingly important role in the maintenance, repair and restoration processes. It is already possible to use 3D printers to recreate spare parts that are no longer available, and to use modern tire technology in replicas of historical tires. In vehicle evaluation, methods that provide information about the paint history of a classic car – without interfering with it in any way – will become the norm. Examples include thermography inspections (www.classic-car-check.com), which originated in the aerospace industry, and ultrasound testing, which can show all the layers of paint on a vehicle.

Figure 8.34 *A thermographic image of a Jaguar MK IX, model year 1960.*

The one question that requires the most care and attention is whether a car really is, what it claims to be. The highly valued qualities of originality and authenticity are increasingly being put to the test with forensic methods. Minor details or convincing forgeries can make millions of euros' worth of difference to the vehicle valuation. As the expert is liable for the opinion they provide, we expect to see new professional structures and training formats making their way into the industry in the coming years.
The field of classic vehicles is becoming more highly specialized than ever before, which will open up new opportunities in this technologically challenging sector.

8 "Original" and “new” paint technology

When working with cars as "historic cultural objects," part of the aim is to get them back on the road.
It is important to note that the latest technologies and methods can be used in the spirit of the Charter of Turin and are supported by FIVA – not only when it comes to paint, but for the entire project. In lots of cases newer technologies and methods give opportunities that were not feasible in the days.

All paint repairs are a fusion of old substance and newly produced paint material regardless of the paint technology used. Paint is a material that must be used within the shelf life specified on the packaging. This is why paint from old stock is either unavailable or unlikely to be of any value.
Even paints that are reproduced using old resin/binders cannot be considered 100 percent historically accurate, as many of the ingredients and raw materials used in the past are no longer available or no longer produced, are limited in availability or are even banned under current regulations. One example of such legislation is REACH, an EU regulation that aims to protect the environment and human health against dangers posed by chemicals. National and regional regulations must be followed and may not allow for any exceptions.

In many countries, the use of very old painting technologies is still permitted or legally regulated. In some cases, it may be a good idea to use historical paint – for example on vehicles that have a particularly high historical or cultural value and that ideally still have their original oil-based, nitrocellulose or thermo-plastic paint. The choice of paint depends on the requirements of the project, the availability of historical materials, traffic safety requirements, regulations and whether the spray painter is familiar with the use of old tools and materials. Locally/nationally there are some “except” regulations in place which need to be followed.

They are in place for vehicles with a special historical significance and may, in exceptional cases, still be repaired using these methods and materials. There are not many of these vehicles around, and they are not often seen on the roads.

Generally, all paintwork can be repaired using the same paint technology, so nitrocellulose paint should be repaired with nitrocellulose paint and TPA paint should be repaired with TPA paint. From a technological point of view this is only half of the truth.
If an older paint technology is no longer available as an option, a decision as to which method to use for the repair/restoration of the vehicle must be made on a case-by-case basis. In addition to the binder base, the correct paint system is of critical importance. Technological "mixed systems" are not uncommon in the history of refinishing. "Historical accuracy" therefore goes beyond materials to also encompass painting processes. As soon as new solutions for old or sensitive substrates have been developed, they have been pragmatically adopted. In some cases, this means that new products and systems may produce repairs that are of higher technical quality, gentler on the old paintwork and perhaps even more sustainable.
The technical data sheets provided by the paint manufacturer must always be followed.
Most of the regularly used paint of the car premium brands are technically approved by the OEMa/car manufacturers. This makes these paints an original spare part.

This applies as well to the paint layer of waterborne basecoats. The difference between waterborne and solventborne basecoats (which are still used in many countries) lies in the components in the thinner. Like water, solvents escape from the paint after application, so the non-volatile content is of much greater relevance. In other words: What matters is what remains on the car and not what has already evaporated!

Body fillers, primers, fillers, topcoats or clearcoats still contain solvents. There are as well waterborne primers available but not used as mainstream products for car refinishing. Technically they would be the best option to isolate solvent sensitive coats. On old surfaces – which are often sensitive to solvents – and/or on sand-through areas, products with a low solvent content offer clear advantages, as the risk of edge markings and similar issues is significantly reduced.

Regulatory changes (including the European chemical regulation REACH) have also resulted in bans and limitations being placed on a number of paint ingredients. There is now a long list of substances that are banned from use in paint or that are subject to special labeling requirements. Examples include the reduction of emissions caused by solvents and a ban on heavy metal compounds in topcoats and primers. Aromatic solvents (such as benzol, toluene and xylol) are also subject to bans or restrictions. Given the ongoing discussions around the topic of environmental

protection, these regulations are likely to be further tightened and special exceptions that are possible today are unlikely to become the rule.

When applied to the field of paint repair, the Charter of Turin recommends that all necessary repairs should be limited to the smallest possible area. To ensure that this principle is upheld, a panel repair is often chosen over blending in. This approach retains the adjacent layers, rather than recoating them when it is not necessary to do so. The skills of the spray painter and the correct process technology are critical to the success of the repair.
During the consultation, it is important to explain that a panel repair may require color test samples to be sprayed to achieve the exact color matching, metallic effect, and/or level of gloss required, and that this process involves additional work and costs that must be covered by the customer.

The owner's vision for how the vehicle is to be used, combined with the condition of the vehicle before restoration, are the key aspects that determine how to proceed with the refinish job. There is no single, universal truth and there are no strict rules. Each owner will have their own opinions, and these should be accepted rather than criticized. The tremendous diversity of this hobby is, after all, what makes it so fascinating.
The latest readily available and fully legally compliant paint technologies provide excellent solutions for the vast majority of historic vehicles, enabling many aspects of the classic look to be recreated to a very high standard by professional restorers.
After all, it is also important that the restored vehicle is safe and that it satisfies all the legal requirements for driving on public roads.
The value of a historic vehicle depends very much on how the paintwork is treated. The figures of global auctions tell the story: An untouched “original” car can achieve a higher value than a restored vehicle. An important source: The Classic Car Auction Yearbook by Historica Selecta.
Open is if those original vehicles are used to drive or are locked in museums. Never the less – an original surface tells the vehicle’s story on vehicles of any value.

9 Color on classic vehicles - Terms

In general, it needs to be understood that

- in the case of a full restoration of a car the “original color” is the best choice (9.2).

- in case of a paint repair the color needs to be adjusted to the adjacent part(s) (9.3).

Terms

9.1 Original coating - The paint system that was applied to the vehicle at the plant before its delivery

In the vintage vehicle sector, "original coating" means the paint system that was applied to the vehicle at the plant before its delivery, i. e. the coating in its original state, untouched since delivery of the vehicle.

9.2 Original color - The manufacturer's officially determined and approved color.

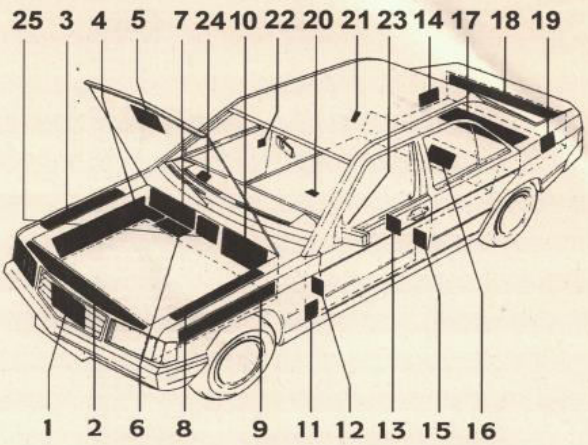
Car manufacturers fix color as the "original". Original color samples are mostly available in OEM archives, in the archives of paint manufacturers, and sometimes in archives at car clubs. There is mostly a name, number or code that can be found at the car body or inside the vehicle documents. Every manufacturer has it's own logic.

In case of a full restoration, we recommend producing a color sample and approve it before the painting starts.

Simple examples are the easy-to-find color nameplates at Mercedes or the Porsche 356 (Photo)

The original master panel of Porsche Auratorium Green from 1958 was used for the production of batches for the Porsche 356 at Stuttgarter Karosseriewerk Reutter & Co. GmbH. Stored in the archive of Glasurit in Münster.

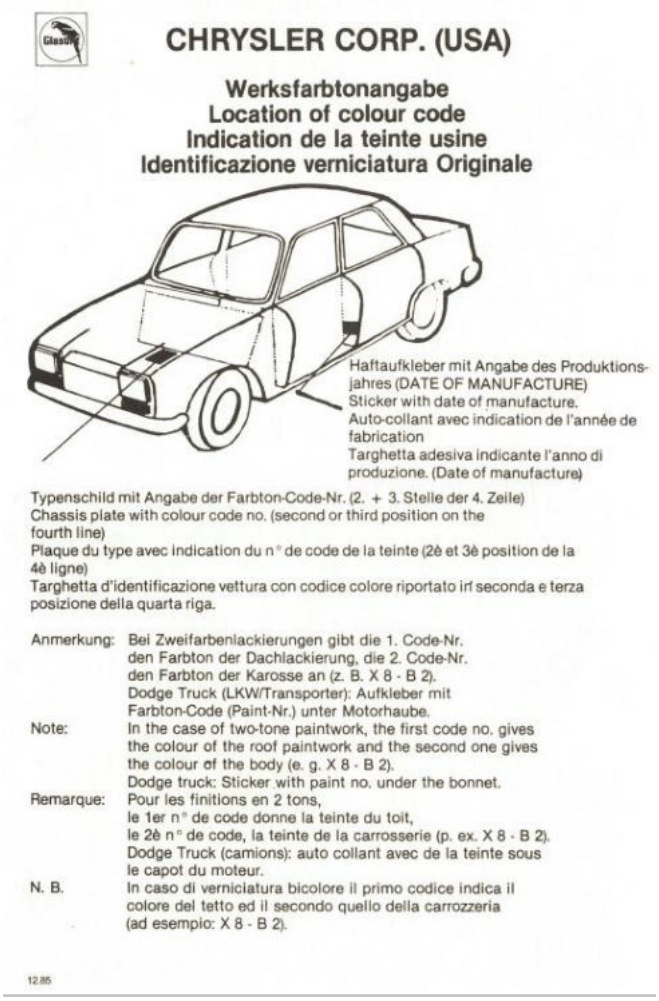
Hinweis auf Farbtonidentifizierung am Fahrzeug
Vehicle Paint Identification



AIXAM	2						
ALFA ROMEO	5	8	14	17	18		
AUDI	14	17	18				
BMW	2	3	4	7	8		
CHRYSLER	2	4	5	8	9	10	
CITROEN	2	3	4	7	8	10	
DAEWOO	2	10					
DAF	7	10	12				
DAIHATSU	2	7	10	20	22		
FERRARI	3	5	18	19			
FIAT	4	5	14	18			
FORD EUROPA	2	3	4	7	8	10	15
	17	18	22				
FORD AMERIKA	15						
FSO	7	10					
GENERAL MOTORS	2	7	10	12	16	18	19
	20	21					
HONDA	15	22					
HYUNDAI	2	7	10	15			
INNOCENTI	22						
ISUZU	2	7	10	13	15		
IVECO	5						
JAGUAR	2	4	5	11	15		
KIA	15	25					
LADA	4	5	8	17	18	19	
LAMBORGHINI	18						
LANCIA	2	4	5	7	18		
LAND ROVER	2	3	7	10	15	17	
LEXUS	3	7	10	15			
LOTUS	3	8	10				
MASERATI	5						
MAZDA	7	10	15	22			
MERCEDES BENZ	2	3	8	10	12	15	24

MITSUBISHI	2	3	4	5	7	8	15
MOSKVITCH	7	14					
NISSAN	2	4	7	10			
OPEL	2	3	4	7	8	10	
PEUGEOT	2	3	8				
PORSCHE	2	7	8	10	12	15	
PROTON	2	7	10				
RELIANT	3	4	7	9	10		
RENAULT	3	7	8	10	15		
ROLLS ROYCE	3	5	10				
ROVER	2	3	5	7	10	15	
SAAB	3	8	10	15	17		
SSANGYONG	12	15					
SEAT	3	8	17	18			
SKODA	8	10	17				
SUBARU	2	7	8	10	11	15	
SUZUKI	7	10	11	17	20	23	24
TALBOT	2	3	4	7	8	9	
TOYOTA	2	3	4	7	8	9	10
	12	15	25				
UMM	4						
VAUXHALL	2	8	9	10			
VOLKSWAGEN	1	2	3	7	8	14	17
	18	19					
VOLVO	2	3	7	8	9	10	11
	12	15					
YUGO	2	3	5	18			

Where to find the color code. Every manufacturer has it's own idea and logic.



CHRYSLER CORP. (USA)

Werksfarbtonangabe
Location of colour code
Indication de la teinte usine
Identificazione verniciatura Originale

Haftaufkleber mit Angabe des Produktionsjahres (DATE OF MANUFACTURE)
Sticker with date of manufacture.
Auto-collant avec indication de l'année de fabrication
Targhetta adesiva indicante l'anno di produzione. (Date of manufacture)

Typenschild mit Angabe der Farbton-Code-Nr. (2. + 3. Stelle der 4. Zeile)
Chassis plate with colour code no. (second or third position on the fourth line)
Plaque du type avec indication du n° de code de la teinte (2è et 3è position de la 4è ligne)
Targhetta d'identificazione vettura con codice colore riportato in/ seconda e terza posizione della quarta riga.

Anmerkung: Bei Zweifarbenlackierungen gibt die 1. Code-Nr. den Farbton der Dachlackierung, die 2. Code-Nr. den Farbton der Karosse an (z. B. X 8 - B 2). Dodge Truck (LKW/Transporter): Aufkleber mit Farbton-Code (Paint-Nr.) unter Motorhaube.

Note: In the case of two-tone paintwork, the first code no. gives the colour of the roof paintwork and the second one gives the colour of the body (e. g. X 8 - B 2). Dodge truck: Sticker with paint no. under the bonnet.

Remarque: Pour les finitions en 2 tons, le 1er n° de code donne la teinte du toit, le 2è n° de code, la teinte de la carrosserie (p. ex. X 8 - B 2). Dodge Truck (camions): auto collant avec de la teinte sous le capot du moteur.

N. B. In caso di verniciatura bicolore il primo codice indica il colore del tetto ed il secondo quello della carrozzeria (ad esempio: X 8 - B 2).

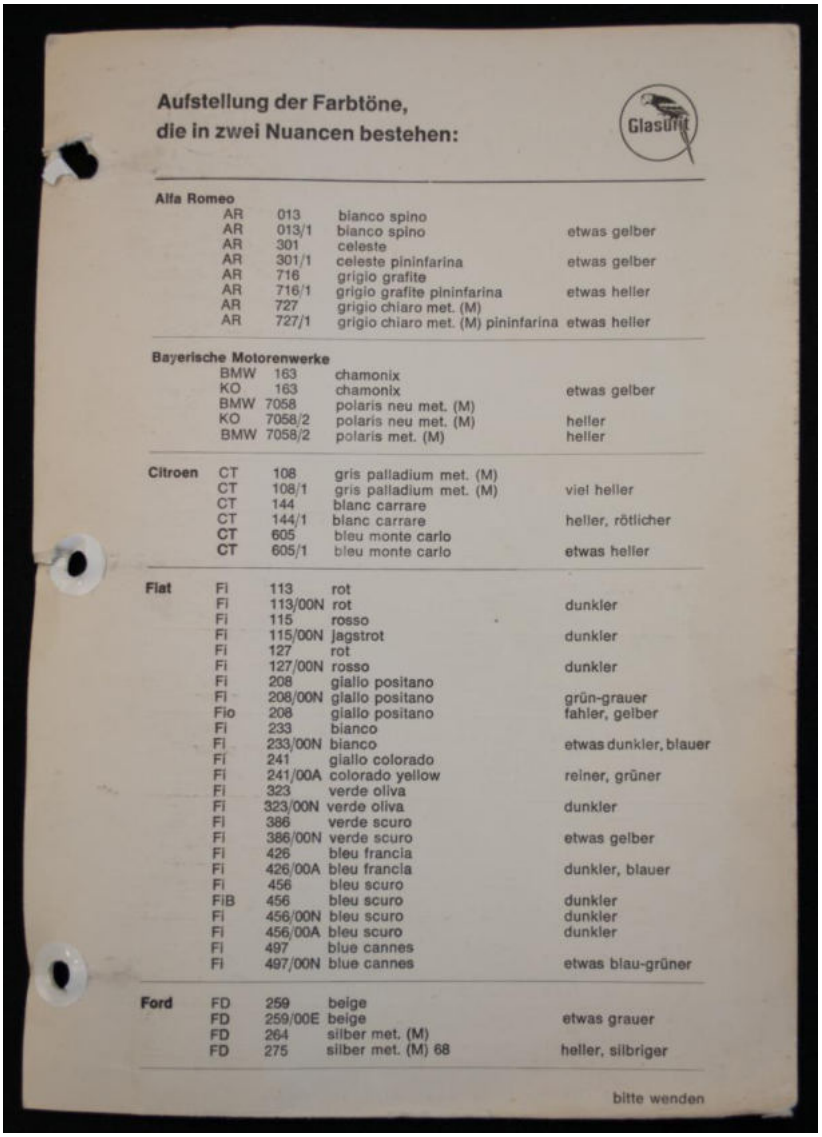
12.85

Finding and reading the color code on the example of Chrysler (12.85)

9.3 Authentic color - The authentic color is the original color variant of the original OEM coating applied to the vehicle mainly when the vehicle was new and/or the actual color on the aged vehicle.

During the production process of vehicles, there are several influencing factors (Different car models, different production places, etc.) that make the color slightly different (lighter, brighter, darker etc.) but are in the normal tolerance framework. These variants are important in case of a repair painting. Today those variants can be identified by spectrophotometers. In some cases, we see more than 25 variants per color even on new cars today.

For historical vehicles we need to add the – always individual - aging process as well. Vehicles are useful objects and over the course of their lives, they start to show signs of use, aging and wear; these signs are referred to as "patina." The appearance of a coating can change due to weather, external influences and mechanical effects.
In case of a repair, the color/mixing formula needs to be aligned with the adjacent surroundings/parts to achieve an invisible repair. This can be achieved by Spectrophotometers and/or other color tools and if needed finally by a tinting process.



Aufstellung der Farbtöne, die in zwei Nuancen bestehen:

Glasurit

Alfa Romeo				
	AR	013	bianco spino	
	AR	013/1	bianco spino	etwas gelber
	AR	301	celeste	
	AR	301/1	celeste pininfarina	etwas gelber
	AR	716	grigio grafite	
	AR	716/1	grigio grafite pininfarina	etwas heller
	AR	727	grigio chiaro met. (M)	
	AR	727/1	grigio chiaro met. (M) pininfarina	etwas heller
Bayerische Motorenwerke				
	BMW	163	chamonix	
	KO	163	chamonix	etwas gelber
	BMW	7058	polaris neu met. (M)	
	KO	7058/2	polaris neu met. (M)	heller
	BMW	7058/2	polaris met. (M)	heller
Citroen	CT	108	gris palladium met. (M)	
	CT	108/1	gris palladium met. (M)	viel heller
	CT	144	blanc carrare	
	CT	144/1	blanc carrare	heller, rötlicher
	CT	605	bleu monte carlo	
	CT	605/1	bleu monte carlo	etwas heller
Fiat	Fi	113	rot	
	Fi	113/00N	rot	dunkler
	Fi	115	rosso	
	Fi	115/00N	jagstrot	dunkler
	Fi	127	rot	
	Fi	127/00N	rosso	dunkler
	Fi	208	giallo positano	
	Fi	208/00N	giallo positano	grün-grauer
	Fio	208	giallo positano	fahler, gelber
	Fi	233	bianco	
	Fi	233/00N	bianco	etwas dunkler, blauer
	Fi	241	giallo colorado	
	Fi	241/00A	colorado yellow	reiner, grüner
	Fi	323	verde oliva	
	Fi	323/00N	verde oliva	dunkler
	Fi	386	verde scuro	
	Fi	386/00N	verde scuro	etwas gelber
	Fi	426	bleu francia	
	Fi	426/00A	bleu francia	dunkler, blauer
	Fi	456	bleu scuro	
	FiB	456	bleu scuro	dunkler
	Fi	456/00N	bleu scuro	dunkler
	Fi	456/00A	bleu scuro	dunkler
	Fi	497	blue cannes	
	Fi	497/00N	blue cannes	etwas blau-grüner
Ford	FD	259	beige	
	FD	259/00E	beige	etwas grauer
	FD	264	silber met. (M)	
	FD	275	silber met. (M) 68	heller, silbriger

bitte wenden

List of colors that are available with 2 variants (January 1972).
Today colors are known with over 25 variants. Key is to identify the right variant in case of a repair.

9.4 Contemporary color – In-period color

This is a color that, at the time the vehicle was produced, was used on the same model, other models by the same manufacturer or models by other manufacturers.

However, only using the color name can cause confusion. A prime example is the famous "British Racing Green," of which there are over 30 versions from at least 18 different manufacturers. It is possible to research the correct color using the Glasurit color database on the Classic Car Colors website.

Some colors of Chrysler between 1974 and 1976

9.5 Contemporary design

Alongside contemporary color, racing stickers, promotional designs, airbrushing or designer paintwork can also be considered "contemporary" if they suit the era.

Promotional stickers can also form part of a contemporary design, as shown here on a DKW-3=6-Schnelllaster van from 1955.

Promotional designs like the BASF M1 is both iconic and notable because it looked like a giant cassette case flying around the track. A very long lasting effect. Even after 40 years the cassettes are the best known BASF consumer products.

Designer paintwork like this example of a BMW painted by Andy Warhol can also be considered contemporary.

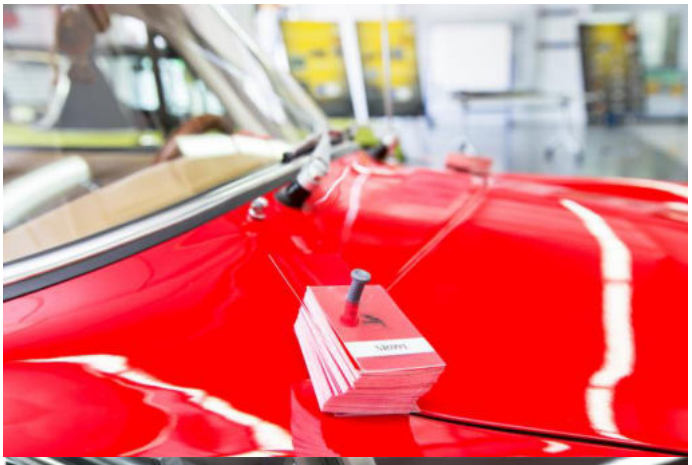
9.6 Color without historical background - Freestyle / Custom / Individual choice
In many cases, owners select a color in line with their own tastes or opinions. Often, spray painters are presented with samples that do not match the vehicle but that the customer wishes to use as an original color sample: perhaps a scarf belonging to the owner's wife or a color from the family coat of arms. There are no limits to what can serve as a source of color inspiration.

In principle, it is possible to reproduce virtually any color test sample. A spectrophotometer or a sample that can be sent to the paint manufacturer for the formulating process are very helpful. In the case of metallic paints, the first step is to decide which mica/aluminum type will best reproduce the flop effect.

10 Identify the right color for repair and restauration

When using paint of a historic vehicle two scenarios are important:
1 A paint repair
2 A Restauration/reconstruction with the original color

1 Paint repair (Refers to 9.3)
When refinishing a vehicle after an accident or in a partial restoration, the color must be adapted to the immediate surroundings of the area being repaired. In this case, the mixing formula of the original color is of no use. It is very often the case that vehicles have been repaired, had an overall respray or the color has changed over the years (e.g. due to exposure to sunlight). This makes every repair a completely individual process.



Photos: Glasurit Color Profi System: Organized reg. colors, not manufacturers and painted with real refinish paint. The high success rate to identify the matching color on the car.

In general, the goal is to retain the intact old paintwork and, in the event of damage, to make an invisible repair where possible. One very important aspect of this is to ensure that the color matches the vehicle and the area being repaired on the vehicle. As described above, this is possible if the color is determined using a spectrophotometer and/or other color information tools. It may also be necessary to tint the color slightly. “Tinting” was a real profession in the old days and is now more and more replaced by Spectrophotometers.

Other elements that can be adjusted by hand are the level of gloss and the flow of the paint. Even if the right color is found, the area being repaired may be visible due to a very high level of gloss or if the flow is too smooth compared with the old paintwork. There are many borderline cases and a high level of experience and craftsmanship are required.

Two-tone paintwork on a 1960 Jaguar MKIX. After several (unknown) paint operations you find ca. 20 different variants across the individual parts of the vehicle.

2 Restauration/Reconstruction with the original color (Refers to 9.2)
When carrying out a complete restoration, car owners can consult http://color-online.glasurit.com to search for the original color and find out which color references and names were used at the time of production, based on the manufacturer, vehicle model, model year, and color group.

There is a high probability that the Glasurit color database contains a color mixing formula; however, this mixing formula is not visible to the vehicle owner, but only to Glasurit body shops. It is based on the "best" available color information, such as original panel sections in the Glasurit color library, information from car manufacturers, clubs, museums, etc. and is constantly being expanded. Thanks to these close partnerships, there is a high likelihood of finding the information you need in this archive, particularly for classic vehicles. In one color project with the Heinkel Club, available color information was used to recreate colors using modern paint technology (http://www.heinkel-club.de; see "Vehicles" section). All colors were approved by the club experts.

When completely restoring a vintage vehicle, it is important to determine this original color for the vehicle or the era in which it was built, as this aspect now plays a significant role when assessing the appearance and value of the vehicle. The selection of the actual original color rounds off a faithful restoration.

Regardless of this, it is generally recommended to create a sample color prior to application, as the selected color does not always correspond to the wishes and expectations of the vehicle owner. A turquoise from the 1950s is often perceived today as a washed-out green and does not necessarily exude the joie de vivre that its name suggests.
For complete restorations the use of the most original color does improve the value of the vehicle.

11 Motorcycle painting

Developments in the technology used for motorcycle painting have followed those used for cars. Until the 1950s, black was the dominant color, even though Triumph under Edward Turner played a leading role in the development of attractive, flamboyant colors and Italian motorcycles in general were painted in a loud red – the color of Italian motorsport teams.
Japanese manufacturers went a step further, with glossy metallic surfaces, transparent pigments, bright colors and tinted clearcoats. They took into account the fact that the light resistance of these coatings did not always reach the standard of a topcoat in metallic or solid colors. "Candy" paint coats in particular, which contained soluble dyes but no pigments, provided a depth of color. However, they also had a tendency to fade severely. For these coatings, it was taken into account that their light resistance did not always reach the standard of a pigmented topcoat in metallic or solid colors.

For this reason, these basecoats needed to be coated with special clearcoats with a high proportion of UV stabilizer. It is generally a good idea to store these paint systems away from direct sunlight.

Now it is possible to reproduce these colors very accurately using very fine (ca. 0,2 µm) pigment generation of translucent pigments. As was the case for the original coating, the film thickness of the translucent layer is responsible for the depth of color. This can be seen on the original panel (front) and the reproduced coating (rear). This can be seen as a “better-than-old” reconstruction.

Motorcycles often have special color effects, decorative lines and individual finishes.

12 Tractors and commercial vehicles

Coatings on tractors and commercial vehicles often consisted of special paint systems with powerful corrosion protection that has always been necessary for intensive use. They were often combined with a zinc rich primer – in most cases chromate-free – as well as an epoxy chromate primer that was applied directly to the sand-blasted surfaces.

To achieve sufficient adhesion, a specific peak-to-valley height of 25 to 30 µm is required, which is approximately achieved with the preparation grade of SA 2.5 in accordance with DIN 55928 or the Swedish SIS 05 5900 standard.
Paint systems of this type were also frequently used on trailers, substructures, cranes and other vehicles that needed a robust coating. Although some of these products are still available, the amount of work involved is probably excessive in the field of repairs and restoration of classic vehicles. The use and production of chromate-based products is increasingly being banned under environmental protection legislation, such as in the EU from 2019 onward by the REACH regulation.

Vehicles used to transport food such as dried food, meat, etc. are subject to particularly strict requirements, for example with regard to food safety, and special paint systems are used for this purpose.
The variety of substrates is generally much wider than for passenger vehicles. The technology and paint systems used are frequently based on the manufacturers' requirements and specifications. Synthetic resin-based paints were often used for refinishing, with additives that made the coating much more resistant after drying at 80°C (80° additive, see Section 8.3).

13 Military vehicles

On military vehicles, the coating should guarantee effective camouflage or low visibility during the day and night. For this reason, the color design of the vehicle is usually adapted to the environment in which it operates (desert, forest, open terrain, etc.) and it is generally given a mat surface.
For vehicles in active military service, the coating must meet particular specifications. The official paints that are used contain components for special requirements, such as protection against discovery by radar, infrared or thermal imaging cameras.
Approval of military vehicles is subject to strict regulations. With regard to the paint, private owners can use a topcoat with a matching color and mat finish for the coating or for repairs.

Author:: Jürgen Book, Classic Cars Manager, BASF Coatings / Glasurit

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