



The quick way to a perfect color match.



The Art of Refinishing.



Content.

What is color, anyway?	4
Effect particles in the automotive industry	6
Causes of color fluctuations	8
Metamerism	9
From the OEM color to the Standox mixing formula	10
Competence in color	12
Genius means quick and effective color identification	14
The quick and reliable way to finding the right formulation	16
Accurately identifying colors	18
Correcting formulations using the Colormix fan	19
Color and effect blending techniques	20
Professional refinishing using professional products	22
Training	22
Outlook	23



Finding the right color.

Every refinisher knows that there is no such thing as “simply white” or “simply red”. Today’s incredible variety of colors and nuances makes finding the right shade a real challenge.

As late as in the early seventies, some 7 000 colors were enough to handle most repair jobs. Today Standox alone offers more than 60 000 shades and rising. Assuming that 6–7 new colors are introduced by each auto maker every year, up to 1 000 new shades are added annually. Add to this their – in some cases numerous – variants. All this has made identifying the right color and the accurate mixing formula an increasingly complex task for refinishers.

Luckily the steady growth in the number of mixing formulas has also promoted the development and improvement of suitable working aids. Yet the refinisher’s expertise remains paramount – professional refinishers know that a perfect color match is key to full customer satisfaction.

In this Standothek, you find everything you need to know about efficient color identification, tinting and blending in.



What is color, anyway?

The first step is understanding what color actually is. Color is actually a property of light that results from reflection.

This means that color is a subjective impression that is perceived through the eye. To make this happen, three things are necessary:

- light,
- a surface that reflects the light,
- a receptor that absorbs the reflected light, e.g. our eye.

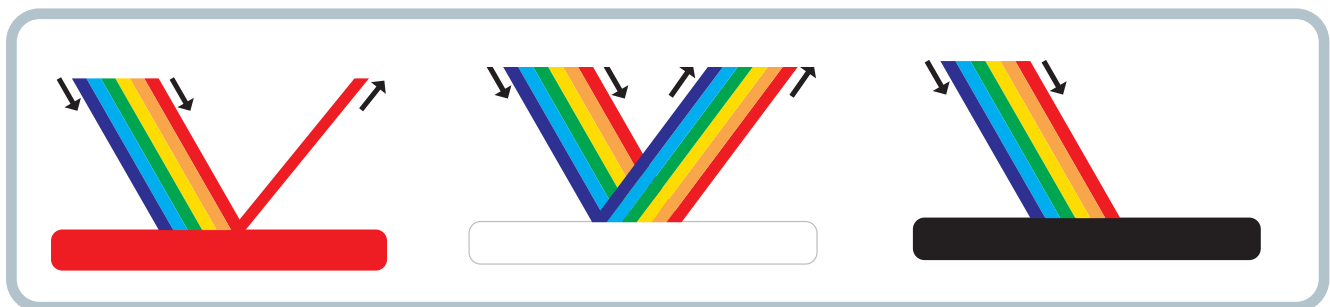
The color of a surface is perceived because it reflects only those components of the entire color spectrum of light that correspond to the color of the object. For instance, this means a red surface only reflects the light in this wavelength, while the rest is absorbed. Black and white are exceptions to this. In case of

a white surface, the entire color spectrum of the light is reflected and we see white. In case of black surfaces, the light is absorbed and the eye perceives black.

This phenomenon is due to the basic structure of light. Light is electromagnetic radiation of various wavelengths. A prism can break down the range of light visible to the human eye into the colors of the rainbow, the so called spectrum of colors. Being above and below the visible light spectrum, respectively, ultraviolet light and infrared light cannot be perceived by the human eye.



Color perception with neutral sunlight.



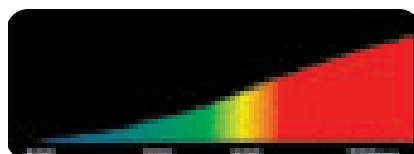
Light shines on a red surface. The red components of the color spectrum are reflected while the residual light is absorbed.

Light shines on a white surface. The entire color spectrum is reflected.

Light shines on a black surface. The entire color spectrum is absorbed.



Color spectrum with normal daylight.



Color spectrum with warm artificial light.



The A to Z of color.

Absorption.

When light hits an object, parts of the color spectrum are reflected and others are absorbed.

Additive color mixing.

The addition of light of different wavelengths. For instance, equal shares of red and green light yield yellow light (the principle behind color TV).

Color.

Physically and anatomically dependent sensory impression.

Infrared (IR).

Light with a wavelength of > 800 nm.

Light.

Electromagnetic radiation in the wavelength range of 400 nm (blue) to 800 nm (red).

Metamerism.

The appearance of two colors under the same light source. A different light source may yield other color impressions.

Primary colors.

Red, blue and yellow (see "Subtractive color mixing").

Reflection.

Where light waves rebound from a surface.

Secondary colors.

The secondary colors are the three colors produced by mixing two primary colors, i.e. green, violet, orange.

Spectral colors.

All the colors perceptible by the human eye, with an electromagnetic wavelength range from 400 nm (blue) and 800 nm (red).

Subtractive color mixing.

All other colors can be obtained by mixing the primary colors red, blue and yellow.

Ultraviolet (UV).

Light with a wavelength below 400 nm.

Wavelength.

The wavelength of an electromagnetic beam determines whether colors are visible or not. The distance between two adjacent wave peaks is indicated in nm.

Effect particles in the automotive industry.

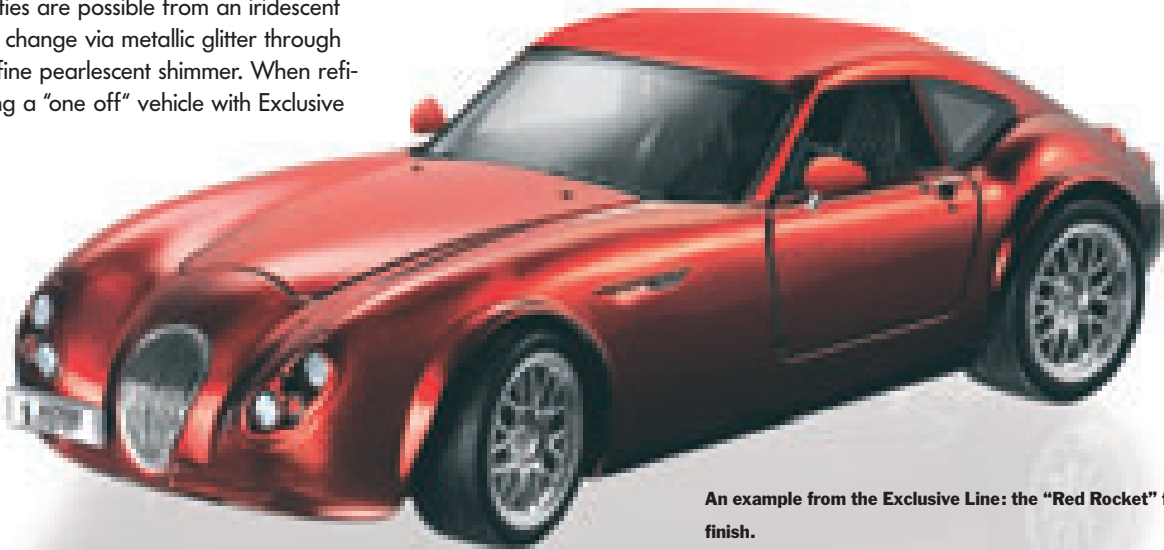
Effect colors are shades that include metallic, pearlescent pigments and other effect particles in addition to color pigments. If a color shade contains only color pigments, it is called a solid color shade.

Effect particles with a wide variety of effects are used in the field of automotive coating. This is why the refinisher has to adapt the color shade to the type and quantity of effect particles used. Many varieties are possible from an iridescent color change via metallic glitter through to a fine pearlescent shimmer. When refinishing a "one off" vehicle with Exclusive

Line or in show car designs there are far more color options than in OEM refinishing.

As the variety of effect particles continues to grow, more and more possibilities arise to modify and design a car at the refinishing level. Matt finishes are the latest trend spotted in automotive OEM coating.

For the manufacturers, color is an important and relatively low-cost means by which they can differentiate their cars from the competition and project a specific image.



An example from the Exclusive Line: the "Red Rocket" flip-flop finish.

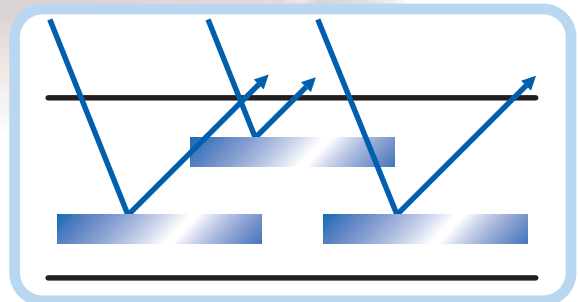
Pigments as effect particles.

As a general rule, effect particles are categorised as aluminium and pearlescent pigments.

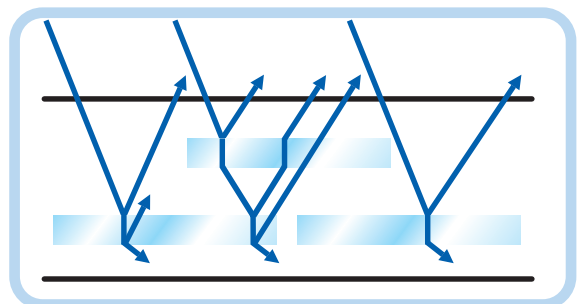
The basis of all color effects is the interaction of light and material.

The effects arise from:

- reflection
- absorption
- scatter
- transmission

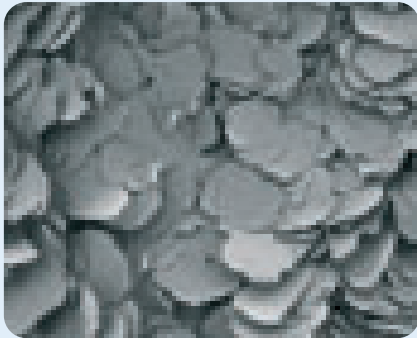


Reflection of aluminium pigments: light is reflected.

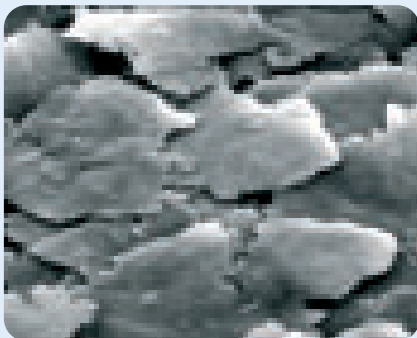


Reflection of pearlescent pigments: light is broken.

The most common effect particles.



Silver dollar aluminium.



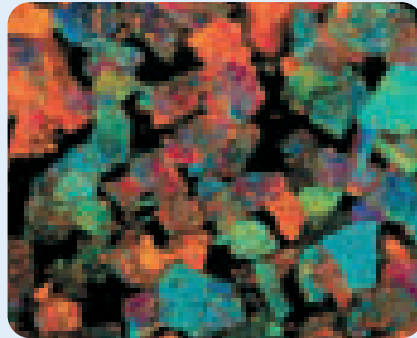
Cornflake aluminium.

Aluminium pigments.

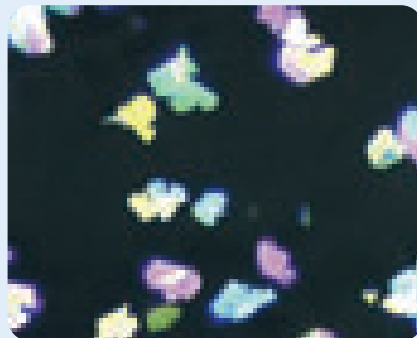
Aluminium pigments are the oldest effect particles known and used in the automotive industry. They consist of small, flaky particles that give the paint its metallic character and flip. The kind of reflection depends on the particle size and surface roughness.

Silver dollar aluminium has a smooth surface and reflects the light in a directed way; colors shine more brilliantly.

The textured surface of cornflake aluminium scatters the light, making colors appear paler.



Pearlescent pigments.

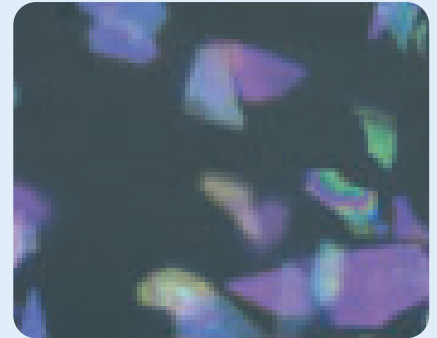


Xirallic®.

Pearlescent pigments.

Pearlescent pigments have been used since the 1980's. They contain natural glimmer flakes which are covered by various metal oxides. Different metal oxides produce different color effects. Thin flakes with various diameters and smooth surface provide for a great effect.

The spectrum of pearlescent pigments is due to interference, transmission and absorption. The flakes themselves are mostly transparent and break the light so that the color changes. Lightness and darkness depend on the viewing angle. In order to obtain a perfect refinishing result, the pigments must be aligned in parallel.



Example of flip-flop finish Exclusive Line "Miami Mint".

Special effects (e.g. Exclusive Line).

The so-called flip-flop pigments are characterised by a change of color or flow. They also consist of covered flakes. These have several transparent layers which shine in a spectrum of different colors depending on the viewing and reflection angle. The light is reflected as by a mirror.

The core of these flakes is opaque. This core has several optical layers whose thickness is precisely controlled during the manufacturing process. This makes it possible to achieve the iridescent color effect. These colors have a very high brilliance and saturation.

Causes of color fluctuations.

Color fluctuations may occur in spite of state-of-the-art testing methods and processes in OEM coating.

There are numerous reasons for color fluctuations in the OEM coating of modern vehicles

- different production parameters within auto maker's worldwide manufacturing networks,
- different application procedures,
- changing paints suppliers and chemical processes.

Different production sites.

The various models of a car maker are manufactured in different locations. Even though the specific color parameters are mandatory throughout a car maker's

manufacturing network, a certain amount of color fluctuation is inevitable for a number of reasons. Apart from the location-specific application equipment and techniques, these also include flash-off times and drying parameters corresponding to the local climate.

Application methods.

Variations in application often ensue from local production conditions. The results vary depending on the coating method – manually, coating robot, electrostatic.

Paint suppliers/paint chemistry.

Each paint manufacturer has its own formulas. When a paint manufacturer is replaced, it may soon occur that a "silver" shows clear color fluctuations

due to different formulas or chemicals (conventional/waterbased paint/powder coating). The color shades are also influenced by the clearcoats used.



Manual finishing.



Electrostatic finishing with bell.

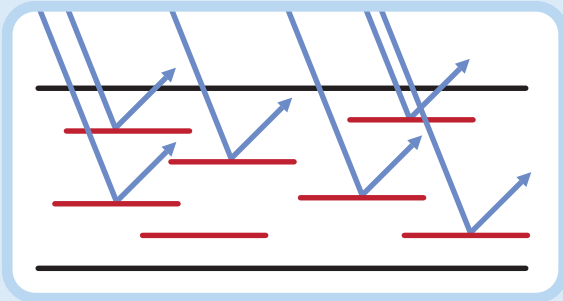


Mechanical finishing by robot.

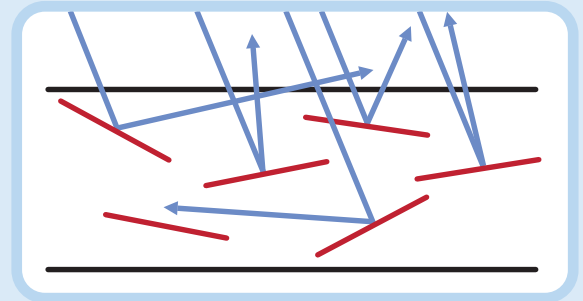


Pneumatic robot coating.

The type of application of effect colors is very important for an optimum result because the effect particles have a very different orientation.



Parallel orientation of the effect pigments.



Disordered distribution of the effect pigments.

Metamerism.

Metamerism is the effect of a color shade changing under different light sources.

Sometimes the color of a repaired vehicle looks perfect in daylight, but shows two distinct colors (OEM and refinished) under different light sources, such as street lighting. This is known as metamerism.

Metamerism occurs because it is possible to mix the same color using different pigments. For example: a green color can be based on a purely green pigment, while the same green can be mixed from blue and yellow pigments.

Metamerism can be avoided by using only those pigments in refinishing which are used in automotive OEM coating too. The Standox color shade formulas meet these requirements.

Before approval, the formulas are tested in the laboratory under various light sources. If any adjustment is required, Standox recommends the use of the mixing bases used in the mixing formula.

TIP.

For testing purposes, Standox recommends daylight lamps or fluorescent lamps, e.g. Osram L58W/32-965 or Philipps T1-D 58 W/965.



Color shade in daylight.



Color shade difference in artificial light.

From the OEM color to the Stadox mixing formula.

Color designers have to meet numerous technical requirements and high demands in the development of new colors for automotive OEM coating.

For example, new colors have to:

- match the vehicle shape and harmonise with it or underline it.
- integrate with the manufacturer's existing range of colors.
- meet certain pigment requirements.
- meet technical demands (e.g. light resistance).
- comply with cost budget.
- be suitable for OEM coating.
- allow for repairs.
- convey individuality (image).
- be in line with current fashion trends.

Each new color formula is a challenge for the Stadox experts. In spite of a comprehensive formula archive, a proprietary formula must be developed for each new color so that the shade can be reproduced precisely.

Aggressive environmental influences, e.g. from UV radiation, will alter even the most stable color over time. Nevertheless, the paint formulation must match the OEM paint precisely.

This is why the colors are physically and environmentally tested by experts every day.



A wide range of mixing paints is available in the Stadox mixing system.

New color shades are tested for stability and resistance. This so-called "Florida weathering test" takes up to 3 years.





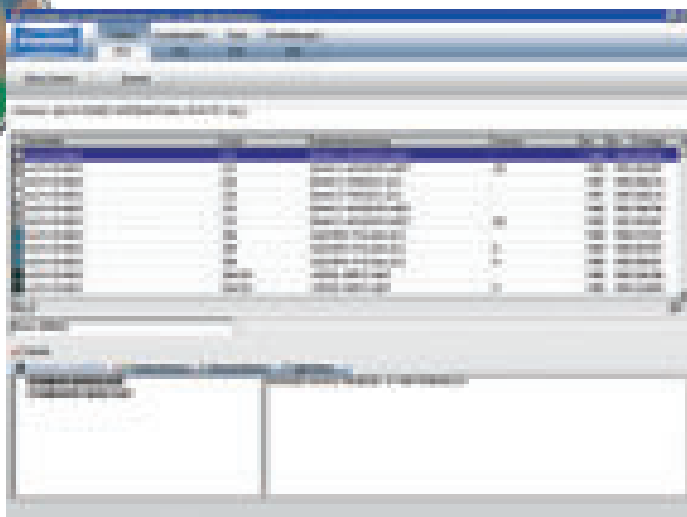
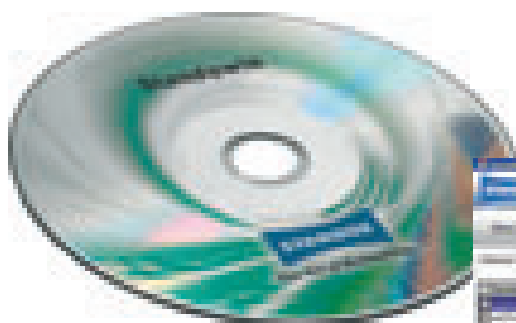
Analysis under the microscope to determine the effect particles of a paint.



Size comparison: pearlescent pigment on a human hair under an electron microscope.

Competence in color.

The Stadox Color Tools at a glance.



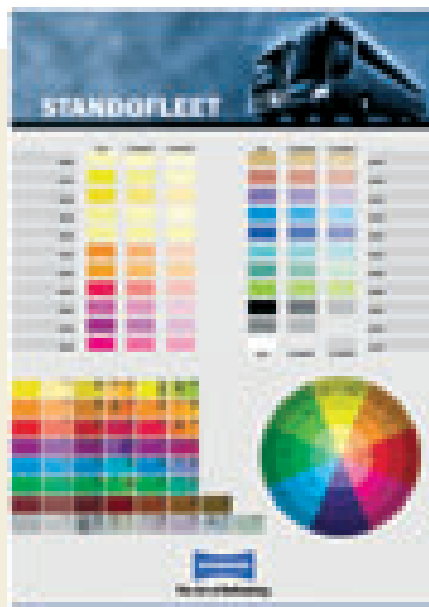
Standown.

Standown puts extensive color shade information onto your PC screen.



Standofleet Color Box.

The stable metal box includes all European and Asian commercial vehicle OEM coating colors and international fleet colors.



Color Poster.

Stadox Color Posters offer highly visible help when tinting colors.



Genius.

The Genius color measuring device quickly helps you measure colors and tints directly from the vehicle body.



Online formula search.

Your local Standox website provides you with current color information 24 hours a day.
www.standox.com

Color Box basic edition OEM.

The indispensable basic edition of the Standox Color Box collects all OEM colors from the European and Asian car brands on convenient swatch fans.



Colormix fan.

Standox Colormix fans come in very handy when it comes to tinting your Standohd colors.



Standox Color Box.

The stable metal box includes all European and Asian OEM coating colors and their variants.



Safe and quick color measuring.

The surface of the color to be measured must be clean. Clean the entire area with degreasing agent and polish the area to be measured with a suitable polish in order to remove all contaminations.

The color should be measured in the damaged area. After the successful measurement, the data is processed using the Standwin software.

Genius means quick and effective color identification.

Genius enables you to measure colors reliably and effectively directly from the vehicle body.

If you want to identify colors quickly, safely and efficiently, look no further than Genius, the electronic color measuring device. In the future, automotive manufacturers may abolish color coding altogether. This would make it much more difficult for independent bodyshops to identify colors the traditional way.

Genius is a convenient and reliable measuring device enabling you to identify all relevant pieces of color information on the spot.

Genius identifies the color directly from the polished vehicle body near the damaged area. Solid and effect shades are identified reliably. The results of this three-angle measuring device are very accurate. Genius stores the measured data which is converted into ready-to-use mixing formulas on your PC using Standwin software.

Genius performs particularly well when it comes to difficult colors, e.g. fluctuations in OEM coating, rare colors or those with many variants. Genius makes it easy for bodyshops to identify all these colors and mixing formulations.



The quick and reliable way to finding the right formulation.

There are different ways to identify the right mixing formulation.

Standex offers a variety of aids to make your searches more effective and efficient.

Color Boxes.

For every paints system, Standox offers a compilation of all OEM colors and their variants. The commercial vehicle colors include fleet liveries, too. The large chips are coated with actual Standox paints to enable a precise color comparison. The relevant color code is printed on the back of the chip.

Standwin.

Standwin offers many functions to facilitate your daily work. The Standwin software gives you access to all current color formulas. You can search for the formula by color code or based on the Genius measuring results.

When you use Genius, Standwin analyzes the measured data and suggests those formulas from the database which best match the measured shade. After the selection of the right basic formula, the mixing formula is corrected automatically on the basis of the measured data.

This data can be transmitted directly to a connected electronic scales with a precise indication of quantity. Customer-specific formulas or nuances identified can be stored for future reference. In addition to the color formula search, Standwin's "Color Information" section offers additional brand-specific information including the color of add-on parts or the position of codes.

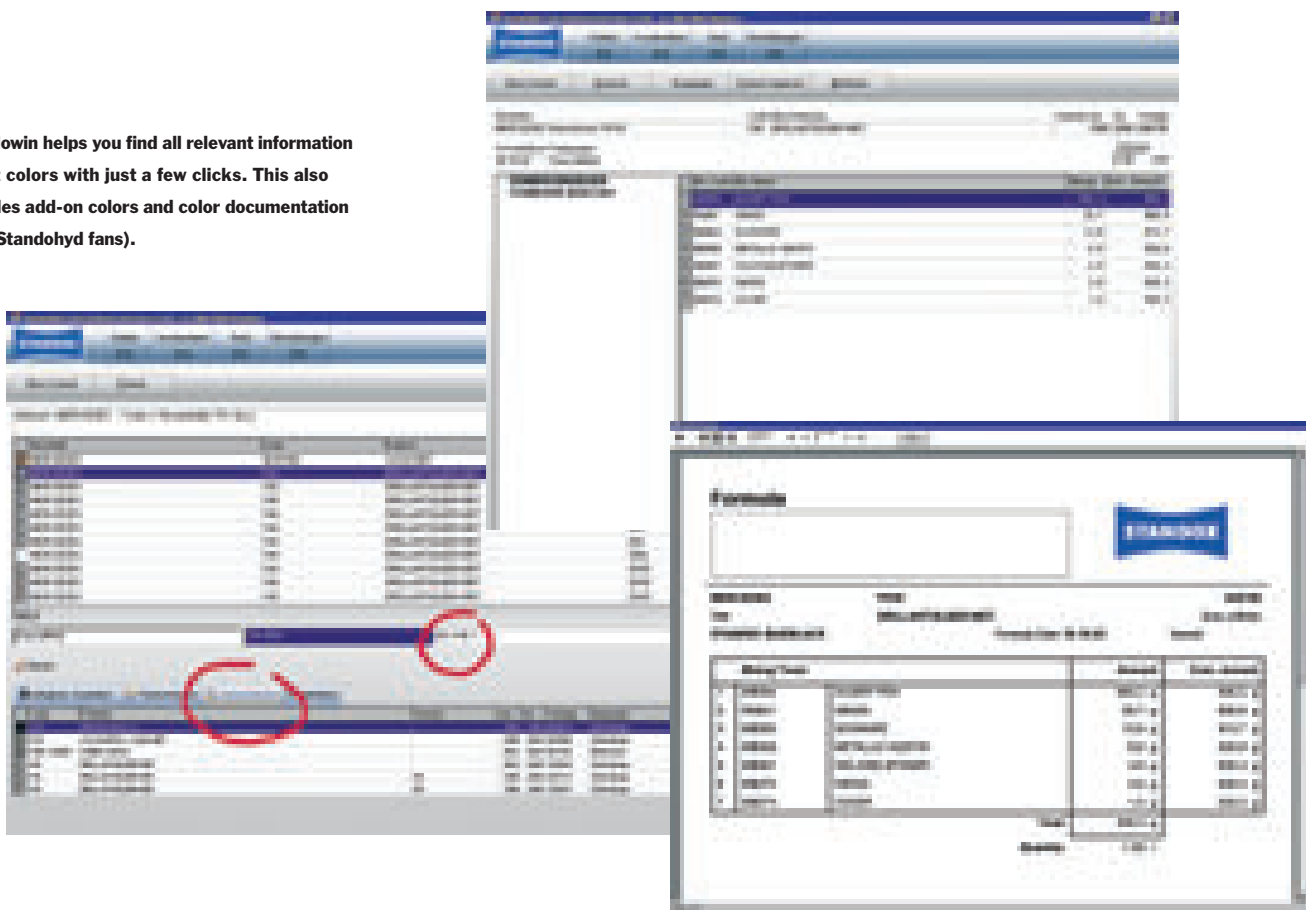
Formula search via Internet.

To find the right color online, consult your national Standox website. At "Formulations Online" you find current color information and formulations.

Color Hotline.

Of course it may happen that you cannot identify the right color in spite of perfect equipment and correct application of the color tools. In this case, the Standox Color Hotline will help you quickly and reliably.

Standwin helps you find all relevant information about colors with just a few clicks. This also includes add-on colors and color documentation (e.g. Standohyd fans).



Variant indication.

BROWN	YELLOW	BLUE	GREEN	GREY	RED	DARK	PALE	LIGHT	BRIGHT	COARSE	FINE	MATT
BR	GE	BL	GN	GR	R	D	F	H	L	GB	FN	MATT
BR+	GE+	BL+	GN+	GR+	R+	D+	F+	H+	L+	GB+	FN+	
BR-	GE-	BL-	GN-	GR-	R-	D-	F-	H-	L-	GB-	FN-	
BR.D	GE.H	BL.D	GN.D	GR.D	R.D							
BR.D+	GE.H+	BL.D+	GN.D+	GR.D+	R.D+							
BR.D-	GE.H-	BL.D-	GN.D-	GR.D-	R.D-							
BR.H	GE.D	BL.H	GN.H	GR.H	R.H							
BR.H+	GE.D+	BL.H+	GN.H+	GR.H+	R.H+							
BR.H-	GE.D-	BL.H-	GN.H-	GR.H-	R.H-							
BR.GB	GE.GB	BL.GB	GN.GB	GR.GB	R.GB							
BR.GB+	GE.GB+	BL.GB+	GN.GB+	GR.GB+	R.GB+							
BR.GB-	GE.GB-	BL.GB-	GN.GB-	GR.GB-	R.GB-							
BR.FN	GE.FN	BL.FN	GN.FN	GR.FN	R.FN							
BR.FN+	GE.FN+	BL.FN+	GN.FN+	GR.FN+	R.FN+							
BR.FN-	GE.FN-	BL.FN-	GN.FN-	GR.FN-	R.FN-							

Service formulas can be recognized by the "S!" which is put in front of the variant description.

Examples:

S! R

S! GN

S! BL.D

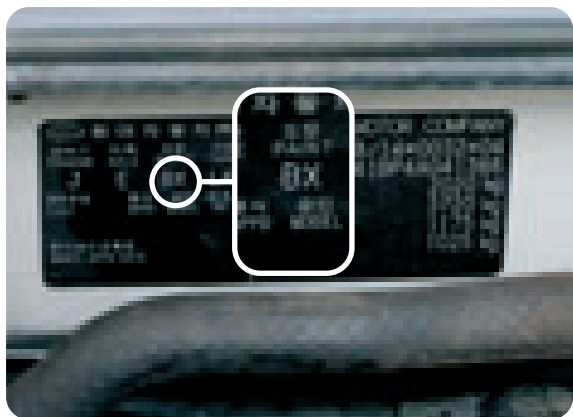
S! GE.FN



Useful additional information is provided on the Standwin CD.

Accurately identifying colors.

Every refinishing job starts with identifying the right color shade.



Identify the code.

The color code number details are often hard to find as each car maker places the type plates in a different position. With the help of the color code, you can identify the right color (see also information box below).



Polish the paint surface.

Clean and polish the area next to the damage.

Problems with the color code number.

It is not uncommon to find that

- color code numbers are missing, incomplete or wrong.
- that the manufacturer has changed the code numbers (e.g. to include contrasting colors for add-on parts or interior colors in the code).

In this case you have various options to identify the right color:

- Use the additional information provided by Standown's "Color Information".
- For updated information, use the Internet color search from Standox.
- Measure the color with the Genius device.

If you still have not identified the right color, you can always call the Standox Coloristics expert who will be glad to help you.



Visual comparison.

Take the Color Box fan to the vehicle and compare the color swatch of the fan with the area next to the damage in order to identify the right shade. It is important to compare it close to the damaged area because even new factory-finished cars show inconsistencies in their color on different parts of the paintwork.

TIP.

Repeat the procedure in various lighting conditions (to prevent metamerism). Also look at the swatch from different angles.

Correcting formulations using the Colormix fan.

Sometimes colors turn out to be different in spite of the correct procedure. In these cases, you have to tint with the help of Standox.

There are a number of useful rules and tips for tinting. If you know them and apply them in the right way, tinting is no problem at all.

Color samples are very important for the tinting process. Important working aids include the mixing fan and color posters with Ostwald's color circle and tinting tools.



TIPS.

- If possible, use only those mixing paints for tinting which are included in the color formulation.
- Observe the rules of complementary colors and partner colors according to Ostwald's color circle. It says that complementary colors are not recommended for tinting, because they tend to refract each other and result in achromatic, "dirty" mixtures.
- Add a maximum of 10% of the mixing paint for correction.



Produce sample panels.

It would be best to spray two sample panels as usual with the identified color. For the second panel, you add half a spray pass (finishing pass) to the wet basecoat film. After drying, the clearcoat is applied. The finishing pass makes the effect pigments deposit at the surface to make the color appear lighter.

The colors should be checked from several angles in daylight (northern light) or under daylight lamps to assess the changing (flip) effect of metallic and pearlescent color shades.

The effective and efficient way to spray sample panels.

The procedure is simple: take the paint mixed for your next job and the sample panels into the spray booth in which a refinishing job is to be performed.

Do the refinishing job first and allow it to flash off. During this time, spray the sample panels (1x normal, 1x finishing pass) in a protected corner. Dry both paint coats (the job and the samples) together.

If the color of the sample panel is correct, you can start on the job right away.

TIPS.

- Always label color samples correctly and store them.
- Store the data in Standwin.

Color and effect blending techniques.

In some cases, the result is not as expected in spite of careful tinting and optimum bodyshop conditions.

Large uninterrupted surfaces (e.g. wing, door, side) are a challenge for the refinisher, in particular if there are no creases or add-on parts or if there is only little distance between the new and the old paint coat. In these cases, a solution may

be provided by the blending technique which is also accepted by insurance companies. This allows you to avoid differences in the flip of special effect paints.

Accurately identifying colors/cost aspects.

In order to ensure efficiency and effectiveness for the refinisher and the customer alike, it is becoming more and more important to observe all relevant factors in the cost calculation for the customer. These factors can have an influence on the pricing and the refinishing work required:

- 1 Is it a multi-coat paintwork, e.g. three-coat system?
- 2 Does the color have any particularities, such as a tinted clearcoat?
- 3 Is a special substrate color/filler required?
- 4 Has the vehicle been resprayed or received a special finish?

To avoid misunderstandings with the customer and unexpected problems during the work, these questions should be answered by the refinisher before calculating the labour and material required for the refinishing job.

Blending in within one vehicle part.



Apply the basecoat only to the area where filler was applied.



Fade out the edges.

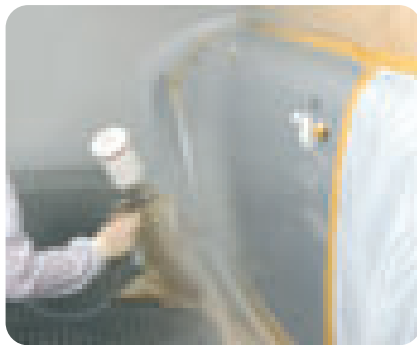


Apply clearcoat to the complete part. Make sure that the clearcoat application is thin in the area next to the adjacent part.

Blending in into adjacent panel.



Apply the basecoat to the new part/area where the filler was applied. In case of major color differences, blend in to about 10 cm of the adjacent part.



Blend in to the adjacent part.

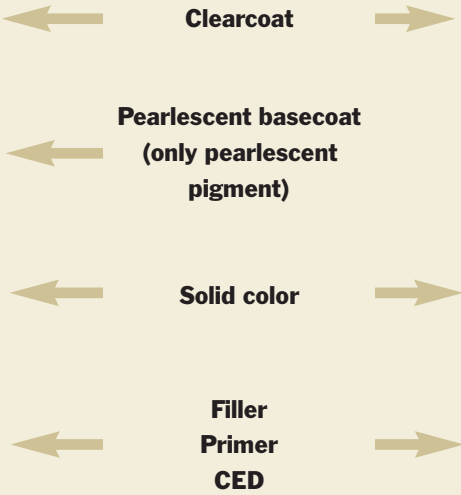
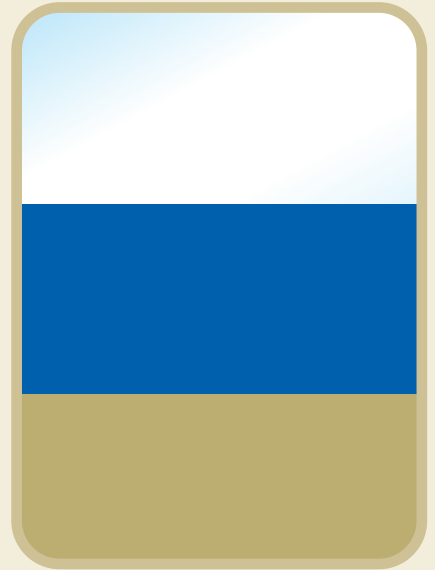


Apply clearcoat to the complete part. Make sure that the clearcoat application is thin in the area next to the adjacent part.

Three-coat pearlescent system.



Two-coat system.



Professional refinishing using professional products.

Standex is one of world's leading manufacturers of automotive refinishing paints, offering innovative and environmentally compatible product systems for modern bodyshops.

The quality of a refinish depends on the right paint. Standox offers sound product systems for every field of application that ensure a perfect refinish. Standox products meet the environmental requirements of the EU and ensure user-friendliness and great efficiency. Standox supplies its customers with a broad range of customised products that is constantly supplemented and improved.

Standex products are frequently recommended by automotive manufacturers for guarantee and warranty work, because Standox has more approvals than other paints manufacturers.

Numerous tools and technical trainings help meet the customer's requirements even better.

Training.

Increasingly complex colors and top-quality materials make the refinisher's work more and more difficult. This is why Standox offers a special Coloristics seminar for refinishers – in addition to many other training courses. In this dedicated color course, you learn everything about color and paint in theory and practise.

Further information is available from your technical advisor.



Outlook.

The automotive and paints industries are subject to changing trends, too, even though things do not change as fast here as they do in fashion.

There are always new, extraordinary colors or effects. Paints manufacturers and refinishers have to be adaptable and react quickly.

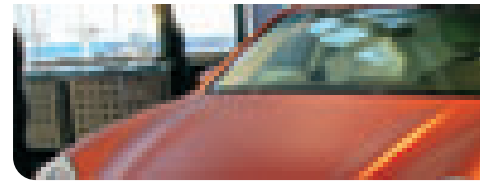
Currently, there are various trends and tendencies which are set to grow in importance. Tomorrow's colors are white, orange and metallic shades of all kinds, like copper, bronze or platinum. Altogether, a trend towards more colorful options is predicted. The era of silver seems to be over.

New technologies are emerging at the same time, including the so-called tricoats (three-coat build-up, with transparent effect coat over the basecoat) or tinted clearcoats (colored, tinted clearcoat). These trends come from Asia and the USA, where they are more common. And so-called liquid metal shades that make the car body look as if it were made of bare steel or chrome, are the focus of the car maker's designers, too. Special series are already being produced. Another persistent trend is matt clearcoat applied to add-on parts or the entire car. The velvety look of the surface invites you to touch it and gives the colors a completely new look. Again, paints makers and refinishers must be prepared and provide solutions if and when such trends conquer the streets.

Standex has faced these challenges and offers the required solutions. Good advice, useful tools and targeted training on various topics support the refinisher.

The art of refinishing with its creative potential and colorful variety remains a major factor in the enduring attractiveness of the automobile. As competent professionals, refinishers know their craft and how to handle the interaction of color and material that makes our cars stand out as new, individual, perfect or even exclusive.

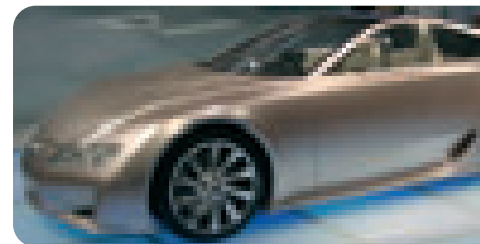
Standex supports them with all means available, ensuring continued excellence in "The Art of Refinishing".



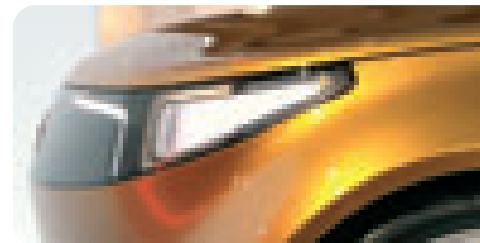
Mattpaints.



White Pearl.



Liquid Metal.



Tinted clearcoat.



Standex GmbH · Postfach · D-42271 Wuppertal · Germany