



MTP-300 Color Theory

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# Color Theory

A color expression often means ten different colors to ten different people. “Name this color” is a very difficult subject. If you show the same color to four different people, you will get four different answers. Color is a matter of perception and subjective interpretation. Even when looking at the same color, people will draw upon different references and experiences and express the same color in vastly different words. Verbal expression of color is too complicated and difficult. However, if there were a standard method by which colors could be accurately expressed and understood by anyone, color communication would be much smoother, simpler and exact. Such precise color communication would eliminate color-related problems.

Words for expressing colors have always changed with the times. If we consider the red mentioned above, it could be described as “vermillion”, “cinnabar”, “crimson”, “rose”, “strawberry” and “scarlet” just to name a few. These are called common color names. By analyzing the color condition and adding adjectives such as “bright”, “dull” and “deep”, we can describe the color a little more precisely. People can still interpret “bright red” differently. Verbal expressions of colors are still not accurate enough.

In the automotive refinish business, color related complaints, concerns and questions will continue to rank at the top of the list for technical support. It is the simple fact that there are too many variables for a paint-manufacturing laboratory to simply write a manual and all the problems go away. Every aspect related to painting a vehicle poses the potential to effect color matches. The shop environment, equipment, painter techniques, material, light sources and so on is hard to manage.

# How Vehicle Colors are Selected

## How Colors are Chosen

Many people think automotive color and fabric designers gaze into a crystal ball to see design trends. That's far from the truth: Trend tracking, developing, planning and communication are all part of the process in envisioning automotive interior and exterior trends.

## Color Development

Many Automotive Manufacturers begin the process by studying color trends in show cars and in fashion and product design. They also attend color conferences. This process revolves around global color popularity data and competitive color palettes, which can directly affect a model's final color palette. Manufacturers look at everything from European fashion to premier auto shows (in the U.S. and overseas) to conferences put on by the Color Marketing Group (CMG). The CMG is a nonprofit association of about 1,600 color designers from around the world. Members forecast color development directions for a wide variety of industries, including fashion, furniture, automotive and architecture. The CMG meetings focus on color palettes three years out; however, many designers work as far as five to six years in the future. It's always a slight gamble, because the jury is still out on the sales data."Designers turn to a variety of industries while evaluating trends. Automotive color and trim specialists for the Manufacturers also play important roles in recommending the color palettes for the U.S. automotive markets as competitive automotive designers debate the hottest color trends on the horizon.

After the North American color trend information has been developed, the color proposals are sent to the Manufacturers Design Department's. Their designers review the color trends and compare color trend data to the Asian and European data. The communication goes back and forth until a global color palette is determined.



*Designers turn to a variety of industries while evaluating color trends.*



It's an art to look at a small paint panel and visualize the entire vehicle in that color. Large paint panels and sometimes fenders are viewed in multiple lighting conditions to judge the colors correctly. The designers go outdoors to take advantage of natural light. They hold up color panels next to vehicles with similar colors to note differences and similarities. Bright daylight shows the true color range, so it's the best way to evaluate color. If the designers look at a reddish blue, for instance, they may want to see how far to the purple side the color will shift. Another tool is a MacBeth color booth, which simulates daylight, clear white fluorescent (the lighting in dealerships) and horizon (sunset) lighting conditions. Shown here on a Legacy wagon, Wintergreen Metallic is the best-selling color for Subaru vehicles.

Designers also use the three F's while evaluating the color range: face, flash and flop. The face is analyzing the color palette straight on, while the flash is the highlight. Designers like to see a bright undertone breaking through the surface of the base color. The flop is the shadow side of the color; designers look for a color to hold true without appearing so dark that it's not recognizable as a blue or red.



*Shown here on a Legacy wagon,  
Wintergreen Metallic is the best-selling  
color for Subaru vehicles.*

**Bulls-eye?**

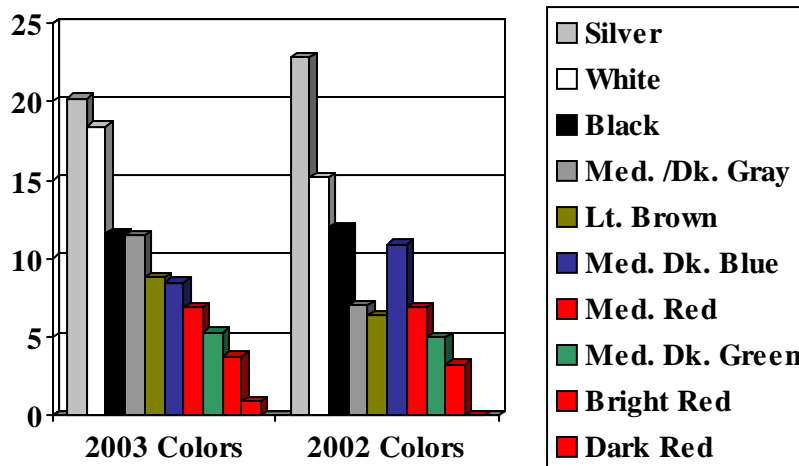
Designers ask themselves after the fact if they were on target with each color selected, and whether there was any big trend that was not considered.

**Down the Road**

What might the future hold in automotive design?

According to the CMG, advances in color and design are driving the development of new pigments, materials and products, which lets designers be innovative with texture and special effects like never before.

“The bottom line is that color sells cars! Color is an essential element that attracts attention, creates mood and affects lifestyle and buying decisions.”



*This chart illustrates the most popular North American Car Colors for 2002 and 2003. The numbers represent the overall percentage of vehicles manufactured according to color during these model years.*

# Color Variables

## **Color Variables**

When mixing formulas for specific automotive paint codes we are bound to come across variances of the standard formulae specific to the particular automotive formula with which we are attempting to mix. A variance in the automotive paint industry is a master standard variation to accommodate a specific color complaint pertaining to a specific automotive color formula. Variations for automotive paint formulas exist due to the widespread manufacture of automobiles across North America as well as batch-to-batch variations associated with the manufacturing process. For example GM, Ford, Chrysler, Toyota and others produce automobiles in North America, Canada and Mexico as well. It is due to these variables as well as differing plant equipment, temperatures constant mixing and shearing of flakes contributing to finer and grayer overall finishes these are the conditions that create color variances at the OEM level and the list goes on.

Variances can be found attached to the standard formulas and are slightly different than the standard formula to account for the color inconsistency that produced the variance. The standard formula for MSB-3881 is displayed on the following pages in figure 1 please notice the note field in the lower right hand corner as it contains a notation relevant to the formula displayed. Please also take notice of the alternates field, as it will contain all the available variations to the standard formula we are attempting to mix. Figure 2 is a variance of the standard MSB-3881 formula, the formula we are now examining is MSB-3881D. Again, please notice the note field in the lower right hand corner as the notation is now indicating to the user that the variant formula MSB-3881D is darker than the standard formula for MSB-3881. Figure 3 is yet again another variance of the formula MSB-3881, this time the variant MSB-3881//L is indicating to the user that the formula MSB-3881//L has a lighter flop than the standard formula for MSB-3881. Color matching can often times be frustrating when the standard formula does not provide an adequate color match, it is in these instances where a variance of the standard color formula may provide a better color match than the standard paint formula itself.



Figure 1 illustrates the standard color formula for MSB-3881, notice the notes field in the lower right hand corner indicates "SEE OTHER FORMULAS"



Figure 2 illustrates the alternate color formula MSB-3881D, notice the notes field in the lower right hand corner indicates "DARKER THAN STANDARD"



Figure 3 illustrates the alternate color formula MSB-3881//L notice the notes field in the lower right hand corner indicates "LIGHTER FLOP THAN STANDARD"

OEM variants are not the only reason for color variables. Some other reasons colors may not match accurately are:

- Wrong color code
- Vehicle was repainted from OEM with the wrong color
- Painter chose the wrong variance for the vehicle
- Intermix toners were not properly agitated
- Application technique of the painter
- Shop conditions, cooler shops produce darker colors
- Improperly measured intermix toners
- Outdated intermix toners
- Many other variables

# Viewing Color

As we discussed earlier color is a matter of perception and subjective interpretation. To see color we require three things

1. A color to view
2. An eye to view the color
3. A light source

Color is nothing more than light reflected back to the eye, as such the following key conditions should be considered whenever attempting to match color.

- Light Source Differences
- Observer Differences
- Directional Differences

## **Light Source Differences**

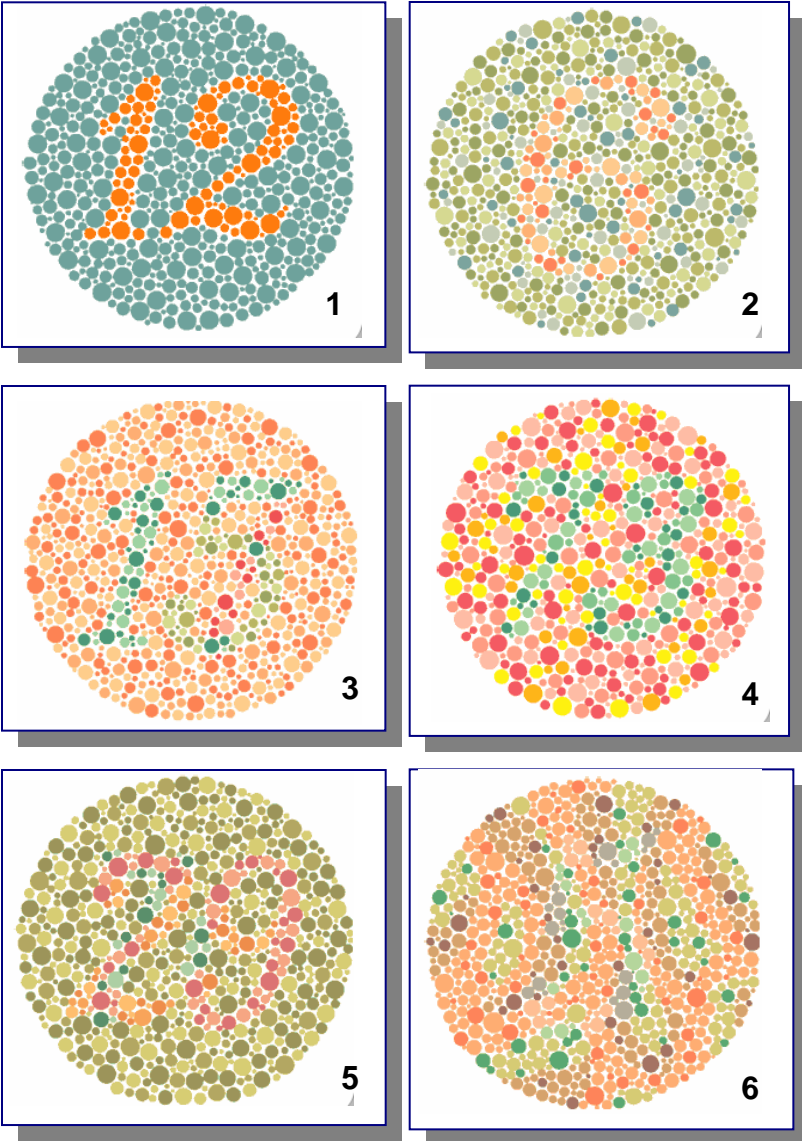
Colors may vary depending on the light source they are viewed under. When a color match between paints changes under different lighting conditions, it is referred to as metamerism. This is the reason why it is possible for a refinish paint to match under indoor lighting conditions, and then show up as a poor color match when the vehicle is inspected outside in daylight. The color match you see under shop lighting can vary depending on the type of light bulbs that are being used.

- Natural sunlight (Daylight) best viewing condition
- Macbeth daylight bulb closest to natural sunlight
- Incandescent bulbs tend to give paint a red cast
- Fluorescent bulbs could give paint a blue or yellow cast
- Cool and soft white bulbs can also alter the appearance

Light sources create these differing conditions as a result of their individual wavelengths. Paint laboratories and well equipped bodyshops often harness the power of corrected light bulbs such as the Macbeth daylight bulb to assist in color matching.

**Observer Differences**

The sensitivity of each person’s eyes is slightly different even for people considered having “normal” color vision, there may be some bias toward red or blue. Also, a person’s eyesight generally changes with age. Because of these factors, colors will appear different to different observers. Therefore, most paint laboratories monitor the color perception qualities of their shaders by administering a “color test”



Test Yourself

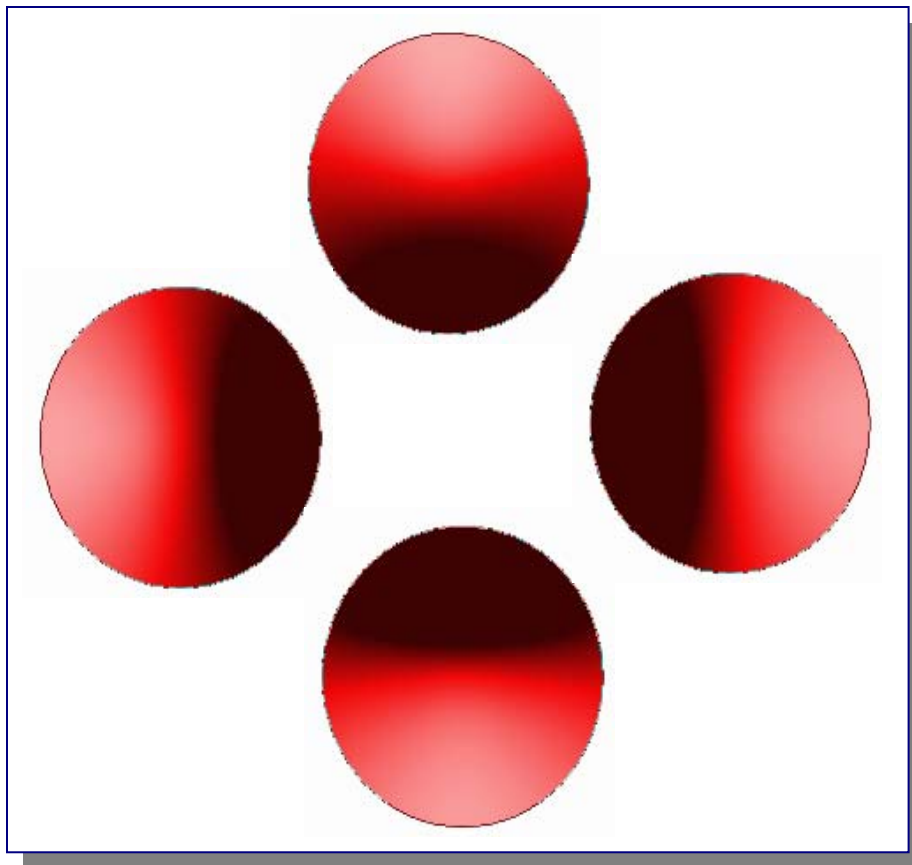
- 1 \_\_\_\_\_
- 2 \_\_\_\_\_
- 3 \_\_\_\_\_
- 4 \_\_\_\_\_
- 5 \_\_\_\_\_
- 6 \_\_\_\_\_

## Directional Differences

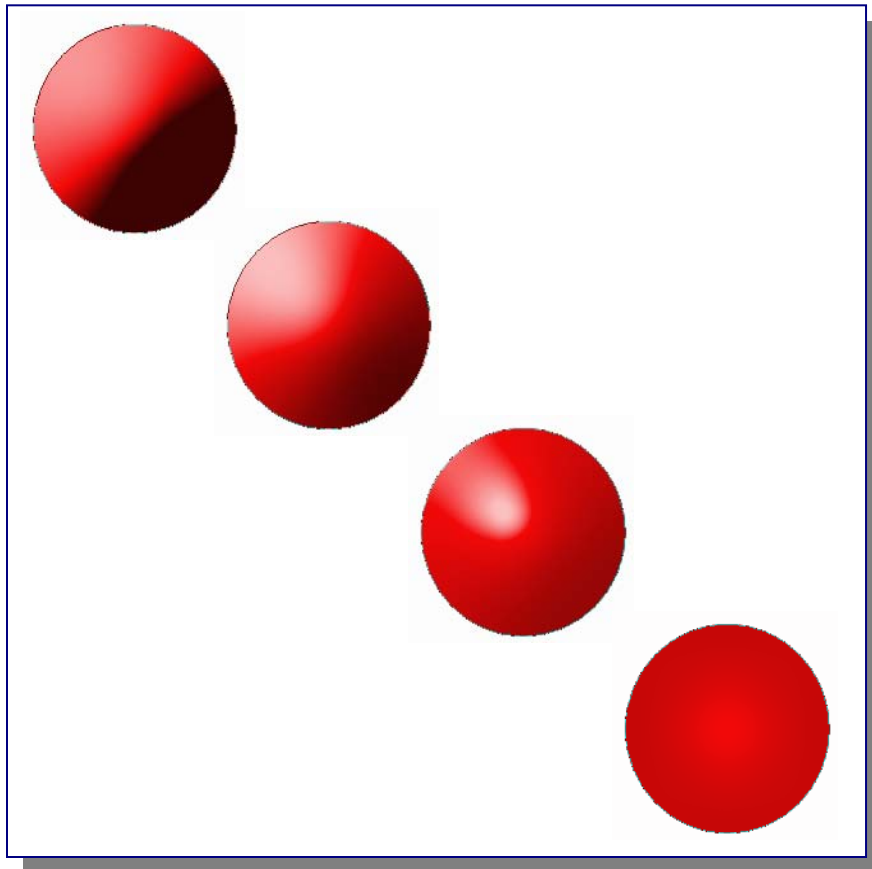
When looking at a car, viewing the car from just a slightly different angle can make a point on the car appear brighter or darker. This is due to the directional characteristics of the car's paint. The angle from which the object is viewed, and also the angle from which it is illuminated, must be constant for accurate color evaluation. There is one more phenomenon related to directional differences, FLOP.

Flop is the change in the color appearance when it is viewed from different angles. For example, viewed head on, a vehicle color may be a good match with your test panel. But when you move 45° or 60° to the left or right the color changes. Usually one or both of the side views is lighter or darker (Value Change), but any one of the three dimensions of color (hue, chroma, value) may change due to the flop.

Flop variations occur only with metallic and/or pearlescent colors. Solid colors do not exhibit flop. If you view a panel directly from the angle where the light is reflecting outward from the finish, you will see the highest level of brightness for that color, usually called the face. As the panel is rotated downward, the brightness decreased drastically and the panel appears to change its color. While high flop colors are attractive, the refinish painter must make sure to match the degree of flop in the area that is being refinished so it matches the rest of the vehicle.



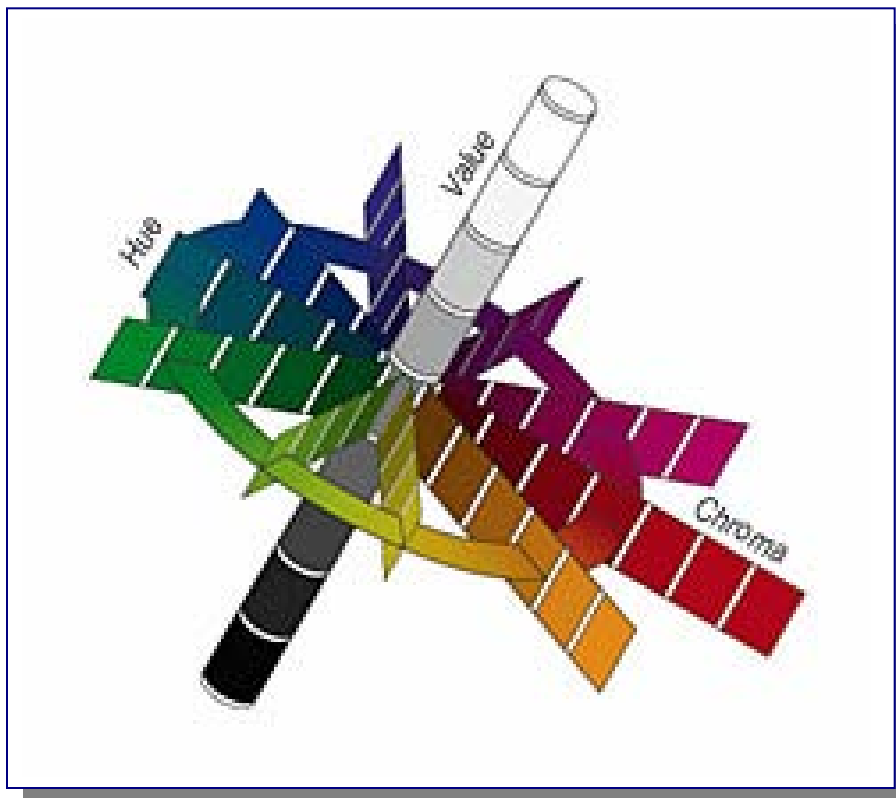
*Figure 1 illustrates the way in which directional differences can change the way a color is perceived from the observer's angle of view.*



*Figure 2 illustrates the directional difference perceived as a panel is illuminated from different positions.*

# The Three Dimensions of Color

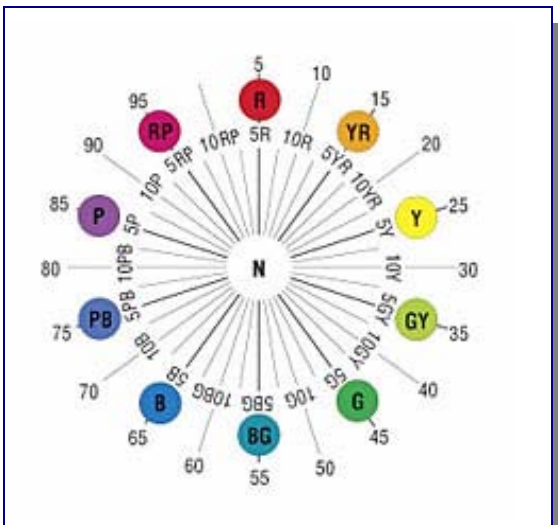
In 1915, Albert H. [Munsell](#), an American art teacher, used the work of Runge as a basis for the development of his own 3D color space. This space is based on pigment, not light. He begins with Runge's sphere, but he works from two observations that he has made as a painter. The first is that pure hues vary in their degree of lightness, and therefore all the pure hues (red, yellow, green, blue, violet) should not be on the same horizontal plane. The second observation is that some colors (red) are more vivid than others (green), and therefore, they should be further away from the axis. These observations all pointed Munsell toward a color space whose shape was very irregular and asymmetric, as shown below. Munsell's color solid has remained very useful, and is used by paint manufacturers, artists and designers.



Red, Yellow, Blue and Green hues form the basic color wheel. Chroma and value aid us in describing the appearance of the color once the hue has been identified. Learning these basic fundamentals will enable you to successfully match colors

## Hue (Color)

This dimension, which is the color we see, moves around the outer edge of the color sphere. It moves from yellow, to red, to blue, to green. Colors can move counter clockwise on the hue scale (I.e. blue can be moved toward the red side and become a purple). Colors also can move clockwise on the hue scale (I.e. a blue can be moved toward the green side and become aqua). By the same token, a red can be made either bluer (purple or maroon) or more yellow (orange). Hue is that attribute of a color by which we distinguish red from green, blue from yellow, and so on. There is a natural order of hues: red, yellow, green, blue, purple. One can mix paints of adjacent colors in this series to obtain a continuous variation from one color to the other. For example, red and yellow may be mixed in any proportion to obtain all the hues from red through orange to yellow. The same may be said of yellow and green, green and blue, blue and purple, and purple and red. This series returns to the starting point, so it can be arranged in a circle. Munsell called red, yellow, green, blue and purple "principal hues" and placed them at equal intervals around this circle. He inserted five intermediate hues: yellow-red, green-yellow, blue-green, purple-blue and red-purple, making ten hues in all. For simplicity, he used the initials as symbols to designate the ten hue sectors: R, YR, Y, GY, G, BG, B, PB, P and RP.



*This figure illustrates the different hues that form a standard color wheel. The first step in color matching is to identify the correct color hue.*

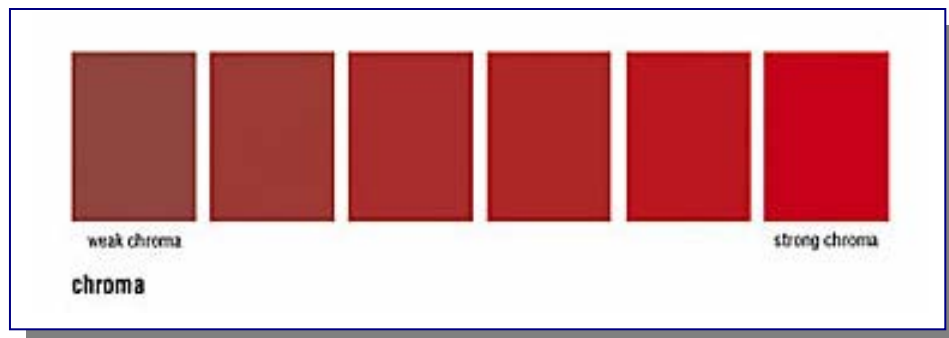
## Chroma (Intensity, Richness, Saturation)

Sometimes called saturation, chroma refers to a color's level of intensity and richness. This dimension moves along the spokes that radiate outward from the central gray axis of the color sphere. Weak washed out colors with the least chroma is at the core of the sphere, while highly chromatic colors that are rich, vibrant and most intense are at the outer edge. A rich pure red therefore is further away from the gray central axis than a red with less chroma.

Chroma is the degree of departure of a color from the neutral color of the same value. Colors of low chroma are sometimes called "weak," while those of high chroma are said to be "highly saturated," "strong" or "vivid." Imagine mixing a little vivid yellow paint with a gray paint of the same value.

If you started with gray and gradually added increasing proportions of yellow until the original vivid yellow color was obtained, you would develop a series of gradually changing colors that increase in chroma, as shown in the Figure below. Visually, the scaling of chroma is nearly uniform; the units are arbitrary.

The scale starts at zero, for neutral colors, but there is no arbitrary end to the scale. As new pigments have become available, color chips of higher chroma can be made for many hues and values. The chroma scale for normal reflecting materials extends beyond 20 in some cases. Fluorescent materials may have chromas as high as 30.

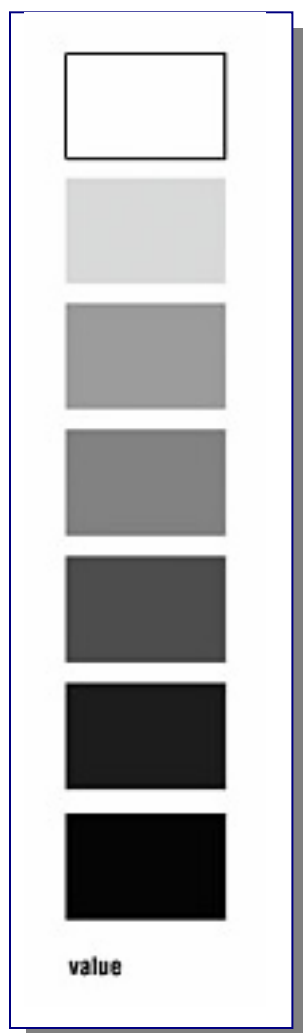


*This figure illustrates the different saturation levels that indicate a color's chroma value. The second step in color matching is to identify a color's chroma or richness.*

## Value (Lightness or Darkness)

This dimension refers to the degree of lightness or darkness of the color. The value scale runs up and down the north/south axis of the color sphere, with the whitest at the top, gradually darkening shades of gray in the middle and the blackest black at the bottom.

The scale of value ranges from 0 for pure black to 10 for pure white. Black, white and the grays between them are called "neutral colors." They have no hue. Colors that have a hue are called "chromatic colors." The value scale applies to chromatic as well as neutral colors.



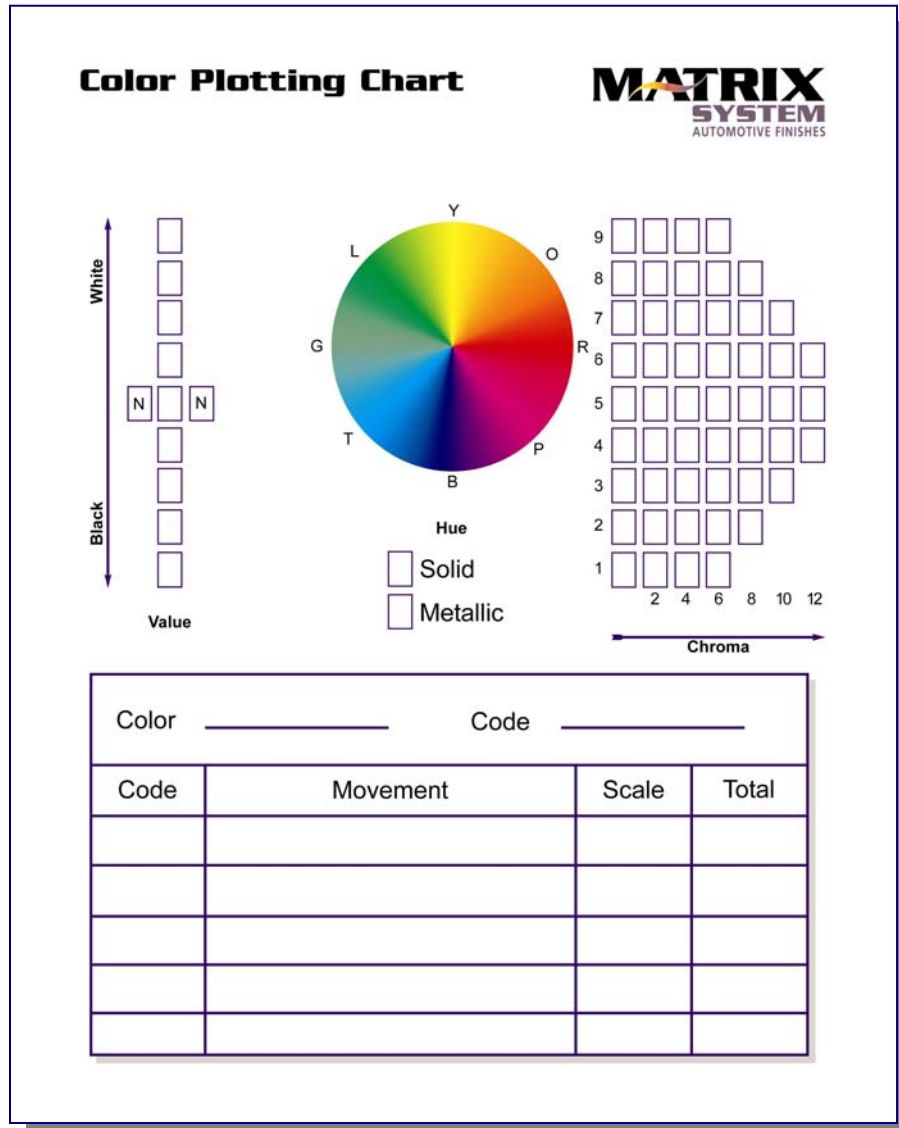
*This figure illustrates the different value levels that best indicate a color's value. The third step in color matching is to identify a color's value.*

# Color Adjustment & Plotting

Color adjustment is and continues to be the most difficult refinish task a painter or paint jobber is required to deal with. The problems associated with color matching are many and today's glamour and tricoat finishes offered by automotive manufacturers continue to challenge automotive painters everyday. There are a number of different reasons colors may require adjustment, among them are different plants, plant equipment, plant temperature, batch to batch inconsistencies, constant mixing and shearing of flakes contributing to finer and grayer overall finishes and the list goes on. Ultimately it is the responsibility of the automotive painter or paint jobber to provide a refinish that matches the original OEM. Only tint colors as a last resort! Before the decision is made to adjust a color double check the following:

1. The color code from the car is correct?
2. Does the car have a secondary color code?
3. Is the color part of a scheme?
4. The formula is correct to the color code, year and make of the vehicle?
5. The color chip (if available) matches the car to the paint formula?
6. Are variants to the color code available?
7. Does the color code or vehicle identification number suggest a variant?
8. Are the toners regularly agitated?
9. Was the mix order followed?
10. Were the correct toner amounts added to the mix?
11. Are you viewing the color under the correct light-source?

In order to correctly tint colors we must apply our knowledge of color to correctly match the car, this operation requires that we plot color to map out a plan for tinting



*This figure illustrates a typical color plotting chart used to determine the movement required to correct a mismatched color*

**Color Plotting**

Color plotting is a method by which we can identify the steps necessary to make Color A match Color B. In order to do that we must first generate a map indicating the directions from point A to point B. We cannot drive from Detroit, MI to Denver, Co without a map and likewise is true for tinting color. Any color can be plotted, by plotting two colors on a color chart we provide ourselves with directions to tint towards the target we are striving to match.

**Color Plotting Chart**

The chart includes a color wheel with labels Y, O, R, P, B, T, G, L. A vertical scale on the left is labeled 'White' at the top and 'Black' at the bottom, with 'Value' at the bottom. A horizontal scale on the right is labeled 'Chroma' at the bottom, with values 2, 4, 6, 8, 10, 12. A legend indicates that a box with an 'X' is 'Solid' and an empty box is 'Metallic'.

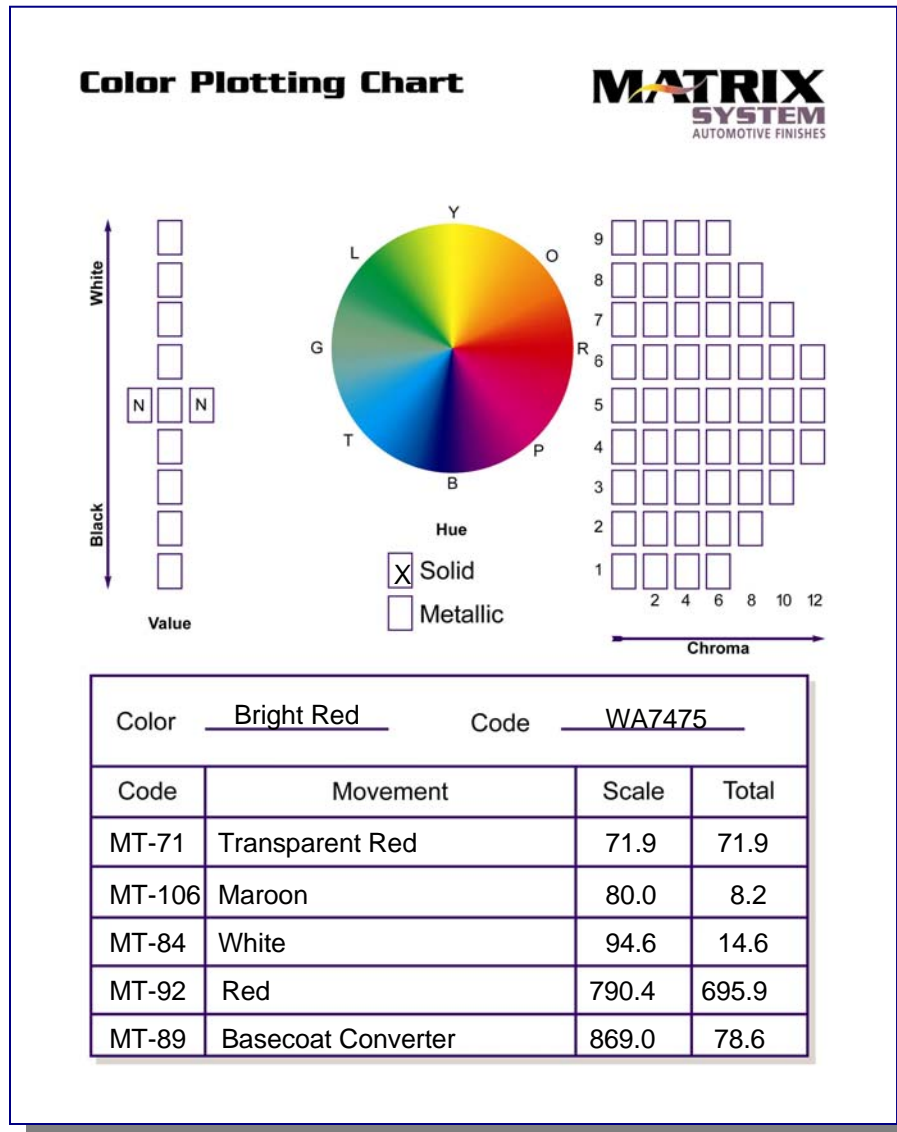
Color Bright Red Code WA7475

Code	Movement	Scale	Total
MT-71	Transparent Red	71.9	
MT-106	Maroon	8.2	
MT-84	White	14.6	
MT-92	Red	695.9	
MT-89	Basecoat Converter	78.6	

**Step 1 Enter the Formula**

Enter the formula in the corresponding spaces provided on the chart, this will aid in properly identifying the colors location on the color wheel as we plot the color.

**Step 2 Identify the Color as a Solid or Metallic**



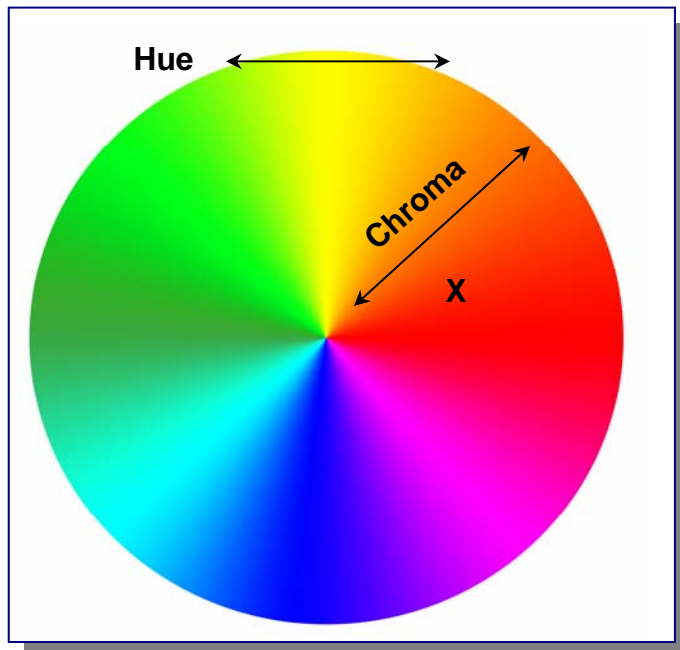
*The formula for WA7475 is primarily made of MT-92 and tinted with other toners to achieve its final shade.*

### Step 3 Determine the Parts of Each in the Formula

Determining the parts of each toner will aid us in properly plotting the color on the chart. To find the amount of each toner in the formula on the chart, take the scale amount of the base color and subtract the scale amount of the color that precedes it.

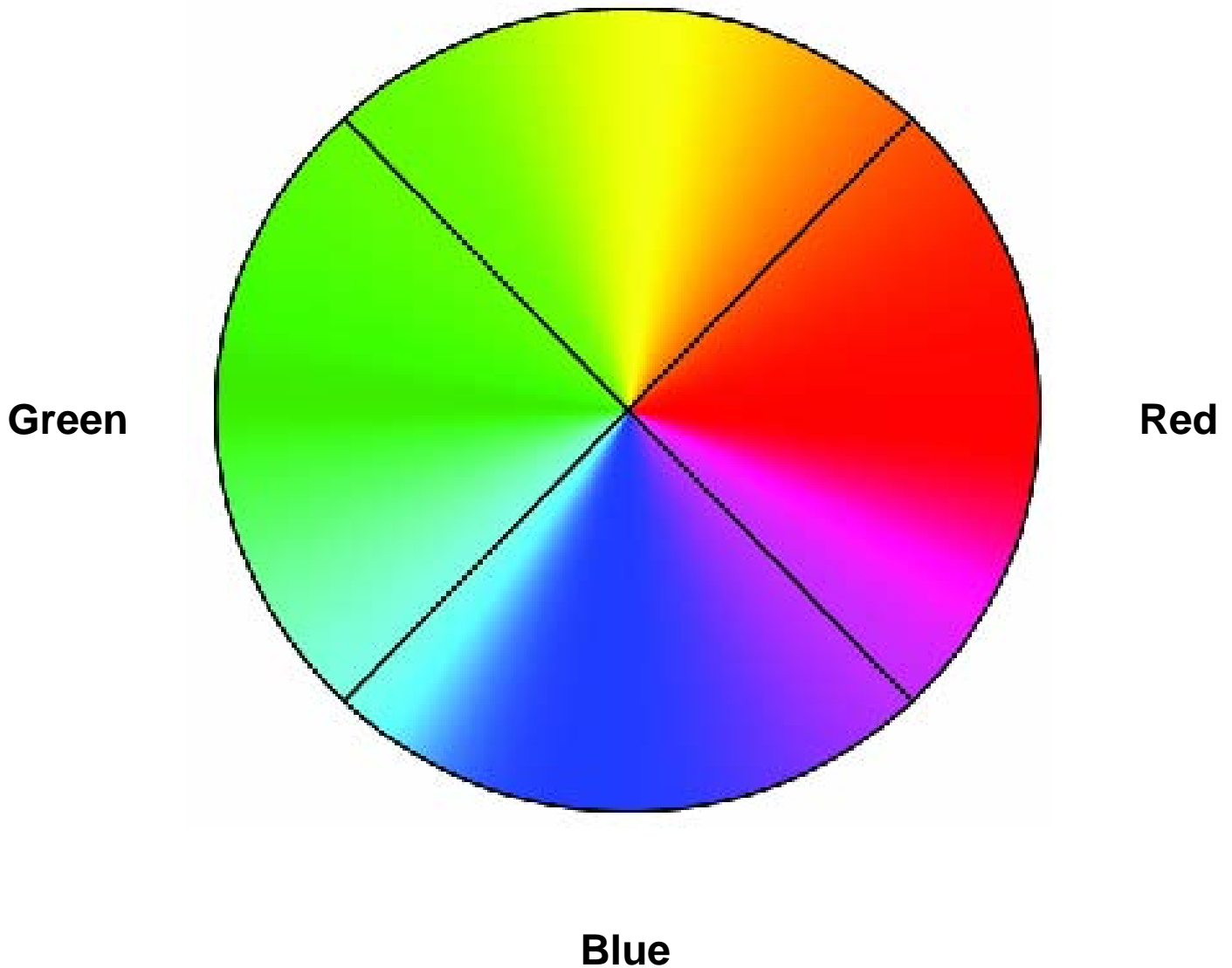
**Step 4 Plot the Color of the Formula and Target on the Color Wheel.**

Plot the Hue (Color) & Chroma (Intensity) of the paint (X) on the color wheel

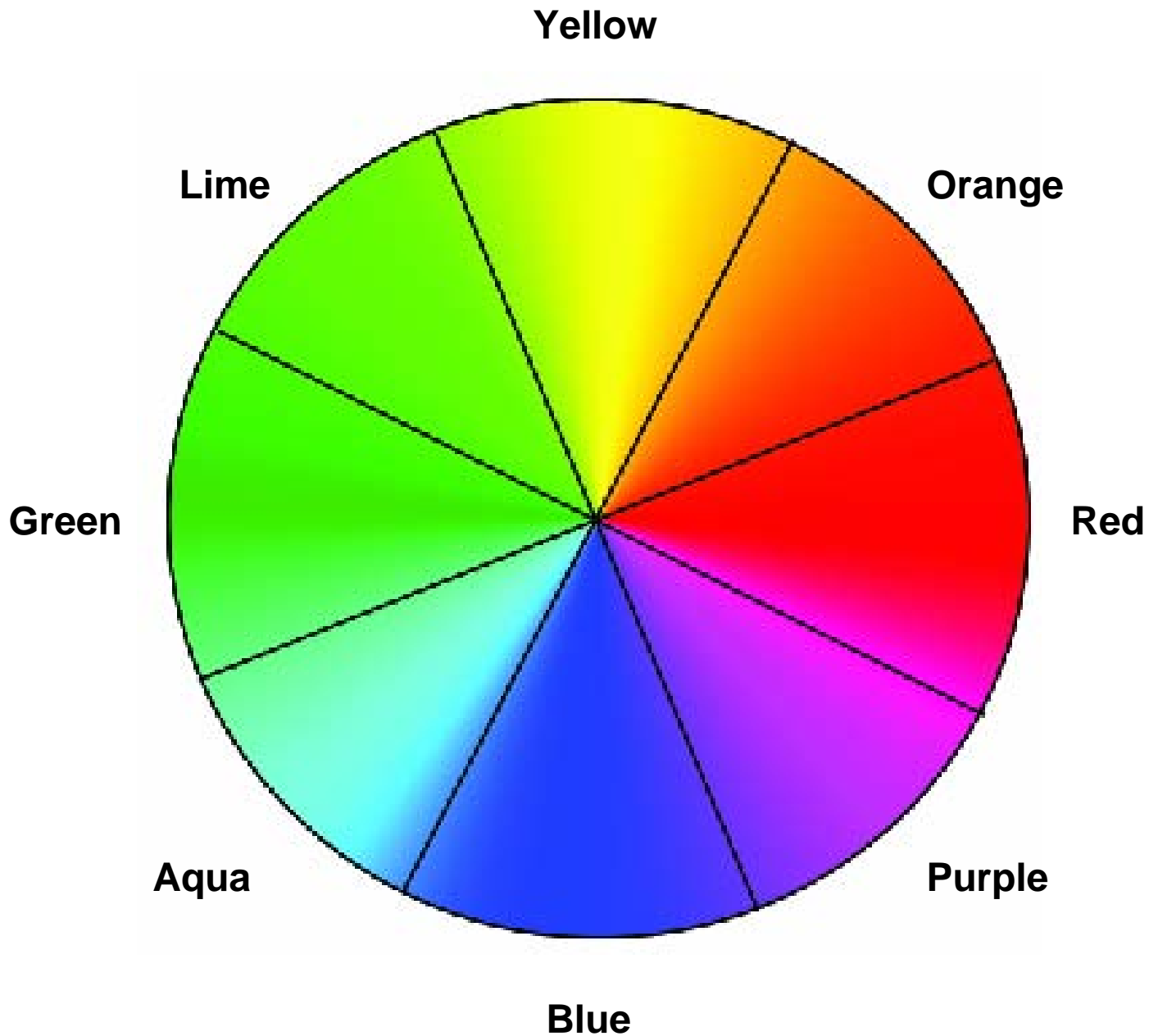


The color wheels on the following pages will help you to more easily identify a colors correct location on the color wheel.

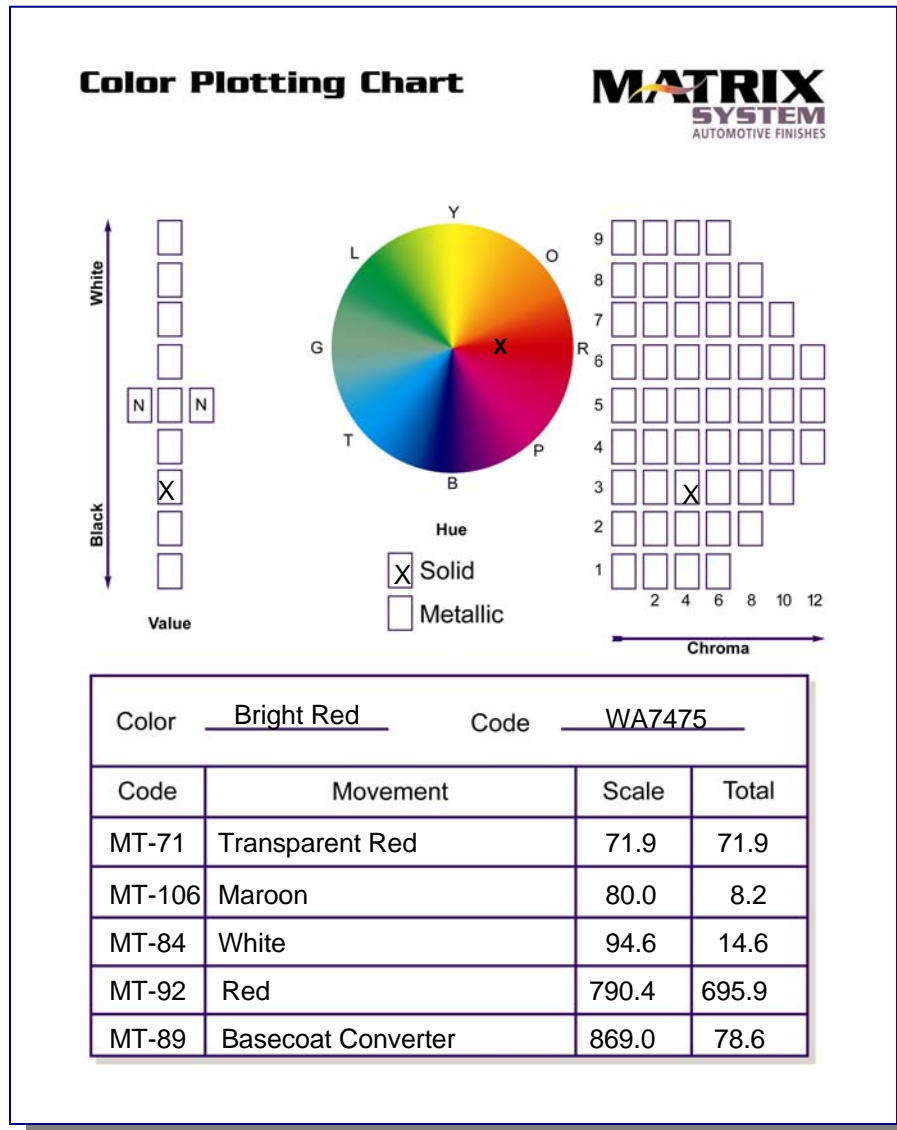
**Yellow**



*Determine first the primary color you are plotting. Yellow, Red, Blue and Green make up the four major color families of the color wheel.*



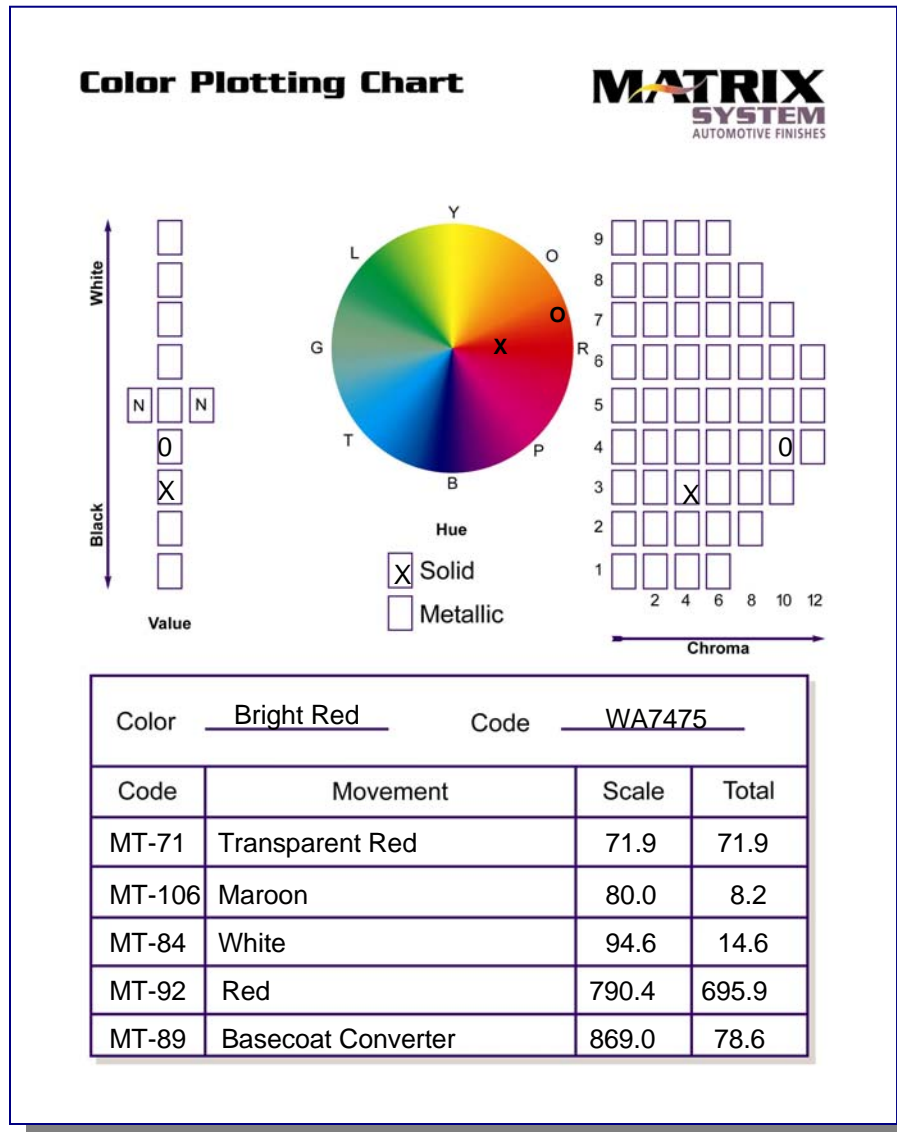
*Next determine if the primary color leans towards either of the minor color families. Lime, Orange, Purple and Aqua make up the four minor color families of the color wheel.*



*After we have plotted the color the formula we can now identify the value of the color.*

### Step 5 Identify the Value of the Paint Color

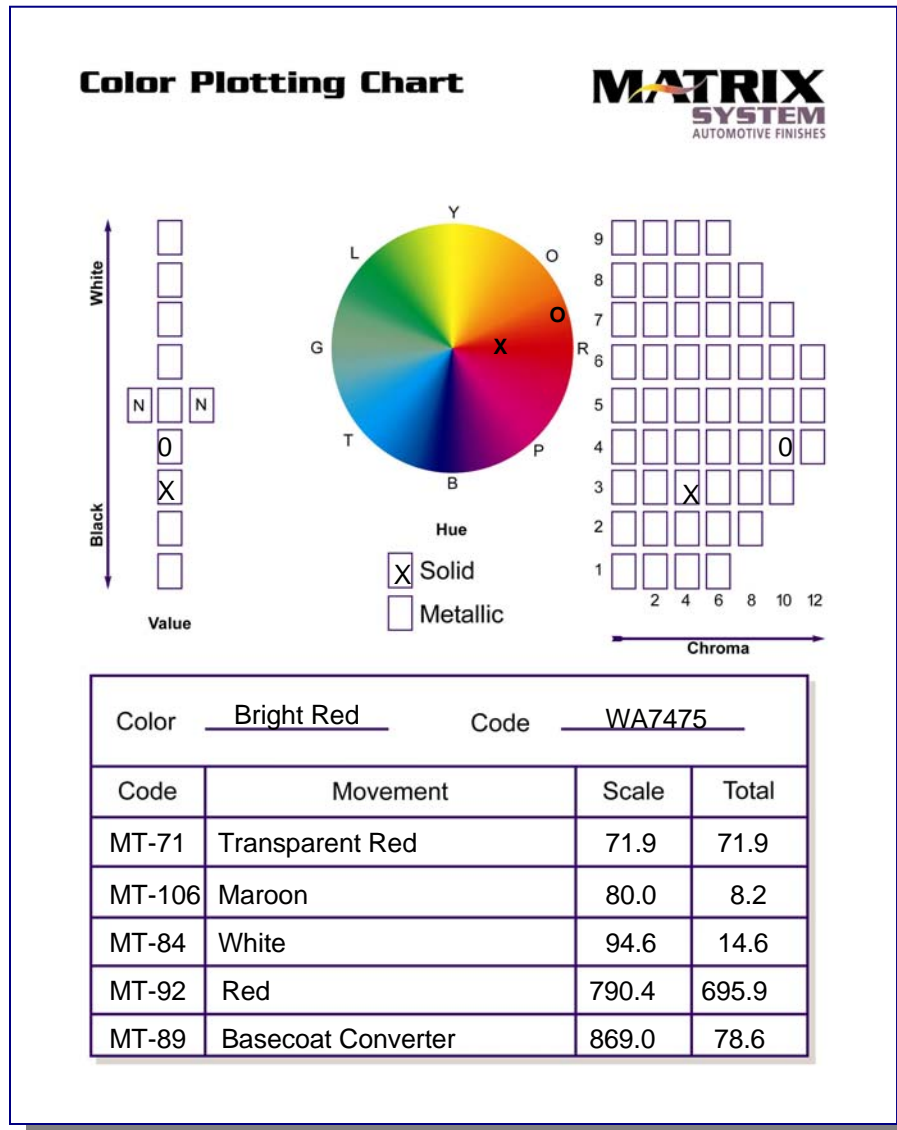
Determining the level of value the mixed formula has. When measuring value be aware that bright vibrant colors often lean towards the white side of the value scale while darker or dirtier colors lean towards the black side of the scale.



*After we have plotted the colors of both the target and the paint we can now identify the direction we need to go to achieve a blendable color match.*

**Step 6 Plot the Color of the Target (Vehicle) on the Color Wheel**

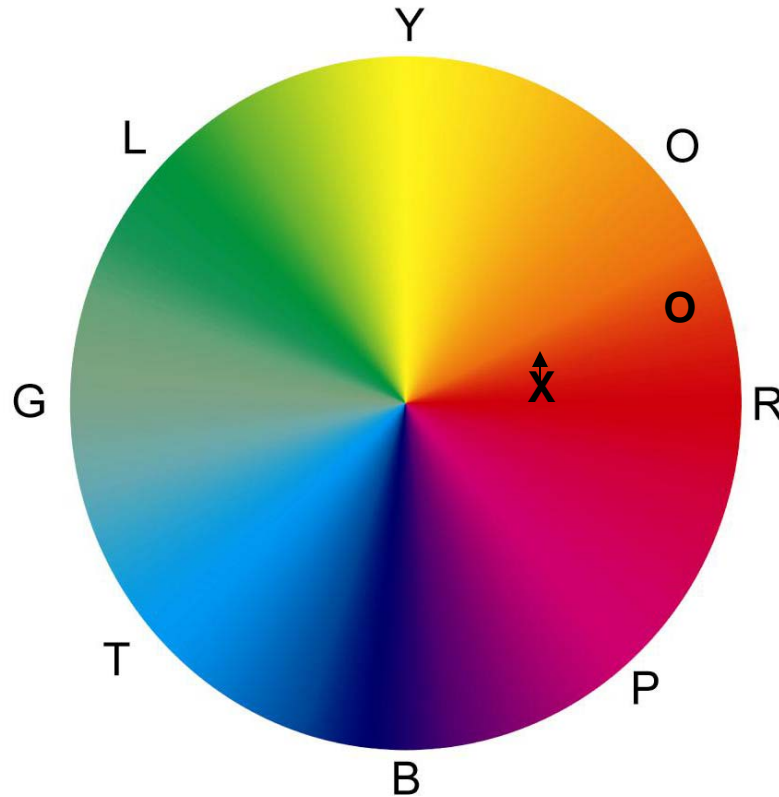
Plot the Hue (Color), Chroma (Intensity) & Value (lightness,darkness) of the target (O) on the color wheel



*After we have plotted the colors of both the target and the paint we can now identify the direction we need to go to achieve a blendable color match.*

### Step 7 Develop a Strategy for Adjustment

Upon examination of the color chart we can now see that we must adjust the paint (X) to the Target (O). We can accomplish this by adjusting the Hue, Chroma and Value until a blendable match is achieved. The following pages will provide tips for adjustment of Hue, Chroma and Value.



## Adjusting Hue

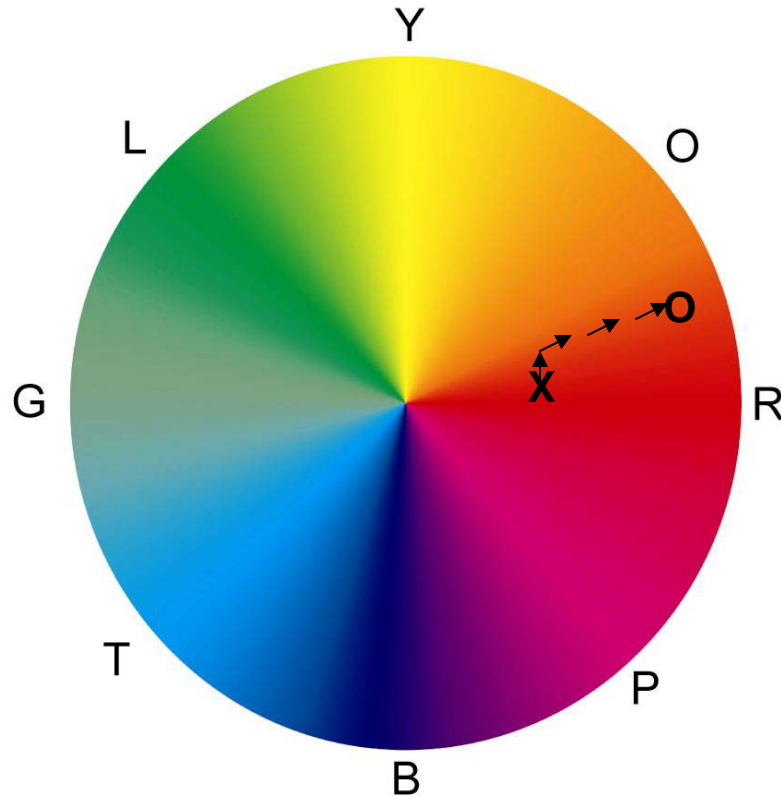
*The first step to adjusting the color is to adjust the hue to that of the Target color*

### **Step 8 Adjusting the Hue**

The diagram above shows that the target color we are attempting to match leans slightly more towards the yellow shade of red than the paint we have mixed. Adjusting the Hue is a matter of choosing the right mixing base to move the color closer to the yellow shade red that we are looking for.

Upon examination of the formula we can see there are no toners that will provide the shift we are hoping to achieve, in which case we must use a toner outside of the formula to properly adjust our color. In this example we will use MT-18 Orange Yellow Shade to adjust the Hue slightly.

*\*Whenever adding color to your mix for color adjustment always do so slowly to avoid adding too much color too fast requiring your to start over.*



## Adjusting Chroma

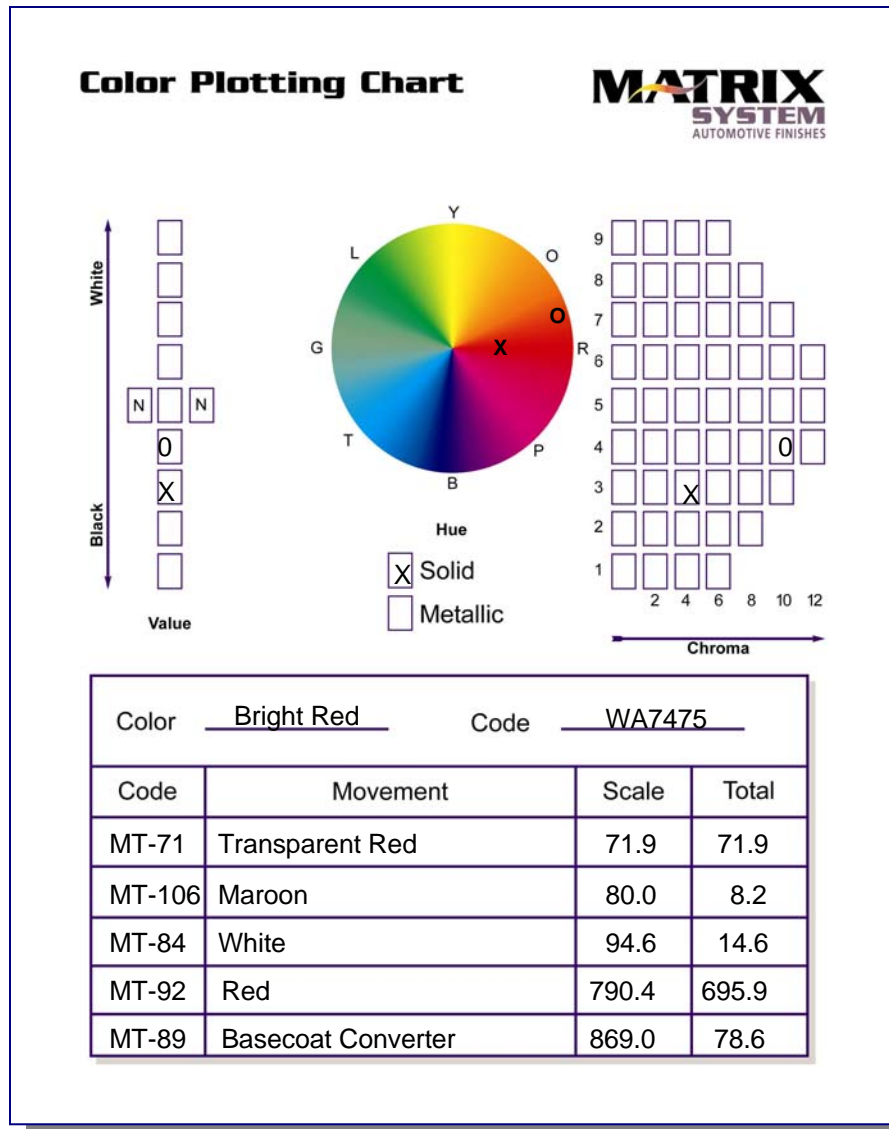
*The second step to adjusting the color is to adjust the chroma to that of the Target color*

### Step 9 Adjusting the Chroma

The diagram above shows that the target color we are attempting to match is a more intense red than the paint we have mixed. Adjusting the Chroma, just as the Hue, is a matter of choosing the right mixing base that will move the color closer to the more intense red that we are looking for. To raise the Chroma we should add more of the primary hue color. Doing this will provide a more intense red due to the higher saturation of the primary color in the formula. Conversely, adding black, white or aluminum to the mix would reduce the Chroma of the color by desaturating the Chroma leaving behind a dirtier, darker look.

After reviewing the formula we would add more MT-92 to bring out the more intense Chroma we are lacking.

*\*Whenever adding color to your mix for color adjustment always do so slowly to avoid adding too much color too fast requiring your to start over.*



### Step 10 Adjusting the Value

The color chart above indicates that the target color we are attempting to match is slightly lighter in color than the paint we have mixed. Adjusting the Value follows the same principle as Hue and Chroma. In solid colors the addition of white will raise the value while the addition of black would decrease the value, in metallic colors the addition of white would be substituted with the use of metallics to brighten or raise the value of the color. All metallics are viewed as being lighter than the midpoint of the Value scale

Upon examination of the formula we can use MT-84 to lighten the Value slightly.

*\*Whenever adding color to your mix for color adjustment always do so slowly to avoid adding too much color too fast requiring your to start over.*

## Tinting Tips

The following section will cover the most common fixes for mismatched colors. In the automotive refinish industry as discussed in section 3 of this manual there can be a multitude of reasons behind color variance at the OEM level, however some of the most common reasons for mismatched color at the bodyshop level are:

- Painter chose the wrong variance for the vehicle
- Intermix toners were not properly agitated
- Application technique of the painter
- Shop conditions, cooler shops produce darker colors
- Improperly measured intermix toners
- Outdated intermix toners
- Many other variables

As these conditions may all result in the requirement for color adjustment, a painter may opt to try the following techniques prior to color adjustment in an effort to save both time and materials if the color is only slightly off from the vehicle:

### •Application

#### To Make Darker

Hold gun closer to surface  
Decrease gun speed  
Use larger fluid tip  
Decrease fan width  
Decrease air pressure  
Increase volume of material

#### To Make Lighter

Hold gun farther away  
Increase gun speed  
Use smaller fluid tip  
Increase fan width  
Increase air pressure  
Decrease volume of material

### •Shop Conditions

#### To Make Darker

Decrease temperature

#### To Make Lighter

Increase temperature

### •Solvent

#### To Make Darker

Use slower solvent

#### To Make Lighter

Use faster solvent

These techniques may work in some instances as stated above however there will come a time when the color must be adjusted in order to obtain an blendable match. In these instances the preceding chapter covering color adjustment and plotting will aid you in matching colors and when combined with these simple tips and charts should prove to be a useful tool for adjusting color

## **Tinting by Adding or Subtracting Color**

There are two distinct methods for adjusting color as discussed in the previous chapter. The two methods require you to either add or subtract paint from the mix and will work with the majority of paint mixes

### **Addition**

Adding additional paint to the mix is the usual method of paint adjustment whenever a mixed color lacks or does not seem to have enough of a certain color or cast to match the target. Whenever this occurs we must add additional color to the mix in order to achieve our target.

### **Subtraction**

Subtracting paint from a mix is the method used whenever a mixed color seems to have too much of a certain color or gives off too much of a certain cast. Whenever this occurs we would mix the color as usual until we reach the toner we wish to subtract some of. Omit this toner and move forward with the mix. Once we have completed we will go back and gradually add in the omitted toner until we have achieved the color or target we are striving towards.

*\*Whenever adding color to your mix for color adjustment always do so slowly to avoid adding too much color too fast requiring your to start over.*

*\*Spray out your tinted color on a test panel and compare it to the target you are trying to achieve before painting the vehicle.*

## **Adjusting Unreduced Colors**

It is the best practice to tint color prior to reduction. By doing so each hit to the paint provides us with an effect that targets a larger area of the paint due to its concentration in the can. Whenever adjusting color this way we must:

1. Thoroughly agitate the paint in the can.
2. Compare the paint to the target after each "hit".
3. Continue to adjust the color until a blendable match is achieved.
4. Keep records of each "hit" for future reference.
5. Reduce a small amount of paint per manufacturers recommendations.
6. Complete a spray out panel and compare to the target color for blendability.

*\*Whenever adding color to your mix for color adjustment always do so slowly to avoid adding too much color too fast requiring your to start over.*

*\*Spray out your tinted color on a test panel and compare it to the target you are trying to achieve before painting the vehicle.*

## **Adjusting Reduced Colors**

Tinting reduced colors should only be done when necessary as each "hit" to the color will affect it more dramatically than when adjusting unreduced colors. This is due to the fact that the paint is not concentrated and thereby each successive "hit" adds more color to a smaller quantity of paint. Whenever adjusting color by this method we must:

1. Thoroughly agitate the paint in the can.
2. Compare the paint to the target after each "hit".
3. Continue to adjust the color until a blendable match is achieved.
4. Keep records of each "hit" for future reference.
5. Reduce a small amount of paint per manufacturers recommendations.
6. Complete a spray out panel and compare to the target color for blendability.

*\*Whenever adding color to your mix for color adjustment always do so slowly to avoid adding too much color too fast requiring your to start over.*

*\*Spray out your tinted color on a test panel and compare it to the target you are trying to achieve before painting the vehicle.*

## **Metallics and Their Affects on Colors**

Whenever adding a metallic base to a color it can affect both the value and the chroma of a color this is primarily determined by the size of the flake, which in turn determines both its shade of gray and its brightness. An important thing to remember is that all metallic bases are viewed as a shade of gray.

When determining the grayness or brightness of a metallic flake and comparing it to another metallic flake a good rule of thumb is that fine metallics are the most gray while coarser metallics are typically very bright. This is chiefly due to their size and larger amount of light that is reflected due to their surface area. As a result of this the flake size will typically increase the brightness or value of a color while the amount of aluminum in the formula regardless of size will mostly affect the chroma of the color. In other words the higher the metallic content of a color the less chromatic, intense or vivid a metallic color will appear.

## **Adjusting Metallic Flop**

Whenever adjusting metallic flop a number of options are available to color matchers in the field. Matrix System manufactures flop adjusters, flattening bases, metallic bases, pearls and white toner which are all capable of adjusting flop in one way or another to produce the desired results. When used correctly these particular product will enable you to lighten flop whenever necessary. The following instructions will aid in you in adjusting metallic flop.

### **MX-20 Flop Adjuster**

MX-20 Flop adjuster can be found in some AccuShade™ formulations and may be added into a formula when trying to adjust flop. MX-20 works by re-orienting the metallic flake to lighten the flop and will not cause the face of the color to gray.

#### ***When using MX-20 to adjust flop:***

Begin adding 5% or less by volume and gradually continue to no more than 15% overall by volume until the flop is corrected.

### **MX-85 Low Gloss Flattening Additive**

MX-85 is designed to produce a flat, eggshell or semi-gloss appearance however it may also be used to lighten flop when adjusting a metallic. MX-85 will cause the metallics to seem further apart causing the color to display more color on the face as well as more reflection from the sides.

#### ***When using MX-85 to adjust flop:***

MX-85 should be used sparingly as its chemical nature will cause a lower gloss therefore the use of MX-85 should be restricted to no more than 5% by volume to minimize the excessive loss of gloss.

*Do not use MX-85 in MAU, MCU systems to lighten the flop use white instead to lighten the flop of a metallic color.*



### **MSP-095 White Pearl**

MSP-095 White Pearl can be used to lighten a metallic flop, however it may gray the face of the metallic color you are tinting.

#### ***When using MSP-095 to adjust flop:***

Add no more than a total of ½ the metallic parts in the formula. For instance if the overall AccuShade™ formula calls for 350 grams of MT-50 Sparkle Aluminum, add no more than 175 grams of MSP-095 half the amount the overall metallic in the formula calls for.

*\*when using MSP-95 to adjust flop, if the formula is an MSB mix re-balance the formula with an equal part of MT-95 Basecoat Balancer to offset the addition of the MSP-095.*

### **MT-46 Weak White Toner**

MT-46 can also be used to lighten the flop of a color, however the addition of MT-46 to an intermix formula can cause the color to wash-out or result in a look that appears to be faded.

#### ***When adding MT-46 to adjust flop:***

\*Whenever adding color to your mix for color adjustment always do so slowly to avoid adding too much color too fast requiring your to start over.

\*Spray out your tinted color on a test panel and compare it to the target you are trying to achieve before painting the vehicle.

### **MT-51, 80, 81, and 82 Metallic Bases**

These metallic bases are specifically for use in adjusting MPB metallic colors. These metallics can be used to adjust metallic flops by adding brightness to the formula thereby lightening the flop.

#### ***When adding MT-51, 80, 81 and 82 metallic bases to adjust flop:***

Mix 1:1 with MT-49 to lessen the strength of the toner before adding it to the mix.

\*Whenever adding color to your mix for color adjustment always do so slowly to avoid adding too much color too fast requiring your to start over.

\*Spray out your tinted color on a test panel and compare it to the target you are trying to achieve before painting the vehicle.



## **Color Matching Rules to Live By:**

Follow proper stock rotation policies, follow daily toner requirements and pay attention to notices the manufacturer mails you. There may be a recall notice included.

To do a good job of color matching, one must be able to see colors as they actually are. One of every twelve people is partially or totally colorblind. If you have normal color perception, learning to match colors is largely a matter of being careful, having patience, and remembering and observing what takes place when certain colors are added.

For color adjusting, use intermix toners that are uniform in tinting strength and stick with them.

Only tint using intermix toners from the quality as the material you are tinting (or equivalent offset) i.e. do not use acrylic enamel toners to tint acrylic urethane basecoat.

When tinting bright metallic colors, transparent or weak intermix toners should be used to maintain the "brightness" or "vividness" of the color. Toners such as transparent red, transparent yellow, weak white and weak black should be used. Other toners may be used, they may however "washout" the color.

If uncertain which variance to mix, choose a lighter one. You can easily make a color darker, it is harder to lighten a color.

Tint systematically. Keep track of which toner and how much has been added. If you know how far a certain amount of toner has moved the color, you have a better idea how much more is needed.

Don't make the final judgment on the match while the material is wet. The color will change as it dries.

Check the color in daylight as well as artificial light. It may not look the same in both lights.

Determine which direction the mixed paint has to be adjusted. Make sure you use descriptions in three dimensions.

Review the formula used to mix the paint. When adjusting color, try to use intermix toners that are used in the original formula. You don't want to confuse things!

If the mixed color is the wrong hue (red shade instead of green shade), select an intermix toner from the opposite side of the color wheel to "kill" the red shade. In this instance add green to kill the red hue.

For metallic colors, use transparent or weak intermix toners so the brightness is not "washed out". If you must use opaque toners, use them sparingly.

**ALWAYS SPRAY A TEST PANEL!**