Named colors in Postscript and PDF workflows (sometimes referred to as spot colors) can be an important part of a printing workflow. Named colors also come in different flavors with the most popular being the PANTONE™ Color Matching System.

Being able to match named colors using color management within products of ONYX is a very handy feature. However there are challenges when trying to match a named color in a file to get an “expected” output. This article discusses the color management workflow for named colors, and looks at possible causes for named color match failures while offering some potential solutions.

Challenges with Named Color Matching
At times there are cases when printing a named color the result is not what is “expected”. This expectation is usually set by a swatch book. For example, a file contains a named color which is printed. The printed result is then compared against a swatch book which has this particular named color. After comparison it is determined that the printed result does not match the swatch book. This comparison can be done in two ways. One way is to compare the two visually and determine that they do not match. Alternately, the printed result and the swatch book can both be measured with a color device and a color difference can be calculated (preferably CIEDE2000) and compared to a tolerance to determine if the two match.

Let us first look at the named color matching workflow, and then we will discuss various causes of named color match failures.

Named Color Matching Workflow
First, we will take a look at how named colors defined in a file (usually in a PDF format) are processed within ONYX products.

A named color in a file is usually defined by a name (hence the term named color) and also has a recipe associated with it in an alternate color space (for example: CMYK). The company that publishes these named colors (like PANTONE™) also provides ONYX Graphics with a list of these colors and their associated color measurement values (usually in terms of CIELAB). When a file containing a named color is opened inside an ONYX rip product, the name is first looked up in the system table containing lists that ONYX licenses from various companies. If the name is found then the corresponding color measurement value is used as a substitute for the name.

This CIELAB value gets converted to the proper printer ink amounts using the print mode’s default ICC profile and absolute rendering intent which are then sent to the printer. If the name is not found in the lists that ONYX keeps track of, then the color recipe associated with the named color is used. This recipe
is then applied through the vector graphics input profile associated with the alternate color’s color space followed by the output profile defined in the job’s profile settings. (Note: If no replacement is found and no input profile for the alternate color’s color space is defined then the recipe is directly converted to the printer color space). The flowchart in Figure 1 represents the named color matching workflow.

**Figure 1.** Flowchart representing named color matching workflow

As can be seen from this figure there are multiple ways to get from a named color to printer color space. However, there are two critical aspects to be especially aware of when using named color replacement:

1. The print mode’s default ICC profile is always used for converting CIELAB values for named colors to printer colors. Hence the job profiles and rendering intent selected in the profile selection dialog in Job Editor or Quickset have NO effect on named color replacement output. If the mode does not have an ICC profile then the default profile with the appropriate printer color space installed by ONYX is used.

2. The absolute rendering intent is used by default to replace named colors. If a different rendering intent is desired then it is necessary to change the RIP option called SPOTRENDERINTENT. The table below lists valid values of this RIP option and the corresponding rendering intent.

<table>
<thead>
<tr>
<th>Value</th>
<th>Rendering Intent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Perceptual</td>
</tr>
<tr>
<td>1</td>
<td>Absolute</td>
</tr>
<tr>
<td>2</td>
<td>Relative</td>
</tr>
<tr>
<td>3</td>
<td>Saturation</td>
</tr>
</tbody>
</table>
Named Color Matching Failures

 Disconnects between the color of a swatch book color and the CIELAB value being used by ONYX

There are several reasons for a mismatch between a swatch book color’s appearance and a printed color. In this first case the CIELAB color used by ONYX doesn’t match that of the swatch book. This can happen because:

1. Many named color systems specify colors as a recipe of pigments used to produce the swatch book. (Note: this is especially true of Pantone™ Colors). Due to differences in the formulation of these pigments and differences in the production of each print run of a swatch book, swatch books from different print runs are most likely to have different colorimetry. This can result in a mismatch between the CIELAB values provided to and maintained by ONYX Graphics and any particular printed swatch book. Additionally, the CIELAB values in the ONYX System Color Tables have been updated as the named color providers have changed the “official” values to match current swatch book production runs. (Note: Because “official” CIELAB values for named colors can and have changed over time it is not safe to assume that the CIELAB values for named colors in other applications (like PhotoShop™) will be identical to the CIELAB values in the ONYX System Color Tables).

2. It is also possible that the swatch book itself has changed over time (due to fading, etc) thus not matching the CIELAB values provided to ONYX Graphics.

Only one CIELAB value is maintained for each named color in the ONYX System Color Table (system table), and due to licensing restrictions the CIELAB values cannot be displayed. However, in cases where the color of the swatch book does not correspond to the CIELAB value being used by the system table, a user defined named color can be used to override the CIELAB value of the named color in the system color table. This can be done by adding a user color with the same name and then measuring the CIELAB value of an actual swatch book patch and specifying this CIELAB value for the named color. The procedure to add a user defined color is listed below:
Figure 2. Screenshots showing procedure to add User Defined Colors

a. Launch RIP-Queue
b. Under Setup menu click on RIP Configuration then Color Matching Table.
c. On the Color Matching Table dialog select the User Defined Colors tab.
d. Click Add button.
e. Type in the desired name for the named color. If the name matched a System defined color then the CIELAB value for the user defined color will be used.
f. Type in the CIELAB values in the L, a, b fields or alternately use a color device to measure a patch.
g. Click OK button to save the user defined color.

User defined color and a swatch book patch do not match visually
If the CIELAB value specified by a user defined color and the measured CIELAB value of a swatch book patch are the same but the colors do not match visually, the next thing to do is to check if the printed color actually measures with the desired CIELAB value. If the measurement of the printed color matches the CIELAB value specified as a user defined color, then the difference in appearance is most likely the result of metamerism. This is a result of using a different light source to make the visual evaluation than the D50 illuminant that is assumed to make the measurement. The CIELAB measurements are relative to this particular illuminant and the CIE 1931 standard observer. To get a better visual match in this case it is suggested to use a light source that is closer to the CIE D50 illuminant.

Metamerism can especially happen with named colors that are closer to the neutral axis of the color space (grays). In this case the mismatch could also be caused by color inconstancy of the neutral colors defined by the print mode’s ICC profile. If the printed output contains CMY inks instead of K ink to make
the gray this can sometimes result in a color that gives a certain cast due to color inconstancy of CMY inks. Recreating the ICC profile with a black generation setting that uses more black ink to make the grays may help in this case. Black ink is usually more stable under different light sources thus avoiding the problem of color inconstancy.

**User defined color and a swatch book patch measured value do not match**
When the CIELAB value specified by a user defined color and the measured CIELAB value of a swatch book patch are not the same then possible corrections are determined by the location of where the CIELAB value is relative to the print mode’s color gamut.

**The named color is outside the print mode’s gamut**
If the CIELAB value of the named color is outside the print mode’s gamut then the color cannot be printed accurately. This can be determined using the Gamut Report tool in Media Manager application. If the color difference estimated in the gamut report for the particular named color is greater than 2 then the color is most probably outside the print mode’s gamut. In this case gamut mapping is being performed by the ICC profile to find another suitable color to print. If this does not result in a desired color then it is possible to choose a different gamut mapping option. This can be done by selecting a different rendering intent for named color processing as described in the named color matching workflow section.

If none of the rendering intent selections give desired results then the user is advised to look into recreating the print mode profile such that it results in a larger gamut. A print mode’s gamut is affected by choices made during the profiling steps of ink restrictions, ink limiting and black generation settings. One should also remember that if the color is some distance away from the print mode’s gamut then it may not be possible to recreate the profile so as to put this color inside the gamut.

**The named color is inside the print mode’s gamut**
If the determination is made that the named color is inside the printer’s gamut and the two CIELAB values still do not match then the cause is most probably due to inaccuracies with the ICC profile, meaning the ICC profile does not accurately predict the printing condition of the print mode. Inaccuracies in the ICC profile could be caused by various reasons.

a) There is no ICC profile created for the print mode. In this case a default ICC profile installed by ONYX is used which is a generic profile and may not describe every print condition accurately. Thus it is recommended that named color printing should be done only with print modes that have their own ICC profiles or ICC profiles for the print mode that is going to be used for named color printing should be created.

b) The wrong media or print mode is being used. If the media and print mode being used are not properly profiled then the colors defined by ICC profile will not correspond to actual colors. If this is the case then properly profiling the printing condition will provide much better results for named color replacement.

c) The ICC profile no longer corresponds to the current printing condition. This can happen if the ICC profile was created a long time ago and the printing condition has now changed. This can
happen if there are changes in how the printer is printing, the ink formulation, or if a different lot of media is used. If the printing condition has changed only slightly then a simple recalibration may possibly be used to bring the printing condition back to the state when the original profile was created. Otherwise, the ICC profile may need to be recreated.

d) There may be inaccuracies within the ICC profile itself. This can be due (among other reasons) to using a swatch with a low number of patches, printing artifacts in the swatch used to make the profile, reading some patches with the color device incorrectly, or some assumptions being made by the ICC build engine about the print behavior are incorrect. Improving the accuracy of the ICC profile in this case may sometimes be challenging as it will depend on the reason for the inaccuracy.

Defining your own color replacement

One can define a color replacement using the named color replacement tool released with ONYX product version X10.2. This is especially helpful when changes to profiles or settings are unsuccessful. When the actual printer device ink amounts to be used for a particular named color are known (and they give desirable results) then these values can be added for the particular named color on a per job basis. The steps to do this are listed below and are also seen in the screenshots in Figure 3.

a) Open the file containing the named color using Job Editor (formerly called Preflight).
b) Select the Color Correction tab.
c) Click on Tools button and then select Named Color Replacements option.
d) Click on the + button.
e) Under the “Color To Replace” dropdown select the named color in the file that you need to replace with desired device ink amounts.
f) Type in the values of the desired ink amounts.
g) When the job is then processed, the named color will be printed using the desired ink amounts.

![Figure 3. Screenshots demonstrating usage of Named Color Replacements](image)
Conclusions

The article has discussed named color matching workflow in ONYX products. Some of the challenges in achieving named color matches have been explained along with the causes for matching failures. Possible solutions have also been suggested.

In review, it can be said that having accurate ICC profiles for print modes to be used for named color printing is critical to getting good matches. It is also important to ensure that the swatch books being used to determine color matches actually correspond to the color values being used by ONYX.