NPG COLOR PROCEDURE MANUAL

FOR AGENT, MANUFACTURER, AND NPG COLORISTS
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INTRODUCTION TO COLOR

Color can be described as the appearance of objects or light sources described in terms of an observers’ perception of them. Although color perception is subjective, a basic understanding of the principles of color will help the Colorist communicate and evaluate color in more objective ways.

- The three elements of color are light source, object and observer.
  - Light Source: illuminates an object
  - Object: reflects light to an observer
  - Observer: senses the reflected light

The Effect of the Light Source and Illuminant - All color originates in the spectral characteristics of the light that impinges upon an object. We see the result of this interaction between the incident light and the object. If there is no light source, then there is no color to experience. The light source provides the light for viewing a sample while an illuminant is the numerical description of a light source used for numerical assessment. It is very important to specify both the lightsource and illuminants used.

Light is the radiant energy that can be described by its wavelength. The total spectrum of radiant energy covers a wide range. The human eye can only see the colors at visible spectrum which ranges from 400-700nm.
The Effect of the Object - The object is the textile fabric being evaluated, the surface of which reflects the wavelength the observer sees and absorbs all the rest. An object appears white when it reflects all wavelengths, and black when it absorbs them all.

The Effect of Observer - The observer is the person viewing the object and responding the light-object interactions. Seeing color is a combination of the mechanics of optics (light, lens, focus) and the psychophysical aspect of the brain. The brain interprets the visual stimuli and it is this interpretation that gives the sensation of color. In color science, this human action of perception of color has been considered “normal color vision” thus being called “The Standard Observer”.

COLOR TESTS
Since variations in color vision exist, all color decision makers should have their color vision tested using a comprehensive hue test. In addition to being initially tested, it is recommended that individuals be re-tested on an annual basis.

- The Farnsworth Munsell 100 Hue Test measures the ability of an individual to see the slight differences between colors
  - Screens for color vision defects and provides specifically where color confusion lies.
  - The individual is presented the test with the color chips in random order and is asked to put them in order in the boxes
  - Once the reorganization of chips completed, the discrimination level can be evaluated using the scoring software.

- The Ishihara Test measures the common color deficiency (Color Blindness) which is red-green color deficiency.

COLOR STANDARDS
Pantone is the color standard service that NPG uses to create the color palette. Agents and Manufacturers are responsible to purchase their own Pantone color standards.

Pantone has reformulated all colors with Clariant dyes. The Pantone Color Standards are consistent, accurate, and reproducible with optimized color consistency and metamerism. The Pantone Color Standards are distributed in BHT-free UV protective packages to protect color and come with spectral data and color formulas which can be used as a guide and starting point. The dye formulas for Pantone Color Standards are available at website: http://www.matchpantonecolors.com.

The steps for the process:

1. After Creative Studio creates the initial color palette, The Color Operations Team will communicate the palette to agents.
2. Each brand will create their brand color palette from the initial palette. The Color Operations Team will communicate the brand color palette with Pantone TCX numbers and color names for that season to all Agents/Manufacturers instead of sending the color palette in swatch form. If any additional colors are added during the development process, The Color Operations Team will communicate that information immediately.
3. If there are color standards used from a different color service or source, the color operations team will be responsible to provide physical standards to Agents/Manufacturers or Mills.
4. The Agents, Manufacturers or Mills will order Pantone color swatches from their local Pantone distributor. The website has the local Pantone distributor information: [http://pantone.com](http://pantone.com). Pantone color standards need to be ordered in a timely manner so that the lab dipping process starts on schedule.
5. The Color Operations Team will also provide the spectral data of the color standards at the beginning of each season for reference.
6. Pantone color formulations are available at website [www.MatchPantoneColors.com](http://www.MatchPantoneColors.com) and can be used as a starting point for lab dipping.

**EQUIPMENT**

**VISUAL EVALUATION**

**Light Box**

All colors should be evaluated in light boxes to prevent outside interferences of opposing light sources and to increase the accuracy and consistency of color comments.

- **NPG Lightbox - Spectralight III from X-rite**
  - Acceptable alternative – SpectraLight QC or Judge II from X-Rite
  - The light box should be placed in a dark place and shielded from exterior lights.

- **Maintenance**
  - The light box should be kept clear of any samples
  - The interior of the light box should be clean and scratch free
  - The background color of light box is recommended to be matte grey neutral surround with a Munsell notation between N5 to N8. This will help to make sure that you eliminate simultaneous contrast or complementary afterimage.

**Light sources**

- **NPG uses Fluorescent Daylight 6500K, 90 CRI (D65) as its primary illuminant for color matching.**
  - D65 refers to a type of lamp whose temperature and color is closest simulation of actual daylight.
  - It is an industry standard, consistent and reproducible.

- **NPG uses Store light as the secondary illuminant to view and evaluate samples for flaring.**
  - Industry Standard U3000 is the secondary illuminant
  - Industry standard CWF (Cool White Fluorescent) is the tertiary illuminant
• Maintenance.
  o The light bulbs should be changed according to the manufacturer’s recommendations for time of use. The light box also needs to be checked to:
  o Replace darkened or burned-out lamps and be sure that all lamps are operating.
  o Clean the fixtures so that dust does not alter the spectral power distribution.

DIGITAL EVALUATION

The purpose of instrumental color measurement is to provide objective, reproducible and quantifiable data for color communication through the use of the spectrophotometer. The spectrophotometer helps improve the accuracy of submittals, reduce the volume of unsatisfactory submittals, and improve communication and decrease time and expense associated with color approvals.

Please note textured fabrics—textured fabric is that which appears differently when viewed from different angles—and, along with pile fabric (velour, corduroy, terry, and fleece), heather yarns, prints or shiny fabrics will not be evaluated by spectrophotometer.

• NPG Spectrophotometer – Datacolor SF600 from DataColor
  o Acceptable Alternative – DataColor 650 from DataColor or ColorEye 7000A from X-rite

• Specifications:
  o Viewing condition: Aperture size varies from 30mm to 3 mm
    LAV = 30mm, MAV = 20mm, SAV = 9mm, USAV = 6.6mm, XUSAV = 3mm
  o Preferred viewing condition: LAV or MAV
  o Color Space - CMC (2:1)
  o Specular: Included
  o Observer: 10 degree
  o Illuminant: D65 for daylight and U3000 for storelight
  o UV Component: UV Calibrated

• Conditioning Requirement
  o Temperature: 70 degrees Fahrenheit (21 +/- 1 degrees Celsius)
  o Humidity: 65 +/- 2%

• Maintenance
  o Calibration must be performed prior to measurement, after 8 hour of use and after changing aperture size.
  o The white tile should be clean and free of scratches
  o The black trap should be free of dust
  o All calibration materials should be stored in the original black case closed when not in use.
  o Ensure that the inside of sphere is clean.
o Calibration using Spectral Test service from DataColor must be done annually

New Agents / Manufacturers are required to complete the Supplier Color Questionnaire providing information on equipment type / model and capabilities. Existing Agents / Manufacturers will be required to provide updated information on an annual basis via the Nordstrom Supplier Questionnaire.

The NPG Color Operations Team will review the Questionnaire upon receipt to confirm equipment compatibility and enter the information into an Equipment Log which will be maintained by the NPG Color Operations Team.

LAB DIP COLOR EVALUATION & APPROVAL PROCESS BY CERTIFIED COLORIST

The purpose of lab dip evaluation is to determine the best color match to a Nordstrom specified color standard that will meet NPG colorfastness requirements. The expectation is that after training and certification are completed, the Certified Colorist will approve lab dips on behalf of NPG brands. The goal is to have lab dips approved within the first submittal. Mills should only submit the dips that have been determined to be an accurate color match to the specified color standard when viewed under the designated light sources D65 and store light U30.

After reviewing the submitted lab dip following Techniques both digital and visual Nordstrom Evaluation Techniques, Agent/Manufacturer Colorist provide their comments.

If color is approved, the approved dip should be sent to NPG Colorist for reference via NPG Lab Dip Submittal Form.

If submit cannot be approved, the Agent/Manufacturer Colorist comment back to the mill to redip.

If redip still could not be approved, it should be sent to the NPG Colorist for review. The NPG colorist need to review the submits with brand and advise correction action plan and review timeline issues.

Once the approved Lab Dips or comments are received, the NPG Colorist will complete the process outlined below.

- Enter information from the Certified Colorist’s into the NPG Color Tracking Tool
- Update all pertinent NPG information on the Color Tracking Tool
- Enter the approved lab dip in the Color Book and review for overall look and aesthetic
- If any color issues (e.g. Lab Dip not approved), follow the Color Approval Process below

Certified Colorists are an extension of NPG, acting as NPG’s eyes in the field. To ensure ongoing correlation between the Certified Colorist and NPG, colorist performance reports shared seasonally. The goal is to keep mutual agreement rate at 80%.
BULK EVALUATION & APPROVAL PROCESS BY CERTIFIED COLORIST

In addition to the Lab Dips, the Certified Colorist will be responsible for Bulk color approvals.

After a lab dip is approved, the same formula must be maintained for the approved color and fabric to ensure reproducibility in bulk production and re-orders.

All bulk swatches are compared to the approved lab dips. If it is a repeat color, it needs to be checked against previously submitted bulk swatches.

After reviewing the bulk swatch following Nordstrom Evaluation Technique both digital and visual, the Certified Colorist needs to send out the bulk swatch to the NPG Colorist via the NPG Production Swatch Submittal Form.

Once the bulk swatch is received, the NPG Colorist will complete the process outlined below.

- Enter information from the Certified Colorist’s into the NPG Color Tracking Tool
- Update all pertinent NPG information on the Tracking Tool
- Enter the approved swatch in the Color Book and review for overall look and aesthetic
- If color issues (e.g. Bulk not approved), follow the Color Approval Process below

TRIM EVALUATION & APPROVAL PROCESS

The purpose of trim evaluation is to determine the best color match to the approved lab dip or bulk fabric. This evaluation and approval is the responsibility of NPG for each brand group and follows the Visual Evaluation Technique as described in the Color Approval Process section below.

Certified Colorist is responsible to review the trims to make sure they are close enough to main body fabric before submitting for NPG review.
COLOR APPROVAL PROCESS

All color evaluations need to follow the Color Evaluation Technique outlined below. In cases where a fabric type that is not compatible with digital analysis and/or the absence of a Certified Colorist at Agent/Manufacturer location, the Agent, Manufacturer or Mill will send the Lab Dips or Bulk Swatches to NPG for evaluation and approval. If there is a Certified Colorist at Agent, Manufacturer or Mill, follow the Certified Colorist Process above to evaluate colors with the Color Evaluation Techniques both digital and visual outlined below.

VISUAL EVALUATION TECHNIQUE

Textured fabric is that which appears differently when viewed from different angles and, along with pile fabric (velour, corduroy, terry), heather yarns, prints or shiny fabrics, will be evaluated using the visual process only. Solid and flat fabrics will be first evaluated digitally using the methods described in the Digital Evaluation Technique section below.

1. Follow all Housekeeping guidelines for handling samples and maintaining work area
2. The certified colorist will enter the appropriate Lab Dip or Bulk information into the Tracking Tool
3. The NPG Colorist will update all pertinent NPG information on the Tracking Tool
4. Prepare the light box by making sure it is clear of any other samples
5. Turn on the D65 light source and allow 20 seconds of adaptation to the illuminant
   o When changing from one light source to another, allow 20 seconds of adaptation before making any color judgment
   o It is also important to allow your eyes to rest before viewing the next color
6. Fold the samples to be viewed to sufficient thickness to make them opaque, typically two to four layers
   o It is important for samples to be opaque when viewing so that the background color of the light box does not visually alter the color
   o The sample is opaque if it does not allow light to pass through
7. Center the sample in the light box with face side up and with the horizontal/vertical direction based on how the fabric will be used in the final product
   o Pile fabrics must be brushed so that the pile is in the natural pile direction
   o Pile samples must be evaluated with the pile direction away from the observer
   o Yarns and threads must be reviewed after winding onto a card. There needs to be enough yarn or thread to wind a card to accurately review the sample without showing the card. Also tension of the yarn or thread during winding is important. Winding a card too tightly will cause the yarn or thread to look different because they are stretched. If there is enough yarn or thread, a knit-down is preferred for better review.
8. Place the sample and color standard (Pantone standard, approved lab dip or bulk swatch) so their edges touch, making visual differences easily detected
   o Do not overlap the sample and color standard
9. View the sample at a 45-degree angle

10. Evaluate the “value”, “chroma” and “hue” of the submitted sample against the color standard for color matching
    - Note the color differences using common and consistent color language
      ▪ Value (L): Light/Dark
      ▪ Chroma (c): Bright/Dull
      ▪ Hue (h): Blue, Green, Yellow and Red

11. Evaluate the sample for flare by viewing it under store light
    - Flaring is the effect when the same color matches under one light source but does not match when observed under another light source
      ▪ Some colors are more susceptible to flaring than others, e.g. Purple, Olive, Chartreuse, Khaki / Taupe
      ▪ Flaring needs to be minimized to ensure coordinates match when merchandised on the floor
    - The Lightbox is the main instrument to determine the visual existence of flaring because it has two light sources for comparison
      ▪ Note: The spectrophotometer can also be used to numerically measure the flaring that you perceive with your eyes

12. Turn on U3000 to evaluate the flaring and also check under CWF

13. Note any flaring observed

14. Comment on color using proper color communication.

15. If lab dip color is reviewed by a Certified Colorist, follow the process below;
    - If color is approved, approved dip should be sent to NPG Colorist for reference via Nordstrom Lab Dip Submittal Form.
If submit cannot be approved, Agent/Manufacturer Colorist comment back to the mill to redip.

If redip still could not be approved, it should be sent to NPG Colorist for review. The NPG colorist need to review the submits with brand and advise correction action plan and review timeline issues.

15. If bulk swatch color is reviewed by Certified Colorist, bulk swatch should be sent back to NPG Colorist for reference via NPG Production Swatch Submittal Form. If any issues with approval, NPG colorist need to review the submits with brand and advise correction action plan and review timeline issues.

16. If lab dip color is reviewed by NPG Colorist, the below process will be followed;
   - If the color is approved, NPG Colorist will communicate color comment to the Agent, Manufacturer or Mill for reference
   - If the color is not approved, NPG colorist request re-dip to Agent, Manufacturer or Mill.
   - If the re-dip is still not approved on 3rd round, the NPG colorist will work with the brand and advise correction action plan and review timeline issues.

17. If bulk swatch is reviewed by NPG colorist, the below process will be followed;
   - If color is approved, NPG Colorist communicates color comment to Agent, Manufacturer or Mill.
   - If color is not approved, NPG Colorist will work with the brand and advise correction action plan and review timeline issues.

COLOR COMMUNICATION

Common and consistent color language should be used to communicate color differences effectively. Please note the recommendations below.

- All samples should be evaluated for hue, chroma and value.

<table>
<thead>
<tr>
<th>Hue (a/b +/−)</th>
<th>Chroma</th>
<th>Value</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>More Bright</td>
<td>More Dark</td>
<td>Add Pink</td>
</tr>
<tr>
<td>Green</td>
<td>More Dull</td>
<td>More Light</td>
<td>Make it Browner</td>
</tr>
<tr>
<td>Blue</td>
<td>Less Bright</td>
<td>More Dark</td>
<td>Make it Cleaner</td>
</tr>
<tr>
<td>Yellow</td>
<td>Less Dull</td>
<td>More Light</td>
<td>Make it Warmer</td>
</tr>
</tbody>
</table>

- Communication to the Agent, Manufacturer or Mill should call out the differences observed in the submit versus the standard or what the submit needs for correction:
  - “Dip A is too blue, too green, too dull and too dark”
  - “Dip A needs to be less blue, less green, less dull and less dark”

- Do not give PERCENTAGES when commenting. They are very subjective and lead to confusion.
- When sending comments via email, clearly state all the information written on your submit forms.
GENERAL GUIDELINES

HOUSEKEEPING

Color can degrade if exposed to light, high humidity, high temperature or dust. All color standards, lab dips and bulk swatches should be properly stored. Listed below are good practices for use when handling standards and samples:

- Wash your hands with soap and water to remove dirt and oils.
- Do not use hand lotions.
- Avoid eating, drinking around the colors and light box.
- Store the standards/lab dips/bulk swatches in file cabinets
- Avoid exposure of standards/lab dips/bulk swatches to light.
- Avoid exposure of standards/lab dips/bulk swatches to dust.
- Avoid over handling the standards/lab dips/bulk swatches.
- All Color Standards stored in centralized color library by Pantone numerical order.
- Color Standards should be replaced immediately if they are not in good condition.
- All color standards are labeled with:
  - Nordstrom Product Group Color Name
  - Pantone Color Reference Code
  - Pantone Color Name

LAB DIP SIZE REQUIREMENTS

- At least 3 lab dips per color (A, B, C) need to be submitted for review.
- The minimum lab dip size must be a 2”x2” to ensure accurate analysis
- Yarns and threads must be in a bundle large enough to review the colors accurately
  - Recommended size: 2” long X ½” thick
  - A knit down made from the yarns is preferred
- The commercial front and vertical direction must be identified
DIGITAL EVALUATION TECHNIQUE

As mentioned previously, the purpose of instrumental color measurement is to provide objective, reproducible, quantifiable data for color communication through the use of the spectrophotometer. Solid and flat fabrics will be first evaluated digitally using the methods described below. Textured fabric, that which appears differently when viewed from different angles, along with pile fabric (velour, corduroy, and terry), heather yarns, prints or shiny fabrics, will be evaluated using the visual process only. Please find outlined below the process for Digital Color Evaluation.

1. Follow all Housekeeping guidelines for handling samples and maintaining work area
2. The certified colorist will enter the appropriate Lab Dip or Bulk information into the Tracking Tool
3. The NPG Colorist will update all pertinent NPG information on the Tracking Tool
4. Make sure to the instrument is calibrated before starting measurement
   a. Calibrate the instrument before use
   b. Calibrate every 8 hour or when the aperture size is changed
5. The samples must be conditioned for a minimum of 30 minutes before measurement
   a. Temperature: 70 Fahrenheit
   b. Humidity: 65%
6. Make sure to have the below settings for measurements
   a. Use the largest possible aperture for maximum accuracy
      (LAV = 30mm, MAV = 20mm, SAV = 9mm, USAV = 6.6mm, XUSAV = 3mm)
   b. Preferred viewing condition: LAV or MAV
   c. Color Space - CMC (2:1)
   d. Specular: included
   e. Observer: 10 degree
   f. Illuminant: D65 for daylight and U3000 for storelight
   g. UV Component: UV Calibrated
7. Fold the samples to be viewed to sufficient thickness to make them opaque, typically two to four layers
   a. The sample is opaque if it does not allow light to pass through
   b. Make sure to measure the face side of fabric
8. Position sample at the instrument port ensuring the:
   a. Commercial front or face is facing the aperture port
   b. Sample is not protruding into the sphere
   c. Sample is flat and covers the aperture completely.
9. Measure the sample
10. Remove the sample from the instrument, refold, reposition and measure
   - Shift the direction of the sample 90 degrees to optimize surface reading
   - Take a total of 4 measurements, repositioning 90 degrees each time
   - Sample rotation and repositioning reduce measurement variability due to fabric construction, directionality of yarns and unlevel dyeing.

11. After all measurements are completed, the instrument will provide the color difference
   - $dL^*$ = difference in lightness / darkness
   - $dC^*$ = difference in brightness / dullness
   - $dH^*$ = difference in cast or shade
   - $da^*$ = difference in redness / greenness
   - $db^*$ = difference in yellowness / blueness
   - DELTA E (DEcmc) = calculated based on these differences

12. Use the NPG established acceptability ranges (Tolerances) to determine approval / rejection:
   - $DE \leq 0.8$ - Submits equal to or less than this value are acceptable
   - $DE = 0.8-1.2$ – Submits within this range may be acceptable after reviewing visually
   - $DE > 1.2$ - Submits greater than this value are considered unsatisfactory
     - Note: Other factors may be taken into consideration before rejecting a color

13. After reviewing the submitted lab dip or bulk swatch following the Nordstrom Digital Evaluation Techniques, the sample needs to be evaluated visually at the light box following the Visual Evaluation Technique.

REPORTING

The NPG Colorist will track the performance of Certified Colorist based on the following:
- 1st Round Approval Rate - Percentage of Lab Dips approval on the first round to total processed and Percentage of Bulk Fabric approvals on the first submit to total processed
- Mutual Acceptance Rate – Correlation of visual acceptance between NPG and the Certified Colorist of Lab Dip or Bulk Fabric submittals

A performance report will be issued on a per Brand / Season basis. To remain in good standing, the Certified Colorist must maintain a minimum Mutual Acceptance Rating of 80%. If the Colorist falls below this performance metric, a corrective action plan will be developed to ensure performance returns to acceptable levels.