VSP Printing, Inc.

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WORKING GUIDELINES

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Artwork:

Customer Supplied Artwork: The final image resolution can never be better than the artwork it was created from. Due to the complex requirements and process steps it is recommended for VSP's art department to provide vector files.

Customer Supplied Graphic Files: Most of the services performed by VSP is from customer supplied graphic files. The typical steps are as follows:

1. A Design Engineer, Graphic Artist or Marketing Personnel will provide a Vector based file designed in Adobe Illustrator or possibly Corel Draw and saved as .eps graphic formats.
2. The files, samples or drawings are sent to VSP via Email, CD-ROM (DVD) or via ftp protocol. Please call if you need assistance.
3. VSP reviews the information to verify all the details and define any additional variables, necessary to complete the job. Files should include dimensions, and orientation needed on the final layout.
4. A comprehensive proof, if applicable, is sent for customer review.
5. The customer approves the proof and if necessary will suggest changes.
6. All changes are re-proofed until approval is final.
7. Once approved, the job proceeds to production.

File Formats:

Customer files can be in different formats although some are more user friendly. The best format to send is Adobe Illustrator .eps when the design was created. The Native Format is always the most accurate due to the fact that whenever a file is converted from one format to another, details can be lost or altered. VSP has the tools to work with the most popular formats.

For customer-supplied files, the following guidelines apply:

Files should be saved as .eps with reference dimensions clearly noted in inches or millimeters.

- Include all necessary layers and drawing information.
- Include supporting files in their Native format (.eps).
- If a file is created with fonts, convert the fonts to curves and outlines before saving the file as .eps.
- Files created with Adobe™ products such as Illustrator™ can almost always be exported and saved as .pdf files.
- Corel™ files in the Native format or exported to .pdf work well.
- Raster files will not work and are not recommended. These files (.bmp, .jpg, .gif) cause problems due to the scale vs. resolution, dot patterns, angles, and color boundaries are already defined. Embedding a Raster file inside an .eps or .pdf type of file makes the problem worse. Often these files need to be modified or re-drawn and can incur an additional cost.

Higher resolution artwork can always be converted to lower resolution but not vice versa. Therefore, the higher the resolution the better, the only drawback is the higher resolution files can be very large. 600 to 1200 dpi works well for most applications. Files with a resolution less than 300 dpi will print poorly.

One way or another, if we have to re-draw a bitmap, or measure and build an image from an existing part; we can turn the concept into reality. Before you contract with an art studio, outside design house or have your in-house art department generate the artwork, please call VSP. We have found the project is completed faster at a reasonable cost and without missed details or communication problems if we complete the art in-house using our guidelines.

Color Control:

Defining the correct color, matching the color and consistently repeating each lot

accurately is a critical part of every job at VSP Printing, Inc. Specific

protocols are listed below to establish and maintain color correctness:

1. Color information is received from the customer as a request to match a

sample part, color swatch or specific PMS color. A precise color match is within plus or minus five delta E when using a Spectrophotometer.

2. The ink sample is drawn on a sample of white or black coated stock to ensure the results.

Duplicate color swatches are created and kept on file at VSP for color control prior to and during the mixing process. It is important that the swatch represents the form and texture of the actual finished part.

3. Once approved, the job will proceed to production.

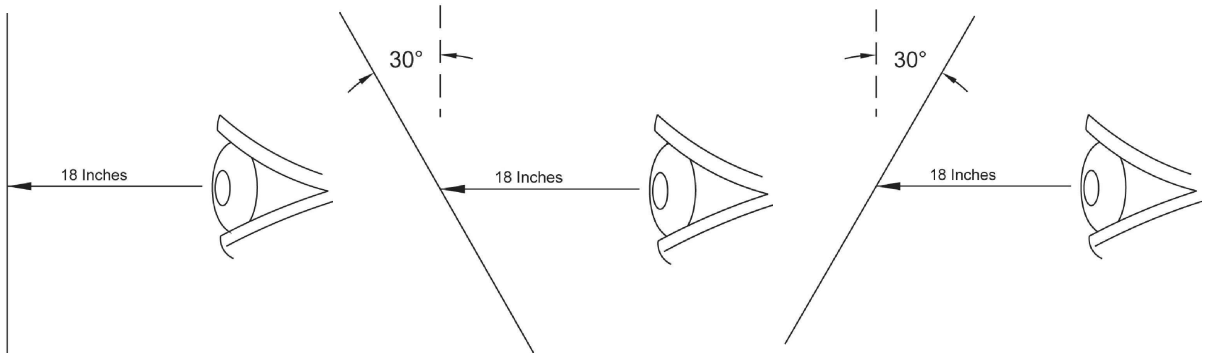
4. Each time the job repeats, the color formula is used and the swatch is used for re-creating the

ink and for quality control inspection.

Print Inspection Criteria:

Cosmetic Flaws Inspection:

- All parts are to be inspected by personnel with 20/20 or corrected 20/20 vision. Corrective lenses cannot be tinted.
- Parts are to be inspected at a distance of 18” under cool white fluorescent lights.
- Parts should not be Inspected at a distance closer than 18” and then moved to 18”.
- View all parts in a continuous scanning manner.
- The illumination at the point the parts are inspected should be between 100 and 175 foot candles.
- Rotate parts +/- 30 degrees during inspection.
- Please see diagram below:



Inspection viewing times will vary with the panel surface area in square inches. Additional time must be applied to areas of the panel that are to be backlit or clear areas in the panel to be used as windows. A guide to determine the time vs. square inches is as follows:

Part Size:	**Viewing Time:**
Up to 10 Sq. In.	5 Seconds
10 - 15 Sq. In.	8 Seconds
15 - 25 Sq. In.	11 Seconds
35 - 45 Sq. In.	15 Seconds
45 - 55 Sq. In.	18 Seconds
55 - 65 Sq. In.	21 Seconds
65 - 75 Sq. In.	25 Seconds
Over 90 Sq. In.	4 Seconds for each additional 10 sq. in.

Using the Cosmetic Flaws Inspection criteria, a visual inspection of each individual part can be conducted and not be accepted if the following defects are present:

- Debris or imperfections including, lint, scratches, smears, blurring, etc.
- Breaks in any character, symbol or line.
- Color variances including, discoloration, fisheyes, or dark spots.
- Improper overlapping of color or bleed-thru.
- Defective material including warps, abrasions, dings, kinks, etc.
- Mis-registration of image, lines, characters, etc.
- Voids of ink including pinholes.

Display Windows including Clear and Transparent Colors:

A fixture to simulate the finished product is used to inspect display windows.

Clear and transparent colors are viewed through the fixture with an illumination

set to approximate the finished product.

- For windows under 12 square inches of total area, each part is viewed for two seconds for every three square inches of display.
- For windows over 12 square inches of total area, each part is viewed for eight seconds plus and an additional second for every three square inches over 12.

No visible flaws, including pinholes or color variation are acceptable.

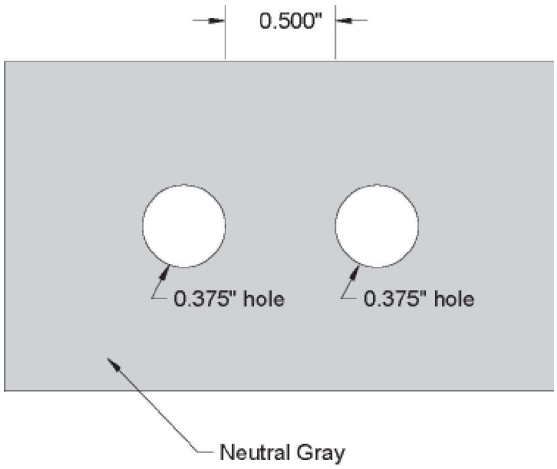
Color Inspection Criteria:

Colors are specified by a color matching system or customer supplied color swatch.

Printed colors must be within 5 E (Delta E) of the specified color when measured on a

Spectrophotometer.

To visually compare colors, the finished printed part is placed next to the specified color swatch.



A neutral gray template with two 0.375” diameter holes is placed over both parts. Position the template with one hole over the printed part and the other over the swatch. For a perfect match, there should be no color variation.

The light source should be a standard cool white fluorescent lamp emitting 75 to 100 foot candles.

For backlit areas and windows, colors should be compared over a fixture to simulate the illumination of the finished part as installed in the field.

Ink Adhesion Test:

The following test procedure is in accordance with ASTM Test Method D-3359-76 and DIN Standard No. 53151 to conduct adhesion testing on inks and related coatings applied to a flat uniform surface.

1. Cut into the ink film with a standard cross hatch tool at 90 degrees to result in the pattern shown below. This cut can be made with a sharp razor blade or an X-Acto type knife.

2. Using Permacel #99 or 3M #600 clear tape, apply a clean strip to the cut area. Apply pressure to tape on the test area. Remove the tape immediately by pulling it off rapidly, back upon itself as close to an angle of 180 degrees as possible.

3. Evaluate the cut area and use the classification chart shown below to determine the adhesion of the particular samples. Different substrates will yield different levels of adhesion. When using an ink that is specifically designed for a particular substrate the cross hatch test should result in a #5 or #4 type test area.

Ink adhesion is tested at every production run for proper adhesion using ASTM D3359-76 and DIN Standard No. 53151 testing standards above.

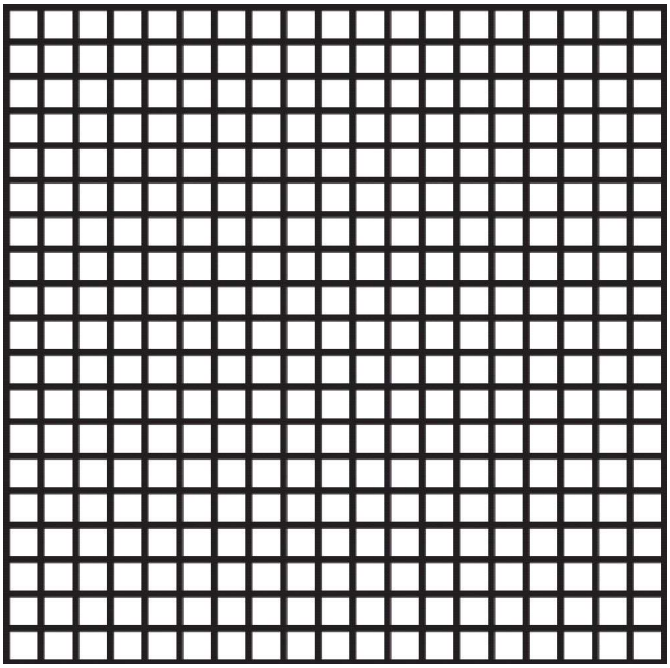
CLASSIFICATION CHART

Surface of cross-cut area from which flaking has occured. (Example for 6 parallel cuts).	None					Greater than 65%
Classification	**5**	**4**	**3**	**2**	**1**	**0**

Ink Opacity Test:

To determine ink opacity, place a 0.25” center-to-center grid pattern of 0.05” thick black lines.

Shown below on white paper under the part to be tested. The grid will not be visible in opaque areas.



To check areas of a backlit part for opacity, place the same grid pattern (but this time printed on clear material) under the part to be tested. The grid and part should be placed on a light source that simulates the part when installed in the finished assembly. The grid should not be visible in opaque areas.

Explanation of Industry Terms:

- ABRASION RESISTANCE: The resistance of a substrate surface to wear away by friction or abrasion during use.
- ADHESION: A bond established upon contact between two surfaces.
- APPLICATION TEMPERATURE: Temperature at the time the overlay or panel is applied. All adhesives have a minimum application temperature rating.
- BLEED: Background printing which extends beyond the dimension of the part. Also referred to as a trap component.
- BLEED-THRU: The evidence of a color visually altering another color when overlapping.
- BLURRING: When images become indistinct or appear out of focus.
- BORDER: A decorative line, which defines a printed area.
- BREAK: A line or character with an unintentional break.
- CHARACTER: A single letter or numerical designation.
- COLOR FASTNESS: Also known as color permanence or color stability.
- COMPATIBILITY: The functionality of inks, substrates and adhesives to work together in an acceptable manner.
- CONFORMABILITY: The capability of thin gauge substrates to conform to the contours of a curved or rough surface.
- CMYK: Abbreviation for cyan, magenta, yellow and key (black). The four colors used to create process colors.
- CROP MARKS: Cross-hair lines used to maintain registration throughout the printing process. Also known as Register Marks.
- CROSS HATCH TEST: Used in accordance with ink adhesion testing.
- DARK SPOTS: Pigments of ink that have concentrated to one spot, usually caused by a defect in the substrate.
- DEADFRONT: A term used to define a printed area that appears only when backlit.

- DING: A small dent or nick that can be seen or felt.
- DISCOLORATION: Any unintended change from the original color.
- DWELL: A recommended measure of time before an adhesive or ink has reached the performance rating by the manufacturer. Also referred to as cure time. Usually in the range of 72 to 96 hours or per manufacturer's recommendations.
- EMULSION: The side of printing films that contains active halide emulsion.
- FILL-IN: An excess of ink that alters the graphic image that is reversed out of a background area.
- FINISHING: General term for trimming, folding, laminating and all other post printing operations.
- FISHEYES: A dark spot surrounded by a lighter colored background or transparent "halo".
- FRACTURING: Cracking of the ink, texture or substrate due to excessive stress.
- GAUGE: Thickness, usually measured in thousandths of an inch. A mil is equal to .001” of an inch.
- GROWTH: Expansion of substrate or adhesive.
- HAZE: Unclear or undesired discoloration generally found in transparent areas.
- HYGROSCOPIC: The characteristic of some substrates to absorb atmospheric moisture.
- INCLUSIONS: Any abnormal type of debris trapped in the printed surface.
- KERNING: Space between letters.
- KINK: An unintentional crease in a substrate.
- LEGEND: An explanation table of characters, nomenclature, text, type or symbols.
- MAR-RESISTANT: The surface of a substrate able to resist damage.
- MIS-REGISTRATION: When graphics do not align.
- MOIRE: Undesirable pattern resulting when halftones and screen tints are made with improperly aligned screens or when a pattern in a photo, such as a plaid, interfaces with a halftone dot pattern.
- NATIVE FORMAT: Art file in the original format from the original software.
- NEUTRAL GRAY: Gray with no hue or cast.
- NOMENCLATURE: The procedure of assigning descriptive names or words.

- NON-ADHESION: Lack of proper adhesion of inks to the printed surface determined by using the Cross Hatch Test.
- OPACITY: (1) Characteristic of a substrate that prevents printing on one side from showing through the other side. (2) Characteristic of an ink deposit that prevents light or an image from showing through the substrate.
- OPAQUE: Impenetrable by light, neither transparent or translucent.
- OPTIUM ADHESION: The final bond between two or more surfaces that can be achieved by the adhesive after a given period of time. Referred to as dwell time usually in the range of 72 to 96 hours or per manufacturer's recommendations.
- PDF: Acronym for Portable Document Format. An Adobe format permitting the viewing of designs cross-platform without special software.
- PEEL ADHESION: The force required to remove a strip of overlay, usually an inch wide, from a stainless steel surface at a fixed rate of removal (most tests are at 12 inches per minute). Peel adhesion is measured at 90 degrees from the surface.
- PHOTO SPECTROMETER: A precision instrument used to measure color values.
- PIGMENT: A powder used to color inks.
- PINHOLE: The appearance of a tiny puncture in the layer of ink.
- PIT: A minute circular imperfection usually located on the substrate surface.
- PMS: Pantone Matching System. The correct trade name of the colors in the Pantone Matching System is referred to as Pantone colors.
- PMT: Abbreviation for photomechanical transfer.
- PROTRUSION: A raised defect in the substrate surface giving the appearance of a blister, bump, or ridge.
- REGISTER: The orientation tolerance of the printing and die cutting process.
- REGISTER MARKS: Cross-hair lines on mechanicals and films that keep printing in register. Also called crop marks or position marks.
- RESOLUTION: Sharpness of an image on film, paper, computer screen, disc, tape or other medium.

- SAW-TOOTH: A jagged or poorly defined edge of the printed image resembling the teeth of a saw blade.
- SCRATCHES: A series of linear gouges of varying degrees in the ink or substrate.
- SCREEN PRINTING: A method of printing using a squeegee to force ink through an assembly of mesh fabric and stencil.
- PAD PRINTING: A method of printing using a silicone pad to transfer ink in the shape of the artwork from a printing etched plate to the part.
- SCUFFS: Closely grouped abrasions in the printed image or substrate.
- SEPARATIONS: Used in the four-color process to separate films holding images of one specific color per piece of film. PMS colors can also be separated through separate films.

- SHELF LIFE: The period of time a product can be stored under specified conditions and maintain its integrity.
- SMEAR: An area on the printed image that was distorted while the ink was wet causing the clarity to be unacceptable.
- SOLVENT RESISTANCE: The resistance of a specific substrate, which will withstand certain destructive chemicals.
- SPOT: Contamination to the printed area by a concentration of pigment or other particles of debris.
- STAIRSTEPS: The appearance of step-like edges commonly called saw-tooth.
- STRESS CRACKS: Same as Fracturing.
- STROKE: Refers to a line of a character or letter.
- SUBSTRATE: Various types of plastic, metal, glass, etc. used in the printing process.
- SURFACE PRINTING: First surface printing refers to ink placement on the topside of the substrate. Second surface printing is ink on the underside of the substrate.
- SYMBOL: An image that represents something else using a picture to describe the function.
- TRAP: See Bleed.
- TYPE: Characters used to form a descriptive word.
- VECTOR ART: Art created as lines or paths rather than pixels.

- VOID: When the ink has failed to completely cover the printed area.
- WARP: A defect in the substrate which prevents the printed product from laying flat.
- WEATHERABILITY: The ability of a substrate to withstand the outdoor elements of sunlight, excessive heat and cold, humidity, for a given time.