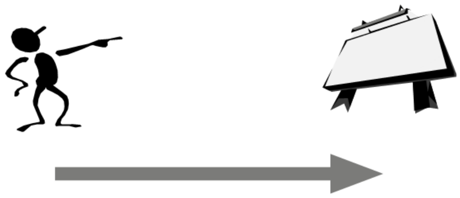
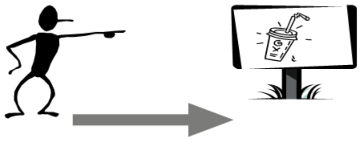
12 Troubleshoot print-quality issues

- General advice
- Basic and advanced troubleshooting
  - Basic print-quality troubleshooting
    - Printhead check and clean
    - Substrate-advance sensor check
    - Printhead alignment
- Advanced print-quality troubleshooting
  - Print-quality artifacts troubleshooting
    - Horizontal banding
    - Color misalignment
    - Bleed, halo, wicking
    - Low gloss, haze
    - Color accuracy
    - Color variations when tiling
    - Edge roughness, text quality
    - Graininess
  - Physical deformation marks
  - Poor curing
  - White-to-color misalignment
  - Static electricity
  - Dual-side marks

General advice

Your printer has been designed and qualified to the highest standards to provide the optimal compromise between print quality and productivity. Prints for outdoor use can accommodate more visible defects as they are viewed from a long distance. For shorter distances, as in indoor advertising, defects need to be less visible. To decide whether a defect is considered acceptable, as a rule of thumb, the table below shows the appropriate viewing distances.

Print mode	To view output at...
4 pass (outdoor)	 3 m
6 pass (indoor)	 1 m
12 pass (high quality) and white printmodes	Any distance

You are recommended to review the acceptability of a defect according to this table before proceeding to diagnose it to make sure the selected print mode is the most appropriate for the purpose of the job. Increasing the number of passes to 8 or more enables higher ink quantities if needed and/or the use of difficult printing materials thanks to the longer drying and curing times. Print modes with more passes are more resistant to banding. In general, follow these recommendations:

- Avoid touching the substrate before printing, as fingerprints can detract from print quality.
- Avoid touching the substrate while printing is in progress.
- Judge the print quality after the print has completely emerged from the printer. In some cases, defects seen while printing disappear after the image is completely cured.
- Check that the environmental conditions (room temperature and humidity) are in the recommended range. See Environmental specifications on page 265.

Before troubleshooting, check the following points:

- To achieve the best performance from your printer, use only genuine HP supplies and accessories, whose reliability and performance have been thoroughly tested to give trouble-free performance and best-quality prints.
- Check that the substrate type selected in the Internal Print Server is the same as the substrate type loaded into the printer.

> ⚠ CAUTION: If you have the wrong substrate type selected, you could experience poor print quality and incorrect colors, and perhaps even damage to the printheads.

- Check that you are printing on the right side of the substrate.
- Check that you are using in the RIP software the correct substrate preset, which includes the ICC profile for your substrate and print mode.
- Check whether there are any outstanding printer alerts in the Internal Print Server. React to the alert as instructed in this guide.

In particular:

- Make sure the substrate is flat and has no wrinkles. See Troubleshoot substrate issues on page 214.
- Check that the substrate has no skew or telescoping. Check that you are loading the substrate using the correct process. See Load a roll into the printer on page 56.
- For color consistency issues, check that the color calibration was performed when the substrate was added to the Internal Print Server. See Use a new substrate on page 64.
- Make sure it has also been performed in the current conditions, especially considering substrate batch and printheads. See Color calibration on page 111.

Basic and advanced troubleshooting

The print-quality troubleshooting process is divided here, for convenience, into two levels: basic and advanced.

- Basic troubleshooting will help to resolve the majority of the typical print-quality issues related to banding, graininess, and printhead alignment.
- Advanced troubleshooting helps to resolve the above issues when the basic steps did not work, but it also covers other possible print-quality defects, diagnosis, and resolution.

Basic print-quality troubleshooting

1. Identify the defect. This basic procedure applies to the following defects:
    - Horizontal banding
    - Graininess
    - Color misalignment
        - Blurred lines, edges, and text, horizontally and vertically
        - Halo of a different color around color lines and at the edges of color areas or text
        - Ink bleeding or wicking or different gloss at the edges of color areas
2. Perform the actions described in the following table.

Defect	Optimizer printhead check	Printhead check and clean	Substrate-advance sensor check	Printhead alignment	Possible causes (for reference only)
Horizontal banding		X	X	X	• Blocked nozzles • Substrate-advance accuracy
Isolated bands (usually of different texture or grain)			X		• Substrate-advance accuracy and navigability
Graininess			X	X	• Substrate-advance accuracy • Substrate thickness • Color alignment

Defect	Optimizer printhead check	Printhead check and clean	Substrate-advance sensor check	Printhead alignment	Possible causes (for reference only)
Blurry edges or text lines, horizontally			X	X	● Substrate-advance accuracy ● Substrate thickness ● Color alignment
Blurry edges or text lines, vertically				X	● Color alignment
Color halo on objects (e.g., magenta shows up under a blue line)				X	● Color alignment
Ink bleeding, wicking, or different gloss at the edges of color areas	X			X	● Optimizer alignment ● Optimizer level
White halo around objects			X	X	● White alignment ● Substrate-advance accuracy

Printhead check and clean

See Check and clean the printheads on page 85. The check and clean process will check the printheads, recover the ones with blocked nozzles, and replace the nozzles that are not recovered with healthy ones for printing.

Substrate-advance sensor check

Run the OMAS diagnostic test.

NOTE: OMAS stands for Optical Media Advance Sensor, usually known as the substrate-advance sensor in this guide.

The test will tell you whether the substrate-advance sensor is working correctly or not (either dirty or damaged).

If the substrate-advance sensor is dirty, clean the sensor. See Clean the substrate-advance sensor on page 167.

For best results, cleaning the substrate-advance sensor is included in the printer's weekly maintenance.

Printhead alignment

Automatic alignment is recommended. See Automatic alignment procedure on page 102.

In case you want to perform manual printhead alignment, see Manual alignment procedure on page 103.

The result of the alignment can be verified with the printhead alignment diagnostics plot. See Printhead alignment diagnostics plot on page 108.

Advanced print-quality troubleshooting

If the basic print-quality troubleshooting does not solve the problem, here are some further procedures that you can try.

One of the most important parts of print-quality troubleshooting is to ensure that the printheads are healthy. See Printhead health troubleshooting on page 241.

Print-quality artifacts troubleshooting

Horizontal banding

Horizontal banding means that your print suffers from added horizontal lines or bands, in a regular pattern. They can look different depending on the cause:

- Thin dark lines
- Thin white lines
- Bands of light and dark zones
- Gloss banding
- Aeroworms
- Banding in white-ink applications
- Image content-dependent banding
- Local color variations
- Microbanding

Thin dark lines

These are thin dark lines across the entire image with certain frequency, more easily seen in solid area fills. There are two likely causes:

- **Printhead alignment.** This is a clear contributor to banding. If printheads are not correctly aligned, the misplaced dots could correlate directly with the severity of the banding, by putting more ink in the same place and thus creating darker lines.

  To check printhead alignment, print the printhead alignment diagnostics plot (see Printhead alignment diagnostics plot on page 108). As a general rule, the biggest contributors to thin-dark-line banding caused by printhead alignment are (in this order):

  - Inter-color alignment (alignment between different colors)

  Here are some tips for solving this problem:

  - If the printhead alignment was done with a different substrate of different thickness, probably a new printhead alignment is needed.
  - Fine-tune the alignment by identifiying the offenders in the printhead alignment diagnostics plot. See Automatic alignment procedure on page 102.

- **Substrate advance.** Before trying to adjust any parameter, make the following checks:

  - Check that no substrate-advance factor was set earlier that could prevent the substrate-advance sensor from working correctly.
  - Run the diagnostics to check that that the substrate-advance sensor is not dirty.

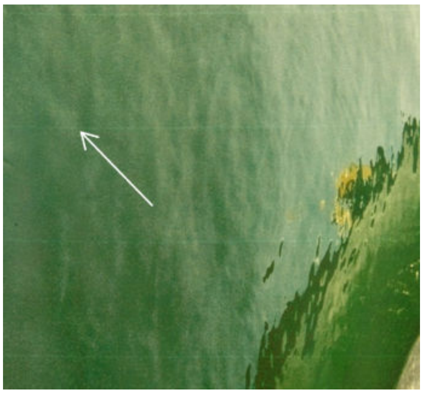
  If the substrate advance is not well adjusted, particularly if it is under-advancing, a dark line can appear between passes.

  A clear symptom of this is when the dark lines appear across all colors, because the cause is common to all of them. To confirm it, in the Internal Print Server, tap **Printer** > **Advance Calibration** to check the substrate advance. See Substrate-advance test print on page 115.

  You can usually correct this problem by adjusting the substrate advance compensation (see Substrate-advance compensation on page 115). However, you are recommended to run the OMAS Diagnostic Tests from the maintenance window as soon as the substrate is unloaded, to avoid having the same problem with other substrates. See Clean the substrate-advance sensor on page 167.

Thin white lines

These are thin white/light lines across the entire image at regular intervals, more easily seen in solid area fills.



There are three likely causes:

- **Nozzle clogging.** A printhead nozzle can be sealed temporarily, by some fibers or dirt in the ink bore. Then not all the ink is fired and a lighter horizontal band appears. Sometimes a bigger drop with all the accumulated ink appears at the end of this light thin line, meaning that the bore is clear then. See Printhead health troubleshooting on page 241.
- **Printhead alignment.** This is a clear contributor to banding. If printheads are not correctly aligned, the misplaced dots could correlate directly with the severity of the banding, by leaving lighter bands where the ink should have been placed.

  To check printhead alignment, print the printhead alignment diagnostics plot (see Printhead alignment diagnostics plot on page 108). As a general rule, the biggest contributors to thin-white-line banding caused by printhead alignment:

  – Inter-color alignment (alignment between different colors)

  Here are some tips for solving this problem:

  – Execute automatic alignment.

  – If the printhead alignment was done with a different substrate of different thickness, probably a new printhead alignment is needed.

  – Fine-tune the alignment by identifiying the offenders in the printhead alignment diagnostics plot. See Automatic alignment procedure on page 102.
- **Substrate advance.** Before trying to adjust any parameter, make the following checks:

  – Check that no substrate-advance factor was set earlier that could prevent the substrate-advance sensor from working correctly.

  – Run the diagnostics to check that that the substrate-advance sensor is not dirty.

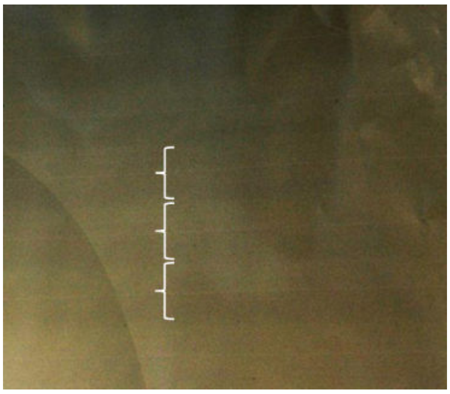
  If the substrate advance is not well adjusted, particularly if it is over-advancing, a white line can appear between passes.

  A clear symptom of this is when the white lines appear across all colors, because the cause is common to all of them. To confirm it, in the Internal Print Server, tap **Printer** > **Advance Calibration** to check the substrate advance. See Substrate-advance test print on page 115.

  You can usually correct this problem by adjusting the substrate advance compensation (see Substrate-advance compensation on page 115). However, you are recommended to run the OMAS Diagnostic Tests from the maintenance window as soon as the substrate is unloaded, to avoid having the same problem with other substrates. See Clean the substrate-advance sensor on page 167.

Bands of light and dark zones

These are periodic horizontal bands formed of a lighter band and a consecutive darker band. This pattern is mostly seen in solid color area fills (such as light purple or gray).



There are three likely causes:

- **Coalescence.** This is due to an excessive amount of ink, and the ink being misplaced as it is deposited on the substrate, generating bands with more ink than other alternate bands. It can also be caused by firing too much ink in a short time. Coalescence is most likely to be seen in areas of high ink density.

  Here are some tips for solving this problem:

  - Use lower ink density.
  - Increase the number of passes.
  - Increase the optimizer level.
  - Change the drying settings. See Edit a substrate preset on page 69.

- **Printhead alignment.** This is a clear contributor to banding. If printheads are not correctly aligned, the misplaced dots could correlate directly to the severity of the banding.

  To check printhead alignment, print the printhead alignment diagnostics plot (see Printhead alignment diagnostics plot on page 108). As a general rule, the biggest contributors to light-and-dark banding caused by printhead alignment are (in this order):

  - Bidirectional alignment
  - Inter-color alignment (alignment between different colors)

  Here are some tips for solving this problem:

  - Execute automatic alignment.
  - If the printhead alignment was done with a different substrate of different thickness, probably a new printhead alignment is needed.
  - Fine-tune the alignment by identifiying the offenders in the printhead alignment diagnostics plot. See Automatic alignment procedure on page 102.

- **Substrate advance.** Before trying to adjust any parameter, make the following checks:

  - Check that no substrate-advance factor was set earlier that could prevent the substrate-advance sensor from working correctly.
  - Run the diagnostics to check that that the substrate-advance sensor is not dirty.

When the substrate advance is incorrect, some light and dark horizontal bands can appear from the misplacement of the ink.

To confirm it, in the Internal Print Server, tap **Printer** > **Advance Calibration** to check the substrate advance. See Substrate-advance test print on page 115.

You can usually correct this problem by adjusting the substrate advance compensation (see Substrate-advance compensation on page 115). However, you are recommended to run the OMAS Diagnostic Tests from the maintenance window as soon as the substrate is unloaded, to avoid having the same problem with other substrates. See Clean the substrate-advance sensor on page 167.

Gloss banding

This appears in dark, high-density areas as horizontal gloss or matte bands about 1 cm wide. It can happen when the curing system settings are not correct for the substrate or overcoat printhead.

If the bands are more apparent when tilting the print (1) or changing your viewing position (2), then it is likely to be gloss banding.

To solve the problem, check your curing settings (airflow, curing temperature), and check and clean the overcoat printhead (see Check and clean the printheads on page 85). You could also try using a different print mode.

Aeroworms

Aeroworms consist of thin bands with higher density than the surrounding area. They are about 6 cm long and have a horizontal tendency, but they tend to curve like worms. They are not continuous across the substrate, and seem to appear at random.

When the ink is being fired, there are airflow turbulences under the carriage that can affect the positioning of the drops. Therefore, some waves of ink can be formed and deposited on the substrate to create this effect.

Here are some tips for solving this problem:

- Increase the number of passes.
- Reduce the ink density.
- Check the scan beam distance in the Internal Print Server. If it is higher than normal, try reducing it.
- Check that the aerosol filters are not saturated or broken (see Replace the aerosol filters on page 92).

Banding in white-ink applications

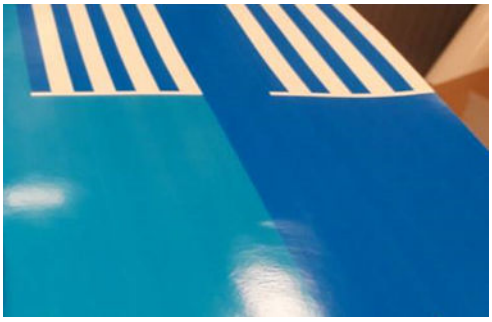
You may see periodic horizontal bands formed of a lighter band and a consecutive darker band. Try the following:

- Align the printheads.
- Check the substrate advance.

- Check and clean the printheads.
- Change the drying settings. See Edit a substrate preset on page 69.

Image content-dependent banding

This consists of a color variation that appears in some color area fills that contain cyan.

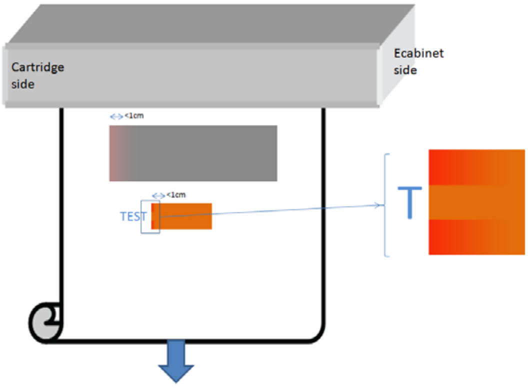


Here are some tips for solving this problem:

- Rotate the image before printing.
- Reduce the ink density.
- Increase the number of passes.

Local color variations

In some cases, at the edges of area fills, a small number of ink drops may be missing or slightly darker, producing a local color variation.



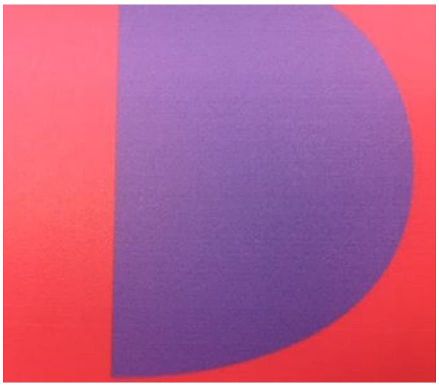
These defects are due to the printheads travelling from side to side without printing.

- In each pass, the first 1 or 2 drops of a color are missing or smaller.
- In each pass, the first 1 or 2 drops of a color are darker because they are more concentrated with pigment.

To resolve these defects, add spit bars at each side of the image, to make sure nozzles are refreshed before printing each pass. If possible, you could also rotate the image to avoid situations such as shown in the example.

Microbanding

This consists of very thin horizontal lines of very high frequency that appear in some area fills. Often they are hardly visible.



Microbanding is probably caused by ink crusting.

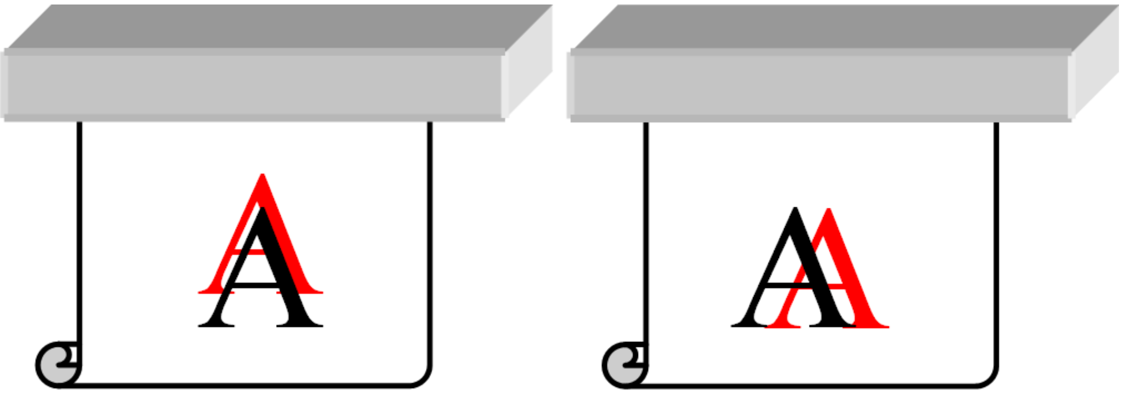
Here are some tips for solving this problem:

- Check and clean the printheads. See Check and clean the printheads on page 85.
- Check and clean the left printhead cleaning blade. See Clean the left printhead cleaning blade on page 126.
- Increase the number of passes.
- Decrease the amount of ink.

Color misalignment

Colors appear misaligned. Typically, lines and text are most affected by this issue.

It can happen in both axes: the substrate axis and the scan axis.

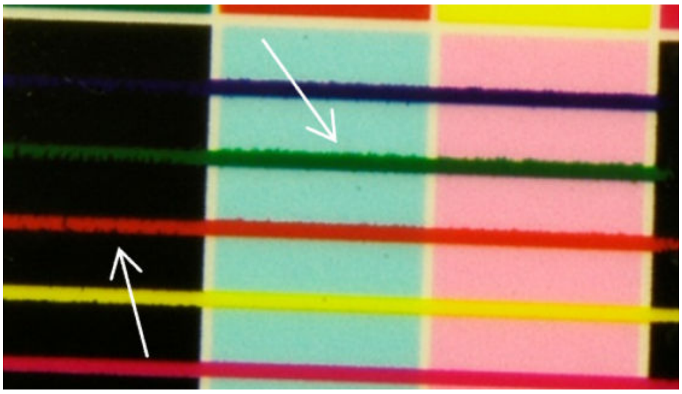


Color misalignment is most likely to be caused by printhead misalignment. To check printhead alignment, print the printhead alignment diagnostics plot (see Printhead alignment diagnostics plot on page 108).

If you see white misalignment along the substrate axis, check the substrate-advance sensor.

Bleed, halo, wicking

Sometimes a small color migration may be observed at the border between different colors (bleed). It may also happen at the border between a color and blank substrate (no ink), reducing the sharpness of the shape. On some substrates, a gloss halo can be observed at the border between colors.



There are three likely causes:

- **Optimizer misalignment:** There may be misalignment between the optimizer printhead and the other printheads. To check the printhead alignment, print the printhead alignment diagnostics plot (see Printhead alignment diagnostics plot on page 108). If necessary, perform a manual alignment, then reprint the printhead alignment diagnostics plot.

  If the problem is in the substrate axis direction, it may also be caused by incorrect substrate advance. See Substrate-advance test print on page 115 and Substrate-advance compensation on page 115.

- **Optimizer level**, which may be too low for this substrate and ink density. Other associated defects may also appear, such as coalescence or grain in the area fills due to low wetting of the ink on the substrate. You can correct this problem by increasing the optimizer percentage in the substrate preset.

- **Drying temperature**, which may be too low for this substrate and ink density. Other associated defects may also appear, such as coalescence or grain in the area fills due to low wetting of the ink on the substrate. You can correct this problem by increasing the drying temperature in the substrate preset.

Low gloss, haze

On glossy substrates, the print may have lower gloss than expected. Try decreasing the optimizer percentage in the substrate preset.

Color accuracy

Ideally, the colors that you see on the screen should match the colors in the print. In practice, you may find that the colors are not sufficiently accurate. There are three possible causes:

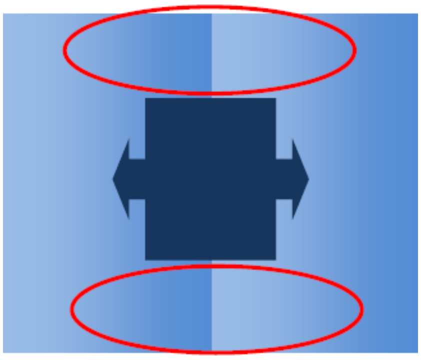
- **Color calibration** provides consistent colors, but consistent colors are not necessarily accurate. However, if the combination of substrate and printheads has not been calibrated recently (or ever), that is a possible source of color inaccuracy. You can eliminate the possibility by performing a color calibration (see Color calibration on page 111).

- **ICC profile.** If you are using the wrong profile, your colors are likely to be inaccurate. Check which profile you are using. If necessary, you can make your own ICC profile for the printer, printheads, print mode, and substrate that you are using.

- **Ink density**, which affects color saturation. If the color saturation of your print seems wrong, try changing the ink density in the substrate preset; you may need to change the number of passes at the same time.

Color variations when tiling

When tiling, it is important that all tiles have the same length and that the colors of the mating edges match. This section focuses on color variations; for recommendations about length consistency, see How to achieve better consistency between jobs of the same length on page 220.



Possible causes

- **Uniform variations from tile to tile.** When color changes uniformly it must be within the color consistency specification; see Color consistency on page 41 for more details. Usually grays are much more sensitive: differences of much less than 2 dE 2000 may be visible, although other colors would not show a difference.
- **Small color variation left to right.** The tile itself looks uniform, but when putting it beside the adjacent tile the differences become visible.
- **Local color variations.** See Local color variations on page 229. Sometimes these defects become visible only when printing tiles, showing in one of the tiles but not in the adjacent. They are also more visible when printing grays.

Possible solutions

- Try to ensure uniform printing of all tiles, and all tiles printed in the same run.
- Rotate every other tile, to compensate for left to right differences.
- Adding spit bars at both sides of the image helps overall, especially when there are local color variations.

Edge roughness, text quality

The edges of objects may appear rough or blurred; this is especially noticeable in text.

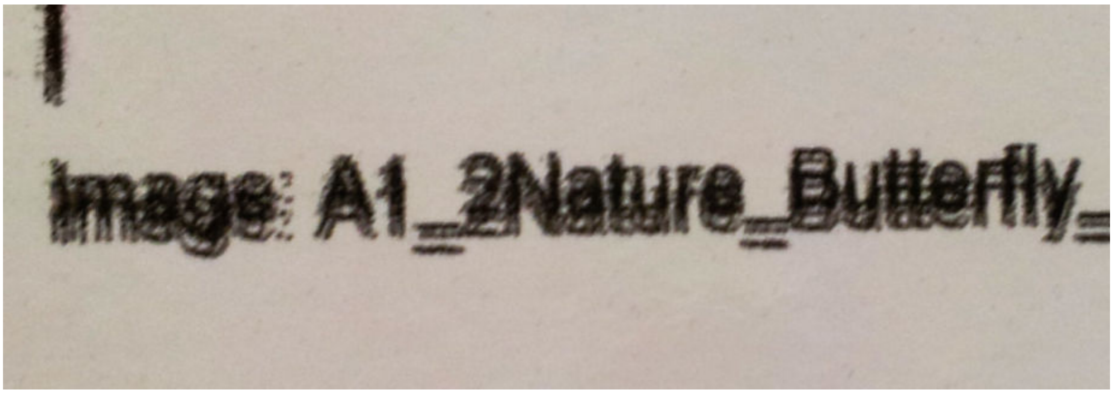


Image: A1_2Nature_Butterfly_

There are five possible causes:

- **Bleed:** see Bleed, halo, wicking on page 231.
- **Printhead alignment.** As ink could be deposited by a combination of different colored printheads, it is important that all printheads are correctly aligned. To do so, print the Printhead alignment diagnostics plot on page 108, and correct any misalignment.
- **Substrate advance.** Before trying to adjust any parameter, make the following checks:
  - Check that no substrate-advance factor was set earlier that could prevent the substrate-advance sensor from working correctly.
  - Run the diagnostics to check that the substrate-advance sensor is not dirty.

  If the substrate advance is incorrectly adjusted, particularly if it is under-advancing, a dark line can appear between passes. When the problem of line roughness or text quality applies to all colors and appears in the substrate axis direction, it is likely to be related to incorrect substrate advance. Another clue that could point to substrate advance as a cause is to observe that the defect is not constant, appearing and disappearing along the print in the substrate axis.

  To confirm it, go to the Internal Print Server and tap **Printer** > **Advance Calibration** to check the substrate advance. See Substrate-advance test print on page 115.

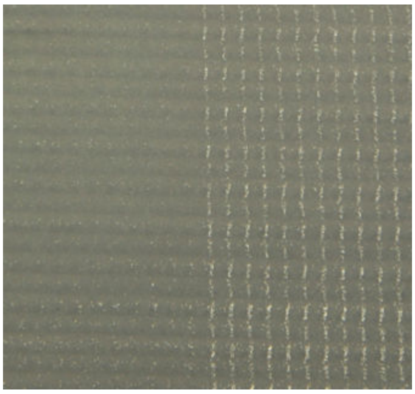
  To correct the substrate advance, see Substrate-advance compensation on page 115. In most cases, this will solve the problem. However, you are recommended to run the OMAS Diagnostic Tests from the maintenance window as soon as the substrate is unloaded, to avoid having the same problem with other substrates. See Clean the substrate-advance sensor on page 167.
- **Printhead-to-belt spacing.** Check the printhead-to-substrate spacing in the Internal Print Server. If it is higher than normal, try reducing it.

Graininess

The print shows a higher level of grain than expected, either throughout the print or in some specific areas. The example below shows more grain in the lower half than in the upper half.

This can occur for various different reasons:

- **Coalescence.** Some substrates, in some particular conditions, can produce a type of grain due to wetting issues. For example, in high humidity or low temperature environments, the ink may not dry fast enough in fast print modes, producing a grainy effect on the print. The example below shows worse coalescence on the right-hand side.



It is difficult to decide whether this kind of problem is due to wetting or to dot placement error (described below). The type of grain could be a clue: in the case of wetting issues, dots tend to aggregate into bigger dots, with empty spaces in between. A magnifying glass can be useful to examine the print in more detail.

Here are some tips for solving this problem:

- Increase the optimizer level.
- Increase the drying temperature.
- Increase the number of passes.
- Minimize the printer-to-belt distance.

- **Printhead alignment.** This is a clear contributor to grain. If printheads are not correctly aligned, the misplaced dots could correlate directly with the severity of the graininess.

  To check printhead alignment, print the printhead alignment diagnostics plot (see Printhead alignment diagnostics plot on page 108). As a general rule, the biggest contributors to grain caused by printhead alignment are (in this order):

  - Bidirectional alignment
  - Inter-color alignment (alignment between different colors)

  Here are some tips for solving this problem:

  - If the printhead alignment was done with a different substrate of different thickness, probably a new printhead alignment is needed.
  - Fine-tune the alignment by identifiying the offenders in the printhead alignment diagnostics plot. See Automatic alignment procedure on page 102.

- **Substrate advance.** Before trying to adjust any parameter, make the following checks:

  - Check that no substrate-advance factor was set earlier that could prevent the substrate-advance sensor from working correctly.
  - Run the diagnostics to check that that the substrate-advance sensor is not dirty.

  Grain in a print can be increased by incorrect substrate advance, due to mispositioning of the dots.

  To check the substrate advance, go to the Internal Print Server and tap **Printer** > **Advance Calibration**. See Substrate-advance test print on page 115.

  To correct the substrate advance, see Substrate-advance compensation on page 115. In most cases, this will solve the problem. However, you are recommended to run the OMAS Diagnostic Tests from the maintenance window as soon as the substrate is unloaded, to avoid having the same problem with other substrates. See Clean the substrate-advance sensor on page 167.

- **Substrate wrinkles.** If you see patches of high grain in some local areas of the print, this could be caused by wrinkles in the substrate. See There are wrinkles and ink smears on the substrate on page 218.
- **Color usage.** In general, 4-color printing produces more grain than 6-color printing.
- **Local graininess** can be caused by wrinkles in the substrate.
- **Not enough passes**. Increase the number of passes.

Physical deformation marks

You may occasionally see physical deformation of the substrate. This issue is not a mispositioning of the dots, but a physical deformation of the substrate that usually occurs after the dots have been printed. There are various kinds of deformation that may occur:

- Belt marks on the underside of the substrate, due to excessive heat.
- Deformation of flexible substrate, due to wrinkles induced by curing.

Both kinds of deformations can be the result of an excessive curing temperature. See There are physical marks on the substrate on page 216.

Poor curing

When the heat applied to the printed substrate is not enough for the quantity of ink laid down, the print may appear wet or with some gloss marks. The heat needed to cure is directly dependent to the combination of: ink density, time under the curing module (printmode), curing temperature, airflow, and drying power. These are the defects you may see:

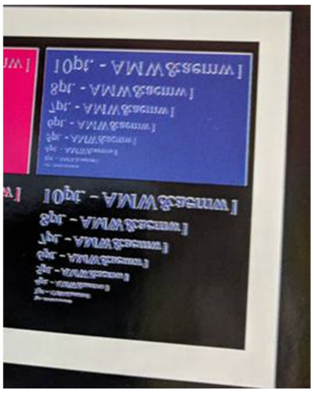
- **Perforated plate gloss marks:** The print suffers from an added matte pattern over the areas with more ink density. You can see small circles scattered over the picture with different levels of gloss.

- **Wet print:** The ink comes out of the curing module not perfectly dry, and in severe cases the ink can be smudged by touching it.

Here are some tips for solving both problems:

- Repeat the Add New Substrate procedure in case you had wrong settings in the substrate preset. Check curing-to-substrate distance, curing temperature, and airflow.
- Increase the curing temperature and/or airflow.
- Decrease the ink density.
- Reduce throughput.

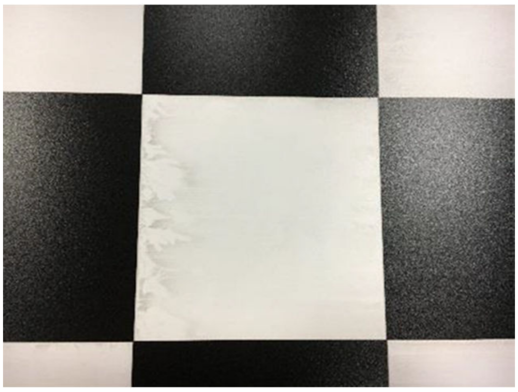
White-to-color misalignment



In some white-ink applications, the white ink may be seen at the edges of the image. If this happens:

1. Check printhead alignment, and realign if necessary.
2. Shrink the white plane in the RIP software.

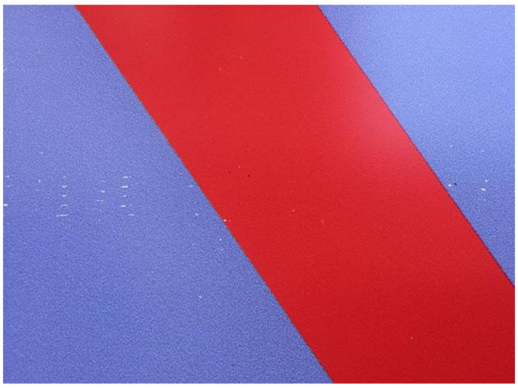
Static electricity



Some substrates have high electrostatic charges because of their liners, and they attract aerosol and dirt while printing. In this case, it helps to clean the substrate with isopropyl alcohol before printing.

NOTE: If you are in an area (such as California) that regulates VOC cleaning and maintenance fluids, instead of isopropyl alcohol use a VOC-certified cleaner such as a properly diluted Simple Green All-Purpose Cleaner.

Dual-side marks



You may see marks on some substrates when printing on the other side. This can be due to small curing margin. In this case:

1. Increase the amount of overcoat.
2. Increase the curing temperature.
3. Decrease the amount of ink.
4. Increase the number of passes.
5. Wait several hours before printing on the other side.