6

Image Quality

Image Quality Troubleshooting Checklist

When faced with an Image Quality problem, use the following checklist as a guide in troubleshooting the problem:

1 Problem reproduction

- Reproduce the problem that the customer is seeing using their original settings.

2 Printer configuration:

- Printhead Service check: Set frequency to “1 Page” (Maximum) (Select *Image Quality* / *Printhead Service* / *Check* from the front-panel).
- Print Mode: Set to “Best” (in the printer and in the drivers).
- Dry time: Set to “Automatic”.
- Select the correct media setting when loading the media.
- Close Loop Color Calibration: Set to “On” (Select *Image Quality* / *Color Calib.* from the front-panel).
- Printhead Alignment: Select *Image Quality* / *Printhead Service* / *Align Now* from the front-panel.

3 Hardware check list

Firmware Revision

- Check if the latest version of the firmware is installed. If not Install the latest firmware revision or download the latest version from the Plotter Support Web Page. Refer to page 1-3 for information on how to upgrade the firmware revision. Refer to Chapter 7 for the part number of the Flash SIMM.

4 Printheads

Printhead Troubleshooting Process:

- If you don’t have any samples yet, reproduce the original problem with the correct printer settings.
- Print the Image Quality Print using the exact settings and Media that the Customer used when faced with the Image Quality problem ➧ page 6-5.

Printhead Alignment and Check:

- Perform the Printhead Alignment (details ➧ page 5-12) using HP High-Gloss Film. If not available, use Coated media if required.
- Perform the Printhead Check calibration (details ➧ page 5-13).

5 Media

- Make sure that you use HP or HP-approved media.
- Select the correct media type through the front-panel when loading it.

6 Driver print quality configuration:

To clarify if the reason of the problem is related with the print mode defined with the Non-HP Driver try the following:

- Print the same sample using the Non-HP driver and their normal media.
- Print one of the internal demos or print the Image Quality Print (details ➧ page 6-5) using HP Media and configuring the plotter/printer as indicated previously.

If the output obtained using the HP Solution is good and the one obtained through the 3rd party solution is bad, HP support organization should:

- Communicate to the customer that the problem is not in the printer and that he should address it through the 3rd party vendor support structure.

7 Service Accuracy Calibration (details ➧ page 5-16)

- Perform “Service Accuracy calibration” using HP Matte Film. If not available, use Coated media if required.

Print Modes

The Printers have a large number of print modes. A print mode specifies how to interpret and put on media a set of bitmap planes, each of which consists of a sequence of rows. Each mode corresponds to a unique combination of the following parameters:

- Print resolution (300 dpi, 600 dpi).
- Number of passes per swath.
- Number of advances per swath.
- Number of swaths per advance.
- Print direction (bidirectional).
- Swath height (swath width).
- Carriage speed.
- Smart Area Fill (SAF).
- Print masks.
- Servicing states.
- Multiple dotting (K).

User input to print mode selection consists of the following:

- Choice of media type.
- Choice of print-quality setting (fast, normal, best).
- The language in which the file is received.
- The model of printer used.
- The type of driver (HP or Non-HP)

Image Quality Print

Introduction

Whenever a Print Quality problem appears, it is advisable to print the Image Quality Print to help diagnose the problem. The Image Quality Print will help you differentiate between possible printhead errors and other problems such as incorrect front-panel selection, driver or RIP configuration or mechanical problems.

To achieve the best performance from the printer, advise the customer to only use genuine HP accessories and supplies, whose reliability and performance have been thoroughly tested to give trouble-free performance and best-quality prints.

Using the Image Quality Print

1. The size of the Image Quality Print is A3 and B so you must use media (roll or sheet) that is this size or larger.

   Do not use 3M Changeable Opaque Imaging media or equivalent when printing the Image Quality Print.

2. Use the same type of media that the customer was using when the image quality problem was discovered.
3. Study each of the test patterns in the order listed to determine the type of image quality problem.
4. If the customer was reporting problems of Image Quality using non-HP media and after the Image Quality Print test the same quality problems appear, advise the customer to use genuine HP media. Repeat the Image Quality Print test using genuine HP Media (Do not use 3M Changeable Opaque Imaging media).

Producing the Image Quality Print

1. Select the Image Quality Print from the *Utilities* / *Service tests* menu, then press **Enter** to print the test**.**
2. The printer will print out a series of images named Test 1 thru to Test 5. The Image Quality Test print looks like this:

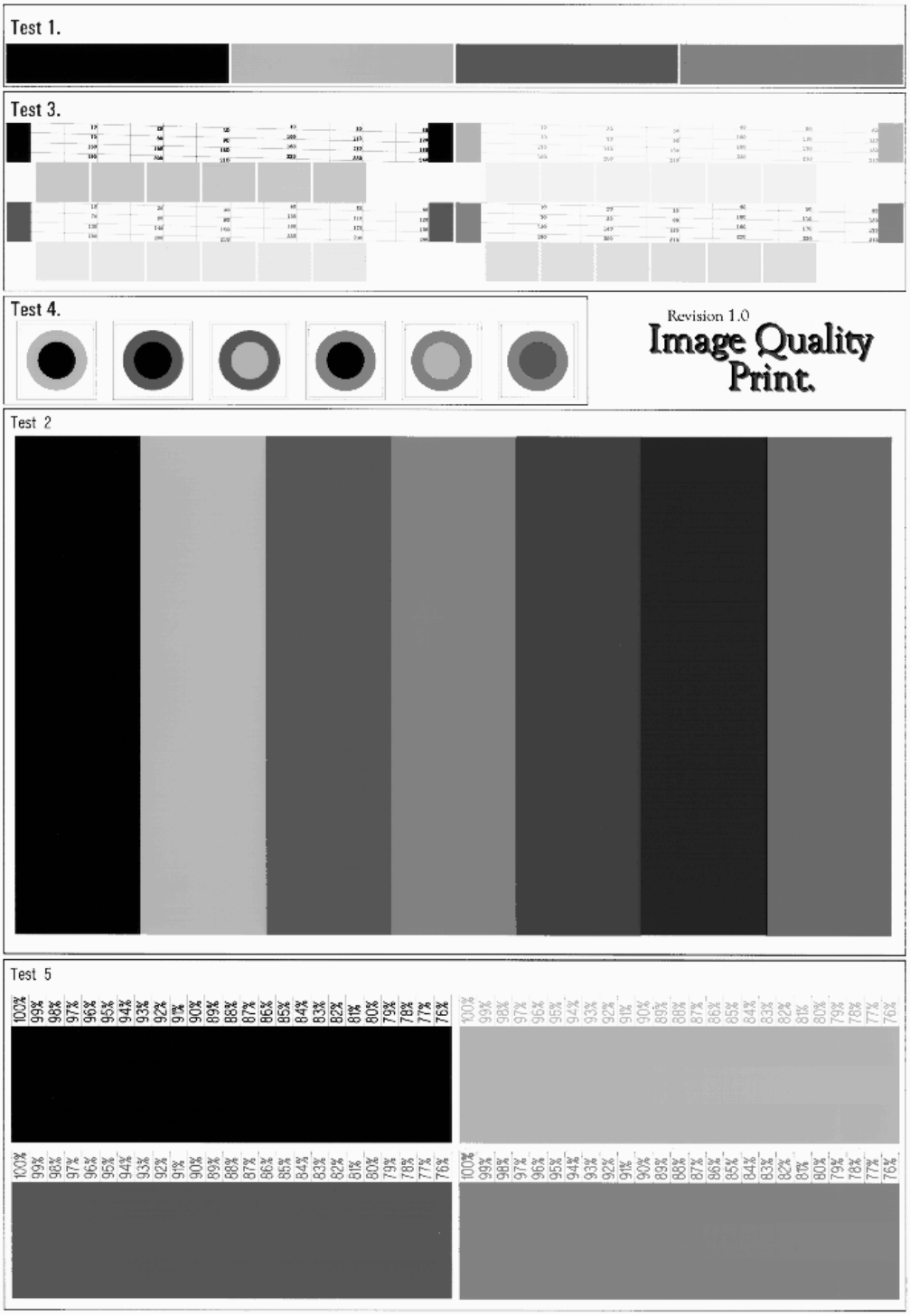


Image Quality Print

Analyzing the Image Quality Print

The Image Quality Print will contain five patterns as follows:

1. Print-head Warm Up (See below).
2. Image Quality Test (See Below).
3. Nozzle Print Test ➧ page 6-13.
4. Color Alignment Quality Test ➧ page 6-14.
5. Color Variation Test ➧ page 6-16.

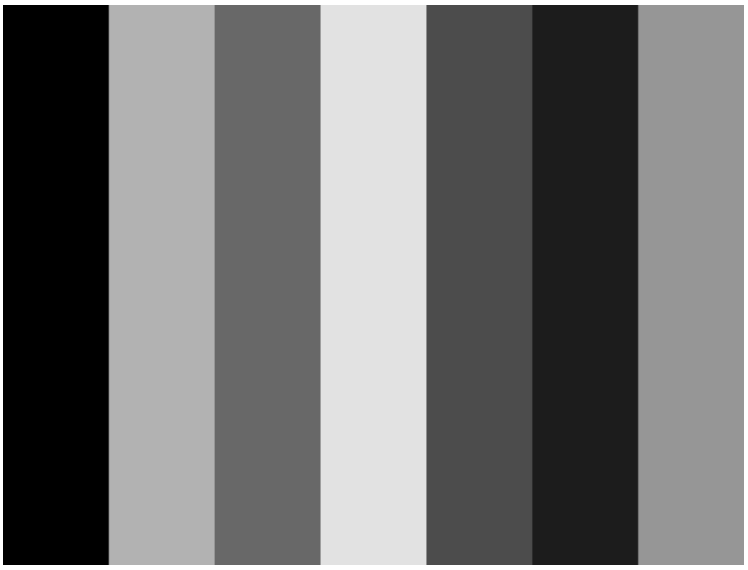
Test Pattern 1: *Printhead Warm-up*

This pattern warms-up the printheads, leaving them in a perfect operating condition. You can ignore this pattern and continue with Test Pattern 2.

Test Pattern 2: *Image Quality Test*

This test pattern checks for overall image print quality.

If you do not see any problems with the image quality test (similar to the example shown below), then the printer is functioning correctly. The problem may be with the RIP, driver, etc. that the customer is using. Refer to page 6-17 for further information.



If you see image problems in this test pattern then continue with the following procedures which will help you determine the nature of the problem.

One of the most common problems that affects the overall image quality is ‘Banding’.

Banding Problems

Banding is when you see repetitive horizontal bands within the printed image (these may appear as light or dark bands).

Test pattern 2 is printed with four primary colors; black, cyan, magenta and yellow. The three secondary colors printed are; red, blue and green which are composed by mixing the primary colors as shown in the table below:

Secondary Color	Primary Color Components
Red (R)	Magenta (M) and Yellow (Y)
Blue (B)	Magenta (M) and Cyan (C)
Green (G)	Cyan (C) and (Y)

The main causes of banding are due to:

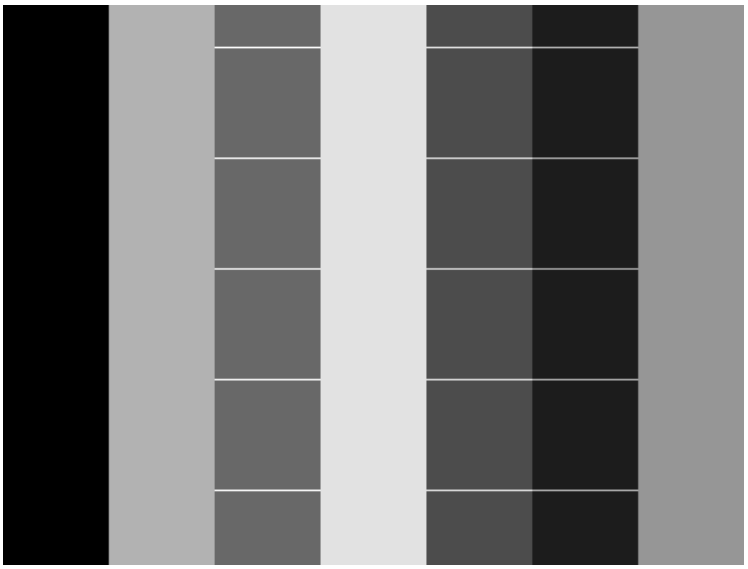
- Printheads.
- Media advance.

Banding Caused by Printhead Problems

If **test pattern 2** has clear or dark horizontal bands in one or more of the primary color columns, then several of the secondary color columns will also have the same type of bands in the same position (but perhaps with less intensity).

These bands are caused by two types of printhead nozzle failure; either nozzles not printing, or nozzles misdirected. For further information on printhead nozzle failures, refer to **Test Pattern 3** ➧ page 6-13.

In the following Example A, several nozzles in the magenta printhead are not printing. There will be clear repetitive bands (perhaps white) in the magenta column. Consequently, you will see lower intensity bands in the same print position in the red (M + Y) and blue (M + C) secondary color columns.



Example A

Banding Problem 1: Banding in cyan, blue and green columns only, but more evident in cyan than in blue and green columns.

Problem Description: This is an indication that the cyan printhead may require servicing or could be damaged.

Corrective Action: Refer to **Test Pattern 3** ➧ page 6-13 to troubleshoot the Cyan Color.

Banding Problem 2: Banding in magenta, red and blue columns only, but more evident in magenta than in red and blue columns.

Problem Description: This is an indication that the magenta printhead may require servicing or could be damaged.

Corrective Action: Refer to **Test Pattern 3** ➧ page 6-13 to troubleshoot the Magenta Color.

Banding Problem 3: Banding in yellow, red and green columns only, but more evident in yellow than in red and green columns.

Problem Description: This is an indication that the yellow printhead may require servicing or could be damaged.

Corrective Action: Refer to **Test Pattern 3** ➧ page 6-13 to troubleshoot the Yellow Color.

Banding Problem 4: Banding in black column only.

Problem Description: This is an indication that the black printhead may require servicing or could be damaged.

Corrective Action: Refer to **Test Pattern 3** ➧ page 6-13 to troubleshoot the Black Color.

Banding Caused by Media Advance Problems

Another type of banding is caused by an inaccurate media advance. The printer prints an image by 'bands' or 'swaths' which are fixed widths depending on the advance of the media roller. If the advance of the roller differs from the theoretical advance, there will be banding (horizontal repetitive bands along **Test Pattern 2**) in all the primary and secondary color columns.

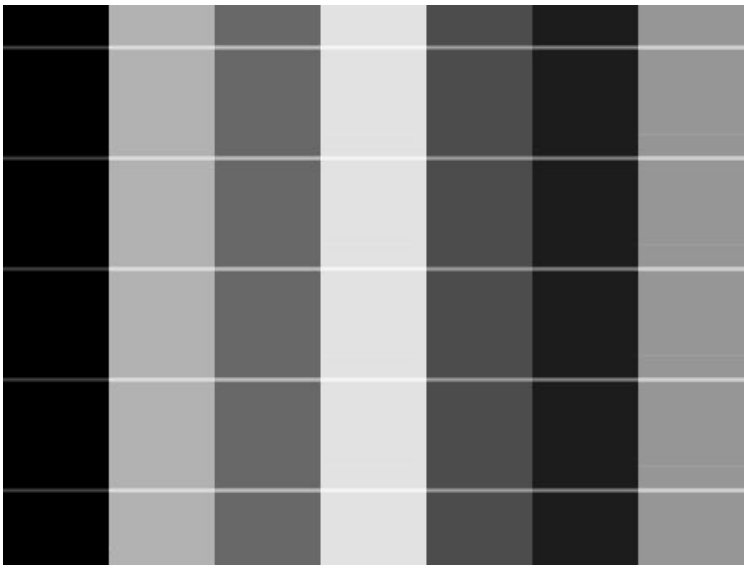
The bands can appear as dark bands, due to a shorter advance of the roller which causes an overlap, or lighter bands due to a longer advance causing spaces.

Banding Problem: Banding in all color columns (see Example B).

Problem Description: The causes are not related to misalignment but the troubleshooting actions are the same.

Corrective Action: Refer to **Test Pattern 4** ➧ page 6-14 to troubleshoot the problem.

It is also possible that the banding was caused because the customer was using non-HP media. The performance of the printer can only be guaranteed if genuine HP media is used.



Example B

Banding Caused by Misalignment

There are two types of misalignment; vertical and horizontal. Refer to **Test Pattern 4** ➧ page 6-14 for further information.

Misalignment between two primary colors when creating a secondary color can cause two different effects:

- If there is horizontal misalignment of the colors, it will create banding.
- If there is vertical misalignment of the colors, it will create gaps or overlaps between colors (see Example C).

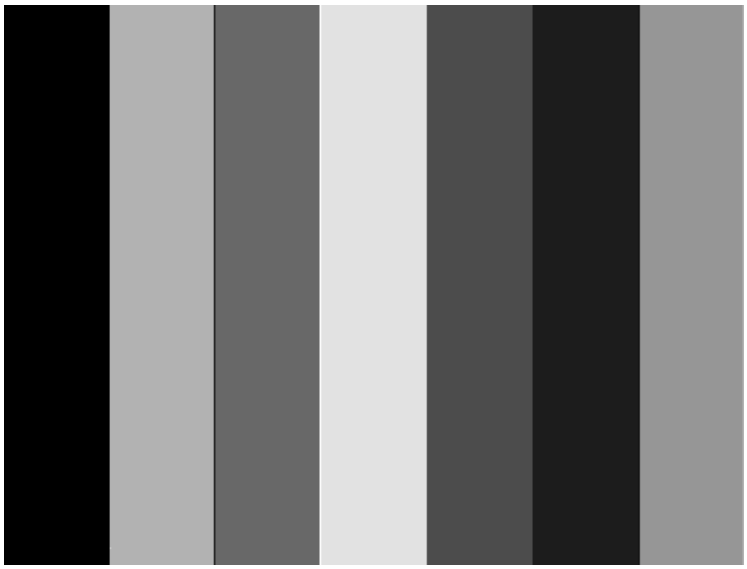
Banding Problem 5:	Black, cyan, magenta and yellow columns are correct but banding in one, or all of the secondary color columns.
Problem Description:	This is an indication that there is a horizontal misalignment.
Corrective Action:	Refer to Test Pattern 4 ➧ page 6-14 to troubleshoot the problem.

Banding Problem 6: Different colors visible in the spaces between some or all of the columns (depending on the color of the printhead that is misaligned) (see Example C).

Problem Description: This is an indication of vertical misalignment.

Corrective Action: Refer to **Test Pattern 4** ➧ page 6-14 to troubleshoot the problem.

It is also possible that the banding was caused because the customer was using non-HP media. The performance of the printer can only be guaranteed if genuine HP media is used.



Example C

Test Pattern 3: *Nozzle Print Test*

Use this test purely to confirm an error highlighted in Test Pattern 2. Some of the printhead nozzle problems that you will see in Test Pattern 3 do not mean you will not get perfect image quality results. The printer has internal corrections that will hide many nozzle defects.

In this test all the 240 nozzles of each printhead are tested. For each of the 4 colors you will see the numbers 10 thru to 240 over the diagonally stepped lines in increments of 10. These numbers correspond to the nozzle number that prints each step.

There are two printhead nozzle errors:

- Nozzles not printing.
- Nozzles misdirected.

Nozzles not printing

There are two ways to see this problem, it is easier to see the error from the first check.

1. In the top pattern, marked with numbers, if the diagonally stepped lines are broken in one or more steps it indicates that this specific nozzle(s) may be blocked and are not printing. White lines will also be visible in the area fill at both sides of the pattern.
2. Below the top pattern, there is a set of horizontal straight lines. When one or more nozzles are not printing the corresponding lines will be missing.

Nozzles misdirected

If all the stepped lines are visible in the top pattern, then all the printhead nozzles are printing. However the nozzles could still be misdirected, possibly due to some dried ink around the nozzles.

There are two ways to see this problem, it is easier to see the misalignment from the second check.

3. In the top pattern, marked with numbers, if the diagonally stepped lines are not equally positioned in every step it indicates that this specific nozzle(s) may be misdirected.
4. Below the numbered pattern, there is a set of horizontal straight lines. When one or more nozzles are misdirected there will be unequal spaces between the corresponding lines.

Nozzles Problem 1: Some printhead nozzles, in any one color, are not printing.

Nozzles Problem 2: Printhead nozzles are misdirected in any one color.

Corrective Action: Try the following steps:

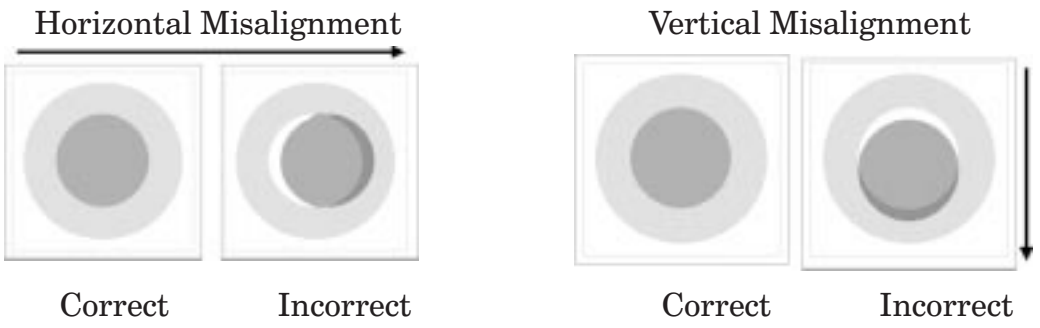
1. From the *Image Quality*/ *Printhead service* / *Printhead check* Menu, set to ***Now*** to run the printhead check.
2. From the *Utilities* / *Service tests* menu, select "Recover printheads" to run the printhead recovery process.
3. Print the Image Quality Print again to see if there has been any improvement.
4. If there has been no improvement, try reinstalling the Ink System Components and print the Image Quality Print again.
5. If the error is still present, replace the Ink System Components and print the Image Quality Print again.
6. If the error continues try the following:
   - Perform the Electronics Test ➧ page 4-6.
   - Replace the Trailing Cable ➧ page 8-36.
   - Replace the Carriage Assembly ➧ page 8-42.

Test Pattern 4: *Color Alignment Quality Test*

This test pattern is to check the color alignment, and produces 6 patterns each with 2 different primary colors. In each pattern you will see primary color circles. If there is misalignment between the primary colors the composite color will be present in one part of the circle and white will be visible at the opposite side of the circle.

There are two types of misalignment (see Example D):

- Horizontal – when the misalignment is in the horizontal axis.
- Vertical – when the misalignment is in the vertical axis.



Example D

Alignment Problem: Third color present/misalignment in either the boxes or circles of the test image (see Example D).

Corrective Action: Try the following steps:

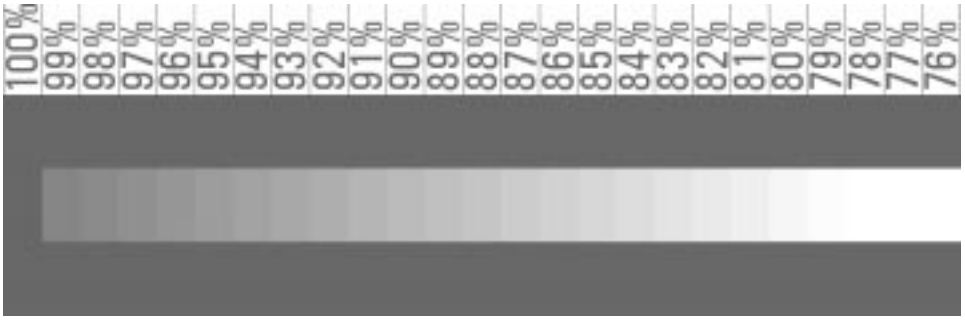
1. Perform the Printhead Alignment Calibration (Details ➧ page 5-12) using genuine HP media then print the Image Quality Print again to see if there has been any improvement.
2. If there has been no improvement, try reinstalling the Ink System Components and try **step 1** again.
3. If the Image Quality Print still has problems then replace the Line Sensor ➧ page NO TAG
4. If the problem continues perform the Service Accuracy Calibration (Details ➧ page 5-16) and print the Image Quality Print again to see if there has been any improvement.
5. If the error continues try the following:
   - Perform the Electronics Test ➧ page 4-6.
   - Replace the Trailing Cable ➧ page 8-36.
   - Replace the Carriage Assembly ➧ page 8-42.
   - Replace the X-axis Assembly ➧ page 8-66.

   Only replace one component at a time and check if the problem has gone before replacing another component. Using this procedure you will be able to determine exactly which component failed.

Test Pattern 5: *Color Variation Test*

This test produces four boxes; black, blue, cyan and yellow. In each box there are three horizontal bands, the two outer bands are 100% shade, the inner band is shaded from 100% scaling to 75%.

The purpose of this test is to determine at what percent the middle shading becomes visible from the two outer bands. The best way to do this is to cover the box with a piece of paper and slide the paper horizontally across the box. Stop as soon as you see a different shade in the middle box. You can then determine the percentage scaling from the figure at the top of the box.



Example E (Correct)

Example F (Incorrect)

Variation Problem: If the middle box shading is **only** visible below 90% it is an indication that the printhead is producing incorrect size ink drops (see Example F).

Corrective Action: Select *Color Calibration* to ***Now***.

No Printing Defects Found in the Image Quality Print

If all the test patterns from the Image Quality Print are correct and you still experience print quality problems, here are some of the more likely causes to check:

- The print mode used in your printer is incorrect (this is defined by the printer's front-panel menu selections).
- Non-HP driver.
- The RIP (If you are using one).
- The software applications you are using.

Refer to the ***User's Guide*** for further information on how to configure the system with correct settings.

Media

Always make sure that the customer is using the appropriate media for the required image and that it is consistent with the software application being used. To ensure color accuracy and print quality performance of the printer, only media types that have been certified for the printer should be used. Use of non-HP media or HP media not certified for the the printer may significantly reduce the color and print quality of the required images. For details of HP media, refer to the ***User's Guide*** or the ***Media Guide for the HP DesignJet CP Printers***.

To have accurate colors, the media settings must match the type of media loaded in the printer.

If the customer is using non-HP media with HP drivers, the colors in the required print may not be accurate. Advise the customer to use HP media if they want to improve the accuracy of the colors.

Print Quality Problems

PQ Problem: Dark Streaks at edges of page (Icicles)

Printheads Affected: Imaging Inks (Not UV resistant)

Problem Description: At one or both edges of print, thin dark lines appear, which are a few millimeters thick at the base, and may extend several centimeters into the print. They usually occur in heavy density prints. Sometimes ink smearing in the print margins is also seen.

Cause of Problem: Excess ink on the printhead surface during printing.

Corrective Action: Switch to a higher print quality mode. They tend to get less ink on the surface of the printhead. If you are printing on non-HP coated paper, if it cockles (gets wavy when printed on), this may be making the problem worse.

Only Applicable to HP DesignJet 3500CP

PQ Problem: Banding at mid-page refill

Printheads Affected: All

Corrective Action: Solution will be different depending on the type of problem:

1. Light band at refill - Band of 0.4 inches, all colors light, sharp edges ➧ cover was opened on printer while printing. This causes the remainder of a swath to not be printed, or to be printed incorrectly.
   - Solution - Don't touch printer while printing.
2. Wider band, single color missing, sharp bottom edge to defect ➧ printhead ran out of ink prior to refill.
   - Solution - Check Ink Cartridge and replace if empty. If still plenty of ink left, printer is not refilling correctly, which could be either a cartridge or a printer problem.

3 Band with sharp top edge, single or multiple colors missing ➧ printhead did not start printing correctly after refill.

- Solution - Slight color variation is normal, particularly on glossy medias. The defect should not normally be visible beyond 0.5-1.0 meter viewing distance. If a more severe defect occurs, this usually indicates that the printheads are dirty. Performing a printhead recovery may fix this problem. These types of problems may occur more frequently when printing at low humidity and temperature.

4 Missing single row of dots within 0.4″ of refill ➧ there is nozzle not functioning on the printhead. The printer cannot hide nozzles within 0.4” of a refill if you are using a type B refill.

5 Improving color variation seen at refill.

- Solution - If customer is printing on coated paper, check that they have indeed loaded it as Coated or Heavy Coated media. If not, they should load the paper as the correct type, or select Refill Type A in the front panel menus (***Device Setup*** / ***Refill Type*** / ***Type A***).

6 Improving haze seen at refill.

- Solution - Haze is the result of an ink-media interaction that is also dependent upon time, humidity, and temperature. Printing in very dry conditions will increase haze problems. Refill Type B will usually give better haze results than Type A (a thin line instead of 1 cm band of haze). On some medias, Refill Type C may reduce or eliminate haze problems. The Refill Type can be selected by the user through the front panel menus, ***Device Setup*** / ***Refill Type*** / ***Default*** is the normal setting, which chooses automatically between Refill Types A, B or C based upon Media type selection and Quality level selection. The User’s Guide contains a table with the default selections.

PQ Problem:	Color spots in print
Printheads Affected:	All
Problem Description:	Small (usually 1-3 mm) dots of color showing up in unexpected places on the print. Dots often show more strike-through on coated paper than normal printing.
Cause of Problem:	Fiber on printhead directly over some nozzles is catching ink drops, then dripping onto print.
Corrective Action:	Usually the problem goes away when the printheads are wiped at the end of the print. If it persists, a printhead check or printhead recovery will give it another try. If a user is having a lot of problems with drips, it may be related to paper dust from their media, or to a dusty environment they are printing in.

PQ Problem:	Ghost image at top of page, first plot after pause
Printheads Affected:	Imaging Inks
Problem Description:	Light spots in imaged media matching up to mechanical features inside the printer (bail, pinch-arm assemblies).
Cause of Problem:	Equilibration rate differences between media and environment in areas that are “protected” by parts of the printer.
Corrective Action:	Advance a little bit of media before the first print of the day. “Move Media” option in the front panel is an easy way to do this.

PQ Problem: Missing/ Light Blocks of color in a print

Printheads Affected: All

Problem Description: Small well defined areas of light color, 0.4 inches tall, with a 4mm half−colored region on either side.

Corrective Action: Solution will be different depending on the type of problem:

1. Cover opened, or cover sensor not making good contact. If the user is present, usually a “Close Window to Continue” message will show on the front-panel if this is happening, or the printer’s carriage will be slowing down in the middle of a printing pass.
   - Solution - Check that covers are all shut. Wiggle covers with printer idle to see if this triggers any front panel messages. If so, the cover sensors need adjustment.
2. Intermittent opens/shorts in printhead. Printhead is shorting, probably due to ink in the electrical contacts. As the liquid short heats up, it may dry out and the printhead will start functioning properly again.
   - Solution - Check printer carriage and printhead electrical contacts for dried ink. Clean if dirty. If printhead still fails with clean contacts, replace IDS.
3. Broken trace in carriage trailing cable.
   - Solution - Replace the Trailing Cable or the Carriage Assembly.

PQ Problem: Bleed into white areas on Glossy media (Chia)

Printheads Affected: Imaging Inks (maybe UV Inks on non-recommended medias)

Problem Description: 1-3 millimeter ring or edge of light coloring where white should be. Occurs worst on thin lines, and after white regions of a print.

Cause of Problem: Thin-layer chromatography effect occurring between inked and uninked areas of the media.

Corrective Action: Try the following:

1. Printing in a faster printmode will reduce or eliminate this effect.
2. Add a 0.5cm stripe of the color showing the problem down the sides of the print, where it can be cut off after the print is finished.
3. If using non-HP media, try using HP media instead. If using HP High-Gloss White Film (not recommended for CP series!), try HP High Gloss Photo or 3M Vinyl instead.
4. Reduce ink density in the affected area of the print. This may prevent the problem as well.

PQ Problem: Bleeding in stacked prints

Printheads Affected: Imaging Inks

Cause of Problem: Prints develop bleed when stacked up soon after printing.

PQ Problem: Light band with frequency of 1/2 media roll circumference

Cause of Problem: Media stop or core insert rubbing against roll cover, causing media tension change.

PQ Problem:	Printer Not Detecting Out Of Ink Properly
Printheads Affected:	All
Problem Description:	1 - Printer fails to stop printing when Printheads out of ink, wasting media, possibly for several plots. 2 - Printer reports out of ink as Printhead Failure message.
Cause of Problem:	Out of Ink is determined when the following conditions are true: **1** Ink Level indicator shows low AND **2** Six or more nozzles are missing in a Printhead Check OR **3** The temperature of the printhead rises to 15 degrees above its normal operating temperature. If the ink level indicator is not showing low, (2) or (3) will result in a Printhead Failure message.
Corrective Action:	The Printhead Check usually does a more reliable job of checking for Out of Ink conditions. Setting the printhead check to more frequent use will reduce the amount of wasted media and ink. This is especially recommended if the printer is being used unattended. The printhead check does take about a minute and a half to perform, and uses a thin strip of media.

NOTES