Kodak

Thermal Imaging Heads

Adjusting Tilt on a Thermal Head

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Revision History

Revision	Date	Author	Comments
DRAFT	10 Sep 2004	Maureen Munroe	Initial draft
719-00424A-EN	15 Dec 2004	MMunroe	Initial release
	12 Jan 2005	Ken DeCarle	Added link info for tilt analysis scripts
Rev A-EN-B	19 Jan 2005	KDeCarle	Changes to shim procedure as per Alvaro and to section 5.1 as per Jeff Edgar
	21 Jan 2005	KDeCarle	Edit shim procedure as per Alvaro. Incorporate all changes as per Ian Williams.
	25 Jan 2005	KDeCarle	Revised presentation of shim dimensions.
	09 Feb 2005	KDeCarle	Changes to procedure in section 5.2. Applied final edits from Jeff Edgar.
A-C	Jun 2006	Maureen Munroe	Updated to include the TH3 head
A-D	04 Oct 2007	M Munroe	Added specification for lenticular printing.
A-E	Nov 2007	M Munroe/Kyle Good	Updated TH3 hex key from 3.0 mm to 2.5 mm. Updated TH1 and TH2 procedure to be manual – no script required.
A-E	21 Jan 2008	D Tatarin/J Edgar	Continuation from Nov/07: Updated TH1 – tilt adjustment.

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1. RELATED DOCUMENTS

The following documents are available from the Troubleshooting page of the Thermal 1, Thermal 2 and Thermal 3 sites on TechPlanet:

- *Troubleshooting Staccato On-Plate*
- *How to check tilt on a thermal head*

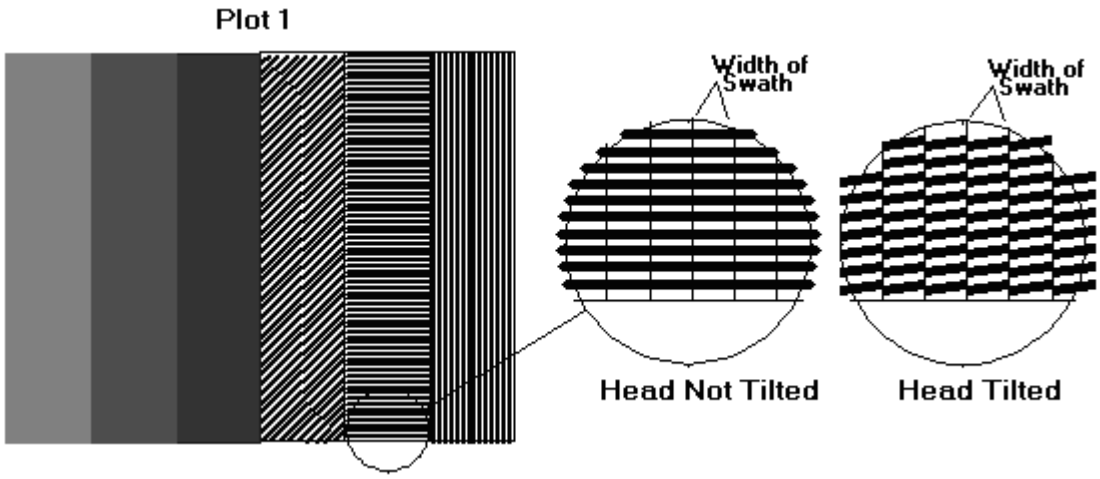
2. WHAT IS TILT?

Tilt refers to the angle of the pixels in a given swath. When the pixels in adjacent swaths do not line up (as shown in the right-hand image in Figure 1), the tilt setting is incorrect and needs to be adjusted.

Tilt is verified during head integration, but it can show up after installation. It occurs most commonly during head installation or when you encounter banding on-plate.

Note: Checking tilt is part of the procedure for troubleshooting banding when using Kodak Staccato® screening.

Figure 1: Tilt example



3. WHEN TO USE THIS PROCEDURE

Use this procedure when:

- Using a microscope or tilt tool, you observe a tilt problem that is larger than 1/3 of a pixel (3 microns, or 1/10 of a bar) in the horizontal lines of a plot (see Figure 1)
- You're troubleshooting banding that is related to Staccato screening

4. REQUIREMENTS

4.1 Thermal 1.7 Requirements

- Tilt viewing tool for 2400 dpi and 1200dpi (part number 690-00225A)
- 3.0-mm hex key

4.2 Thermal 2 Requirements

- Test pattern with plot #7 (3 pixel horizontal line)
- 2.5-mm hex key
- Tilt viewing tool for 2400 dpi and 1200 dpi (part number 690-00225A)
- Tilt viewing tool for 2540 dpi and 1270 dpi (part number 690-00226A)
- Shim kit with a modified 5th point (part number 512-00116A)
- Shim kit (part number 518-00646A)

4.3 Thermal 3 Requirements

- 2.5-mm hex key
- Tilt viewing tool for 2400 dpi (part number 690-00225A)
- Test Plot Applet with plot #7 (3-pixel horizontal line)

4.4 Lenticular Printing Requirements

- The fine tilt adjustment for lenticular printing is *1.5 microns* (1/6 of a pixel) or less.

Note: Add the tilt viewing tool to your toolbox for future use.

5. PROCEDURE

Note: Before you attempt to troubleshoot tilt, make sure you have tried other banding troubleshooting procedures as listed in *Troubleshooting Staccato On-Plate*.

This procedure consists of two parts:

- Determine if there is a tilt problem by running a tilt analysis plot and using the lenticular tilt viewing tools.
- If a tilt problem is identified, correct the problem by adjusting the head-tilt screw (Thermal 1 and Thermal 3) or the 5th point (Thermal 2).

5.1 Determine if there is a Tilt Problem

1. Load a plate on the device.

   On a Magnus VLF, load the plate on the centre pins.

2. Temporarily disable geometric correction (GC) rotation.

Note: GC rotation can look like head tilt and cause confusion in the test results.

- On MPE devices: Note the current setting and set the GC plate rotation for the registration pins being used to 0.
- On MCE devices: Type

```
NEWS_SA>> plot gc rotation disable
*** Command Complete
```

- On GMCE devices: Disable rotation in the TPA setup.

3. Run a plot 7 (3-pixel horizontal line). Type: `>>plot 7`
4. Select the appropriate tilt viewing tool for the device you're working on (either 2540 dpi or 1200/2400 dpi) or use a high power loupe.
5. Place the tilt tool, with the ridges up, over the imaged area on the plate and align it so you can see near-horizontal lines.



Figure 2: Placing the tilt tool over the plot 7 strip.

We recommend that you use the tilt tool as it highlights tilt issues more effectively than a loupe.

Note: In most applications, accuracy greater than 1/3 of a pixel is not required; however, the fine tilt adjustment for lenticular printing *must not be greater than 1.5 microns* (1/6 of a pixel).

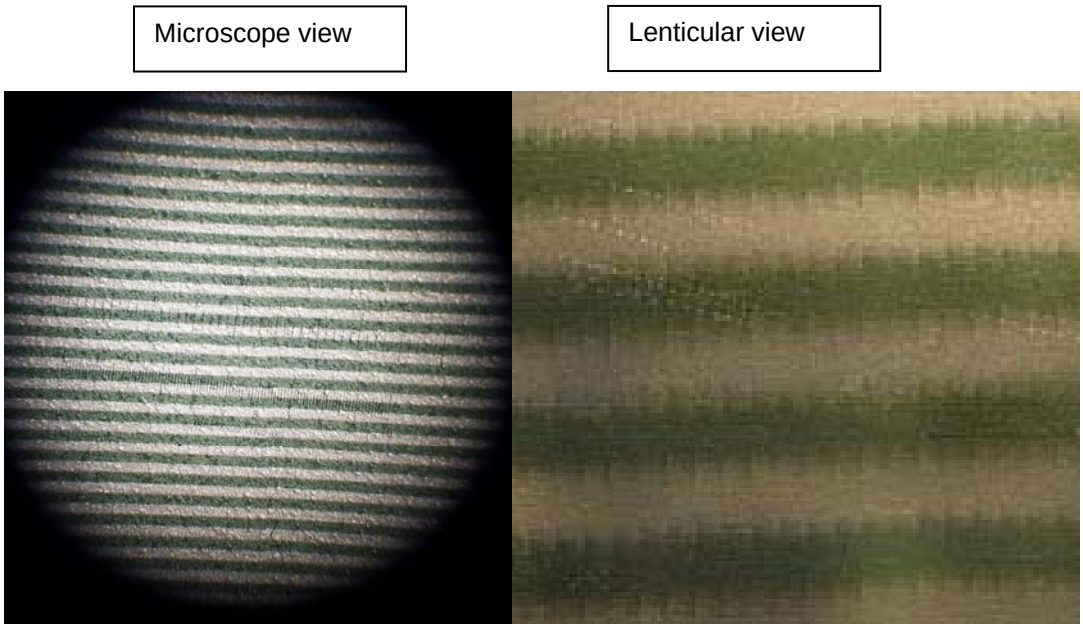


Figure 3: An example of -0.3 pixel tilt

6. Determine if there is positive, negative, or zero tilt.

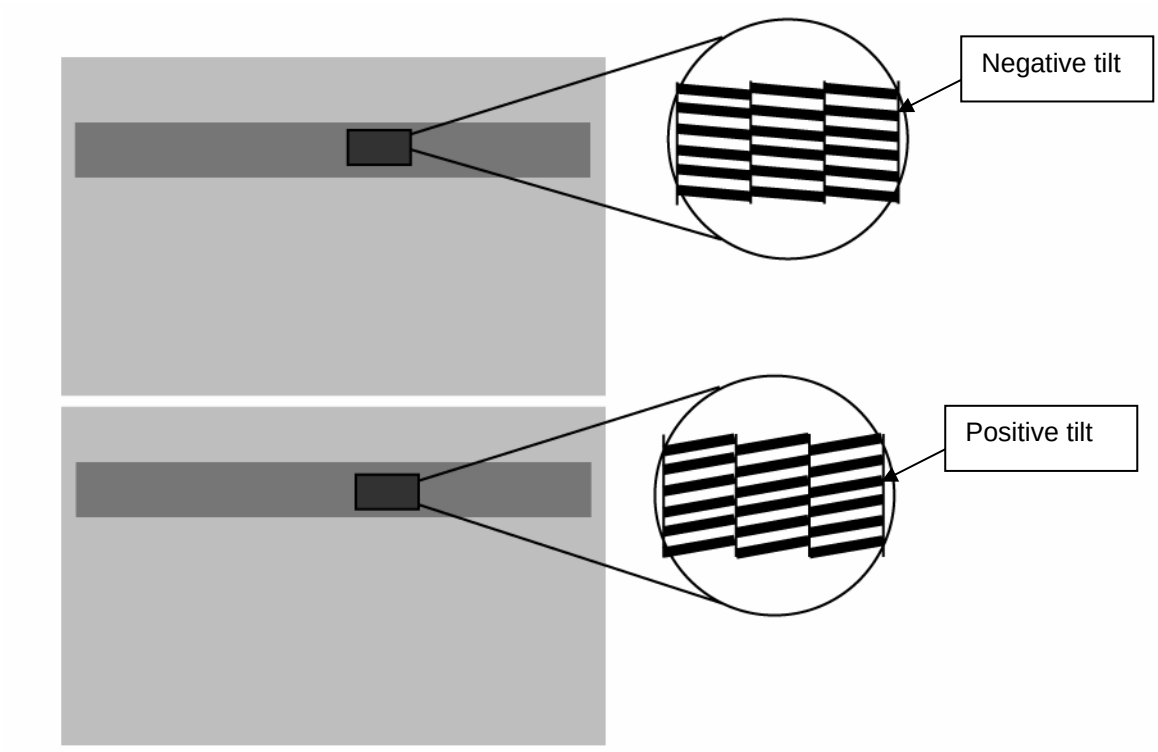
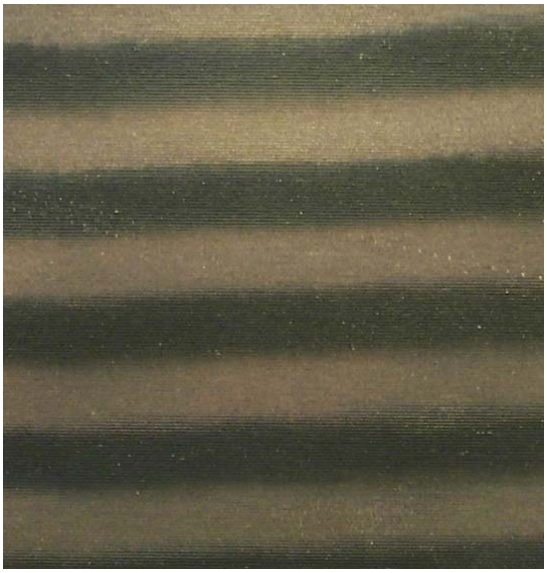


Figure 4: Using the lenticular to identify positive or negative tilt

7. Determine the amount of tilt.

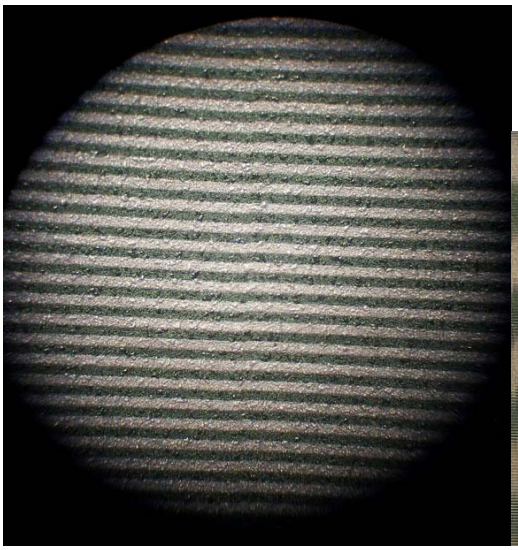
The following examples show tilt at 0, -0.5, and +1.0 pixels. Use these examples to help in your calculations. You will need these calculations for the next section.



Ideal tilt

Figure 5: An example of zero pixel tilt

Microscope view



Lenticular view

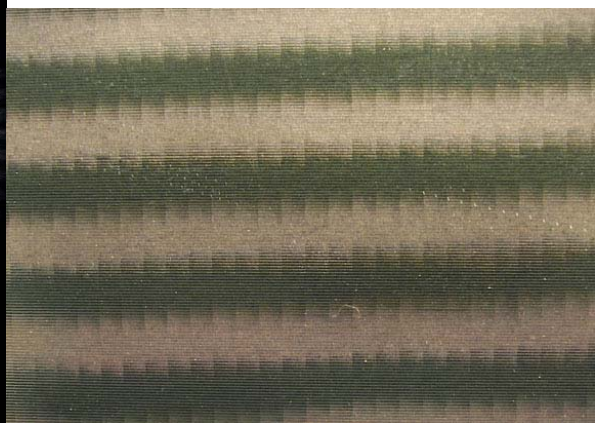


Figure 6: An example of -0.5 pixel tilt

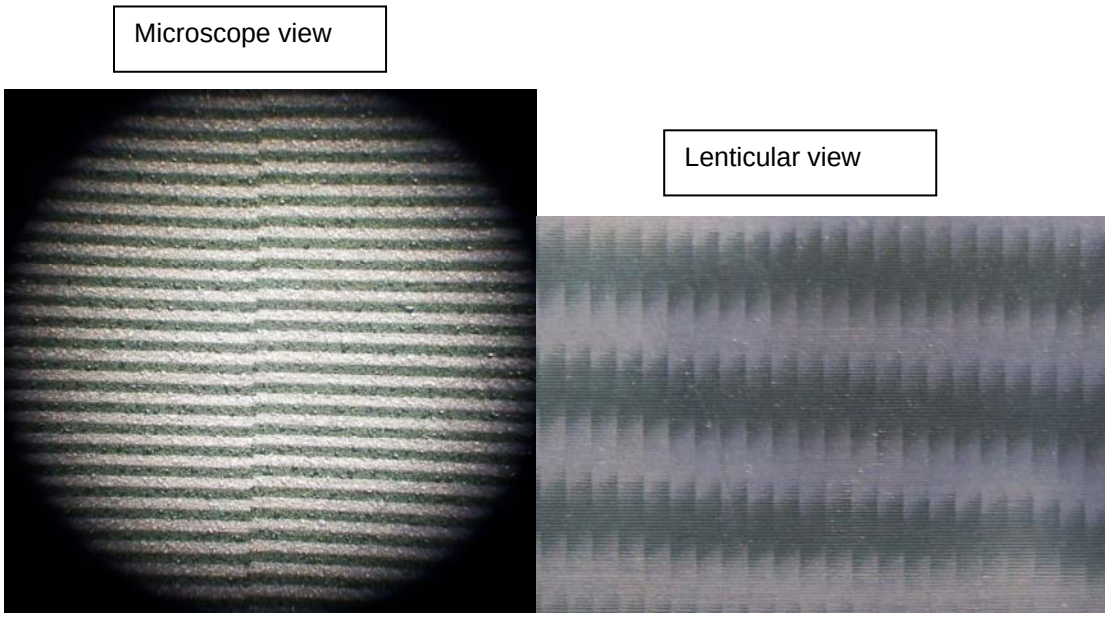


Figure 7: An example of +1.0 pixel tilt

5.2 Adjust the Head to Correct Tilt: Thermal 1.7

1. Unfasten carriage mount latch #3 (away side) to access the head positioning screw.
2. Using a 3-mm hex key, loosen the setscrew.

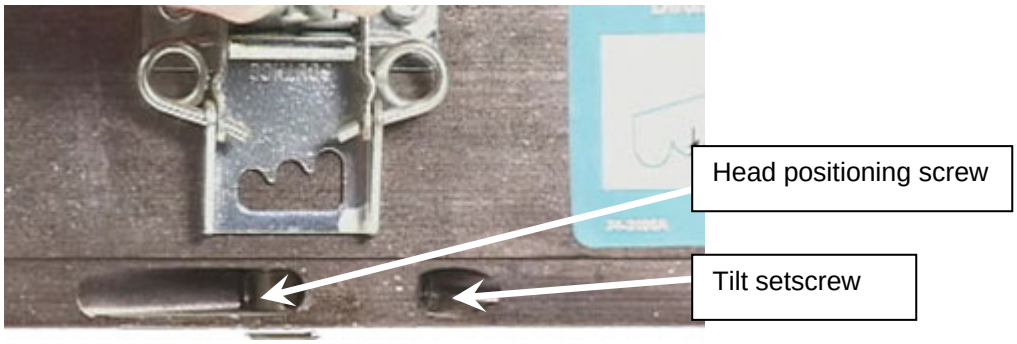


Figure 8: Thermal 1.X tilt adjustment screws

3. Determine how much tilt correction is required using the pixel tilt examples in section 5.1.
4. Calculate the number of clicks needed to correct the tilt.

   For a 224 pixel head: 1 pixel = 6 clicks (multiplier)

   For a 192 pixel head: 1 pixel = 5 clicks (multiplier)

   Apply the following calculation to determine your tilt correction:
   Tilt Adjustment = Pixels of Tilt x Multiplier

   For example, if you have 1.5 pixels of tilt for a 224 pixel head, multiply 1.5 by 6 (the multiplier). Your tilt adjustment is 9 clicks.
   For a 192 pixel head, multiply the 1.5 pixels of tilt by 5 (the multiplier). Your tilt adjustment is 7.5. Round the number up to 8.

Note: Round to the nearest whole number; the adjustment is in number of clicks.

5. Turn the positioning screw to correct the tilt: insert a hex key into one of the exposed holes in the head positioning screw and lever it in the required direction one full click position at a time until the correct adjustment is achieved (see Figure 9).

- For negative tilt, turn the positioning screw counter-clockwise
- For positive tilt, turn the positioning screw clockwise

Note: Make sure that you hear a full click for each adjustment.

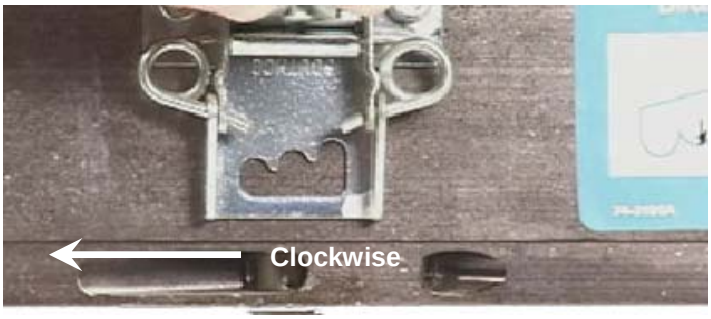


Figure 9: Adjusting the head positioning screw

6. Tighten the tilt setscrew and fasten carriage mount latch #3.
7. Load a plate on the drum and check that the head is properly zeroed using the command `>>head install on`. Make the necessary adjustments if the error is greater than ±25.
8. Re-run a plot 7 and check that the tilt is now within 1/3 of a pixel (less than 1/9 of the 3-pixel line). If not, return to step 1.
9. Run the appropriate power, slope, and curve scripts to verify image quality. For full details, see the head installation procedure.

5.3 Adjust the Head to Correct Tilt: Thermal 2

1. Remove the head from the device and place it on a safe work surface.

Note: To adjust the 5th point and the shims, you *must* remove the head from the carriage.

2. Using a 2.5-mm hex key, remove the 5th point from the head.

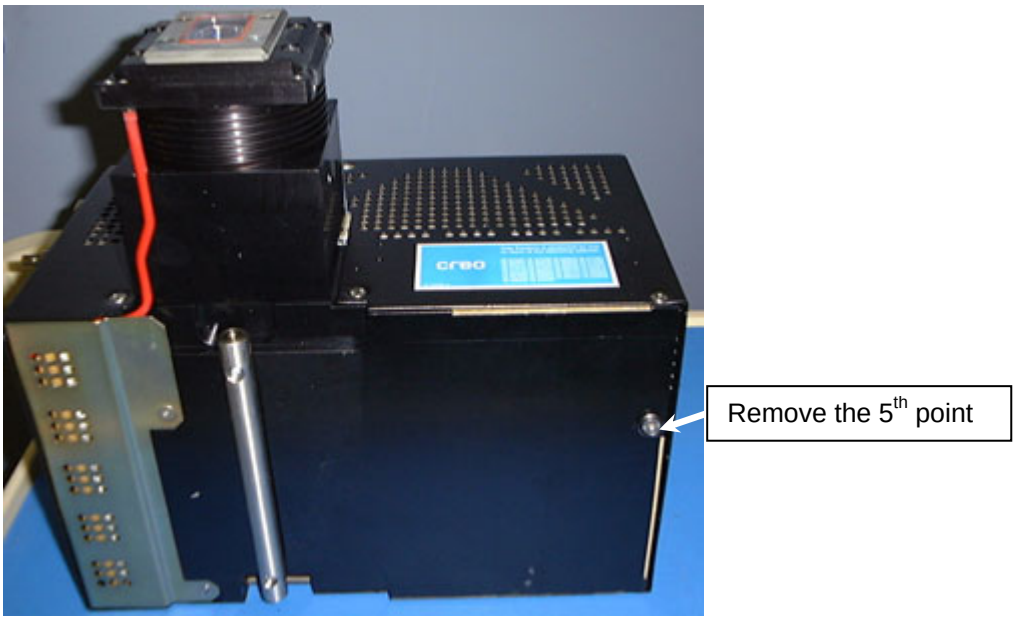
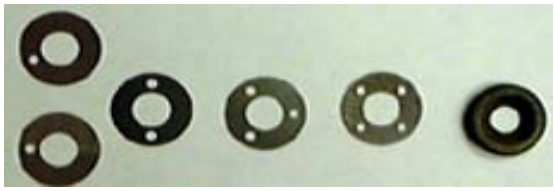
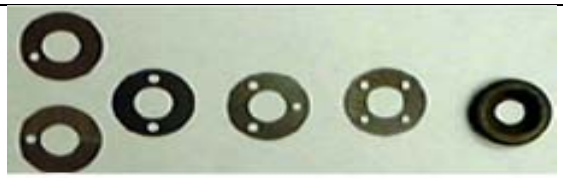
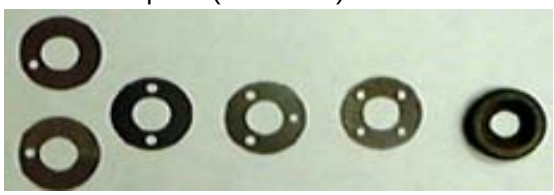
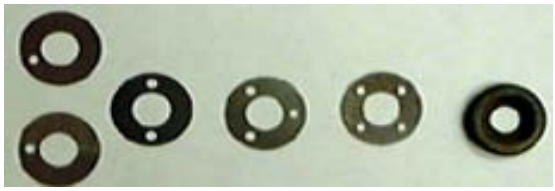


Figure 10: Location of the 5th point

Note: For Thermal 2, only tilt problems larger than 1/3 of a pixel (3 microns) require correction *unless you are using lenticular printing*. The fine tilt adjustment for lenticular printing *must not be greater than 1.5 microns* (1/6 of a pixel). In general, minimize the head tilt to as little as possible as this increases the imaging latitude.

3. Determine the 5th point and shim combination that was installed on the head, and make the changes for adjusting tilt:

	Type of 5th point	**Configuration required to adjust tilt**
A	Old 	Install the shim kit and modified 5th point (PN 512-00116A). 
B	Old with extra shims 	 +  Install the shim kit and modified 5th point (PN 512-00116A) and reinstall any extra shims from the old 5th point.
C	Modified 5th point (new head) 	Reinstall the modified 5th point and shim kit from the new head. Add or remove shims, as required (use shim kit 518-00646A). 
D	Modified 5th point with alternative shims (new head) 	Reinstall the modified 5th point and shim kit from the new head. Add or remove shims, as required (use shim kit PN 518-00646A). 

You are now working with one of three possible configurations:

- new 5th point plus extra old shims (configuration B in the preceding table)
- new 5th point (configuration C in the preceding table)
- new 5th point with alternative shims (configuration D in the preceding table)

4. Determine how much adjustment is required:
   - 720 microns of shims changes the head tilt by 1 full pixel. For example, if the test plots shows a positive tilt of 1/6th of the plot 7 bar, this is equivalent to ½ of a pixel. This requires the addition of 360 microns of shims.
   - For details, see section 5.1, *Determine if there is a Tilt Problem*.
5. Add or remove shims to correct the tilt problem.
   - Positive tilt: add shims
   - Negative tilt: remove shims

   Shims are identified by the number of holes, and have the following dimensions:
   - Shims with one hole: 0.002 inches (50 microns)
   - Shims with two holes: 0.003 inches (76 microns)
   - Shims with three holes: 0.006 inches (150 microns)
   - Shims with four holes : 0.012 inches (300 microns)
6. Re-install the head. Type the command `>>head install on`.
7. Re-run the test plots to confirm the new shim settings.
8. Run the appropriate power, slope, and curve scripts to verify image quality. For full details, see the head installation procedure.

   Note: For more detail on the shim kits, see *Appendix A: About the Thermal 2 Shim Kits*.

5.4 Adjust the Head to Correct Tilt: Thermal 3

1. Once you have determined whether there is positive or negative tilt, determine how much adjustment is required. For example, if the tilt is out by 0.5 pixels, you need to adjust the tilt screw half of a turn. Use a microscope, if available, to determine the amount of adjustment required.
2. Using the 2.5-mm hex key, loosen all the screws on the flexures on both sides of the head (3 screws on each side).
3. Using a hex key, adjust the tilt screw (one complete revolution equals 1 pixel or 10 microns change on plate).

Note: 1/6 of the plot 7 bar is equivalent to ½ of a turn.

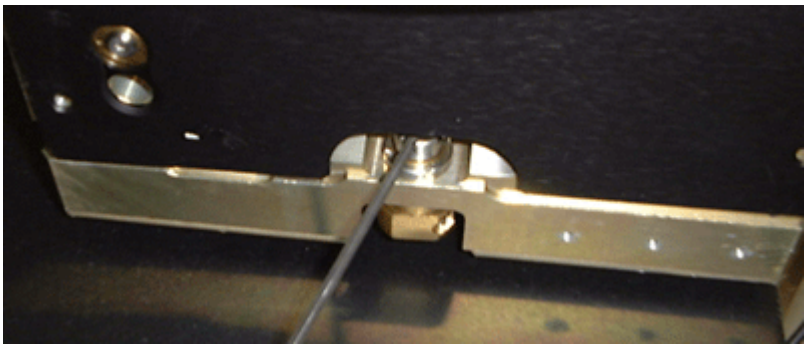


Figure 11: TH3: Adjusting the tilt screw

- Positive tilt: turn the tilt screw counterclockwise
- Negative tilt: Turn the tilt screw clockwise

4. Tighten the flexures.
5. Type the command `>>head install on`.
6. Re-run plot 7 and analyze using the tilt tool. Use the lenticular to make sure that the tilt problem has been eliminated (see Figure 4: Using the lenticular to identify positive or negative tilt), and that the error value is within +/– 10 microns.
7. Run the appropriate power, slope, and curve scripts to verify image quality. For full details, see the head installation procedure.

APPENDIX A: ABOUT THE THERMAL 2 SHIM KITS

- The original (old) 5th point does not allow for negative tilt adjustment.
- The new, modified 5th point allows for both positive tilt adjustment (by adding shims) and negative tilt adjustment (by removing shims).
- The shims have different thicknesses. Each shim has a number of holes to indicate the thickness:
  - Shims with one hole: 0.002 inches (50 microns)
  - Shims with two holes: 0.003 inches (76 microns)
  - Shims with three holes: 0.006 inches (150 microns)
  - Shims with four holes : 0.012 inches (300 microns)