DETECTING FRIXION ERASABLE INK

by:

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PART 1: THE EXPERIMENT

When the first erasable pens were introduced, the ink was pale and blotchy. The eraser provided on the pens did not effectively erase the ink. The friction from the eraser often damaged the paper. The quality of the colour of ink in present day pens has improved greatly as well as the eraser.

These pens have special thermo-sensitive ink and are available in bold bright colours. The erasers will remove the ink without a trace, unlike pencil, where the rubbing process leaves a messy residue.

The obvious questions for document examiners attempting to detect the erased writing are:

1. Can the erased writing be recovered?
2. If yes, how can this be accomplished and what methods are available?

In order to do this it is necessary to identify the types of erasable pens available.

Generally, there are three main types of erasable ink pens:

1. **Thermo-sensitive Erasable Ink Pen**: (e.g. the Pilot Frixion pen; the Uni-ball Fanthom gel ink pen). The ink disappears when exposed to heat.

2. **Erasable Ink Pens and Ink Erasing Marker**: (e.g. Stabilo Point 88, Colorkilla Erasable Fineliner Marker Pen.) This pen comes in a set with a special "eraser." The ink is erased when

the special erasing ink is applied. However, the erased area can be quite easily detected.

3. **Traditional Erasable Ink Pens**: e.g Uni-ball Signo gel ink pens. These ink pens can be erased with a rubber ink eraser.

In this experiment, we focused on the Thermo-sensitive Erasable Ink pen namely the Pilot Frixion Erasable Gel pen.

1. Methodology:

1.1 A 80 gsm Simili paper with 3 rows of writing in Blue, Red and Green ink was used in this experiment.

1.2 Each sample was written with different pen pressure; light, medium and heavy.

1.3 The word 'pressure' was erased with ease by using the rubber stub that served as an eraser at one end of the pen.

1.4 After erasing, the document was placed in the freezer.

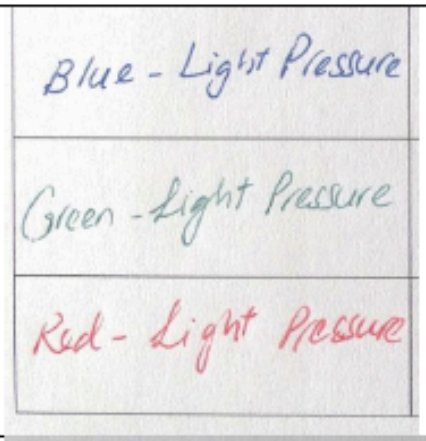
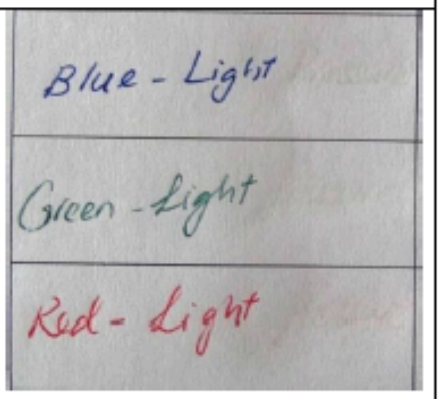
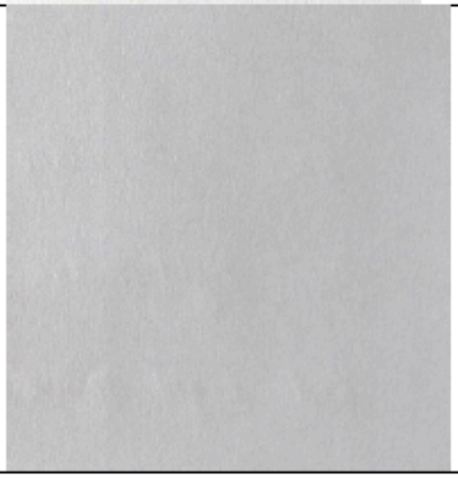
1.5 The document was examined and the images were inspected in each process, using 4X magnification under oblique lighting.

Another method of removing and or erasing the writing was with the use of a product "Freeze Spray" manufactured by Perfects.

2. Visual examination for indentation and residue:

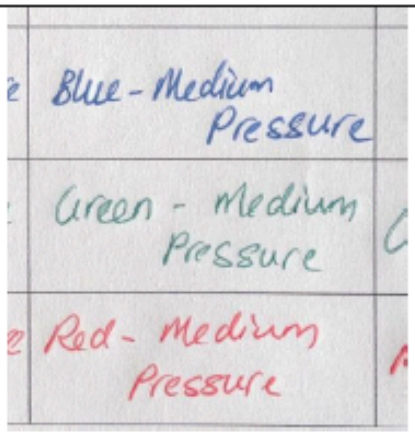
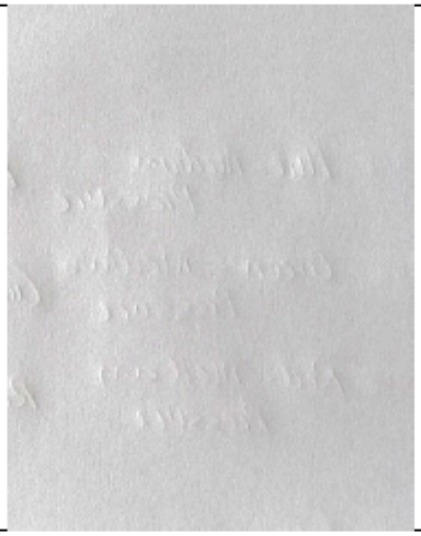
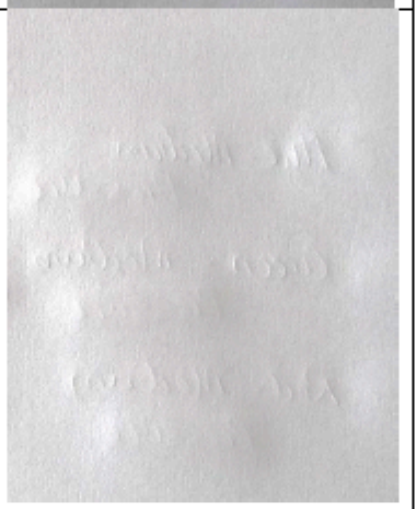
The images below are the record of our observations on the word "Pressure" before and after erasure.

2.1 Light Pressure

	Before	After erasing "Pressure"
LIGHT PRESSURE (Front)		
(Reversed side of page)		

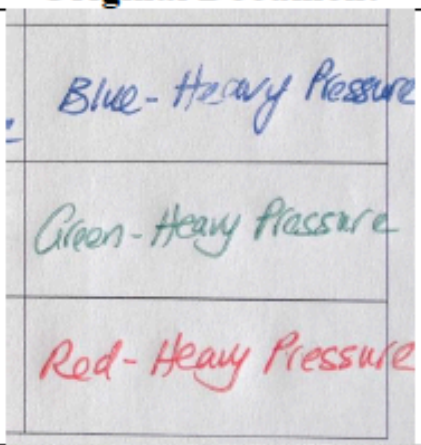
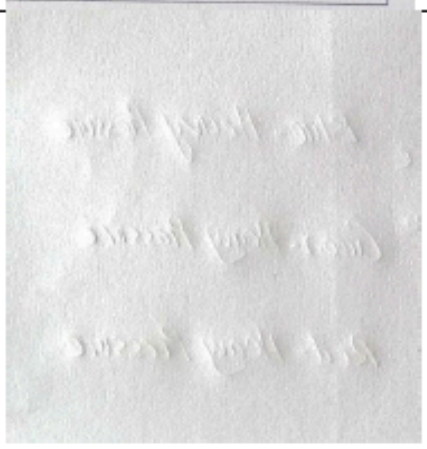
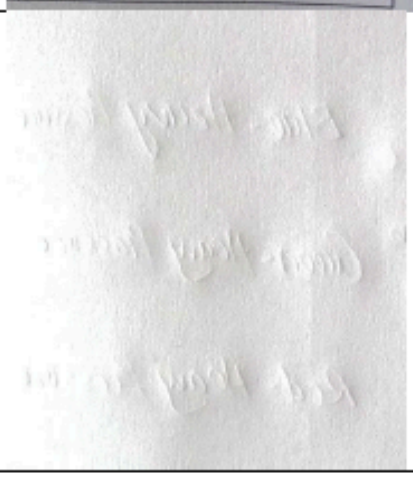
2.1.1 Observation: Where the writing pressure is 'light', ink traces and impressions are less visible on the reversed side of the paper.

2.2 Medium Pressure

	Before	After erasing "Pressure"
MEDIUM PRESSURE (Front)		
(Reversed side of page)		

2.2.1 Observation : Where the writing pressure is 'medium', ink traces and impression are more visible on the reversed side of the paper. The impressions are more pronounced in areas that had been erased.

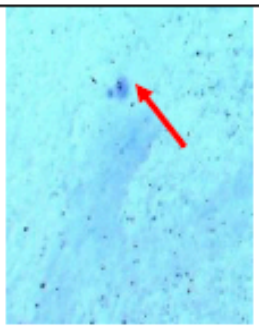
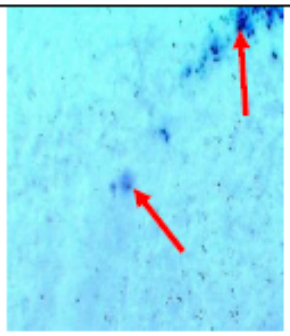
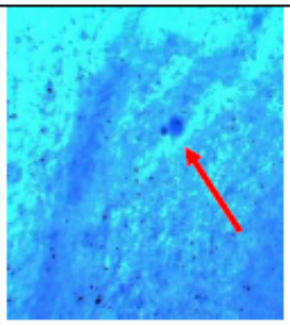
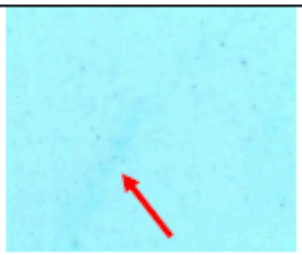
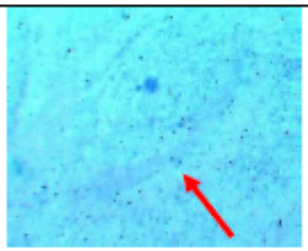
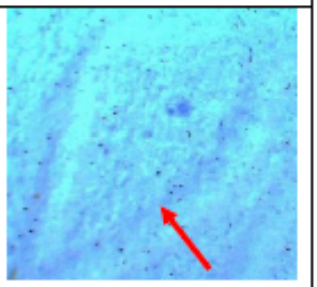
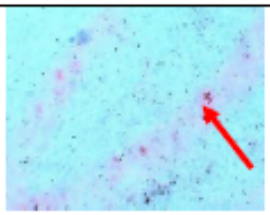
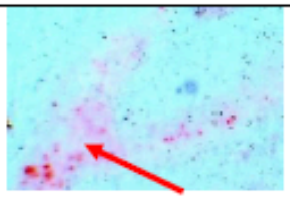
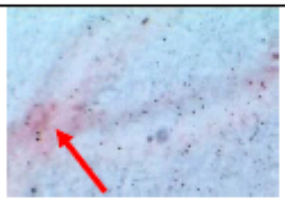
2.3 Heavy Pressure

	Original Document	Word "Pressure" erased
HEAVY PRESSURE (Front)		
(Reverses side of page)		

2.3.1 Observation: Where the writing pressure is 'heavy', ink traces and impressions are clearly visible on the reversed side of the paper. The area that had been erased can be clearly observed and the impressions are distinct.

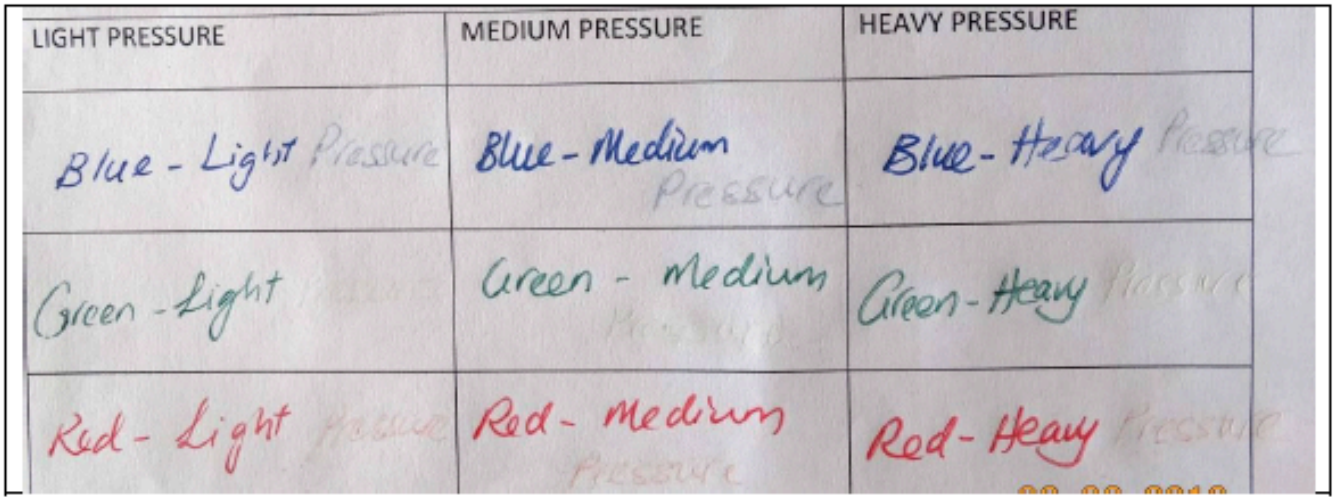
2.4 Observations on the erased area under 30X magnification

Images seen under magnification of 4X to 30X revealed presence of ink residue that were not completely erased

	Light Pressure	Medium Pressure	Heavy Pressure
Blue Ink			
Green Ink			
Red Ink			

3. **<u>The document was placed in the freezer to see if the writing will reappear.</u>**

The illustration chart below shows the reappearance of the erased writing after 15-30 minutes of the freezing process:



LIGHT PRESSURE	MEDIUM PRESSURE	HEAVY PRESSURE
Blue - Light Pressure	Blue - Medium Pressure	Blue - Heavy Pressure
Green - Light	Green - Medium	Green - Heavy
Red - Light	Red - Medium Pressure	Red - Heavy

3.1 Observation: The red and blue ink became visible after the freezing process of 15 minutes. The green ink did not appear as clear even after 30 minutes of the freezing process.

SUMMARY OF FINDINGS

Frixion Erasable ink can be detected by the following:

1. By visual inspection for indentation using oblique lighting.

2. Under higher magnification and oblique lighting the presence of residual ink could be accounted for although visually the ink was not visible to the naked eye.

3. By depositing the document in the freezer after erasing the ink, the ink will reappear.

   Note: *When freezing the document, place the document in a transparent plastic folder for protection.*

PART 2

A CASE OF CHEQUE TAMPERING: FRIXION ERASABLE PEN

We were engaged to examine several hundred Cheques at a Bank. We were instructed to determine if the Cheques had been subject to any tampering and if the signatures were or were not authentic.

During this inspection, we examined nearly 500 cheques with magnifying loupes, a stereomicroscope, a light box and ultra violet light.

1. LIMITATIONS

The use of camera was not permitted.

2. ABOUT THE CHEQUES

The cheques in this bank are printed with watermarks of the bank's logo in areas as indicated Figure 1. In the original cheque all the watermarks fluoresced distinctly under the UV light (as illustrated in Figure 1 below)

Figure 1 (Approximately 50% of the original)

3. OBSERVATIONS OF THE CHEQUES GIVEN

3.1 In many instances where the earlier text was erased the Bank's logos appeared less visible under UV lighting. The erased text was observed at the area of the Payee's name. See an example in figure 2 below.

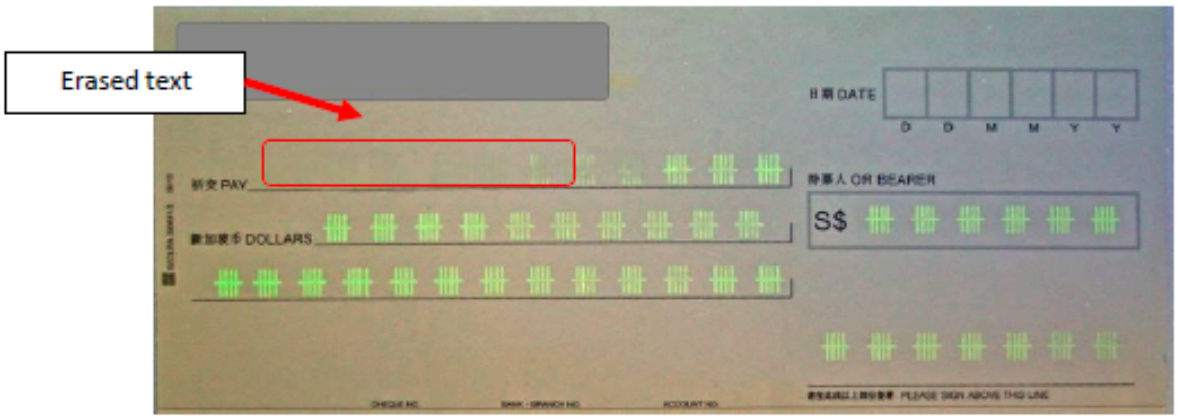


Figure 2 (Approximately 50% of the original size)

Next we analyzed the pen that was used for this case.

3.2.1 There are no graphic marks to indicate the writing was in pencil. There were no indication of fiber disturbances in the erased area.

3.2.2 The ink on the other part of the cheques had the similar striation characteristic of the Frixion (erasable) pen.

3.2.3 Erasure mark and indentation of the earlier text were observed and are visible to the naked eye on close scrutiny.

Based on this observation, we were able to conclude that the pen used was likely to be made by a Frixion (erasable) pen manufactured by Pilot Pen because it was Thermo-sensitive.

To confirm this we applied the "Freeze Spray" and like magic, the writing reappeared.

*Note: Some printed details on the cheques were removed for confidentiality.

PART THREE: Twelve Months Later

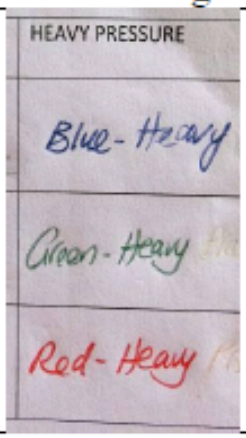
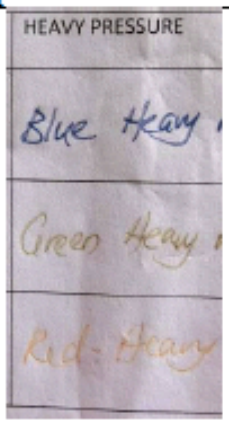
Objective: To determine what happens when the Frixion Erasable ink is exposed to heat over an extended period of time.

Following the same procedure in Part 1 of our Experiment we prepared another document using the same Frixion Pen (Blue, Green and Red) and exposed it to an outdoor temperature averaging 30+ ^{0}C for a period of 12 months.

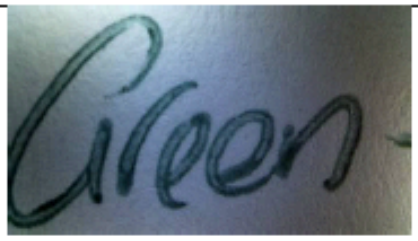
A control document was placed indoors at the normal room temperature of averaging 25^{0} C.

Comparison was then made between the two documents and recorded.

Original **Twelve Months Later**

Exposure Average 25^{0}C	Exposure to 30+ ^{0}C
	

Approximately 5x Magnification

Exposure Average 25^0C	Exposure to 30+ ^{0}C
	
	
	

3.1 Under the heat exposure, the deterioration of the ink is most significant in the Red and Green ink colour.

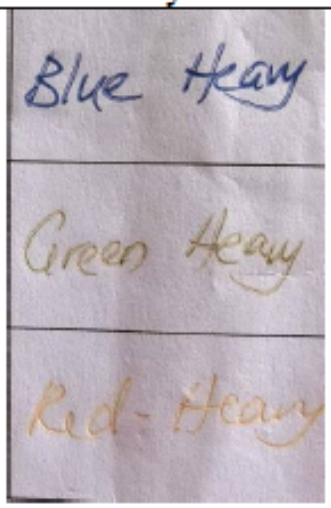
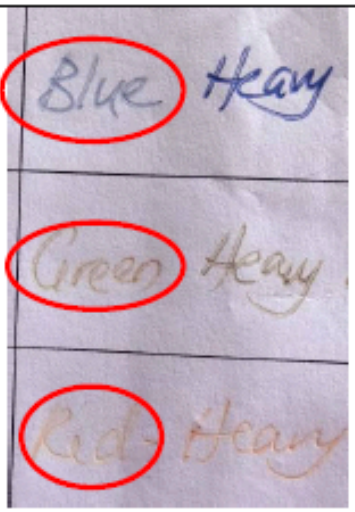
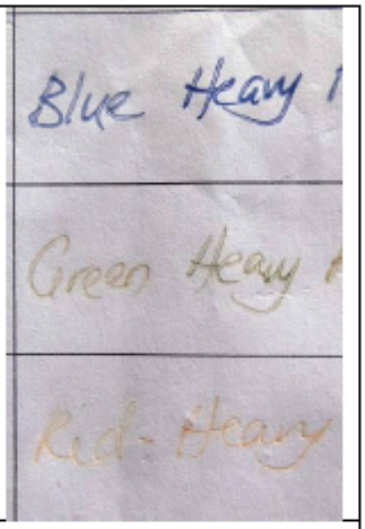
3.2 This document is then placed under a freezing temperature for 30 minutes to examine if the colour would return to normal.

Findings: The freezing process did not restore the ink colour.

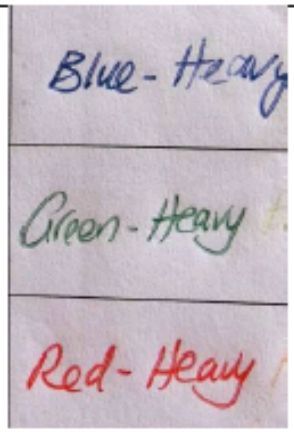
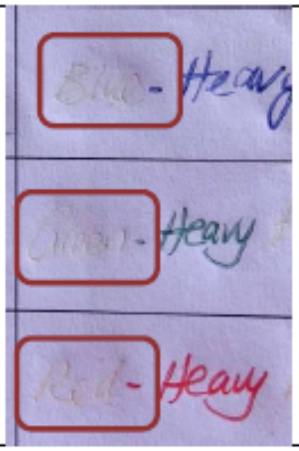
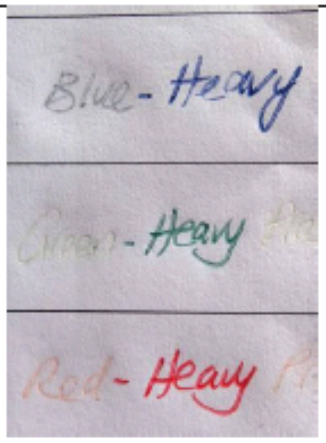
3.3 Attempt to erase the text on the 'test' document (red circle below) to examine the quality of the text.

Findings: The erasing process could only partially remove a fraction of the ink but the text remains clear and legible. This indicates that over a period of time under constant heat condition,

the ink may be more difficult to remove and may not be erasable.

		
Before erasure	**After erasure**	**After freezing**

3.4 Attempt to erase the text on the 'Control' Document (red rectangular) to examine the quality of the text.

		
Before erasure	**After Erasure**	**After freezing**

Findings:

The erasing process could remove the ink and the freezing process partially restored the ink. This indicates that over a period of time (12 months) exposure averaging 25^{θ} C, the ink could still be erased and restored.

Article on Frixion Pen Experiment conducted and written by:

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William Pang is a court-qualified handwriting and document examiner with approximately 18 years experience.

He has testified approximately 100 times in the State court and High court in Singapore and Malaysia, on civil and criminal matters. He has also testified in the Labour and Syariah court in Singapore.

In addition he has conducted workshops and courses to banks, accounting firms and commercial institutions, and presentations to 32 Schools, 16 Public Libraries, 12 Rotary Clubs, 7 Lions Club and 4 Institutes of higher learning.

William has been interviewed on television, radio and has contributed articles to Straits Times, Sunday Times, New Paper, Today Newspaper, Lian He Wanbao Newspaper, Lian He Zao Bao Newspaper, Star Newspaper, Berita Harian Newspaper, and other major publications.