AN ALTERNATIVE USE FOR BAR CODES

Introduction

In nearly every packaging magazine or at any conference related to packaging and distribution of goods, we hear about Radio Frequency Tags as the replacement for the bar code. I will leave that subject to a later date, but maybe this article will result in printers and print buyers making extended use of bar codes as a reference for checking print quality. You may consider this idea to have its limitation — because bar codes are only printed in one colour and most boxmakers print using more than one colour. However, the concept can easily be implemented if you have a bar code verifier. But take note, a bar code reader will not be enough.

The History

The bar code originates from the 1970s and there are several different designs. However, they all consist of printed bars with the coding principle based on the differences in the width of the bar and the space between the bars. Bar codes appear on nearly anything that is put in a box. Today it is the main tool to identify products in the supply chain.

Around 1995, I got involved in dealing with customer complaints. One of the major complaints was that bar codes, printed on corrugated, were not always readable. Customers believed it was a problem with our printing, but we were producing the same quality we had been for years. It turned out that customers were only then starting to actively use the bar codes. The problem was that the printers were not verifying the bar codes and therefore didn't realise that there was a problem.

Printed bar codes are still not properly vertified, because you need a measuring instrument to provide quality assurance concerning the readability of a bar code.

Picture 1: Bar Codes.

Some printers are using bar code readers but that only tells you that your bar code reader can read the bar code. Therefore, bar code verification becomes a hot topic. While the bar code as we know it may disappear from packaging, there is still good use for bar code verification equipment in relation to analysing the capabilities of your printing process.

The Problem

Following the introduction of the bar code, it was discovered that the printing process influenced the actual printed width of the bars. Solutions were found in the repro of the bar code to compensate for average bar-width gain, better known as bar width reduction. When checking a bar code with a bar code verifier it will give a value for the average bar width gain for all bars in the bar code. It is this value that we are interested in.

MR STREEFLAND HAS WORKED IN THE CORRUGATED INDUSTRY SINCE 1992. DURING THIS TIME, HE HAS BEEN TECHNOLOGY DEVELOPMENT MANAGER FOR SCA PACKAGING AS WELL AS TECHNICAL MANAGER AT STORK SCREENS. HE STARTED TECHNOLOGY COACHING BVBA IN FEBRUARY 2005.

If the width of the bars in a bar code changes during printing, relative to the original design specification, then there will be "bar width gain" variation in the process. There are many possible reasons for this variation. It can relate to:

— raw material properties;
— the roundness or total indicated run out of the cylinders;
— the alignment of the cylinders in the printing machine.

Checking the alignment of the cylinders in a printing machine is important. It is not always easy (or possible) to get access to the printing nips in a printing machine to check the evenness of the gaps between the cylinders, across the width of the machine. The result is that many machine operators are not aware of a misalignment and are continuously adjusting the printing machine to compensate. If you talk to the operators, they can accurately describe the many problems they have, but are not able to relate them to gap variation and or misalignment. Therefore, there is a need for a testing method to link what the operator sees in his day to day job and the status of the printing machine. We need to evaluate the printed results quantitatively and relate the results back to the process.

In earlier articles, I have fully discussed colour to colour register variation and colour variation in relation to the print process. In this instance, it is printing pressure variation, specifically the impression pressure variation.

The Theory

Bar width gain can be influenced by: changing impression pressure, slurring of print, TIR of the rolls and alignment of the cylinders.

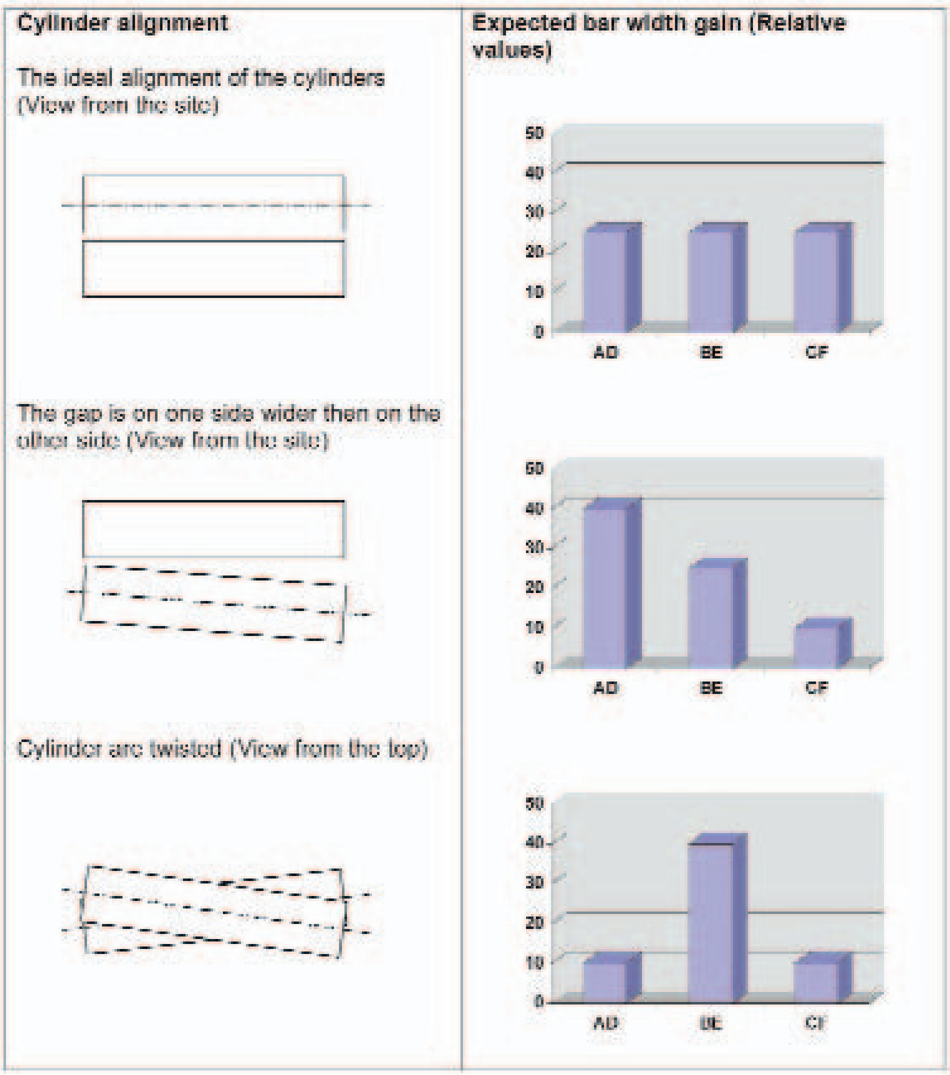
Changing impression pressure will give an overall change in the bar width gain. It is difficult to detect if we don't have a reference. You could use it to check if you have the same pressure setting as the last time, but what the level should be is something you can only determine by doing systematic testing.

The slurring of print would result in a different gain in the width of the bars in the print direction (bottom bar code in picture 1) and the bars in the cross print direction (the top bar code in picture 1). In the case of slurring, the gain will be greater for the top bar code in the picture.

The total indicated run out is a bit more difficult. In this case you need to look at the overall variation in bar width gain data. A large variation in the bar width gains data points to a large total indicated run out of the plate cylinder and/or impression cylinder. This is also detectable in the print direction colour to colour register variation data being larger then the cross print direction data variation.

The alignment of the cylinder would show a bar width gain variation of the bar codes across the machine. This is what we are interested in.

The following drawings show some misalignment and graphs of the expected width gain. The characters in the graph correspond with the position of the bar code as shown in figure 2: the 5 colour test form. It is assumed that the smaller the gap, the higher the bar width gain.



Tests

So how do we check the alignment of the impression cylinder and plate cylinder? The procedure is based on a test by print station, using the same plate and colour in each print station. Preferably, we use black on all print stations and a white substrate. The test plate can look like the one shown in Figure 2. We only use the "cyan" colour and in principle only the bar codes in position A, B, C, D, E and F are needed.

In each position is the bar code with the bars in the print direction and in cross print direction. For the evaluation I used an Axicon 6000 series barcode verifier. On each print station the cyan plate was printed using black and a sample was taken of 10 consecutive printed sheets. The samples were measured and the data accumulated in a spreadsheet. To avoid errors, all 12 bar codes in the test form have a different code. From all the data collected by the bar code verifier, we use the "average bar width gain" data for the evaluation.

Results

We had the opportunity to test the same machine on two different occasions. At right are the bar width gain results for each test.

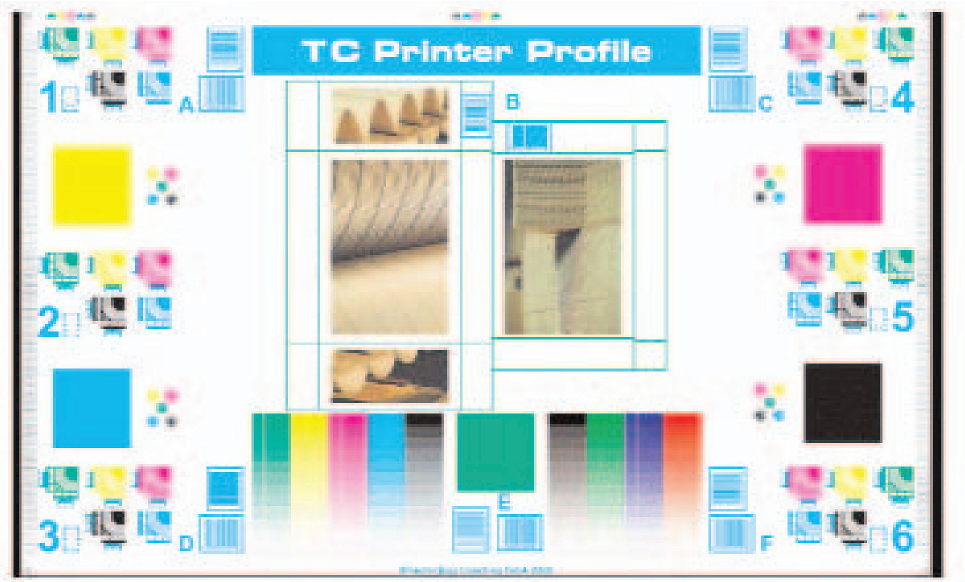
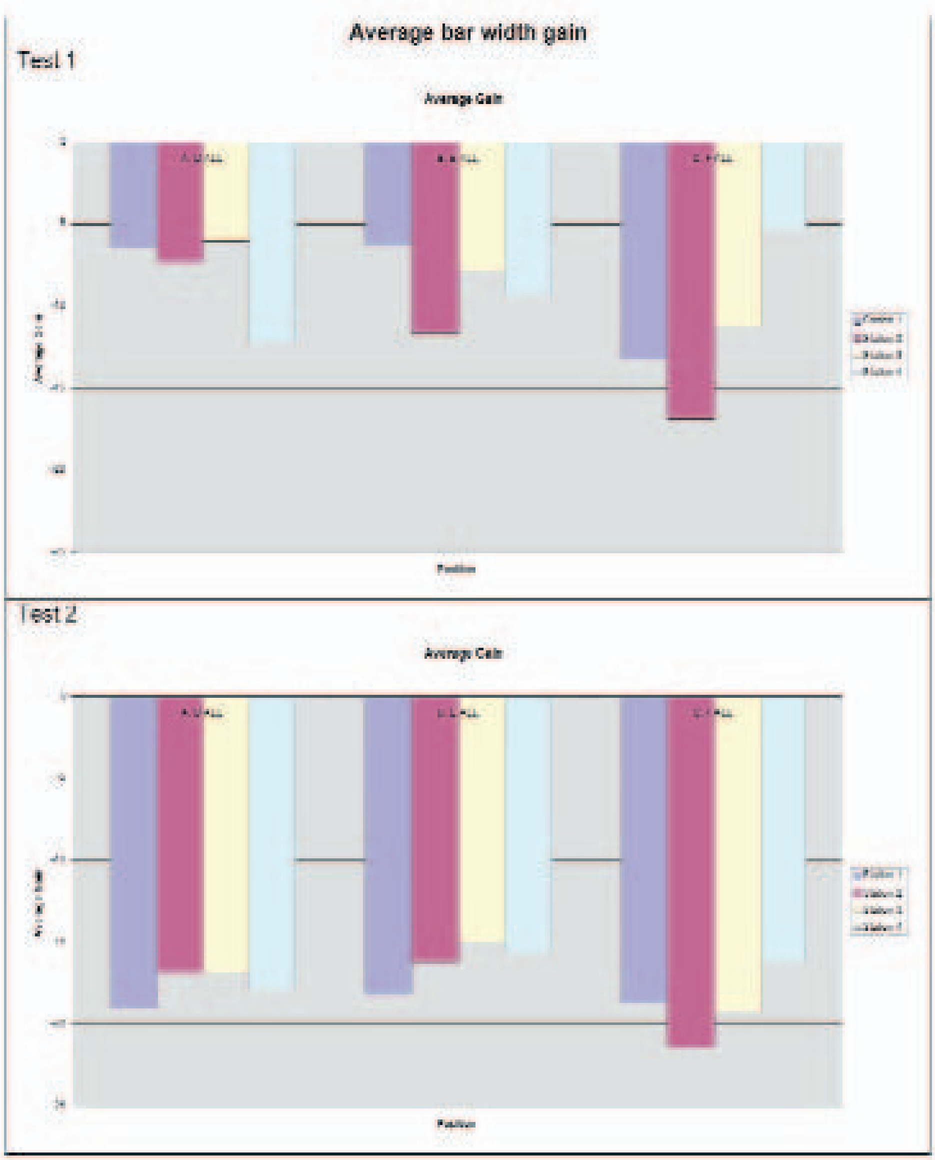


Figure 2: 5 colour test form. We only use the bar codes in the cyan colour!



Test 1 was the first time we tested the machine and we noticed larger differences in the average gain for all the bars. Then we ran a second test.

Notice that in both tests we find negative values for the bar width gain. This means that the bars were actually smaller than expected. The more negative the value, the lower the pressure between the cylinders, thus the wider the gap.

The graphs show the average of all measurements for the bars in the print direction and cross print direction for Positions AD, BE and CF across the printing machine. The blue bar is print station 1 followed by 2, 3 and 4.

Notice that in the first test for station 1, the bar width gain in positions AD is greater then in position CF. The same is the case for the stations 2 and 3. For station 4 the average gain is greater in position AD than in CF. Look now at the graph for the second test. The gain values are more or less at the same level between -15 and -20. Modifications were obviously made to the machine between the first and the second test.

If you notice a problem in the bar width gain for bar codes printed across the printing machine, the next step should be to check the alignment of the machine

Conclusion and Recommendation

From the two tests, it was possible to detect a misalignment of the cylinders in the printing machine and show what effect the corrective action had.

If you notice a problem in the bar width gain for bar codes printed across the printing machine, the next step should be to check the alignment of the machine using feeler gauges to confirm the misalignment. Use the bar code print test as a detection method to find out if there is something wrong.

Misalignment of your cylinders can effect colour to colour register — the board “skews” in the print station. It can also create colour variation difference across the printing machine, resulting in no print on one side and print with hallows on the other. It is therefore wise to check the alignment of your printing equipment on a regular basis.