

# Analysis of Wire Wear Pattern

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## ABSTRACT

Timely evaluation of any failure and its mechanism is important to any equipment or part of it. If we can view the wear behavior of wire immediately after the wire is taken out, it becomes easier to take decisions on closer view of table elements and replace these if required. The present paper shows such a simple effort to use conventionally available office scan-copy-fax machine to scan the wire and using generated image for fault finding.

### Introduction:

Just like any other consumable, the life of wire is also a limited one. However, analysis of a used wire can reveal a lot about the working condition of wire on machine and give some interesting clues to increase life of the same.

### Conventional System:

When the wire is mounted mills record mounting date, supplier details, quality of wire etc. Almost all good wire suppliers provide facility to evaluate the wear pattern of the wire, and for the same mills are required to send a CD sample of the wire to the supplier. Some suppliers, however, offer evaluation of competitors' wire just to keep track on the performance of their supplied wire as well as competitors' wire in a particular mill.

### Tools for Evaluation:

The following tools are commonly used to evaluate a particular wire-

1. Caliper profiling
2. Microscopy

Caliper profiling is a simple technique used since long to study the pattern of wire wear. In this technique, the caliper of wire is measured at different places throughout the deckle and a plot is made. Wire suppliers often recommend critical caliper of wire after which the wire should be considered as worn out.

Microscopy is generally done using good quality microscopes along with camera for capturing the image of wire. An enlarged photograph of the wire reveals a lot about the degree of wear, wear pattern, presence of foreign material like gum, charcoal, etc.

As most of the time the analysis is done by the wire supplier, it takes a lot of time to send the sample to supplier, who does the evaluation and sends the report to the mill. Obviously, another wire is put in place of this, and it becomes difficult to take any immediate action, like change in suction box top etc.

### Past Observations:

Initially, it was observed that the caliper profile was of an inverse cup shape, meaning that the wear was more at ends. A report from wire supplier suggested that this could be due to stationary elements like hydrafoil, suction box top, too dry a wire at suction boxes, or uneven surface of these. As a result, the first action planned was to check all elements thoroughly during the next wire change that was due after a few months. During the next wire change, immediately after the old wire was cut and removed from machine, the wire table was cleaned and straightness of all elements was checked. Nothing abnormal was observed, still, a couple of tops were replaced with new ones to double ensure that all elements are in perfect condition. A new wire was put, and the machine started.

After the wire was taken out after the normal life, a sample of it was sent again for evaluation. The received caliper profile was again skewed at ends (fig.1) similar to the previous wire. So it was decided to replace all the suction boxes with new ones during the next wire change that was due after a couple of months. But, the next wire, which was mounted along with

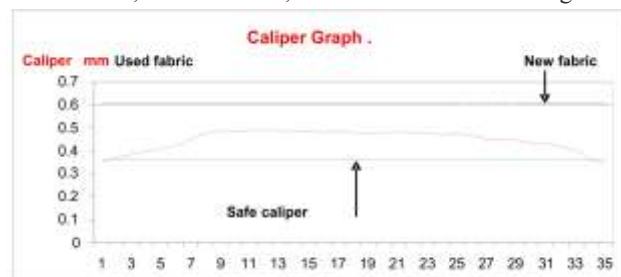


Fig.1: Wear Pattern of wire



Fig.2: Wear pattern of wire mounted with new suction box tops

new suction boxes, gave exactly the same wear pattern (Fig.2)

The wire manufacturer recommendations were mainly of general nature, and repetition of the previous ones. On enquiry from some other mills, we observed that the wire life we were getting (around 5 months) was better than some other mills in the nearby area, and probably, this was the reason that a level of satisfaction was being observed.

After some time, the mill decided to switch over to some other grades and for the same a bigger vacuum pump almost thrice the capacity than the earlier one was installed for wire part. The result was horrible. Wire life reduced from 150 days to 40-45 days only.

This sudden reduction in wire life was a major issue for the mill. To further evaluate the wire life related issues, it was decided to closely study all the parameters. Meanwhile, wire from some other supplier was tried, mainly with the intention of reducing price of wire as the life has gone down. The performance of this wire was almost same as the previous supplier. Simultaneously, some other findings started appearing-

1. Suction box tops were getting uneven even within a couple of months, needing regrinding.
2. Some black ink like sticky material was found on suction box tops as well as on wire requiring frequently cleaning the wire.
3. Wire part drive load increased.

As a result it was decided to switch back to virgin UHMWPE tops in place of ceramic mix type, and to reduce the vacuum as to previous one. Also to reduce the vacuum as far as possible to reduce wearing of wire and suction box tops.

### Scanning of Wire:

During another wire change, samples were cut around 5" wide (CD) and 10" in length (MD) and scanned at 2400 DPI resolution using the HP Officejet 4500 G510g-m scanner, which was available in factory office for general office work. This is a general purpose copier, scanner and fax device.

The scanning process took a long time (nearly 30-35 minutes initially. Also the file size was too large (approx. 2GB) and this created problem in viewing the scanned image as the computer response was too slow. As a result, the scanned images were discarded, and another scanning was taken using part of samples of 2"(CD) X 3"(MD). Again during scanning, the active area was limited to a smaller one around 15mm X 25mm only, and the scanned imaged were viewed on computer screen after zooming to get an enlarged picture.

### Study of Scanned Images:

As the wire had to be removed premature, it was expected to show a better shape of weave yarns. The images are shown in fig. 3, 4.

A study of the images indicate the following-

1. In some of the samples, black spots are observed at the bottom side yarns.
2. These black spots are more at the center, while front side has minor marks. Also, at the back side, the spots

are almost invisible. The black spots seemed most probably due to presence of ink particles as just before wire was removed, the machine was running with a furnish containing more ink. The same can be verified if next wire change is made after a non-ink containing furnish is being run. Alternatively, there is a possibility of melting of bottom layer of wire yarns and blackening due to inadequate lubrication.

3. Front side and back side wear is visible, while center yarns are in very good condition. Again, it was observed that on the machine, the bagalley box was mounted a little upwards, thereby exerting pressure on wire. Now, every time the guide moved to guide the wire, the frictional stresses adversely rubbed the wire at either end. Most probably, this was the reason of observed wear pattern of wire.



Fig. 3: Scans of top side of wire



Fig. 4: Scans of bottom side of wire

As a result, the bagalley box was lowered in such a way, that it just touches the wire in both extreme positions of guide roll. The next wire was mounted, after 45 days, it is showing no effect of wear at either end, unlike previous few wires.

It was also observed that the scanned picture quality was sufficiently good enough to understand and evaluate wire performance quickly. However, to get a better guidance a strip of wire should be sent to the wire supplier for evaluation, while small pieces of remaining wire may be used for immediate in-house study of wire wear behaviour.

### Conclusion:

Use of office equipments can be tried if it is required to evaluate wire wear pattern immediately. If you get a picture about the previous wire before mounting a new one, it is generally easy to review the wire table under the light of recent observations and taking corrective actions. In the present work, available HP Officejet 4500 G510g-m scanner was used. But, using high resolution scanner may be more advantageous for quick in-house studies.