

Poorly maintained tension gauges may cause severe damages.

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Almost every paper mill using forming fabrics has one: a mechanical tension gauge to measure the tension of Paper Machine Clothing, mostly forming fabrics. When these instruments are not in a perfect condition they can cause serious problems on the paper machine like torn fabrics, too narrow and/or too long fabrics and bearing failure.

Working principle

To understand the risks, it is important to understand how the mechanical tension gauges work. In illustration 1 the working principle is shown.

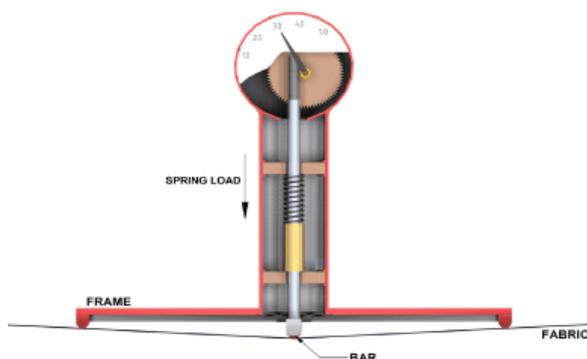


Illustration 1 - working principle of a mechanical tension gauge

The sensor bar at the bottom is pushed into the fabric by a predefined spring load. The amount of travel of the bar is converted through spindle and clockwork into a value on the dial. The higher the fabric tension, the more the bar is pushed upwards, causing the needle to rotate clockwise, indicating a higher value on the dial.

What happens when the devices get older?

After a certain period of use, the instrument will start showing signs of wear and tear. Mechanical wear of the sensor bar and a leaking bellows seal are the most common problems with older tension gauges and exactly these two phenomena represent the highest risks.

Worn sensor bar

In many older tension gauges the sensor bar is worn down for several millimeters, resulting in a flat contact surface of the bar, like in illustration 2, compared to the original rounded bar.

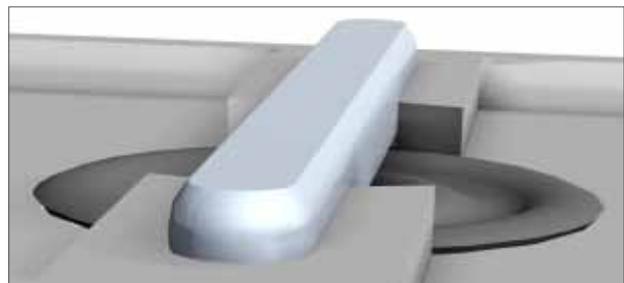


Illustration 2 - example of a worn sensor bar

Now remember the working principle of the gauge: in fact the travel of the sensor bar is converted into a tension value. In illustration 3, a worn bar is compared to a new bar. The spring load is equal in both cases, and also the fabric deformation will be practically the same with an old or worn sensor bar. But illustration 3 shows that the worn sensor bar will travel further downwards than its new counterpart.

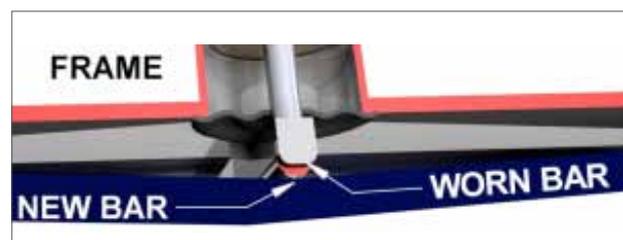


Illustration 3 - a worn bar compared to a new sensor bar

Leaking bellow seal

The tension gauges are used in a very wet environment and the splash water can be quite corrosive. Aging effects of the rubber material and the moving spindle will wear out the bellow, making it no longer watertight. When process water can enter the instruments interior, soon the bearings of the spindle will start corroding. This internal corrosion will give the spindle extra mechanical resistance during the measurement. In other words: with a certain amount of fabric tension the sensor bar will not travel as easy upwards as it should.

Conclusion:

worn tension gauges give too low test results

Summarized the two most common defects on mechanical tension gauges are a worn sensor bar and a leaking bellow, causing internal friction. Both defects have the same effect on the measurements: the gauge will show lower tension values than what they really are.

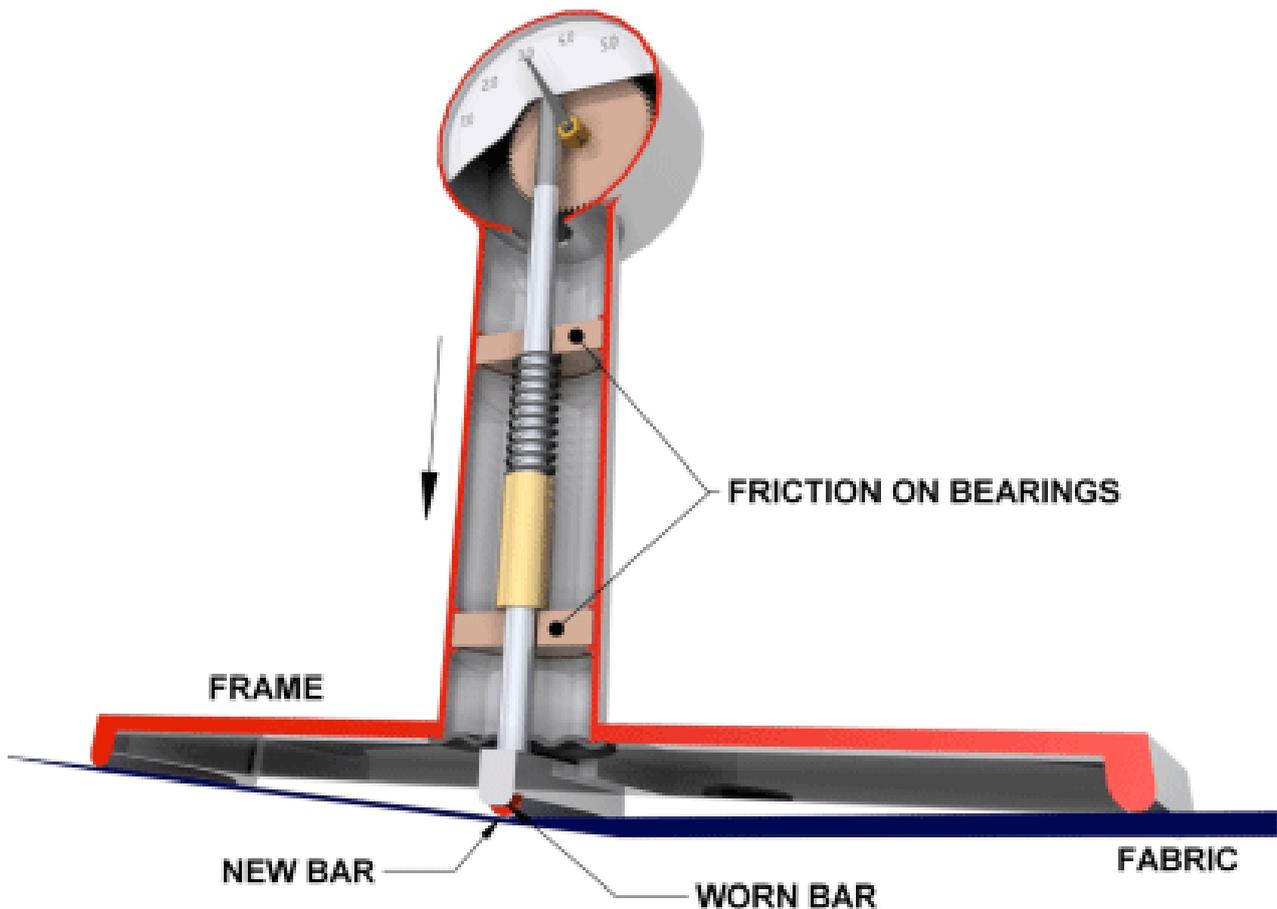


Illustration 4 - worn tension gauges give too low values

A worn sensor bar will move the spindle downwards and hence the needle moves counter-clockwise towards lower values on the dial. More friction on the bearings makes the spindle 'stick' where it should be moving up; again resulting in lower values on the dial.

What happens in daily practice

In many paper mills the tension gauges are used as long as the needle is still moving; the accuracy is often not questioned. For every Paper Machine Clothing position the operators know the desired fabric tension; for example 6 kN/m (see illustration 5). If the fabric tension is measured and the gauge shows 5 kN/m, the machine tension is increased until the gauge shows the desired 6 kN/m. The true fabric tension will then be clearly over the 6 kN/m mark.

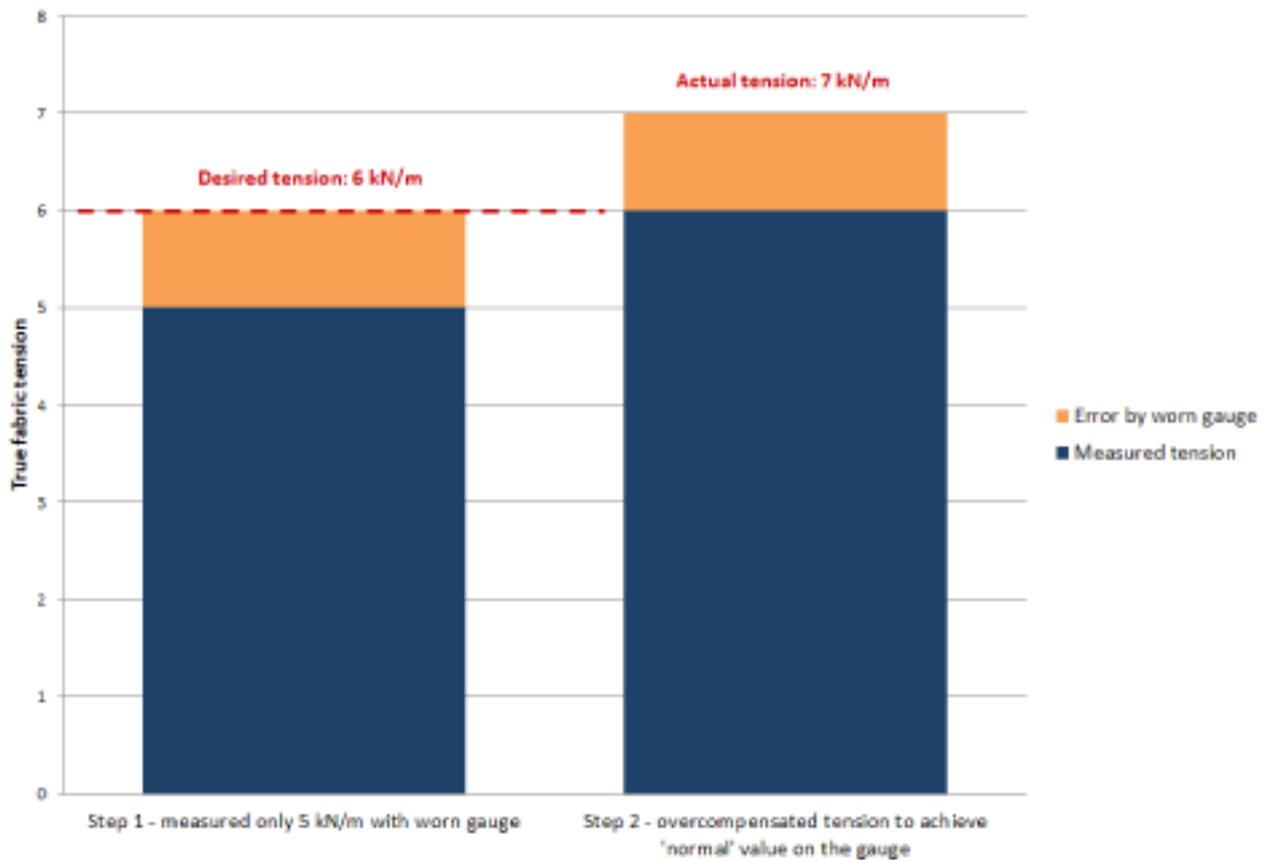


Illustration 5 - running too high tension due to a worn gauge

Consequences of machine clothing running at too high tension

When the Paper Machine Clothing is running at a higher than expected tension a number of things can happen:

- the fabrics may stretch, finally running out of tension possibilities;
- the fabrics can become narrow;
- the dewatering behavior of forming fabrics can change;
- the seam can be overloaded, resulting in torn fabrics;
- when the fabric guiding rolls cannot handle the extra tension, roll-bending or bearing failure may occur.

The negative effects of poorly maintained tension gauges are often underestimated.

The conclusion of this article is clear: a regular service or timely replacement of this precision measuring instrument can prevent many costly problems and damages.