

Mechanical engineering and maintenance considerations of a felt roll driven paper machine dryer section

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Several key factors must be considered when selecting this innovative type of drive for rebuilds.

In the spring of 1985, Nekoosa Papers, Inc. started planning a rebuild of its No. 4 paper machine at the Nekoosa, Wis., mill. Prior to the rebuild, this machine had a lineshaft, flat belt drive, open dryer gearing, and a poor steaming system.

The objective of the rebuild was to increase the speed of the machine.

Project discussion

The original project scope for the rebuild included replacement of the press section, installing a new dryer drainage and steam supply system, replacement of the lineshaft drive with a sectional dc drive, and the replacement of the entire main dryer section. The original intent was to install new open gearing and split the 34-dryer section into two sections.

The idea of a felt roll driven dryer section was raised by our engineering consultant on the project. At the time of these discussions, there was only one other machine we knew of which was operating with a felt roll driven dryer section.

We began looking at the pros and cons of this type of drive. The advantages we identified were:

- Reduced capital dollars in dryer gears and drive pinions
- Reduced maintenance due to the elimination of open gearing
- Reduced noise level due to the elimination of open gearing
- Improved access to the back of the machine.

The disadvantages we identified were:

- Increased cost of the electric drive
- Risks of draw problems between top dryers and bottom dryers
- Risks of dryers which had minimal wrap not being positively driven
- Concerns over dryers filling up with condensate due to siphons not being synchronized.

Based on the above factors, in June 1985 we decided to proceed with a felt roll drive. We did hedge our bet somewhat by ordering the dryers with gear extensions, finished and keyed.

In April 1986, the machine went down for the 30-day rebuild. Existing felt rolls, 8 in. in diameter and of a dead shaft design, were reused in the idler positions, and new 8.625 in. rolls were purchased for the 12 driven roll positions (Fig. 1).

The 35-dryer main section is driven by 12 20-hp motors—three on the first top felt driving nine dryers, three on the first bottom felt driving eight dryers, three on the second top felt driving nine dryers, and three on the second bottom felt driving nine dryers.

Each felt has a master motor and two slaves. The motors are set back from the end of the felt rolls with 48-in. long floating drive shafts.

The startup went well, with very few drive problems. The goal of 1500 ft/min was reached shortly after startup.

Operations

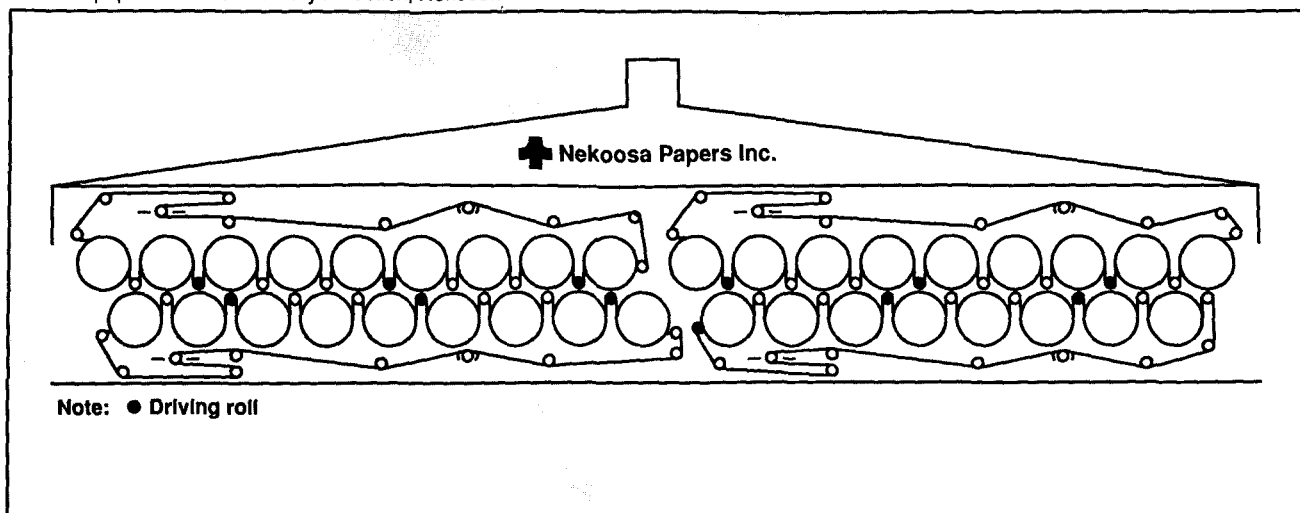
The same felts are used on the machine as were used prior to the rebuild. The life of these felts ranges from 220 days to 240 days. Felt runnability is the same as a gear-driven machine. Ropes were used on the leader for initial felt installation. When changing out an old felt, the new felt is run through on the old felt.

Draws between sections are as good or better than a gear driven split section.

We have not experienced any sheet quality problems

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1. No. 4 paper machine main dryer section, Nekoosa mill.



such as scuffing due to the felt driving the dryers.

Our concerns about the dryers filling with condensate due to lack of siphon synchronization proved unwarranted.

When the dryers are warmed up, they are set at a crawl speed. If the dryers are stopped for an extended period due to a badly wrapped dryer, the steam is turned off. On normal breaks, the machine is operated as if it had a conventional drive with synchronized siphons.

Automatic load cell type felt tension units are used on the two top felts and two bottom felts. Normal operating felt tension range is 10-12 pli. It is believed we were running 5-8 pli prior to the rebuild. It is recommended to plan for felt tensions in the order of 15-pli operating and 20-pli design.

A good dryer drainage system is required to keep the dryers empty. The drive becomes unstable when the dryers begin to fill up.

Maintenance considerations

Dryer installation time is reduced considerably over a gear driven machine. Since gear mesh is not a consideration, the dryer need only be level and square. The machine direction dimension need only be close.

Rear dryer bearing maintenance is much easier since gears need not be pulled to replace a bearing.

Dryers which have differing circumferences due to grinding do not cause draw problems, since the surface speeds are always equal.

The absence of gear lash results in a very smooth running dryer section.

Felt roll failures have not been a problem with the recommended design of 20 pli being used for the new felt rolls.

We attribute the low mechanical maintenance on the dryer section to reduced vibration due to the elimination of all gearing.

The electrical maintenance record has been tapering off since startup and is considered excellent at this point. A diagnostics system is used which we feel is a great help in improving uptime.

Subsequent project

In 1987, a decision was made to upgrade Nekoosa Papers' No. 7 paper machine at our Port Edwards mill. A main section felt roll drive was also selected for this machine. It started up in April 1989.

Since we had the track record of the No. 4 paper machine to use in evaluating the gears versus felt roll decision, a good evaluation was possible. A maintenance savings of \$100,000 per year was claimed for the elimination of the dryer gears. The No. 7 paper mill had a history of very high gear maintenance, and undoubtedly some of the troubles could have been caused by poor dryer drainage. With the rebuild, the dryer drainage system was upgraded as well. Dryer cans which are poorly drained cause shock loadings on the gears at and below rimming speed. On a felt roll drive system, the felt acts as a shock absorber, thus preventing the transmission of the shock to other drive components. This machine is running very well and exceeding our expectations.

Conclusion

We feel that felt roll driven dryer sections have many advantages over gear driven sections when considering rebuilds. These advantages include initial costs, maintenance, and operation. □

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