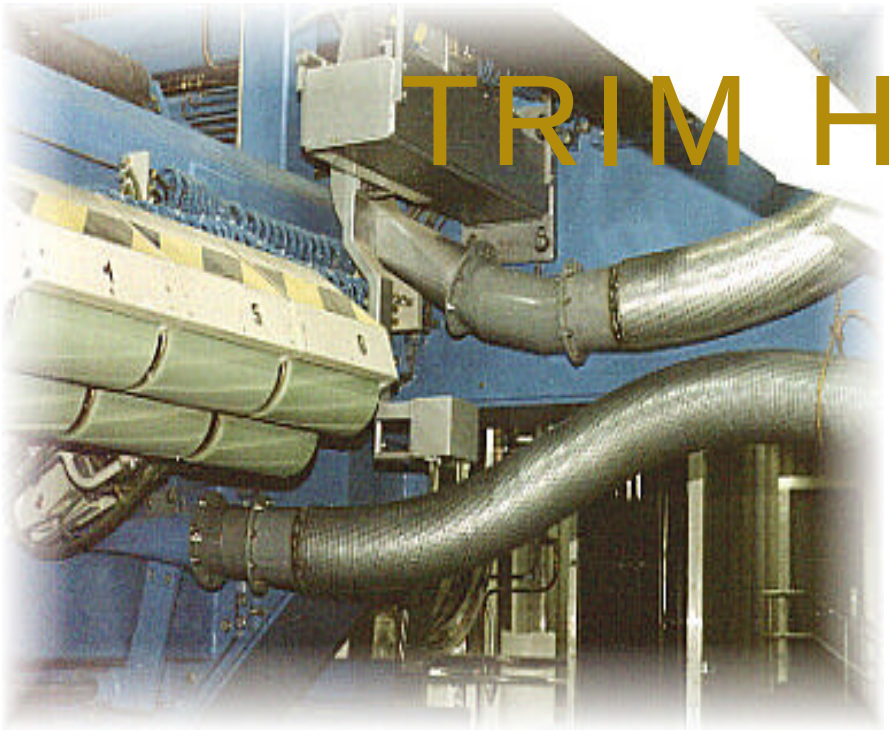


Presented at TAPPI Papermaking Conference, Atlanta Georgia, 1991

TRIM HANDLING SYSTEMS

Vacuum trim conveying systems are energy efficient and cost effective alternatives to the more conventional paper trim handling systems

Preface

In the manufacture of paper, paper broke called trim is produced during roll winding and finishing processes. To reduce losses, the trim must be recovered. The amount of trim produced varies depending on paper grade, manufacturing process and market demand. Trim losses normally range between 3 to 5% of total production at the reel.

In most cases, trim can be returned to the process, whereby trim costs are reduced to those arising from the trim handling and repulping equipment. In other cases where coated, coloured or other special papers are produced, trim may be partially or entirely discarded.

The removal of trims would be relatively easy, if the trims were produced at a constant fractional rate of machine line production. Paper coming off a paper machine is, however, usually sent to off-line winders where the speed is considerably higher than that of the paper machine. This can cause a momentary rise in the rate at which trims are produced, and the trim conveying system must be able to accommodate such peak rates. For example, consider a newsprint machine with a sheet width of 7 m and a production of 500 tpd, the production of trim would be8.5 tpd or 1.7% of machine production for a trim width of 2 x 50 mm. The momentary trim width, however, at an off-line winder may be 4 x 100 mm with a winder speed of 2300 m/min, causing trim production to rise to 63 tpd or 12% of machine production.

The momentary production rates of trim may in theory become very high, when one considers most paper machines have at least two winders. The trim removal system must, hence be dimensioned according to the specified winder performance. An aspect worth consideration is optimal dimensioning of trim removal systems, i.e. winder speeds are reduced in accordance with the reduction in paper machine speed when heavier grades of paper are produced.

The repulping of trims is usually arranged either by machine or by paper grade, using the various repulpers of the machine line. If feasible, an alternate method is to concentrate all mill trim handling to a single repulper. The trim conveying system would then be designed with a repulper of its own having no other broke added. The repulped stock would be returned to the various paper machines.

When selecting a concentrated trim conveying system, as outlined above, the rates of trim production should be given careful consideration, to avoid choosing a system which is too large and too expensive to operate. Theoretical figures alone will not give satisfactory results. A change of paper grade or other special circumstances, along with the simultaneous operation or several winders, yields cumulative effects. Considerations gained from experience must, therefore, be taken into account to assure correct sizing of such a trim handling system.

Trim Conveying Systems - General

Trim conveying systems may be divided into five categories as follows:

1) a system for discharging the trim directly into a repulper below the winder (Figure 1), 2) an injector system (Figure 2),
3) a chopper fan system (Figure 3),
4) a combination shredder and transport fan system (Figure 4), and
5) a vacuum system.

Trim Discharge Directly To Pulper Below Winder

This system is practical only if the repulper is located directly under the winder and the repulper operates continuously and the winder is designed in such a way that the trims are slit down towards the repulper. The trim handling equipment then consists of trim chutes, light air jets and sufficient ventilation to prevent air from being blown into the machine room through a broke opening, etc.

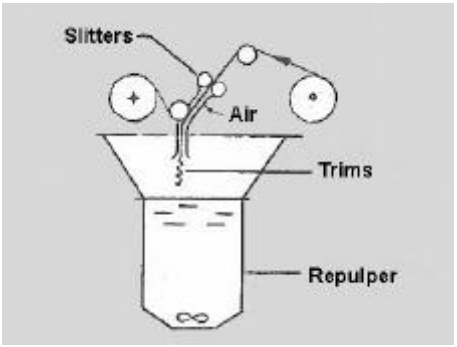


Figure 1: Direct Discharge o f Trims into Pulper

Injector System

The injector system removes continuous trims from the winder by means of high-velocity air and discharges the trims into the repulper through a settling chamber usually located directly above the repulper.

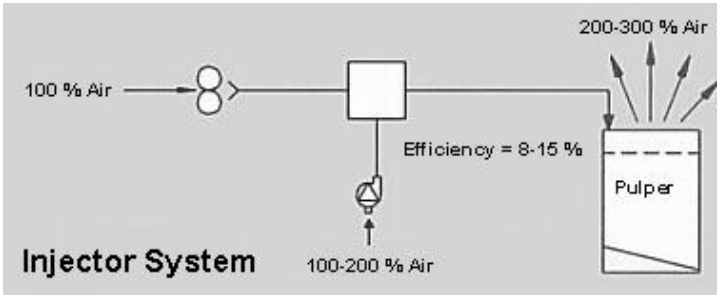


Figure 2: Injector Trim Handling System

Chopper Fan System

In a chopper fan system, the trims are drawn from the winder by means of a fan which also breaks the trim into small pieces. The decimated trim is then conducted through ducting into a settling chamber above the repulper. A separator such as a cyclone may be used instead of a settling chamber.

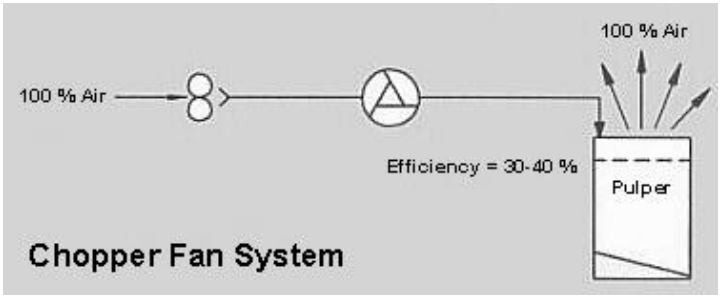


Figure 3: Chopper Fan Trim Handling System

Combination Shredder and Transport Fan System

The combination shredder and transport fan system first shreds the trim and then sends it to the repulper by means of ducting and a regular pneumatic fan.

In addition to these well known systems, there are special applications which require various combinations of the above systems to satisfy certain requirements.

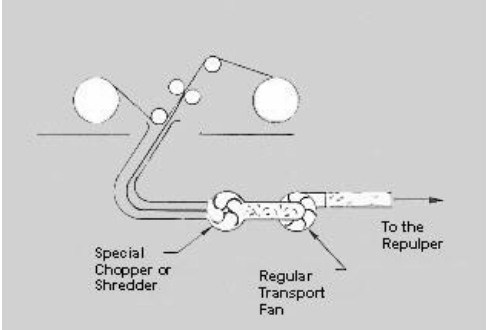


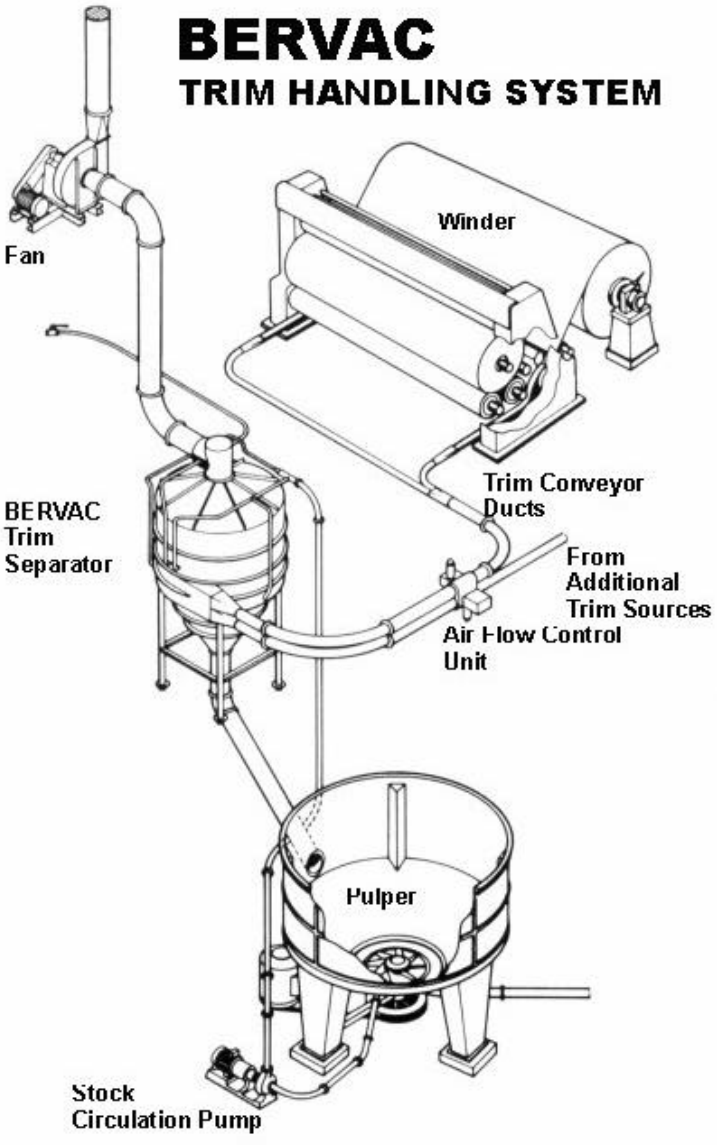
Figure 4: Combination Shredder andTransport Fan System

The one common set back of conventional systems is the need for effective repulper ventilation, because of the adverse effects of discharging high rates of transport air into the repulper.

Vacuum Trim Conveying Systems

Due to increasing winder speeds, stricter noise control and aims to conserve energy, there has been a definite trend towards selecting vacuum trim conveying systems.

A vacuum trim system conducts continuous trims into a separator in the vicinity of the repulper. Air for the pneumatic trim transport enters the separator and is removed by a standard centrifugal fan. If the repulper is used for trims only, then the separator is installed directly over the repulper, which then operates under a slight vacuum. If the repulper is used for other broke as well, trims are flushed into the repulper from an individual separator.



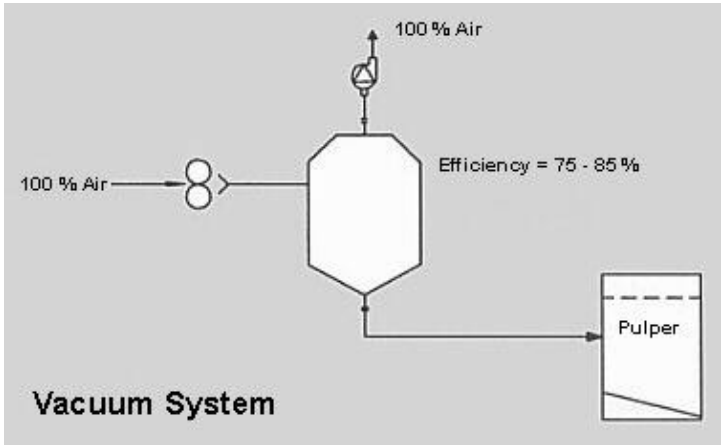


Figure5: Vacuum Trim Handling System

The BERVAC Trim Conveying System

The BERVAC system uses a high-efficiency centrifugal fan, which generates the air flow necessary to convey the trim. This type of fan system consumes less power than conventional fans and/or injectors. Other advantages of the BERVAC system include less noise and superior operational reliability, because the interaction between paper and air is less violent than in a conventional trim conveying system. Automatic trim chute air velocity controls allow the BERVAC system to operate quietly at all winder speeds.

The BERVAC system eliminates dust problems at the repulper and along the trim duct route, because the trim is moved under vacuum. The emission of humid air from thepulper is similarly eliminated. This feature is of particular importance at the repulper where delicate instrumentation devices are located. In addition, the BERVAC unit may be located quite far from the machines it serves allowing the repulper to be chosen from a wide range of alternatives.

Figure6:Six Winders are Connected to this Single Bervac System

In principle, an infinite number of winders may be connected to a single BERVAC system. In fact the system efficiency improves as more winders are connected to it. The trim removal rate from each winder is individually adjusted by means of air velocity control equipment.

The total energy consumption of a BERVAC system is so low that in most cases, this alone would justify the investment. Additional advantages to be gained are as follows: decreased maintenance costs, lower noise level and a better working environment. The most important advantage of the BERVAC system, however, will be seen at the winders - a reliable, efficient and tidy trim conveying system which will aid in the production of high quality rolls at peak winder performance.

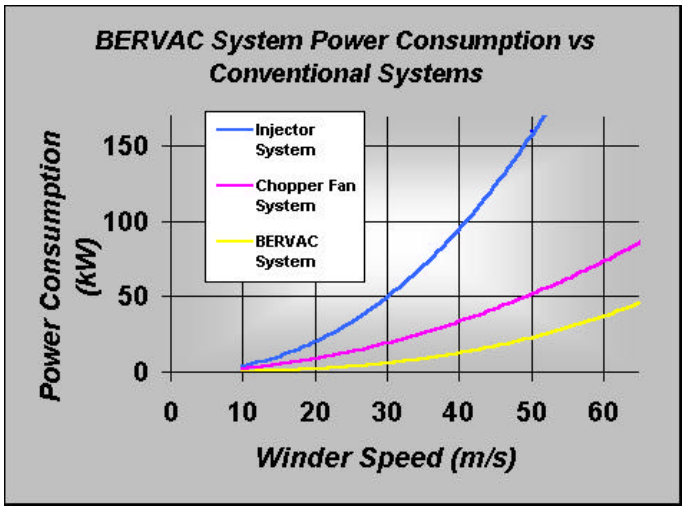


Figure 7: Energy Consumption of BERVACSystem Compared to Conventional Systems

Special Design and Operating Aspects of the BERVACSystem

Well designed trim chutes are of vital importance to the performance of a trim handling system. On many older winders, especially rebuilt ones, the design of the chutes was a trial and error basis, not always leading to the desired results. Increased winder speeds have made it necessary for winder manufacturers to study trim dynamics. Because of this, new winders are generally equipped with efficient, well designed trim chutes. Trim chutes are designed according to the initial trim tension, while trim ducting is designed mainly in accordance with the trim weight and width. Due consideration must also be given to conveying distance and balance between the different machines on the vacuum system. The components must be compatible with respect to the air velocities required at each winder.

Another aspect which cannot be overlooked is the correct design of the duct fittings and joints. A trim duct that has been properly designed, will allow for long conveying distances with a minimum power consumption.

An important part of the BERVAC system is the automatic air velocity control for the trim chutes. The trim chute air velocity is automatically adjusted according to winder speed, from a minimum velocity for machine speed. The minimum velocity is selected so that the trims lie still in the chutes eliminating noise caused by trim flutter.

Although the air velocity control operates using chute bypass, the special design of the bypass valve does not significantly increase the air rate through the separator and fan at open bypass conditions. In some favourable cases, the total air rate may even be reduced when the bypass valve is open. If there is only one winder connected to a BERVAC system, air velocity control is implemented by means of an inlet vane control at the fan. When a winder connected to a BERVAC system is shut down for a long period of time, its trim duct may be closed, reducing the overall power consumption of the system.

At the separation unit, trim and recirculated stock from the bottom of the BERVAC separator are fed into the repulper below its stock level, by means of a connecting pipe. In cases where the repulper is used for trims only, the separator is integrated with the repulper. This allows the repulper to also operate under vacuum. Stock is recirculated from the repulper and is used for knocking down and flushing the trim into the repulper. Recirculation may in some cases, be deleted depending on the design of the repulper. A portion of the repulper dilution water, or fresh water may be introduced into the separator to aid in retaining dust and paper fragments and keeping the separator interior clean.

A non-integrated BERVAC separator may be located some distance from the repulper, provided that sufficient vertical distance be maintained between the separator and the repulper stock level.

The vacuum required by the BERVAC separator is normally generated by means of a standard, medium pressure, centrifugal fan. The exhaust ducting and fan may be arranged at any convenient location in the building. The fan is usually installed in the basement, on the mezzanine, or on the roof.

In most cases, a BERVAC system can use existing control systems in the mill. The repulper level control can maintain the stock level within the limits necessary for the trim handling system operation.
The consistency control assures undisturbed stock flow for the knock-down showers. The air velocity control is connected to the machine speed transmitter, and the trim duct shut-off dampers are connected to the machine electrical shutdown functions.

Summary

The rate of trims produced in a paper converting plant may momentarily be more than ten times the average rate. This presents a substantial challenge to trim conveying equipment. Vacuum trim handling systems, such as BERVAC, are replacing conventional trim conveying equipment around the world.

In a concentrated trim handling system, the design trim handling rate should not be the cumulative maximum design output of all winders, i.e. the effect of decreased paper machine speed, when producing heavier grades of paper, should be accounted for with a reduction in winder speed. Correct design and dimensioning of the trim handling system is a must. Moreover, the components must be compatible with those supplied with the winder.

The development of winders is making the conventional trim handling system obsolete. Vacuum trim handling systems meet today's requirements in several ways:

- increased winder speed capacity
- conservation of energy and
- occupational comfort.