

The information and data contained in this document were prepared by a technical committee of the Association. The committee and the Association assume no liability or responsibility in connection with the use of such information or data, including but not limited to any liability under patent, copyright, or trade secret laws. The user is responsible for determining that this document is the most recent edition published.

CAUTION:

This Technical Information Paper may require the use, disposal, or both of chemicals which may present serious health hazards to humans. Procedures for the handling of such substances are set forth on Material Safety Data Sheets which must be developed by all manufacturers and importers of potentially hazardous chemicals and maintained by all distributors of potentially hazardous chemicals. Prior to the use of this technical information paper the user should determine whether any of the chemicals to be used or disposed of are potentially hazardous and, if so, should follow strictly the procedures specified by the manufacturer as well as local, state, provincial, and federal authorities for safe use and disposal of these chemicals.

Control of stock activity on a fourdrinier table

Scope

The scope of this Technical Information Paper is to give an overview of the various factors that affect stock activity on a fourdrinier table.

Safety precautions

No safety precautions have been specified for use with this Technical Information Paper.

Introduction

The small scale motions seen on the stock surface of a fourdrinier table are referred to as “stock or table activity.” Small disturbances originating in the headbox and slice area can amplify as the stock moves along the table. Stock activity can range in amplitude from slight ripples to high amplitude spouts that neck down and eject drops into the air (e.g., see Figure 1). Some activity is often viewed as positive for improving formation and other sheet properties, while excessive activity can be detrimental to sheet properties and can also lead to defects, such as light spots, under certain circumstances.

At jet impingement and as the fabric deflects over the various drainage elements, surface disturbances will be subjected to changes in centripetal acceleration. These acceleration changes are the drivers for spout growth. These deflections generate local curvatures that generate centripetal accelerations on the fluid that drive fluid normal to the wire, resisted by surface tension forces and viscosity. Details on the mechanisms involved may be found in references (1-5). Acceleration forces will increase as the square of web speed and are inversely proportional to the local radius of curvature. Spout growth will increase with increasing machine speeds, increasing jet impingement angle, and with increasing fabric deflections at the various drainage elements.

Factors influencing stock activity

Initial spout activity over the forming board will depend on surface disturbances on the free jet, the jet impingement angle, and jet speed. Greater jet roughness will lead to larger amplitude activity. Jet roughness is largely determined by headbox design and also by the flow rate through it. Higher slice flow rate will lead to greater jet roughness and higher initial table activity. Higher impingement angles and higher speeds will lead to greater initial table activity.

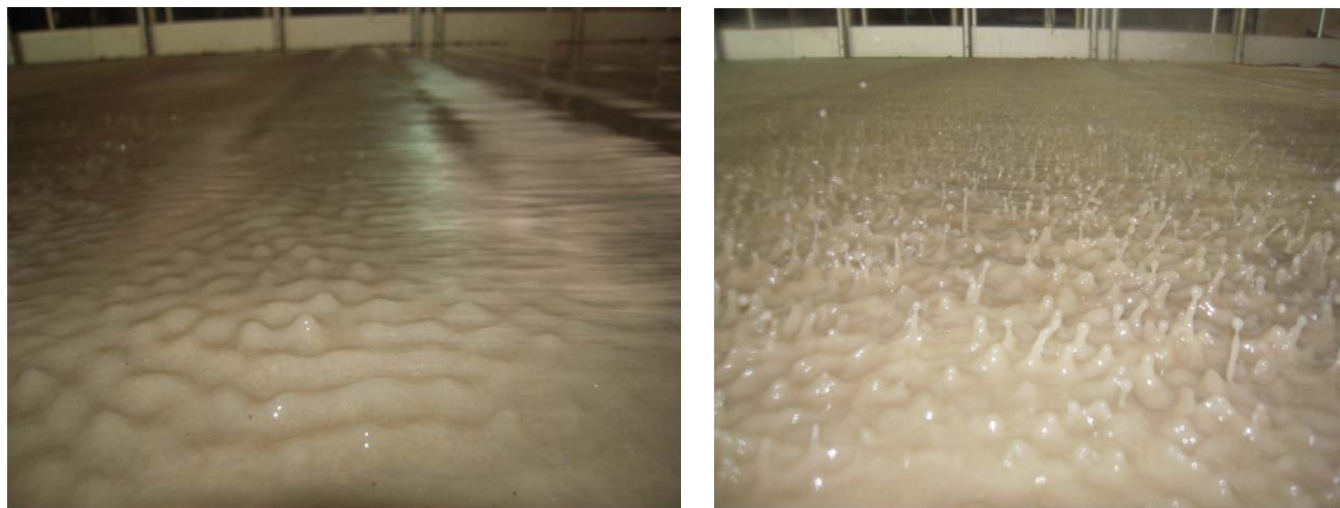


Fig. 1. Examples of stock activity ranging from ripples to higher amplitude spouts.

On low speed, heavy weight grades, inducing stock activity may be difficult. Traditional tools for “triggering” stock activity at low speeds are by introducing surface disturbances through use of serrated slice lips or using formation showers.

Suction pressure at the various table elements will lead to fabric/stock deflections which will affect activity. Standard gravity foils generate vacuum pulses that deflect the wire. Higher angle foils lead to greater deflections and higher stock activity. Commercial, pilot machine, and computational results have shown that equally spaced foils (known as having a harmonic table) will reinforce spout amplification from foil to foil and lead to greater table activity. Varied spacing will not be as effective at generating spout growth and will “detune” a table. Lower fabric tension will lead to increased deflections and higher activity levels. Decreasing blade spacing and increasing speed will lead to finer scale activity.

Another commonly used tool for generating activity is to use a blade that generates agitation by having a diverging angle similar to a standard foil, followed by a converging angle back to the fabric level, forcing stock re-entry into the fabric/suspension. The combination of the fabric deflection and stock re-entry has proven to be a very effective tool for increasing activity. There are numerous types of blade designs with different profiles that have been used historically that can impact table activity through related deflection and/or stock re-entry effects.

For vacuum assisted elements, a widely used method to control fabric deflection and shear has been to use the “broken plane” blade set-up on low vacuum boxes. In these set-ups, there are support blades at the table level, with intermediate control blades whose top faces are below table level. As illustrated in Figure 2, vacuum will pull the fabrics down to these blades and also into the slots between the blades, leading to deflections that drive stock activity. Both flat blades and agitation style blades with the foiling and re-entry sections have been used in the control blade positions (fixed and variable position styles are common). The lower the position of the intermediate control blades, the greater the fabric deflection and table activity. Higher levels of vacuum can increase activity if slot widths are sufficiently high to allow fabric deflections. See Table 1.