**EQUIPMENT ENGINEERING**
**Reprinted from the International Fiber Journal August 2004**

# Solving the Crimper Enigma

**Part I**

*By Van Durrett, Vice President, DM&E Corp., USA*

*e`nig´ma something that is mysterious and seems impossible to understand completely.*

Many staple fiber manufacturers find the crimper to be an enigma. Management sees it as a machine that can make or devour money, maintain or disrupt schedules, enhance or destroy fiber, and eliminate or create customer complaints. Process engineers can be perplexed by its idiosyncrasies. For crimper maintenance personnel it can be the focus of many hours of demanding work with a machine that seldom responds to repeated pleading for cooperation.

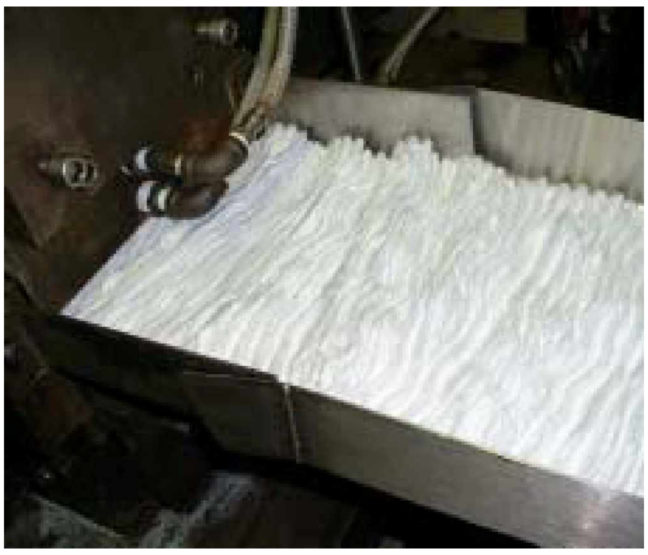
To begin to reveal the mysteries of the crimper, in this article we will examine the causes and cures for tow input failure. In subsequent articles in this series, we will address the care and feeding of crimper rolls, stuffing boxes and components. We will talk about crimper maintenance, selection of materials, considerations for stuffing box geometry, and even reveal the reason most crimper rolls crack.

## TOW INPUT FAILURE

Each year we conduct in-plant seminars and audit staple process lines. Our engineers address many crimper issues. By far, the most confusing problem is the failure of the crimper to pull the tow band into the crimper. Some call it "dropping the tow," or "losing ends." Subsequently, the tow packs or "jams" in the crimper, processing stops and valuable time is spent getting the line running again.

Most crimper problems are NOT problems with the crimper. Barring a mechanical failure or improper

*Crimper entrance*



*Crimper exit*

adjustment, crimper problems are usually a reaction to pre-crimper tow conditions. Such is the case with tow input failure.

The two major causes of tow input failure are improper tow presentation and improper pre-crimper tow tension. We have customers who operate crimpers for months without experiencing a tow input failure. How can this be? These customers have proven that tow presentation and proper pre-crimper tension can result in less downtime, and increased efficiency.

## TOW PRESENTATION

Crimpers require very rigid structures to maintain the small clearances necessary for proper operation. The roll support arrangement does not allow the rolls to adapt to uneven surfaces. If you were to place a block of wood between the crimper rolls at one end and close the rolls with operating pressure, you would find that the unblocked end will only close a few hundredths of a millimeter more than the blocked end. It follows that if the tow is presented to the crimper with a millimeter difference in thickness, the crimper cannot grip the tow uniformly and force it into the stuffing box. When the thicker tow is gripped and the thin tow slips, the tow will turn in the stuffing box and the crimper "jams."

Whether you process tow from a creel or at the end of a drawline, proper tow presentation to the crimper begins at the start of the line, not at the end. The final tow band begins as a number of smaller tow bundles fed from a spinning system, or from a collection of cans or wound packages.

Here is a checklist to examine your process.

1) Do you slightly pre-tension each subtow to assure it guides properly and remains in place through the process?
2) Are the subtows carefully placed on the first roll with individual guides?
3) Do the guides distribute the tow uniformly on the roll and ultimately control the width of the tow at the crimper?
4) Do the operating procedures define exactly how the subtows are placed?
5) Have you eliminated perpendicular guide bars that force the tow to bunch on the edges?
6) If you stack multiple tows, is the stack procedure defined to produce a uniform pre-crimper tow?
7) Does the tow enter the crimper at nearly the same width as the crimper rolls? Or, are you depending on the crimper entrance guide to squeeze the tow down, rolling the edges?
8) Is the tow exiting the stuffing box moving uniformly across the width of the exit? Does one side move faster than the other because there is more tow on that side, or in the middle?
9) Is the crimp level across the box uniform? High and low crimp distribution reveals thick and thin tow.

*Eyeboard*

### PRE-CRIMPER TOW TENSION

For the most part, tow presentation is a visual exercise. Uneven tow distribution on rolls, and even at the crimper entrance is obvious. Tow tension on the other hand is not so apparent. Once the tow band is tight, it is impossible to visually determine the actual tension. Pre-crimper tow tension should only be as high as is required to guide the tow through a tow stacker. And, if being delivered from a drawline, the tension should be only high enough to maintain contact with the final roll of the drawline.

The crimper cannot break or draw the tow band. A 1million denier [111 ktex] tow band has at least a 6000 Lbf [24kN] breaking strength. If this same tow band is inserted into a crimper, and the crimper pulls the tow with normal roll pressure, the crimper can only pull with a force of 2000 Lbf [8kN].

In addition to pulling the tow, the rolls are also required to force the tow into the stuffing box. If the required traction to pull the tow and to stuff the crimper box exceeds the available traction, the tow will slip between the rolls. When the rolls spin against the tow, the coefficient of friction becomes lower, and even less grip is available.

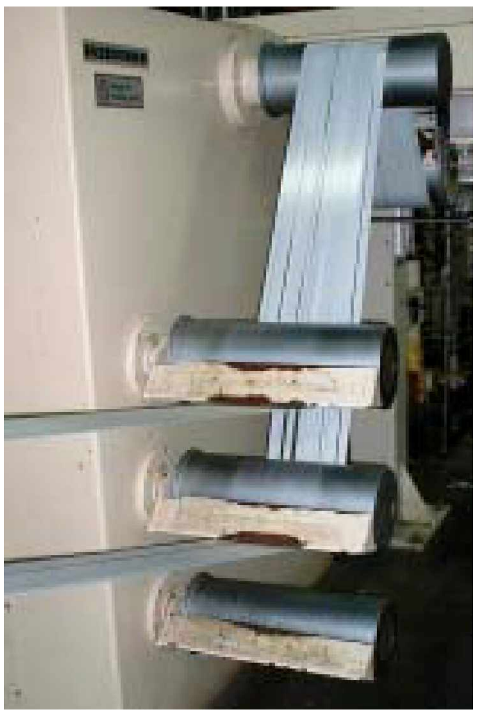
Every crimper installation should be equipped with a dancer or tension roll to measure pre-crimper tension. The tension value is then integrated into the control of the crimper speed, and proper tension can be maintained. Pre-crimper tension should not exceed 250Lbf/million denier [10N/ktex]. Control of pre-crimper tension frees the crimper to crimp fiber.

Unfortunately, many installations have ignored this guideline. Instead they set a maximum torque or amperage on the crimper motor drive. The horsepower required by the crimper is a combination of crimper speed, total denier, denier per filament, the fiber's short column bending modulus, stuffing box coefficient of friction, temperature of the tow, and many other variables in addition to the incoming tow tension. It is impossible to control crimper speed and pre-crimper tension in this manner.

Other installations have established a crimper speed slightly higher than the pre-crimper tow speed. This practice assures that the crimper rolls are always slipping on the tow since they are always running faster than the tow.

The plant manager, with this crimper control, is continually paying to have his worn crimper tires resurfaced. He is like the father of the teenager who impresses friends by spinning the tires on the family car.

Using a dancer or tension roll and integrating the tension values into the crimper speed complicates the drive technician's job. It may be easier for him to avoid this complication, but it shortens the life of the crimper roll surfaces, and accentuates the slight-



*Tow stacker*

est irregularity in tow presentation. We have measured crimper pre-tension in some cases exceeding 1500Lbf/million denier [60N/ktex].

Here is a checklist to examine your process.

1) If the system employs a dancer, is the dancer operating in a proper control range? Is it pulled to the end of travel?
2) Does the dancer or tension roll actually control the pre-crimper tension? Has the system been bypassed?
3) Does the surface speed of the rolls match the speed of the last roll on the drawline?
4) Is there a written operating procedure for setting pre-crimper tension?
5) If the tension is being controlled, what is the tension setting?

## SOLVING THE ENIGMA

Some plants already exercise good tow presentation and have their pre-crimper tension under control. This discussion of tow input failure will only reinforce what these operations already know and practice. They will question why tow presentation and pre-crimper tension control that is so obviously critical to crimper performance even warrants review.

Other operations will examine their process and see corrections they can make to tow presentation and pre-crimper tension. Crimper performance will improve, and they will question why it had not been done sooner.

We have begun to explain the crimper with an examination of tow input failure. Worldwide competition for the staple fiber market is growing. To survive in this market you must solve the crimper enigma. **IFJ**

The author may be contacted at DM&E Corp. Tel 1 704 482 8876. Email: vand@dmecutter.com