



Lamination Techniques for Converters

Technical Bulletin

April, 2017

Lamination Process

Basic Requirements for Good Results

1. Clean substrates.
2. Selection of best adhesive for the job.
3. Proper equipment and lamination conditions.

Lamination Process Conditions

Problems

Wrinkles, misalignment, poor bond, cross web curl
Internal laminate stresses, down web curl, edge lifting
Wrinkles, bubbles, alignment
Weak bond, adhesive ooze, steering trouble, wrinkles
Trapped air bubbles, wrinkles, adhesive picking

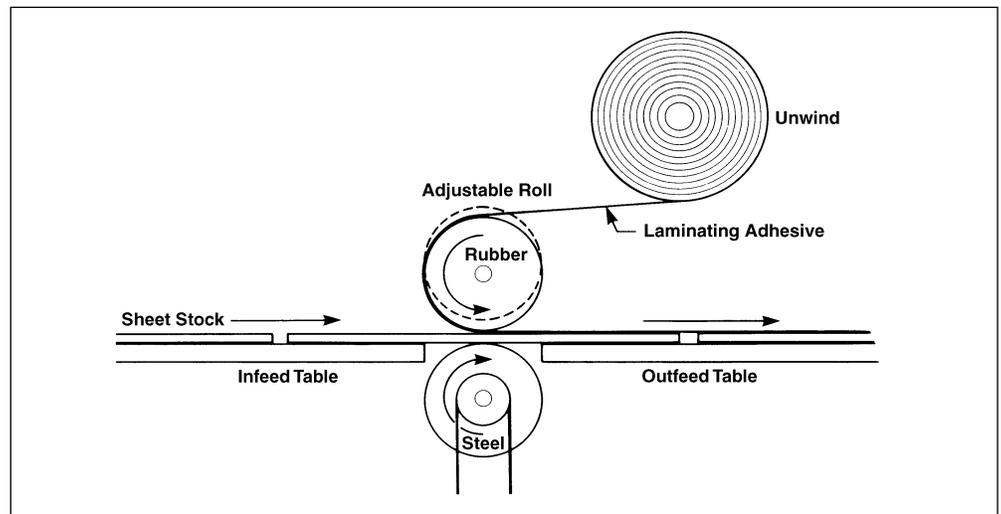
These problems can be solved by adjusting the following

Roll Condition, tension control
In and Out Feed, tension control
Thread Up
Nip Adjustment, tension control
Contact Point

A few basic requirements must be followed.

There are several variables that can affect proper lamination conditions. Most of these variables are a result of laminator condition and adjustments. These problems can cause completely unsatisfactory laminations.

Typical Lamination Machine

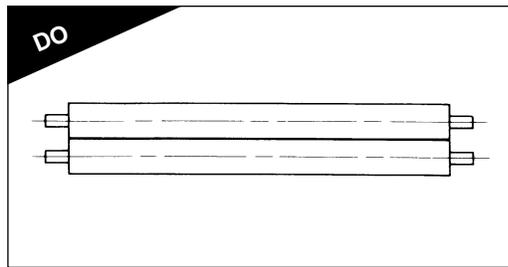


With a typical laminator, there can be many variations, but all should use this basic thread up.

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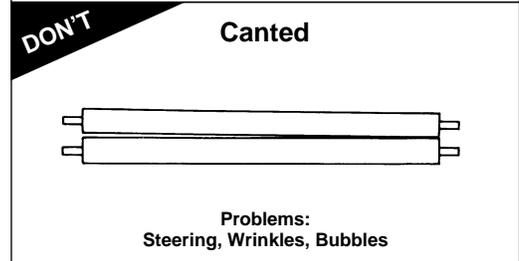
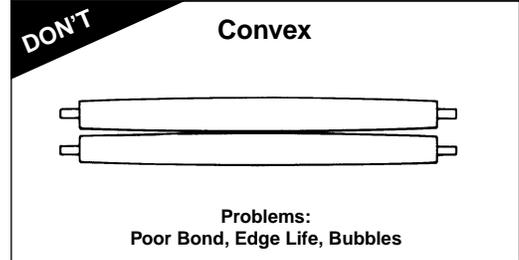
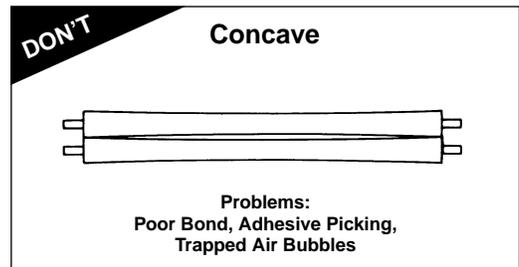
Roll Condition



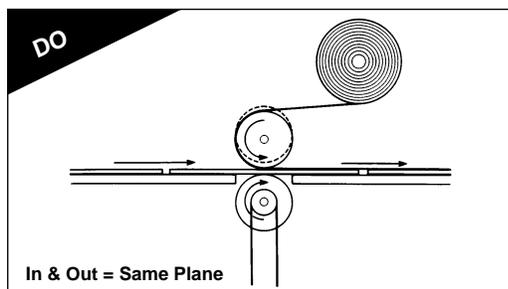
Smooth, clean, parallel, properly adjusted pressure.

Good lamination must start with nip rolls in excellent condition and adjustment. The upper and lower rolls should be smooth, clean, parallel, and have left and right side pressure adjustability.

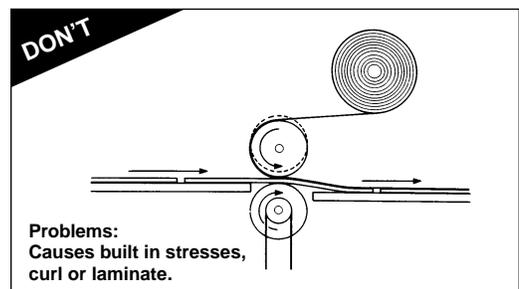
Concave, convex, or canted rolls will cause problems such as poor adhesion, adhesive picking, lifting, wrinkling, trapped air bubbles and web steering difficulty.



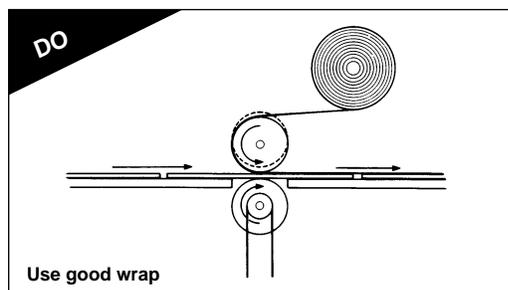
Feed – In & Out



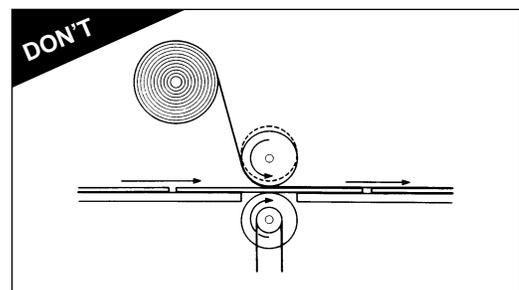
The in and out feed tables must be at the same level or plane and should be of adequate length to hold at least one sheet of substrate. There will normally be curl stresses if the out feed table is positioned as shown above.



Thread Up – Roll Wrap



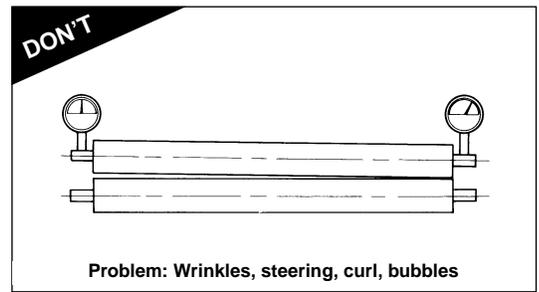
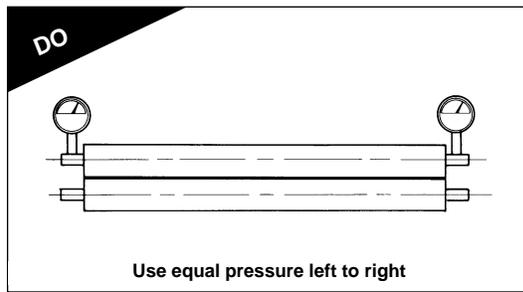
It is also very important that the roll of laminating adhesive be threaded into the machine so that there is a good smooth wrap around the rubber roll. This will smooth the adhesive and liner and prepare it to be laid down on to the substrate. A lesser degree of roll wrap will not accomplish this and wrinkling and bubbling may result.



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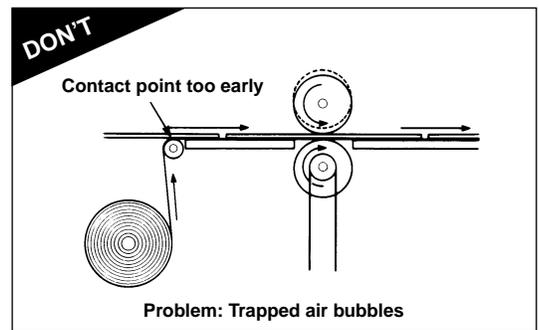
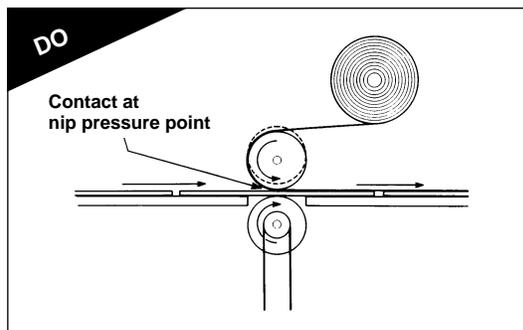
Nip Pressure



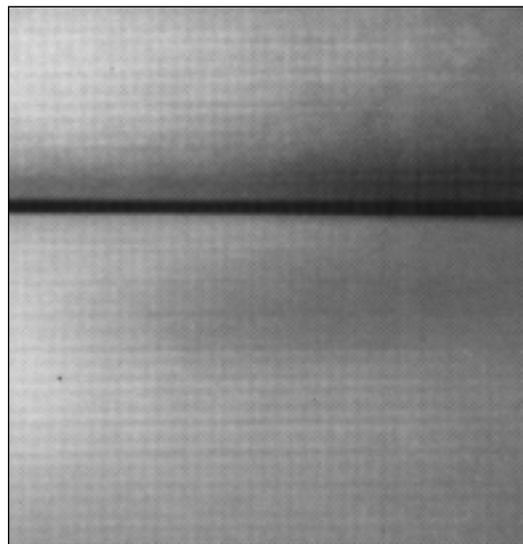
Nip roll pressures can be controlled either manually by screw downs or air cylinders. The best design would be single control for simultaneous and uniform adjustment of both actuators.

The major problems of non-uniform pressure as shown (exaggerated) here, are wrinkling and steering of the web.

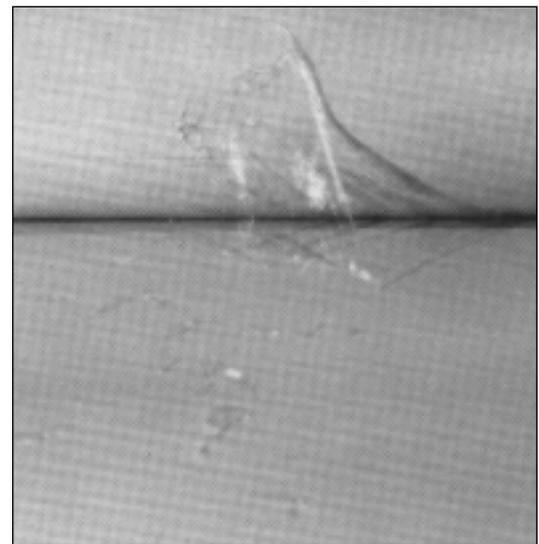
L/A – Substrate Contact Point



A common application problem is caused if the technique allows the laminating adhesive to contact the substrate prior to the nip pressure point. Air entrapment can only be minimized or eliminated by keeping the adhesive off the substrate until it enters the nip contact point. The diagram on the left shows how air can be trapped by premature non-pressure contact of the laminate materials. The air will then remain trapped in the laminate as it passes through the nip and trapped air results in adhesive picking during liner removal.



This photograph shows the liner being removed smoothly from a good lamination.



This photo shows the adhesive picking or lifting problems due to an entrapped air bubble. This is a common cause for reject parts.

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General Nip Roll Characteristics For PSA Laminating

- A. Top Roll = Rubber or elastomer**
Urethane
Neoprene
Silicone
35-40 Shore A durometer hardness for urethane or neoprene
60-80 Shore A for silicone
Top roll applies pressure to laminating adhesive and rubber allows deflection to compensate for caliper variations.
- B. Bottom (back-up) Roll = Steel or hard rubber**
Nickel or chromium plated to resist corrosion and nicks, and easy to clean.
- C. Correct roll diameter to roll width ratio is required to prevent roll deflection.**
Generally 6-8" roll diameter is required for 30" wide laminator.

When laminating an adhesive to a substrate (such as aluminum or polycarbonate sheet), utilize a firm (steel) back-up roll and a softer elastomeric upper pressure roll to compensate for any caliper variations to give a more uniform pressure distribution.

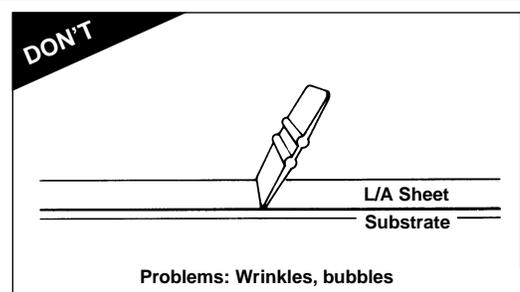
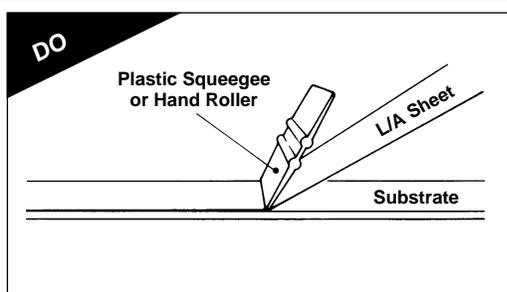
The roll diameters are typically 6-8". This is a design factor which minimizes roll deflection across the length of the roll.

Nip Roll Pressure

- Depends on adhesive and substrate
- General = 1³/₄ to 20 pounds per lineal inch (PLI)
- Screw adjusters
- Air cylinder adjusters (preferable)
- Lower pressure for softer adhesives and fragile substrates
- Higher pressure for firm adhesives and substrates
- Must be uniform across web

Roll pressure is best determined by trial, and depends on the firmness of the adhesive, type of substrate and rolls. Roll pressure must be uniform across the web to prevent wrinkles and to give the proper adhesive contact and bond strength.

Hand Lamination For Small Parts and Difficult Registration



Often small parts, low volume or precise registry of complex die-cut-out parts preclude the use of a nip roll machine lamination.

In simplified form, using either a hand plastic squeegee or small hand roller, the process would look like this. You are using the same principles of nip roll lamination – firm, uniform pressure, keeping the adhesive off the substrate until pressure contact is made to prevent entrapment of air.

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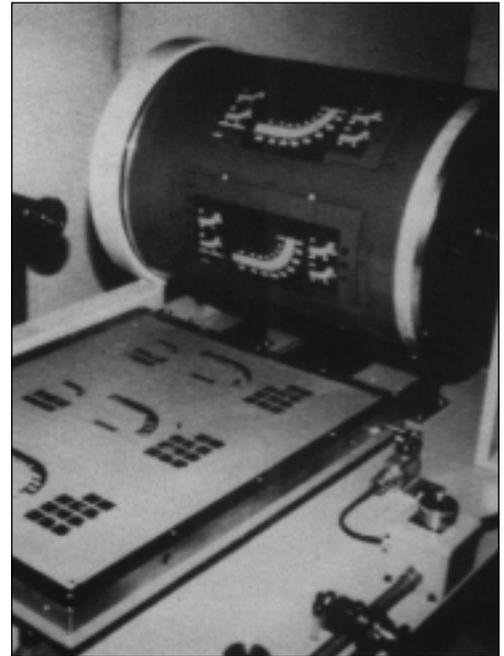
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Precise Registry Machine

- Provides precise registry of complex die-cut adhesive to substrate.
- Eliminates air entrapment of hand lamination.
- Faster production rates.

The preferred way to apply complex small parts, requiring precise registry would be in a machine designed to simulate the nip roll conditions we have described.

Here is a type of laminating press for precise registration and high quality lamination of selectively die-cut adhesive and graphic-overlay parts.



Summary

To Laminate

- I. Clean substrate surface.
- II. Always laminate to exclude air entrapment.
- III. Provide adequate and uniform nip roll pressure.
- IV. Provide good roll wrap, (i.e., 180°), web tension, and steering for a wrinkle free laminate.
- V. Allow minimum adhesive dwell time of 15-30 minutes before liner removal, 24 hours is preferable.

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Lamination Techniques for Converters

Summary (continued)

The following is a partial listing of manufacturer's or suppliers of lamination equipment.

Laminator Manufacturer's List

- **Press Type Laminators**

Jesam Industries, Inc.
Sechelt, B.C., Canada
604.885.7010 / jesamind@hotmail.com

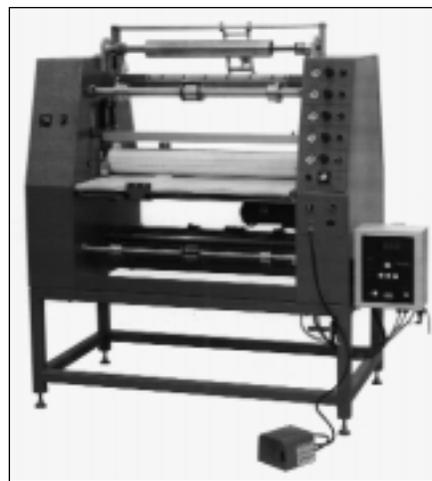
- **Nip Roll Type Laminators**

Advanced Greig Laminators, Inc.
Madison, WI
608.223.1380 / www.aglaminators.com

Innovative Machines
Jenison, MI
616.669.1649 / www.innovativemachines.com

A basic variable speed PSA Laminator can be purchased with optional equipment such as heated rolls, extended tables, air brakes for unwinds, and silicone rolls. It is suggested you contact a laminator manufacturer to design equipment for your specific needs.

Platen press type machines with vacuum hold down of sheets are also available for more precise sheet to sheet or part lamination work.



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