

Avery Dennison® Instructional Bulletin 4.06

Processing Tips for Laminating Films (DOL/SL)

Revision 4

Introduction

This bulletin provides recommendations for the application of Avery Dennison clear digital overlamine (DOL/SL) films, which provide additional abrasion and weathering resistance to digitally printed graphics and images. The procedure for applying premask, packaging and converting films is also covered. It is also imperative that you understand, and practice the proper safety and operating procedures recommended by the manufacturer of your laminator.

Overlaminating printed images with transparent overlamine films is a necessary step to provide maximum performance and durability of finished graphics. Overlamination provides gloss, matte, satin, colour depth, durability and graphic protection.

Laminating and Premasking Equipment

To properly apply Avery Dennison overlaminating (DOL/SL) films, and approved premask, a lamination machine will be required. The information contained in this bulletin provides an overview of the use of Avery Dennison DOL/SL films with the proper equipment. For specific information regarding equipment, follow the manufacturer's instructions or consult with the manufacturer's technical service department.

Types of operation:

- **Manual** - A manual laminator requires the top roller movement and pressure to be applied by hand. On some low spec equipment, the movement of the media through the laminator might also be controlled by hand.
- **Automatic** - On an automatic laminator the top roller movement and pressure is controlled electronically. Typically these are pneumatic laminators run with an air compressor and can accurately control the required pressure to deliver perfect pressure every time.

Types of laminators

- **Cold** - These are the most common laminators in the market due to their great value for money. You do not need heat for signage DOL films but it does have some advantages (see Heat Assist below). Cold laminators will leave a slight "Silver" finish on the graphics which is air trapped between the adhesive of the laminate and the printed surface, this will dissipate over a day or two once the adhesive wets out into the trapped air pockets.
- **Heat Assist** - These laminators have larger rollers (around 200mm diameter) and are internally heated (up to 50°C typically). These are made for signage DOL films and deliver the best possible result, the larger and slightly softer rollers smooth out the film more effectively and you get less issues with creases. In high production environments these are the most popular laminators.
- **Thermal** - Also known as Hot Laminators, these are not designed for signage but can be used if needed, they are designed for laminating wide format posters in the print industry. Their rollers are often small (50~100mm diameter) and much harder than Heat Assist laminators which makes them less forgiving. The Heat function can be used at very low temperatures around 35°C but care must be taken as these machines can run extremely hot (well over 100°C).

Laminator set-up

In addition to the set-up procedures and tools recommended by the laminator manufacturer, it is also recommended to check the following.

- **Install Location** - Laminators should always be installed on a solid and level floor. Allow for at least 1m of space on all four sides of possible, this will make loading and unloading rolls easier.
- **Power Supply** - Typically cold laminators do not require any additional power over your standard 12 amp supply but heat assisted can sometimes require a 15 amp fuse for the heater unit.
- **The Rollers** - On new equipment, this should already be checked by the equipment installer but on second hand equipment it is a good idea to check the rollers are parallel to each other and don't have any damage on them. E.g. cuts or slices.
- **Nip Impression Paper** - Nip impression paper is a wax transfer paper used to determine the evenness of the nip 'footprint' across the width of the laminating rolls. More on this below.
- **Lift The Top Roller** - It is good practice to always lift up the top roller when you have finished your job or if in a production environment then at the end of the day. This will stop a potential "Flat Spot" from appearing in the rollers as they sit pressed against each other for prolonged periods of time.
- **Cutting** - Cutting on the laminator roll can cause major damage to the roll and affect finish quality, it is good practice to never use knives around laminators. Always use an Avery Dennison Snitty for trimming media and backing liners on laminators.

Nip Impression Paper

Nip Impression Paper is a wax transfer paper used to determine the evenness of the nip 'footprint' across the width of the laminating rolls. If the footprint is inconsistent (too heavy on the edges, too heavy in the middle, or too heavy on one side) you will get poor adhesion of the overlamine to the print media. Bubbles and/or wrinkles will also most likely occur.

Alternatively, an inexpensive nip impression paper can be made by printing three solid black images on plain paper in a xerographic copier or printer. The laminator rolls must be hot to perform this test. Mark the strips left, right, and middle and insert the sheets into their respective positions between the top and bottom heated rolls. Close the nip momentarily (about 10 seconds). Remove the sheets and examine the consistency of the impression across the width of the laminator. If necessary, adjust or repair the laminator according to the manufacturer's instructions.

Prior to laminating

Prior to beginning lamination, ensure the following:

- Laminate (DOL/SL) you are using is matched to the print film (MPI/SP) and you have enough laminate for the job.
- The printed media is properly cured, solvent free and dry.
- You have masking tape, a knife (only used for setup), an Avery Dennison Snitty and two spare cores to set up the laminator with.
- The rollers of the laminator are clean and not damaged. Any imperfections will show in the finished product.
- The rollers are at room temperature, do not turn on your heat just yet as this makes it harder to set up as the laminate will become soft if it sits on a heated roller.
- The print media to be laminated is in the centre of the feed mandrel.

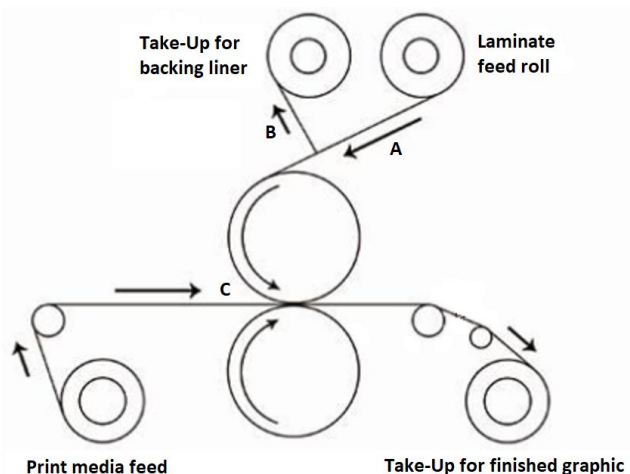
Webbing up the laminator

The following general recommendations apply to Avery Dennison digital print media (MPI/SP) with Avery Dennison laminate films (DOL/SL). For specific instructions relating to equipment operation when overlaminating, please refer to the instructions provided by the equipment manufacturer.

There are many types of laminators and ways to web up a laminator, the instructions and image on the following page show one way that works with a large majority of equipment both Cold and Heat Assist.

The steps to follow

1. Open the laminator main rollers "C" as wide as they can go.
2. Load the laminate roll onto the Feed Roll location as close to centred as possible, the laminate when fed in the direction of "A" below should have the backing liner facing upwards.
3. Install an empty core (same width as laminate) onto the Backing Liner Take-Up location.
4. Using your masking tape lock the laminate with the backing liner (not separated yet) to the core using 3 points of contact. Start in the middle first and then do each side around 100 mm in for the edge. Give the Take-Up roll 2 full turns so the material overlaps the masking tape to lock it in position. Make sure that the laminate coming from the Feed Roll is perfectly straight to the Take-Up and the tension is even. If it's not you will need to reset and try again.
5. Using your knife with a brand new blade you will need to cut a straight line along the very top of the laminate without cutting through the backing liner. This will allow you to separate the laminate from the liner exposing at this stage around 30~40mm of adhesive.
6. Using a metre ruler (or similar long and thin object) place on top of the exposed adhesive to give yourself a hard edge to grip instead of just vinyl.
7. Using the ruler feed just the laminate down and through the "C" opening and back up over the laminate feed roll (the adhesive is exposed outwards so should not stick to the feed roll). You may need to wind the Take-Up roller by hand to take up any slack in the paper.
8. Align the webbed laminate edges with the edges of the laminate feed roll and tighten the tension with your hands, the end result should be straight laminate through the machine with no waves and even tension across all surfaces. Masking tape the laminate down with 3 points so it doesn't move.
9. Load your print roll onto the Print Media Feed mandrel. Make sure it is centred.
10. Very carefully feed the print through opening "C", being careful not to touch the print media to the exposed laminate and also make sure that the print media is on the back landing area and not wrapping down around the laminator bottom roll (common issue). If you have enough feed media now is also a good time to web it onto the Take-Up mandrel for finished graphics.
11. Checking first that your Print Media is centred and straight, you can now lower the top roller onto the print media joining the laminate and print media together. The excess exposed laminate at the back of the machine can now be removed (carefully cut the excess away) and you are ready to run. It is recommended to always start on a slow speed setting and confirm everything is running smoothly before speeding up.



Lamination Process Notes

The use of heat is generally not required when overlaminating with Avery Dennison laminate (DOL/SL) films. Should heat be required to limit silvering, it is recommended not to exceed 35°C on the top or bottom roller.

For further tips on limiting silvering, please read the Troubleshooting section of this guide.

After applying any overlaminates, allow the graphics to sit for at least 24 hours before use in ambient conditions (22°C / 50% RH). This allows the overlaminate’s adhesive to reach a functional bond with the film it is applied to, critical to ensure proper adhesion between the two films.

Laminators should be run with as little tension as possible. The Laminate Feed Roll and Print Media Feed Roll should be set up with just enough back pressure to stop the rolls free spinning. The Backing Liner Take-Up should have just enough tension to take up the liner without pulling it tight, a pulse back and forth in a similar location to the above graphic means you have the right tension.

If you see waves, wrinkles, bubbles or similar please read the Troubleshooting section.

Having overhanging laminate is typical and this can be removed with a knife before unrolling the Print Media Take-Up Roll. Note: If this becomes an issue for you, most distributors offer a cut down service where a 1.52m wide roll of Avery Dennison DOL can be trimmed to 1.49m (or your preferred width) which will eliminate the overhang but you now can’t laminate full width printing.

Laminated graphics are less flexible when joined as they are now twice as thick, if possible feed the laminated graphics onto a flat table and cut into sheets.

To hand feed smaller printed sheets into the laminator, web the laminator top section as described in the above section but instead of loading your print media you can load some spare backing liner or a BOP sacrificial liner into the laminator to protect the bottom roller from contacting the adhesive.

Always lift the top roller when you have finished using your laminator to avoid getting a flat spot on the rollers.

For optimum results when laminating, the following settings are recommended:

Avery Dennison - DOL/SL	Pressure	Speed	Roller Temperature
DOL 1000Z / 1000 Max / 1400Z / 1400 Max / 6460	50-70 psi (350-490 kPa)	0 - 2.5 m/min	0-35°C Only use heat if needed and do not exceed this temperature.
DOL 2000 / 2100 / 2200			
DOL 2800 / 2900			
DOL 2960/ 2980			
DOL 3000 / 3100 / 3200			
SL 4530 / 6460			
DOL 5900 / 6000			

*Good condition surfaces should meet AS/NZS 2598.1.1997, level 5 finish, see notes. *Longer drying times are required in colder (<15°C) and/or humid conditions (>55% RH).

Applying Application Tape with a Laminator

Generally, it is not necessary to use an application tape on film that is 100 micron or thicker, or for any film that has an overlamine film applied. However, Application Tapes do prevent stretching, can hold thinner cut sections in place (from a print and cut job) and can protect the graphic during handling and application.

Application Tapes are rolls of specialised paper (also available in PVC) with pressure sensitive adhesive on one side. It is applied to the front of the graphics before applying the graphics to the substrate. The application tape aids in the successful production, handling, and protection of a graphic during application.

Application Tapes have a lower adhesion to the film than the film has to the substrate allowing for it to be removed easily from the film after final application to the substrate.

Application Tape Selection

The type of application tape required for a job depends on the surface finish of the Laminate (DOL/SL), film type (PVC DOL vs Non-PVC SL) and the substrate its being applied to.

- Signage going onto Flat Surfaces where no stretch is required use Paper Application Tape.
- Signage going onto Vehicles where curves and slight stretching is required use PVC Application Tape
- Signage that requires water to aid in the application to the substrate will required a PVC Application Tape with a non-water based adhesive
- Gloss DOL (SL) - Application Tape with Medium Tack Adhesive - (SL test for suitability)
- Satin DOL - Application Tape with Medium~High Tack Adhesive (test first for suitability)
- Matte DOL - Application Tape with High Tack Adhesive

Using Application Tape on a Laminator

To set up your laminator using Application Tape follow the below procedure.

1. Lift the main roller as high as it can go.
2. Load the Application Tape roll onto the Laminate Feed Roll location. Make sure it's centred. Check the adhesive side of the application tape is facing upwards.
3. Feed the Application Tape around the main top roller and loop back up towards the Feed Roll location.
4. Align the webbed Application Tape edges with the edges of the Application Tape feed roll and tighten the tension with your hands, the end result should be straight Application Tape through the machine with no waves and even tension across all surfaces. Use Masking tape on the feed Application Tape to hold it down with 3 points so it doesn't move. Double check it is still straight once taped into place
5. Load your print roll (or print + laminate roll) onto the Print Media Feed mandrel. Make sure it is centred.
6. Very carefully feed the print through opening "C", being careful not to touch the print media to the exposed Application Tape and also make sure that the print media is on the back landing area and not wrapping down around the laminator bottom roll (common issue). If you have enough feed media now is also a good time to web it onto the Take-Up mandrel for finished graphics.
7. Checking first that your Print Media is centred and straight you can now lower the top roller onto the print media joining the Application Tape and Print Media together. The excess exposed Application Tape (if less than 50mm exposed) should not interfere with the operation.

Aftercare / Storage

After applying the Application Tape, avoid exposing the graphic to sunlight except during application. Sunlight, or UV light, can cause the tape to permanently bond to the film making it much harder to remove.

Avoid storing graphics with Paper Application Tape in locations with high humidity, the paper will suck up moisture and will not remove cleanly after application to the substrate.

Finished graphics should be laid flat or if needed wound face out with a minimum inner diameter of 150mm. Keeping the inner diameter at 150mm or larger will prevent the graphic from tunnelling (the media separates from the backing liner and the adhesive starts to set).

Troubleshooting

The following table describes a number of common problems encountered with lamination machines, along with possible causes and solutions:

Problem	Possible Cause	Solution
Print film tracking to one side	Print media not loaded straight	Increase slack in print media feed to alleviate issues. Find a good spot to cut the film and reset.
Wrinkles in print film going into main nip roller	Print media not loaded flat (buckled)	Increase slack in print media feed to alleviate issues. Find a good spot to cut the film and reset. Make sure film is past nip before lowering the roller, this should deliver even pressure.
"D" shape forming in print media going into the nip roller	Too much pressure on the main nip roller.	Decrease pressure in small increments until the issue works its way out.
Wrinkles in DOL film going into main roller	Tension too low	Increase unwind brake setting on affected web.
	Uneven feeding of webs (tracking)	Cut webs and re-thread according to steps described.
	Uneven tension across web (slack on one side)	Laminators without side adjustment: Cut webs and re-thread according to steps described. Laminators with side adjustment: Reduce unwind brake setting momentarily on the loose side and then increase to bring tension back up checking that tension has evened out.
Air bubbles in finished graphic (large, not silvering)	Not enough pressure	Increase pressure. Also check rollers are not deformed.
Excessive Silvering	*Cold Laminator: Not enough pressure	Increase pressure. * Cold laminators will leave a slight "Silver" finish on the graphics which is air trapped between the adhesive of the laminate and the printed surface, this is normal and will dissipate over a day or two once the adhesive wets out into the trapped air pockets.
	UV Printer	Some UV printers use large droplets of ink, check with your local Avery Dennison Representative if this can be fixed.
	Heat Assist: Not enough heat	Check machine setting is at 35 degrees and confirm with an IR Thermometer.
	Heat Assist: Running laminator too fast	Run the laminator as slow as possible until desired result is found then slowly speed up until it starts to change and then pull it back a bit. This will give you your maximum speed without silvering.

Problem	Possible Cause	Solution
Mottle	Uneven footprint in nip	Check graphic - if the mottle has consistent repeat in roll direction or is heavier on one side, the problem may be in laminator set-up or laminator rollers. Refer to the instruction manual or contact laminator manufacturer.
Mottle in film or adhesive coat	Film or Adhesive Issue	Check mottle pattern - if consistent across web or decreases in repeat as roll unwinds, the problem may be film or adhesive related. Try slower speed, higher pressure, or add heat (no more than 38°C). Note: Mottle towards the end of the core, is induced due to the higher pressure at the core, typically limited to the last meter, if after lamination it is still present, can be eliminated with heat via heat gun or sunlight.
Curved or Wavy End Product	Too much heat and/or tension	Increased roller temperatures in combination with higher winding tension could lead to unwanted elongation of the DOL and printed media. Winding tension therefore should be carefully monitored and kept at the lowest possible level. Run laminator cold (turn heat setting off, allow enough time to cool to room temperature: 20C). Commence tension application, with weight of roller, and gradually increase tension to lowest level to obtain successful results.
Laminator making noises (banging or creaking)	Too much tension on laminate feed roll	Flick the backing liner with your finger to confirm it is tight, release pressure until noises stop.
	Too much tension on laminate take-up roll	The separation point for the laminate from the backing liner will be in the wrong location as a visual indicator of this issue. Release pressure on the backing liner take-up roll until the separation point is floating in the middle.
Backing liner transitions through the laminator main nip rolls and stops everything.	Not enough tension on the backing liner take-up roll.	When it is running slowly you can use your hand to manually take up the slack on the backing liner take-up roll while making adjustments to the take up pressure until the separation point is floating in the middle.

Warranty and Limited Remedy

This instructional bulletin describes a technique. The information contained herein is believed to be reliable, but Avery Dennison makes no warranties, express or implied, including but not limited to any implied warranty of merchantability or fitness for a particular purpose. To the extent allowed by law, Avery Dennison shall not be liable for any loss or damages, whether direct, indirect, special, incidental or consequential, in any way related to the technique of making a graphic regardless of the legal theory asserted.

The above information provides basic information on how to apply pressure-sensitive graphics. The instructions are designed to help ensure success across a broad range of applications. Depending on the size and complexity of applications, a certain amount of expertise is needed.

Professional applicators can be hired to ensure proper application of finished graphics. When mounting graphics in remote geographic areas, professional applicators can offer the added benefit of local service.

Avery Dennison has a vast network of Certified Installers who have been specially trained and certified in accordance with our recommended techniques.

You can review the Certified Installer list here: [Find a Graphics Installer](#)

Consider hiring a professional whenever the application requires:

- Multiple panels to be registered
- Complex surfaces, such as rivet and corrugated trucks
- Harsh environmental conditions (i.e. outdoor applications in high heat climates)
- Remote geographic locations

For further information, contact your local Avery Dennison representative.

