TECHNICAL BULLETIN 5.9

Application of Avery Dennison® MPI™ cast films on irregular substrates.

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Avery Dennison MPI cast films have to be applied in the best possible manner in order to ensure that the product will perform as intended and designed. Successful application results in an adequate bond between adhesive and substrate. Please read the instructions for surface preparation of the substrate prior to application.

The information provided in this document can also be found on our website, academy.graphics.averydennison.com . This website also contains instructional How-to videos and additional theory modules.

Prior to application or lamination, prints must be sufficiently dried in order to prevent negative influence on film properties or adhesion properties.
In general a drying time of 24 hours (full solvent) or 48 hours (eco-/mild solvent) will be sufficient. In case a lot of ink is deposited, materials may need up to 72 hours in order to be sufficiently dry.
When drying, material should **not** be tightly wound on a core, as the solvents are then unable to evaporate. The materials should be left to dry loosely, wound on a core or stacked in racks as sheets.
Properly dried images are always needed in order to benefit from each product's specific feature.

Surface preparation

The surface has to be cleaned by:

1. Washing with a mild detergent solution, after which the surface should be rinsed and dried with a lint-free cloth.
2. Larger flat shaped surfaces can be cleaned with Avery Dennison Flat Surface Cleaner
3. More critical shaped substrates (corrugations, complex curves or more demanding substrates) must be cleaned with Avery Dennison Surface Cleaner.

Many commercially available cleaning/degreasing products exist: the applicator should establish the suitability of a product prior to actual use. In addition, the following factors should be considered prior to any application:

Car wax and polish residues must be **completely** removed.

Paint surfaces must be completely dry, hardened and free of scratches. On most baked paints, films can be applied immediately after cooling down. Air-dried and car repair paints require at least one week to dry out before films should be applied. Solvent residues in painted substrates may adversely affect film adhesion and might cause excessive shrinkage or blistering.

Painted substrates for self-adhesive films should be prepared according to the paint manufacturer's instructions. Here, too, it is important to avoid solvent retention. Paint system components which are not compatible or do not adhere properly to each other may cause paint to be lifted when films have to be removed after use.

Special attention should be given to critical areas such as edges, corners, welding seams, rivets, corrugations and the like. These areas must be thoroughly cleaned and dried before application.

Print preparation

Before printing, it is required to have the right media profile installed and selected in your print server. The media profile contains a combination of information on printer / rip / ink / media. The right media profile not only produces the best colours but will also reduce the amount of ink deposited on the material, resulting in less influence of the solvent on the material properties. Media profiles are available via the Avery Dennison website.

In case a material is overlaminated, make sure the right combination is chosen. Only the use of an Avery Dennison 1400 series cast laminate (or specified varnish) is recommended for corrugated or riveted surfaces in combination with the right cast base films (please check TB 5.3 for additional information).

There is a wide variety of laminates available for different functional purposes. And for all sorts of substrate shape; from flat to most complex curved. For corrugated or 3D curved substrates use an Avery Dennison DOL 1400 series overlaminate or a recommended varnish.

In case of solvent printing, films need to be fully dried before an overlaminate or varnish can be applied. In general a drying time of 24 hours (full solvent) or 48 hours (eco-/mild solvent) will be sufficient. In case if a lot of ink is deposited, materials may need increased drying time in order to be sufficiently dry. When drying, material should **not** be tightly wound on a core, as the solvents are then unable to evaporate. The materials should be left drying loosely wound on a core, or stacked in racks as sheets.

Lamination

After printing the film is recommended to be overlaminated. Please refer to Technical Bulletin 5.4 Processing Tips for Avery Dennison DOL films.

Note: With regards to laminating ultra-conformable laminates (DOL 1460 or DOL 1480) it is very important to monitor temperature and tension;
Both DOL 1460 and DOL 1480 are extremely flexible. Heat used during lamination could easily allow the film to be stretched. “Brake” or resistance on the roll of laminate when unwinding in the laminator could also cause the film to elongate. Increased temperature and/or higher winding tension could lead to unwanted elongation of the overlaminate when laminated onto the printfilm, potentially causing defects after the combination has been applied to a substrate. Therefore temperature and winding temperature should both be kept at an appropriate (low) level

Application method

Avery Dennison MPI Cast films have a high degree of conformability compared to other cast vinyl’s, and the films show excellent results on 3D-shaped surfaces. The use of an industrial hot-air tool is needed to improve the ease of application. After application it is absolutely necessary to re-heat those parts exposed to stretch, strain or other deformations to obtain their final shape. Re-heating will eliminate the applied tensions in the film. Always respect the minimum application temperatures as specified in the technical datasheets.

Avery Dennison MPI Cast films are designed for dry application on prepared surfaces. Although not recommended, it is possible to apply certain Avery Dennison Cast films using the “wet method", for flat applications only. Both methods will be explained in the following two sections of this document.

Dry Application Method
When using the dry application method it is not strictly necessary to use application tape. The application tape can be laminated over the graphic for ease of positioning and to protect it against stretching and scratching. Hereafter this newly formed laminate will be referred to as film.

Application surfaces

This bulletin refers to five types of surfaces (concave, convex, compound, corrugated, riveted) with short descriptions and instructions.

1 Concave surfaces
This hollow or bowl-shaped form implies that the material will be laid into a rounded or curved-in surface. Position the film over the entire surface area as explained in our Technical Bulletin 1.4. Remove (a part of) the liner and apply the film on the surface with the help of your thumb or a squeegee. Remove the application tape and start working the film into the hollow shape.

If convenient, some heat can be applied to soften the film, thus making the inlay process easier. The applied temperature should be between 35° and 50°C.

The use of hand gloves (dry or slightly wet) will make this process easier. Gently follow the form of the substrate until all the material has been positioned.
Apply heat over the entire area, especially over the concave part, in order to allow the film to adopt the shape of the substrate. The stretched parts of the film should be re-heated in a temperature range between 85° and 90°C. It is important that both the film and the substrate are heated to these temperatures. This is best achieved by re-heating gradually, instead of a short blast of heat. Let the film and the substrate cool down till room temperature prior to any cutting of edges or overlays, etc.

2 Convex surfaces
This curved or rounded form implies that the material will be stretched around a curved-out surface. Position the film over the surface area as explained in Technical Bulletin 1.4.

Remove (a part of) the liner and apply the film on the surface with the help of a squeegee. Move around the convex area and apply gentle strikes until the film cannot not stretch any further in order to avoid air being trapped.

Remove the application tape and start shaping the film with a felt squeegee or use hand gloves making gentle movements around the area. Remove air entrapment by punching small holes in the film and if convenient, use hot air to make the film more conformable. During the conforming process the applied temperature should be in the range between 40° and 50°C.

After completing the application, apply more hot air to the film in the temperature range between 85° and 90°C over the convex area and apply pressure again in critical areas using a squeegee covered with felt or hand gloves. Again, it is important that not only the film reaches these temperatures, but also the substrate should be heated to these temperatures. The best result is achieved by re-heating gradually instead of a short blast of heat. Let the film and the substrate cool down to room temperature prior to any cutting of edges or overlays, etc.

3 Compound surfaces

This is generally a complex form of concave and convex surfaces, which can be found one after another or even side by side. These shapes are frequently found in modern models of cars or vans. The method of application follows the description of the two individual shapes provided in the previous two sections.

4 Corrugated surfaces

Position the film to the application surface with a masking tape that can serve as a hinge (see Technical Bulletin 1.4). Ensure that the hinge is in a flat section of the surface. Only remove a small area of liner to prevent pre-sticking. Application to this type of surface has to be done systematically; section by section is the best approach. Deviation from this application sequence may result in pleats, which are sometimes difficult or even impossible to be eliminated.

Start the application at the hinge (continue section by section) and apply the film from the centre to the side of the film or printed graphic. This method will limit the occurrence of pleats.

While keeping the adhesive free from the substrate, apply the film with a plastic squeegee. Do NOT stretch the film, but follow the irregular shaped surface. Use the full width of the squeegee and press the film firmly down over the entire surface area. Vertical sections should be applied with vertical squeegee strokes. Make sure the film is applied correctly in the edges, corners, seams, etc. Remove the application tape after 3 to 5 minutes and re-squeegee the edges or corners.

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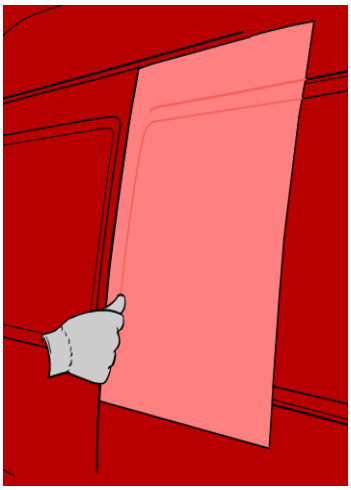
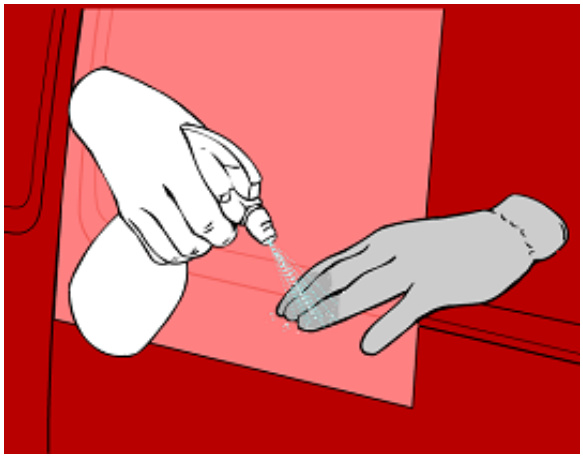
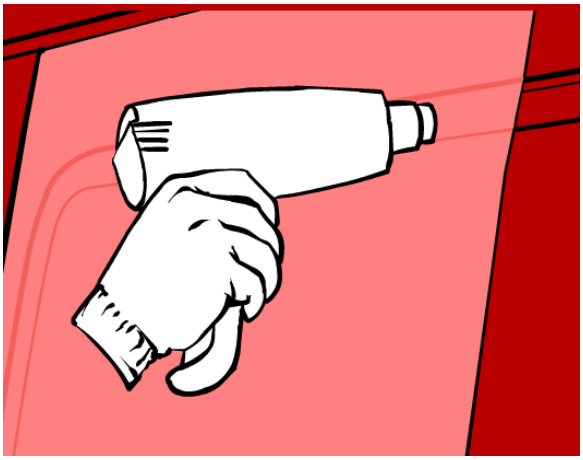
When edges and corners are re-squeegeed, make sure the material is fixed on the edges of the corrugation (see below), and work your way around the entire corrugation, just fixing the edges!!



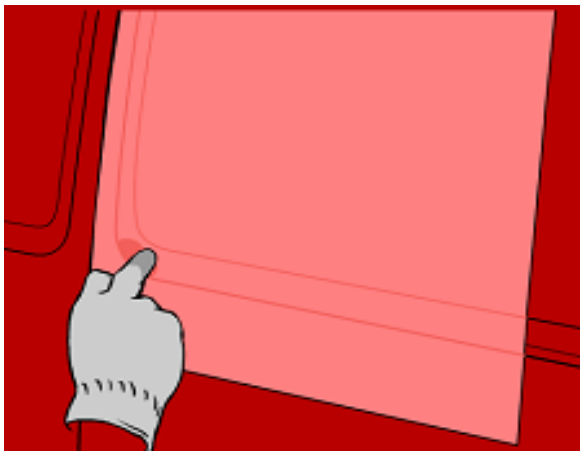
Now, the application of the material in the corrugation can start. In order to be able to do so without forming pleats or creases, it is advised to wet the glove, using a water/soap mixture.



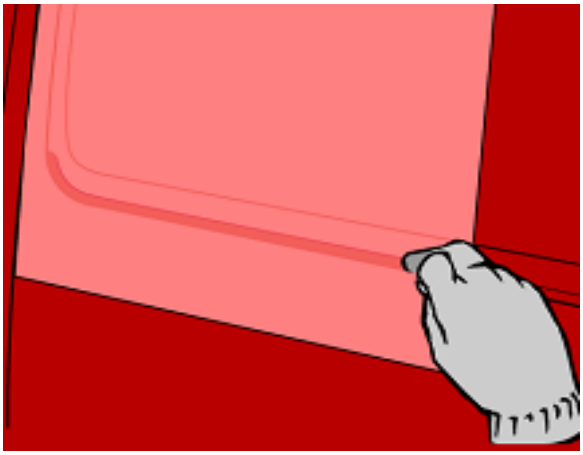
The next step is to heat the material gently, using a hot-air gun, to about 40°-50°C. It is advised to do small areas at a time.



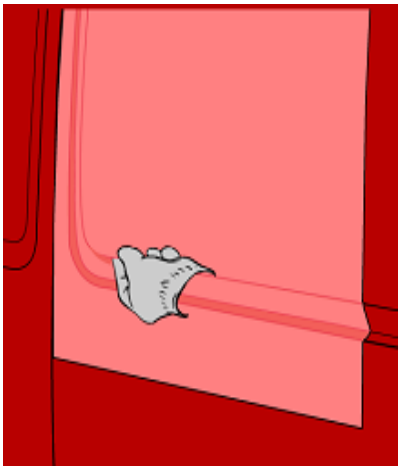
Start stretching the material in the corrugation, starting in the deepest part of the corrugation first. Make sure that the material is heated to remain in the 40°-50°C temperature range.

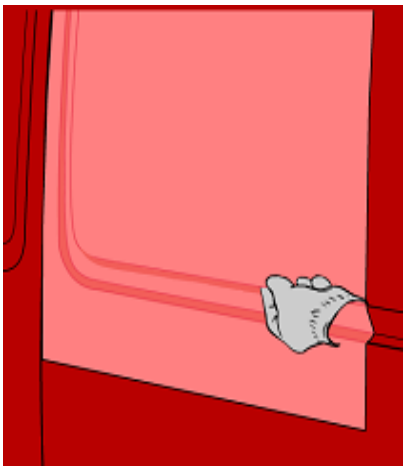


Continue your way around the corrugation, only focussing on the deepest part of the corrugation.

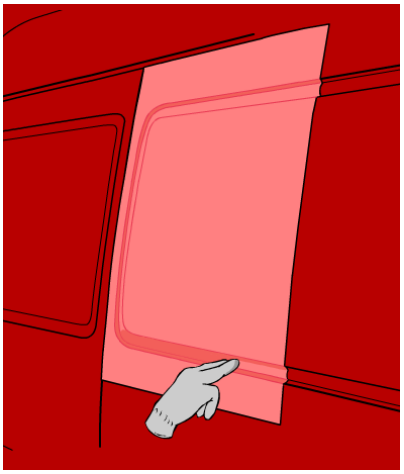


When all the deepest parts of the corrugation have been applied, the inside of the corrugation can be done. Again, make sure the material is heated to the required 40°-50°C, and work your way through the corrugation.

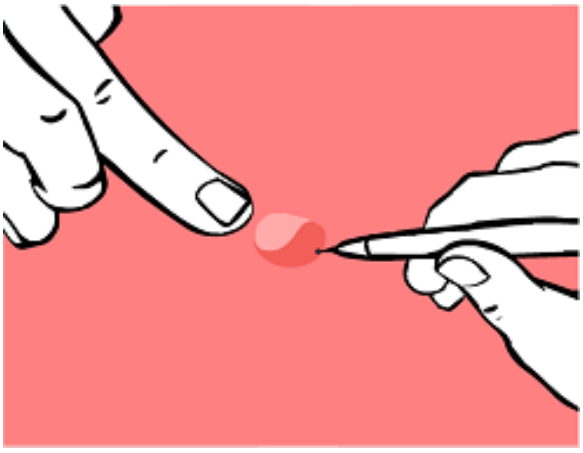




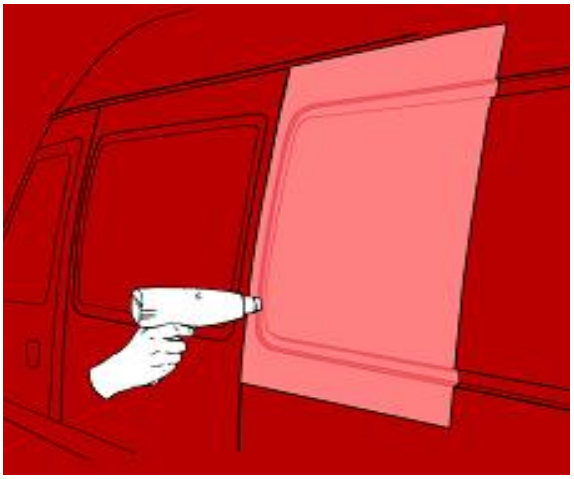
With all the edges now properly applied, apply the material in the centre of the corrugation. Make sure that no air is trapped, by always leaving an opening for the air to escape.



Check the application for remaining bubbles. If you see any small air bubbles, remove them by making a small puncture, heat it a little and push out the air.



Then the final stage of the application starts. Using the hot air gun, the material should be heated to a temperature of approx. 85-90°C, especially in those areas where the material is stretched. Make sure that the heating is done gently, and the temperature is gradually increased. It is important that both the film and the substrate are heated to these temperatures. The best result is achieved by re-heating gradually, instead of a short blast of heat.



5 Riveted surfaces
Position the film to the application surface with a masking tape that can serve as a hinge (see Technical Bulletin 1.4). Ensure that the hinge is in a flat section of the surface. Only remove a small area of liner to prevent pre-sticking.

Start the application at the hinge and work towards the edges of the film or graphic. When a rivet is reached, push the film towards the rivet head with the squeegee and apply the film leaving an air “bubble” around the rivet. Maintain sufficient tension in the film to prevent pleats around the rivets. Once the film part or graphic has been applied (with the application tape still in place), use a needle to punch 4 or 5 holes around the rivet and proceed to apply the film with a plastic squeegee. After this stage has been completed, remove the application tape.

Gently push the air out of the entrapment by hand, using gloves or with a soft squeegee. Apply heat to the film around each individual rivet with a portable hot-air tool until the film softens. It is advisable to use a temperature range of 40°-50°C. Push the film further into shape around the rivet with your thumb (using gloves) or a felt covered squeegee.

Eventually the film can be moulded around the rivet head by means of a brush, using circular movements. Be aware to apply the pressure of the brush on the film only at room temperature and avoid scratching the surface.

Wet Application Method
This application method is recommended for **flat surfaces only**. Do not use on concave, convex or compound surfaces.

Note: Do NOT use wet application method for Avery Dennison Easy Apply or Easy Apply RS products.

The film can be positioned on the substrate without adhering to it by wetting the surface with a 1% detergent solution in water. The detergent liquid provides slideability and repositionability to the pressure-sensitive film until the water film has been removed. A plastic squeegee can be used for the removal of the water layer. Start squeegeeing from the centre towards the edges of the film or graphic and gradually increase the applied force until almost all water has been removed. Repeat this process several times.

The advantage of the wet application method is that during application the film can be applied without the use of application tape. However, adhesive build-up via this application method will take much longer than under dry conditions. In general this means longer application times for certain areas since drying has to occur prior to the finishing touch of a job.

If an application tape has been used on the film it is advisable to check on the build-up of adhesion at the edges in order to determine the right moment for removal of the tape. This time span can be from 1 hour up to 6 hours, depending on the kind of substrate or the wetness of the application tape, etc. If the tape is removed too early, its removal may cause the film to lift from the substrate and consequently permanent surface imperfections or bubbles may be introduced.
Complete the application by applying hot air to the film using a temperature range of 80°-90° C. It is important that you heat both the film and the substrate to these temperatures. The best result is achieved by re-heating gradually, instead of a short blast of heat. Check and re-squeegee the edges of the rivets of the applied film or graphic, where required.

Note:
- **The wet method should not be used on riveted, concave and compound surfaces. Water will be encapsulated, and it is impossible to remove this water entirely. As a result, the film may be lifted in rims, edges and compounded curves at a later stage.**
- **On convex surfaces the delay in adhesive build-up may jeopardize the overall performance of the product during its final product utilisation.**