A vertical red bar on the left side of the page. Inside the bar, the word "CALON" is written in a large, white, stylized, sans-serif font. The letters are bold and have a slightly irregular, hand-drawn appearance. The 'C' has a small circle in the center, and the 'O' is a simple circle. The 'A' has a small triangle at the top. The 'L' is a simple vertical bar. The 'O' is a simple circle. The 'N' has a small triangle at the top. The bar is solid red and extends from the top to the bottom of the page.

**CALON**

# APPLICATION MANUAL

Signmaker's Guide to  
Usage of Calon<sup>®</sup> Film Products

# APPLICATION MANUAL

## Signmaker's Guide to Usage of Calon Film Products

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## STORAGE OF CALON® VINYL

**Vinyl on Rolls:** Calon® vinyl product stored at controlled conditions will remain flexible and retain high tack for at least a year after purchase from the distributor. Arlon's central warehouse is kept cool and dry to preserve vinyl product on the shelf. Additionally, it employs the "first in first out" inventory system popular with all suppliers and strongly recommends this to distributors and end-users. No matter what storage conditions are used it is important to consume materials promptly, avoid mixing old and new lots, protect film from excessive ambient moisture and insure roll edges remain flat and unwrinkled. If product is certain to be on the shelf for an extended period before being completely consumed it will be wise to store it in the coolest part of the facility and control relative humidity near 50%.

Storage position and location in the warehouse or rack is important as well. As all these materials are laminated to paper release liner care must be taken to keep them from direct contact with concrete floors or unsealed, exterior concrete or masonry walls. If rolls are stored out of their protective box, it is important to store them upright with space between rolls. This prevents the development of mottling (dulling) at points of contact with either the floor or adjacent rolls.

If excessive direct moisture contact occurs with any graphic film, the following damage may follow:

- The liner will expand at the location of moisture contact, causing surface mottling.
- The silicone release coating on the liner will become inconsistent and cause difficult character weeding.
- The thin layer of clay, which is coated over the upper surface of the release paper, will rip away from the base paper and come off with the adhesive during weeding.
- The paper will tend to curl or become "wavy" when it is unwound. This will make both friction fed and flatbed cutting, weeding, overlaying with application tape and installing very difficult.

### **Arlon Recommendation:**

- Keep the product cool and dry (preferably in its box - this also helps with color and lot number I.D.)
- Do not lay rolls directly on their side for extended periods.

**Finished Graphics:** Store cut and masked graphics flat, in a clean, dry, cool place. Never subject fabricated graphics to moisture, excessive humidity, direct sunlight or temperatures above 100°F (38°C). Finished graphics should be stored flat, rather than rolled to prevent them from separating and forming bubbles or wrinkles in the finished product. If rolling is needed for transport then roll with the graphics facing outward and liner inward. This will reduce the amount of tunneling or separation between graphics and release liner.

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## INSTALLATION TOOLS

*Before starting an installation it is best to have the appropriate tools handy to avoid interruptions during the application. Starting and stopping midway through sign fabrication can be costly due to inadvertent material damage and loss.*

- Nylon Squeegee (for standard applications)
- Low friction teflon squeegee
- Rivet Brush
- Air release punch tool or "Wartenberg" Pinwheel
- Utility or craft knife
- Industrial heat gun or Propane torch
- Tape measure
- Metal straight edge
- 1 inch (2.5cm) rolls of masking tape
- Felt squeegees for digital wraps
- Marking pencils
- Lint-free rags
- Plastic spray bottle of Isopropyl alcohol and water blend @ 1:1
- Plastic spray bottle of liquid detergent and water blend @ 50:1
- Scissors
- Tool apron or tool belt
- Masking Tape (1.5")

## SELECTION OF APPLICATION PAPER

Once vinyl is cut and weeded, application paper (also called transfer tape, premask or prespacing tape) is applied over the remaining film. This application paper serves many purposes. First, it protects the surface of the vinyl from damage during storage and installation. Secondly, it serves as a stable medium with which to transfer very flexible, easily distorted vinyl from the liner paper to the substrate.

Application Tape is usually made of thin paper tissue for both cost and performance reasons.

- Paper has some obvious advantages in that it is compatible with many stages of sign fabrication. One can write on it easily for registration marks and it is more compatible with wet application techniques than film based types due to the papers ability to absorb and transmit water to the graphic face. This is needed to reduce adhesion between the vinyl film and application tape, making it easier to strip the application tape away from the applied graphics.
- Plastic film as transfer tape proves its greatest advantage when registration of multicolor overlays is needed. A weakness of plastic film is that it doesn't have water absorption capability so does not work well for wet applications. In the mid-nineties clear plastic film gained in popularity as cost was reduced, lamination performance improved and finishing steps in the manufacturing process allowed the plastic to be torn cleanly from the roll rather than requiring a knife or scissors cut.

Proper lamination of application paper or film is a relatively simple procedure. Although this seems to be a minor step in the production process, adherence to a few basic rules can help avoid major installation disasters.

1. Take the time to select the right application paper for your shop. This will require some simple comparative tests. For example, application paper comes with either low, medium or high tack adhesive. Choose a tape that bonds sufficiently to lift the graphics off the liner paper. After the graphics are applied, the application paper should remove easily without tearing. In short, select an application paper that is easy to use over a wide range of films and substrates.
2. Use a single sheet of application tape to cover a vinyl graphic rather than trying to get by with overlapped pieces of tape. Overlapped application tape results in a line of small bubbles at the overlap and excessive wrinkles during final installation.
3. Take care in applying application tape to a vinyl graphic. Wrinkles and bubbles caught in the application tape result in wrinkles and bubbles in the installed vinyl. Also, avoid stretching the application paper, this helps prevent poor graphic registration and wrinkles.

When removing graphics from liner lift away slowly, be sure that the tips and leading edges of the graphic film do not remain with the liner. If the vinyl has trouble separating from the liner a method for easier removal is to turn the graphic upside down (so the graphics are face down) and strip the liner away from the graphic on the workbench.

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# SIGN SUBSTRATES

## SUBSTRATE PREPARATION

Before installing any graphics a clean substrate is critical. Although many cleaners will do an adequate job, some outperform others for specific applications. Based on our experience, recommendations for final cleaning are the following:

<u>Substrate</u>	<u>Cleaning Fluid</u>
Painted metals & wood	Isopropyl Alcohol a.k.a. 70% Rubbing Alcohol @ 1 to 1 mix with water.
Glass	IPA or vinegar mixture @ 1 to 1 mix with water.
Acrylic & Polycarbonate	Acrylic cleaner and antistatic rag or deionized compressed air to remove electric charge and particles of dust
Banners & Awnings	IPA or vinegar/water mix or liquid detergent and water mix
Expanded PVC	Vinegar followed by a quick wipe with toluene
Large Panels on Vehicles	Degreaser, if needed, then IPA and water mix. See Riveted Application for details.

***Caution:** It is common to think that a strong solvent will be the best cleaner for surfaces that are hard to stick film to. In the case of many plastics and paints this is wrong. Cleaning with a strong solvent such as MEK and acetone can lead to premature sign failure via embrittlement, cracking and crazing or loss of gloss. Use the mildest solvents possible - only clean until the surface dirt is gone.*

## INSTALLATION CONSIDERATIONS for SPECIAL SUBSTRATES

1. **Aluminum** – Unpainted aluminum begins to oxidize almost immediately after production. This surface needs to be etched with a commercial acid brightener. Following the etching process, the surface should be alcohol wiped prior to graphics application.
2. **Plastics** – Fiberglass, polycarbonate, styrene and polystyrene will outgas. Outgassing can occur for an extended period of time and cause graphics to bubble. Outgassing can be predicted by accelerating the aging process. A sample of the substrate with applied vinyl is placed in an oven at 150°F (78°C) for as long as 24 hours or in the sun on a vehicle for a couple of days. If bubbling occurs during the test, it will likely occur in the sign.

*Polycarbonate sheets absorb and outgas moisture. These materials should be dried prior to and after vinyl application. (Consult the polycarbonate manufacturer's recommendations for drying). Vinyl applied over undried polycarbonate can trap outgassing moisture, resulting in bubbles. (See Thermoforming Section for more detail, beginning on pg. 13.)*

3. **Banner Applications** – Today's sign professional can choose many banner substrates that are designed for paint and vinyl receptivity. However, there are also a number of products that are unsuitable. If you have a question regarding a sign substrate, do not hesitate to ask your Calon® distributor or call Arlon direct. Banner compatibility has been tested for the greater majority of U.S. and many internationally produced banners.

For non-vinyl receptive banners, primer coats will aid vinyl adhesion and act as a plasticizer barrier. These coatings must be applied properly in order to achieve success. As a general rule, first clean the banner with either a mild solvent such as IPA. Never use lacquer thinner; it will draw the banner's plasticizer to the surface, adversely affecting the prep coat and ultimately the vinyl adhesion. After cleaning, coat the banner and allow it to dry at least 24 hours prior to vinyl application.

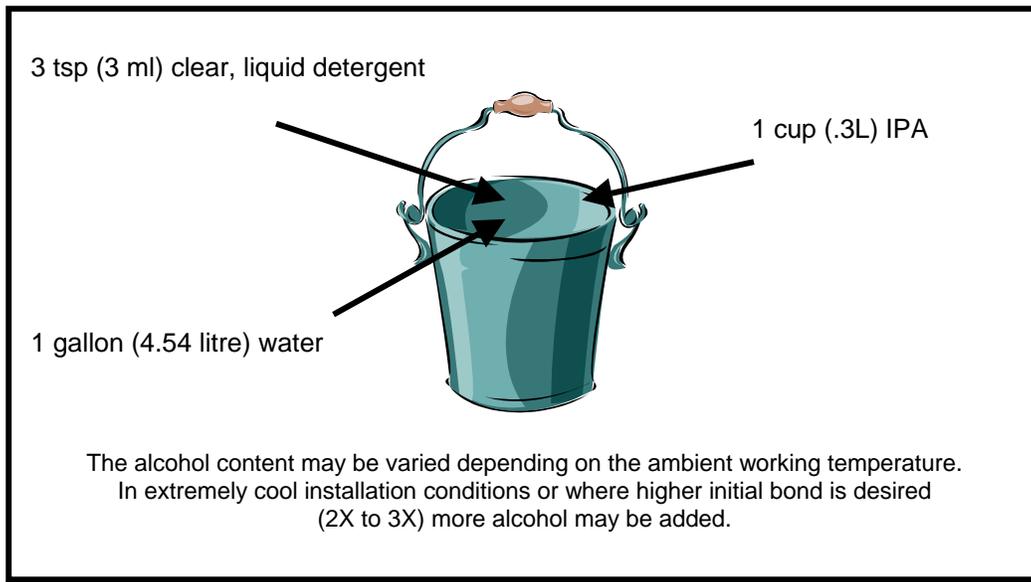
Vinyl installation on reinforced plastic panels is easy if you remember that these materials are essentially "textured" surfaces.

The following techniques will ensure a quality finished product:

- When applying pressure during lamination it is important to achieve good contact regardless of whether wet or dry application is used. A rivet brush or soft squeegee is recommended for attaining the best surface conformability. This is especially important with vinyl-impregnated fabrics that have rough texture.
- Using heat with the rivet brush or soft squeegee increases conformability of the vinyl to "textured" surfaces. Heat softens the adhesive, making it more pliable and a bit tackier. Heat also melts the film slightly, reducing memory and allowing the vinyl to conform more readily to the new shape. The warmed vinyl "sets" in its new shape as it cools and thus exerts less delaminating force on the bond. In short, the film stays where you put it.

4. **Coated Fiberglass** – Female-molded, gel-coated fiberglass typically has a waxy film caused by the mold release agent used in the manufacturing process. This waxy film must be removed with an appropriate mold release solvent before graphics installation.
5. **Varnish** – Arlon does not recommend a varnish coat to be applied to vinyl graphics. Varnishes contain solvents that will attack the vinyl facestock and the adhesive system. Varnished graphics will typically peel away from the sign substrate. If an overcoat is demanded use acrylic, water-based types where possible.
6. **Application Fluid** – Application of pressure-sensitive material to flexible signface material, plastic sign faces and glass often requires the use of application fluid. Use the least amount of fluid needed to achieve repositionability. Be absolutely sure that all the wetting agent is removed from between the vinyl and the signage substrate. If any application fluid remains, bubbling will likely occur later. Also, be sure to allow enough time for good adhesion to build before removing the application tape.

Several commercial application fluids are available from sign supply distributors. Although Arlon recommends using commercially made application fluid, many shops find they can get along with home recipes. One blend commonly used by shops preferring to mix their own is listed below. The primary reason Arlon does not recommend the use of homemade solutions is due to the wide variability of liquid detergents on the market.



*NOTE: Not all application fluids (even commercial brands) result in optimal adhesive bond. The user assumes the responsibility to test all application fluids prior to installation to ensure successful film performance.*

- 7. Paints** – All paints should be dried and cured before installation of signage. When painting signs to be decorated with films, use two lighter coats rather than one heavier coat; the drying and curing will be faster and more complete.

Low gloss latex paints are harder to stick vinyl to than others. Although wiped with alcohol before installing graphics, a latex surface may still be incompatible with pressure sensitive graphics. If adhesion is tentative, use primer or switch to glossier finishes.

Note: All gelcoats and urethane paints require cure time before vinyl may be applied. The curing period varies depending on product type, temperature, humidity and amount of catalyst or hardener. During curing, the paint or gelcoat will outgas. This outgassing must be completed prior to vinyl application or bubbling can occur.

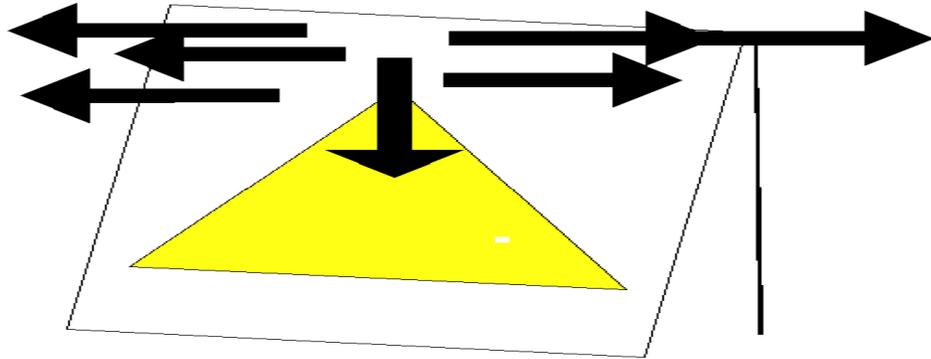
- 8. Application Temperature** – Though recommended application temperature varies from product to product, optimum application temperature range on the substrate is typically between 60°F (16°C) and 90°F (32°C). Successful installation can be accomplished at temperatures as low as 40°F (5°C) and as high as 120°F (49°C). At these temperature extremes, one can expect additional difficulty.
- 9. Windows** – If designing for large plate glass applications which experience high sun exposure, be sure to avoid large areas of very dark color next to a very light and reflective color. The difference in heat gain and glass expansion under extreme gray scale differences will cause fatigue and early failure of the glass. It is best to break up the design and use hue, rather than gray scale to achieve contrasting sign elements.

For glass and many other smooth substrates when the sign face temperature reaches over 100°F (37°C) the tack of the adhesive can become unmanageable, especially if repositioning is going to be required. Before beginning an application on hot surfaces a clean water mist will achieve "evaporative cooling" on sign faces. This technique can bring the temperature down 5 to 25 degrees depending on the starting surface temperature, relative humidity and amount of water used.

## APPLICATION PROCEDURES

### Rule of Thumb

Only lay down and make substrate contact with the area of film to which you can apply high-squeegee pressure. While squeegeeing work from the center, outwards, toward the edge and from the top, down, in overlapping strokes.



*Air is easily trapped between the surface of the adhesive and sign. A sign installer who squeegees toward the nearest edge will find that the possibility of air entrapment is minimized.*

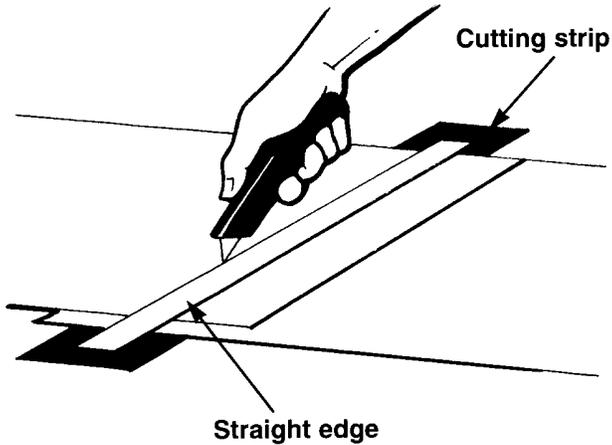
### Wet Application Method for Flexible Sign faces

1. Position the vinyl with the film face down against a clean surface. Starting at a corner, remove the liner. If the liner is a standard kraft type, do not get it wet prior to removal; the coatings on the paper could split off causing unsightly adhesive contamination.
2. Spray application fluid on both the adhesive side of the film and the sign substrate.
3. Position the film (sticky side down) on the sign substrate.
4. Initially use light strokes squeegeeing the film into position. Starting at the center of the marking, re-squeegee the film using firm strokes. Firm strokes and a stiff squeegee will force the application fluid from underneath the film.
5. After application, spray the paper application tape with application fluid; allow to soak into application paper and remove in no more than 30 seconds. Remove the application tape by pulling it 180° against itself. This step prevents the formation of small bubbles that can develop during application tape removal. Re-squeegee all edges after application tape removal to ensure good adhesion and prevent edge lifting. A rivet brush may also be used in this part of the installation sequence to achieve a good film/substrate bond. Different sizes of rivet brushes are available through sign supply distributors.
6. To eliminate air bubbles or trapped application fluid puncture the bubble at one end and press it flat with a thumb or rivet brush starting at the other end. Large blister sized bubbles will need to be popped in the center and flattened from either edge towards the middle. (Always use a pin; never use a knife. A round pinhole will close around itself while a knife cut will open up over time.)

### NOTES:

*Vinyl film may be applied to flexible sign face material either prior to, or, after tensioning. In either case, apply adequate squeegee pressure to achieve maximum ultimate adhesion. If application tape is not used, spray the film face with application fluid to facilitate the squeegeeing procedure. It is advisable, in these instances, to use a low friction sleeve on the squeegee to prevent scratches on the film. Low friction sleeves are available through sign supply distributors. In this latter technique, it is recommended application be performed prior to installation.*

## Overlaps



Joined sections of film should overlap at least 1/16".

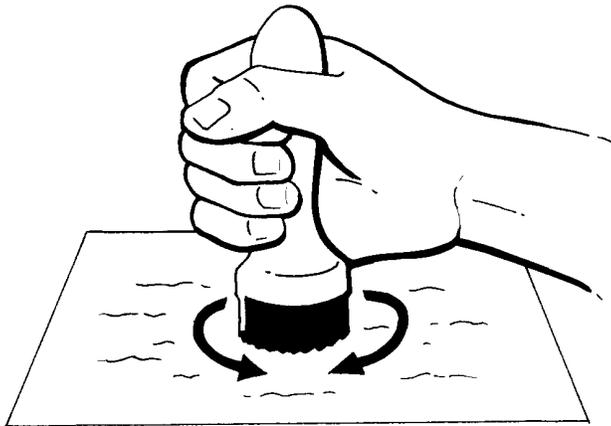
### A Common Method

1. To create a uniform overlap, first tape a cutting strip onto the substrate.  
*A two-inch (5 cm) piece of thin steel at 1/16<sup>th</sup> inch (1.6 mm) thickness is a good dimension for a cutting strip.*
2. Lay both pieces of vinyl over the cutting strip.
3. Place a metal straight edge where the two pieces of film cover the cutting strip. With a sharp utility knife, cut through all layers of film.
4. Remove the straight edge, excess film and the cutting strip.
5. Complete the squeegeeing procedure to create a proper overlap with uniform and straight edges.

## Textured Surfaces

Cast vinyl films may be successfully applied to heavily textured surfaces. These include architectural panels, banner material with a dense scrim, and masonry block. For substrates such as masonry block, trouble-free installations begin with good surface preparation. Masonry is porous and absorbs moisture as well as releases dust from its surface, which adversely affect adhesion. To avoid failures the substrate must be sealed. Non-latex masonry paint will generally serve this purpose. As always, before vinyl can be applied to a painted surface, the paint must be completely cured.

Some banner materials are not vinyl receptive and must be primed prior to film application. Commercial primer is available from sign supply distributors. Never clean the banner with a strong solvent such as lacquer thinner to get it to accept vinyl or screenprinting. Strong solvents will draw the plasticizers to the surface, making the prime coat ineffective and potentially contaminating the adhesive.



1. Begin the application to a textured surface by first squeegeeing graphics into position.
2. Remove the application tape from the graphic. Starting at one edge of the graphic, heat the vinyl with your heat gun. Burnish the vinyl with a rivet brush, using a circular motion to work the film into the texture. The finished product should look as if the graphic had been painted.
3. To avoid potential lifting and peeling at the edges for masonry applications, seal the edges with a commercial edge sealer.

## Riveted and Corrugated Trailers

### General Installations:

Install vinyl after registering the lowest rearward panel (if a series of panels are to be applied) so that all panels afterward overlap to shed oncoming wind and dripping water. Starting from the top of each element squeegee from the center outward with each stroke overlapping the last in the downward direction. The vinyl should be draped up and over each corrugation rather than stretched from ridge to ridge then pressed into the valleys. Vinyl installed by exaggerated stretching will inevitably pop back off the surface and the graphic will quickly fail. Complete each corrugation row before moving to the next in order to retain proper material registration along the direction of the corrugations.

- Sweep over rivet heads with the squeegee at a low angle while applying. Make sure the squeegee covers the entire head of the rivet or wrinkles will develop at the edge of the rivet.
- Once all film is applied, any sections that cover a seam in trailer panels or other metal to metal joins must be slit and separately tucked into the seam.
- Minor air bubbles are then worked out or popped with a pinhead, dart or other pointed tool.

At this point the rivets will be covered with a loose dome of application paper laminated to vinyl and must be fixed securely to the whole surface of the rivet and surrounding panel.

- Remove application paper by slowly pulling away from graphics at a low angle.
- Punch holes (3 to 5) around the rivet heat with a pointed tool.
- Press vinyl in place at ambient temperature with a rivet brush.
- Secure the vinyl around the rivet with heat 300°F (150°C) and rivet brush using a circular motion.
- Be sure the film is secure around all rivet heads and all panel to panel seams.

**Cold Weather Installation:** The optimal installation range of a substrate is between 60° and 90°F (15° and 32°C). Substrate temperature may drop as low as 39°F or rise as high as 118°F (4° to 48°C) but expect more difficulty at the extremes.

- Commercial shipping units such as piggyback containers and over the road trailers should be cleaned at least a day ahead of installation time.
- To quickly warm trailers in cold environments, use portable blower type heaters to heat the inside of unit. Fifteen minutes of warm temperatures inside the trailers will help reduce the massive heat sink that has developed both inside the trailer and on the aluminum skin while sitting in a truck staging lot. To expedite heating in a warmed shop, open all trailer doors.

**Cold Weather Finishing Steps for ProFleet™ - Series 6000:** Due to the repositionable nature of the ProFleet™ adhesive, the bond between substrate and graphic builds slower than with standard high tack “sign-vinyl.” While repositionability is a great advantage during installation, in cold weather it relies on proper technique during the final steps to maintain the bond created during earlier installation steps.

Key points to remember when finishing cold weather installations:

- The installer must be careful not to strip application paper before strong squeegee pressure has been applied.
- If installing in cold environments use a heat gun or propane torch to soften the adhesive while using a squeegee. This ensures faster and more complete contact – doubling the adhesion bond.
- Let as much time as possible elapse before removing application tape - up to three or four hours.
- Remove application tape from the center of the graphics, working toward outer edges to avoid lifting.  
Pull the application tape parallel to the surface of the graphic.  
Remove tape in a smooth, slow manner rather than quickly or forcefully.
- Go over the graphic with a heat source and squeegee or rivet brush after removing application tape. This ensures that all segments of the graphic during the application tape removal form a secure bond.

## **THERMOFORMING OF TRANSLUCENT FILM: SERIES 2500**

Whether thermoforming prelaminated vinyl/plastic sheeting into simple pan faces or raised letters each aspect of fabrication: from material dehydration and lamination to releasing the formed piece is critical to the success of the finished sign.

For successful thermoforming, the following factors must be considered:

- Drying of sheet before and after lamination of film
- Lamination step
- Temperature of sheets and molds
- Rate of application and level of vacuum
- Sharpness of corners and edges

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### **1. Predry**

Remove protective masking from the surface which is to receive vinyl and predry all acrylic and polycarbonate sheets prior to lamination of film. Predrying prevents bubbling during the forming cycle. Predrying is more critical to forming success when working with vinyl laminated plastic sheet than with sheet alone – especially for polycarbonate signfaces.

Preferred method:

Oven drying of suspended and separated sheets at approximately 200°F (93°C) for six hours. The simplest method is to load the drying ovens at the end of the workday for the following days fabrication. This allows the use of lower temperatures, down to 180°F (82°C) and more than enough time for adequate ventilation. For example, 6 hrs @ 200° F is minimum drying time for .080 in. thickness, according to a major polycarbonate fabrication guideline.

Alternate method: (adequate for thin gauge acrylic sheeting)

1.2 Quick dry suspended and separated sheets at 230°F (109°C) for 30 minutes.

1.3 Slow dry sheets by removing masking and putting in a warm/dry area of the shop for 24 hours.

Note: Once the sheet has been dried it should be further processed within 12 hours of being removed from dryer.

### **2. Lamination**

Although lamination may be wet or dry, wet lamination can lead to problems with bubbles and cracking of film if all the surface water is not squeegeed away and dried before heating and forming.

#### **2.1 Dry Application**

When applying full sheets of uncut film with a mechanical laminator use the highest practical laminating pressure at throughput speed of about 30'/min. (10m/min).

- Vinyl is best applied as free film immediately after being stripped away from the release liner. The point of stripping should be where the film and liner are in tight contact with a rubber lamination roller. This eliminates stretching and unevenness as the film travels toward the laminating nip.
- The shorter the distance between stripping station and lamination nip the better. The combination of tacky adhesive surface and the static generated by stripping the liner away creates an environment highly susceptible to dust contamination.

## **2.2 Wet Application**

This method is used when lamination is done by hand, either as background color or at the point of multicolor registration of cut graphics.

Use only proven application fluids, or an appropriate mix of water, clear unscented liquid detergent and alcohol. (A common recipe is 20 oz., ½ tsp., and ½ tsp. respectively.)

- Lay film upside down, strip release liner and discard. Avoid getting the release liner wet before it is removed from vinyl. Water damages the paper liner and leaves small pieces of paper on the adhesive. Wet the whole film or substrate. It is advisable to use more liquid at the location where squeegeeing will begin and let this wave of water travel ahead of the squeegee rather than saturating the entire sheet and ending up with excess water on the work table, floor and installer.
- Spray a fine mist on the adhesive surface of the film, turn it adhesive side down and position the graphics until registration marks are aligned. Squeegee the top couple of inches of material or application paper in place to establish a straight line.
- Lift the remaining graphic (up to the squeegee line) and allow it to drape loose but square. Squeegee in overlapping strokes from center to edge and towards the lifted end.

The squeegee should be dragged at a shallow angle for effective and stretch free work. Keep the vinyl unattached to the sheet surface for as long as practical by lifting it; this keeps trapped fluid to a minimum and helps avoid wrinkling along the edges.

- Once all water has been squeegeed from underneath the vinyl and a secure bond has been established remove the application tape by spraying it with a light mist of water, allowing 30 seconds for the water to loosen the adhesive and immediately peeling it from the graphic. Use even pressure and a low angle of removal to prevent graphic edges lifting.
- After application paper has been removed and discarded, resqueegee the edge of any graphics that may have lifted or come loose while the application tape was being lifted.
- If the application is being done without application paper, it is advisable to mist the vinyl surface with the same application fluid to avoid scratching or stretching the vinyl while it is being laminated.
- Wipe off the face of the sign with clear water to remove any soap residue from the application fluid. If soap remains, it can leave streaks of discoloration on the vinyl. This is particularly true for films to be thermoformed.

## **3. Post Lamination Conditioning**

If the vinyl has been dry laminated no dwell time or additional dehydration is needed prior to forming.

If wet laminated, all residual surface moisture must be removed prior to the thermoforming process. Temperature and time needed to dry the laminate vary according to facility and can range from as much as 24 hours at room temperature to as little as 2 hours at 200°F (93°C). As with the initial dehydration step it is important to separate the sheets for best ventilation and fastest drying.

## **4. Preforming Conditioning**

Prior to forming it is important to store the sheets in such a way that they are uniformly warm and dry. Warm sheets going to the thermoformer will process faster and more consistently than if taken from cold or moist environments. The best possible practice is to store sheets in drying ovens. Other options include racks along walls free from direct contact with the ground moisture.

- Sheets may not remain in an uncontrolled shop for more than 12 hours between dehydration and forming. If more time elapses return sheet to dehydration conditions for a minimum of three hours.

## 5. **Forming**

Many types and thicknesses of plastic sheet with vinyl laminated to it can be formed in exactly the same manner as when forming unlaminated materials. For extremely thick polycarbonate materials that demand high forming temperature, a modification of standard technique is needed. Rather than bring a bare sheet immediately to its closest position relative to heating elements it is better to bring the laminated construction toward the heat source in two stages. For example; if the distance for successfully forming unlaminated sheet is 6.5 inches (17cm) from the heat elements and the dwell is 7 minutes but excessive staining or bubbling is observed in a finished sign made from a laminated construction then a good solution is to lengthen the distance and time, i.e. 12 inches (30 cm) from elements for 3 minutes, 6.5 inches (17cm) inches for 5 minutes.

## 6. **Molds**

The tooling and design used for forming a laminated piece is most successful where the vinyl does not come in contact with the mold.

Mold depth and consequent distortion and stretching of translucent film should be kept in mind while designing draw distance, corner radius, wall relief and draft angle.

The film may be drawn over mold depths of 4 inches (10 cm) providing the sheeting stretches uniformly. Corners should be radiussed generously to avoid "bright spots" at the outer corners and angles.

If one tries to mold vinyl against the mold face a variety of problems develop.

- At high temperature the adhesive softens and vinyl is pulled away from the sheet as the vacuum is created
  - At high temperature the vinyl becomes molten seeks to take the shape of all minor seams, joints and surface discontinuities of the mold when a vacuum is created.
  - As the surface of vinyl is slightly tacky until cool it does not release easily from the mold shape.
-

## CARE AND CLEANING of CALON®

Graphics manufactured using Calon® vinyl provide the maximum durability available today. Proper care of these graphics is critical to achieving the ultimate life and appearance of the overall sign.

When cleaning vinyl graphics, always use a liquid detergent and water mix. The cleaner selected should be free of strong solvents such as MEK and acetone as well as highly acidic or alkaline pH.

When preparing cleaning solutions always follow the manufacturer's instructions for proper dilution and safe use.

### Cleaning Procedures

#### Manual Cleaning:

- Using clean water, spray the graphics to remove loose dirt.
- Using a mild detergent, wash the graphic with a soft brush, rag or sponge. Never use a hard bristle brush.
- If tar or oil remains on the graphic, clean with a rag moistened with mineral spirits or a household cleaner such as "Formula 409". Wash again with detergent and water.
- To remove mold and fungus, use a solution of one part "Clorox"® and 30 parts water.
- Finish all cleaning processes with a rinse using clean water.

#### Note:

When reconditioning flexible sign faces it is important to recognize that many sign faces are topcoated to prevent UV or other environmental damage. Whenever vinyl graphics are removed, the chance of stripping these coatings is high. Please read and follow the flexible substrate manufacturer's reconditioning or reuse recommendations. Arlon suggests reconditioned flexface not be intended for long-term applications. If reconditioned, carefully check to see that all shadows of prior graphics (if present) do not detract from the new image.

#### Pressure Washing:

Vinyl is easily cleaned using pressure washing – *but* it can just as easily be damaged by improperly handling the water spray or incorrectly blending the cleaning solutions. In order to keep from degrading the vinyl or lifting the edges of the film during pressure washing, it is important to remember the following rules of thumb:

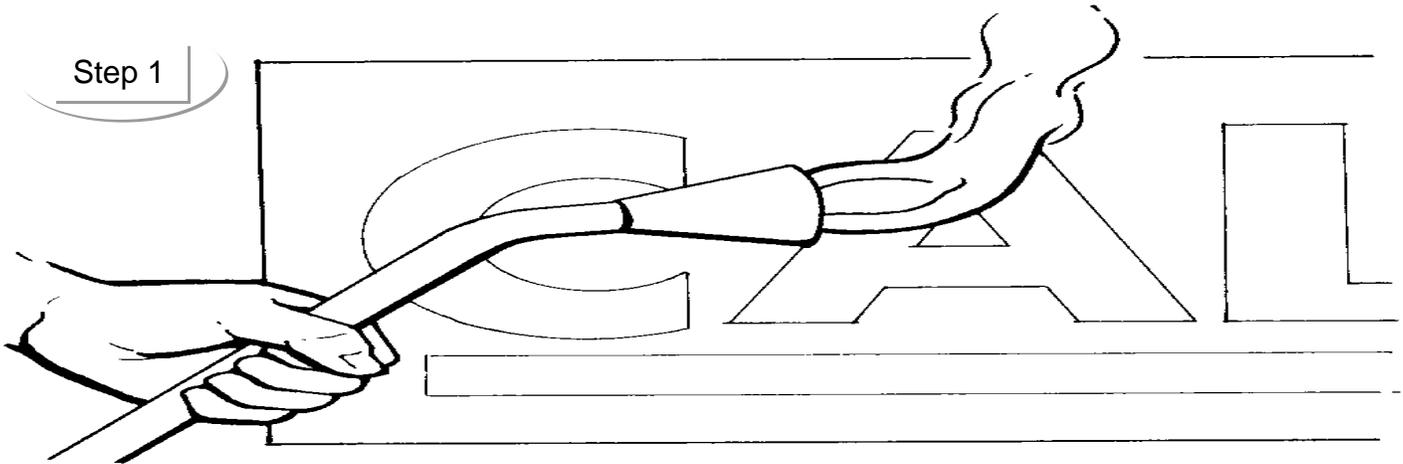
- Nozzle pressure should never exceed 1,300 psi (91 kg/cm<sup>2</sup>).
  - Water temperature should not exceed approximately 140°F (60°C).
  - Nozzle tip should never be closer than five feet (1.5m) from the graphics.
  - Angle of water spray should be no shallower than 60 degrees from perpendicular.
  - The detergent solution should always be blended with water at the correct ratio – a more concentrated solution can damage both the adhesive and the vinyl.
  - Fresh-water rinsing of the cleaned area will prevent streaks and bleach stains from developing later.
-

## REMOVAL OF GRAPHICS

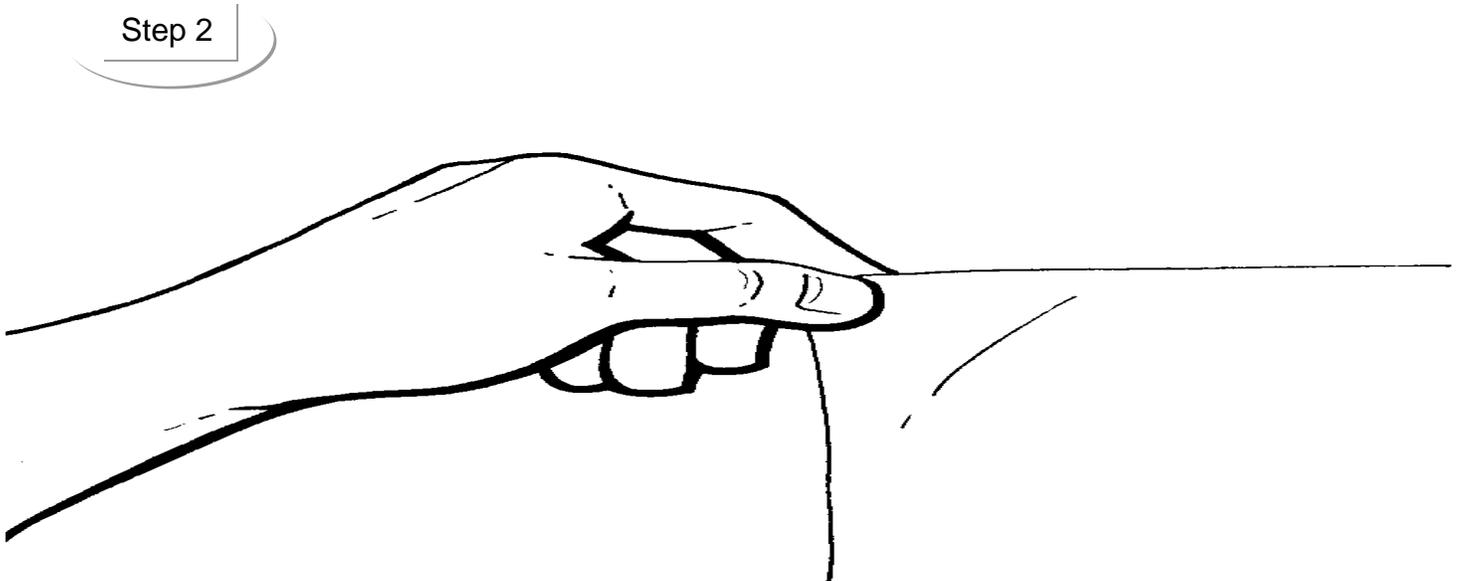
### Tools of the Trade

To soften the film and the adhesive a heat source is needed. A propane torch or an industrial heat gun will suffice for removing small letters and graphics. For removal of full coverage truck graphics, you will need a large torch such as a weed burner, which produces a cooler flame. An assortment of chemicals such as isopropyl alcohol, and solvent or citron-based adhesive removers will also be needed. Before using chemicals, read and follow the manufacturer's safety precautions. For scraping the softened adhesive off the substrate, you will need squeegees. Old rivet brushes are also handy for scrubbing adhesive off rivet heads.

### Film Removal



The first step is to warm up the vinyl with a heat source. A weed burner heats a large area quickly...and the surface stays warm for several minutes. Be sure to keep the flame moving to prevent burning the vinyl or the substrate. This heating process softens both film and adhesive.



Once film is warmed, pick up an edge and pull the film from the vehicle's surface at a 15° angle. If the temperature is just right, the adhesive often will come off with the film in a single operation. If the temperature is too hot, the film will separate from the adhesive.

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## ADHESIVE REMOVAL

In many cases, vinyl film and adhesive will come off perfectly with heat. In other instances, as the environment acts on the laminate, adhesive residue may remain on the sign face while the vinyl releases.

Removing adhesive involves the use of chemicals. When using chemicals, always exercise caution. Read and follow the manufacturer's instructions. The first step in using an adhesive remover is to test the remover on an inconspicuous spot on the truck to see if the remover reacts with the paint.

Next, test the adhesive remover on the adhesive. What worked on the last removal may not work this time. Start with the mildest adhesive remover, if that does not work, try a stronger one. Hardware stores and distributors of paint and sign supplies carry adhesive removers.

For best effect with a remover, saturate the adhesive with it rather than simply wetting the surface. Apply the remover by using a rag, a spray bottle or a pressurized sprayer. Let the remover soften the adhesive to a jelly-like state. Then scrape the gel from the surface with either an old installation squeegee or hard plastic squeegees made for that purpose. Arlon recommends:

- LIFT – X from Supply One in Sydney, Australia
- XR-1000 from Mod Industries in Rolling Meadows, Illinois.
- Rapid Remover from Rapid Tac in Merlin, Oregon
- Sprayway No. 894 from Sprayway in Addison, Illinois
- 3M Woodgrain and Stripe Remover from MM in St. Paul, Minnesota
- Orange peel – 800/866-8440
- Autotech – Adhesive Remover
- VinDotco – Adhesive and Mastic Remover in Largo, Florida

Please note, all of these products have specific instructions for their use which should be followed closely with a special eye on safety and recommended contact time.

A method used when the surface area is large or the climate is hot and dry involves applying thin plastic sheeting over the area to be removed immediately after spraying the remover on the adhesive. When the plastic is taped around its edges the solvent does not evaporate and removal proceeds more rapidly. This is a handy method to use when trying to contain remover in a specific area on the sign surface. In all cases it is better for containing both solvent and adhesive than when uncovered.

Use old rivet brushes to scrub the adhesive off the rivet heads. At this point, paper towels are suggested for easiest removal. Once adhesive has been completely removed use standard cleaning procedures to prepare the vehicle for the next installation. Adhesive removers are great for dissolving glue but leave an oily residue on the surface and are not to be substituted for alcohol and water as the final cleaning step.

Detail for all guidelines and suggestions are found in Arlon's T.I.P. Series available through all Arlon distributors.

# GLOSSARY

## **ACRYLIC**

This film exhibits low elongation, low tensile strength, and resistance to UV, solvents and chemicals. Used for interior and exterior signage and labels.

## **ACRYLIC-BASED ADHESIVE**

Pressure sensitive adhesive based on acrylic polymers.

## **ADHESIVE**

A substance capable of holding materials together by surface attachment.

## **ADHESIVE BLEED (OOZE)**

Adhesive exudation from pressure sensitive material to a finished product resulting from cold flow or pressure.

## **ADHESIVE RESIDUE**

Adhesive deposit remaining on a substrate as a result of cohesive failure when a pressure sensitive material is removed.

## **AGGRESSIVENESS**

A comparison of adhesives based on tackiness and speed at which bond occurs.

## **APPLICATION TAPE**

(Premask, Pre-spacing tape) - Carrier tape used to aid the application of pressure sensitive markings.

## **BACK SLIT**

A slit cut through the liner paper or backing sheet of pressure sensitive film, which aids removal of the film from the liner.

## **CALENDERED VINYL**

Pressure sensitive film available in flexible and semi-rigid forms. Manufactured by pressing PVC solids suspended in oils (of dough-like consistency) between heated pressure rollers.

Economy-grades are most often comprised of monomeric plasticizers resulting in poor dimensional stability and weathering of the finished product. Performance and durability improved by polymeric plasticizers. Typical thicknesses are from three to ten mils.

## **CAST VINYL**

Pressure sensitive film suitable for long-term exterior applications. Typical thickness from 1.5-3.0 mils. Dimensionally stable and conformable to irregular surfaces such as rivets and corrugations. Most have high gloss finishes, though mattes and textures are available. Manufactured by applying liquid plastic resins to a casting paper, then heating the liquid to form a solid sheet.

## **COLD FLOW**

Viscous flow of a pressure sensitive adhesive under pressure or other stress, at room temperature.

## **COLD-WEATHER ADHESIVE**

An adhesive usable at 32°F (0°C) or other specified low temperature.

## **DECAL**

Abbreviated form from decalomania, the French designation of a design printed on special paper for transfer to a substrate. Current usage includes pressure sensitive markings.

## **FACE DOWN**

Decal designed for application to a transparent substrate through which the graphic can be seen.

## **FACE MATERIAL (BASE MATERIAL, BODY STOCK, FACE STOCK)**

Any paper, film, fabric or foil which can be converted into a pressure sensitive decal.

**FACE SLIT**

Slit in the face of a pressure sensitive product which aids removal from the liner.

**FACE UP**

Decal designed for application to an opaque substrate where the design is on the same side as the application surface.

**FILM GAUGE**

Number which indicates the thickness of films - usually expressed in thousandths of an inch or mils.

**FLEET MARKINGS**

Term refers to decals or pressure sensitive graphics designed for application to commercially operated truck and van fleets.

**HIGH TEMPERATURE ADHESIVE**

A pressure sensitive adhesive which allows a decal to adhere to a substrate with an elevated temperature.

**LAMINATING FILM**

Clear or transparent sheeting applied to the face of a decal as protective layer. Applied as a cold-seal or thermal lamination. Laminates provide abrasion and chemical resistance.

**LAY FLAT LINER**

A release liner which resists curling in response to changes in humidity.

**LOOP TACK TESTER**

An instrument which measures the tackiness of pressure sensitive adhesive.

**LOW TACK ADHESIVE**

Adhesive exhibits non-aggressive initial character to aid application. Its bond usually becomes more permanent after 24 hours.

**MOTTLING (BLOTCHINESS, ORANGE PEEL)**

The non-uniform loss of the vinyl's surface shine occurring on wound rolls. Found most frequently with conformable films, the finish

may often be restored by exposing the facestock to a heat source.

**NIP POINT**

Contact point between two calendaring or laminating rollers.

**ORGANOSOL**

A mix of vinyl resins, pigment and solvents, resembling paint, used in the preparation of cast vinyl films.

**PEEL ADHESION (ADHESION, ADHESION STRENGTH)**

Force required to remove a pressure sensitive material from a standard test panel at a specified angle and speed after the material is applied under controlled conditions.

**PERMANENT ADHESIVE**

Pressure sensitive adhesive which becomes difficult to remove (after application) without leaving a residue on the substrate.

**PLASTICIZERS**

Plastic or ink additives which improves compatibility of components and/or improves flexibility, workability of the finished product.

**POLYCARBONATE**

Strong, abrasion-resistant, embossable film. Resistant to a variety of solvents and chemicals. Used for nameplates, signage and membrane-switch applications. Generally poor UV resistance.

**POLYESTER FILM**

Film, that may be adhesive coated, which features high tensile strength, excellent dimensional stability, resistance to heat, chemical, abrasion and solvents. Difficult to die cut. Must be top-coated or treated for printing, typically short-term out-door life unless protected by clear coat or over-laminate. Non-topcoated polyester is often used as a protective over-laminate for window decals, name plates and POP items. White polyester is used for signage, decorative trim, nameplates, decals and labels.

## **POLYMERS/COPOLYMERS**

Basic building block compounds used in the manufacture of all films, foams and adhesives.

## **POLYPROPYLENE FILM**

Mainly used as an over-laminate and for flexible labels. This film is a more flexible over-laminate than polyester. Exhibits high tensile strength and resists chemicals, water and acids. For indoor use only; not durable outdoors.

## **POLYSTYRENE FILM**

A stiff sheet sometimes used in place of semi-rigid vinyl. Features excellent handling properties, moderate tensile strength and excellent chemical resistance. Offered in thicknesses of 7 mil and above. Not recommended for outdoor use.

## **POLYVINYL FLUORIDE FILM**

Thin (1-2 mil), clear pressure sensitive film designed for exterior applications. Excellent dimensional stability. Resistant to UV, chemicals and water. Printable-grade polyvinyl fluoride is suitable for flat-surface exterior applications such as fleet marking and building graphics.

## **POSITIONABILITY**

Characteristic of pressure sensitive products which permits initial positioning to be changed or repositioned during application.

## **PREDISPERSION**

A mix of pigments and oils used in refining colorants by grinding to their highest color strength and efficiency.

## **PRESSURE SENSITIVE**

Tacky adhesive applied to sheet material which allows adhesion of the material to the substrate by contact and light pressure.

## **REFLECTIVE SHEETING**

Pressure sensitive film used for promotional and decorative decals, fleet markings, signage, night time safety graphics for trucks. Thickness ranges from 5-25 mils. Reflective sheeting features excellent dimensional stability and outdoor durability. Conformable grades for irregular surfaces are available.

## **RELEASE COAT**

Surface treatment of the release liner permitting the pressure sensitive adhesive to be removed from the protective liner.

## **RELEASE LINER (BACKING, BACKING SHEET, LINER, LINER PAPER)**

Component of the pressure sensitive stock that functions as the carrier for the pressure sensitive material, protecting the adhesive prior to application.

## **REMOVABILITY**

Descriptive term applied to the force required to remove pressure sensitive material from a substrate.

## **TACK (GRAB)**

Surface "stickiness" of a pressure sensitive adhesive; the ability of an adhesive to adhere.

## **TAMPER-PROOF ADHESIVE**

Extremely aggressive adhesive which will not permit decal removal without self-destruction.

## **ULTIMATE ADHESION**

Mature bond established between a pressure sensitive material and a substrate, under specific conditions.

## **VINYL (PVC)**

Pressure sensitive film used for screen printed decals, fleet markings, automotive and OEM markings, POP, signage. Typically dimensionally stable, easily die cut (steel rule and thermal).



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