



INSTALLATION & FABRICATION GUIDE

MONARC is a new product from 3A Composites Americas developed for wet-wall applications as well as other interior design solutions such as kitchen backsplashes, accent walls, fireplace surrounds, etc. It is comprised of 3A Composites' aluminum composite material (ACM) that has been embedded with realistic images of natural stone, tile, and other materials, utilizing proprietary technology and processes. This installation and fabrication manual has been developed to assist installers working with 3mm MONARC material in the most efficient and effective manner.

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INTRODUCTION

Product Information

MONARC from 3A Composites Americas

MONARC is a new product from 3A Composites Americas developed especially for wet-wall applications as well as other interior design solutions such as kitchen backsplashes, accent walls, fireplace surrounds, etc. It is composed of 3A Composites' Aluminum Composite Material (ACM) panels that have been decorated with realistic images of natural stone, tile, and other materials, using proprietary materials, technology and processes. These 3mm thick panels are lightweight, durable, dent-resistant, and easy to fabricate and install.

The following installation instructions are focused on wet wall installations in residential structures. There is additional information on the fabrication of ACM on 3ACompositesUSA.com.

GETTING STARTED

Fasteners

Fasteners or screws can be used to attach MONARC panels to the wall. It is recommended that either aluminum or stainless steel be used to attach the panels to the wall. It is not recommended for copper, brass, iron, bronze or steel fasteners to be used as this will create the possibility of corrosion due to electrolysis of dissimilar metals.

Fixtures

For bathrooms requiring a new tub or shower base it is important that the new plumbing fixture is installed as per the manufacturer's recommendations and that it is installed as level and square with the walls as possible.

Plumbing Valves

When a new tub/shower valve is being installed, make sure to install the new plumbing valve to align with the center of your plumbing fixture. Also, when installing a new shower head, adjust the height of the shower head so that the escutcheon cover plate for the new shower head can completely sit on the MONARC wall panel or sit completely on the finished wall above the MONARC shower wall panel. This can be accomplished by making sure that the shower head height is 2 inches above or below the finished MONARC shower wall height.

Backer Materials

MONARC wall panels are designed to be installed over any type of a securely mounted wall or wall substrate. This would include any type of sheetrock or other solid wall backer materials. Before installing MONARC wall panels, make sure that the panels and the walls they will be covering are clean, dry and free of any oils, dust, loose paint, or other contaminants that could prevent the MONARC shower wall panels from adhering to the desired installation wall.

STANDARD WALL PANEL INSTALLATION

MONARC wall panels are the perfect choice when it comes to decorative interior walls due to their smooth surface, high-resolution imagery, strong impact resistance, easy cleanability & installation, and surface versatility & customization.

Mounting Surface

MONARC panels can be installed over solid wall surfaces such as wood, drywall, backerboard, etc. All surfaces should be **clean, flat, dry and smooth**. Uneven wall surfaces must be corrected before the installation of MONARC wall panels.

Panel Preparation for Adhesives

There are several methods and recommendations for adhering MONARC panels to wall surfaces. Make sure both surfaces are clean and dry. It is recommended that Isopropyl Alcohol is used to clean the back side of the MONARC panels before the adhesive is applied. This removes any dust, oils and other contamination that could cause poor adhesion.

Contact Adhesive Method

The use of a contact adhesive is recommended and typically sprayed on both the backside surface of the MONARC panel as well as the wall surface to be adhered. The adhesive should be allowed to flash off before the panel is applied to the wall surface (reference the adhesive manufacturer's guidelines). Once the panel is placed on the wall, it is then recommended that a "J" roller be used to remove any air pockets or bubbles. This ensures that good contact is made between the MONARC panel and the wall. It is recommended that only medium pressure is used to make good contact between the panel and the wall. It is also recommended to roll from the middle of the panel out so that no air bubbles are trapped behind the panel.

****Important** - remember that contact adhesives produce an immediate & permanent bond, so it is crucial that the panel is installed at the desired area as it cannot be adjusted once applied.

Polyurethane & Silicone Adhesive / VHB Tape Method

The use of a polyurethane or 100% silicone adhesive can be used in conjunction with VHB tape (3M VHB or very high bond double sided tape). It is recommended to apply quarter sized beads of the polyurethane or silicone adhesive liberally to the back side of the panel, or apply a running bead approximately 3/8" wide back and forth across the back side of the panel. This will ensure good adhesion of the panel to the wall. It is also recommended that 3M's VHB double sided tape (or equivalent) be used to secure the panel in place until the polyurethane or silicone adhesive has cured. The tape can be applied directly to the back side of the MONARC panel in between the adhesive that has already been applied. It is recommended that the tape be applied near the edges of the panel and throughout the middle. Once the panel has been applied to the wall, it is recommended that a "J" roller be used to ensure good contact has been made between the panel, the adhesive and double-sided tape, and the wall.

****Important** - Remember that VHB tapes produce an immediate & permanent bond, so it is crucial that the panel is installed at the desired area as it cannot be adjusted once applied.

SHOWER WALL INSTALLATION

Corner Seal Protection Methods

Corner Seal Protection (**CSP**) is a process that has been developed to provide the maximum water leakage protection available for wet wall corner applications. This process has been developed for showers using slabs, solid surfaces, and composite type shower panel products. Two CSP methods are detailed on the following pages.

Method 1:

MONARC wall panels have a unique property and functionality that set them apart from other materials when it comes to corner seal protection. MONARC panels have the advantage of being able to be scored, or cut, on the back side which allows them to be bent and formed as an inside corner. By cutting the back aluminum skin only, going from the top edge to the bottom edge of the panel, the front aluminum facer remains intact and acts as a hinge that allows the MONARC material to be bent to an inside 90-degree, water-resistant corner. This allows you to run an excess of 2 inches or more of the MONARC panel around the inside corner and onto the adjoining wall.

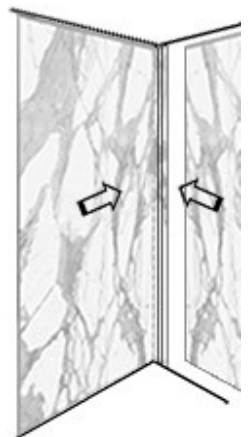
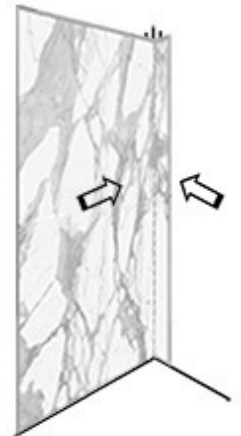
Note: If this is a 3-wall shower system, repeat these steps on the opposite side wall of the shower.

After gluing and installing this panel into place, the installer should then run 2 continuous beads of silicone on the face of the 2-inch flange, with the beads being 1/2" apart and extending from the top edge to the bottom edge of the MONARC panel. Next, the adjoining MONARC panel would be installed snug into the inside corner(s) of the panel(s) that were just installed.

Note: Apply the 2 beads of silicone only after the adjoining panel has been fitted, cut-to-size, and the back wall has had the glue applied to it.

With the back wall ready to be installed, the 2 beads of silicone can be applied, enabling the silicone to adhere to the back side of the adjoining panel. When the adjoining MONARC panel is glued and pressed into place, a water tight seal is created. Using this system allows the final silicone bead in the finished corner to be smaller and more aesthetically pleasing as it will not affect the durability or water resistance of the finished corner.

This is the preferred and recommended method of installation for MONARC wall panels.



Method 1

SHOWER WALL INSTALLATION

Corner Seal Protection Methods

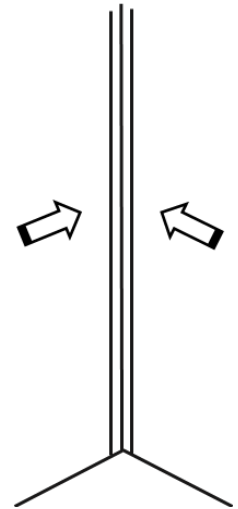
Method 2:

This is an optional 2-inch wide plastic drywall corner bead that comes in a roll and can be bent down the middle after it has been unrolled and cut to size. These are to be used for each inside corner that exists inside the wet-wall area that needs to be covered. This CSP acts as a corner reinforcement and a two stage joint fault protection.

To install this option, apply a bead of caulk adhesive into the inside corner where the two MONARC wall panels will meet together. Make sure to apply the caulking just short of the measured height that the MONARC wall panels will be covering.

Then cut to size the flat, pre-embossed corner bead to the desired length and fold it over on itself making a V shape. With a putty knife, push the V-shaped CSP into the adhesive and center it into the corner of the wall. Using the same putty knife, flatten each side of the CSP to each of the adjoining walls and spread the adhesive smooth, making a nice sealed and smooth corner that is ready for the MONARC wall panels to be applied.

During the process of applying glue to the wall in order to prepare it for the cut-to-size and pre-fit MONARC panels, apply a continuous bead of silicone from top to bottom on each side of the newly installed CSP. The silicone will adhere the edge of the MONARC panel to the CSP making it water tight and will prevent water from migrating into the shower back board, thereby preventing future water damage.



Method 2

SHOWER WALL INSTALLATION

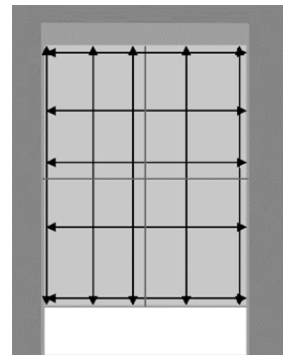
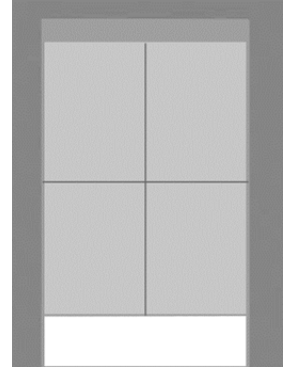
3 Wall Panel Installation

Using the Plumb & Level Method

Step 1: Draw two plumb vertical lines on the outside walls that indicate where the shower wall edges will be once the MONARC shower wall panels are installed. Draw a level line on each of the three walls indicating where the top of the shower panels will reach. If the kit is going to the ceiling, the ceiling will act as this line.

Step 2: Next draw a level horizontal line across the middle of each of the three walls to receive MONARC shower wall panels. Finally draw a plumb line that is centered in the middle of the back wall of the installation.

Step 3: Measure and write down the measurements from the plumb, level, and perimeter lines to the ceiling, tub/shower pan, and adjoining walls in multiple places across the wall.



Side Wall Panel Installation

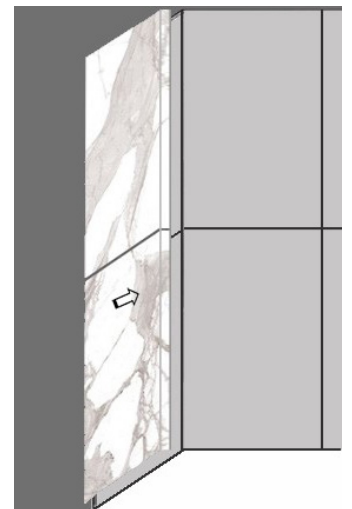
Non-Plumbing Wall

Step 4: Determine what will be the finished result on the outside edge of your shower walls by reviewing steps 25 and 26 on page 12. These installation instructions will assume that the side wall panels will be made using Step 26:3 CSP (Method 1). After making 2 rolled front edge side wall panels, 1 for the right side / 1 for the left side as per step 26:2, draw one horizontal line across the middle of each of the MONARC side wall panels on the protective film.

Note: The outside edge of the MONARC shower wall panel and the outside perimeter vertical line located on the installation wall will act as the plumb line for the side wall installations.

Step 5: Transfer all measurements from the plumb, level, and perimeter lines to the ceiling, tub/shower pan, and adjoining walls on the non-plumbing wall. Using a jigsaw, router, or power-plane, you can start by cutting the top and bottom of the panel to size and making adjustments as needed for a perfect fit. Next, follow the instructions in step 26:3 to cut the panels width and create a return flange that will be bent to a 90 degree inside corner. This has turned your side wall panel into a CSP (Method 1).

Note: If using wall panels with grout lines make sure to measure and transfer measurements to grout lines as well to ensure the alignment of grout lines between panels.



SHOWER WALL INSTALLATION

Side Wall Panel Installation (cont'd.)

Non-Plumbing Wall

Step 6: After the MONARC side wall panel has been dry fitted and trimmed to a perfect fit, make sure that the backer board is clean, and then clean the back side of the panel with denatured alcohol. This will eliminate contaminants from interfering with the adhesion of the shower wall panel to the wall backer board.

Step 7: Now that the panel is ready to install, apply dollops of adhesive on the wall backer board placing the adhesive in 1-1/2" x 3/8" thick plugs every 6 to 7 inches apart. The adhesive for installing MONARC panels should be a polyurethane adhesive or a 100% silicone adhesive. Make sure to always follow the adhesive manufacturer's directions.

Optionally, a contact spray adhesive may be used by spraying adhesive on the wall backer board as well as on the MONARC panel. Allow the contact adhesive to flash off the solvents by waiting for the manufacturer's recommended time before sticking the panel to the wall. Again, make sure to always follow the adhesive manufacturer's directions.



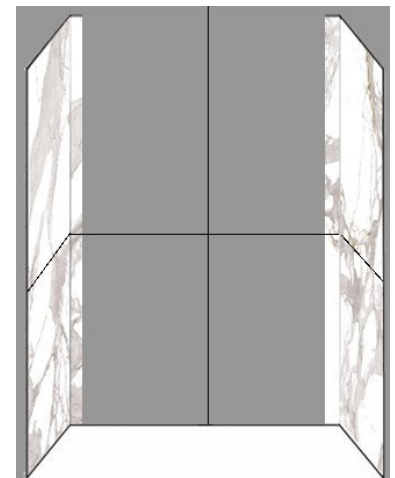
Step 8: Install and push panel by hand into place, then roll with a roller to ensure a good bond.

Plumbing Wall

Step 9: Repeat steps 4 and 5 for the MONARC shower plumbing side wall panel to be installed on the plumbing fixture wall.

Step 10: After achieving a perfect fit on the plumbing wall, mark and cut holes for the plumbing fixture valve and showerhead. This can be done using a hole saw or pre-drilling the panel and using a jigsaw with a bimetal blade for cutting non-ferrous metals. After cutting holes for the plumbing fixture valve and shower head, dry fit the panel one last time to be sure of a good fit before moving on to step 11.

Step 11: Repeat Steps 6, 7, and 8 for adhering MONARC shower plumbing side wall panel to the wall.



SHOWER WALL INSTALLATION

Back Wall Panel Installation

Step 12: Take the MONARC panel to be used for the shower back wall and draw one vertical and one horizontal line down the middle on the protective film of the MONARC shower wall panel.

Step 13: Transfer the measurements to the MONARC back wall panel. Using a jigsaw, router, or powerplane, you can cut the panel to size and make the adjustments as needed for a perfect fit.

Note: If installing panels with a grout line, you can align the grout line to the plumb and level lines. This will help to ensure that your grout lines are installed both plumb and level. Use this same process for end walls ensuring that grout lines align where the panels come together in the corners.

Step 14: After the MONARC back wall panel has been dry fitted and trimmed to a perfect fit, make sure that the backer board is clean and dry, and clean the back side of the panel with denatured alcohol. This will eliminate contaminants from interfering with the adhesion of the MONARC wall panel to the wall backer board.

Step 15: Now that the panel is ready to install, apply dollops of adhesive on the shower wall backer board, placing the adhesive in 1-1/2"x3/8" thick plugs every 6 to 7 inches apart. The adhesive for installing MONARC panels should be a polyurethane adhesive or a 100% silicone adhesive. Make sure to always follow the adhesive manufacturer's directions.

Step 16: Additionally, run the 2 beads of silicone down each inside 2-inch flange as suggested in the corner seal protection option 1 on page 6. This will ensure a nice, water-tight seal to protect the shower from leaking.

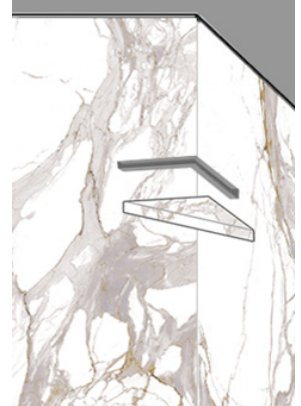
Step 17: Install and push panel by hand into place and roll with a roller to ensure a good bond.



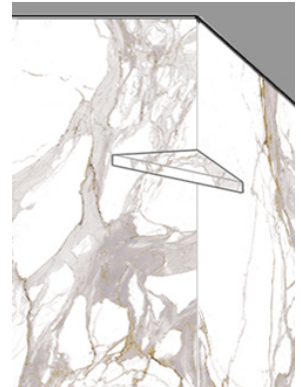
SHOWER WALL INSTALLATION

Installation of Corner Shelf (Optional)

Step 18: Remove protective masking at desired corner shelf location. Measure and mark location of the corner shelf on MONARC back and side shower walls. Install corner bracket on MONARC shower walls with double face tape and mechanical fasteners. Allow for 1/16th of an inch fall from back corner of bracket to the front edges of the bracket. This will eliminate any puddling or excess water remaining on the shelf during and after use.



Step 19: Trim and adjust MONARC corner shelf to fit squarely and securely over the top of the installation bracket. Apply adhesive to the bracket and clamp the MONARC corner shelf over the top of the adhesive covered corner shelf bracket.



Sealing Corners & Joints

Step 20: Remove all protective masking from the MONARC panels and corner shelf.

Step 21: Using denatured alcohol, clean all corners, edges, and joints where the MONARC panels and seams will be sealed. This would include all places where MONARC panels meet corner shelves, tub/shower pans, plumbing fixtures, finished walls and other MONARC panels.

Step 22: Using a 100% silicone adhesive, seal all joints of MONARC materials that previously had been cleaned. These would include all joints and corners where MONARC wall panels meet corner shelves, tub/shower pans, plumbing fixtures, finished walls and other MONARC shower panels.

Step 23: (Optional) Latex caulk can be used instead of a 100% silicone adhesive where MONARC panels meet the finished wall in order to facilitate the ease of painting that joint in the future.

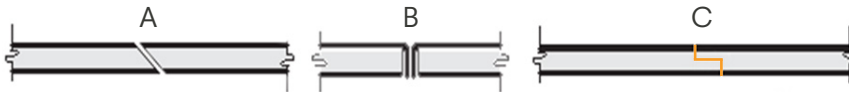
Step 24: (Optional) Finish all caulk and silicone lines with a caulk tool for a neat, uniform line and appearance.

FABRICATION TECHNIQUES

Trim and Variations (Optional)

Step 25: For walls that are taller or wider than the 60 inch maximum MONARC panel width, there are several options for finishing as described below:

1. Butt the panels together and silicone the joint between the panels. Below are three different options for joining.



2. Make a batten strip that will overlap the joint between two panels.



3. Overlap the panel with a finished end panel that spans to the edge of the wall.



Step 26: Variations for finishing the edge of the panel at the wall:

1. Raw panel edge finish

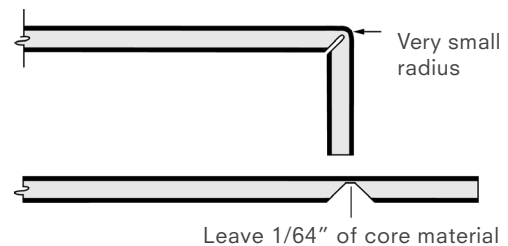


This edge can simply be caulked against the wall or it can be used in conjunction with a Schluter type J channel that covers the edge of the MONARC panel.

2. Rolled front edge

This edge is known as a route and return. It is made from a panel that has been V-routed on the back side with the flange or smaller portion of the panel being bent to form an outside 90° corner. This can be done using a hand router or track saw with the appropriate V bit or V blade.

Start by placing the track for the saw or the fence for the router so that the tip of the V blade is approx. 1-3/4 of an inch away from the long edge of the panel. Clamp the track into place if you're using a track saw. If you're using a router, the fence of the router will ride against the edge down the long side of the panel.



Next, make sure to adjust the router or saw blade so that there's just a little bit of the core material remaining at the bottom of the V groove after passing the router or saw over the panel, approximately 1/64". It is recommended to run some tests on a few sample pieces to ensure bendability and quality of the bend before proceeding with larger panels for the final application.

FABRICATION TECHNIQUES

Trim and Variations (Optional)

2. Rolled front edge (cont'd.)

After adjusting for height, the cut can be made and the 1-3/4" flange can be bent to an outside 90° bend. Once you have routed and bent the 1-3/4" flange to a 90° bend, you can trim any excess flange material that extends beyond the desired length.

If this edge is going against a flush finished wall, the flange would be trimmed back to somewhere between flush with the back side of the panel and a lip that extends 1/8" past the back side of the panel. This will allow for adhesive thickness behind the wall without pulling the finished edge of the panel away from the wall. This can be done by taking a router with a flush trim router bit and cutting the unwanted portion of the flange off by allowing the bearing on your flush trim router bit to ride on the back side of your finished panel.

If a thicker lip is desired, you can purchase replaceable bearings for your router bit that allow for different thicknesses of your finished lip. An example of this would be replacing the 1/2" router bearing with a 3/4" router bearing to achieve a 1/8" extended lip. Remember that you will only increase the size of the finished lip by 1/2 of the overall increased size of the bearing. Using this 3/4" bearing example would allow 1/8" for glue to be applied to the wall while still allowing the routed lip of the panel to remain touching the finished wall to which it's being applied. Another means for achieving the desired finished lip thickness is by running the panel upright through a table saw that has been set up for the desired lip thickness.

3. Corner Seal Protection - Method 1

Making a CSP (Method 1) side wall begins with making a rolled front edge panel as described in Step 26:2. After completing this process, you will transfer the sizes from your shower application side wall to the back side of your rolled front edge panel. When the panel is cut and being bent into place, the width of the panel will grow 1/8"



due to the panel being that thick - reference above picture. This means you will need to subtract 1/8" from your measurements and draw a straight line down the back of the panel.

Next, using a utility knife or a small circular saw with a 1/16" wide blade, make a cut that penetrates through the back aluminum skin only. You'll need to run this cut from top to bottom of the side wall panel. After assuring that a clean cut has been made, bend the remaining portion of the panel away from the cut to form an inside 90° bend or corner. Generally, a 2" lip of flange is preferred, but whatever portion of the remaining panel that returns around the corner is acceptable as long as it's glued well to the back wall.

FABRICATION TECHNIQUES

Trim and Variations (Optional)

4. Finished trim over edge of panel

Trim pieces can be achieved by repeating the rolled front edge process in step 26:2. The inside lip or side of the trim that's overlapping the panel should have the flange cut to somewhere between being flush with the back side of the panel

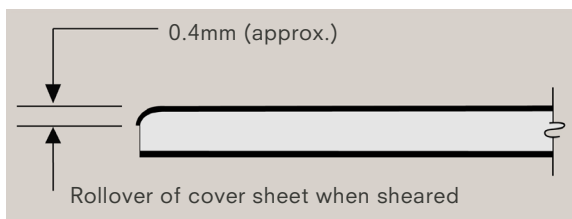
and 1/8 of an inch past the back side of the panel. The wall side flange on the trim should be cut between 1/4" - 5/16" past the back side of the panel. Generally, a 3" trim is made as an outside trim or a trim for 2 panels that have been butt joined together. In the case of overlapping 2 panels butt joined together, the 2 flange sides of the trim would both be cut off equally. This would be somewhere between flush and 1/8" past the back side of the trim or panel.



Shearing

The ACM substrate can be easily sheared. However, a slight roll-down of the aluminum cover sheet may occur on the impact side. This "roll-down" area is often referred to as the "edge zone." In this area, the polyethylene core is compressed and can lead to increased stress between the core and the aluminum cover sheet. The curled edge could be used as an edge for caulking to the wall.

Figure 1 - Shearing



FABRICATION TECHNIQUES

Saw Cutting

The ACM substrate is manufactured with a polyester paint finish. Care should be taken to protect the finish during any sawing operation. In some cases it is best to move the saw blade rather than the substrate when sizing the panels.

Blades

1. CIRCULAR BLADES

Blades should be carbide tipped or high speed steel designed for cutting non-ferrous materials, ground thinner from the rim towards the center to prevent pinching. The blades should have angled or circular teeth, alternate beveled, triple ground with the tooth gap wall rounded. The chip angle should be 5 to 15 degrees with a clearance angle of 10 to 30 degrees and a tooth spacing of 3/16" to 1". Cutting speeds of 5,500 RPM and feeds of 16"/second are possible.

NOTE: Table saws are not recommended for cutting sheets larger than 4'x4' in size.

2. RECIPROCATING BLADES

Reciprocating saws work well for cutouts. Care should be taken with portable and reciprocating saws to prevent damage to the surface of the panel. Blades should be high speed steel, .03" to .047" thick, 3/16" to 9/16" wide, with hook or circular teeth with alternate angles, set or waved at a spacing of .010" to .250". Cutting feeds up to 4"/second are possible.

Drilling

The ACM substrate can be drilled with twist drills usually used for aluminum and plastics, and on drilling machines customarily used for metals. Drill bits should be high speed twist drill with a tip angle of 100-140 degrees, or counter-bore grind with centering tip. Cutting speed of 164 RPM to 984 RPM.

*Quick removal of chips can be achieved by a high RPM, slow feed speed and occasional lifting of the bit.

Routing

The ACM substrate can be cut to size using either portable commercial or automated routing equipment. Bits should be carbide tipped and kept sharp. Single or multiple flutes may be used.

FABRICATION TECHNIQUES

Routing for Bending

The ACM substrate can be accurately folded by hand after a simple routing operation is done on the back skin. This fabrication method is called Rout and Return. It is unique to metal composite panel fabrication. Do not use a press brake for tight folds of the substrate. The material may be routed by using one of the following methods:

1. Hand operated routers equipped with modified 90-108 degree "V" bits (See **Figure 2**) can be used effectively to remove material for folding.
2. Table or circular saws can be equipped with a special blade (See **Figure 3**); these blades refer to as "V" routing blades produce very close tolerances at a much faster rate than hand routers.

Figure 2 - Router Bits

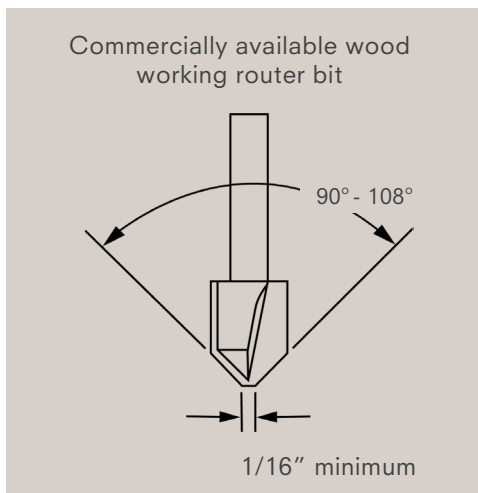
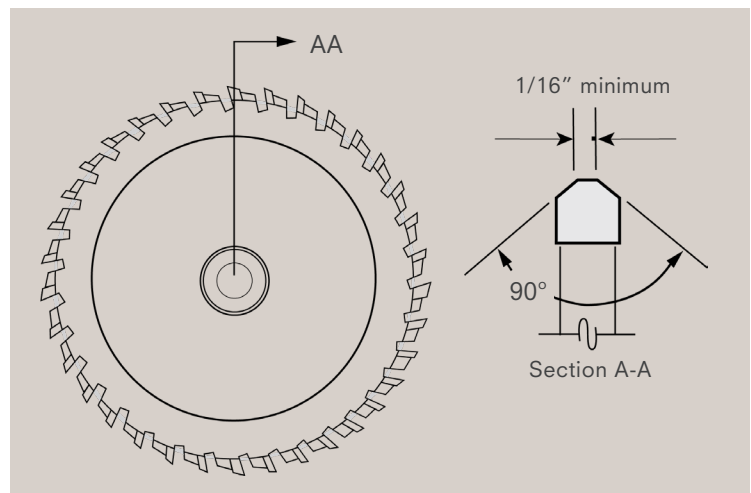


Figure 3 - Routing Saw Blade ("V" routing blade)

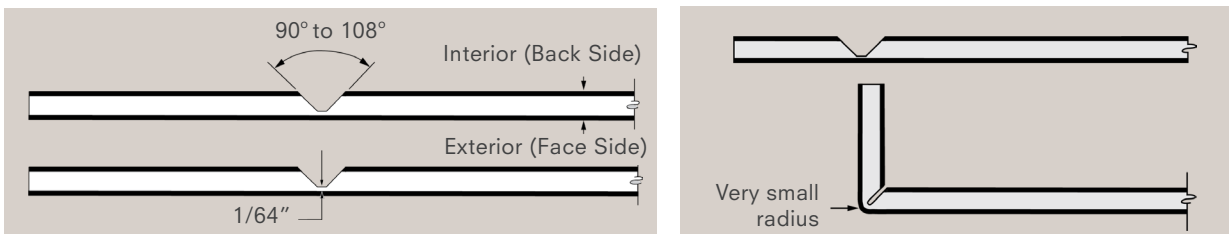


FABRICATION TECHNIQUES

Routing for Bending - Small Radius

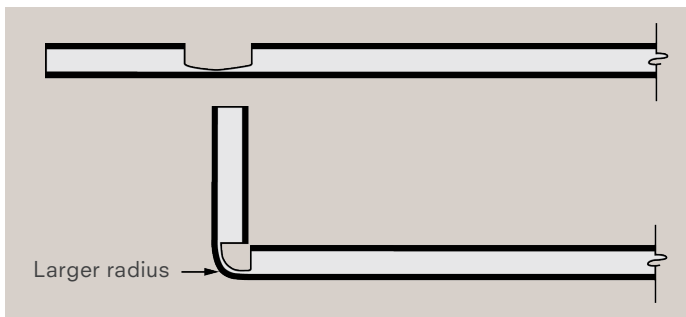
A very small radius can be achieved by “V” routing and folding. The depth of the “V” rout is critical. As general guideline, the exterior aluminum skin should be visible through the polyethylene core at the valley of the rout; this visual appearance should be consistent along the entire length of the rout (See **Figure 4**). Constant depth of the rout ensures a good smooth line when the fold is made. Extreme care should be taken not to score the exterior aluminum skin with the cutter.

Figure 4 - “V” Routing



By changing the shape of the cutter used, a larger radius can be achieved. A flatter, wider cut will result in smoother bend (See **Figure 5**).

Figure 5 - Flat Routing



90° Corners

The most common corner is a 90° Rout and Return. This corner is made by folding a V-Routed panel to a 90° angle. It is critical that the modified V-Rout is made to the correct depth to create a good return angle. “Spring back” will occur if the rout is not deep enough, however, extreme care should be taken not to score the exterior aluminum skin with the router bit or blade during the routing operation so that the aluminum is not weakened. The depth is correct when the exterior skin is intact with approximately 1/64” of polyethylene in the bottom of the V-Rout and the return does not “spring back” when folded.

FABRICATION TECHNIQUES

Routing & Folding for Corners

MONARC material “pan” is easily fabricated by routing all four sides, notching the corners (shown in **Figure 6** and **Figure 7**), and folding or returning each of the routed sides (**Figure 8**). This type of fabrication is commonly referred to as “Rout and Return”.

Figure 6 - Square Corner Cutouts

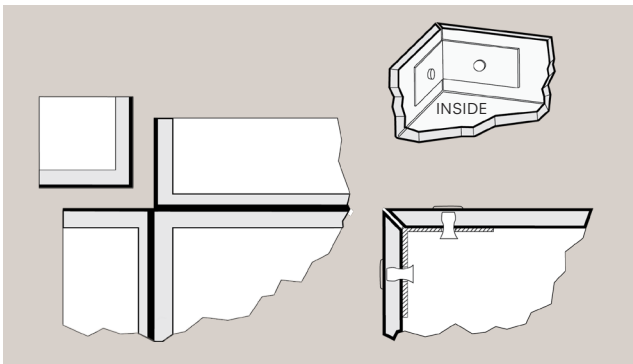
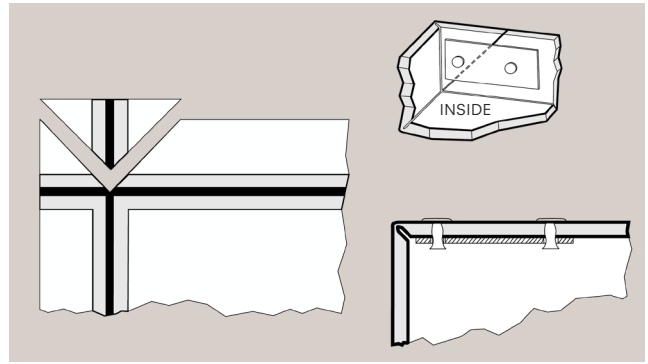


Figure 7 - Envelope Corner Cutouts



By routing only one side, MONARC material can be bent either upward or downward to create both an inside or outside corner (**Figure 9**).

Figure 8 - Rout & Return

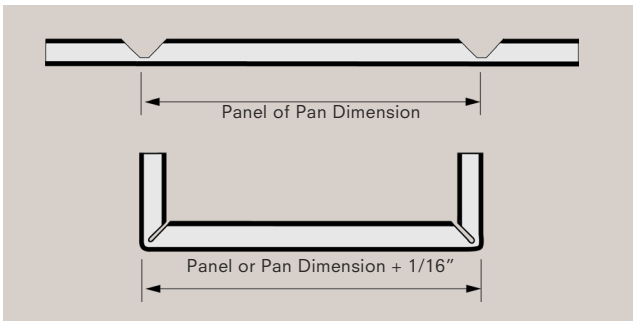
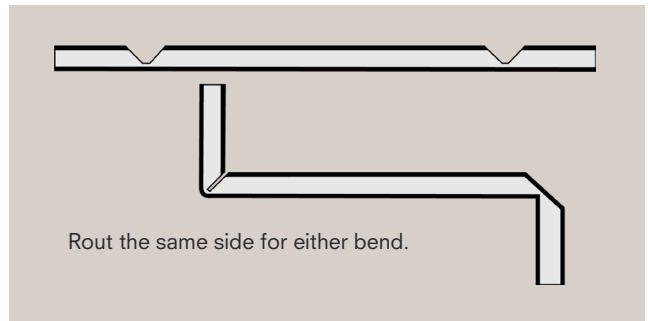


Figure 9 - “V” Routing



Notes:

The material is most easily bent when the rout is made at least one inch or more from the edge of the panel.

*As a result of the slight radius produced when bending, your finished panel dimension will be 1/32” to 1/16” larger when folded. This is determined by the profile of the cutter used to make the rout. Trial cuts should be made prior to full production to determine any necessary adjustments in layout dimensions (reference **Figure 8**).*

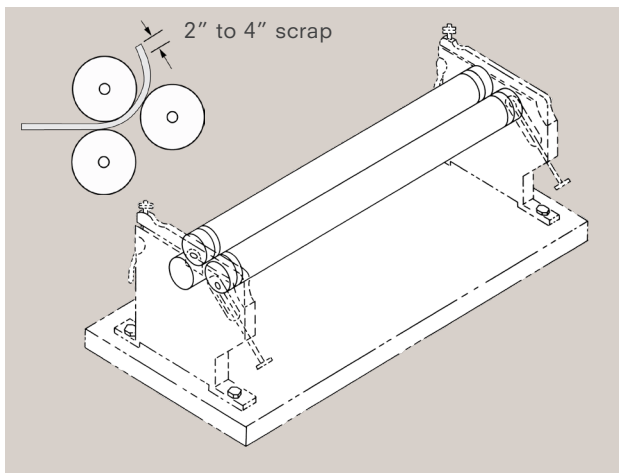
FABRICATION TECHNIQUES

Curving Through Cold Forming

The minimum curving radius of the substrate without routing the back skin is 30 times the thickness of the material. For example, using a 2mm thick sheet: $2\text{mm} \times 30 = 60\text{mm}$ radius (2-3/8"). The substrate may be curved using one of the three methods common to the sheet metal industry:

1. Pyramid Roller

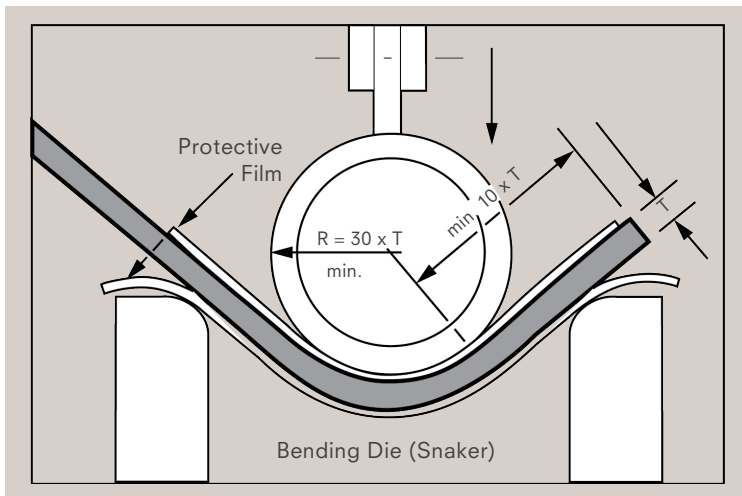
The use of a pyramid roller to curve the substrate is an acceptable method of obtaining a radius. As a precaution, film should be used between the substrate and the rollers to protect the substrate surface.



1. Make sure rollers are clean
2. Use protective material between the rollers and MONARC material - top and bottom
3. Adjust rollers for thickness (3mm)
4. Allow 2" to 4" scrap at each end

2. Press Brake

1. When forming with a brake press, use a top die with the desired radius
2. The lower die should always have a protective film of less than 1/8"
3. The radius of the top die will be the approximate inside radius of the finished panel
4. The end of the substrate should extend at least 10 times its thickness from the tangential contact point of the bending die



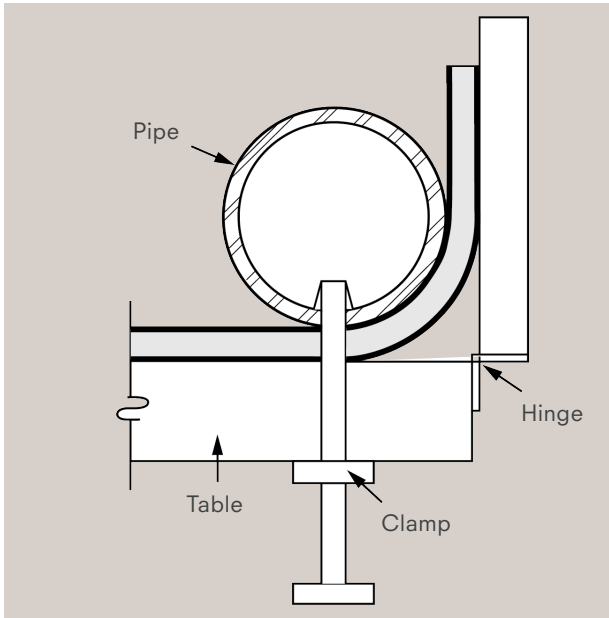
R - Radius
T = Thickness

FABRICATION TECHNIQUES

Curving Through Cold Forming (cont'd.)

3. Bending Over a Clamped Pipe

The substrate may be bent over a pipe of desired radius that is securely clamped to a table. A hinged "leaf" attached to the end of the table will bend the substrate easily.



ADDITIONAL NOTES

Fastening

Joining ACM

Typical methods of joining the ACM substrate are the use of threaded fasteners, rivets, adhesives and double-faced high strength tapes. Proper consideration should be given to the thermal expansion characteristics of ACM. See Thermal Expansion Section on page 20. Use the general guidelines listed below when other elements come in direct contact with the surface of the substrate. It is always recommended to trial application various joining techniques to ensure success.

ACCEPTABLE JOINING ELEMENT MATERIALS

- Aluminum
- Plastic
- Stainless Steel

UNACCEPTABLE JOINING ELEMENT MATERIALS

- Copper
- Brass
- Bronze
- Iron
- Raw Steel

Unacceptable materials may cause corrosion of joining surface due to electrolysis of dissimilar metals.

Threaded Fasteners

Threaded fasteners will allow the removal of the panel if needed. The use of a large flat washer will aid to minimize surface pressure and possible compression due to cold flow of the core material. Placement of the threaded fasteners should not be less than 0.75" from the edge of the sheet. It is not recommended to torque fasteners due to the cold flow of the core material, one turn past finger tight is common practice.

Rivets

Panels of the ACM substrate can be fastened together or joined to aluminum extrusion profiles with rivets common to aluminum construction. Rivet connections are well suited for parts that may be subjected to vibration. Colored plastic concealment caps can be used to conceal the exposed rivet head. Consult the rivet manufacturer for details.

ADDITIONAL NOTES

Thermal Expansion

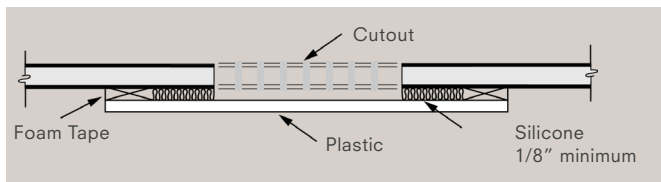
Thermal expansion should always be considered in designs using aluminum composite materials. The ACM substrate has been tested and has a rate of expansion of .000156"/FT/°F. That translates into approximately a 1/8" movement in an 8' panel with a 100°F temperature change. Temperature differences must be considered between shop (fabrication) temperature and the highest and lowest panel application temperature. Care should always be taken to avoid restricting thermal movement of the panel to eliminate unacceptable bowing or over stressing of the fasteners.

The coefficient of expansion for unlike materials should be considered in joint design.

Adhesives

For interior design purposes, high strength contact adhesives that do not require lengthy setting times can be used. Where moderate cure times are acceptable, construction adhesives and silicones can be used to obtain a stronger bond than with contact adhesives. Silicones take a good deal of time to cure before a load can be applied, whereas the faster curing adhesives may not have the movement capabilities to meet the project needs. In these instances, a combination of double sided foam tape and adhesive is often used. When using an adhesive to hold dissimilar materials, select one that will allow thermal differential movement without shearing. Use a low modulus sealant where greater amounts of movement are expected (i.e., plastics to ACM), and medium modulus sealants if minimum movement is expected (i.e., bonding aluminum to ACM). See **Figure 10**.

Figure 10 - Adhesive & Tape Placement



Tapes

For stress-free applications and to hold parts while the primary adhesives cures, double-faced foam tapes are effective (**Table 1**). Both surfaces to be bonded must be clean and dry. It is important that the tape manufacturer’s directions are followed for best results.

TABLE 1

3M - Industrial Tape & Specialties Division	VHB Double Coated Acrylic Foam Tape
Avery Dennison - Specialty Tape Division	FasTape Acrylic Foam Tape
Mactac - Technical Products Division	MACmount Double-Coated Foam Tapes
Norton - Norton Performance Plastics Corp.	Normount

ADDITIONAL NOTES

General Adhesives & Double-Sided Tape Guidelines

1. To achieve reliable bonding, it is imperative to follow the adhesive manufacturers's application instructions.
2. Although many adhesive materials work well on MONARC material, no product, either adhesive or tape, has been found that will adhere to the core materials. All attachments should be made through contact with the aluminum facers of MONARC material.
3. Care must be taken in the selection of an adhesive regarding the expansion of the materials to be joined. Where significant thermal expansion can occur, adhesives should be of medium or low modulus materials to allow for movement without shear or loss of bond. For interior applications where thermal expansion is not a consideration, high modulus adhesives can be used to join materials.
4. Cure time is generally a consideration in the choice of adhesives. Silicones take a good deal of time to cure before a load can be applied whereas the faster curing adhesives may not have the movement capabilities to meet the project needs. In these instances, a combination of tape and adhesive is often used.

Example: Two pieces of MONARC material must be connected for a strong permanent bond in a short period of time. The adhesive area is 2" x 36".

Many times a strip of double-sided tape (approx. 3/4" wide) will be applied next to a bead of silicone adhesive. For the near term, the tape holds the MONARC material. For the longer term, the silicone adhesive will cure and relieve the load applied to the tape, which now acts as a joint filler.

The following adhesives have been shown to adhere to MONARC material. Please refer to the adhesive manufacturer guidelines or contact 3A Composites Technical Services.

- **Boss 380 Silicone**
- **Manus-Bond 75-AM**
- **Geocel 2300 Construction Tri-polymer Sealant**
- **Everkem Trusil 100**
- **Adhesion Products AP 502**
- **Liquid Nails Sealant LS 205**
- **ASI 5900 Construction Adhesive**
- **SikaSil GP-101**
- **Sikaflex 11FC Polyurethane Adhesive**

Isopropyl alcohol two-cloth cleaning method is a minimal surface preparation for all adhesive bonding.

It is important to follow the guidelines listed above and to experiment with any new adhesive or technique prior to generating the final product.

CONCLUSION

This Installation & Fabrication Guide has been developed to assist installers to work with the MONARC substrate in the most efficient and effective manner. The tips and suggestions contained in this guide are the result of combined experience by various installers in the U.S.

These installation and fabrication suggestions are based on information which is, in our opinion, reliable. However, since skill, judgment, and quality of equipment and tools are involved, and since conditions and methods of using the substrate are beyond our control, the suggestions contained in this manual are provided without guarantee. We recommend that prospective users determine the suitability of both the material and suggestions before adopting them on a commercial scale.

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Also, normal safety and health precautions practiced in any fabricating environment should be used when fabricating the MONARC substrate.

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