

# Application: Special Considerations for Watercraft

## Instruction Bulletin

### General Information

This Bulletin is specifically for the application of 3M recommended films to watercraft.

Watercraft intended for personal pleasure such as motor boats, sailing boats, catboats, mega yachts, jetskis, runabouts and speedboats having aluminum and/or smooth fiberglass/gel coat bodies, but no other boats used in connection with commercial or business enterprise. 3M specifically excludes all other recreational vehicles from this definition.

Be sure you obtain and use the most current supporting Product and Instruction Bulletins referenced in this Bulletin.

Make sure each applicator reads and understands this Bulletin before beginning.

Follow each step in the order given. Do not take short cuts.

3M requires that a properly executed and signed *Pre-installation Inspection Record* be completed before any 3M graphics are applied. This record, which identifies any potential problem areas, is mandatory if a warranty claim is made in the future. Make a copy of the appropriate record, located at the end of this Bulletin, and take pictures before and after the application for every watercraft.

3M recommends that graphics manufacturers clearly define mutual obligations between the watercraft graphics operating companies and themselves and strongly suggests that graphics manufacturers seek written limitations of claims or liabilities on individual watercraft for unsound paint.

### *IMPORTANT NOTICE!*

**All graphics must be applied above the static water line.** Graphics applied below the static water line are not warranted or recommended.

**All cut seams and edges must be edge sealed or taped.**

### Do Not Apply Film to These Surfaces

- Textured plastic substrates. 3M does not warrant the application of film to textured plastic substrates under any circumstances. However, if you wish to try, using heat and a rivet brush to conform the film to the texture may be satisfactory for an unwarranted application.
- Substrates with poor bond between paint and boat. Substrates with multiple layers of paint may be even more susceptible to places of unsound paint. We do not warrant graphics applied to unsound paint.
- Rubber, silicone or flexible plastics. The adhesive on the recommended films does not adhere to these materials.

### Safety

When handling any chemical products, follow the container labels and the Material Data Safety Sheets for health, safety and environmental information.

Please dispose of cleaning cloths and paper toweling in a responsible manner. Since regulations vary, consult applicable regulations or authorities before disposal. When using any equipment, always follow the manufacturers' instructions for safe operation.

Refer also to the Product Bulletins for each product in your graphic construction for specific details that may influence the information in this Bulletin.

### Ventilation

Always provide adequate ventilation to remove emissions that may result from the use of heat. Failure to provide adequate ventilation can result in operator exposure.

**Air Quality Regulations** Country Volatile Organic Compound (VOC) regulations may prohibit the use of certain cleaning chemicals with VOC's in graphic arts coatings and printing operations. Check with your country environmental authorities to determine whether use of this solution may be restricted or prohibited.

## Films and Inks

### Films for Piezo Inkjet Printing

- 3M™ Controltac™ Graphic Film IJ180-10
- 3M™ Controltac™ Graphic Film with Comply™ Adhesive IJ180C-10
- 3M™ Controltac™ Graphic Film with Comply™ v3 Adhesive IJ180Cv3-10
- 3M™ Envision™ Print Wrap Film LX480Cv3
- 3M™ Envision™ Print Wrap Film SV480Cv3
- Use the inks and printers recommended in the film's Product Bulletin.

**About Film Memory** Film has a memory for its original shape. Consequently, stretching the film does result in some shrinkage as it attempts to return to its original dimensions. As it shrinks, you can expect minor tenting and lifting. Heating the film helps reduce its memory, which reduces tenting and lifting around sharp changes in contour. This is discussed more later in this Bulletin.

**Electronically Cut Film**

- 3M™ Wrap Film Series 1080
- 3M™ Scotchcal™ Electrocut Graphic Film Series 100
- 3M™ Fasara™ Glass Finish SH2MACRX2 Mat Crystal 2
- 3M™ Fasara™ Glass Finish SH2MLCRX Milky Crystal

**Interior Application**

- 3M™ DI-NOC™ Architectural Finish
- 3M™ Scotchcal™ Dusted/Frosted Crystal Special Effects Graphic Film Series 7725-300
- 3M™ Scotchcal™ Special Effects Graphic Film Series with Comply 5525C-300
- 3M™ Fasara™ Glass Finish

**Important Notice** Film with carbon, brushed or matte film surface can be susceptible to dirt. In addition, due to the film roughness it is almost impossible to clean these films. Please inform your customer before the application.

**About Applying Film to Contoured Surfaces of Watercraft** Covering complex curves and contours requires special techniques, including heating and stretching the film. The specific characteristics of a film and the inks with which it is printed, as well as whether the shape is concave or convex, determine how well the film stays bonded to the curved substrate. 3M recommends and warrants only the above listed films for watercraft graphics. These films are two-mil cast films and have less tendency to lift from contoured surfaces.

**Adhesive Considerations** The recommended 3M films have pressure-activated adhesive that is slideable, positionable and repositionable until film application pressure is applied. Comply adhesive, available on some of the films, has been proven to improve speed and ease of application with virtually no trapped air bubbles.

3M™ Controltac™ minimizes the initial contact area of the adhesive and allows the applicator to reposition the graphic during application. This means that when only light finger pressure is applied to "tack" the film in place, you can still slide it around to position it as needed and even reposition it if it isn't quite right. However, as soon as firm pressure is applied, these features are no longer functional. These features are also affected if you apply the film to a substrate that is too warm. Films with Comply adhesive (for example, film 180C) have a grid of air release channels that provide a fast and easy way for air to escape which reduces the risk of air bubbles developing. However, be careful not to randomly close off these channels.

**Effect of Ink on Film's Ability to Stretch** Unprinted films have the least stretch and solvent piezo printed films have the most stretch, although UV piezo inkjet inks may also inhibit the stretchiness of the film. Also read about the effect of using application heat with UV piezo inkjet inks on page 6. Refer to the specific ink and film Product Bulletins for comments on special application techniques or limitations of use.

**Tools** These tools are recommended for a successful application. 3M does not endorse any particular brand of tools that we do not sell ourselves.

- Application Tools**
- 3M™ Gold Squeegee PA-1-G
  - 3M™ Scotchmate™ Reclosable Hook and Loop Fastener - Loop portion SJ-35231
  - 3M™ Pressure Brush RBA-1 or RBA-3
  - 3M™ Air Release Tool 391X
  - 3M™ Primer 94
  - 3M™ Overlamine 8914i
  - 3M™ Edge Sealer 3950 (Edge Sealing)
  - 3M™ Roller S
  - 3M™ Roller L
  - 3M™ Masking Tape 3434 or 2328
  - 3M™ VCAT-2 Vehicle Channel Applicator Tool (*see page 6 for information*)
  - Knifeless™ Tape
  - Infrared pyrometer
  - Snap-off cutting knives or razor blades in safety holder
  - Industrial heat gun, or the equivalent, that is capable of attaining at least 260°C
  - Nylon gloves

**Cleaning Products** This list of tools and cleaners is provided for your convenience; other acceptable cleaners may be available. 3M does not endorse any particular chemical manufacturer or supplier.  
Always obtain, read and observe the information in the appropriate MSDS sheet for the chemicals you are using.

**Solvent-Free General Cleaner** 3M™ Scotch-Weld™ Citrus Cleaner

**Lower Solvent Content Cleaner** 3M™ Surface Preparation System

**Adhesive Remover** 3M™ Scotchcal™ Adhesive Remover R-231

## Surface Preparation

### Clean the Surface

All substrates must be considered contaminated. Clean the substrate immediately before applying the film. Dust and other contaminants can collect quickly on the substrate and prevent the film from adhering properly. Even a freshly painted substrate can collect dust before graphics can be applied.

- Use a solution of 30 ml of a good quality liquid dish detergent per 3.5 liter lukewarm water to thoroughly clean the watercraft. Rinse with water.
  - Avoid soaps or preparations that contain waxes, oils or lotions; some window cleaners contain waxes!
  - Be aware that the chemicals used in some automated washing equipment may prevent good film adhesion.
  - Pay particular attention to cleaning the front and rear of the watercraft, which tends to have more oily residue.
- Dry the surface thoroughly with clean, lint-free paper towels. A heat gun may be used to apply moderate heat and accelerate the drying.
  - Moisture prevents the adhesive from adhering correctly, can cause bubbles, and can freeze in cold environments. Any moisture trapped beneath the graphic will cause the graphic to fail prematurely.
  - Moisture on the substrate results from:
    - Inadequate drying after cleaning as well as from application solutions.
    - Condensation at low temperatures ( $< +4^{\circ}\text{C}$ ).
    - High humidity environments (60% rH).
- Wipe the surface again with a solvent-based cleaner. Refer to the list of cleaners on page 3. Be sure that the cleaner does not damage the watercraft's paint.

Note: Wax can greatly reduce graphic adhesion. Solvent-based cleaners must be used to thoroughly remove any wax residue. Alcohol-based cleaners do not remove wax as effectively.

- Saturate a clean paper towel with a solvent.
  - Wipe with a lint-free paper towel before the solvent evaporates from the substrate. As the paper towel becomes dirty, discard it. A dirty towel will simply move the dirt around, rather than remove it.
  - Make sure the substrate is completely dry. If necessary, use a heat gun to dry any retained solvents.
- Using all of the instructions that follow in this Bulletin, apply the graphic immediately. Dust and contaminants prevent the adhesive from performing as expected.

## Application Temperature and Environment

### Best Application Temperature

For the best success with the films recommended for watercraft graphics, always apply the graphics when the air and watercraft surface are both above  $+16^{\circ}\text{C}$  but no more than  $+32^{\circ}\text{C}$ .

### Cool Application Conditions

If the temperature is too cool, move the watercraft indoors to bring its surface temperature up to at least the minimum application temperature of  $+16^{\circ}\text{C}$ .

Below the recommended minimum application temperature:

- Films are not able to maintain the elevated temperatures required for stretching; films will cool too quickly.
- The initial bond of the adhesive may be insufficient to ensure the film stays adhered.
- Moisture may condense on the watercraft surface if the temperature of the watercraft surface is below the dew point.
- In very humid conditions, it may be difficult to keep the substrate dry.

**Very Warm Application Conditions**

If the temperature is too warm, move the watercraft indoors or into the shade and be sure the watercraft surface cools to below +32°C before beginning the installation.

Above the recommended maximum application temperature:

- Graphics may pre-adhere thereby trapping air.
- The adhesive will be more aggressive.
- Controltac films may lose their positionability feature.
- The film may become too stretchy.

**Post-Application Conditions**

After application of the graphic, keep the watercraft surface temperature above +16°C for at least 12 hours before exposing the watercraft to either cold or wet climate; this strengthens the graphic's bond to the contoured areas.

**How to Reduce or Avoid Film Lifting**

Identify all areas on the watercraft where the graphics may tend to lift such as in concave channels. Mark all difficult areas in the Pre-Installation Bulletin at the end of this Instruction Bulletin.

**Use Tape Primer 94**

Use 3M's tape primer 94 to promote better film adhesion where the film will be stretched.

- In **concave channels**, apply a thin layer of primer over most of the concave area. Allow the primer to dry for five minutes.
- When going around **convex areas**, apply a thin layer of primer 94 at the outer edges of the curve to prevent film edge lifting. Allow the primer 94 to dry for five minutes.

**Flat Areas First**

Apply the film to flat areas of the watercraft first.

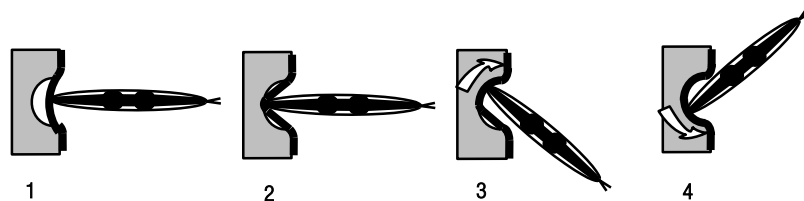
**Soften Film with Heat**

Use heat to soften the film when stretching it around and into complex curves.

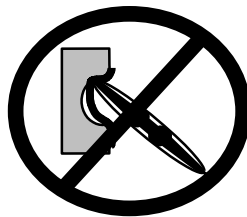
- Use as much heat as possible to soften the film without burning it. Typically, heat the film to about +30°C up to +40°C for convex and concave areas including ridges and channels.
- Film cools within seconds so gently stretch the film immediately after the heat source is removed. The film should be too hot to touch with unprotected hands; be sure to wear gloves.
- To apply film into concave channels, use nylon gloves or use a squeegee with a low friction sleeve or Scotchmate loop material. Press the heated and softened film into the middle of the channel first so that the film is stretched evenly across the channel. See FIGURE 1.

**Figure 1**  
**Technique for Stretching Heated Film into Channels**

**Right**

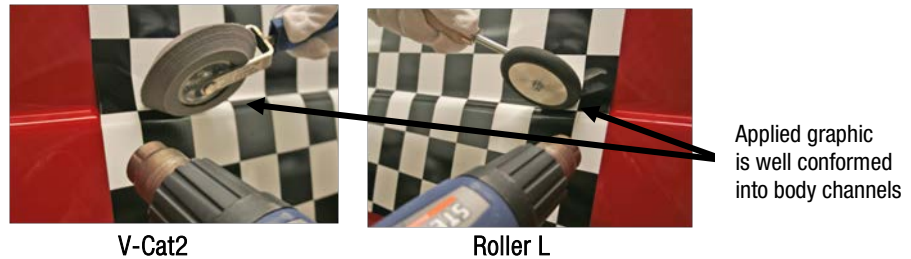


**Wrong**



- Another option for deep channels is to use the 3M-licensed vehicle channel applicator tool VCAT-2 to effectively work the heated film into deep channels. See FIGURE 2. Proper technique includes bridging the film over the channels, heating the film to about +85°C, and then working it into the channels. It is essential that you refer to Product and Instruction Bulletin VCAT-2 for complete details.

**Figure 2**  
**Technique for Stretching**  
**Heated Film into Channels**



**Graphics Printed with UV Piezo** Please follow the instruction of each product bulletin and its instruction bulletin.

**Use Heat in Post-Application** After the film has been applied, apply heat to the graphic to reduce the internal stress in the vinyl film. Temperature control must be done with a spectrometer.

- Adjust the heat source according to the post-heating table below.
- Move the heat source slowly across the stretched film surface.

Post-Heating	LX480Cv3, SV480Cv3	+100°C up to +120°C
100		> +85°C up to a maximum of +100°C
180		> +85°C up to a maximum of +100°C
1080		Matte and glossy > +85°C up to a maximum of +100°C Carbon and BR +45°C up to +60°C

**Note:** Post-heating of all film edges is required at a minimum temperature as above. Stretching of films of Carbon fiber looks and brushed looks at the edges should be avoided due to possible color fading and cracking. This method of post-heating helps avoiding entrapped air bubbles, and releases stretched areas. It will also improve adhesion.

**Stretching in Deep Channels** Cutting the film in deep channels relieves the inherent stress of the applied film. This technique is used with films for longer term applications. Cutting is only recommended when edge tape 8914i or edge sealer 3950 is used to secure the edges of the film.

In general, cutting is not necessary if the previous application techniques have been followed unless the film is expected to lift in the high stress areas. In this case inlay method must be done.

**Cutting Technique** Identify areas where the film is stretched by more than 125% of the original film dimension and the radius of the channel is 6 mm or less (see figure 3). To determine the percent of stretch, measure the travel distance through the channel and divide by the length across the channel (example: 46 mm / 25 mm = 180%). See figure 4.

**Figure 3**  
**Checking Radius of Channel**

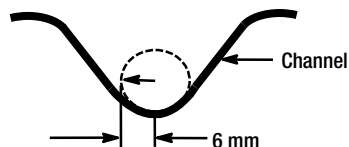
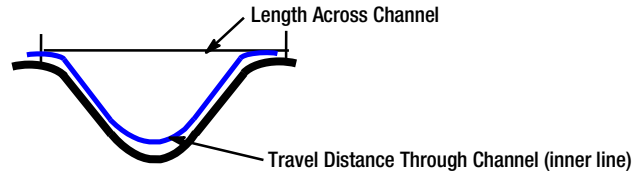


Figure 4  
Determine Percent of Stress



You must use edge tape 8914 or edge sealer 3950 if you cut the film in the channel to avoid lifting. Make the cut only after the film is fully applied and the post heating is done.

## Application Sequence

Remove the rub-rail and as much additional hardware from the body as possible.

A clean application surface is critical for a good application to watercraft. Clean the surface as instructed below immediately before applying the film, and apply the film in a clean, dust-free environment.

### Apply Primer

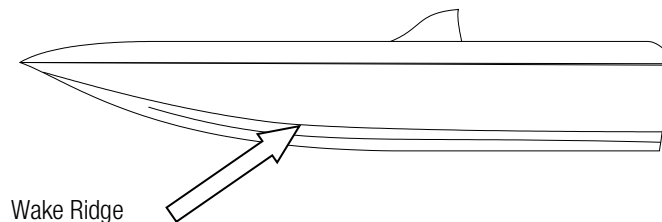
Apply 3M tape primer 94 to all concave or convex surfaces and around any hardware that could not be removed.

- Shake Primer 94 well before using.
- Apply the primer 94 1.2 cm above the “wake ridge” line of the boat. The film will be trimmed or cut a minimum of 1.2 cm above the wake ridge line. See figure 5.
- Apply a thin, uniform coating to the bonding surface using the minimum amount that will fully coat the surface. Use a brush to apply Primer 94.
- Porous surfaces may require two coats of Primer 94 for uniform coverage and good adhesion. Allow the first coat to dry thoroughly before applying a second coat. Apply the film within one hour.
- Use isopropyl alcohol for cleaning.

### Removal of Primer 94

Primer 94 can be removed using 3M™ Citrus Base Industrial Cleaner.

Figure 5  
Wake Ridge



### Apply Knifeless™ Tape

One of the finishing touches in the application will be to cut the film at all seams in the watercraft panels. 3M recommends using Knifeless™ Tape for fast, clean and accurate cutting without any risk of damage to the watercraft. Apply Knifeless™ Tape to the watercraft seams before applying film to the watercraft. See <http://knifelesstechsystems.com> for details.

### Apply First Film Panel to Length of Watercraft

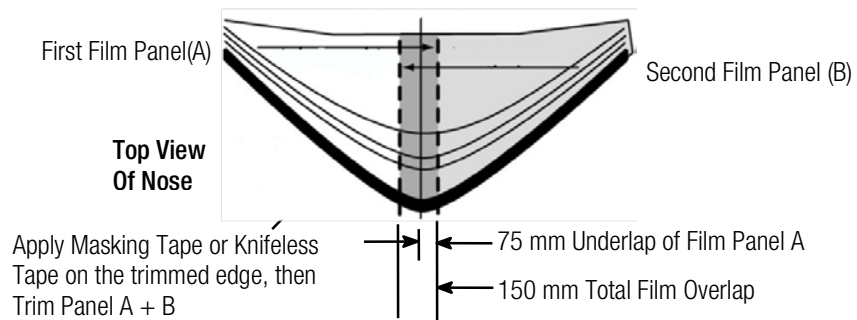
If the film wraps entirely around the watercraft, plan for only one seam at the middle of the back behind the motor, and one seam just off center of the leading edge of the front. Apply one horizontal film panel to the entire length of the watercraft, making sure there is enough film to apply at least 75 mm beyond the center front over the front and the center rear.

- If installed as shown figure 6, apply Panel A at least 75 mm past the center line (indicated by the right side dotted line).
- Apply Knifeless Tape or 3M Masking Tape 3434 over Panel A film, 75 mm to the left of the center line (indicated by the left side dotted line).
- Apply Panel B so it extends over the Knifeless Tape.
- Be sure the film is well squeegeed, and then pull the filament in the Knifeless Tape to trim Panel B. Resqueegee.

**Overlaps on Center of Nose** On the nose of the watercraft you need to create a total film overlap of about 150 mm. To do this

- Apply 3M™ Masking Tape or Knifeless™ Tape on the center of the nose.
- Position the edge of the first film panel (A) so it extends about 75 mm past the center of the nose. Squeegee this film as instructed.
- Overlap the next film panel (B) so it extends about 75 mm past the center of the nose, going the other direction.
- Cut through film panels A + B and remove the unwanted film.
- Remove the masking tape and complete the application.
- To secure the edges use edge sealer 3950 or edge tape 8914i.

**Figure 6  
Nose Overlaps**

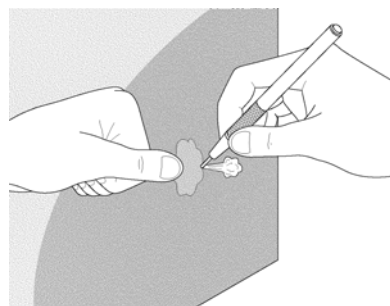


**Application  
Techniques**  
General Technique

- Apply 3M™ Scotchmate™ loop portion SJ-35231 on the plastic applicator 3M™ Gold Squeegee PA-1-G to minimize the possibility of surface scratching.
- Use firm, even application pressure.
- Stroke from the center of the film panel to the nearest edges (usually vertically). This reduces the chance of trapping air and forming air bubbles.
- Use overlapping squeegee strokes to be sure you do not miss any areas that could trap air.
- If air is trapped use an air release tool to aid in removing air bubbles. A missed area leaves wrinkles and bubbles in the applied film. These are areas where premature film failures may occur.
- Seams on a watercraft flex as the craft moves. If they are not cut, the graphics will pull away from the seam, resulting in premature failure. If you applied Knifeless tape to all seams before applying the film, simply pull the filament in the tape to cut the film. Gently lift the film at the cut and remove the Knifeless tape. Use a squeegee to firmly adhere the film to the substrate. Edge finishing will be required at these cut seams.

**Figure 7  
Puncturing and Rubbing Out  
an Air Bubble**

- Puncture the bubble at one end with a pin or the air release tool 391X. Do **NOT** use a razor blade or knife.
- Press out the entrapped air by moving your thumb toward the puncture. See figure 7. Post-heat the punctured spot at a temperature of more than +85°C using a heat gun.





**Application of Controltac™ Films**

3M™ Controltac™ minimizes the initial contact area of the adhesive and allows the applicator to reposition the graphic during application.

This effects easier installation of large formats in a wide temperature range.

Product variants with Comply™ adhesive also have air release channels for fast and easy, bubble-free graphic installations.

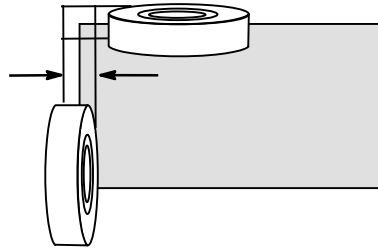
**Final Squeegee and Edge Finishing Required!**

After the graphic installation is complete, re-squeegee all film edges, overlaps and cuts in channels. Then apply edge tape 8914i or edge sealer 3950 to these edges. This step is required for warranted watercraft graphics.

**Figure 8  
Applying Edge Tape 8914i**

This tape is 12 mm wide. Apply it so it straddles the edge of the film evenly (6 mm on the film, and 6 mm on the watercraft). See figure 8.

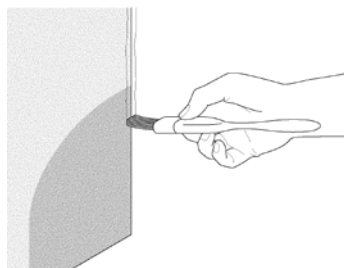
- Overlap the corners.
- Squeegee firmly, once again.



- Sealing with 8914i can have 4 layers of film in some areas. In these areas is a very thick film layers therefore, we need to use a higher temperature of +120 °C in combination with high pressure to close all film edges. As an alternative use 3950.

**Figure 9  
Applying Edge Sealer 3950**

- Apply the edge sealer when the substrate temperature is +10°C to +38°C.
- Use the felt dauber supplied or a 1.2 cm brush.
- Hold the brush or flat edge of the dauber so it straddles the film and the substrate.
- Pull the dauber or brush along the edge in a smooth, continuous motion. Make sure the entire length is covered, with no gaps (see figure 9). Edge sealer dries in about 15 minutes at +15°C.
- Edge sealer can be removed using 3M™ Citrus Base Industrial Cleaner.



- Replace the watercraft's hardware and seal all edges with silicone.

**You are required to complete the 3M Watercraft Pre-Installation Inspection Record on the following pages before applying 3M film.**

**Removal** Refer to the film's Product Bulletin for information on its removal, and [Instruction Bulletin 6.5](#) for additional details on film removal.

**Remarks** This bulletin provides technical information only.

**Important Notice** All questions of warranty and liability relating to this product are governed by the terms and conditions of the sale, subject, where applicable, to the prevailing law.

Before using, the user must determine the suitability of the product for its required or intended use, and the user assumes all risk and liability whatsoever in connection therewith.

3M requires that a properly executed and signed *Pre-installation Inspection Record* be completed before any 3M graphics are applied. This record, which identifies any potential problem areas, is mandatory if a warranty claim is made in the future. Make a copy of the appropriate record, located at the end of this Bulletin, and take pictures before and after the application for every watercraft.

**Additional Information** Visit the web site <http://www.3Mgraphics.com> for getting:

- more details about 3M™ MCS™ Warranty and 3M™ Performance Guarantee
- additional instruction bulletins
- a complete product overview about materials 3M is offering.



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*The use of trademark signs and brand names in this bulletin is based upon US standards. These standards may vary from country to country outside the USA.*

# Watercraft Graphics Pre-installation Inspection Record

## Instruction Bulletin

**Note:** Complete both pages of this Pre-installation Inspection Record, using a separate record for each vehicle, before each new graphic installation and between subsequent graphic installations on the same vehicle.

Watercraft is intended for personal pleasure such as runabouts and speedboats having aluminum and/or smooth fiberglass/gel coat bodies, including boats used in fishing tournaments and off-shore racing boats.

### Installer Requirements

1. Carefully and thoroughly examine each watercraft and record all potential problem areas prior to installing the film. We recommend washing the watercraft so that potential problem areas are easily seen.
2. Ensure that the paint is sound so that the film will have good adhesion to the paint. For the purpose of this program, "sound paint" is defined as paint that is free of defects (see the "Defects" bullet below). Note, however, there is no paint refurbishment warranty offered.

Circle all areas on the following diagram where your inspection shows that the paint may be unsound, the graphic may not be able to adhere well, or graphic removal may damage the watercraft paint. This includes:

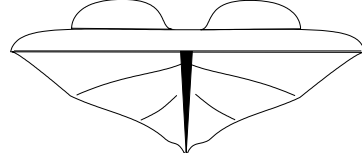
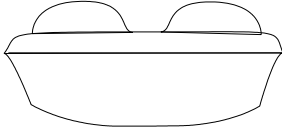
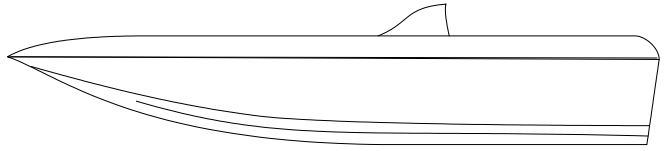
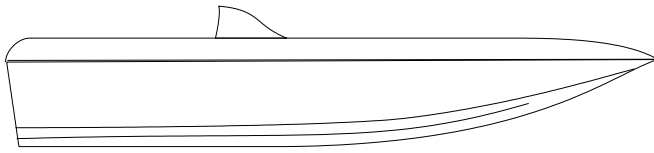
- Defect: paint that is not well bonded over the entire application surface, including multiple layers of paint being well bonded to one another; loose paint, dents and surface damage; rough surface; fillers used for damage, rust or blistered paint.
- Areas where water can collect, which are more likely to rust, resulting in paint adhesion problems.

**Note:** Primer, which does not outgas, may be applied to bad paint spots on the watercraft to prepare it for film application. However, the use of primer on bad paint spots does not guarantee success or a warranty; this must still be considered a problem area and must be documented on the Pre-installation Inspection Record.

3. Photograph all areas that you circled on the diagram as exhibiting unsound paint.
4. Explain proper graphic maintenance to the Watercraft Owner/Operator. See Instruction Bulletin 6.5.
5. Complete the Pre-installation Inspection Record (see the next page of this document).
6. Make and distribute copies to all signing parties.
7. Maintain a file with the signed form and photographs

### Durability and Exceptions

1. Failure to obtain a properly executed and signed Pre-installation Inspection Record (see the next page of this document) prior to graphic installation voids all expressed or implied 3M product warranties.
2. If the pre-inspection shows the paint is not free of defects, the owner of the watercraft waves all expressed or implied 3M product warranties.
3. 3M makes no warranty (expressed or implied) for paint or existing graphic damage that occurs during the removal of a graphic. See the Graphic Market Center Warranty brochure for complete details at [www.3Mgraphics.com](http://www.3Mgraphics.com), Warranties.



**Circle all areas where the paint may be unsound**



## Remarks

This bulletin provides technical information only.

## Important Notice

All questions of warranty and liability relating to this product are governed by the terms and conditions of the sale, subject, where applicable, to the prevailing law.

Before using, the user must determine the suitability of the product for its required or intended use, and the user assumes all risk and liability whatsoever in connection therewith.

## Additional Information

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- more details about 3M™ MCS™ Warranty and 3M™ Performance Guarantee
- additional instruction bulletins
- a complete product overview about materials 3M is offering.



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