



Piezo Ink Jet Printing

with 3M™ Piezo Ink Jet Ink Series 6000

For the Océ Arizona 30 Printer

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More Information on the Web

Find out more about piezo ink jet printing, including software profiles that help ensure successful printing by visiting our website at www.scotchprint.com. Then click on *business partner login*, which is located under the Scotchprint® logo.

To enter the *business partner login* area, you must be a Scotchprint® Graphics Authorized Manufacturer or 3M Piezo Ink Jet Registered Fabricator. If you are not, please contact your 3M sales representative or Lisa Burns (ljburns3@mmm.com or 651-736-9719).

Description

3M™ Piezo Ink Jet Ink Series 6000 make attractive, multicolor graphics on the Océ Arizona 30 Printer. These pigmented inks are weather resistant and have excellent color retention.

Product Line

This information is subject to change. Be sure this is the most current Product Bulletin. See 3M Related Literature at the end of this bulletin.

No.	Color
6091	Magenta
6092	Yellow
6095	Black
6096	Cyan
6081	Light Magenta
6086	Light Cyan

Compatible Products and Equipment

Note: For details on using a particular film or substrate for piezo ink jet printing, please refer to that product's Product Bulletin.

4 mil Films

- 3M™ Controltac™ Plus Graphic Film IJ160-10
- 3M™ Controltac™ Plus Graphic Film Series IJ162
- 3M™ Scotchcal™ Changeable Graphic Film IJ3555

2 mil Films

- 3M™ Controltac™ Plus Graphic Film with Comply™ Performance IJ180C-10
- 3M™ Scotchcal™ Translucent Graphic Film IJ3630-20
- 3M™ Scotchcal™ Perforated Window Graphic Film IJ8171

Reflective Film

- 3M™ Scotchlite™ Removable Reflective Graphic Film with Comply™ Performance IJ680CR-10
- 3M™ Scotchlite™ Reflective Graphic Film IJ5000
- 3M™ Scotchlite™ Reflective Graphic Film IJ5100R

Banner Material

- 3M™ Banner Material 8450

Overlaminates and Screen Print Clears

- 3M™ Screen Print Gloss Clear 1920DR
- 3M™ Scotchlite™ Screen Print Gloss Clear 2920DR
- 3M™ Screen Print Gloss Clear 9720UV
- 3M™ Scotchcal™ Luster Overlamine Film 3645
- 3M™ Scotchcal™ Luster Overlamine 8908
- 3M™ Scotchcal™ Matte Overlamine 8909
- 3M™ Scotchcal™ Optically Clear Overlamine 8914
- 3M™ Scotchcal™ Luster Overlamine 8519
- 3M™ Scotchcal™ Matte Overlamine 8520

Application Tapes

- 3M™ Premasking Tape SCPM-3, SCPM-44X
- 3M™ Prespacing Tape SCPS-2, SCPS-53X, SCPS-55

Printers

- Approved for use with the Océ Arizona 30 printer

Health and Safety

 **Caution**

When handling any chemical products, read the manufacturers' container labels and the Material Safety Data Sheets (MSDS) for important health, safety and environmental information.

To obtain MSDS sheets for 3M products:

- By fax, call 1-800-364-0768 in the US and Canada or 1-650-556-8417 for all other locations.
- Electronically, visit us at <http://www.3m.com/msds>.
- By mail, or in case of an emergency, call 1-800-364-3577 or 1-651-737-6501.

When using any equipment, always follow the manufacturers' instructions for safe operation.

Ventilation

Provide local and/or general exhaust ventilation in the print drying areas to prevent a buildup of solvent vapors and to maintain levels of solvents below the limit for worker exposure. An experienced industrial ventilation engineer and/or a certified industrial hygienist can help evaluate your ventilation requirements and design based on your site process conditions. Océ Display Graphics Systems, the printer's manufacturer, also provides ventilation information. Please refer to their literature too.

Note: Additional environmental, health and safety information is available in EHS Bulletin 6000, which is available on our web site at www.scotchprint.com. See the information on page 1 for how to access the site.

Guidelines for Successful Printing with Solvent-Based Piezo Ink Jet Inks

The Role of the Piezo Press Operator

An operator who understands pre-press operations and the relationship between film characteristics, printer setup, total ink coverage and drying time can produce graphics that achieve the performance expectations of the film and the customer. The operator should also work with the graphic designer and/or color conversion operator so there is a common understanding of print and media parameters.

A wide variety of printing substrates (film) can be used with piezo ink jet printing. Although 3M films have been extensively tested in laboratory conditions, the knowledge and skill of the operator is the most important factor in producing high quality graphics.

About Solvent-Based Piezo Inks Used in This Printer

The inks used in this printer contain a very high percentage of solvent. If the solvent is not evaporated quickly through heat and air, it may significantly affect post-printing operations and how the film handles when applying it.

Solvent's Affect on Film

Normally, the solvents in piezo inks do not damage the film or adhesive unless the solvent remains too long on the film and is also absorbed by the adhesive. When the film is not sufficiently dried immediately after processing, it may result in edge curling, shrinkage, aggressive adhesive and/or stretching, which all contribute to handling and performance problems. The more solvent you can eliminate, the better the film performance.

How to Manage the Total Physical Amount of Ink on Film

Testing shows that properly managing the total physical amount of ink laid down in any area on the graphic results in better image quality, less ink usage, quicker drying times and greater throughput. It also helps ensure good film performance.

To help you achieve these goals, we have established maximum Total Ink Coverage for each 3M film. Total ink coverage is the total percentage of all inks (CMYK) used in the darkest shadow regions of the graphic. For example, CMYK values of 60%, 60%, 60% and 100% produces a total ink coverage of 280%.

Note: Depending on the software you are using or the color printing reference books you use, total ink coverage may be called: total area coverage; total dot area; max CMYK; maximum ink amount; total ink limit; total printing dot.

There is a common misconception that because the ratio of ink solids to solvent is very low, the only way to achieve satisfactory density is to use high ink coverage. Testing shows that in many cases you can achieve very good density with lower total ink coverage with little or no loss of quality. The rest of this section discusses options for managing the total ink coverage.

Setting Total Ink Coverage During Color Separation

The best results can be achieved when total ink coverage is taken into consideration by the graphic designer and set during pre-press operations.

The graphic designer and/or color separator should always discuss printing parameters with the piezo press operator so that the total ink coverage can be set during separation. The typical methods of color separation are Adobe® Photoshop®, ICC-based color management, third party color separation packages and direct conversion to CMYK at the time of scanning.

Part of establishing the total ink coverage is determining maximum black. We recommend limiting black ink to the minimum level necessary to achieve a maximum density. For example, if you review a series of black patches in 1% increments from 90% to 100%, a visible difference in density usually stops being noticeable between 94% to 100% of total black.

When doing color separations, we recommend setting the UCR/GCR to 260% to 280% and no more than the recommended total ink coverage (usually 300%), which includes selective strike for those printers having that capability.

Correcting Total Ink Coverage During Printing

If the total ink coverage on a color-separated image is too high for the film, and your RIP software supports ink limiting, you may be able to use this function to reduce the total physical amount of ink on the film.

Continued on the next page.

For example, in 3M's **Scotchprint® Graphic Maker Software**, the ink limiting feature manipulates the print data to reduce the amount of ink used while maintaining color balance for the best possible image quality. It does this by limiting the number of ink spots that are printed over the top of one another without restricting the 100% solid colors (cyan, magenta, yellow and black). Ink limiting can be set for none, 100%, 150%, 200% or 250%. For complete details refer to the Graphic Maker User's Manual.

If you are not using Graphic Maker software, consult your RIP software manual for how to limit ink.

If you do not have print time ink limit functions

You may have to re-separate your image for correct total ink coverage. This is not the optimal method as loss of color fidelity and image quality problems can occur.

Keys to Successful Printing and Application

There are many keys to successful printing and application. If we had to pick just two it would be total ink coverage and drying. However, because of the variety of films used and the different operating conditions of each shop, all of the following keys are important to overall success.

Very short term graphics, such as promotional posters and banners, may not require this level of consideration.

1. Discuss the project with the graphic designer and/or color separator.

Make sure the designer and/or color separator know the parameters and printing recommendations for both the film and printer being used for each graphic.

2. Discuss the project with the film applicator.

Work with the film applicator so you are both aware of any special handling or application techniques that may be needed for the selected film construction. Any combination of high total ink coverages, hot application temperatures, and irregular application surfaces may make applying the film more difficult.

Be aware that all 4 mil films with an overlamine will tent over rivets; this is true for all printing technologies.

3. Select the right film/media for your type of graphic and application needs.

- Each film has specific intended uses and applications, which are described in the film's Product Bulletin.
- Do not use rolls of film/media that are damaged; it can result in printer failure.
- Condition the media for 24 hours in the same environment as the printer prior to printing.

4. Understand the unique processing characteristics needed for each film/media.

- a. *Specific Media Processing Recommendations* on page 6 are guidelines we have developed that help provide the best graphic results with the film you are using.
- b. *An overlamine or screen print clear* is required for graphics subjected to abrasion such as road debris and automatic/power washing, harsh cleaners, or chemicals. Window graphic film and graphics for floors always requires an overlamine.

- c. *Clear and translucent films for backlit signs require special consideration.* Clear films tend to be more sensitive to shrinkage due to high total ink coverage. Film that is not sufficiently dried prior to creating an overlap or seam may shrink and result in a light leak. Rather than increasing the total ink coverage to increase the density of the backlit image, we recommend printing two layers of film at lower ink levels. Refer to the appropriate instruction bulletin for the technique.

5. Use the correct printer profile.

Each film/media has a unique printer profile that helps ensure successful printing. If you do not have the correct one, contact Océ Display Graphics Systems.

6. Limit the Total Ink Coverage.

Refer to the "How to Manage the Total Physical Amount of Ink on Film" on the previous page.

Too much ink on the film results in media characteristic changes including shrinkage, loss of changeability, loss of positionability (3M™ Controltac™ Plus Graphic Films) and air release features (3M Graphic Film with Comply™ Performance), as well as inadequate drying, overlamine lifting, difficult application and/or poor graphic performance.

Note: For the full product names of the 3M products listed on this page, please see page 1.

7. Don't take shortcuts when drying graphics.

Graphics that seem dry to the touch may still be saturated with solvent. This causes the graphic to become soft and stretchy and the adhesive may become too aggressive. Typical dryer settings are given in *Specific Media Processing Recommendations* on page 6.

If the graphics don't seem to be drying sufficiently in the printer, we recommend increasing drying time or drying temperature in the printer, or using an auxiliary dryer to complete the drying (2 hours @ 150°F should be sufficient), or air drying. Air drying is less effective than oven drying. The average air drying for graphics printed with a total ink coverage of 300% is about 12 hours; graphics printed with higher total ink coverage may require up to 24 hours.

Remember, reducing total ink coverage reduces solvents and therefore reduces drying time.

These are problems that may occur due to insufficient drying.

- If the film you are using is a 3M™ Controltac™ Plus Graphic Film (with or without Comply performance), the positionability feature will be significantly reduced if the film is not sufficiently dried.
- You may notice some problems, such as blocking or embossing, when the graphic is unrolled prior to application.
- An overlamine may be difficult to apply.

Too high a drying temperature can distort the printed media, resulting in:

- Transport problems in the printer.
- Wrinkling when the printed graphic is overlaminated or premasked.

8. Prepare test graphics.

The default settings in the printer for drying temperature and time, and the preselected settings in the software for total ink coverage and linearization, may not be the optimum for the graphic that you are printing.

You'll save time and money if you print test graphics for each film type you use. Print the graphics at different printer settings, total ink coverage and drying times. We recommend starting your tests with the total ink coverage at 250% to 270%. Refer to **Specific Media Processing Recommendations** for guidelines. Keep these samples for future reference.

9. Follow all operation and maintenance procedures recommended in the printer user's guide.

Note: For the full product names of the 3M products listed on this page, please see page 1.

Specific Media Processing Recommendations

Film	Total Ink Coverage (Maximum)	Overlamine or Screen Print Clear Required?	Lifting on corrugations/ tenting on rivets	Other Considerations	Typical Dryer Setting for 8-pass Mode*
IJ160-10	380%	YES, selected applications	Possible at high total ink coverage		5.5
IJ162-10	380%	YES, an overlamine	Not applicable		5.5
IJ180C-10	300%	YES, selected applications	Likely at high total ink coverage		5.5
IJ3555	300%	YES, selected applications	Possible at high total ink coverage	Possibly some shrinkage at this coverage level and default printer drying time and temperature.	5.5
IJ3630-20	300%		Not applicable	Pay close attention to Key 4c.	5.5
IJ680CR-10	300%	YES, selected applications	Not applicable		5.5
IJ5000		YES, all printed graphics	Not applicable		5.5
IJ5100R		YES, all printed graphics	Not applicable		5.5
IJ8171	300%		Not applicable	Due to the perforations in this film, it is harder to match the image quality of a solid film. Higher total ink coverage increases drying issues; the film may lift from liner, stick to liner when rolled up, wrinkle when being overlaminated. Retained solvent can cause film to lift from substrate after application.	5.5
8450	300%		Not applicable	Banner material is susceptible to blocking or embossing when rolled, especially if the graphic is not totally dried.	5.5

*Increase dryer settings for higher print rates (4-pass and 2-pass modes) and higher ink coverage. Use the maximum dryer setting that does not change the media characteristics.

Recommended Overlaminates, Screen Print Clears and Application Tapes

Note: For the full product names of the 3M products listed on this page, please see page 1.

	Ink 6000	Overlamine or Screen Print Clear									
		1920DR	2920DR	9720UV	8519	8520 ²	8908 ¹	8909 ¹	3645	8914	
Film											
IJ160-30	●	●		●	●	●	●	●			
IJ162-30	●								●		
IJ180C-10	●	●		●	●	●	●	●			
IJ3510	●	●		●	●	●	●	●			
IJ3630-20	●	●		●	●	●	●	●			
IJ680CR-10	●		●	●	●						
IJ5000	●		●	●	●						
IJ5100R	●		●	●	●						
IJ8171	●	●		●						●	
IJ8450	●				●	●					
Application Tape											
Premask Tape	SCPM-44X	SCPM-3	SCPM-3	SCPM-3	SCPM-3	SCPM-3	SCPM-3	SCPM-3	SCPM-3	None	Do NOT Use Application Tape
Prespace Tape	SCPS-53X	SCPS-2	SCPS-2	SCPS-2	SCPS-2	SCPS-2	None	None			
<i>Most films 180C-10 and IJ680CR</i>	SCPS-55	SCPS-55	SCPS-55	SCPS-55	SCPS-55	SCPS-55	SCPS-55	SCPS-55	SCPS-55		

¹ Overlaminates 8908 and 8909 are not recommended or warranted for use on fleet graphics or banners.

² Do not use matte overlaminates on reflective film IJ680CR-10.

Overlaminates and Screen Print Clears

Note: See the table above for an overview of film and overlamine/screen print clear recommendations as of the date of publication. Please refer to the film Product Bulletins for complete details. See 3M Related Literature at the end of this bulletin.

Graphics That Require Protection To Be Warranted

Most graphics, even durable, screen printed graphics, require additional protection under certain conditions. When using ink series 6000, the durability of the graphics is reduced when frequently subjected to any of the following environments: road debris or impinging foreign debris, foreign material rubbing on the graphic, power washing equipment, aggressive brushing, occasional chemical spillage such as acids and alkalis, and petroleum products such as gasoline spills at pumps.

Therefore, to protect the ink and graphics and receive the Warranted Durability, an overlamine or screen print clear is required when the graphic is used in such environments.

These Types of Graphics Specifically Require An Overlamine or Screen Print Clear

- Graphics on the exterior of vehicles and railroad rolling stock
- Any graphics exposed to the abrasive or harsh environments mentioned above
- All graphics for floors
- Window graphics that require optical clarity (use overlamine 8914)

Graphics That Do Not Require Protection To Be Warranted

If the graphics are not exposed to the environments listed above, a screen print clear or overlamine is not required to receive the Warranted Durability. However, for graphics applied in high contact areas such as bus shelters, hallways, etc., using an overlamine or screen print clear will provide additional protection.

Note: For the full product names of the 3M products listed on this page, please see page 1.

Application Tapes

Refer to the Instruction Bulletin 4.3 for more complete information on applying the recommended application tape.

The type of 3M application tape to use depends on the type of graphic produced. Refer to the table below for the recommended tape for the overlamine or screen print clear you are using.

- Use premasking tape if there is very little exposed liner.
- Use prespacing tape if graphics have large amounts of exposed liner or are kiss cut.

Dryness Test

The dryer times vary with the equipment being used, oven temperature, humidity conditions, etc. Insufficient drying can result in blocking or severe surface impression. Therefore, it is important to check for sufficient dryness when the printing starts. We recommend using the following procedures to determine if adequate drying has occurred.

1. This test is used to set the dryer conditions and approximate dryness.
 - a. Touch a printed sheet face to face.
 - b. Place the touched area close to your ear and separate it.
 - If the graphic is adequately dried, there is either a slight or no discernible sound when the surfaces separate.
 - If the graphic is not sufficiently dry, a crackling sound is heard. The louder the sound, the greater the amount of additional drying needed.
2. Even when the graphic feels or appears dry, some solvent will remain. Use this test to determine if minimum drying has taken place. If it does not pass this test, more drying is required.
 - a. Place several printed sheets face-to-face under a 12 inch (30 cm) stack of film or under a weight of 2 pound per square inch (135 gm/cm²).
 - b. After 10 minutes, remove the sheets and check for blocking or surface impressions.
 - If blocking or severe surface impressions are noted, either increase the temperature or decrease the drying time.

Shelf Life, Storage and Shipping

Inks

- Store the inks in their original packaging.

- Store the inks at 32° to 95°F (0° to 35°C).
- Use the inks within one year of purchase. The date of manufacture is on each bottle.
- Ink series 6000 is classified as non-hazardous by the Department of Transportation. The inks are non-regulated when transported via ground and air.

Finished Graphics

- Be sure ink series 6000 is dry before packaging the finished graphic.
- Ship the finished graphic lying flat or rolled. To roll, wrap the graphic, film-side out, onto a core that is 5 inches (130 mm) or larger in diameter. These methods help prevent the liner from wrinkling or popping off.
- Put a slip sheet, such as 3M™ Easy Release Liner SCW-33, on the face of the printed side of these types of graphics: a graphic that is premounted on panels, panels that have graphics on both sides, or a liner that is printed by a customer.
- Store the graphics in a clean, dry area.
- Store the graphics out of the direct sunlight and at a temperature less than 100°F (38°C).

Waste Disposal

Waste from the printer includes ink and solvent waste, printer blotting cloth and felt absorber, and plastic bottles. We encourage you to handle all waste in a responsible manner. Some general guidelines are provided below.

Inks

The inks and solvents are considered non-hazardous waste according to U.S. EPA requirements. Even though the inks and solvents are classified as non-hazardous, non-regulated waste, the EPA requires that any ink or solvent waste must be incinerated in an industrial or commercial facility. Do not pour the inks or solvents down the drain, or put in the general trash, or in a landfill. Since regulations vary, consult applicable regulations or authorities before disposal.

Printer Blotting Cloth and Felt Absorber

The printer blotting cloth and felt absorber can be disposed of in the general trash or in a landfill if free liquid cannot be squeezed out. If inks or solvents can be squeezed out, the blotting cloth and felt absorber should be incinerated in an industrial or commercial facility.

Plastic Ink Bottles

Once bottles are empty of free liquid, dispose of the bottles in the general trash or in a landfill. The ink bottles are made of High-Density Polyethylene (HDPE) plastic as indicated by the recycling number "2". Check with your local recycler regarding recycling the bottles in your area.

Warranty and Disclaimers

The information contained and techniques described herein are believed to be reliable, but 3M makes no warranties, express or implied, including but not limited to any implied warranty of merchantability or fitness for a particular purpose. 3M shall not be liable for any loss or damages, whether direct, indirect, special, incidental or consequential, in any way related to the techniques or information described herein.

3M Related Literature

Listed below is related 3M technical literature that may be of interest. You may view and print these Bulletins from our Web site at www.scotchprint.com, or order them via our Fax-on-Demand (FOD) system. Call one of these phone numbers to order the desired bulletins, and specify the FOD document number provided in the chart.

United States or Canada: 1-800-364-0768
International: 1-651-732-6506

Subject	Bulletin No.	FOD No.
Product Bulletins		
3M™ Piezo Ink Jet Ink Series 6000	6000	4560
3M™ Controltac™ Plus Graphic Film IJ160-30	IJ160-10	4567
3M™ Controltac™ Plus Graphic Film IJ162-10 and IJ162-114	IJ162-10	4561
3M™ Controltac™ Plus Graphic Film with Comply™ Performance Series IJ180C-10	IJ180C-10	4540
3M™ Scotchlite™ Removable Reflective Graphic Film with Comply™ Performance IJ680CR-10	IJ680CR-10	4564
3M™ Scotchcal™ Changeable Graphic Film IJ3555	IJ3555	4548
3M™ Scotchcal™ Translucent Film IJ3630-20	IJ3630	4527
3M™ Scotchlite™ Reflective Graphic Film IJ5000	IJ5000	4566
3M™ Scotchlite™ Changeable Reflective Graphic Film IJ5100	IJ5100	4562
3M™ Scotchcal™ Perforated Window Graphic Film IJ8171	IJ8171	4545

3M™ Banner Material 8450	8450	3523
Subject	Bulletin No.	FOD No.
3M™ Scotchcal™ Luster Overlamine 8908	8908	3554
3M™ Scotchcal™ Matte Overlamine 8909	8909	3565
3M™ Screen Printing Ink Series 1900	1900	2501
3M™ Scotchlite™ Screen Printing Ink Series 2900	2900	2512
3M™ Scotchcal™ Overlamine 3645	3645	1508
3M™ Scotchcal™ Optically Clear Overlamine 8914	8914	3542
3M™ Scotchcal™ Overlamine 8519 and 8520	8519/8520	4524
Instruction Bulletins		
Design of graphics	2.1	5501
Screen printing with ink 1900	3.11	6011
Screen printing with line ink series 2900	3.18	6018
Screen printing with ink series 9700 UV	3.4	6004
Application, substrate selection, preparation and substrate-specific application techniques	5.1	7001
Application, special applications and vehicles	5.4	7004
Application, general procedures for interior and exterior dry applications	5.5	7005
Making backlit signs with 3M digitally imaged graphics	4.26	6526
Cold roll lamination	4.22	6522
Scoring and cutting	4.1	6501
Using 3M application tapes; premasking and prespacing for films	4.3	6503
Applying 3M Graphic Films with Comply™ Performance	5.31	7031

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Bulletin Change Summary

180C-10 is now IJ180C-10, changed film IJ5100 to IJ5100R (no longer called "changeable"), added 9720UV as a compatible clear for most films -- these changes affected Compatible Products, and the tables on pages 6 and 7.



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Health & Safety

Refer to the package label and the Material Safety Data Sheet for health, safety, and handling information on the products referenced in this bulletin. For 3M products, if necessary, you may contact our Toxicology/Product Responsibility Department on 01344 858000.

Important Notice to Purchaser

The 3M products described in this publication are covered by a 3M warranty and limitation of liability.

3M's warranty provides that if 3M finds that goods are defective in material or workmanship they will be replaced or the price refunded at 3M's option but note that 3M does not accept liability for other direct losses (except for personal injury or death) or consequential losses relating to defective products or from information supplied by 3M.

Purchasers and users of 3M products, and not 3M supplying companies, are always solely responsible for deciding on the suitability of the 3M product for their required or intended use.

Technical Assistance

For help on specific questions relating to 3M Commercial Graphics Division Products, contact your local Technical Service Representative.

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