



DIEMARK™ FILAMENT AND PNEUMATIC INK CARTRIDGE OPERATION AND TROUBLESHOOTING MANUAL

820-0013 Revision V
September, 2024



**DM-2
Pneumatic
Cartridge**

**DM-1
Filament
Cartridge**

SERVICE AND SUPPORT INFORMATION



1360 Redwood Way, Suite A
Petaluma, CA 94954 USA

Telephone: (707) 763-7799

OR (800) 767-9543

FAX: (707) 763-2631

Internet: www.xandexsemi.com

Email: info@xandex.com

International Distributors

China

PREMTEK TECHNOLOGY INC. (Shanghai)

RM 1201, NO.1077
ZuChongZhi Rd
Zhang Jiang Hi-Tech Park
PuDong New Area
Shanghai, China 201203
Telephone: 86-21-5027-5859
Email: ptis@premtek.com.cn
Website: www.premtek.com.tw

Japan

HUGLE ELECTRONICS, INC.

4-5-7 Iidabashi,
Chiyoda-Ku
Tokyo, Japan 102-0072
Telephone: (81) 3.3263.6661
Fax: (81) 3.3263.6668
Email: Xandex@hugle.co.jp
Website: www.hugle.co.jp

Korea

HUGLE ELECTRONICS, INC.

Br. Office: 2FL Hugle Bldg.
86-14 Garak-Dong, Songpa-Ku
Seoul, Korea 138-803
Telephone: +82 (02) 431-7477
Fax: +82 (02) 449-6295
Email: hugle@hugle.co.kr
Website: www.hugle.co.kr

Taiwan





PREMTEK INTERNATIONAL

4F, No. 47, Lane 2, Kuang-Fu Road
Sec 2, Hsinchu City
Taiwan R.O.C.
Telephone: (886) 35.722000
Fax: (886) 35.725000
Email: pil@premtek.com.tw
Website: www.premtek.com.tw

SAFETY INFORMATION

Safety and Hazard identification symbols used in this document are intended to be compliant with ANSI/NEMA Z 535.6 2006. The table below lists the symbols used in this document along with a description of each type of safety hazard. Failure to observe identified safety risks may result in serious injury or death.

Safety and Hazard Identification Symbols

SYMBOL	DESCRIPTION
	DANGER = Indicates a hazardous situation which, if not avoided, will result in death or serious injury
	WARNING = Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
	CAUTION = Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
	NOTICE = Indicates a practice that is not related to personal injury, but may cause damage to equipment or property.

This page is intentionally left blank.

Table of Contents

Section 1. Filament Cartridge Operation	1-1
General Information.....	1-1
DM-1 Ink Cartridge Overview.....	1-1
Ink Cartridge Labeling.....	1-2
Cartridge Label Color Coding.....	1-3
Manual Ink Cartridge Priming	1-4
Vacuum Ink Cartridge Priming	1-9
Setup and Adjustments	1-14
Plunger Stop Assembly	1-15
Filament Cartridge Tips	1-16
Section 2. Pneumatic Cartridge Operation	2-1
General Information.....	2-1
Ink Cartridge Labeling.....	2-2
Cartridge Label Color Coding.....	2-3
Pneumatic Ink Cartridge Tips	2-4
Cartridge Preparation.....	2-5
Section 3. Ink	3-1
Ink Overview.....	3-1
Ink Curing	3-2
General Notes on Ink Curing	3-2
Ink Curing Guidelines.....	3-3
Ink Removal Information.....	3-4
Section 4. Troubleshooting.....	4-1
Filament Ink Cartridge Troubleshooting	4-1
Electric Inker Troubleshooting.....	4-4
Pneumatic Ink Cartridge Troubleshooting.....	4-6
Pneumatic Inker Troubleshooting	4-8
Pneumatic Controller Troubleshooting.....	4-10
Section 5. System Specifications	5-1
Filament Cartridge Specifications	5-1

Filament Cartridge Dot Production 5-1

DM-2 Cartridge Specifications 5-2

DM-2.3 Cartridge Specifications..... 5-2

Dot Size Guidelines in Mils (0.001 inch) 5-3

Dot Size Guidelines in Microns (µm)..... 5-4

Ink and Cartridge Availability..... 5-5

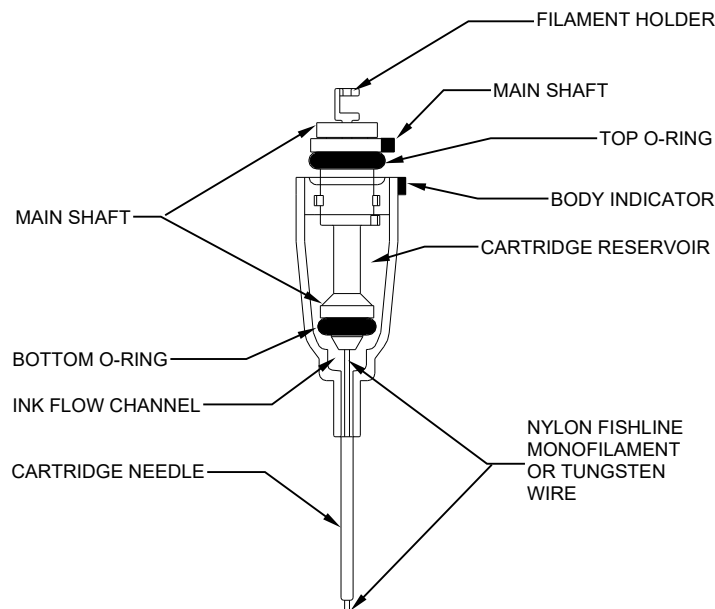
DieMark Limited Warranty..... 5-6

Section 1. Filament Cartridge Operation

General Information

The DM-1 and DM-1.25 filament ink cartridges have a polypropylene reservoir and monofilament fishline encased in a stainless steel needle. The DM-1 differs from the DM-1.25 in that the overall needle length of the DM-1.25 is 0.50 inches (± 0.005 ") longer than the DM-1. Both the DM-1 and DM-1.25 cartridges contain approximately 0.60 grams of ink in the reservoir. After opening and priming, the monofilament fishline wicks the ink to the filament tip each time the inker solenoid fires. For dot production figures and related information see **Section 3 "Ink"** and **"Filament Ink Cartridge Specifications"** in **Section 5**.

DM-1 Ink Cartridge Overview



• Cartridge Description

A cartridge is an ink reservoir sealed by two O-rings, top and bottom. A monofilament "fish line" (or tungsten wire for 3 mil & 5 mil small dot cartridges) passes through the cartridge main body and needle and is attached at the top to the filament holder. A cartridge is opened by turning the top of the main shaft to open position and pulling the main shaft up to lift the bottom O-ring and open the ink flow channels.

• Cartridge Priming

Priming is necessary to establish continuous ink flow into the cartridge needle. The cartridge is primed by lifting the main shaft (and bottom O-ring) to fill the reservoir under the bottom O-ring with ink and actuating the filament, coating it with ink all the way to the needle tip. For small dot 3 mil and 5 mil cartridges, a new vacuum priming fixture has been developed to make priming these small filament cartridges easier and faster. See a description of the Vacuum Priming Tool in the cartridge priming section of this section. The cartridge is ready for use when the ink flow channels are open (i.e., bottom O-ring is raised and the space below the bottom O-ring is full of ink), the filament is coated with ink to the needle tip and the main shaft is locked in position so that it cannot move up or down. Detailed cartridge opening, priming and installation instructions appear later in this section.

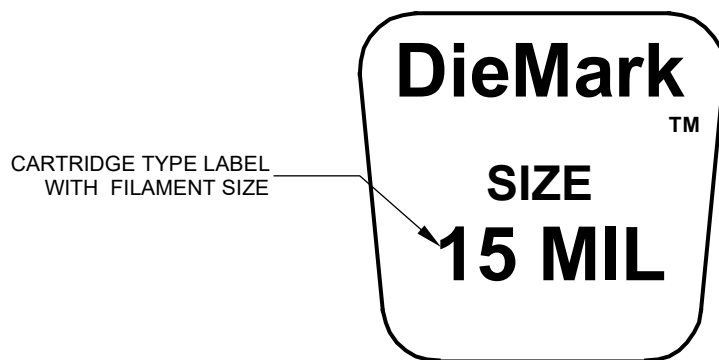
Ink Cartridge Labeling

DieMark™ ink cartridges are individually labeled with two distinct labels. One label shows the cartridge dot size and the other label indicates the ink batch number, ink type and expiration date of the cartridge.

Do not remove the labels from the cartridges as this can cause cartridge type and ink types to be confused at cartridge installation, resulting in improper performance. Removal of cartridge labels will also void the cartridge warranty.

DieMark™ Cartridge Size Label

This label contains the cartridge dot size, (10mil, 15mil etc.).

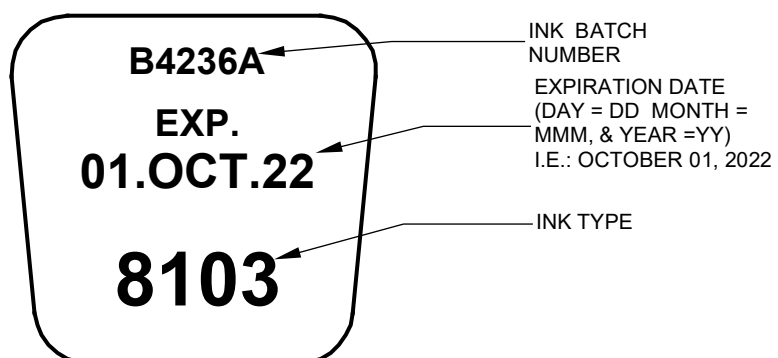


DieMark™ Cartridge Expiration Date Label

This label indicates the ink type, the batch number of the ink contained in the cartridge and the cartridge expiration date. Expiration dates shown are for *unopened* cartridges.

- ◆ 6990, 6993, 6997, 7824, 7824T, 8103 and 8104 (except 8103 White), = Four (4) months.
- ◆ 8103 White = Two (2) months

After the cartridge is opened, consistent ink flow can only be expected for up to five (5) days for 6990, 6993 and 6997, three (3) days for 7824 and 7824T and two (2) days for 8103 and 8104.

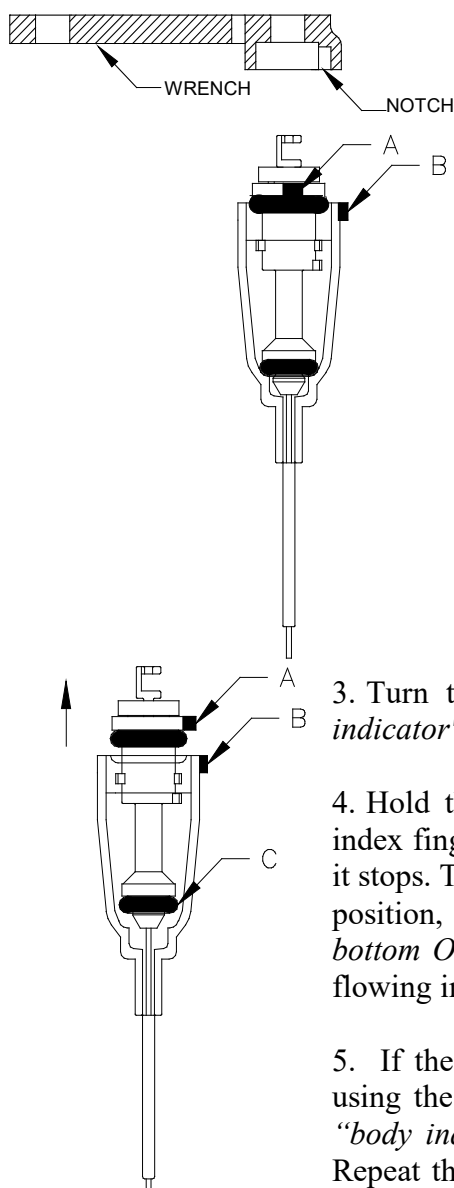


Cartridge Label Color Coding

3 / 5 / 8 / 10 / 15 / 25 / 30 MIL FILAMENT CARTRIDGE LABELS	
LABEL	DESCRIPTION
	3 MIL IS ORANGE
	5 MIL IS SILVER
	8 MIL IS RED
	10 MIL IS BLUE
	15 MIL IS GREEN
	25 MIL IS YELLOW
	30 MIL IS PURPLE

Manual Ink Cartridge Priming**Opening the Cartridge**

Notice: For 3 mil and 5 mil cartridges, see Vacuum Ink Cartridge Priming description following the Cartridge Installation portion of this section.



A plastic wrench is used to open and prime a cartridge. The wrench fits very tightly and has a shallow cup with a notch to fit over the top of the main shaft. The notch location is indicated by an alignment "bump" on the end of the wrench.

1. Two reference points on the ink cartridge are used in opening and priming the cartridge.

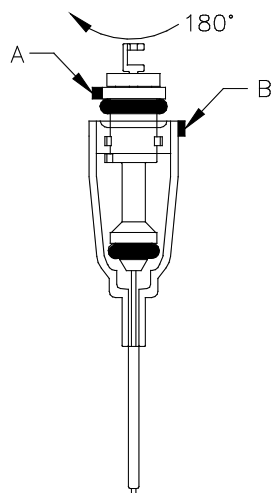
- An alignment "bump" at the top of main shaft called the *"main shaft indicator"* (A).
- An alignment "bump" on the cartridge body near the top called the *"body indicator"* (B).

2. Align the *"main shaft indicator"* (A) with the notch in the wrench and fit the wrench over the top of the *main shaft*.

3. Turn the *"main shaft indicator"* (A) towards the *"body indicator"* (B) on the cartridge until they are aligned.

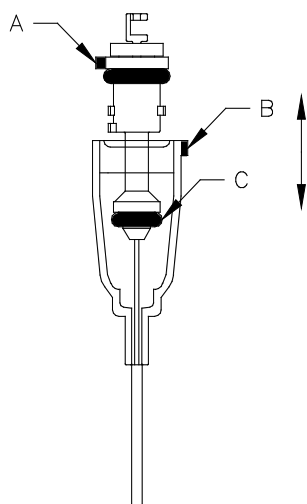
4. Hold the wrench at the cup section, between thumb and index finger, and pull up the *main shaft* with the wrench until it stops. The *bottom O-ring* (C) should be lifted from its sealed position, opening the *ink flow channels*. Visually inspect the *bottom O-ring* (C) and verify that it has lifted and the ink is flowing into the channels.

5. If the *bottom O-ring* is not lifted, close the cartridge by using the wrench to re-align the *"main shaft indicator"* and *"body indicator"*. Push the *main shaft* down to re-seat it. Repeat this procedure if necessary until the *bottom O-ring* is lifted.



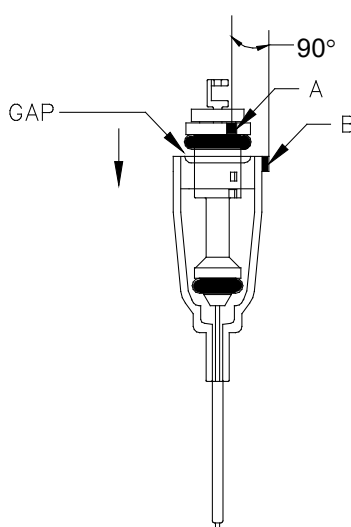
6. After the *main shaft* and the *bottom O-ring* are lifted, turn the *main shaft* with the wrench until the *indicators* (A & B) are positioned exactly at opposite sides of the cartridge (at 180° with respect to each other). There is a small hole at the top of the wrench through which the “*body indicator*” (B) can be seen when it is at 180° from the “*main shaft indicator*” (A). Turn the wrench slowly while looking through this hole for the “*body indicator*” (B).

Priming the Cartridge



The purpose of priming the cartridge is to ensure that the lower reservoir and the *ink flow channels* below the *bottom O-ring* are completely filled with ink. This will ensure even, continuous ink flow. To prime the cartridge, follow the steps below.

1. Hold the cartridge steady in one hand and the wrench at the cup area (top of the *main shaft*) with the other.
2. Keeping the indicators at 180° from each other, pull up very gradually and lift the *main shaft* while wiggling the wrench slightly from side to side.
3. Stop lifting the *main shaft* when it is ½ way out of the reservoir.
4. Lower the *main shaft* back to its original position while gently stirring the ink. Take care not to bend the filament.

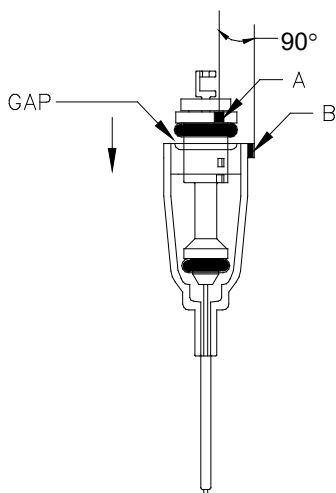


5. Repeat steps 1-4 as many times as necessary until space below the *bottom O-ring* is completely filled with ink.

Notice: Avoid over priming! No more than 60 seconds should be required for steps 1-5

6. Lower the *main shaft* the final time, as far down as it will go (until it stops). The *indicators* should still be 180° from each other and the *main shaft* back down to the pre-priming position.

7. Turn the *main shaft* 1/4 turn in either direction. This locks the *main shaft* in position so that it cannot be moved up or down. There should be a gap between the *top O-ring* and the *cartridge body*. Push the *filament holder* down and remove the wrench. The cartridge is now primed and ready for installation.

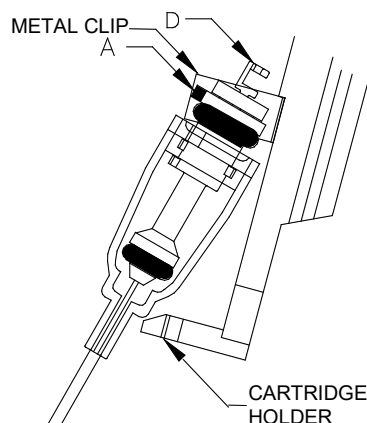


Cartridge Inspection

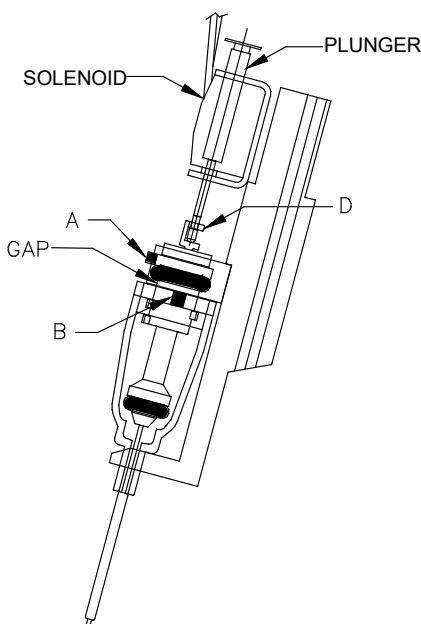
Visually inspect the primed cartridge before installing it on the inker and verify that the following conditions exist;

- The *bottom O-ring* is lifted and the *ink flow channels* under the bottom O-ring are completely filled with ink.
- The cartridge alignment indicators are 1/4 turn from each other. This way the main shaft cannot be pushed up or down.
- There is a gap between the top O-ring and the cartridge body indicating that the cartridge has not been inadvertently closed.

Cartridge Installation



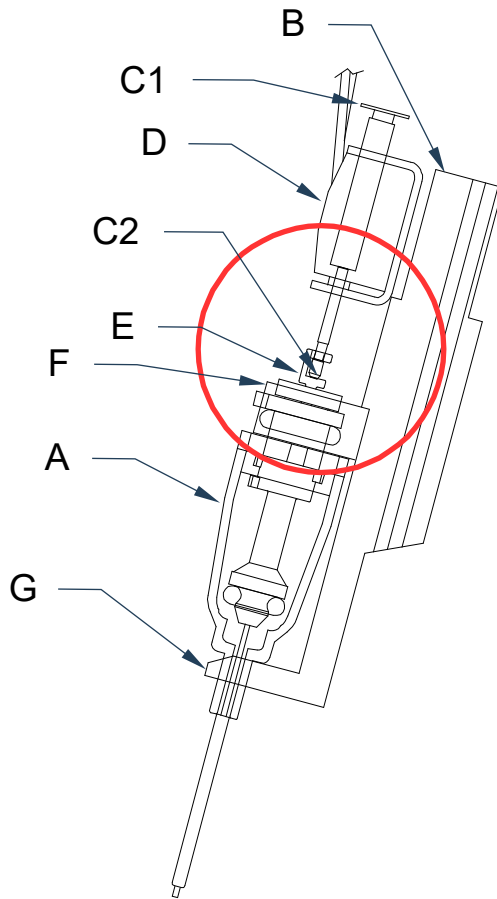
1. Verify that the *filament holder* (D) has been pushed down.
2. Push the *main shaft* section into the *metal clip* on the *cartridge holder*. Make sure the "*main shaft indicator*" (A) is pointing outwards. Press the *cartridge body* until it snaps into place. Verify that the *gap* has not closed and the *indicators* are still 1/4 turn from each other. If these conditions are NOT satisfactory, remove the cartridge from the clip and review the priming procedure.



3. Align the *solenoid plunger* with the *filament holder* (D) and push the *plunger* until it snaps into the *filament holder*. In this position the *plunger* should move up and down freely. Manually depress the *plunger* a number of times to verify operation, occasionally rotating the *plunger* to ensure free movement.

4. Exercise the *plunger* manually or electrically until

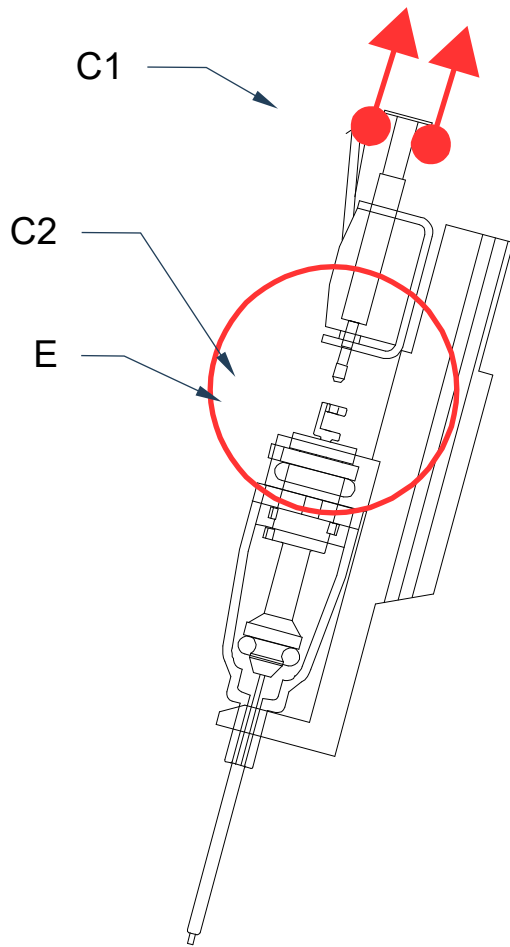
ink flow is established in the *stainless steel needle* and the *monofilament* is coated with ink. A standard DM-1 cartridge requires a minimum of 30-40 *plunger* strokes to properly establish ink flow. When the *filament* is completely coated with ink, check the *needle tip* for excess ink and wipe with a clean, lint free cloth if necessary.

Cartridge Removal

When the cartridge (A) is installed on the holder (B), the plunger (C1-C2) passes through the coil (D) and is captive in the top of the cartridge filament holder (E). Removing the cartridge from the holder with the plunger connected will eventually bend the plunger.

A bent plunger will bind inside the coil and result in inconsistent dot production from the new cartridge.

- | | |
|---|--------------------------------|
| A | INK CARTRIDGE |
| B | HOLDER BODY |
| C | 1 PLUNGER TOP |
| C | 2 PLUNGER TIP |
| D | SOLENOID COIL |
| E | CARTRIDGE FILAMENT
HOLDER |
| F | HOLDER METAL CARTRIDGE
CLIP |
| G | HOLDER DOVETAIL |

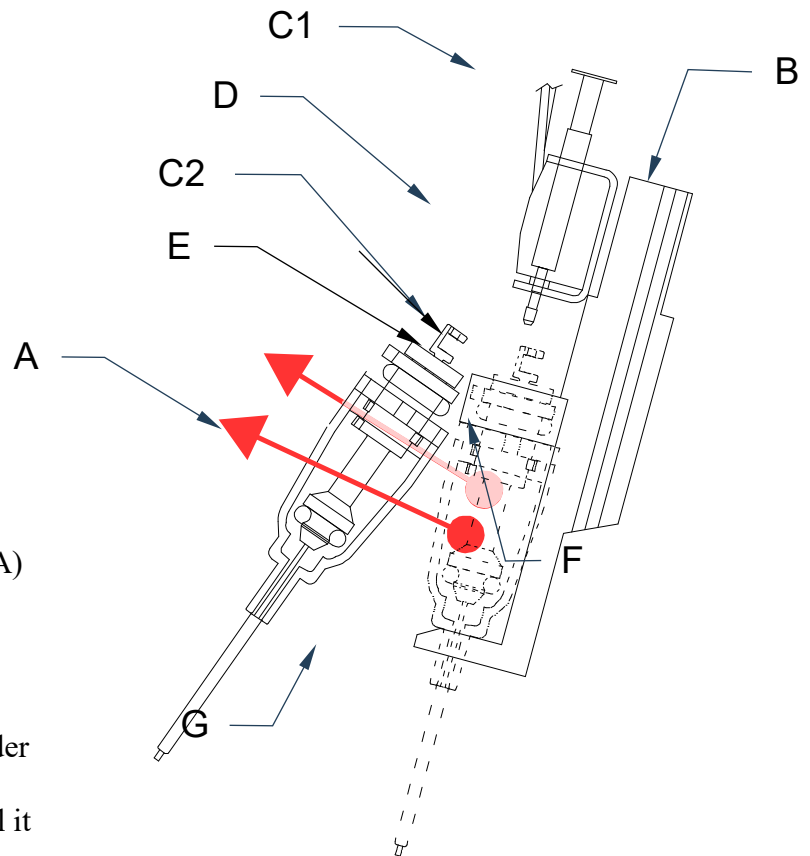


NOTE: If Plunger Stop Assembly is installed on the inker, the plunger stop adjustment dial needs to be raised (backed off) until the plunger top (C1) can be lifted enough to disconnect the plunger tip (C2) from the cartridge filament holder (E) .

Before removing the cartridge from the holder, lift the plunger top (C1) until the plunger tip (C2) disconnects from the cartridge filament holder (E).

Once the plunger tip (C2) and the filament holder (E) are separated, remove the bottom of the cartridge (A) from the holder dovetail (G) at the bottom of the holder.

With the ink cartridge (A) free of the dovetail (G) at the bottom of the holder (B), pull the ink cartridge clip (F) until it is free of the clip. Before installing a new cartridge verify that the plunger (C1-C2) moves freely in the coil (D) without binding.



Vacuum Ink Cartridge Priming**Vacuum Priming Tool Overview**

The priming tool has only been tested and factory certified for use with DieMark 3 mil and 5 mil cartridges. The purpose of priming the cartridge with the priming tool is to expedite the priming process for the small dot filament ink cartridges. The vacuum priming tool ensures that the lower ink reservoir and ink flow channels below the bottom O-ring are completely filled with ink. This will ensure even, continuous ink flow to the filament and shorten overall priming time.

Priming Tool Setup

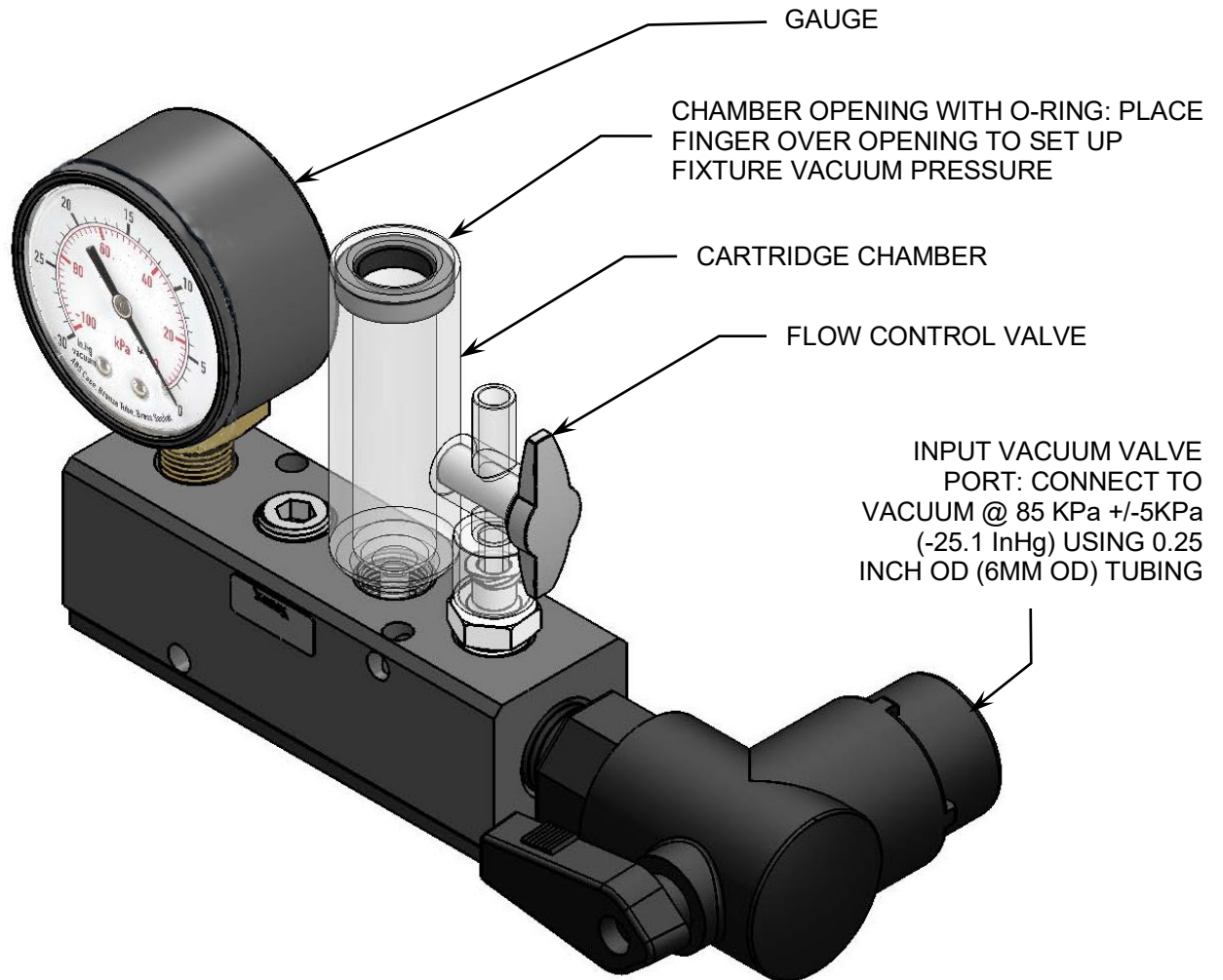
1. Connect the *input vacuum valve* on the Priming Tool to vacuum source at -85 KPa +/- 5KPa (-25.1 InHg) nominal. The *input valve connection port* will accept either ¼ OD or 6mm OD tubing.

Note: There are two Priming Tool values that change dependent on cartridge filament size (3 mil or 5 mil) and the cartridge ink type. First is the Vacuum Control Setting, second is the Vacuum Time. See values in Table 1 to locate the Vacuum Control Setting and Vacuum Time for your ink cartridge's filament size and ink type before proceeding.

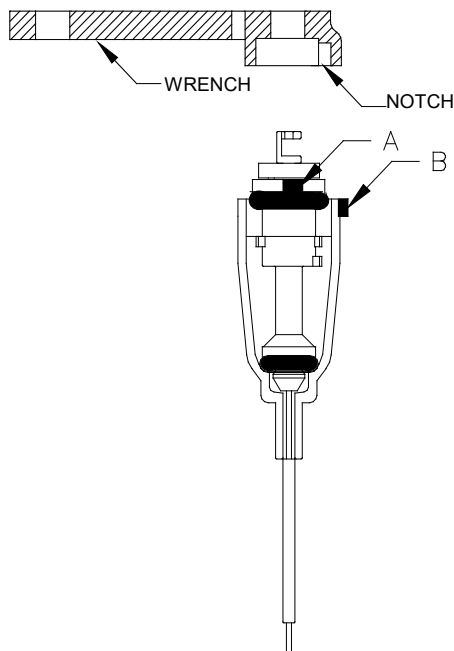
2. With the *input vacuum valve* OPEN and *flow control valve* CLOSED: place your finger on the *cartridge chamber opening*, eliminating air flow through the *cartridge chamber*. Vacuum on the *gauge* should now read -85 kPa ± 5kPa / -25.1 inHg ± 3 Hg, nominal. Adjust vacuum by slowly opening the *flow control valve* until the value listed in Table 1 for Vacuum Control Setting matches what is listed for your Cartridge type (either -34 kPa /-10 inHg for 3 mil OR -17 kPa /-5 inHg for 5 mil) is achieved on the priming fixture *gauge*, then close the *input vacuum valve*. The tool is now set up for use.

Table 1. Vacuum Priming Flow Control Setting and Vacuum Time Values

Cartridge Filament Size	Ink Type	Vacuum Control Setting (Value on Gauge in inHg ± 3 inHg)	Vacuum Time (In seconds ± 3 seconds)
3 mil	8103 Black	-10" inHg	25
3 mil	6993 Black 6997 Black 6990 Black	-10" inHg	15
3 mil	7824 Black	-10" inHg	15
5 mil	8103 Black	-5" inHg	20
5 mil	6993 Black 6997 Black 6990 Black	-5" inHg	10
5 mil	7824 Black	-5" inHg	10



Opening the Cartridge

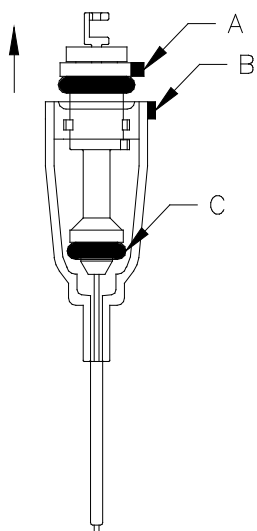


A plastic wrench is used to open and prime a cartridge. The wrench fits very tightly and has a shallow cup with a notch to fit over the top of the main shaft. The notch location is indicated by an alignment "bump" on the end of the wrench.

1. Two reference points on the ink cartridge are used in opening and priming the cartridge.

- An alignment "bump" at the top of main shaft called the *"main shaft indicator"* (A).
- An alignment "bump" on the cartridge body near the top called the *"body indicator"* (B).

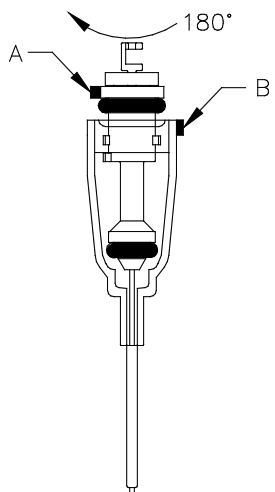
2. Align the *"main shaft indicator"* (A) with the notch in the wrench and fit the wrench over the top of the *main shaft*.



3. Turn the "main shaft indicator" (A) towards the "body indicator" (B) on the cartridge until they are aligned.

4. Hold the wrench at the cup section, between thumb and index finger, and pull up the *main shaft* with the wrench until it stops. The *bottom O-ring* (C) should be lifted from its sealed position, opening the *ink flow channels*. Visually inspect the *bottom O-ring* (C) and verify that it has lifted and the ink is flowing into the channels.

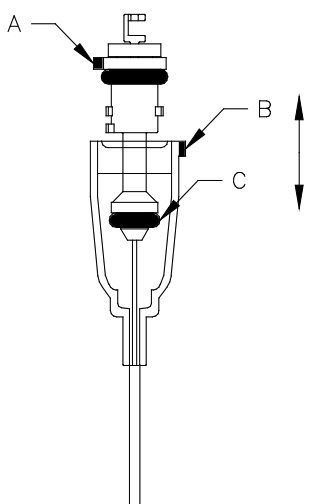
5. If the *bottom O-ring* is not lifted, close the cartridge by using the wrench to re-align the "main shaft indicator" and "body indicator". Push the *main shaft* down to re-seat it. Repeat this procedure if necessary, until the *bottom O-ring* is lifted.



6. After the *main shaft* and the *bottom O-ring* are lifted, turn the *main shaft* with the wrench until the *indicators* (A & B) are positioned exactly at opposite sides of the cartridge (at 180° with respect to each other). There is a small hole at the top of the wrench through which the "body indicator" (B) can be seen when it is at 180° from the "main shaft indicator" (A). Turn the wrench slowly while looking through this hole for the "body indicator" (B).

Prepare Cartridge for Vacuum Priming

The purpose of priming the cartridge is to ensure that the lower reservoir and the *ink flow channels* below the *bottom O-ring* are completely filled with ink. This will ensure even, continuous ink flow. To prepare the cartridge for priming, follow the steps below.



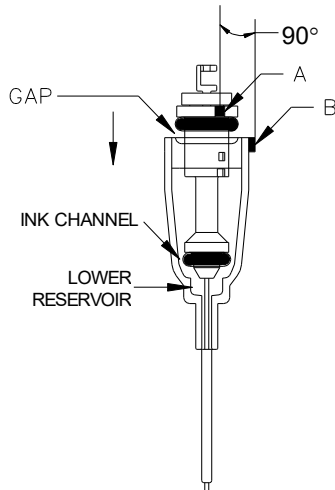
7. Hold the cartridge steady in one hand and the wrench at the cup area (top of the *main shaft*) with the other.

8. Keeping the indicators at 180° from each other, pull up very gradually and lift the *main shaft* while wiggling the wrench slightly from side to side.

9. Stop lifting the *main shaft* when it is ½ way out of the reservoir.

10. Lower the *main shaft* back to its original position while gently stirring the ink. Take care not to bend the filament.

11. Repeat steps 1-4 a few times until ink is beginning to flow into the space below the *bottom O-ring*



8. Lower the *main shaft* the final time, as far down as it will go (until it stops). The *indicators* should still be 180° from each other and the *main shaft* back down to the pre-prime position.

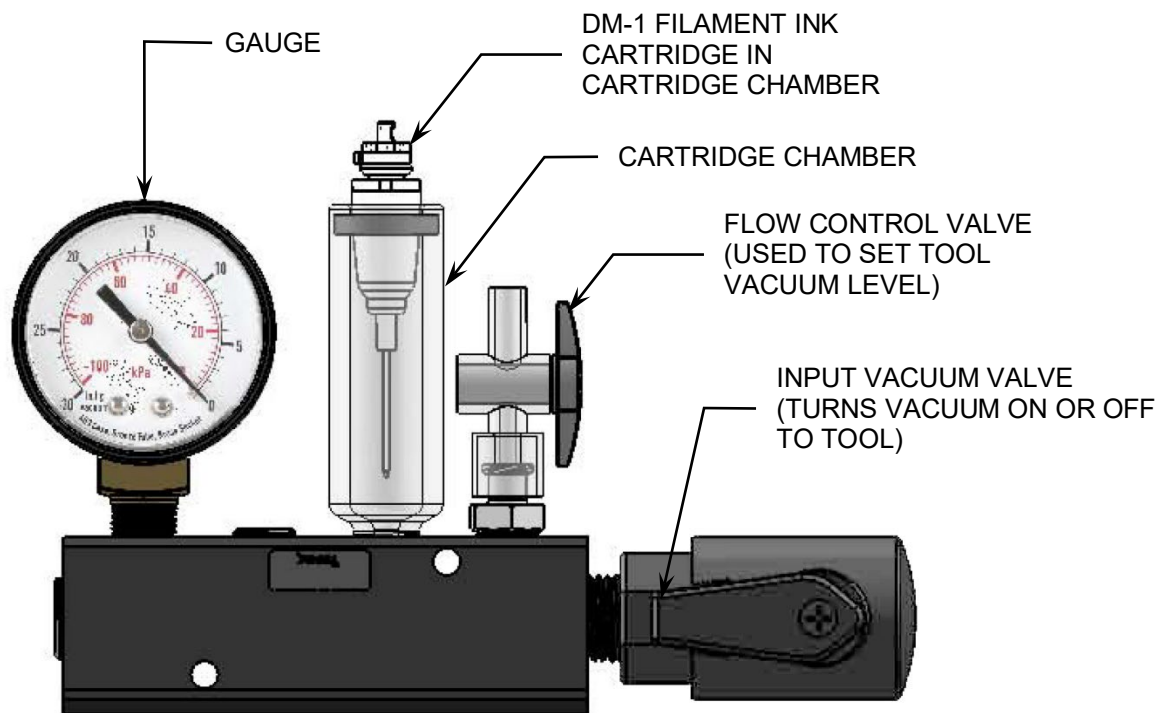
9. Turn the *main shaft* 1/4 turn in either direction. This locks the *main shaft* in position so that it cannot be moved up or down. There should be a gap between the *top O-ring* and the *cartridge body*. Push the *filament holder* down and remove the wrench. The cartridge is now prepared for the priming tool.

Cartridge Inspection

Visually inspect the cartridge before installing it in the priming tool and verify that the following conditions exist;

- The *bottom O-ring* is lifted and the *ink flow channels* under the bottom O-ring are open to allow ink flow.
- The cartridge *alignment indicators* (A & B) are 1/4 turn from each other. This way the *main shaft* cannot be pushed up or down.
- There is a *gap* between the *top O-ring* and the *cartridge body* indicating that the cartridge has not been inadvertently closed.

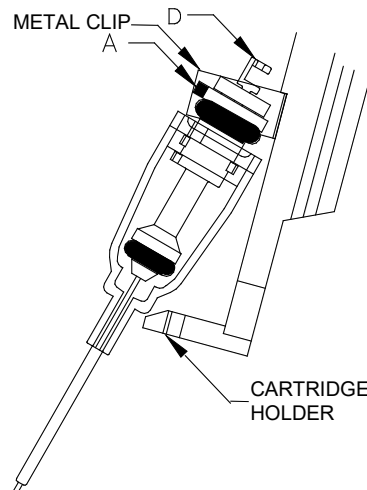
Priming the Cartridge with the Vacuum Priming Tool



Cartridge Priming with Priming Tool

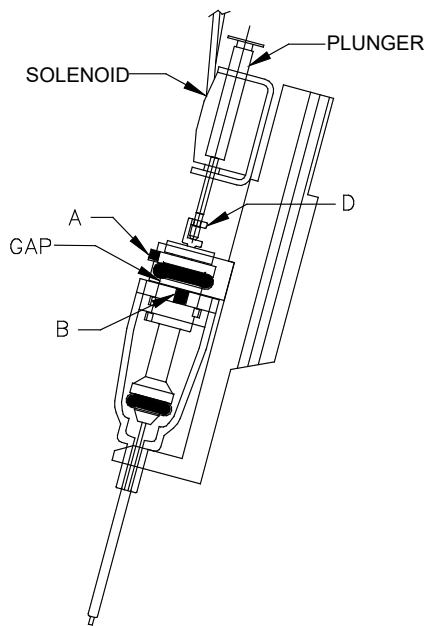
1. Place the *ink cartridge* in the *cartridge chamber* as shown. Ensure a good seal is present between the cartridge body and the O-ring (listen for hiss and adjust cartridge for good seal: some hiss is unavoidable). Take care not to bend/damage the cartridge filament.
2. Open the *input vacuum valve* for the amount of time listed in Table 1 for your cartridge ink type under Vacuum Time (10-25 seconds \pm 3 seconds), and then close the valve and remove the cartridge, taking care not to bend the filament.
3. Inspect the cartridge and proceed as noted:
 - If the ink channels and lower reservoir are not full of ink, use the cartridge priming tool again but apply vacuum in 10 second intervals, until the ink channels and lower reservoir are full of ink.
 - If the ink channel and lower reservoir are full of ink, and there is no ink at the end of the filament tip, proceed to Cartridge Installation and perform Manual Priming step.
 - If the ink channel and lower reservoir are full of ink, and there is an ink drop / ball of ink at the end of the filament tip, the cartridge is primed. Carefully remove the excess ink from the cartridge tip with clean, lint free swab or cloth and proceed to Cartridge Installation step. Since ink has already reached the needle tip, Manual Priming step can be skipped.

Cartridge Installation



1. Verify that the *filament holder* (D) has been pushed down.
2. Push the *main shaft* section into the *metal clip* on the *cartridge holder*. Make sure the "*main shaft indicator*" (A) is pointing outwards. Press the *cartridge body* until it snaps into place. Verify that the *gap* has not closed and the *indicators* are still 1/4 turn from each other. If these conditions are NOT satisfactory, remove the cartridge from the clip and review the priming procedure.
3. Align the *solenoid plunger* with the *filament holder* (D) and push the *plunger* until it snaps into the *filament holder*. In this position the *plunger* should move up and down freely. Manually depress the *plunger* a number of times to verify operation, occasionally rotating the *plunger* to ensure free movement.

Manual Cartridge Priming



If there is not a drop / ball of ink on the cartridge filament tip but the ink channels and lower reservoir are full of ink, perform this additional step until the cartridge is primed.

Note: For clarity, the images shown here do not show the Plunger Stop Assembly that is required for 3mil and 5 mil cartridges. Do not perform step 4 without the Plunger Stop assembly installed and initially adjusted.

4. Exercise the *plunger* manually or electrically until ink flow is established in the *stainless steel needle* and the *filament* is coated with ink. A DM-1 cartridge may require 20-40 *plunger* strokes to properly establish ink flow to the needle tip. When the *filament* is completely coated with ink, check the *needle tip* for excess ink and wipe with a clean, lint free cloth if necessary.

Setup and Adjustments

The following instructions are generic and may not apply to your inker.

1. Prepare, prime and install an ink cartridge per the instructions in this section (1).
2. With the chuck still in a safe position out from under the probe card, verify the inker Z height is set to full Z up (full counterclockwise *Z adjust knob* adjustment) position before lowering the inker arm or installing inker in the test head.
3. Using the microscope or camera, focus on the *cartridge tip*.
4. Place a sample or scrap wafer on the chuck and move directly under the cartridge tip. Raise the chuck height to normal Z inking position.
5. While monitoring the cartridge/wafer surface through the microscope or camera, fire the inker a few times and inspect the results. Slowly turn the *Z adjust knob* clockwise while firing the inker until dots begin to appear on the wafer surface. The cartridge *filament* should barely contact the wafer surface.



NOTICE

Do not allow the cartridge tip to contact the wafer surface while performing Z Height adjustment. Damage to the filament and/or wafer surface may occur.

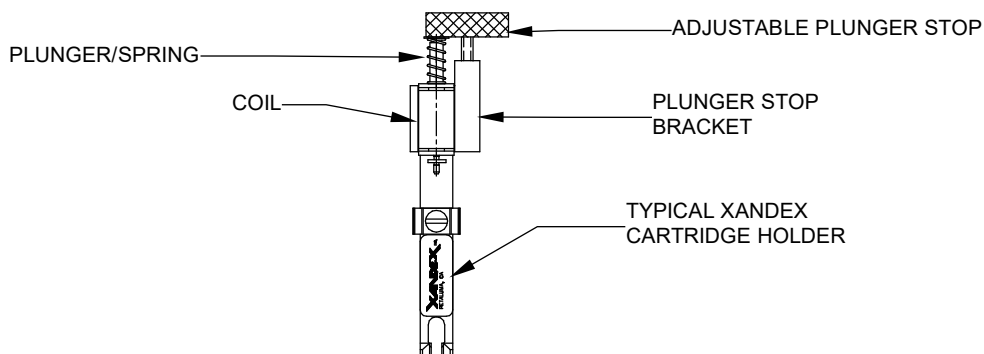
6. Adjust Z height with *Z adjust knob* until dots are round and of proper size. The cartridge *filament* should barely contact the *wafer surface* only close enough so the ink droplet wicks off onto the wafer surface.
7. Remove the sample/scrap wafer and replace with a production wafer. Move chuck under the inker and perform X & Y adjustment to desired die position.

Cartridge Removal

Removing the cartridge from the holder with the plunger connected will eventually bend the plunger. A bent plunger will bind inside the coil and result in inconsistent dot production from the new cartridge. Follow the **Cartridge Removal** procedure located on Page 1-7 to avoid damaging the plunger.

Plunger Stop Assembly

This optional assembly, available for Xandex electric inker cartridge holders, is necessary



when the tungsten filament 3 mil or 5 mil DM-1 ink cartridges are used. The assembly consists of an adjustable plunger stop, which is attached to the solenoid/cartridge holder with a bracket. Limiting plunger travel via the adjustable plunger stop provides higher control and therefore consistency of dot sizes in applications where small dots (3-5 mil) are required. The assembly is required for use of DieMark™ 5 mil tungsten and 3 mil tungsten filament cartridges. Order part number 210-0016, or contact Xandex Customer Service for assistance with your specific application.

Filament Cartridge Tips**Tips to avoid common problems with Filament Ink Cartridges.**

DO NOT attempt to refill Xandex DieMark Ink Cartridges. Cartridges are disposable and designed for single use only. Using a refilled cartridge will have an adverse effect on functionality and performance. Please note; Xandex does not warranty refilled cartridges.

Handling Tips:

Handle cartridges with care to avoid damaging the exposed filament.

When removing the cartridges from the clamshell package, lift the cartridge straight up to avoid bending the needle or damaging the filament.

Allow the cartridge to reach optimal temperature of 18-25C (65-78F) before priming the cartridge. Never attempt to prime and use cartridges that are not at optimal temperature.

Follow the Cartridge Removal procedure listed in this section to avoid damaging the plunger that passes through the solenoid coil. Failure to follow the recommended cartridge removal procedure will bend the plunger. The plunger must move freely in the solenoid coil in order to place ink dots without skipping or misplaced dots.

Priming Tips:

DO NOT over-prime the cartridge during Step 2 of the priming process. Twenty or thirty (20-30) up and down movements of the main shaft should be enough to remove the large bubbles and get a continuous flow of ink into the needle.

Use of the DieMark Vacuum Priming Tool is recommended for priming 3mil and 5 mil cartridges.

NEVER perform Step 2 of the priming process with the plastic tabs on the cartridge body and main shaft lined up. The tabs must be 180 degrees apart from each other so that the main shaft can be lifted all the way out of the cartridge body.

Wipe off any excess ink on the outside of the needle using a lint free cloth or swab before use.

NEVER re-close the cartridge. The cartridge should be left in the open position as described in Step 5 of the priming instructions, until the cartridge is ready to be discarded (cartridge is either empty or expired).

DO NOT use the cartridges beyond the recommended open time for the ink type in the cartridge. Recommended open time is two (2) days for 8103 and 8104, three (3) days for 7824 and 7824T and five (5) days for 6990, 6993, and 6997.

Section 2. Pneumatic Cartridge Operation

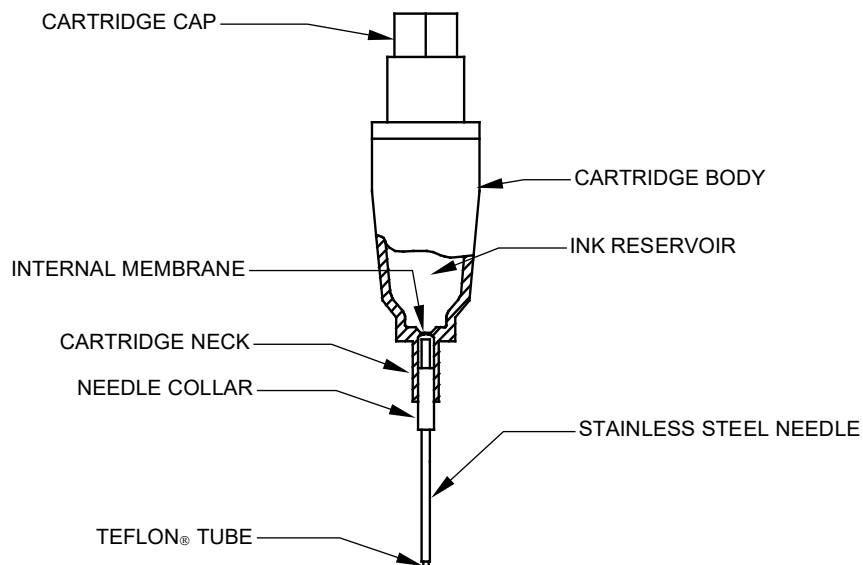
General Information

The two DieMark™ pneumatic ink cartridges used with Xandex Pneumatic Inkers are the DM-2, and the DM-2.3. The DM-2.3 differs from the DM-2 in that the overall needle length of the DM-2.3 is 0.20 inches (± 0.005 ") shorter than the DM-2. They are both available in A5, A6, and A8 (designating 0.005", 0.006", and 0.008" Teflon® tube I.D., respectively). The DM-2 is also available in type A4, with 0.002" Teflon tube ID. The A4 cartridge is designed for placing small ink dots using the new Micro-Z pneumatic inking systems. For more information on the DM-2 A4 cartridge, contact Xandex Customer Service. DM-2 and DM-2.3 cartridges have a polypropylene reservoir which is sealed at the bottom by a thin membrane, and a small Teflon® tube encased in a stainless steel needle. When the cartridge is opened, the needle punctures the membrane to provide ink flow through the Teflon® tube.

Each cartridge holds 1.0 grams minimum of ink and can produce a wide range of dot sizes. Dot size is controlled by changing the duration of the air pulse into the cartridge reservoir, which determines how much ink is forced through the Teflon® tube to create the ink drop at the needle tip. A4, A5 and A6 cartridge types will produce an average of 30,000 dots*, while the A8 averages 10,000 dots*. For more information see **Section 3 “Ink”** and **“Pneumatic Ink Cartridge Specifications” in Section 5.**

** Averages exclude 8104 ink type. Dot production figures are averages and as such, are not guaranteed. Testing is performed at ambient temperature of 70 degrees F, relative humidity of 50% on polished, unetched silicon wafers (no passivation) and based on pneumatic controller operating at "MIDDLE" dot size setting (standard controller = dot size knob centered between "MIN" and "MAX": Micro-Z Controller = dot size thumbwheel setting of 50). Dot production figures represent an average of results for multiple ink types. Your yield may be higher or lower depending on the ink type and dot size setting you use. Average figures are based on complete cartridge use within **cartridge open shelf life periods** as stated for each specific ink type.*

Cartridge Overview



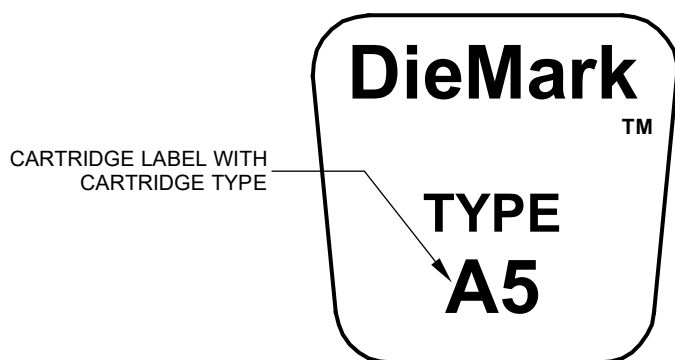
Ink Cartridge Labeling

DieMark™ ink cartridges are individually labeled with two distinct labels. One label shows the cartridge type and the other label indicates the ink batch number, ink type and expiration date of the cartridge.

Do not remove the labels from the cartridges as this can cause cartridge type and ink types to be confused at cartridge installation, resulting in improper performance. Removal of cartridge labels will also void the cartridge warranty.

DieMark™ Cartridge Type Label

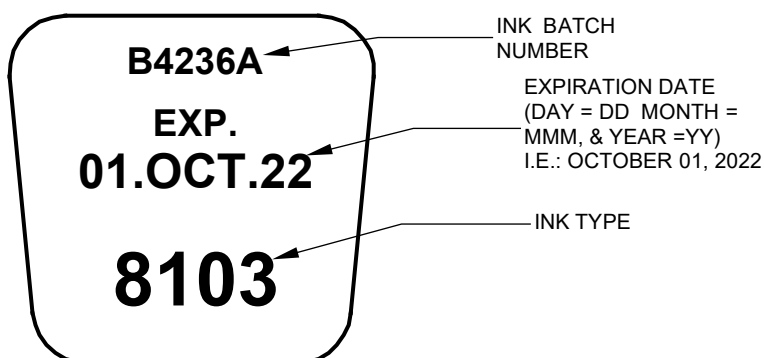
This label contains the cartridge type, (either **A4**, **A5**, **A6** or **A8**).

**DieMark™ Cartridge Expiration Date Label**





This label indicates the ink type and batch number of the ink contained in the cartridge and the cartridge expiration date. Expiration dates shown are for *unopened* cartridges.

- ◆ 6990, 6993, 6997, 7824, 7824T, 8103 and 8104 (except 8103 White), = Four (4) months.
- ◆ 8103 White = Two (2) months

After the cartridge is opened, consistent ink flow can only be expected for up to five (5) days for 6990, 6993, 6997 and three (3) days for 7824, 7824T, 8103 and 8104.



Cartridge Label Color Coding

DM-2 & DM-2.3 PNEUMATIC CARTRIDGE LABELS	
LABEL	DESCRIPTION
	A4 IS GREEN
	A5 IS RED
	A6 IS BLUE
	A8 IS YELLOW

Note: A4 cartridges are qualified by Xandex for use on Micro-Z Small Dot inking systems. A4 cartridges can be purchased for use on other DieMark pneumatic inker models, however, performance is not guaranteed, and subject to limited warranty conditions. The A4 is available only in the DM-2 cartridge configuration, as of the release date of this manual.

Pneumatic Ink Cartridge Tips**Tips to avoid common problems with Pneumatic Ink Cartridges**

DO NOT attempt to refill Xandex DieMark Ink Cartridges. Cartridges are disposable and designed for single use only. Using a refilled cartridge will have an adverse effect on functionality and performance. Please note, Xandex does not warranty refilled cartridges.

Handling Tips:

Handle cartridges with care to avoid damaging the exposed Teflon tube at the tip of the needle

When removing the cartridges from the clamshell package, lift the cartridge straight up to avoid bending the needle or damaging the Teflon tube.

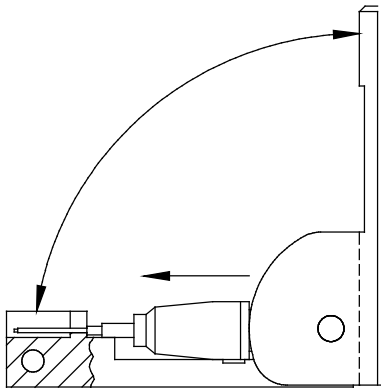
Allow the cartridge to reach optimal temperature of 18-25C (65-78F) before priming the cartridge. Never attempt to prime and use cartridges that are not at optimal temperature.

Inspect the Buna washer on the cartridge fitting each time a cartridge is changed to ensure it is not distorted, broken or over compressed. Failure to replace a damaged washer can result in a range of performance issues, including leaking ink, and/or ink splatter during inker operation. For optimal performance, Xandex recommends replacing the Buna washer after 50 cartridges have been used. Buna washers (Part Number 511-1003) are available from Xandex in packages of quantity 25 by ordering Part Number 330-0001.

Priming Tips:

Wipe off any excess ink on the outside of the needle using a lint free cloth or swab before use.

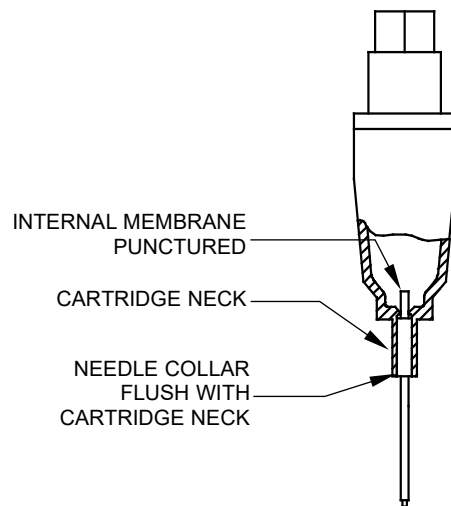
DO NOT use the cartridges beyond the recommended open time for the ink type in the cartridge. Recommended open time is three (3) days for 7824, 7824T, 8103 and 8104 and five (5) days for 6990, 6993, and 6997 in pneumatic ink cartridges.

Cartridge Preparation

1. Place the cartridge into the cartridge preparation tool (Xandex Part No. 200-0001) as shown, exercising care to avoid damaging the Teflon® tip. The cartridge cap should be seated in the tool hinge with the needle resting in the slot.

2. Firmly squeeze the tool fully closed with a smooth, quick motion. This will push the cartridge body forward, causing the needle to puncture the internal membrane.

3. Open tool and remove cartridge. The needle should be straight and the needle collar flush with the cartridge neck.

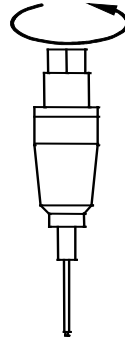


Note: Do not shake the cartridge at any time, as air bubbles may be introduced into the reservoir and restrict the flow of ink. If mixing of the ink in the reservoir is desired, roll the cartridge between thumb and forefinger (or between palms) for 1-2 minutes prior to installation.

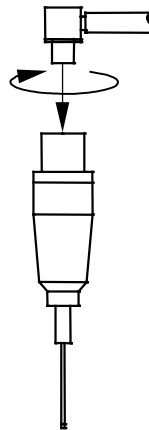
Cartridge Installation

The following instructions are generic and may not apply to your inker. Please refer to your inker manual for specific instructions for your inker.

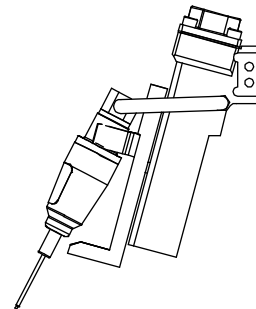
1. Use the slotted section of the cartridge preparation tool and a *counter-clockwise* motion to remove the cartridge cap.



2. Thread the cartridge onto the brass air fitting of the RED AIR HOSE, turning the cartridge *clockwise* until snug.

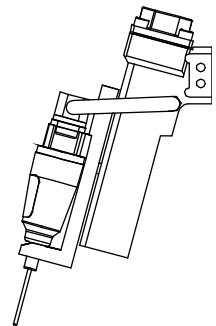


3. Press top of cartridge into shuttle spring clip.



4. Press cartridge body into shuttle forks until the neck fully snaps into place.

5. Cartridge is now ready for priming.



Caution: Ink Cartridge needle can pierce skin when moved manually or when shuttle valve is actuated:

1. Keep hands and fingers clear of the cartridge needle tip after cartridge change out and priming.
2. Never place hands or fingers under the cartridge needle
3. Keep hands and fingers clear of needle tip during cartridge change out and priming.



Always follow recommended cartridge priming procedure. Place the controller toggle switch in RUN position and press the controller RESET button, which fires ONLY the cartridge valve to send ink to the needle tip. Priming using any other mode that actuates the shuttle valve during the priming process exposes the user to possible hand or finger puncture when the shuttle actuates.

Changing the Cartridge

The following instructions are generic and may not apply to your inker. Please refer to your inker manual for specific instructions for your inker.

1. Place thumb and forefinger on each side of the cartridge and gently pull out to remove cartridge from clips.
2. Unthread the cartridge from the air fitting and discard in the proper manner.
3. Inspect the air fitting, the Buna (rubber) washer on the air fitting and air supply hose for ink contamination and clean or replace as necessary.

Note: *Inspect the Buna washer on the cartridge fitting each time a cartridge is changed to ensure it is not distorted, broken or over compressed. Failure to replace a damaged washer can result in a range of performance issues, including leaking ink, and/or ink splatter during inker operation. For optimal performance, Xandex recommends replacing the Buna washer after 50 cartridges have been used. Buna washers (Part Number 511-1003) are available from Xandex in packages of quantity 25 by ordering Part Number 330-0001.*

4. Install a new cartridge per installation instructions.

Cartridge Priming



Always wear protective eyeglasses when handling an active pneumatic inking system!

The following instructions are generic and may not apply to your inker. Please refer to your inker manual for specific instructions for your inker.

1. Prepare a cartridge per the “Cartridge Preparation” section of this manual.
2. Install a prepared cartridge on the inker.
3. Move the controller switch to “RUN”.

Note: *When the “RESET” button is initially pushed the “INK ON” LED will not be lit and the “STATUS” LED will begin to flash. At the end of 3 seconds both the “INK ON” and “STATUS” LED will light continuously and the air valve will begin to pulse, priming the cartridge.*

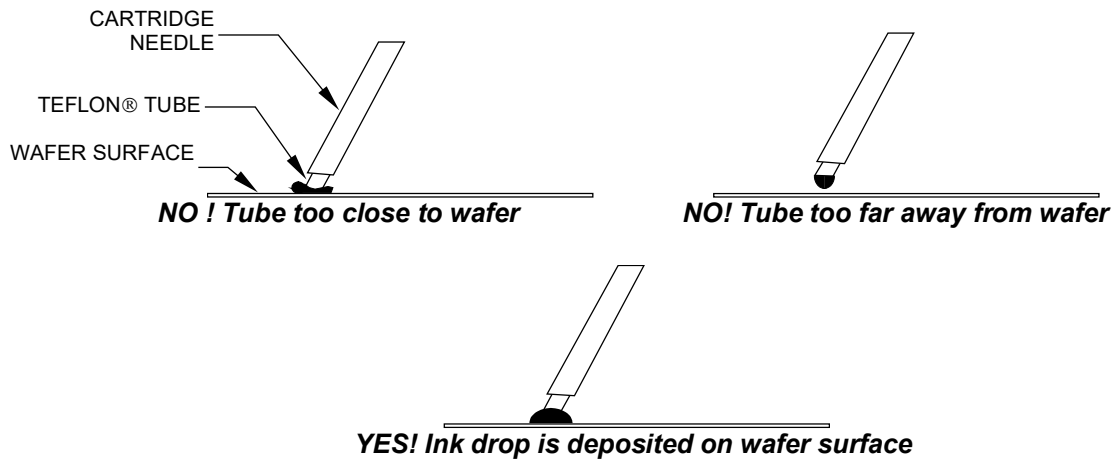
4. Push the “RESET” button on the controller for at least 3 seconds and hold down until ink appears at the needle tip.
5. Once priming is completed, clean excess ink from the needle tip with a clean, lint free cloth. The cartridge is now ready for operation.

NOTICE

Always use the RESET button to pulse the cartridge valve when priming a cartridge with the inker swing arm in the up position. The RESET button fires only the inker's cartridge valve. If the shuttle valve is fired with the swing arm in the up position, (by using the prober's test inker function for example) ink may be forced into the cartridge air fitting and air hose, contaminating both.

Cartridge Alignment

Cartridge alignment in relation to the wafer surface is very important in obtaining the best performance from a pneumatic inking system. Please refer to your inker manual for specific setup and alignment procedures for your inker. After your inker is aligned, the Teflon® tube will be 1-2 mil from the wafer surface when the dot is deposited. The Teflon® tube should never come into contact with the wafer surface.



NOTICE

Do not let the Teflon® cartridge tube contact the wafer surface. This may crush the tip preventing ink flow and damaging the cartridge or the wafer!

This page is intentionally left blank.

Section 3. Ink

Ink Overview

Semiconductor manufacturers use the vision system of automatic pick and place equipment during the assembly process to detect damaged and/or rejected die. This is done by shining a combination of different lights on the wafer surface to create a “white” background. Ink dots and defects like chipped corners are easily recognizable against this background.

DieMark black and red inks are opaque and easily recognizable under most lighting conditions. Glycol Free 8103 ink is thick in viscosity and delivers opaque dots ranging from 6 to 40 mils. 8104 is not as viscous as 8103 and provides thinner dots with excellent geometry and adhesion in larger dot range up to 86 mils.

8103 ink is certified to contain less than 10 ppm of Sodium (Na) and Chloride (Cl). 8104 ink is certified to contain less than 20 ppm of Sodium (Na) and Chloride (Cl). Both 8103 and 8104 premium inks are free of glycol ethers, which are identified reproductive hazards and carcinogens. 7824 and 7824T inks are certified to contain less than 10 ppm of Na and Cl. 6990, 6993, and 6997 are certified to contain less than 10 ppm of Na and Cl. Analysis reports are available upon request from Xandex Customer Service.

Glycol Free 8103 and 8104 inks have a 4 month shelf life, except for 8103 White ink, which has a 2 month shelf life. Glycol Free inks rapidly air dry at ambient conditions and will give consistent flow for 2-3 days after cartridge opening. 6990, 6993 and 6997 inks have a 4 month shelf life, require heat curing to be permanent, and will give consistent flow for 5 days after cartridge opening. 7824 and 7824T inks have a 4 month shelf life and will give consistent flow for 3 days after cartridge opening. 7824 and 7824T can be air or “heat set” cured.

Glycol Free 8103 and 8104 inks are thermally stable at temperatures up to 150° C and can be used in hot chuck or oven drying applications without cracking or loss of adhesion. Use of either 6990, 6993 and 6997 or 7824 and 7824T inks in hot chuck applications is not recommended as the elevated ambient temperature in the probing area can reduce cartridge life and cause inconsistent ink flow. However, use of a hot chuck to heat set dots during offline inking has reportedly been successful when employed by some customers. All of the inks offered by Xandex are non-magnetic.

Safety Data Sheets (SDS) are available for all DieMark inks. To obtain SDS or information about choosing the appropriate ink for your application please contact your local distributor or Xandex Customer Service. ¹ Test measurements are dependent on test method used.

Ink Curing

The procedure for curing will depend on the type of ink used and other factors such as dot size and spacing (see “General Notes on Ink Curing, below). Xandex guidelines are developed under laboratory conditions using single wafers and are intended as a baseline to develop a curing process that meets your specific needs.

6990, 6993, and 6997 should be cured/baked within 2 hours of inking due to the evaporation of solvents in the ink over time. If a wafer (or boat of wafers) is left uncured for an extended period of time, the dots may crack and/or flake after the baking process.

6990, 6993, and 6997 inks, when air-dried, will not smear when touched. They are not permanent, however, and will not withstand most post-probe handling or processes. Conversely, 7824 and 7824T inks air cure within 2.5 hours (≤ 20 mil, up to 10 hours for >20 mil dots). 7824 and 7824T may also be heat cured at up to 150°C for 10 minutes.

8103 and 8104 Glycol Free inks hard cure under ambient conditions in the least time of any of the inks offered by Xandex. Ink dots of ≤ 25 mil typically air dry to a hard cure in 45 minutes. Dot sizes >25 mil may require significantly longer to cure. An ambient cure time of up to 6 hours may be needed for larger dot sizes. 8103 and 8104 may also be heat cured at up to 150°C for 10 minutes if a faster cure is desired.

General Notes on Ink Curing

Several factors have greater influence on the time required to get a full cure in the shortest amount of time, either when heat curing or curing at room temperature:

- **Dot Size:** Larger dot sizes will require longer cure times.
- **Dot Spacing:** Large numbers of closely spaced ink dots will require a longer cure time than small numbers of widely spaced dots.
- **Air Flow:** Continuous air flow across the wafer surface will reduce the amount of time required for ink curing. This is especially important when air curing at ambient temperatures.
- **Wafer/Die Surface:** Both the surface chemistry and degree of patterning on the die affect how the ink spreads on the wafer. If the ink does not spread as much, the dots will be thicker. And if the dots are thicker, they will require a longer cure time.
- **Temperature:** Higher temperatures will lead to faster ink cure times.
- **Wafer Boat / Cassette:** Wafers stacked in a boat / cassette will require increased cure time compared to single wafers.

Ink Curing Guidelines

The following table provides guidelines for curing each type of ink sold by Xandex:

INK CURING GUIDELINES			
CURE TYPE	TEMPERATURE	CURE TIME	RESULT
6990, 6993, and 6997			
Soft Cure	70-100°C	5-30 minutes	Ink is semi-permanent and will not withstand wash of alcohol, acetone, or photoresist removers
Hard Cure	150-185°C	30-60 minutes	Ink is permanent and resistant to wash process
7824, 7824T			
Hard Cure	Air dry, ambient conditions*	1-3 hours for ≤20 mil 3-4 hours for 20-25 mil 4-10 hours for 25-40 mil	Ink is permanent and may only be removed with great difficulty
Hard Cure	150 Watt heat lamp at 5-6 inches OR oven at 110-150°C	5-10 minutes	Ink is permanent and may only be removed with great difficulty
8103 and 8104 Glycol Free			
Hard Cure	Air dry, ambient conditions*	5-15 minutes for ≤ 15 mil 15 minutes – 3 hours for 15-25 mil 3-6 hours for 25-40 mil	Ink is permanent and may only be removed with great difficulty
Hard Cure	150 Watt heat lamp at 5-6 inches OR oven at 110-150°C	5-10 minutes	Ink is permanent and may only be removed with great difficulty

**Ink cure testing performed on single, (not stacked in a wafer boat/cassette) polished silicon wafers with dot spacing of 50 mil (1270 μm) with moderate air flow at 70-72 °F (21.1-22.2 °C).*

Ink Removal Information

A rinse with isopropyl alcohol or acetone generally removes ink completely if the wafer is washed shortly after inking (within 5 minutes). An ultrasonic bath is recommended to ensure complete removal of ink residue. Ink dots that have been air dried or hard cured, require the application of an ink remover.

Xandex DieMark Remover 8000

Xandex has developed DieMark Remover 8000 specifically for the semi-conductor industry. DieMark Remover 8000 thoroughly removes all inks supplied by Xandex, including oven baked ink dots. DieMark Remover 8000 has very low levels of organic and inorganic contaminants and is an efficient and thorough ink remover when used in simple bench top cleaning methods. Due to its high flash point, DieMark Remover 8000 is also safe and effective when used in ultrasonic, temperature/pressure cycling under vacuum and deep bath heating and agitation ink removal processes.

DieMark Remover 8000 is carcinogen and teratogen free (NTP, OSHA) and all ingredients used are TSCA listed. For an SDS or more information on using DieMark Remover 8000 in your specific ink removal process, contact Xandex Customer Service.

Ink Removal Procedure

The following is the recommended bench top procedure for removing ink from wafers using DieMark Remover 8000. *



All procedures should be performed under a laboratory hood, following proper safety precautions (protective goggles, gloves and clothing).

1. Apply sparingly with an eyedropper to a localized area of the wafer.
2. Allow 2-3 minutes for the DieMark Remover 8000 to begin solvating. Time required will vary depending on the degree that the ink was cured.
3. For highly cured ink dots, use longer soak times, then wipe gently with a clean lint-free cloth to facilitate removal. If necessary, repeat steps 1 and 2.
4. For large areas or removal of ink from entire wafer, soak a clean lint-free cloth with DieMark Remover 8000, then lay the wet cloth over the entire surface and allow time to soak/solvate ink, then remove wet cloth. Repeat as necessary.
5. After dots are removed, clean wafer via standard procedures, such as vapor degreasing, and/or rinse with a clean solvent (Isopropyl Alcohol) followed by a bake cycle at 65° C to dry.

* The following ink removers may be substituted for DieMark Remover 8000, however, Xandex does not guarantee that satisfactory results will be obtained. None of the following solvents or ink removers are available from Xandex.

- ◆ Aptek 6515 Ink Remover
- ◆ Markem® 540
- ◆ P-300 Resist Remover
- ◆ 712-D Resist Remover
- ◆ Uresolve Resist Remover
- ◆ Methyl Ethyl Ketone (MEK)
- ◆ N-Methyl-2-Pyrrolidone (M-Pyrrol)

This page intentionally left blank.

Section 4. Troubleshooting

This Troubleshooting section is divided into two parts. The first part covers the filament ink cartridge. The second part covers the pneumatic ink cartridge. More troubleshooting information is available in the “Support” section at <http://www.xandexsemi.com/>.

Filament Ink Cartridge Troubleshooting

Problem	Solution
The lower O-ring does not lift when opening a cartridge.	This happens sometimes when some ink dries around the lower O-ring. Push the main shaft down, keeping the indicators aligned, then pull up the shaft while slanting it to one side as much as possible.
The cartridge is opened per instructions and the fishline comes out smoothly, but the ink does not flow down the needle.	It usually takes 30 to 40 strokes before the ink travels all the way down the needle. Viscous and air dry inks may require longer. After priming and installation manually activate the inker plunger 30 to 40 strokes until ink appears at the needle tip.
Some ink dots tend to crack after baking using Xandex recommended cure cycles.	This occurrence is related to the ink surface tension, wafer surface conditions and too long a delay time between inking and curing. To remedy this situation, the curing cycle has to be modified (reduce time and temperature). See Section 3 “Ink Curing.”
Runny, blobbing ink or skipping dots.	<ol style="list-style-type: none"> 1. Check ink shelf life. Filament cartridges containing 6990, 6993 and 6997 should be used within 4 months or 5 days of cartridge opening. 8103 and 8104 glycol free air dry inks should be used within 4 months (except for 8103 White ink which should be used within 2 months) or 2 days of cartridge opening. 7824 and 7824T inks within 4 months or 3 days after cartridge opening. 2. Check for exposure to extreme temperatures. Cartridges should be stored at 25°C. DO NOT refrigerate the cartridges. Occasionally, ink is subjected to much higher temperatures (40-50° C) for an extended time during transport. This could break down the ink such that its viscosity and surface tension are altered permanently.

Problem	Solution
Runny, blobbing ink or skipping dots (continued)	<p>3. Inker Z height may be adjusted too high. Ink can not wick off the filament and builds up, creating blobbing and skipping. Re-adjust inker Z height and alignment as detailed in your inker manual.</p>
Small, inconsistent, skipping or no ink dots.	<p>1. The ink flow channels may be blocked. It could be due to any one of the following:</p> <p>A. The bottom O-ring is not lifted. In this case, when the cartridge is primed only a small amount of the ink flows into the space below the O-ring. This is enough to start inking, but the inker quickly uses up that ink (i.e., on two or three wafers) and will start to skip. To eliminate the problem, close the cartridge, re-open and prime again. See Section 1 "Opening the Cartridge."</p> <p>B. The cartridge is opened and primed correctly but is closed inadvertently before it is mounted on the holder. The main shaft is pushed down all the way, leaving no gap and the fishline appears to be too long. To correct this problem, pull up the main shaft until it stops, then turn it 1/4 of a turn in either direction. See Section 1 "Priming the Cartridge."</p> <p>C. During priming, an air bubble may have become trapped under the bottom O-ring. This inhibits the full flow of ink. To eliminate air bubbles, reseal the cartridge and repeat the priming procedure in Section 1.</p>

Problem	Solution
Small, inconsistent, skipping or no ink dots (continued)	<ol style="list-style-type: none"> 2. Verify that coil and cartridge are in line, visually check the straightness of plunger and check for possible damage to the plunger spring. The plunger should travel smoothly and freely when actuated manually from any position. If there is any binding replace the actuator assembly (coil, plunger/spring). 3. Chuck top or wafer surface not planar. Verify planarity of both.
Elongated instead of round dots.	<ol style="list-style-type: none"> 1. Inker is set too close to the wafer, which results in a kinked monofilament. The cartridge should be positioned so that the filament barely touches the wafer surface when it is fully exposed. See Setup and Alignment procedure as detailed in your inker manual.

Electric Inker Troubleshooting

Problem	Solution
<p>The inker is working intermittently from the outset.</p>	<ol style="list-style-type: none"> 1. Incorrect inker drive, in which case the plunger will travel very sluggishly. The 290Ω coil requires an inker drive signal of 48 volts with a 25 ms pulse duration. Contact Xandex Customer Service for more information. 2. The plunger might be bent. This can happen when removing a cartridge unless the proper removal procedure is used. See Cartridge Removal on page 1-7. Manually actuate the plunger a few times, rotate 1/4 turn and repeat. The plunger should travel freely. If it does not, contact Customer Service for actuator replacement options. 3. During opening of the cartridge, the fishline monofilament has been kinked because the main shaft was lowered quickly or incorrectly. Replace the cartridge and review Section 1 “Priming the Cartridge.” 4. Faulty electrical connection somewhere on the line. Check the continuity of electrical supply connections to the inker and correct.
<p>The inker works fine for a while (4-8 hours), then starts to skip badly.</p>	<ol style="list-style-type: none"> 1. Ink flow channels are blocked by the lower O-ring. If the bottom O-ring is not lifted during opening and priming, a small amount of ink below will be used up after a few rows, while the remainder is trapped in the reservoir. Remove the cartridge, close and repeat opening and priming procedure in Section 1. 2. When the cartridge is installed on the holder, the indicators are left aligned and the main shaft has been pushed closed. The indicators should be moved 1/4 turn into locking position. Remove the cartridge and repeat opening and priming procedure in Section 1.

Problem	Solution
The inker works fine for a while (4-8 hours), then starts to skip badly (continued)	3. Wrong inker drive being used. Sometimes the coil problem does not appear from the outset. If the actuation pulse is marginally acceptable the plunger will travel less than a full stroke as the solenoid heats up. This causes the inker to miss badly. Contact Xandex Customer Service for more information.

Pneumatic Ink Cartridge Troubleshooting

This Troubleshooting section for the Pneumatic Inkers is divided into three parts. The first part covers ink and the DM-2/DM2.3 ink cartridge. The second part covers the Inker Assembly, and the third part covers the Pneumatic Controller.

Problem	Solution
Some ink dots tend to crack after baking using Xandex recommended cure cycles.	This occurrence is related to the ink surface tension, the wafer surface conditions and too long a delay time between inking and curing. To remedy this situation, the curing cycle has to be modified (reduce time and temperature). See Section 3 “Ink Curing.”
Runny, blobbing ink or skipping dots.	<ol style="list-style-type: none"> 1. Check ink shelf life. Pneumatic cartridges containing 6990, 6993 and 6997 should be used within 4 months or 5 days of cartridge opening. 8103 and 8104 glycol free air dry inks should be used within 4 months (except for 8103 White ink which should be used within 2 months) or 3 days of cartridge opening. 7824 and 7824T inks within 4 months or 3 days after cartridge opening. 2. Check for exposure to extreme temperatures. Cartridges should be stored at 25°C. DO NOT refrigerate the cartridges. Occasionally, ink is subjected to much higher temperatures (40-50° C) for an extended time during transport. This could break down the ink such that its viscosity and surface tension are altered permanently. 3. Improper Z Height set-up. Re-adjust Z Height as detailed in your inker manual. 4. Chuck top or wafer surface not planar. Verify planarity of both.
After changing the controller dot size settings, the dots are too small or the ink blobs at the tip of the needle.	<ol style="list-style-type: none"> 1. The cartridge tip may be damaged. Examine cartridge and replace if necessary. 2. Whenever dot size is changed there may be minor inker Z height adjustments required. The inker should be set so that just the bottom of the ink drop touches the wafer.

Problem	Solution
Small, inconsistent or no ink dots.	<ol style="list-style-type: none"> 1. Soft Teflon® tip of the cartridge tube is clogged or damaged. Change cartridge. 2. The controller dot size setting may be too low. Increase dot size setting. 3. Wrong cartridge type (A4, A5, A6, A8). Change cartridge type. 4. Air pressure too low. Verify that regulator setting is 70 ± 10 PSI for all inkers <i>except</i> for the X411X and X421X Motorized Z inkers and the X711X and X7120 Micro-Z inkers, which require 80 ± 5 PSI. 5. Z height adjustment is incorrect. Adjust Z Height. 6. Verify that the inker swing arm is all the way down and locked in position. 7. Shuttle mechanism may be binding. Perform shuttle maintenance as detailed in your inker operation manual.

Pneumatic Inker Troubleshooting

Problem	Solution
Dots too large.	<ol style="list-style-type: none"> 1. Dot size setting too high. Decrease dot size setting. 2. Main Air pressure too high, verify setting at 70 ± 10 PSI, 80 PSI for Motorized Z and Micro-Z inkers. 3. Wrong cartridge type. Change cartridge type. 4. Controller dot size potentiometer defective. Run controller diagnostics test as detailed in your inker manual.
Cartridge tip does not reach wafer surface.	<ol style="list-style-type: none"> 1. Check Z height by switching the controller into "SETUP" mode, which will extend the shuttle downward into the "inking position". 2. Adjust inker Z height as directed in your inker manual.
Unit functions normally, no dots, no shuttle movement.	<ol style="list-style-type: none"> 1. Verify that the Controller-Shuttle air hose connector is plugged into the controller. 2. Verify that the Controller-shuttle air hose is not kinked, clogged or pinched closed. 3. Check Main Air pressure setting (verify 70 ± 10 PSI air input, 80 PSI for Motorized Z and Micro-Z inkers).
Inker produces dots during "puff pulse" or ink flows out of cartridge with toggle switch in "SETUP".	<ol style="list-style-type: none"> 1. Verify that the air hoses from the controller to the inker are connected properly: <ul style="list-style-type: none"> ◆ RED AIR HOSE (air in) connects to the ink cartridge. ◆ BLUE AIR HOSE connects to the shuttle connection on the shuttle mechanism.

Problem	Solution
Unit functions normally, shuttle moves, no dots.	<ol style="list-style-type: none"> 1. Check red air hose to top of cartridge to be sure it is connected and not kinked, clogged or pinched. 2. Verify cartridge preparation, insuring Needle Collar is flush with the Cartridge Neck and the internal membrane is broken. See Section 2 “Pneumatic Ink Cartridge.” 3. Check the Teflon® tip of cartridge tube to confirm that it is not clogged or damaged. 4. Verify that the Buna (rubber) washer on the cartridge air hose connector is installed and not damaged. Replace if damaged.
Cartridge air hose and connector contaminated with ink.	<p>Always use the RESET button to pulse the cartridge valve when priming a cartridge with the inker swing arm in the up position. This also applies to remote adjust inkers when the cartridge is being primed and the inker is not oriented in vertical (operating) position.</p> <p>The RESET button fires only the inker's <i>cartridge</i> valve. If the shuttle valve is fired with the cartridge in a horizontal orientation, (by using the prober's test inker function for example) ink may be forced into the cartridge air fitting and air hose, contaminating both.</p>

Pneumatic Controller Troubleshooting

Problem	Solution
The controller is plugged in but the "POWER" LED is off.	<ol style="list-style-type: none"> 1. Make sure that the AC outlet has power. The requirement is 100-240 VAC @ 47-63Hz. 2. Verify that the power supply is connected to the 24V input on the back of the controller and that the ON/OFF switch on the controller is in the ON position.
Controller powers up okay but will not respond to prober signal.	<ol style="list-style-type: none"> 1. Verify input cable is plugged into the prober input on the controller. 2. Verify input cable is plugged into inker jack on prober. 3. Check continuity of cable. 4. Perform Pneumatic Controller diagnostics tests as detailed in your inker manual to verify controller operation.
Controller powers up okay, responds to prober input but the shuttle does not move.	<ol style="list-style-type: none"> 1. Check that shuttle toggle switch on the front of the controller is in the RUN position. 2. Check that the air hose "quick disconnects" are correctly oriented. 3. Perform Shuttle Valve diagnostic test as detailed in your inker manual to verify operation.
Dot size does not change or does not change sufficiently with adjustment of Dot Size Knob	<ol style="list-style-type: none"> 1. Verify that the air hoses from the controller to the inker are connected properly: Reference the drawings in your specific inker manual. 2. Run Dot Size Potentiometer diagnostic Test as detailed in your inker manual. If test results are not within parameters, consult Xandex Customer Service. 3. Cartridge tip is damaged. Replace ink cartridge.

	<p>4. Wrong ink cartridge type. Replace ink cartridge with larger (or smaller) type dot size rating. See “Dot Size Parameters” table in Section 4. “Operation.”</p>
--	---

This page is intentionally left blank.

Section 5. System Specifications

Filament Cartridge Specifications

Cartridge Model	Available Inks	Cartridge Type
DM-1	6990	03 mil†
	6993	05 mil‡
	6997	08 mil
	7824	10 mil
	7824T	15 mil
	8103	25 mil
		30 mil

Cartridge Model	Available Inks	Cartridge Type
DM-1.25	6990	10 mil*/**
	6993	15 mil**
	6997	25 mil
	7824	
	7824T	

† Available only with tungsten filament ‡ Also available with tungsten filament in most configurations * Not available in 7824 ** Not available in 7824T

Cartridge Model	Needle Type	Available Inks	Cartridge Type
DM-S	S-Curved	6990	10 mil
		6993	15 mil
		6997	

Filament Cartridge Dot Production

Cartridge dot production and dot size are influenced by many factors, including inker drive, coil voltage, ambient temperature and ink type. The following figures are average dot quantities for the cartridge types listed and are based on complete use within DM-1, DM-1.25 and DM-S cartridge open shelf life periods of 5 days maximum for 6990, 6993 and 6997 inks, 3 days maximum for 7824 and 7824T and two days maximum for 8103 and 8104 glycol free inks. Testing was performed under controlled, optimum laboratory conditions on unetched wafers with no passivation. These figures are meant for use as guidelines and as such, cannot be guaranteed.

Filament DieMark™ Cartridge Average Minimum Dot Production			
Type	# of Dots	Type	# of Dots
3 mil	400,000 dots	15 mil	175,000 dots
5 mil	400,000 dots	20 mil	125,000 dots
8 mil	325,000 dots	25 mil	60,000 dots
10 mil	250,000 dots	30 mil	15,000 dots

DM-2 Cartridge Specifications

Models:	DM-2, Type A4, A5, A6, A8
Total Needle Length:	0.845" (± 0.005")
Teflon Tube I.D.:	A4* - 0.002" / A5 - 0.005" / A6 - 0.006" / A8 - 0.008"
Reservoir Capacity:	1.0 grams minimum
Available Inks:	6990, 6993, 6997, 7824, 7824T, 8103, 8104
Dot Sizes:	Dot sizes (± 10%) consistent for speeds of 12 dots/second to 1 dot/2 minutes

* A4 cartridges are qualified by Xandex for use on Micro-Z inking systems. A4 cartridges can be purchased for use on other DieMark pneumatic inker models, however, performance is not guaranteed, and subject to limited warranty conditions.

DM-2.3 Cartridge Specifications

Models:	DM-2.3, Type A5, A6, A8
Total Needle Length:	0.645" (± 0.005")
Teflon Tube I.D.:	A5 - 0.005" / A6 - 0.006" / A8 - 0.008"
Reservoir Capacity:	1.0 grams minimum
Available Inks:	6990, 6993, 6997, 7824, 7824T, 8103, 8104
Dot Sizes:	Dot sizes (± 10%) consistent for speeds of 12 dots/second to 1 dot/2 minutes

Pneumatic Ink Cartridge Dot Size Parameters

Cartridge dot production and dot size are influenced by many factors, including regulator pressure setting, ambient temperature and ink type. The following figures are average dot quantities for the cartridge types listed and are based on complete use within **cartridge open** shelf life periods 5 days maximum for 6990, 6993 and 6997 inks and 3 days maximum for 7824 and 7824T air dry inks and 8103 and 8104 glycol free air dry inks. Testing was performed under controlled, optimum laboratory conditions on unetched wafers with no passivation. These figures are meant for use as guidelines and as such, cannot be guaranteed.

Dot size is also determined by the internal diameter of the Teflon® tube in the cartridge type being used (A4, A5, A6 or A8) and by adjustment of the pneumatic controller DOT SIZE KNOB or DOT SIZE THUMBWHEELS. The table on the next page gives average minimum and maximum dot size setting parameters for DM-2 and DM-2.3 cartridges. For more information on the controller DOT SIZE adjustment refer to the appropriate sections of your inker manual.

<i>Dot Size Guidelines in Mils (0.001 inch)</i>	Micro-Z X711X Manual & X712X Micro-Z Motorized Series DM-2		X1000 & X901 Series DM-2		X5000 Series DM-2.3	
8103 INK						
A4	Min.	3.5 mil	Min.	0	Min.	0
	Mid.	6.75 mil	Mid.	0	Mid.	0
	Max.	10 mil	Max.	0	Max.	0
A5	Min.	10 mil	Min.	12 mil	Min.	13 mil
	Mid.	19 mil	Mid.	21 mil	Mid.	23 mil
	Max.	22 mil	Max.	24 mil	Max.	27 mil
A6	Min.	11 mil	Min.	15 mil	Min.	17 mil
	Mid.	23 mil	Mid.	25 mil	Mid.	27 mil
	Max.	28 mil	Max.	29 mil	Max.	30 mil
A8	Min.	17 mil	Min.	22 mil	Min.	23 mil
	Mid.	32 mil	Mid.	37 mil	Mid.	39 mil
	Max.	38 mil	Max.	42 mil	Max.	43 mil
6990 / 6993 / 6997 INK						
A4	Min.	4 mil	Min.	0	Min.	0
	Mid.	7 mil	Mid.	0	Mid.	0
	Max.	10 mil	Max.	0	Max.	0
A5	Min.	9 mil	Min.	16 mil	Min.	17 mil
	Mid.	12 mil	Mid.	28 mil	Mid.	29 mil
	Max.	16 mil	Max.	32 mil	Max.	33 mil
A6	Min.	8 mil	Min.	20 mil	Min.	18 mil
	Mid.	16 mil	Mid.	32 mil	Mid.	32 mil
	Max.	19 mil	Max.	36 mil	Max.	36 mil
A8	Min.	12 mil	Min.	29 mil	Min.	27 mil
	Mid.	24 mil	Mid.	52 mil	Mid.	50 mil
	Max.	29 mil	Max.	60 mil	Max.	57 mil
7824 INK						
A4	Min.	6 mil	Min.	0	Min.	0
	Mid.	8.5 mil	Mid.	0	Mid.	0
	Max.	11 mil	Max.	0	Max.	0
A5	Min.	10 mil	Min.	19 mil	Min.	18 mil
	Mid.	18 mil	Mid.	33 mil	Mid.	33 mil
	Max.	21 mil	Max.	38 mil	Max.	38 mil
A6	Min.	13 mil	Min.	25 mil	Min.	20 mil
	Mid.	24 mil	Mid.	44 mil	Mid.	36 mil
	Max.	29 mil	Max.	50 mil	Max.	41 mil
A8	Min.	20 mil	Min.	37 mil	Min.	29 mil
	Mid.	34 mil	Mid.	59 mil	Mid.	50 mil
	Max.	40 mil	Max.	69 mil	Max.	56 mil
8104 INK						
A5	Min.	14 mil	Min.	26 mil	Min.	24 mil
	Mid.	25 mil	Mid.	49 mil	Mid.	44 mil
	Max.	30 mil	Max.	54 mil	Max.	50 mil
A6	Min.	20 mil	Min.	33 mil	Min.	27 mil
	Mid.	34 mil	Mid.	56 mil	Mid.	50 mil
	Max.	39 mil	Max.	65 mil	Max.	56 mil
A8	Min.	38 mil	Min.	51 mil	Min.	54 mil
	Mid.	59 mil	Mid.	80 mil	Mid.	85 mil
	Max.	67 mil	Max.	90 mil	Max.	93 mil

* Contact [Xandex Customer Service](#) for information on using 8103 ink in small dot applications.

0= A4 cartridges are qualified by Xandex for use on Micro-Z inking systems. A4 cartridges can be purchased for use on other DieMark pneumatic inker models, however, performance is not guaranteed, and subject to limited warranty conditions.

Dot production figures are averages and as such, are not guaranteed. All ink dot characterization testing performed at ambient temperature of 70° degrees F, relative humidity of 50% using polished, unetched silicon wafers (no passivation).

<i>Dot Size Guidelines in Microns (µm)</i>	Micro-Z X711X Manual & X712X Micro-Z Motorized Series DM-2		X1000 & X901 Series DM-2		X5000 Series DM-2.3	
8103 INK						
A4	Min.	89 µm	Min.	0	Min.	0
	Mid.	172 µm	Mid.	0	Mid.	0
	Max.	254 µm	Max.	0	Max.	0
A5	Min.	254 µm	Min.	304.8 µm	Min.	330.2 µm
	Mid.	482.6 µm	Mid.	533.4 µm	Mid.	584.2 µm
	Max.	558.8 µm	Max.	609.6 µm	Max.	685.8 µm
A6	Min.	279.4 µm	Min.	381 µm	Min.	431.8 µm
	Mid.	584.2 µm	Mid.	635 µm	Mid.	685.8 µm
	Max.	711.2 µm	Max.	736.6 µm	Max.	762 µm
A8	Min.	431.8 µm	Min.	558.8 µm	Min.	584.2 µm
	Mid.	812.8 µm	Mid.	939.8 µm	Mid.	990.6 µm
	Max.	965.2 µm	Max.	1066.8 µm	Max.	1092.2 µm
6990 / 6993 / 6997 INK						
A4	Min.	102 µm	Min.	0	Min.	0
	Mid.	178 µm	Mid.	0	Mid.	0
	Max.	254 µm	Max.	0	Max.	0
A5	Min.	228.6 µm	Min.	406.4 µm	Min.	431.8 µm
	Mid.	304.8 µm	Mid.	711.2 µm	Mid.	736.6 µm
	Max.	406.4 µm	Max.	812.8 µm	Max.	838.2 µm
A6	Min.	203.2 µm	Min.	508 µm	Min.	457.2 µm
	Mid.	406.4 µm	Mid.	812.8 µm	Mid.	812.8 µm
	Max.	482.6 µm	Max.	914.4 µm	Max.	914.4 µm
A8	Min.	304.8 µm	Min.	736.6 µm	Min.	685.8 µm
	Mid.	609.6 µm	Mid.	1320.8 µm	Mid.	1270 µm
	Max.	736.6 µm	Max.	1524 µm	Max.	1447.8 µm
7824 INK						
A4	Min.	152 µm	Min.	0	Min.	0
	Mid.	216 µm	Mid.	0	Mid.	0
	Max.	279 µm	Max.	0	Max.	0
A5	Min.	254 µm	Min.	482.6 µm	Min.	457.2 µm
	Mid.	457.2 µm	Mid.	838.2 µm	Mid.	838.2 µm
	Max.	533.4 µm	Max.	965.2 µm	Max.	965.2 µm
A6	Min.	330.2 µm	Min.	635 µm	Min.	508 µm
	Mid.	609.6 µm	Mid.	1117.6 µm	Mid.	914. µm
	Max.	736.6 µm	Max.	1270 µm	Max.	1041. µm
A8	Min.	508 µm	Min.	939.8 µm	Min.	736.6 µm
	Mid.	863.6 µm	Mid.	1498.6 µm	Mid.	1270 µm
	Max.	1016 µm	Max.	1752.6 µm	Max.	1422.4 µm
8104 INK						
A5	Min.	355.6 µm	Min.	660.4 µm	Min.	609.6 µm
	Mid.	635 µm	Mid.	1244.6 µm	Mid.	1117.6µm
	Max.	762 µm	Max.	1371.6 µm	Max.	1270 µm
A6	Min.	508 µm	Min.	838.2 µm	Min.	685.8 µm
	Mid.	863.6 µm	Mid.	1422.4 µm	Mid.	1270 µm
	Max.	990.6 µm	Max.	1651 µm	Max.	1422.4 µm
A8	Min.	965.2µm	Min.	1295.4 µm	Min.	1371.6 µm
	Mid.	1498.6 µm	Mid.	2032 µm	Mid.	2159 µm
	Max.	1701.8 µm	Max.	2286 µm	Max.	2362.2 µm

* Contact [Xandex Customer Service](#) for information on using 8103 ink in small dot applications.

0= A4 cartridges are qualified by Xandex for use on Micro-Z inking systems. A4 cartridges can be purchased for use on other DieMark pneumatic inker models, however, performance is not guaranteed, and subject to limited warranty conditions.

Dot production figures are averages and as such, are not guaranteed. All ink dot characterization testing performed at ambient temperature of 70° degrees F, relative humidity of 50% using polished, unetched silicon wafers (no passivation).

Ink and Cartridge Availability

The following table illustrates ink and cartridge configurations. Configurations designated with a 0 are available as a Customer Specific Product (CSP) but have not been tested by Xandex and are subject to limited warranty conditions. The information in this table is accurate as of the time of publication but is subject to change without notice.

	Pneumatic Cartridge Types							Filament Cartridge Types											
	DM-2				DM-2.3			DM-1							DM-1.25			DM-S	
Ink Type	A4	A5	A6	A8	A5	A6	A8	3 mil	5 mil	8 mil	10 mil	15 mil	25 mil	30 mil	10 mil	15 mil	25 mil	10 mil	15 mil
6990 Black	+	+	+	+	+	+	+	T	T,F	+	+	+	+	+	+	+	+	+	+
6993 Black	+	+	+	+	+	+	+	T	+	+	+	+	+	+	+	+	+	+	+
6997 Black	+	+	+	+	+	+	+	T	T,F	+	+	+	+	+	+	+	+	+	+
Empty (no ink)		+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+
7824 Black	+	+	+	+	+	+	+	T	T,F	+	+	+	+	+	0	+	+	0	0
7824T Black	+	+	+	+	+	+	+	T	T	+	+	+	+	+	0	0	+	0	0
8103 Black	+	+	+	+	+	+	+	T	T	+	+	+	+	+	0	0	0	0	0
8103 Red	0	+	+	+	+	+	0	T	T	+	+	+	+	+	0	0	0	0	0
8103 White	0	+	+	+	+	+	+	0	T	+	+	+	+	+	0	0	0	0	+
8104 Black	0	+	+	+	+	+	+	X	X	X	X	X	X	X	X	X	X	X	X

+ = Available standard cartridge and ink configuration.

0 = Not yet qualified by Xandex. Available as a special order, subject to limited warranty conditions.

T = with Tungsten filament

F = with Mono-Filament

X = Not available in filament cartridge configurations.

DieMark Limited Warranty

Seller warrants as follows: All material supplied will conform to the description stated. All products will be free of defects in materials and workmanship under normal use for the following periods:

Stated shelf life of DM-1, DM-1.25, DM-S Ink Cartridges:

- ◆ 6990, 6993, 6997 = Four (4) months. Five (5) days after cartridge opening.
- ◆ 8103 and 8104 (except for 8103 White) = Four (4) months. Two (2) days after cartridge opening.
- ◆ 8103 White = Two (2) months. Two (2) days after cartridge opening.
- ◆ 7824 and 7824T = Four (4) months. Three (3) days after cartridge opening.

Stated shelf life of DM-2, DM-2.3 Ink Cartridges:

- ◆ 6990, 6993, 6997 = Four (4) months. Five (5) days after cartridge opening.
- ◆ 8103 and 8104 (except for 8103 White) = Four (4) months. Three (3) days after cartridge opening.
- ◆ 8103 White = Two (2) months. Three (3) days after cartridge opening.
- ◆ 7824 and 7824T = Four (4) months. Three (3) days after cartridge opening.

Pneumatic Controller = One (1) year only when clean, dry, filtered air is used, and when product is installed and operated per manufacturer's recommendations and instructions.

Electric Controller = One (1) year when product is installed and operated per manufacturer's recommendations and instructions.

Ninety (90) days from the date of delivery to the customer for all other products.

Xandex makes no other warranty, express or implied, including without limitation any warranty of merchantability or of fitness for a particular purpose. Customer, OEM or Distributor's exclusive warranty shall be, at Xandex's option, to have defective product repaired or replaced, or to receive a refund of purchase price.

Xandex may, upon request, furnish to buyer such technical advice, as it may be able to supply with reference to the use by buyer of any materials delivered. Xandex assumes no liability for the advice given or results obtained. Buyer expressly agrees that it will implement any advice thus given at its own risk and agrees to indemnify and hold Xandex harmless against any liabilities, costs or expense resulting therefrom.

Xandex makes no warranty for performance, service or support of any products unless they are purchased directly from Xandex or through an authorized Xandex Distributor.

Exclusions: This warranty shall not apply to defects or damage resulting from;

- Improper or inadequate maintenance by customer, including failure to perform preventive maintenance per manufacturer's specified schedule
- Misuse or unauthorized modification
- Operation outside the environmental specifications for the product
- Improper site preparation and maintenance

Some states and provinces do not allow limitations on how long an implied warranty lasts, so the limitation or exclusion contained in this warranty may not apply to you. However, any implied warranty of merchantability or fitness is limited to the duration period of this written warranty.

If you have any questions or need further assistance, please contact your authorized Xandex distributor or contact our Customer Service Group.

Xandex Customer Service
1360 Redwood Way, Suite A, Petaluma, California 94954 U.S.A.
TEL: (707) 763-7799 Toll Free in the United States (800) 767-9543 FAX: (707) 763-2631
Website: www.xandexsemi.com Email: info@xandex.com