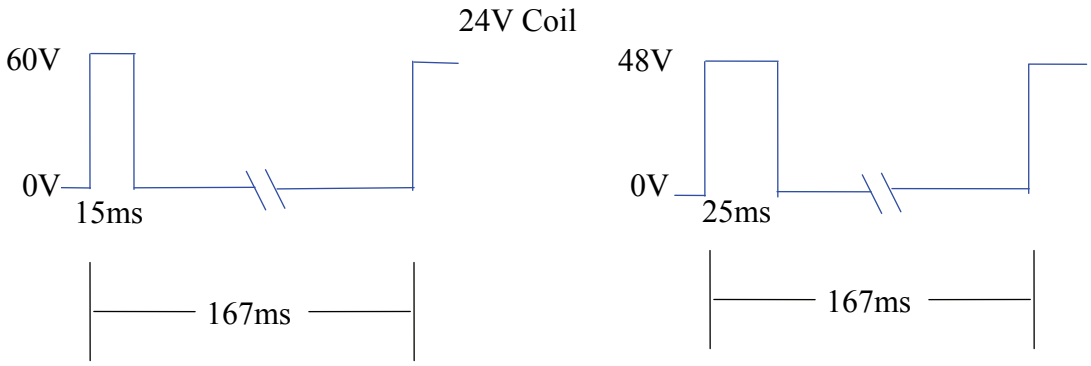
Electric Inker Operation

Inker Actuation

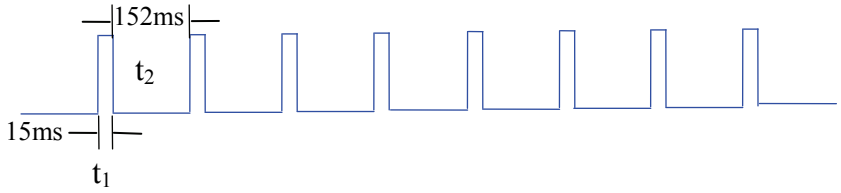
The Xandex Electric Inkers operate via an electronic pulse sent from the prober to actuate the solenoid. Upon actuation, the solenoid plunger drives the cartridge filament to the fully extended position, making slight contact with the wafer surface and depositing an ink droplet, forming a dot. The electronic pulse will vary depending on the coil drive voltage (48VDC minimum), as well as the pulse width and duty cycle. It is recommended that the drive voltage of the pulse is at least twice the solenoid coil voltage specification (i.e., 24VDC solenoid = 48VDC drive voltage). The pulse width will vary depending on the drive voltage, as shown below:



Pulse Width in milliseconds.

For voltages greater than 60VDC the on time of the cycle must be shortened. Maximum coil operating temperature must not exceed 100°C. The inker should not be operated more than 10 cycles without an ink cartridge installed (the cartridge can be empty) or damage to the solenoid may occur. 167ms is the minimum total cycle time. If faster inking is required, a pneumatic inker is recommended.

The duty cycle is a function of the time the solenoid is energized versus the total cycle time, as shown below where t_1 = time on and t_2 = time off. For example:



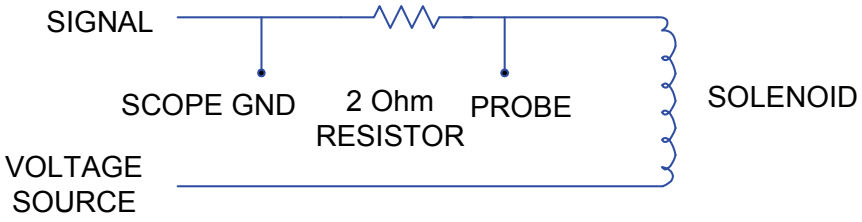
$$\text{Duty Cycle (as \%)} = \frac{t_1}{(t_1 + t_2)} \times 100 \quad \text{or} \quad \frac{15}{(15 + 152)} \times 100 = 8.9\%$$

A duty cycle of 20% is acceptable, <10% is optimal. If problems exist with the inker actuation, please refer to Inker Drive Verification**,** Electric InkerTroubleshooting or contact Xandex Customer Service.

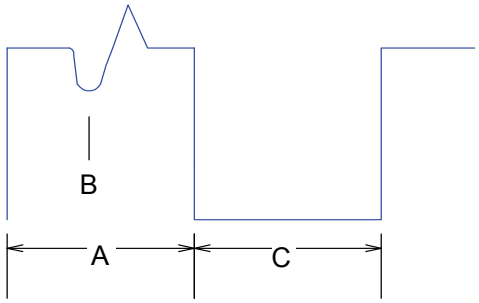
Inker Drive Verification

Xandex inkers operate nominally across all common prober circuits. If inker performance is not acceptable, it may be due to an incorrect inker drive. The coil used in the Xandex inker requires a signal that is a minimum of twice the coil voltage rating for consistent solenoid actuation. Verify that the inker drive output signal is ≥ twice the coil voltage rating by connecting an oscilloscope to the prober inker connection and actuating the inker several times. If the drive voltage is less than twice the coil voltage rating consult your prober manufacturer for prober inker drive voltage modification procedure. If the voltage is ≥ twice the coil voltage rating and acceptable results are still not achieved, the drive signal may be analyzed using the procedure below.

Referring to the prober manual, install a 2Ω 10 watt resistor in series with the inker solenoid as shown below:



Using an oscilloscope, connect a probe as shown above and measure the arrival time of the solenoid. Set the time scale to 5 ms per division and the voltage to 1 mV per division. Fire the inker several times and look for the following trace.



A = On time of inker pulse.
B = Solenoid arrival point. This indicates that the plunger has bottomed out in the coil.
C = Off time of inker cycle.

"B" is the critical component of this waveform. It is the visual indication that the plunger has traveled its full stroke. If the "kick" is not visible, or if it moves off the right side of the trace to a point beyond the falling edge, adjustment to the prober inker drive circuit is required.

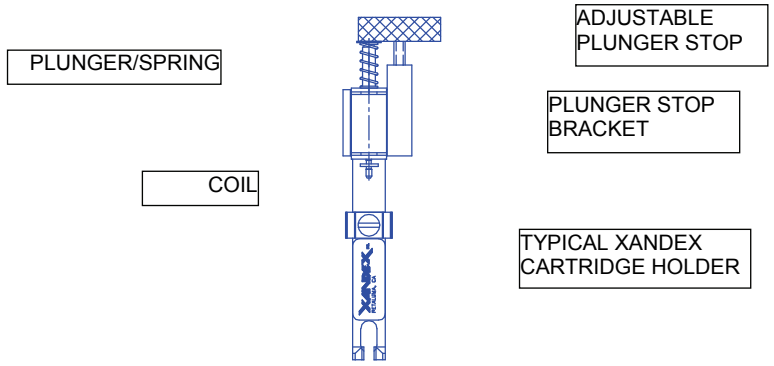
COIL DESCRIPTION	COIL RESISTANCE	MINIMUM DRIVE VOLTAGE	COLD ARRIVAL TIME	HOT ARRIVAL TIME
12 v Open Frame	60 Ω	24VDC	15-18 ms	20-24 ms
24 v Open Frame	290 Ω (±10Ω)	48 VDC	15-18 ms	20-24 ms
Ledex (Off Line)	209Ω	48VDC	9-10 ms	13-17 ms

To verify the inker drive circuitry, perform a minimum of 5 test cycles with each cycle consisting of 2 minutes of constant inking using "Typical Drive Voltage" with a 25 ms pulse width and a 30 second rest period between cycles. The "Cold Arrival" times are measured during the 1st cycle and the "Hot Arrival" times are measured during the 5th cycle.

If arrival times are acceptable, no further change is required. If the current configuration is inadequate, increase the drive pulse width to 30 ms. If this still does not provide acceptable operation, increase the inker drive voltage by 20% and decrease the pulse width by 25%.

If acceptable results are still not achieved, contact **Xandex Customer Service** for assistance.

Plunger Stop Bracket Assembly



This optional assembly is available for Xandex electric inker cartridge holders. 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 (5 mil) are required.

Order part number 210-0016, or contact Xandex Customer Service for assistance with your specific application.

Electric Inker/Cartridge Troubleshooting

This Troubleshooting section is divided into two parts. The first part covers the Filament Ink Cartridge and the second covers the Xandex Electric Inker**.**

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 phenolic inks travel all the way down the needle. Viscous epoxy 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).
Runny, blobbing ink or skipping dots.	1. Check ink shelf life. Markem® 6990, 6993 & 6997 inks should be used within 4 months or 5 days of cartridge opening. Markem® 7224, Xandex 7824 and Xandex 7824T inks within 2 months or 3 days after cartridge opening. 2. Check for exposure to extreme temperatures. Cartridges should be stored **VERTICALLY** 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. Inker Z height may be adjusted too high. Ink can not wick off the filament and builds up, creating blobbing and skipping. Readjust inker Z height.

Problem		Solution
Small, inconsistent, skipping or no ink dots.		1. The ink flow channels may be blocked. It could be due to any one of the following: A. The bottom O-ring is not lifted at all. 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. 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. 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. 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 plunger and/or spring. 3. Chuck top or wafer surface not planar. Verify planarity of both.
Elongated instead of round dots.		1. Inker is set too close to the wafer, which results in a kinked fishline. The cartridge should be positioned so that the filament barely touches the wafer surface when it is fully exposed. See Setup and Alignment or refer to your specific inker manual.

Electric Inker Troubleshooting

Problem		Solution
The inker is working intermittently from the outset.		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. See Inker Drive Verification**.** 1. The plunger might be bent. This can happen when pushing the plunger through the coil. Manually actuate the plunger a few times, rotate 1/4 turn and repeat. The plunger should travel freely. Replace if necessary. 2. During opening of the cartridge, the fishline monofilament has been kinked because the main shaft was lowered quickly or incorrectly. Replace the cartridge. 3. Faulty electrical connection somewhere on the line. Check the continuity of electrical supply connections to the inker and correct.
The inker works fine for a while (4-8 hours), then starts to skip badly.		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. 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. 2. 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. See Inker Drive Verification to check inker drive, pulse width, and cycle time.