## How Inking System Works

No matter what kind of printer you bought from us, the principle of ink delivery is the same. In this video, I will explain to you how the inking system works in general and give you some guidelines of daily maintenance and troubleshooting.

## The Components

Right here is a printhead, this is an XP600 printhead from EPSON. Once the printhead has been installed onto the machine,the damper will be plugged in it . A Damper serves as a flow control chamber for the ink, when ink flows from the tank at the back of the machine, it first storage in the Damper, to keep a continuous ink supply of the printhead.

A Printhead may have different sorts and types of technology, some may use  heat, some use mechanical processes , some use vacuum, etc. The end result is the same, ink will be squeezed out from nozzle which is an array of them on printhead surface which is very small.

No matter how many nozzles a printhead has, they are always grouped and stacked on top of the printhead, you will see the ink inlet for each colour, which is also the place the damper sits in. If a printhead has more than 1 inlet, meaning that it can print more than 1 colour. Sometimes we try to use more than one inlet for same colour to improve printing speed. The order of the colour generally is not a major issue but the software has to be setup in the same sequence so that the RIP (Raster Image

Processing) software process the printing file, knows which colour is from where.

Once ink left printhead by whatever means, the space that was occupied by the ink became a vacuum , therefore the ink started to flow from the Damper into the printhead, and since the pressure inside damper drops too, the ink from ink tank in the back of the machine starting to flow and refill the damper. The ink in the damper always around half full because the air inside the damper will prevent it from being too full. When it's very full, it won’t act as a flow controlling device.

When the printhead does not print, we will cap the printhead to prevent ink from drying ensuring that it does not have any contact with the air or lights especially for the UV ink. Our ink capping device consists of two parts. The first one is an Ink Cap,  which is a square shape that matches the printhead surface with a rubber seal. Underneath the Printhead is 1 or more outlet for tubes to move ink away. There will be mechanical or motorised structure to move the ink from cap to cap to the printhead when needed, we call this the ink cap station.

The tubes that connect to the cap will connect to an ink pump. This is used to pull the ink from the ink cap itself as well as from the printhead if capped. The ink that is pulled out will be sent to a bottle to store waste ink that is there.

The ink starts flowing from the ink tank at the back of the machine, and then gets pulled by pressure applied through the tubes all the way to the damper, inside the printhead. The Ink is either sprayed out by printhead onto printing media, or pulled

out by using the ink pump at the back of the ink bottle. This whole system is called the inking system.

**How Cleaning Works**

The ink is a form of fluid. The fluid tread is used to separate the ink from each other which usually causes a feeding problem to the printhead. The ink is also likely to dry up when it comes into contact with air or lights. All the other Ink types are pigment based except for the water based ink type, that has very tiny particles suspended into the solution. These particles tend to stick together, clog and block the printhead. So it is imperative that the printhead is washed. To wash the head, we use the ink itself to pull the ink out of ink tank , this will result in new ink flowing to the head and the old ink seeps into waste ink bottle. In this way we washed the printhead by simply having the ink flow itself. The speed at which the printhead is washed is faster than normal printing speed. We also provide a cleaning liquid (cleaner), that is very similar to the formula of the solution used to make the ink. This in turn turns dried ink into liquid form again. Each Ink type has its own kind of cleaning liquid. To test whether or not you are using the right liquid, you can use the liquid to wipe the dried ink. If it is easy to wipe away, then it’s the right type of cleaning liquid for the ink. However, you are not supposed to use any other strong chemical when trying to remove the ink because it might cause damage to the printhead while cleaning.

Now to sum up everything, the pulling motion by the ink pump is used to create ink flow used to wash the inside of the printhead, it also removes air bubbles inside the printhead

which can be very problematic at times. All the ink will be pulled out from the nozzle right into the waste ink bottle. If some parts of the nozzle gets blocked due to ink that dried out near the outlet such as a plug on the pipe, then it is advisable to use cleaning liquid to soften and remove the dry particles.

In order to achieve optimum cleaning results, the flow speed of ink has to be faster than the normal printing speed. Be alerted that this can cause damage to the internal structure of the printhead and permanent damage on the nozzle.

This is how the cleaning process works: Press the “Menu” button on your printer, you will see a menu with “Maintenance” inside, select it. Or you can press the “Right” button directly go onto the “Maintenance” menu. Inside “Maintenance”:

“**The Nozzle Test**”: print a pattern of all nozzles on the printhead, if the pattern is complete, then you don’t need to do any cleaning. The “Status” of the printhead would be known to be perfect in this instance.

“**The Clean Nozzle Test**”: this is an automatic process that cleans the ink, by having the printhead spray a bit of ink, use the ink pump put a little, also will try to wipe the printhead etc. A combination of action for generally maintenance. You should try this first, then do a “Nozzle Test” see if improves, please don’t over use this function because pulling the ink a long time is not good for the ink as I mentioned earlier. Besides the end of the cleaning cycle, a rubber ink wiper will also be used to wipe the head, even if it's the purest rubber we are using, still a physical contact which is not good for the printhead surface.

“**Manual Pump**”: is known as the pumping action and will go on forever until you stop it.

“**Wipe Nozzle**”: is used to erase the wiper and to wipe the head.

“**Flush**”: This part is used to enable the printhead to squirt out ink;

“**Cap Head**”: is used to move the cap from the ink cap station to seal the printhead by the cap.

“**Inking**”: is the first process that takes place when the printhead is empty on the inside (or rather, when there is just shipping liquid inside, I will explain what the shipping liquid is later), this action is much milder than pumping, it won't clean the head thoroughly.

**Troubleshooting**

Let’s first assume that all settings on your printer are correct. Referring mainly to position settings here. If you realize that the wipe action does not wipe the head, this means that the cap is spaced apart from the printhead. Then we have to change the position setting in the menu, and I would suggest you to contact our support for that.

**Do not Waste Ink When Cleaning**

Whether you are doing a manual or automatic cleaning process, you will see ink come out from the tube into the waste ink bottle. The ink looks black because of the mixture of all colours.

If no ink comes out but you can hear that the pump is working (when the pump is working, you will hear the buzz sound go on and off continuously). You can press the “Left” button and the carriage will move out (to set up starting position of printing), you will see the ink cap exposed, use a syringe (and you can put a short ink tube in front to make the process easier) to pull some cleaning liquid and squeezes into the ink cap until almost full. Then restart the pump, if you see the liquid come out to the waste ink bottom (you can also confirm this by move carriage away again and all liquid in cap will be gone), then we say bottom part is fine, otherwise not.

<u>If the Bottom Part is not Working:</u>

If you can hear the ink pump emitting a pumping sound but see that there still is some liquid in the ink cap, the first possible situation is that the ink pump itself is stuck, because ink might dry inside as well. As much as electricity may pump it but the ink inside the tube will not move. To test this, you can remove the cover and you will see the pumping action, remove the tube from the pump and when the pump is working, you can use your finger to feel it sucking or blowing depending on which side of the tube that you removed. The Ink pump can be opened and washed, or simply replaced. It is a cheap component.

If the pump is working but there is no flow, then there are two probable situations, the pump is either blocked by the dry ink, or leakage of air between the Ink Cap to the Ink Pump. Those tubes can also be replaced, or you can wash them by syringe and cleaning liquid.

<u>If the Top Part is not working:</u>

First, you need to ensure that there is ink inside the damper, if you notice air bubbles inside the tube that feeds into the damper, you can pull the damper out from the printhead, then use a syringe against the end of the damper and pull it to get rid of all the bubbles and also to fill the damper with ink. This also ensures that the ink does not run dry but flow freely and not leak anywhere. If there is a leakage, you will see bubbles starting to form from the place where there is a leakage.

Then still if you are unable to pull the ink down, most likely it is because of the Ink Cap because the blockage due to changing the printhead is very rare. Although the inside of a printhead that is installed on the machine may be damaged some ink will still pass through.

First check the rubber of the Ink Cap, you can use your finger to feel around it, to determine if its smooth and has no damage of any kind. If any damage is found, you need to change Ink Cap because it won't seal the printhead. When talking about not seal the printhead, there is another possibility is Ink Cap didn't align with the printhead so it cannot be sealed. If cannot be sealed, no matter how much you pull underneath the Ink Cap, the ink won't flow down from the printhead.

Once Both Working:

Once the top and bottom is both working, you will see a mix of ink go into the ink tank when cleaning. And when you pause it and move the carriage away, you can also see the ink inside the Ink Cap, and you can see which colour is missing from there.

When the printhead is cleaned, you can try and do a "Nozzle Test" to see the cleaning result. If all colours are out but some parts of the nozzle is still blocked, you can try and clean it

again, or just try printing again. The nozzle will unblock itself because the printhead will squeeze the ink out, it will also help unblock the nozzle.

If Nothing Prints:

If the ink flow freely when cleaning, but none of the nozzles in one colour block is printed, or nothing is printed at all, then it is likely that the printhead itself is damaged. In this case, you can try and take the printhead out and clean the data cables, remember to take a photo before removing the printhead because if you put it back on the wrong side, then it has a higher chance of burning the printhead out. If the cables are clean and intact and still do not print, please contact our support team.

**Clean Heavily Blocked Printhead**

If most nozzles are clogged because of the ink and you struggle to wash it out. There is a chance that the printhead itself is damaged. The internal electric circuit is damaged, the ink can still flow freely, but it won't print. The method of cleaning - we call it flush the printhead - instead of pulling from the bottom by a pump, we push the cleaning liquid from the inlet of the printhead.

You can either take the printhead out, or simply keep it on the machine but move the printhead to most left, there is an empty cabinet on the left of the machine. If you decide to do so, put a bucket underneath to catch the cleaning liquid flow out.

Get a syringe and put an ink tube on, and fill with cleaning liquid. Push the ink tube on the inlet of blocked colour of the printhead. Once the tube firmly attached to the inlet, starting to push the syringe gently, you will see droplet starting to form on the surface of the printhead. Increase pressure gently and eventually you will see a thin stream shooting out, normally it will form a line but this depends on the nozzle arrangement.

In most cases, you can wash the printhead out. However, you may also experience other phynominals.

Cleaning liquid comes out from nozzle of different colour block: if this happens, means internal damages and ink leaking from one to another. You need to replace the printhead.

Stream of cleaning liquid shooting to different directions: if this happens, printhead may still functional but printing result will be bad because the position accuracy of ink droplet is bad. This is also a sign internal starting to fall apart, and printhead won't last long.

Some nozzles are still blocked after cleaned: this normally caused by tamination or dried ink inside ink feeding into the printhead, and it's permanently blocked the printhead. You can still use the printhead but printing quality will be degraded. You can increase passes and increase feathering setting to cover up the white stripes caused by unfired nozzles.

You can also take the printhead out to wash, just need to make sure to keep the circuit board side higher, you don't want to let cleaning liquid there, or it will damage the printhead.

**If Colour is mixed in the Damper**

If the ink flows back (also known as the ink backflow) and is mixed in the damper meaning that the ink in the damper is not in it's original colour anymore. In some cases, you may even see the ink backflow when it travels through the tube back into the ink tank and tamilate the whole tank of ink. The printhead cannot suck ink inside, the real reason is the pressure of ink in different ink tank is different because the level of the ink is different, which means some ink level is higher than the other one, so the gravity want to balance the ink level and the high level ink go into the lower level ink damper through the printhead.

This process is very slow, so you are more likely to see after didn't use the printer in a while. And also, most printheads, when it has power, will slow or stop the ink flow.

To get ink in damper back to original colour, just use cleaning function, the ink pump will pull all mixed ink out until the fresh ink from ink tank refill the damper again. If the ink tank has been terminated with wrong colour ink, you have to throw away the ink and flush it with cleaning liquid, then put new ink in. Once you have new ink in the tank, use the cleaning function to get the new ink into the damper.

Since the colour mix is caused by ink level, you can simply solve this issue from happening by refill the ink to the tank and make them same level, generally 80% full is fine. And also you don't need to do this all the time, just balance the ink level before the end of the day is fine, besides refill the ink when ink level goes low when printing.

**If there is Ink dripping from the Printhead or any that will not go into the Printhead**

The inking system is a pressure like process whereby, ink is fed into the damper and then into the printhead. This is because when the printhead squeezed the ink out, a vacuum space has been created which creates a negative pressure and the ink flows and fills up the space because the atmosphere pushes on it. That's why we call it negative pressure, it’s a comparison to the atmospheric pressure.

If your ink level is very high (like almost full), and you also in a near sea level area which means atmosphere pressure is higher than any other placed, the ink may start to drip from the printhead and you will see excess ink when printing because of this phenomenon, or you what you need to do is to not put too much ink in the ink tank at the back.

This is also often seen on modified ink tank when theclient wants to use a bigger ink tank, which can store more inks and need refilled in a short period of time, and without much option, place the bigger ink tank on top of the machine. This has become a common option. It will create a much higher pressure because of gravity. As you may have noticed, no matter the shape of our printers, the printhead are always at a similar level of ink tanks. When you place the ink tank higher, the extra pressure caused by gravity will push the ink out of the printhead and those tiny droplets will start to form and either terminate your print or make the whole printer unusable.

On the other hand, sometimes we cannot get ink into the damper, even we pull it by syringe. In some simple cases, the

reason for this is because the cap for the ink tank is too tight. When you make the feeding side of the ink airtight, then there is no pressure from atmosphere so ink won't come out. This may also not be the case because we normally get ink tube from a hole into the ink tank, and the hole is always bigger than the tube which will let the air in. Sometimes we do not notice that some of our clients block it by sealing it with Prestik because air will terminate the ink and cause ink dry. Initially, the vapor from the ink fills the empty tanks which usually protects the ink, the gap between the tube nearby the edge of the hole are usually small, there won't be any flow of air to exchange vapor with air, so that ink does not dry because of the little gap. The cap also has to be tightened.We normally suggest that you screw the cap to close to the position and unscrew it about roundabout half circle to make some space to let the ink tank link with the atmosphere.

Of course, the contamination, dried ink etc may also block the tube and cause ink to not flow or flow very slow and eventually cause ink feeding issue, and this can be easy to figure out when you use a syringe to pull.

**What is Shipping Liquid and How to Store a Printhead**

Ever wondered why there is liquid on the surface of a printhead when it's brand new. It sure feels like it has been used before right? The answer is, it has been used. Based on my knowledge, all printheads manufactured are tested, the injected shipping liquid inside the printhead is there to keep it in a new condition.

So, what is shipping liquid, it's a form of liquid that doesn't dry out easily. It is not meant for cleaning and will not absorb or

dilute any ink. It is not suitable for cleaning but has two main uses.

The first one is used to keep the printhead from drying when you are not going to use the printer for awhile for e.g. During the festive holidays. Have a look at the section on how to turn off the printer.

Another usage for the liquid is to keep the printhead wet for storage. If you have a printhead that is designated to design for a longer lifespan or a disposable printhead, then you need to store it appropriately, if you decide to use it in future.

Turn off the power before you can remove the printhead. Once you remove the printhead, you need to flush all the ink out otherwise it will dry inside the printhead and eventually cause permanent damage. Use a syringe that has an ink tube that is the same size as the inlet of the printhead, push the cleaning liquid into the head. Then you can wash ink blockages in the printhead. Once you see that all of the colours are gone you should know that the head has been washed thoroughly. Ensure that the circuit board is at the top when flushing the head, otherwise the cleaning liquid will cause damage to the printhead.

Then use a different syringe to push the shipping liquid inside the printhead, this will keep it moist all the time. If your storage location is not cool enough and the middle moisture temperature level is around 60% there, you can always wrap your printhead with clear wrap to prevent it from drying.