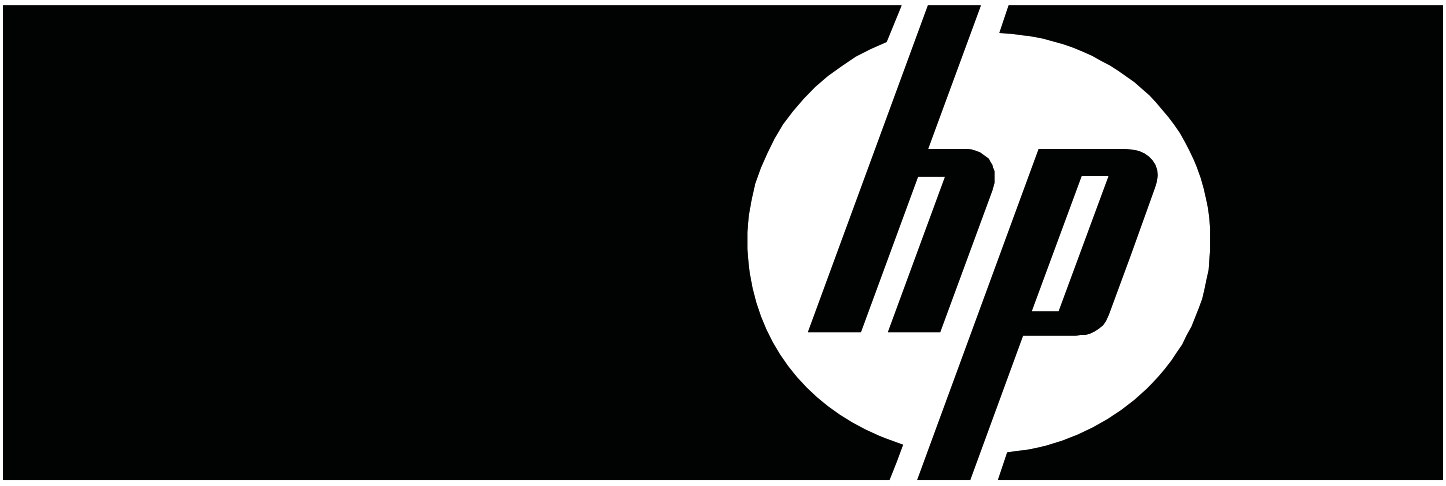
Vacuum Pressure System

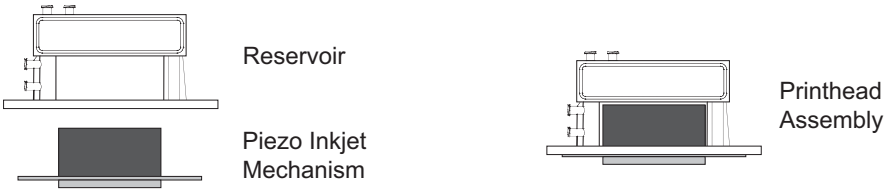
An Operator's Guide



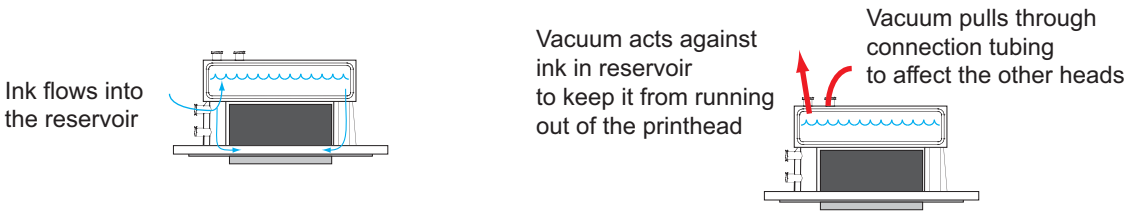
ColorSpan Legacy solvent and UV-curable ink printers use a vacuum and pressure system applied to the printheads. This document explains the system from the point-of-view of a printer operator. The goal is to assist users of these printers to troubleshoot small problems, prevent larger issues, and communicate accurately to ColorSpan Technical Support when things do go wrong an help is needed.

How Vacuum is Used

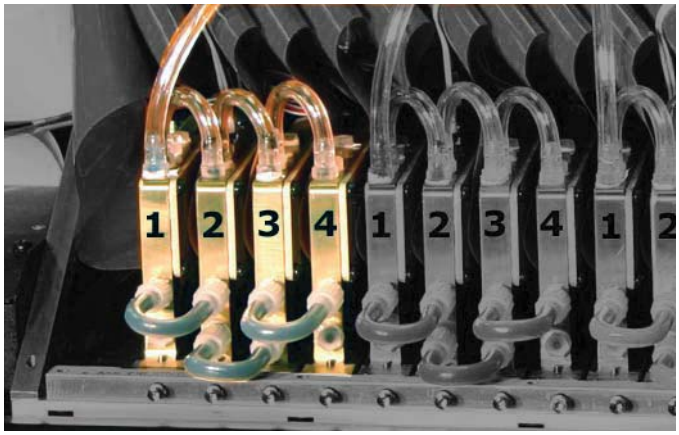
Each of the 16 printheads is an assembly composed of two parts: the actual piezo inkjet printing component, and a small reservoir to hold ink for immediate jetting.



The reservoir holds about 20ml of ink. Ink flows into the reservoir through one set of tubes. A second set of tubes allows a small vacuum to be exerted against the ink. A connecting tube from one printhead to its neighbor allows the same vacuum to act against the other printheads, too. This keeps the ink from flowing out through the bottom of the printheads. This is the same effect as when you put your finger over the end of a straw in a glass of water and lift the straw out of the glass. The vacuum at the top of the straw keeps the water in place.



Each color channel (cyan, magenta, yellow, black) has four printheads. Each group of four printheads has its own vacuum line that acts on that channel only. The illustration below highlights a single channel.



The tube that extends from printhead #1 off the top of the picture is the vacuum line. The U-tubes connecting the tops of the printheads allows the vacuum to affect the adjoining heads. The U-tubes at the front of the printheads distribute ink.

The tube extended from printhead #1 on each of the four channels connects to a block of valves at the top of the carriage. The valves normally are open to allow the vacuum to pass through to the printheads. When the Purge option from the control panel is selected, however, the valves stop the vacuum and instead allow positive air pressure to act on the printheads.

How Pressure is Used

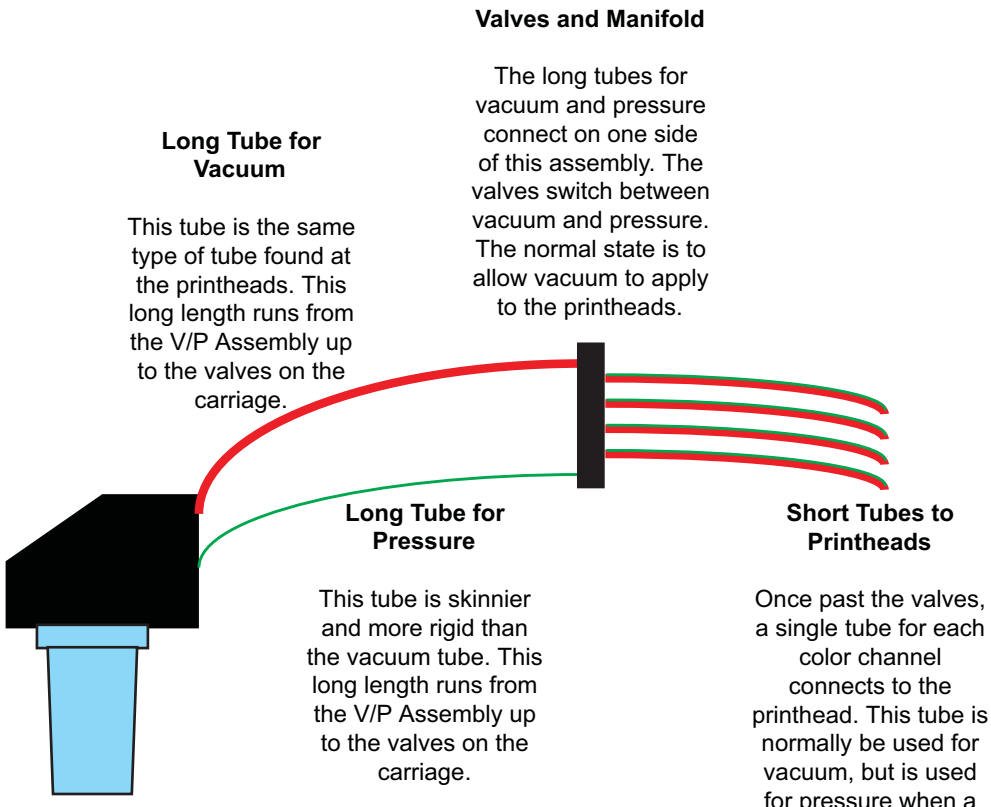
Air pressure is used for two purposes. The first and more frequent purpose is as part of the Purge cleaning process. When pressure is applied to the reservoirs, air displaces the ink. The ink has nowhere to go but out the inkjet nozzles on the bottom of the printheads. The ink under air pressure will try to dislodge any partially solidified ink or foreign particles that may have accumulated inside or around the inkjet nozzles. If an individual jet on the printhead has stopped firing, the purge—followed by appropriate cleaning of the residual ink from the bottom of the printhead—can restore that jet to working order.

The second purpose of pressure is to move all the ink (or HP printhead flush solution) out of the printheads as part of a maintenance or service procedure. This is really no different than the cleaning Purge described above, but it continues for a sustained period of time until all of the liquid has been pushed out of the reservoir and piezo inkjet printing mechanism.

Air pressure uses the same tubes shown in the photograph above. The valve, not visible in the picture, stops the vacuum and allows the pressure to enter the tubes instead.

Components of the Vacuum/Pressure System

The preceding pages have already described the tubing used at the printheads. The remaining parts of the Vacuum/Pressure system are as follows:



Filters

While the blue "cup" is not a filter, there are several air filters used on the VP system. These disk-shaped filters are about 1" (2.5cm) in diameter. One filter is found in-line on the long vacuum tube. The remaining filters (2 of them) are inside the V/P assembly, underneath the metal enclosure.

Two views of the air filters used in the Vacuum/Pressure assembly.
On the left is the in-line filter, removed from the vacuum line.
On the right is the input filter inside of the V/P assembly. Not visible is another filter on the vacuum regulator. All of the filters have the same specification.

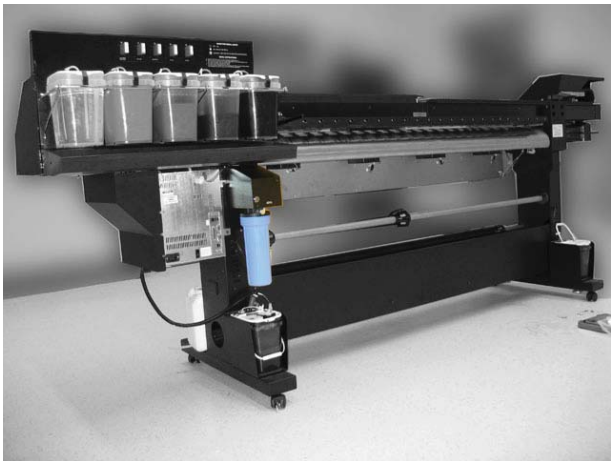
Printers that are in unusually dusty or other environments with many airborne particles will need to have these filters replaced regularly. Filter kit 0901421 includes three filters with fittings and replacement instructions.

Setting and Adjusting the Vacuum Level

The V/P assembly has a regulator to adjust the amount of vacuum applied against the printheads. For solvent printers, the nominal vacuum level should be 3.25 inches of water. For UV printers, the nominal vacuum level should be 5.00 inches of water. Note that for both printer types this figure is different than the number specified in the respective printer's User Manual. A variation of ±0.20 from the nominal value is normal and acceptable.The printer software is programmed to know what the correct vacuum settings is and will show a Warning if the actual vacuum is too high or too low.

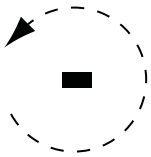
If you do encounter a warning, or if you simply observe that the vacuum level has changed, you can easily adjust it back into the desired range. You will need a regular flat-bladed screwdriver to make the adjustment.

On the ColorSpan Legacy Solvent and UVR-UVX printers, the regulator is located on the back of the printer, on the VP assembly, shown below.

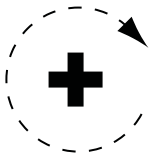


On the HP Scitex FB910 (ColorSpan 9840uv), the V/P assembly is just inside the output-side user cabinet, shown below.

The regulator is located in the lower-left corner of the assembly, visible as a grey circle with a brass-colored metallic center. Insert the screwdriver in the metal center and make small turns to the regulator and wait for the control panel to update to see the effect.



Turn counter-clockwise
to reduce vacuum



Turn clockwise
to increase vacuum

Vacuum Drift

The vacuum regulator used in the V/P assembly is expected to have some drift and still be performing to specification. For UV printers, a variation from as low as 4.75 to as high as 6.00 will still allow the V/P system to function as intended. After the initial setting of the V/P regulator to achieve a vacuum of 3.25 or 5.00, respectively according to printer type, it may be necessary to adjust the regulator periodically to maintain the desired nominal setting. This adjustment may be required as often as daily. The printer software will display a warning if the current vacuum is outside the desired range.

Symptoms of Vacuum/Pressure System Problems

The pressure aspect of the V/P system seldom has any problems, so this section will discuss only the vacuum aspect of the system.

For all of these symptoms, if only one color is affected, the problem is more likely to be between the valve and the #1 printhead or among the four printheads of that color only. If all colors are affected, the problem is more likely to be found further back, along the track and reaching back to the V/P assembly.

Ink drips out of the printheads

As noted at the beginning of this document, the purpose of the vacuum system is too keep ink suspending in the printhead reservoirs. When ink drips out, it signals a problem. The source of the problem may be any one (or more) of the following:

1. Vacuum level is too low (regulator needs adjustment).
2. Leak in the system somewhere.
    - Hole in tube
    - Tube loose around a fitting
    - Fitting loose in its receptor
3. Pinched tube.
4. Stuck valve.

Aside from adjusting the regulator, most of these problems will require a service visit to resolve. Some inspection of the components, however, may identify an obvious problem that can be corrected easily, or at least will confirm what parts may be needed to restore the system to correct operation.

Jets drop out while printing

This symptom is not necessarily due to a vacuum-related problem, but a vacuum issue can cause jet drop out.

1. Vacuum is level too high (regulator needs adjustment). The extra draw by the vacuum prevents enough ink from getting down to the piezo inkjet mechanism. The jets starve out and fail to print.

2. Vacuum level is too low (regulator needs adjustment). As ink starts to escape from the printhead, it first gathers (pools) on the bottom surface. Surface tension of the ink makes it impossible for individual ink drops to fire through the pool, so the jets fail to print.

You can try to distinguish between the two causes by canceling the print and immediately sending the carriage to the capping station (solvent printers) or parking station (UV-curable printers). Remove the station and inspect the bottom of the printheads. If an unusual amount of ink is present, the vacuum is probably too low and is allowing ink to pool.

The same problems named above that can cause ink dripping from the printheads can also cause jet drop-out from inadequate vacuum. Ink dripping is really an advanced stage of the same issue that caused jet drop-out.

Warning that “Vacuum Not Recovering”

This message may appear on the control panel after you perform a Purge. As noted earlier, during the Purge procedure vacuum is shut off to the printheads and pressure is used momentarily. After the pressure process is done, the vacuum is reapplied and must recover back to its nominal state. If this does not happen within the expected period of time, this Warning will be displayed.

Within the V/P assembly is a very small-diameter part called the vacuum restrictor. If this part becomes clogged with dirt, the vacuum will be slow to recover and the Warning will appear. The air filters described earlier in this document are in place to help keep the restrictor clear, but in very dirty environments they may not be 100% effective or may be effective for a shorter period of time.

Once the restrictor has become clogged, it can be cleaned or replaced, but this should be done only by an authorized service provider. The air filters should be changed at the same time, and spare air filters should be ordered and a more frequent change schedule be implemented to prevent a repeat of the problem.

Vacuum pump runs excessively

The noise from the vacuum pump is not always uniform from one printer to another (or even from one V/P assembly to another installed on a particular printer) but the noise from any given unit should be recognizably consistent. If the normal noise changes to a louder and continuous growling, it may indicate that there has been breach of the vacuum system right at the V/P assembly. The most probable cause is that the blue vacuum reservoir cup is not tight enough on the assembly. In rare cases it may have been overtightened and have cracked, or in even more unlikely cases the black rubber o-ring seal inside the cup has failed to seal. Usually it is just loose and can be retightened by hand.