PALL

Microelectronics

Pall Ink Jet Team

Digital Printing Presses

Contamination control for digital printing printheads

Digital printing presses describe a class of printers that produce their prints through digital means. These printers typically have several common qualities: (a) they can customize every piece of output, making each print unique with respect to content; (b) they typically use ink jet printing technology; (c) they are focused on production of printed material with speeds of 100m^2/hr (1,000 ft^2/hr) or greater; and (d) they can be cost effective for small print runs and print on demand jobs. Also, this class of printers does not use printing plates, printing blankets, or fountain solutions.

The core technology used on many of these systems is piezo ink jet printheads. Piezo ink jet printheads are small, fabricated devices that contain a piezoelectric micro-pump in each ink chamber. The small pumps are able to quickly eject small drops of ink at rates of up to 40,000 drops per second. These printheads vary from low-cost, disposable-like devices to heavy-duty, industrial models.

Due to the very small orifice sizes and demanding print duty cycles, piezo ink jet printheads are sensitive to contamination. However, the proper selection of filter assemblies can alleviate contamination issues and enhance printing performance.

Contamination can lead to plugging

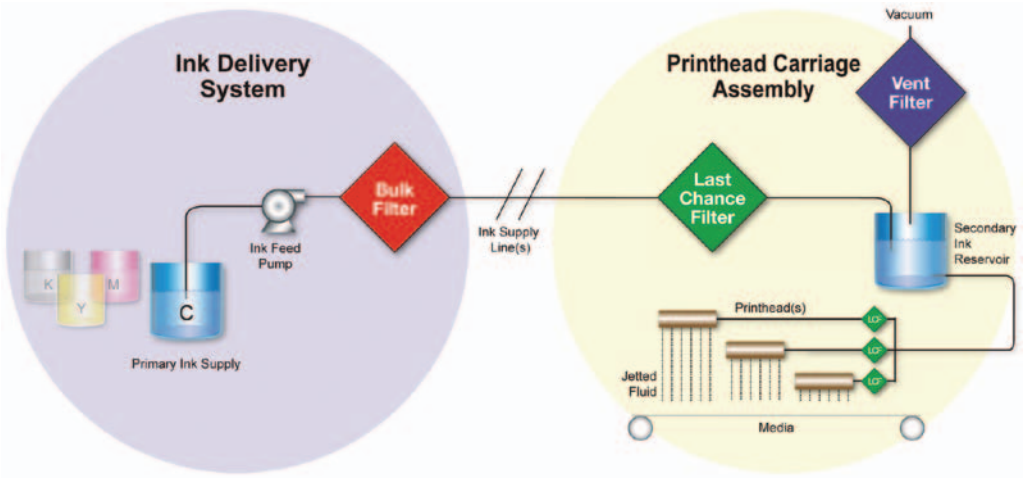
The primary failure modes that are related to contamination in digital printing presses are total plugging and partial plugging of the ink jet orifices. These openings can be as small as 10µm and produce ink drops as small as 10 picoliters. Plugged or partially plugged jets can lead to printing problems such as missing print lines or poor resolution. It is important to note that most digital printing systems have some facility to maintain the printhead performance, which may include ink purging, solvents flushing, and/or vibration to dislodge contaminants. Maintenance cycles usually are performed during pauses in the printing cycle. However, web-based digital printing presses with fixed printhead arrays cannot afford to stop for maintenance – they must be reliable and run non-stop to keep up with demand. This simple fact emphasizes the need for proper filtration and contamination control.

There can be a wide range of contaminants that will cause printhead failure. The most common contaminants include: (a) gels formed from the UV ink chemistry; (b) oversized or agglomerated pigments that were not filtered out earlier in the process or formed in the ink containers; (c) system contaminants, such as plastic from tubing or fibers from filters; and (d) general environmental contaminants such as dust.

Filtration philosophy

Pall typically recommends a dual-filter strategy for most digital printing presses. We have found that the application of filtration technologies to both the ink delivery system and the printhead cartridge assembly yields optimal print performance. This strategy has several benefits: (a) it allows the filter selections to be carefully matched to the ink characteristics; (b) it enables the OEM to include enough capacity for long life between filter replacements; (c) it allows easy servicing with minimal downtime when needed; and (d) it assures printer performance and prevents printhead damage.

The diagram below illustrates a typical filtration scheme for most digital printers.



Bulk Filter – The bulk filter is the primary and finest filter in the system, and will be required to remove a large range of contaminants. The contaminants can come from a wide range of sources including gels or insoluble materials formed during shipping or from the ink containers. In addition, if the ink was poorly filtered during formulation, the bulk filter will help to improve the overall ink cleanliness level. The bulk filter should be located where it can be easily monitored and changed. For most digital printing systems, it is recommended that a filter rating is selected that is about 1/5-1/10th of the orifice size. A good rule-of-thumb is 3-5 µm for UV curable systems and 5-10 µm for others.

Last Chance Filter – The main function of the last chance filter or 'LCF' is to prevent irreversible or catastrophic printhead failure due to large contaminants. In addition, the LCF is in place to capture any degradation debris from equipment change-outs. The last chance filter has a very small envelope size, and consequently a limited contaminant capacity. A typical filter rating target is 1/2 of the orifice size, usually 10-20 µm.

Filtration technology that meets application-specific needs

Bulk filter option: Multiple Application Capsules (MAC) – Pall's Multiple Application Capsules feature a compact and highly flexible design that meets the needs of most digital printing presses. The capsules utilize Pall's Profile® Star, Profile II and HDC® II media.

See www.pall.com/pdf/IJ_1777.pdf

Attribute	Benefit
Opaque capsule option	Prevents curing of UV fluids during filtration
Choice of available filtration media options	Filter media can be optimized to specific application needs
Compact capsule with large effective filter area	Easily fits into many printing systems, and provides long service life

Bulk filter option: Small Capsule Filters (SCF) – Pall's Small Capsule Filters are also very compact and can be used as either a bulk filter or last chance filter for digital printing presses, depending on the printer's architecture. The capsule features Pall's HDC II filter media for excellent flow rates.

See www.pall.com/pdf/IJ1768A.pdf

Attribute	Benefit
Opaque capsule option	Prevents curing of UV fluids during filtration
Features luer lock compatible connections	Quick, easy filter change with minimum ink spillage
Pleated internal filter construction	Large effective filter area provides long service life

Bulk filter option: Pall's DFAC filter capsules – Pall's DFAC filter capsules are larger assemblies for digital printing presses that require very high flow rates. The DFAC capsule filter family uses the same Profile Star and HDC II media as the smaller MAC filter. However, this filter capsule offers 2-4x more filter capacity.

See www.pall.com/pdf/MEDFACEN_DFAC_Filter.pdf

Attribute	Benefit
Filter media is consistent with other Pall ink jet capsules	Will allow seamless scale-up to larger flow rates
Features large-bore Swagelok-compatible compression fittings	Low pressure loss under a wide range of flow condtions
Compact capsule with minimal dead space	Quick start-up and minimal ink loss during filter changes

LCF option: Pall's Acro® Last Chance Filters (LCF) – The Acro Last Chance Filter family consists of a wide range of small, encapsulated disc filters for point-of-use printhead protection.

See www.pall.com/pdf/IJ_1796.pdf

Attribute	Benefit
Available in three sizes	Can support many different printer platforms
Economical construction	Significant printer performance improvement with minimal cost impact
All polypropylene construction	Good chemical compatibility across a wide range of ink types

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