White Paper

THOMAS
by Gardner Denver

What you should know about...

PUMPS IN INKJET PRINTING SYSTEMS

TRANSFORMING PRINTING

Years ago, at the verge of the computerization era, people were convinced that computers would render paper obsolete. This idea was rooted in the human mindset so firmly that one of the world leaders in the photocopying business shifted their focus to developing computers. However, printing stayed as popular as ever: it was too common and useful to replace. Starting from printing on paper, new technologies and applications began to emerge and develop.

Since its first "baby steps" in the 1950's, inkjet printing technology is rapidly progressing and provides possibilities for new design styles and workflows, short production runs, sustainable printing environments, quick response time, and customization.

Inkjet printing machines are used in a wide range of productions, from large-format advertisements to books, labels, packaging material and other commercially used items. Inkjet is viewed as an enabling technology, allowing print supply chains to be significantly improved by reducing the cost of short runs by printing on demand, or in the case of continuous inkjet – aiding steady, mass scale printing and production.

KEY INDUSTRIES:

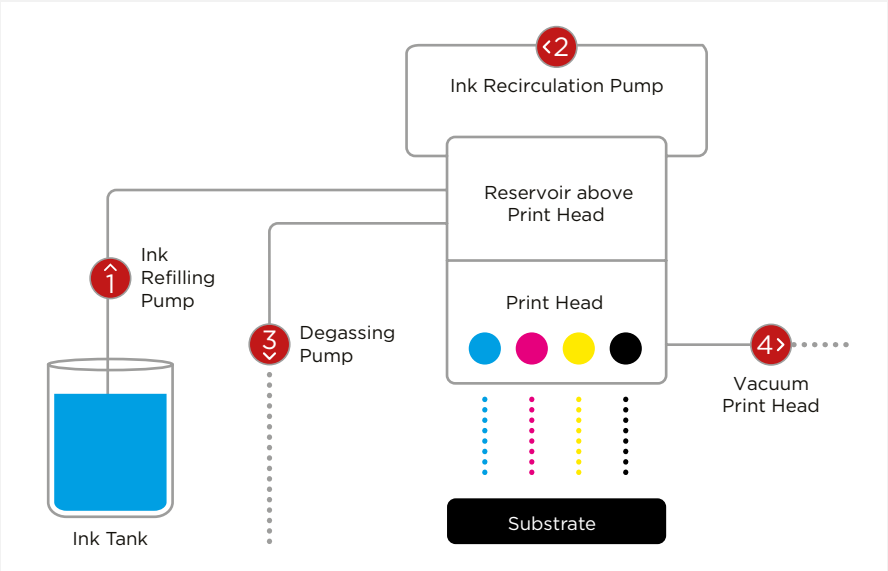
- **Marking and coding**
  (for example in the food and beverage industry)
- **Advertising**
- **Printing on textiles and ceramics**
- **3D printing manufacturing**

1 WHICH INKJET TECHNOLOGIES USE PUMPS FOR INK HANDLING?

There are two types of inkjet technologies that utilize pumps:

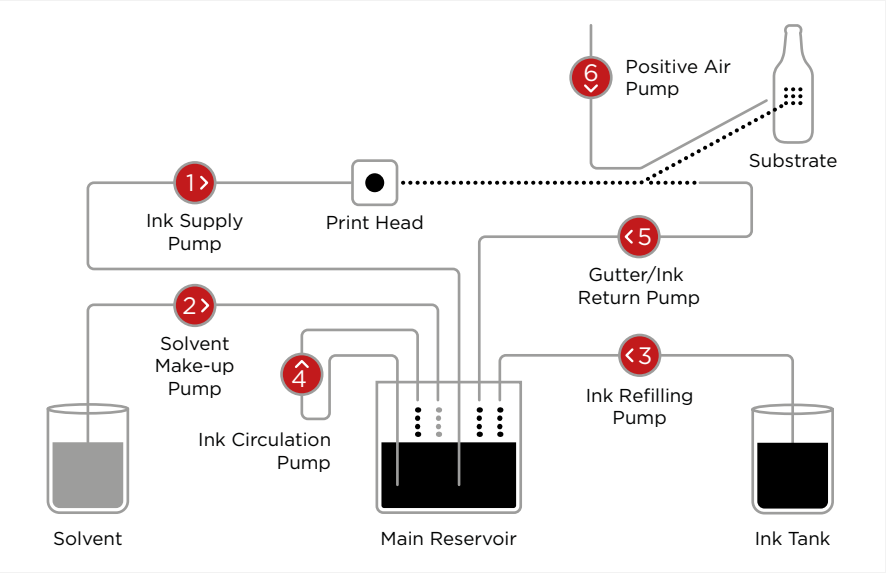
Drop-on-demand inkjet

In this technique, bubbles of ink are formed and expand, then a small drop of ink is injected through a nozzle onto the printing surface.



Continuous inkjet

In continuous inkjet technology, a continuous stream of ink is separated into individual droplets in the print head of the inkjet printer. Some of the droplets are electrostatically charged and then pass through a deflecting electrode. Uncharged droplets are input back again into the ink circuit through the gutter. Charged droplets are put onto the surface of the object to be printed on.



Most importantly, the pumps are used for:

- Ink degassing
- System vacuum and pressure
- Cleaning station
- Vacuum (maintaining constant meniscus pressure at print head)
- Gutter pump
- Chemistry make-up
- Ink supply
- Positive air
- Ink circulation

2 HOW CAN PUMPS HELP TO INCREASE SYSTEM UPTIME?

Diaphragm pumps are considered to be one of the most robust pumps. They can be compatible with high temperatures over a long period of time and are resistant to chemical and mechanical wear, increasing uptime and longevity.

3 WHAT TYPES OF INK CAN BE HANDLED BY DIFFERENT PUMP TYPES?

The printing market offers a wide range of inks of different viscosities, particles, additives and solvents.

There are currently five main types of inkjet inks:

- phase-change inks;
- solvent-based inks;
- water-based inks;
- UV curable inks;
- Oil-based inks.

Other types also exist, but are less prevalent.

4 HOW DO YOU ENSURE PUMP COMPATIBILITY WITH INKS AND FLUIDITY REQUIREMENTS?

Determining the compatibility of the pump with the type of ink is crucial to guaranteeing quality of the final product and longevity of the printer. For example, UV curable inks and coatings have a unique chemistry and composition, requiring unique handling and pumping needs. To ensure that the pump of your choice is fully compatible with ink, undertake the following steps:

1. Evaluate the fluid's characteristics:

- type and concentration;
- temperature;
- specific gravity;
- viscosity;
- solids content.

2. Determine if the fluid characteristics of the pumped ink are chemically compatible with the materials the pump is constructed of.

3. Determine and evaluate the conditions of operation for the application including:

Flow Rate: Calculated in gallons per minute or in liters per minute.

Head Pressure: Calculated in feet, PSI or Bar and measured at the head of the pump, it determines how far and high the ink can be pumped.

Self-priming: If necessary, determine how many meters (feet) or centimeters (inches) there are from fluid level to the pump.

Duty cycle: Determine the amount of time the pump is used during an average production day and week.

4. Select a pump size in reference to the flow rate and pressure.

5 WHAT TYPES OF PUMPS ARE NEEDED FOR INK HANDLING IN INKJET SYSTEMS?

In ink handling, diaphragm pump technology is widely used:

- can handle liquids with high viscosities (<150 cSt)
- designed to pump inks that feature a considerable amount of pigments.
- can be constructed out of materials that can handle pumping even the most acidic chemicals.

Also, used are peristaltic pumps:

- Easy to use
- The tube within can be easily changed
- Dry running and self-priming
- Gentle transfer of ink

Another technology that can be found is gear pumps.

6 HOW CAN PUMPS HELP TO MINIMIZE MENISCUS PRESSURE VARIATIONS?

Gas diaphragm pumps provide constant vacuum level over long time operation so that it minimizes meniscus pressure fluctuations providing smooth and balanced operations to ensure constant vacuum levels at all times.

Circulation pumps are often incorporated with two pump heads and therefore have minor effect on meniscus pressure variation. The two heads create an alternating fluid output that minimizes pressure fluctuations.

7 CAN THE RIGHT PUMP CHOICE HELP REDUCE INK CONSUMPTION?

Yes. The correct pump choice provides for a steady flow rate and what is more important: the appropriate level of pressure or vacuum, preventing ink dripping at the head or returning unused ink back into the reservoir, in turn reducing the amount of ink used.

8 WHAT ARE THE INK VISCOSITIES DIAPHRAGM PUMPS CAN WORK WITH?

Basically, diaphragm pumps are designed to handle just about any kind of fluids, from water to even oil. Therefore, diaphragm pumps are very effective in handling inks of even high viscosities up to 150 cSt.

9 HOW DO DIAPHRAGM PUMPS ENSURE THAT UV-INKS ARE NOT CURING INSIDE THE PUMPS?

Pumps most suitable for the transfer of UV inks have to consider three factors: seizing, shearing and viscosity. A pump using a mechanism which shears the ink as it is being transferred will lower the UV ink or coating's viscosity. This will affect coverage and final UV cure as thicker films cure at a different rate than thinner films.

On the other side, diaphragm pumps shear material less extensively compared to gear pumps. An additional resonating diaphragm in the pump head minimizes pulsation and ensures gentle transfer of ink. This action maintains viscosity and is ideally suited for handling UV inks and coatings. Also, these diaphragm pumps can be customized with a special pump head that does not allow UV light to enter.

10 HOW CAN PUMPS HELP TO TACKLE INCREASING COST-PRESSURE ON PRINTING SYSTEMS?

Double-headed diaphragm pumps double pump performance while using only one motor, which is a significant cost-driver of the pump. At the same time such a pump configuration achieves the same lifetime as a single-headed pump. Additionally a double-headed diaphragm pump makes best use of the space within a printer compared with using two separate single-head pumps.

TALK TO OUR PRODUCT EXPERT!

Our product manager Markus Orlando is available to answer your questions and help you find the pump solution you need for your printing application.

markus.orlando@gardnerdenver.com

Looking for a reliable diaphragm liquid or gas pump for your printing application?

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Liquid Diaphragm Pump

6311
Liquid Diaphragm Pump

6410
Liquid Diaphragm Pump

6420
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1410
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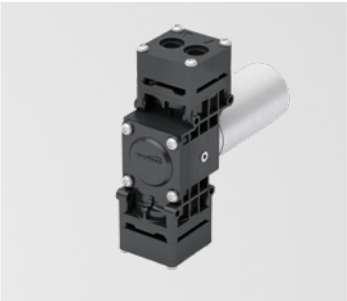
Gas Diaphragm Pump

1610
Gas Diaphragm Pump



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Gas Diaphragm Pump

With a wide range of pressure, vacuum and liquid technologies including WOB-L piston, articulated piston pumps, miniature diaphragm pumps, rotary vane pumps, linear pumps and peristaltic pumps, Thomas offers the broadest oil-less product range in the industry. With this vast product offering, Thomas designs ideal, customized pressure and vacuum pump solutions which meet our customers' precise needs.

Have a look at the whole portfolio and visit: www.gd-thomas.com

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