Production of InkJet Cartridges
Pelikan Hardcopy International AG

Manufacture of InkJet Cartridges

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1 Introduction

The history of the Pelikan brand dates back over 160 years. It was originally made famous by ink and fountain pens. Innovation has always played a major role for Pelikan. At an early stage, Pelikan Hardcopy started to develop ink and toner products for printers, fax machines and copiers. The division of Pelikan Hardcopy AG has emerged from the Pelikan parent company in Hanover and is today’s undisputed No. 1 in the alternative market for printer supplies in Europe.

What is characteristic of the brand Pelikan Hardcopy is its in-house research and development department, state-of-the-art logistics, national companies in 12 European countries as well as a well-organised and certified quality management system. As a global player with its headquarters in Egg (Switzerland), Pelikan Hardcopy employs more than 1000 people in Europe and Asia. With its own ultra-modern plants in Switzerland, the Czech Republic, Scotland, China and Malaysia, Pelikan Hardcopy is able to manufacture its products in a cost-effective way. Pelikan Hardcopy guarantees attractively priced, high-quality products.
2 Ink – a high-tech product

Ever since the days of the fountain pen, ink has undergone dramatic changes. Ink has turned into a high-tech product and its development today is conducted on a seriously scientific level.

One may differentiate between two types of ink: while pigment ink is waterproof and light-fast, these characteristics are less distinct in dye ink since these colours are completely soluble in water. Dye ink is better suited for the printing of brilliant colour photos. Pigment inks are more complex and more expensive to produce whereas dye ink comes at a more reasonable price and the cartridges can be more easily filled.

According to the printer model, the printer manufacturers use either pigment or dye inks. For the production of its Inkjet cartridges, Pelikan Hardcopy uses high-quality raw materials so as to match its inks precisely to the specifications of the printer models.
### History of InkJet

<table>
<thead>
<tr>
<th>Year</th>
<th>Inventor</th>
<th>Event Description</th>
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<tbody>
<tr>
<td>1867</td>
<td>Lord Kelvin</td>
<td>First practical experiments (Continuous Jet)</td>
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<tr>
<td>1878</td>
<td>Lord Rayleigh</td>
<td>Development of the required mathematical equations to define the conditions of the drops.</td>
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<tr>
<td>1967</td>
<td>Pelikan</td>
<td>Starts production of industrial ink in Hanover.</td>
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<tr>
<td>1972</td>
<td>Pelikan</td>
<td>Starts production of industrial ink in Switzerland.</td>
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<tr>
<td>1974</td>
<td>Kyser/Sears</td>
<td>Invention of Piezo Technology</td>
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<tr>
<td>1977</td>
<td>Ichiro Endo (Canon)</td>
<td>Invention of Bubble Jet Technology</td>
</tr>
<tr>
<td>1984</td>
<td>HP</td>
<td>First “Think Jet“. Small and compact with disposable print head (Bubble Jet).</td>
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<tr>
<td>1985</td>
<td>Canon</td>
<td>First Bubble Jet Printer. Supplies for office printers (Siemens, Sharp).</td>
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<tr>
<td>1992</td>
<td></td>
<td>First Inkjet Colour Printer</td>
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<tr>
<td>1998</td>
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<td>First Photo Printer</td>
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3 From raw material to ink

As the leading ink specialist, Pelikan has decades of experience in the analysis and development of formulations. This unique Pelikan know-how guarantees the utmost quality from A-Z: starting with the respect for purity of components, through the light-fastness of inks, ending up with true-to-life colour reproduction.

Pelikan Hardcopy uses chemically manufactured, high-quality raw materials from well-known European chemical companies for the production of its inks. The raw materials are supplied as powders, granulates or liquids.

The manufacturing process of inks:

A water-based ink consists of five main components:
1. Water
2. Biocide
3. Solvent
4. Surfactants
5. Dyes or pigments

The components under items 1 to 4 are put together in a specific order and are well stirred for a few minutes until all raw materials have dissolved in the water. Then, the fifth component is added and the ink is stirred for at least one hour. Dyes are water-soluble whereas pigments (solid particles) can only by dispersed. Finally, the ink is filtered. In the case of dye inks, solid particles or impurities are removed by filtration. Pigment inks already contain particles and are filtered so that the particles that are too big can be removed. The exact manufacturing process depends on the formulations.

Pelikan Ink is exclusively developed and manufactured in Egg (Switzerland).
4 High quality for highest demands

The research and development department continuously strives for optimum adjustment of the inks to the requirements of the individual printers. To facilitate this, Pelikan Hardcopy focuses in particular on the chemical and technical aspects of printer consumables. The products have to meet the specifications of the individual printer models 100% in order to guarantee a smooth printing operation with optimum printing results. Strict production requirements and quality controls (ISO 9001) provide the guarantee for high reliability and safety of all Pelikan Hardcopy products.

The research and development laboratory in Switzerland (Egg) specialises in the chemical and technological development of ink, toners and ink rollers. Similarly, the laboratory in Scotland specialises in the chemical and technological development of Thermal Transfer Rolls and Impact products (supplies for typewriters, calculators and dot matrix printers) whereas the laboratory in the Czech Republic specialises in toner development.

Inks and cartridges manufactured by Pelikan Hardcopy guarantee the utmost quality by meeting the following essential requirements:

Waterproof: Pelikan Inks dry quickly and are extremely waterproof.

Smudge resistant: Pelikan Inks dry quickly and are lastingly smudge-resistant.

Stability against smears: Pelikan Inks dry quickly and do not smear, e.g. in case of underlining with a marker pen.

Light-fast: The high-quality ink raw materials in Pelikan inks make sure that the brilliant colour reproduction lasts for a long time.
**Colourfast:** Pelikan Inks are compatible with original inks and fulfil the required colour standards. Accordingly, true to life, natural and subtly graded colours are guaranteed.

**Printing format:** The quality of Pelikan Hardcopy ink plus exact dosage control provides for optimum viscosity. Unsightly banding, e.g. via crystallization at the nozzle can thus be avoided.

**Leak proof:** The Inkjet cartridges manufactured by Pelikan – like those produced by the original manufacturers - are equipped with closing valves preventing the remaining ink from spilling on to hands or into the printer via the ink outlet.

**Warranty:** There is a two-year warranty for all Pelikan Hardcopy Inkjet cartridges.

It is anything but trivial to develop ink that conforms to the precise physical and chemical parameters like boiling point, surface tension, pH-value and also all of the requirements of the end user in respect of quality and handling. Pelikan Hardcopy continuously strives to improve the lightfast quality and the ageing stability of its products and it also focuses on an the exact adjustment of the colour reproduction in accordance with the products of the printer manufacturers.
5 Product development

The path to reach the market for a product of Pelikan Hardcopy is paved with a lot of intricate work. It is not only chemists and engineers that are called for, but also patent specialists. Putting the technical analysis of the printer manufacturers’ products to one side, it is the patent situation that needs to be clarified. As soon as all the details are known, the realisation of own products begins. First, the chemical and technical properties of the Inkjet cartridges of the new printer models are tested. The second step lies in the development of prototypes for the ink tank. Pelikan Hardcopy manufactures the ink tanks itself and is also active in the area of intensive research and further development. Then the chemists develop printer-specific ink formulations. To secure compatibility and quality, extensive product performance tests are made. Amongst others, these cover reliability, yield and print quality on different types of paper. Meanwhile, the packaging designers are also involved in the work. What is also important to Pelikan Hardcopy is: No assembly-line production without ISO 9001 certification. Once this situation has been reached, pilot production can begin. As soon as the patent situation has been finally clarified, Pelikan Hardcopy may launch a new quality product.

Own chip development:

Chips for Epson cartridges for instance, are analysed and developed by Pelikan Hardcopy itself, thereby providing greater independence and flexibility. The production itself is then operated by external companies specialising in the manufacture of chips.
6  Strong environmental awareness

Pelikan Hardcopy has been one of the first companies to introduce the recycling of inkjet- and toner cartridges. Pelikan Hardcopy champions the objective of treating the environment responsibly. In the continuously growing market of printer supplies, the idea of recycling and waste reduction is of prime importance. Empty printer consumables are often put in the waste bin, although it is just the ink that has been consumed and the printer system itself is still operable. Up to 80% of the parts of used toner cartridges are reusable. In principle, all inkjet print heads with electronic parts (e.g. from manufacturers like Hewlett Packard, Lexmark and Canon) and toner cartridges are collected.

The remanufacturing of inkjet cartridges takes place in accordance with the DIN 33871-1 standards. Strict remanufacturing principles apply, in particular in respect of environmental aspects and customer safety. Further aspects concern topics like harmlessness, functional safety of the cartridges, new test charts regarding quality and yield as well as final DIN certification of the tested product. Pelikan Hardcopy is an active member of DIN and CEN Committees for Standardization. Remanufactured inkjet and toner cartridges and toner modules from Pelikan Hardcopy are therefore of equal quality to the products of the printer manufacturers.

Recycling process of Inkjet refilled cartridges in accordance with DIN 33871-1

- Empty tanks returned undergo a visual check for damages and are electronically tested.
- Useable inkjet cartridges are completely cleaned and rinsed. Cleaning agents are exactly chemically adjusted to the corresponding inks. One can thereby exclude unintended, chemical reactions.
- After rinsing, cleaning agents are extracted from the cleaned cartridges.
- The refilling with Pelikan inks is permanently checked for compliance with the filling level.
- Pelikan inks are always oriented towards the products of the printer manufacturers. When printer manufacturers use pigment ink, Pelikan Hardcopy will also do so.
- The functionality of each refill cartridge will be tested. Only good quality products will find their way into Pelikan packaging.
- The cartridge will be sealed with a tape or a clip as a protection during shipping.
- Packaging is suitable for storage and delivery.
Extract from DIN 33871-1 standard for remanufactured inkjet cartridges

- All inkjet cartridges are tested for yield, operation and print quality.
- The image must be flawless as soon as the inkjet cartridge has been inserted.
- Inkjet cartridges must ensure trouble-free mechanical operation throughout the period of use.
- Comparative testing of 3 Pelikan Hardcopy inkjet cartridges with 3 cartridges of the particular printer manufacturer determines the yield.
- Yield must be visible on the packaging.
- Packaging and storage instructions are given on the packaging.
7 4 strong arguments in favour of Pelikan Hardcopy

- The first-class ink quality that stems from our own research, development and production guarantees the perfect adjustment to the specific requirements of the particular printer and flawless operation.

- Inkjet cartridges from Pelikan Hardcopy are up to 40 percent cheaper than the products of the printer manufacturers.

- Pelikan Hardcopy manufactures the inkjet cartridges itself and also does intensive research and further development in this field (new technologies, chip development etc.). Other manufacturers of alternative printer supplies receive the completely manufactured cartridges or individual component parts for remanufacturing from various sources – which in turn results in inconsistent quality of supplies and corresponding inconsistent quality of the product!

- Remanufactured print heads from Pelikan Hardcopy are of equal quality to those produced by the printer manufacturers, since they are manufactured according to the strict remanufacturing standards of DIN and ISO 9001.