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The confidential version has 85 pages

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Introduction

To Introduce I&P Europe

I&P Europe – Imaging and Printing Association is a European association of product manufacturers and technology providers for the imaging and printing industry. I&P Europe members' products include conventional and digital materials and their processing solutions. The product portfolio of the membership includes in particular consumables such as inks for digital printing applications, toners, pressroom chemicals, printing plates, photographic mixtures and films as well as equipment products such as printers, printing machines etc..

I&P Europe strives for working together with competent authorities in Europe and at the supranational level in the Stockholm Convention.

I&P Europe wishes to emphasize that from an environmental and health perspective, our organization is fully committed to the replacement of PFAS in printing products.

Thanks to the commitment and efforts of our affected members, they successfully develop and market printers that do not require the use of fluoropolymers or other types of PFAS in their toners and carriers to ensure good performance.
It is important to be aware that the new, PFAS-free toners were developed in a necessary combination with modifications to the hardware of the printing systems themselves.
However, there is a difficulty with the existing printers on the market that have been engineered based on a toner and a carrier in which a fluoropolymer (FP) plays a critical role to match with the printer specifications. No solution has yet been found to replace the FP in the current toner-carrier-printer electrophotographic system for many existing printers that use PFAS-containing toners, despite extensive research efforts in the R&D departments.
I&P Europe has on April 4th 2023 submitted a separate submission to the public consultation which is dedicated to toners needed to service the printers installed in the field, i.e. the so called installed base printers already on the market, to request for the use of fluoropolymers in toner, carrier and developer a transition period that is extended to 5 years after entry into force of the restriction.

The current contribution relates to the printer hardware and more specifically to some specific applications in printer hardware for which the use of PFAS is essential and for which the knowledge around the underlying functional requirements is only available at the printer manufacturer and thus not at the PFAS producer.

Problem analysis

Specific applications in printer hardware for which the use of PFAS compounds is essential and for which the knowledge around the underlying functional requirements is only available at the printer manufacturer, not at the PFAS producer.

There are certain specific instances of PFAS use that are unique to printer hardware and for which the knowledge and know-how concerning the underlying functional requirements is limited to the printer manufacturers.

Certain - sometimes common and commonly used - PFAS compounds are necessary and even essential in printer hardware because they possess the right combination of properties to meet functional requirements that are very specific to printers.

In a number of cases, it is anticipated that PFAS-free alternatives can be found and deployed in a timely manner within the projected timeline of the PFAS restriction proposal.

However, for some specific applications in printer hardware, this is not the case and a longer transition period of 5 or 12 years is indispensable to safeguard the production of state of the art printers.

The manufacturers of the PFAS ingredient or the PFAS-containing component do not have the information as to why that PFAS is suitable or state-of-the-art for certain specific applications in printer hardware and have no knowledge as to which non-PFAS alternative may or may not work as a substitute and for what fundamental underlying technical reason.

For this reason, I&P Europe developed the present contribution addressing the use of PFAS in specific applications in printers and submits it to the the public consultation on the PFAS Annex XV dossier.

Scope

Specific applications in printer hardware for which the use of PFAS compounds is essential and for which PFAS free alternatives are not (yet) available.

Certain uses of PFAS compounds are necessary - and even essential - in printer hardware because they possess the right combination of properties to meet functional requirements that are sometimes very specific to printers.

Upfront, we wish to emphasize as a general comment that I&P Europe member companies have a policy of strict compliance with all applicable regulations, including the EU POPs Regulation Recast (EU) 2019/1021 implementing the decisions of the Stockholm Convention on Persistent Organic Pollutants (including listing for PFOS and PFOA) and REACH restriction regulations (including listing for LC-PFCAs (C9-C14) and PFHxS). As an example: PTFE used in printer hardware thus does not contain substances related to these classes that are already regulated.

In a number of cases, it is anticipated that PFAS-free alternatives can be found and deployed in a timely manner within the projected timeline of the PFAS restriction proposal.

However, for some specific applications in printer hardware, this is not the case and a longer transition period of 5 or 12 years is indispensable to safeguard the production of state of the art printers.

Examples include:

- PFAS in nozzle plates of the print head of inkjet printers
- Fluoroelastomers in image forming parts in printers
- Fluoropolymers in sealing materials (O-rings, gaskets), valves and pumps in printers
- Fluoropolymers in tubing/piping, sealing materials (O-rings, gaskets), valves and pumps in manufacturing sites for printer components and for printing inks
- The use of PFAS in opitical sensors for certain types of inkjet cartridges

In the "supporting information" sections later in this document and in the confidential appendices to this document, the technical function of PFAS for each application is described in detail and detailed information is provided on (the lack of) alternatives, the time required for substitution with non-PFAS compounds, the cost of substitution, the CASNr and tonnages of the PFAS used, emissions to the environment and measures to minimize release into the environment.

This section now gives a brief description of the PFAS uses in these specific applications in printers:

- PFAS in nozzle plates of the print head of inkjet printers:

  PFAS is used in the antiwetting coating on the nozzle plate of print heads mainly because of its repellence properties.
  The example on the webpage https://imagexpert.com/what-causes-wetting/ is a good (but not exhaustive) example.

Print heads (PHs) have PFAS such as e.g. perfluoropolyether-polyurethane polymer on polyimide substrate as antiwetting coating (AWC) on the front face. The AWC is the last surface the ink contacts before leaving the PH for the paper. Jetting failures - i.e. misdirected jets, missing jets, low drool pressure - result if the ink wets the AWC and leaves a residue (high adhesion to AWC), which is hard to clean off in PH maintenance cycles. Robust AWC is critical for maintaining jetting health and reliability. We cannot have a functioning PH without an AWC!

There are no alternative non-PFAS materials known that have the same functions. Leaving the PFAS out will stop the droplet formation process. Nozzle plates without PFAS do exist in some printers, but the printing process in those printers is quite different. If a redesign is possible, it could take up to 10 years because the droplet formation is at the very core of the printer. You would have to start designing the printing process again. Considering the very small amount of PFAS and the very small emissions of PFAS to the environment from this use, it is disproportionate to completely redesign a printer to take this PFAS out.

- Fluoropolymers in image forming parts in printers

  Fluoroelastomers and fluorinated thermoplastics are used for image-forming and fuser subsystems in toner based printers. These materials provide a critical and enabling function to develop the toner image and fix and fuse toner on to paper or some other substrates.

  PFAS (often fluoropolymers) are used in parts of the printer that come into direct contact with toner. It is important that toner particles do not stick to the photoconductor, transfer rollers/belts, fixation rollers/belts and other critical parts in the printer. Only PFAS is known to have the required non-stick properties. Sticking of toner to these parts will result in quickly deteriorating image quality or even lead to breakdown of the printer. PFAS are also used for lubrication at high temperature, either as grease or as construction material of parts. Also fixation rollers that are not in direct contact with the toner but make the fixation nip are sometimes made of fluoroelastomers in order to prevent swelling (swelling leads to deformation of the printed image).

- Fluoropolymers in sealing materials (O-rings, gaskets), valves and pumps in printers

  These parts need to be chemically inert and mechanically stable at high temperatures and pressures. They must be flexible but also resist ink. They are not allowed to be affected during the life time of the printer. Degradation or swelling of the material can result in leaking of ink from the printer. PFAS-based sealing ensures safe functioning of equipment and prevents leaks and emissions of hazardous wastes. There are no non-PFAS materials known that are resistant to all ink components. Other polymer based O-rings, gaskets, etc. will dissolve or erode due to chemical exposure. They will also deform and fail at high pressures and temperatures.

- Fluoropolymers in tubing/piping, sealing materials (O-rings, gaskets), valves and pumps in manufacturing sites for printer components and for printing inks

  Just as in the printer we need rubbers and plastics that do not degrade or swell under the influence of ink, this is also the case in the ink factory. Just like any chemical factory, ink and toner factories use PFAS in sealing materials, valves, pumps, piping etc. These parts need to be chemically inert and mechanically stable at high temperatures and pressures. For some chemicals, there is no known non-PFAS alternative material that is sufficiently chemically resistant and also does not deform and fail at high pressures and temperatures..

- Fluoropolymers for the use in cabling for high voltage and/or high temperature applications in printers

  Electrical insulation used in cabling for connecting high voltages of 0 – 8 kV to corona wires in order to charge surfaces in an even manner. Corona wires are commonly used in dry toner electro photographical printing processes.
  Thanks to the superior technical properties of fluoropolymers regarding high electrical resistance, high voltage cabling can be created with limited diameters. This enables the mechanical design of subassemblies and machine concepts to be functional in tight spaces, due to the easy cable routing and to have relatively small components and connectors.
  There are alternatives to high voltage cabling that use silicone rubber as an alternative electrical insulation material. However, because the electrical resistance is lower, much larger layer thicknesses of insulation material are required, which has a major mechanical impact on the current new machines and an even larger incompatibility problem in replacement spare parts for machines in the field.
  An additional derogation period of 5 years is needed: supportive information is given in the appropriate section of this document.

  The use of high PTFE or other PFAS wire insulation for high temperature applications is very common and also used in some printers, with no non-PFAS alternative for temperatures above 180 °C.
  We believe alternatives can be found by using glass fiber insulation but we (and our suppliers) also need a derogation period in order to implement this alternative.

  Another use of PFAS as wire insulation for which there is currently no non-PFAS alternative is when contact with specific chemicals is possible, a situation that also occurs in some printer equipment.

- the use of PFAS in optical sensors for inkjet cartridges

  An optical sensor is a mechanism used on certain types of ink cartridges to detect the presence of ink in the cartridge. The ink is detected by reflection differences on the surface of the optical sensor from ink or air. This part of the cartridge must remain clean to perform its function. If ink remains on the surface of the optical sensor, the printer will keep moving even if there is no ink in the cartridge.

  It is essential that the ink does not stick to the surface of the optical sensor. To achieve this, PFAS is used as a water repellent in the optical sensor technology. Because the optical sensor remains clean, printers can accurately detect ink from ink cartridges.

The demand

A transitional period that is extended to 5 or 12 years after entry into force of the restriction for the use of PFAS in identified specific applications in printer hardware

In some cases, it is anticipated that PFAS-free alternatives for uses in printers can be found and deployed in a timely manner within the projected timeline of the PFAS restriction proposal.

However, for some specific applications in printer hardware, this is not the case. Moreover, for certain specific applications the development (R&D) and implementation of PFAS-free alternatives cannot be achieved within a 5 year additional derogation period. Therefore a longer transition period of an additional 12 years is indispensable to safeguard the production of state of the art printers.

In printing equipment and in the manufacturing of inks and toners, PFAS can currently not be replaced in the following applications:

- Print heads in inkjet printers
- Sealing materials (O-rings, gaskets), valves and pumps in inkjet printers
- Sealing materials (O-rings, gaskets), tubing, valves and pumps in manufacturing sites for printer components and for printing inks
- Electrophotographic printers
- Paper guiding parts
- Electrical insulation in cabling for high voltage and/or high temperature applications in printers
- Cabling in printers that may come into contact with specific chemicals
- Opitical sensors for certain types of inkjet cartridges

The following text is proposed for specific derogations:

By way of derogation, paragraphs 1 and 2 shall not apply to:
a. fluorinated compounds, fluorinated resins and perfluoropolyethers in inkjet printer print heads until 13.5 years after EIF. **b. fluoropolymers for use in sealing materials, valves and pumps in inkjet printers until 13.5 years after EIF.** **c. fluoropolymers for use in sealing materials, tubing, valves and pumps in manufacturing sites for printer components and for printing inks until 13.5 years after EIF.** **d. fluoropolymers and perfluoropolyethers for the use in drums, rollers and belts in electrophotographic printers until 13.5 years after EIF.** **e. fluoropolymers for the use in paper guiding parts in printers until 13.5 years after EIF.** **f. fluoropolymers for the use in cabling for high voltage and/or high temperature applications in printers until 6.5 years after EIF.** **g. fluoropolymers for the use in cabling in possible contact with chemicals in printers until 13.5 years after EIF.** **h. fluorinated compounds for use in optical sensors in inkjet cartridges until 6.5 years after EIF.**

Supporting information

For each of the identified specific applications in printer hardware requiring a transitional period of 5 or 12 years after entry into force, in the following dedicated "supporting information" sections as well as in the confidential appendices to this document, detailed information is provided on: - technical function of the PFAS - information on (lack of) alternatives - required timing on replacement - cost of substitution - CASNR or chemical name of the PFAS substances used - tonnages of PFASs used - emissions to the environment

On the next pages the above mentioned information is provided in separate sections for each of the following specific applications in printer hardware:

1. Print heads in inkjet printers
2. Sealing materials (O-rings, gaskets), valves and pumps in inkjet printers
3. Sealing materials (O-rings, gaskets), tubing, valves and pumps in manufacturing sites for printer components and for printing inks
4. Electrophotographic printers
5. Paper guiding parts
6. Electrical insulation in cabling for special applications in printers
7. Opitical sensors for certain types of inkjet cartridges

Whenever information was flagged as CBI by submitting I&P Europe member companies that contributed to this document, it has been provided in one of the 12 confidential appendices enclosed. For a specific application it is hence possible that some information is presented in more than one confidential appendix.

1. Print heads in inkjet printers

The parts of the nozzle plate of the printhead used in inkjet printers and printing presses produce printed materials at high speed and quality, providing users with printed materials that can be used for documents, photographs, and commercial applications. Taking advantage of the features of digital printing, it contributes to shortening the delivery time and reducing waste such as trial printing, and it continues to develop while mutually complementing conventional analogue printing.

Inkjet printers use PFAS in the parts of the printhead's nozzle plate for ejecting ink for the purpose of developing functions described below.

With the current technology, there is no substitute that can maintain the same quality as PFAS. If PFAS materials cannot be used, a complete redesign of the printing process in the printer is required since the functionality of the printhead is at the heart of the printer. But even after a redesign, the quality of the product will be much worse than current. As a result, there is a risk that the product life will shorten and the environmental impact will increase due to the increase of waste.

There is no substitute at present, so new material development will be necessary, and if the quality equivalent to PFAS cannot be achieved, not only the print head material may need to be changed, but also the unit configuration of the printer body and the control mechanism may need to be redesigned. Because of the required development of new materials and printers including a long-term evaluation, a sufficient exemption period (approximately 12 years) must be set.

technical function of the PFAS

To provide such an objective at a low cost and with a simple mechanism, PFAS is used in the parts of the print head nozzle plate.

In particular, technological advances in the latest print heads include a decrease in the volume of ink droplets. This serves two purposes. One is to reduce the graininess of the image, which stands out when the droplet size is large. In order to produce high-quality images as required for photography and commercial applications, low graininess is required.

The second purpose is to minimize user costs and the environmental impact of operating inkjet printers. The use of ink can be significantly reduced by efficiently coating the recording media with small ink droplets in high density. This can help reduce the cost of using ink and the CO2 emissions associated with transportation. And while commercial high-speed printing machines require drying of the ink by evaporation of moisture, the energy required for drying can be significantly reduced to minimize environmental impacts by lowering the droplet volume.

In order to form a print with a minimum amount of ink and with good image quality, the ink needs to land precisely on the medium at a defined location. To make such small droplets of ink to fly stably, it is important that the surface of the nozzle plate is clean and that the nozzle plate does not degrade or change over a long period of use.

If the surface of the nozzle plate is contaminated, for example, by ink sticking to it, there is a risk that the flight will be bent when ink is ejected from the nozzle plate. Very precise control of the ink wetting at the nozzle exit is critical for high-quality, high-speed printing.

Especially in recent years, the volume of droplets has become smaller. Very small ink droplets are susceptible to contamination of the nozzle plate surface, and the surface must be kept extremely stable.

For this reason, water repellent PFAS materials are used as nozzle plate surface coating to prevent contamination of the nozzle plate surface. PFAS material on the nozzle plate is applied to control the precise location of the liquid/air/nozzle plate interface. Without the use of PFAS materials it is not possible to make the small droplets fly stably in the right direction.

information on (lack of) alternatives

Detailed information on the lack of alternatives can be found in the confidential appendices 1, 9 and 10.
It can be concluded that there are no viable alternatives to the use of PFAS for water repellence of the printhead nozzle plate.

required timing on replacement

As mentioned above, there are currently no candidates for alternative materials, and it is necessary to advance the development of materials that achieve PFAS equivalent performance without increasing user cost or environmental impact during operation.

Building on previous research findings, the industry will continue the investigation for alternative materials. Because it is very difficult to reach the target simply by substituting materials alone, we believe that it is necessary to review the structure and mechanism of inkjet printers/printers, such as the maintenance mechanism of the print head, as well as to simultaneously develop inks to accommodate these changes.

Thus, adding to the scope not only the development of alternative non-PFAS materials but also a redesign of the printing system, we believe that a minimum of 12 years is necessary, approximately 7 years for the development of materials and systems and 5 years for the confirmation of mass production of materials and the evaluation of their deployment in various products.

In case the development of such alternative materials does not go well, we believe that other methods need to be studied in parallel. These studies need to be initiated from scratch, and similarly, a period of about 12 years may be required.

cost of substitution

The costs of substitution are more than 100,000 euro per kg substituted PFAS.
See confidential appendices 1, 9 and 10 for more details.

CASNR or chemical name of the PFAS substances used

See confidential appendices 1, 9 and 10.

tonnages of PFASs used

See confidential appendices 1, 9 and 10.

emissions to the environment

Printheads are shipped with the printer itself or supplied as spare parts for replacement. These print heads are loaded into the printer and consumed.

PFAS is a component that is integrated in/coated on the printhead's nozzle plate, so there is little risk of it being released outside the printer.

Cartridges that have reached the end of their life or run out of ink are collected or disposed of as waste.

measures to minimize release into the environment

The Electrical and Electronic Waste (WEEE) Directive requires the collection and safe recycling of end-of-life electronic products. When considering recycling, it is important to ensure long-term durability. Alternative materials will not be as durable as PFAS, and it is expected to be difficult to reuse usable parts of recovered print heads.

With the collection of cartridges/printheads and the very low concentration of PFAS in the printhead the emissions to the environment are considered to be very low.

As described above, the use of PFAS in printers is unlikely to significantly increase environmental pollution. The ban on PFAS used in print heads risks generating more waste due to the shorter life time of printers and printer parts.

2. Sealing materials (O-rings, gaskets), ink tubing, valves and pumps in inkjet printers

technical function of the PFAS

In all inkjet printers the parts that are in direct contact with ink must be resistant to that ink. In small home office printers, the ink system is small and only a few parts in the ink reservoir and in the print head are in direct contact with ink. In larger printers there are more parts with ink contact, for example tubes, pumps, valves etc. PFAS is typically used for parts that must be flexible as well as ink-resistant.

Examples of these parts are:

- O-rings: a non-leaking connection between different components of the ink system is of high importance. No ink may leak out of the printer during its lifetime. Proper sealing is provided by flexible rubbers
- Tubing: in small printers, the ink supply is mounted on the printhead. In large printers the ink supply is in a fixed location separated from the moving printhead. Because of the printhead movement, flexible tubing is required
- Pumps and valves: interior parts of pumps and valves are intended to move and must also provide a good sealing to prevent leaking.

These flexible parts are made of plastics or rubbers. Many plastics and rubbers show an interaction with ink. Over time they can become brittle, beak up or dissolve, ultimately leading to breakdown of the printer or even leaking of ink from the printer. Rubbers may swell due to interaction with ink. Swelling leads to deformation of the rubber and can ultimately result in leaking of ink from the printer. Leaking will damage the property of customers with stains that cannot be cleaned again. It can also lead to safety issues because of exposure of customers to hazardous materials. This must be avoided at all times.

Often PFAS plastics and rubbers have to be chosen because of their resistance to ink and other liquids. These other liquids that are handled in a printer include primers, coolants and varnishes.

information on (lack of) alternatives

In general there are two groups of materials that are flexible and resistant to ink during printer life time: polyethylenes and PFAS. Very often a fluorinated substance is the material of choice.

For tubing an inner layer of polyethylene can be used as an alternative. It is expected that it is possible to change the printer design and replace PFAS tubing with a PFAS-free alternative in new printers before the end of the transition period. Therefore a derogation request for "ink tubing" is NOT enclosed in the current document illustrating the commitment of I&P Europe members to substitute PFAS with non-fluorinated alternatives wherever possible.

For O-rings a rubber material is required. Non-PFAS rubbers include for example EPDM, silicones and NBR. Non-PFAS rubbers have insufficient resistance against important ink ingredients.

One category of inks is the UV-curable ink. It contains acrylates and photo-initiators. After initiation with UV light, a polymerization reaction starts. The acrylates are the monomers and join together in the polymer network resulting in a dry and very robust in layer on the paper or other substrate.

Most rubbers are not resistant to acrylates (acrylic acid esters). Information on the chemical compatibility of different types of rubbers and plastics is widely available on the internet. See footnote[1] for examples. It can be seen that there is some resistance with polyethylene and polyamide and good resistance against acrylates for fluoroplastics. Non-fluorinated rubbers are not compatible with acrylates. Although a single rubber might be resistant to a single acrylate, they are not compatible with the acrylate mixture in UV curable inkjet inks. FKM rubber (a fluorinated rubber) is not even resistant to all acrylates.

Actual experience in practice confirms the information that non-fluorinated rubbers cannot be used in combination with UV curable inks: either the rubber is deteriorated by the ink or components of the rubber dissolve in the ink and make it unusable. Even standard FKM rubbers are affected by the ink. The more fluorinated FFKM or special grades of (F)FKM like peroxide cured (F)FKM or PTFE coated FKM are the only suitable rubber materials for UV curable inks.

The other main category of inkjet inks, besides UV curable ink, is the aqueous ink. On the paper, this ink is not cured by polymerization but dried by evaporation of water and other solvents. Sometimes the printer jets a primer liquid in combination with these inks. In general the ingredients in these ink are “milder” than those in UV curable inks and more rubber materials are compatible with these inks. However there still are some ink and primer formulations for which only fluorinated rubbers can be used safely. An example can be seen in the confidential appendix 2.

The test results in the appendix 2 are in line with other tests that have been performed. The non-PFAS EPDM rubbers are suitable for use in combination with several aqueous inkjet systems, but not with all. For some applications in aqueous inkjet only special grades FKM rubbers and FFKM rubbers can be used safely.

Pumps and valves also contain some polymer material. Two metal parts cannot move along each other and at the same time provide a sealing that does not allow the liquid to pass. A polymeric gasket, seal or seat is always used. In diaphragm pumps the diaphragm is made of a flexible material, a polymer. As for O-rings, for UV curable inks and for some aqueous systems only fluorinated rubbers are inert to the ink and can be used in pumps and valves. If a plastic material is used, polyethylene has insufficient mechanical strength to withstand the frequent movement. This makes fluoropolymers like PTFE the only suitable material.

Similar to the situation of O-rings, not all inkjet printers will require PFAS materials for all pumps and valves. In some cases EPDM rubbers can be used or a gear pump can be used instead of a diaphragm

[1] https://dutchwatertech.net/en/kenniscentrum/chemical-resistance-epdm/
https://www.kendrion.com/fileadmin/user_upload/Downloads/Datasheets_Operating_instructions/Valves_Fluid_Control/Chemical-resistance-valve-technology-Kendrion-EN.pdf
https://www.fernco.com.au/wp-content/uploads/2022/07/Fernco-Rubber-Chemical-Resistance-Chart-V002JUL22-LR.pdf

pump. Although it leads to a significant increase in cost, it leaves out the diaphragm. Nevertheless, gear pumps are not compatible with UV curable ink. They break down quickly.

Stop using UV curable inks and move to aqueous inks is also not an option. Both ink systems have their own application range. UV inks provide a better robustness, water resistance and adhesion to non-paper media. For printing books and paper document aqueous ink can be used. For outdoor applications and several non-paper application UV ink cannot be replaced by aqueous ink.

required timing on replacement

Currently there are no other materials known that can serve as replacement for the PFAS materials in O-rings, valves and pumps. New materials will have to be developed and no quick solution is foreseen. A derogation for 12 years is required with the possibility to extend if no suitable materials have been developed after 12 years.

cost of substitution

Since no alternative is known, the costs of substitution are not known either. If no derogation is granted, the costs will be enormous because it will no longer be possible to sell any inkjet printer.

CASNR or chemical name of the PFAS substances used

The substances involved are PTFE, PVDF, FKM and FFKM.

tonnages of PFASs used

For annual volumes, see appendix 2.

emissions to the environment

Emissions to the environment are not expected during the lifetime of the article. The are no volatile PFAS components, there is no emission. Only in the waste phase the materials will be discarded. The printers are treated as electronic waste and will be handled and disposed of according to all locally applicable regulations.

3. Sealing materials (O-rings, gaskets), tubing, valves and pumps in manufacturing sites for printer components and for printing inks

technical function of the PFAS

Printers contain several components that require special manufacturing processes. These components include printheads, photoconductor drums or belts, fixation rollers etc. The manufacturing process includes chemical processing using solvents and other liquids. When certain solvents are used and especially at elevated temperatures the only flexible materials resistant to these chemicals are fluoropolymers.

There are several uses of PFAS in the factories where printing inks are manufactured. Those parts of the equipment that come into contact with ink, its ingredients or other chemicals must be resistant to these chemicals. If there is an interaction between the material and the chemical, the material will start swelling, deforming, degrading or dissolving. The result is that the product gets contaminated with the equipment material and even worse, the equipment will start leaking.

For rigid materials, stainless steel is a suitable material. For flexible and moving parts plastics or rubbers must be used. As already described in the section about the use of PFAS in inkjet printers there are only a few materials that are resistant to all inks. For an ink factory the situation is more critical because ingredients are processed in their pure form (instead of only diluted in the ink) and sometimes at elevated temperatures. Only fluorinated materials are resistant against all ink ingredients.

PFAS therefore have to be used for example in:

- Valves (PTFE ball valve seats allow opening and closing of the valve while ensuring non-leaking when it is closed)
- O-rings (used for closure and sealing of lids, connectors etc)
- Diaphragm pumps (the diaphragm is moving and must be flexible)
- Gaskets (rotating parts like the axis of pumps and stirrers)
- Flexible tubing (rigid piping is not possible when equipment parts are moving)

In the absence of an exemption for the use of certain PFASs, the manufacturing of printer components and printing inks will no longer be possible in the EU and it will have to move to non-EU countries. This will have a huge impact on the EU economy and will lead to extremely high costs for printer companies to build new factories outside the EU.

information on (lack of) alternatives

Because of the required flexibility and sealing properties, only plastics and rubbers can be used. These plastics and rubbers must be able to resist the chemicals they are in contact with.

The type of plastic and rubber that can be used depends on the chemical and on the temperature of use. When the medium is water, non-PFAS rubbers can be used for sealing. Examples of non-PFAS materials are: EPDM rubber and silicone rubbers.

As explained in the section about ink handling components in printers, for several applications only fluorinated materials are not affected by ink and ink components. Currently no alternative is known.

PFAS materials that are used for this application include

- PTFE (9002-84-0)
- PVDF (24937-79-9)
- FKM
- FFKM

Currently there are no alternatives known. The suppliers of the process equipment and parts do not have suitable PFAS-free parts available. If an alternative has to be developed, first the material has to be developed, then the manufacturer of the equipment has to design equipment using the new materials. When new equipment parts are to be used in existing equipment it usually does not fit in the same way as the old part. To some extend the piping and the connections have to be changed. Considering that there are several thousands of parts with PFAS in a factory (a first count in the ink factory of a member company resulted in over 2000 parts; probably still incomplete), it is a significant effort to replace a PFAS-containing part by a future PFAS-free part once the old part fails. So even after PFAS-free equipment parts would become available it will take time to make the factory suitable for using them. Therefore a 12 years exemption is requested, with the possibility to extend the exemption if no alternatives are available yet after 12 years.

required timing on replacement

Since no alternative material is known yet, the timing is also unknown.

cost of substitution

Since no alternative material is known yet, no information on costs of substitution can be provided.

CASNR or chemical name of the PFAS substances used

PFAS materials that are used for this application include

- PTFE (9002-84-0)
- PVDF (24937-79-9)
- FKM
- FFKM

tonnages of PFASs used

The articles can either be fully made of PFAS or have a PFAS coating. The total PFAS usage in a typical manufacturing site is not exactly known but is estimated to be around 100 kg or a few hundred kg per year. The number of toner and ink manufacturing sites in the EU is limited. The total usage in toner an ink manufacturing is not expected to exceed one or a few tons per year.

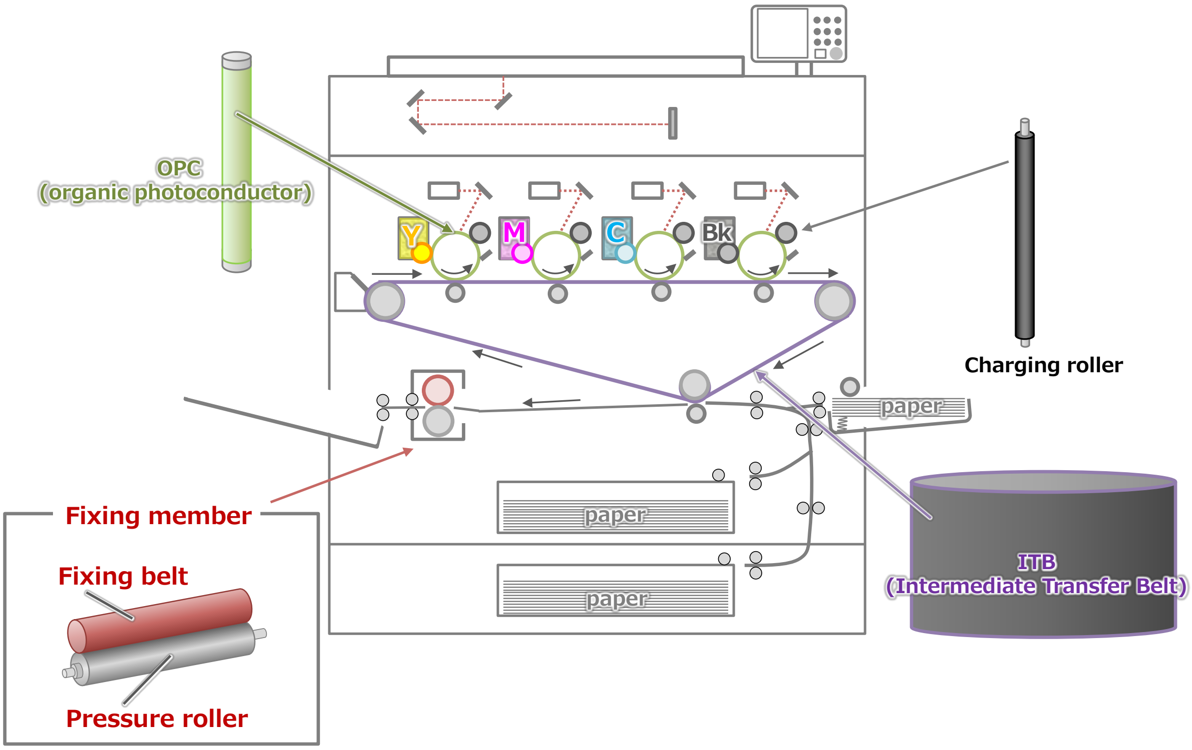
emissions to the environment

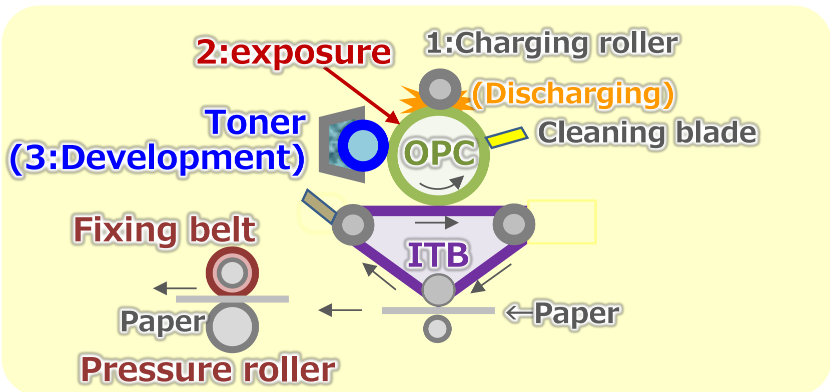
Emissions to the environment are not expected during the lifetime of the article. The are no volatile PFAS components, there is no emission. Only in the waste phase the materials will be discarded. Discarded equipment parts are often treated as metal waste and will be handled and disposed of according to all locally applicable regulations.

4. Electrophotographic printers

technical function of the PFAS

In electrophotographic printers and copiers, PFAS materials are used in parts that come into contact with toner or are at the core of the printing process and are subjected to high stress such as high temperature or high voltage. These are for example the charge roller, photoconductor drum, intermediate transfer belt (ITB), fuser parts. See the pictures below for the location of these parts in the printer. More explanation about the function of a printer can be found in several open sources on the internet.





With the current technology, there is no substitute alternative that can maintain the same quality as PFAS materials, and if PFAS materials become unavailable, the image output becomes impossible in the electrophotographic device. As a result, there is a risk that the product is no longer usable as a printer.

For the charge roller, the photoconductor drum and the ITB the available non-PFAS alternatives have not yet achieved sufficient performance. However, with technological progress the challenges could be overcome in the future. For the fuser parts the alternative components have no prospect of becoming functioning alternatives.

The charge roller, photoreceptor drum, intermediate transfer belt (ITB), and fuser parts used in electrophotographic products need to have a good releasability with toner. Toner consists of small particles and in order to avoid contamination of the printing system, it must be possible to release these particles again from the roller, drum, ITB and fuser parts. To improve the releasability with the toner, a PFAS compound is contained in the surface layer.

Charge roller, drum and intermediate transfer belt (ITB)

In the charge roller, photoreceptor drum and ITB, the surface in contact with the toner uses electrostatic force to move the toner. In other words, the toner and parts slide against each other while constantly being exposed to high voltage electrical energy and friction energy. These components must continue to exhibit releasability under severe conditions. Fluoropolymers, which are PFAS, are chemically stable and durable, and can exhibit release properties for long periods even under these harsh conditions. In addition, the latest electrophotographic products tend to use smaller toner for better image quality. This is to reduce the graininess of the image and to reduce the amount of toner used. On the other hand, the smaller the particle size of the toner, the less the release property of the toner, and therefore, the more waste toner remains. Fluoropolymers can reduce the amount of waste toner in the first place, so that they can meet the ever-increasing demand for reducing toner waste. In addition, PFAS compounds in the charge roller, photoconductor drum and ITB also have a friction-reducing effect, which can reduce the amount of wear on these components and reduce the frequency of replacement, thereby contributing to waste reduction. Depending on the customer's usage, it is quite possible that a component that can last from six months to the life of the machine using fluoropolymers, etc. will only last for a few days or months without PFAS.

Fuser parts

The fusing process is a process in which the toner is instantly melted and the melted toner is soaked into the paper fibres to fix the toner on the paper. At this time, the fuser contacts the toner and applies heat (up to approx. 240 °C) and pressure (up to approx. 0.6GPa) to bring the toner into contact with the paper. The toner containing resin or wax melts and penetrates into the paper fibres. At this time, the toner should remain on the surface of the paper but not on the surface of the fixing member. For this reason, it is necessary to have a material that maintains the releasability to the resin under high temperature and high pressure, and whose performance can be obtained stably over a long period of time. In addition, materials are limited in the sliding part with the heater, which is another key part in the fixing process. In the sliding portion between the heater and the fuser belt, the material and grease must be a material that remains highly slidable even at high temperatures up to approx. 270 °C. The fluoropolymers and fluoropolyethers currently in use are chemically stable and have excellent heat resistance, as well as excellent releasability and slideability, and their performance is stable over a long period of time.

Fuser parts: rollers in high-speed printers

In high-speed printers that have monthly print volumes of several hundreds of thousands up to millions of prints per months, contamination of the fuser system can be a significant problem. Small amounts of additives from the paper can be transferred to the fuser belt during the fusing of the toner. Because of the large printing volume, these small amounts can build up to significant quantities over time. The presence of substances that originate from the paper cannot be influenced by the printer manufacturer. However, in these high-volume printers cleaners are included that clean the fuser belt. Unfortunately not all substances can be cleaned for 100%. Some substances can migrate to the rollers in the fuser unit (e.g. the pressure roller or one of the rollers inside the fuser belt). When these substances accumulate, they can cause swelling of the outer layer of the rollers, which is made of rubber. This swelling is not evenly distributed along the roller. One part of the roller will get a larger diameter then another part of the roller. This will result in serious printing problems. Examples of these problems are: a cleaner that does not function on the complete width of the belt anymore, speed differences across the fuser belt or temperature differences across the fuser belt. This results in print quality problems or severe pollution of the printer to the extent that the printer will fail.
To prevent the build-up of contamination in the rollers, the outer layer of the rollers is covered with fluoropolymers. Fluoropolymers are resistant to most other chemicals. In this application they are inert to swelling due to contaminants. Fluoropolymers are also resistant to the temperatures of up to 175 °C in these systems and are strong enough to withstand the mechanical forces in the system.

information on (lack of) alternatives

For the charge roller, photoconductor drum and intermediate transfer belt (ITB) alternative materials have been investigated. The performance is not sufficient yet, but with further progress in research the challenges could be overcome. If the same quality as PFAS materials cannot be achieved, it may be necessary not only to change the materials of the above components but also to redesign the unit configuration and control mechanism of the whole electrophotographic machine.

For the fuser parts, there is no expectation that the technical problems with the available alternatives will be overcome. The development of alternatives will have to start from scratch again, as there are currently no alternatives that can play the full role of PFAS. In addition, even when the properties required by the material quality are not achieved, the fundamental principle of fusing cannot be changed, so that the lack of properties cannot be compensated by redesigning the machine. So far, no replacement is in sight.

See the confidential appendices 3, 5, 6 and 7 for more details.

required timing on replacement

There are currently no candidates for alternative materials, and the development of materials that can achieve comparable performance needs to start from scratch.

In addition to the search for alternative PFAS materials to achieve equivalent release and lubricity, it will take approximately seven years to develop the required electrical, optical, and durability fittings for each component. It would also take five years to evaluate the production process to produce each component with alternative materials for PFAS, the start-up of the production equipment and its deployment to various products, including current products. As a result, we believe a total of at least 12 years is necessary.

Also, if the development of alternative materials does not go well, it may be necessary to develop materials that have tried an entirely different approach, such as inorganic surface materials, or other means that do not rely on material properties. In that case, it will be necessary to develop manufacturing equipment, and there is a possibility that even 12 years will not be sufficient.

cost of substitution

Information on the costs can be found in the confidential appendices 3, 5, 6 and 7.

CASNR or chemical name of the PFAS substances used

The substances are all fluoropolymers.
See attached confidential appendices 3, 5, 6 and 7 for details on substances and volumes.

tonnages of PFASs used

See attached confidential appendices 3, 5, 6 and 7.

emissions to the environment

These components are manufactured both in the EU and outside the EU and are included in the electrophotographic printer. They are also replaced by service personnel as consumables and service parts.

Despite the fact that copiers and printers use about 0.0001% to 0.1% PFAS by weight (depending on the type of printer), they play a crucial role, especially when it comes to fuser parts. Therefore, if the use of PFAS is effectively prohibited, the entire copier must be discarded even if the use of PFAS is only at most 0.1%.

According to International Data Corporation (IDC), about 17 million copiers and printers that use electrophotography and inkjet technology are shipped to Europe annually. These are estimated to be approximately 500,000 tons by weight. If the number of copiers and printers already on the market is estimated to be about 5 times the annual sales, the number in operation would be 85 million. It is estimated that if all of these were discarded, 2.5 million tons of waste would be generated when the regulations were implemented. The impact on the environment is enormous.

In copiers and printers, parts including PFAS do not come into contact with people. The aforementioned fuser parts, photoreceptor drums, ITBs, and charge rollers are not touched by people during the service life of the copier, except by the service technician who replaces them. There are no volatile PFAS components, there is no emission.

In addition, because the fluoropolymers are chemically stable, it is almost impossible for them to react chemically with the human body when touched. Contact with human bodies and the environment is limited after disposal, but as mentioned above, the WEEE directive is followed and the risk of contamination is minimized. It is unlikely that PFAS caused by copiers and printers will spread into the environment and become a source of pollution that threatens the human body.

5. Paper guiding parts

technical function of the PFAS

In high speed printers the paper is transported through the printer by many different parts. Because of the high speeds there can be high friction forces between the paper and the printer parts. In some cases this can lead to contamination of these parts with toner and ink. When the contamination builds up during use of the printer, it will damage the prints and eventually lead to paper jams. This is often solved by using low friction and non-stick PTFE parts or PTFE coatings on parts.

Paper guiding rollers

"Continuous feed printers" do not print on cut sheet papers, but on large rolls of paper that are cut into sheets after printing. These are high speed production printers. Monthly production print volumes reach several millions of pages per month. The inkjet printing process on a continuous paper feed includes a paper transport system with a series of rollers to pass the paper through the first print station (with sub functions inkjet print heads, drying, cooling), a turning unit and the second print station for two sided printing. These printers are well-balanced systems and are the result of over a decade of research, development and step-wise product improvements. In the most recent generation of these printers some paper transport rollers are coated with PTFE.

The printing process includes the following main functions:

- jet ink droplets on paper side 1 by drop on demand printheads
- dry ink on paper to achieve sufficient robustness of the printout
- cool down paper to allow further processing
- turn over paper side
- jet ink droplets on paper side 2
- dry ink to achieve sufficient robustness of the printout
- cool down paper to allow further processing

See confidential appendix 4 for a more details.

Technological innovations to improve colour gamut and resolution have been driving factors for successful marketing of new inkjet production printing systems. In order to achieve these targets new ink recipes have been developed.

Ink composition is constrained by many factors such as environmental requirements (water based inks), print quality, incl. e.g. colour gamut and good ink adsorption on a wide range of papers, stable jetting properties of the picolitre-size droplets, long storage stability. Also drying properties are taken into account but need to be balanced with all other key aspects. Due to these limitations ink has not yet reached full robustness after the fixation unit. Robustness of the print will come with time, but when the paper is still in the printer, immediately after drying, the ink tends to stick to contact surfaces. This results in problems with ink pollution on the transport rollers. To prevent ink pollution and deterioration of print quality an anti-adhesive coating based on PTFE is used for the rollers after the drying unit.

Paper heating and guiding plates

In high speed cutsheet printers, metal plates are used to guide the paper and/or to heat the paper. The warm paper will move along these plates. Pollution of these plates with toner must be avoided. Also pollution from pre-printed logos and images on the paper must be prevented. Since these printers print high monthly volumes, small amounts of toner pollution on the plates can quickly build up to larger amounts. This larger toner pollution on the plates will damage (scratch) the prints or can lead to paper jams. The pollution can be avoided by using a PTFE coating on the plates.

Other paper guiding parts

There are other small components involved in the transport of the paper through the printer. For those parts that come into contact with the printed paper and have high friction with the paper, toner or ink contamination will build-up leading to damaged prints and paper jams. Also in these cases including PTFE in these parts lowers the friction, provides non-stick properties and solves the contamination problem

information on (lack of) alternatives

No alternatives are known at this moment. If the PTFE is left out and standard materials are used, there is a build-up of contamination that will eventually lead to damaged prints and paper jams. Cleaning these parts is time consuming and not always possible. The build-up of contamination can be even within a few hours of printing. Leaving out the PTFE is not an option. Alternative low-friction and non-stick materials have been investigated but have not been successful so far.

See confidential appendix 4 for more details on materials that have been tested.

required timing on replacement

The feasibility of alternative coating materials without PFAS is unclear at this moment. The known candidates have been tested and failed. There are no other candidate materials known. New materials have to be invented.
Therefore substitution of the PFAS material has an uncertain lead time. An exemption for 12 years would be required.

Technological innovation could allow other solutions in future. However the risk of not finding a suitable solution without PFAS is estimated high, besides the fact that industrialization of a technological innovation requires high additional efforts and long lead times.

Developing an alternative coating will require at least 12 years due to the required improvement iterations and lifetime testing. In a first step material candidates need to be identified, samples have to be prepared by the supplier and evaluated with respect to anti-adhesive properties and potential side effects on paper transport stability. Each iteration would take at least 6 months. Lifetime testing would start under laboratory conditions within R&D. After successful completion a customer staging is needed with minimum. 1 year duration. Including preparation of serial production and manufacturing ramp up 3-5 years lead time are estimated for market introduction. However, since all known candidate materials have been tested and were not suitable, there is a high risk that no solution compliant to the PFAS restrictions can be found. In that case we have to wait for new materials to enter the market. In that case it can easily take more than 10 years before an alternative is implemented.

An alternative approach could be based on a complete redesign of the printing process including a change of the ink or toner recipe together with modification of printing, drying and cooling process. A modification of these process means that the fundamental design of the printer has to be changed. This will take at least five years and will require at least 50 man years. Given the uncertainty of the feasibility it is also possible that the investment of man years will be twice as much. The total development costs are between 12 and 25 million euro for the coating of the paper guiding rollers only. For the paper guiding plates and other parts similar numbers apply. These are used in a different family of printers. A redesign of that family would have costs in the same order of magnitude.

cost of substitution

The costs of alternative materials cannot be estimated because an alternative material is not known. However, an estimation can be given of the resources required to implement a new material in printers. See also previous section.

A fundamental redesign of the printing processes, eliminating the need for PFAS would cost millions of euro. When taking into account the current annual emission of PFAS use for ten years, a full redesign of the printing system only for this purpose would cost more than 50,000 euro per kg avoided PFAS emission. This is not proportionate if this redesign is done only for avoiding PFAS. However, it is expected that a new generation of printers will be developed and ready to be placed on the market by 2035. This next generation can be designed PFAS free from the start.

CASNR or chemical name of the PFAS substances used

See confidential appendix 4.

tonnages of PFASs used

See confidential appendix 4.

emissions to the environment

Since the materials involved are all polymers with high molecular weights, there is no evaporation or emission to the air. When the equipment parts are end of life, they are discarded as waste metal. Due to abrasion there will be some wear of PFAS containing components. It is estimated that less than 50% of the PFAS material will be released into the environment in this way.

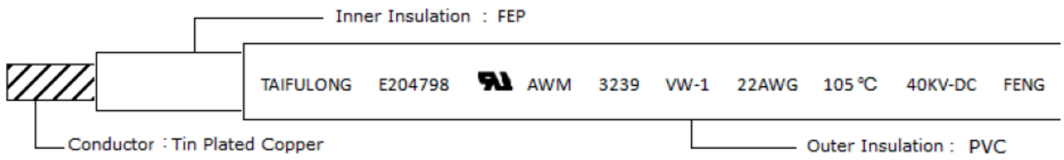
6. Electrical insulation in cabling for special applications in printers

6.1. applications involving PFAS in need of derogation : high voltage cabling

Application name : High Voltage cabling

Application description : Electrical insulation used in cabling for connecting high voltages of 0 – 8 kV to corona wires in order to charge surfaces in an even manner. Corona wires are commonly used in dry toner electro photographical printing processes.

- Needed derogation time : 5 years
- Substance : FEP



technical function of the PFAS

In dry toner printers a corona wire, also known as a corotron or a charge electrode, is an important feature. Its primary function is to generate a corona discharge, which is a high-voltage electrical field that ionizes the air around it.

In order to achieve this effect, a corona wire is connected to a high voltage power supply implementing up to 8kV. This corona wire is used to charge the photoreceptor drum, which is then selectively discharged by LEDs to create the desired image. Corona wires are also used to charge the printing substrate, which then attracts toner particles from the photoreceptor to form the image.

To charge these corona wires high voltage cabling is needed to connect a high voltage supply with the corona wire. Printing equipment manufacturers typically use custom made power supplies and custom made connectors for this function. Due to the superior technical properties of FEP regarding high electrical resistance, high voltage cabling can be created with limited diameters. This enables the mechanical design of subassemblies and machine concepts to be functional in tight spaces, due to the easy cable routing and to have relatively small components and connectors.

information on (lack of) alternatives

High voltage cabling alternatives can be found using Silicone rubber as alternative electrical insulation material. However due to the fact the electrical resistance properties are lower, much bigger layer thicknesses of insulation material is needed. Resulting in a large mechanical impact on our current new machines and an even larger incompatibility problem in replacement spare parts for digital printing machines in the field.

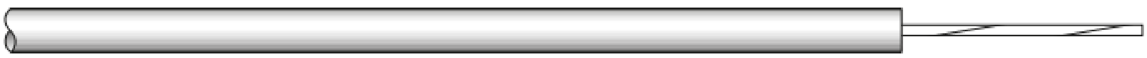
Typical diameter of FEP insulated wire 40kV = D 4.2 mm

Typical diameter of Silicone rubber insulated wire 50kV = D 8.4 mm

The snapshot below shows a part of a high voltage wire with silicon insulation. It states the need for a diameter 8.4 mm for a similar voltage rated cabling wire.

MEDI Kabel

Schaltlitzen – Silikon / *Stranded wire – Silicone*



RoHS COMPLIANT

UL Style 3239

Leiter : Cu-Litze - verzinnt
Isolation : Silikon
Temperaturbereich : +150°C Standard
+200°C Optional
Wanddicke : 1,0 - 3,8 mm
Prüfspannung : 12500 - 62500 V
Betriebsspannung : 10 kV - 50 kV
Kennzeichnung : Bedruckung + Label

Conductor : stranded copper wire - tinned
Insulation : silicone rubber
Temperature range : +150 °C standard
+200 °C option
Wall thickness : 1,0 - 3,8 mm
Test voltage : 12500 - 62500V
Operating voltage : 10 kV - 50 kV
Marking : printing + label

AWG-Nummer *AWG number*	Querschnitt *Cross sectional area* mm²	Leiteraufbau *Stranding* mm	Ader *Outer* Ø mm	Cu-Zahl *Copper Weight* kg/km	Gesamtgewicht *Total Weight* kg/km	MEDI Artikelnummer *Part number*
24	0,21	19 x 0,127	2,6 – 8,2	2,0	10,3-87,2	128 xx 24 . .
22	0,32	26 x 0,127	2,8 – 8,4	3,1	12,5-92,3	128 xx 22 . .
20	0,52	16 x 0,20	2,9 – 8,5	5,0	14,8-96,0	128 xx 20 . .
18	0,82	26 x 0,20	3,2 – 8,8	7,9	19,6-105,0	128 xx 18 . .
16	1,31	42 x 0,20	3,4 – 9,0	12,6	25,2-113,5	128 xx 16 . .
14	2,08	41 x 0,25	3,8 – 9,4	20,0	35,0-129,0	128 xx 14 . .
12	3,31	65 x 0,25	4,2 – 9,8	31,8	48,8-148,5	128 xx 12 . .
10	5,26	105 x 0,25	5,2 – 10,8	50,5	76,4-190,3	128 xx 10 . .

Mechanical impact on new machines

Cable routing

Cable routing of high voltage cabling is extremely important. High voltage cables must not touch metal edges in order not to have issues with electrical breakthrough and cabling derogation. Therefore routing these cables in tight spaces is a challenging matter in the mechanical design process. In order to have a good cable routing custom made injection molded parts are being used.
Obviously, when the cabling diameter should almost double, this design exercise will become more challenging and will result in changing existing molds or even produce new injection molds to come with larger cabling diameters.

Wire connection on custom made power supplies

Printing press manufacturers typically use custom made power supplies to power the corona wires using the high voltage cabling. The connection to these power supplies is done by using faston elements that are crimped on the high voltage cabling.

In order to make a correct and strong connection both the electrical conductive part and the insulation must be attached to the faston. When the outer diameter of the high voltage cabling enlarges (doubles) this becomes more challenging in sourcing the correct cabling components. No alternatives have currently been found so exploration of new connection methods is needed.

Wire connection on custom made corona wire connectors

Specific custom made connectors for connecting the high voltage cabling to the corona wire are typically created for these corona wire applications. These connectors all rely on the diameter of the cable being smaller than 5mm.

In order to cope with higher diameters these molds for these connectors need to be reworked or even new molds need to be made.

required timing on replacement

See confidential appendix 8.

cost of substitution

See confidential appendix 8.

CASNR or chemical name of the PFAS substances used

Chemical Name : FEP
CAS Nr. : 25067-11-2

annual tonnages of PFASs used

See confidential appendix 8.

concentration ranges in these articles

A substantial part of a high voltage cable is made out of PFASs : in a typical example it is 54.4 %

emissions to the environment

FEP insulation in cabling comes in a solid form and have no abrasion applications. No emissions are expected during use as they will not melt of sublimate in their application.

measures to minimise release into the environment

- All High Voltage wires containing FEP are colored red, future alternatives will have other colors for identification.
- Spare usage in general is really low, lifetime of these wires are high. Spare components are only distributed for accidental breakage due to calamities or due to electrical breakthrough issues.
- Spare part wires will in future contain documentation to alert then service technician and to give instructions on how to dispose.
- Documentation for decommissioning of printing press machines will contain information regarding the components using PFAS substances in order to dispose correctly.

6.2. applications involving PFAS in need of derogation : high temperature wiring

Application name : High temperature wiring

The use of high PTFE or other PFAS wire insulation for high temperature applications is very common and also used in some printers, with no non-PFAS alternative for temperatures above 180 °C.
We believe alternatives can be found by using glass fiber insulation but we (and our suppliers) also need a derogation period in order to implement this alternative.
Reference is made to confidential appendix 11.

6.3. applications involving PFAS in need of derogation : wiring with possible contact with specific chemicals

Application name : wiring with possible contact with specific chemicals

technical function of the PFAS

Another use of PFAS as wire insulation for which there is currently no non-PFAS alternative is when contact with specific chemicals is possible, a situation that also occurs in some printer equipment.
Wires on or near the printhead and ink system can come into contact with ink. Other wires might come into contact with vapors evaporated from the ink system. Prolonged contact with chemicals can deteriorate wire insulation material. PTFE (and other fluoropolymers) are highly resistant to these chemicals. Non-PFAS materials are less resistant to chemicals. Depending on the chemicals used, it can be necessary to use fluoropolymers as wire insulation.

information on (lack of) alternatives

No alternative is currently known. The chemical resistance of PFAS is unique.

required timing on replacement

See confidential appendix 8.

cost of substitution

See confidential appendix 8.

CASNR or chemical name of the PFAS substances used

Chemical Name : PTFE
CAS Nr. : 9002-84-0

annual tonnages of PFASs used

Although no exact numbers are available, the total amount of PFAS used in this application is small. Most wiring in printers can be made without the use of PFAS.

concentration ranges in these articles

A substantial part of a cable is made out of PFASs.

emissions to the environment

PTFE insulation in cabling comes in a solid form and have no abrasion applications. No emissions are expected during use as they will not melt of sublimate in their application.

measures to minimise release into the environment

No emissions are expected during use.

7. Optical sensors

technical function of the PFAS

An optical sensor is a mechanism used on certain types of ink cartridges to detect the presence of ink in the cartridge. The ink is detected by reflection differences on the surface of the optical sensor from ink or air. This part of the cartridge must remain clean to perform its function. If ink remains on the surface of the optical sensor, the printer will keep moving even if there is no ink in the cartridge.

It is essential that the ink does not stick to the surface of the optical sensor. To achieve this, PFAS is used as a water repellent in the optical sensor technology. Because the optical sensor remains clean, printers can accurately detect ink from ink cartridges.

information on (lack of) alternatives

see confidential appendix 12.

required timing on replacement

see confidential appendix 12.

cost of substitution

see confidential appendix 12.

CASNR or chemical name of the PFAS substances used

Undecafluorohexanoic acid, PFHxA,
CASNR: 307-24-4

annual tonnages of PFASs used

see confidential appendix 12

concentration ranges in these articles

emissions to the environment

see confidential appendix 12

measures to minimise release into the environment

see confidential appendix 12

CONFIDENTIAL APPENDIX 1

This section contains confidential business information and is added as a separate confidential attachment.

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CONFIDENTIAL APPENDIX 2

This section contains confidential business information and is added as a separate confidential attachment.

CONFIDENTIAL APPENDIX 3

This section contains confidential business information and is added as a separate confidential attachment.

CONFIDENTIAL APPENDIX 4

This section contains confidential business information and is added as a separate confidential attachment.

CONFIDENTIAL APPENDIX 5

This section contains confidential business information and is added as a separate confidential attachment.

I & P Europe
Imaging and Printing Association

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CONFIDENTIAL APPENDIX 6

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CONFIDENTIAL APPENDIX 7

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CONFIDENTIAL APPENDIX 8

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CONFIDENTIAL APPENDIX 9

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CONFIDENTIAL APPENDIX 10

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CONFIDENTIAL APPENDIX 11

This section contains confidential business information and is added as a separate confidential attachment.

CONFIDENTIAL APPENDIX 12

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