# Factsheet "PFAS in power tools”

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| Fig. 1, Illustrative picture of a power tool<br>© Mirka Ltd. | Fig. 2, Illustrative picture of a power tool<br>© Mirka Ltd. | Fig. 3, Illustrative picture of the battery pack used in power tools<br>© SERSOLL – stock.adobe.com |

## Product(s):

- **Products**: In the power tools sector, PFAS is used in components and batteries of all different kinds of power tools, such as hammers, drills, saws, angle grinders, or sanders.
- **Function:** Power tools are designed to make tasks easier and more efficient, providing higher speed, precision, and effectiveness in various applications. They make some tasks possible in the first place and are essential for safe and easy work processes in construction, woodworking, metalworking, automotive repair, and other industry sectors as well as DIY projects.
- **Typical customer sectors:** Power tools are used mainly in two vastly different customer sectors. On the one hand, power tools are used by private end-consumers for various DIY projects such as home improvement. On the other hand, power tools are used widely by different kinds of professionals, such as in the construction or automotive industries or by craftsmen, for example when erecting or renovating buildings or installing energy infrastructure.

## Market Information:

- **Market environment:** The power tools sector employs ca. 170.000 people and has an annual turnover of around 8 billion €.
- An estimated 65% of these jobs and turnover is accounted for by products containing fluoropolymers, as battery-powered products make up a rapidly growing 50% of the market, with additional products such as chainsaws coming on top of that.
- The power tools sector has highly complex supply chains, with a strong production base in central Europe, while producing for international markets.
- Power tools must be easy and safe to use, reliable, and have the necessary power for various kinds of professional applications, while often being subjected to rough environmental conditions, such as wetness or very high or low temperatures. Portable lithium-ion batteries offer important characteristics in this regard such as high specific energy and power, which are valued by customers in the power tools sector, as proven by the growth of the cordless/battery-powered segment.
- Power tools due to their wide usage and the dependence of many industries and professionals on them to fulfil their tasks easily and safely, are vital for the European Union goals of the twin digital and green transition. Without power tools, renewable energy infrastructure cannot be installed and maintained,

buildings cannot be renovated to be more energy-efficient, electrical cars cannot be manufactured and new urban infrastructure for public transport or bikes cannot be built.

## Requirements Profile

- Power tools have a very long lifetime (often 10 years or more), which components must support. To be able to further sustain this long lifetime, suitable spare parts must stay available for the same period of time.
- Re-designing and recertifying products takes at least 24 months, taking into account all necessary steps (research and development, production, testing, standardisation, certification, logistics) if the supply chain is secured and test capacities are ensured.
- Power tools are used in varying temperatures, and components must be able to withstand a fluctuation of between -20° and 60° C for batteries and -30°C to 200° C for combustion engines, e.g., in chainsaws.
- **The following chemical and physical properties of PFAS must be ensured:**
  - Flame retardant properties
  - Low coefficient of friction
  - High permeation resistance
  - Mechanical cohesion and strength
  - Resistance to aggressive chemicals (e.g., in battery gaskets and separators; against fuels and engine oils)
- In **combustion engines**:
  - A maximum swelling rate for components of 25% after contact with fuel and oil
  - Keeping flexibility over lifetime in contact with fuel and oil without using plasticisers
  - Withstanding vacuum (-350 mbar at 60°C)
  - Fuel hoses must comply with limit value of 15g/m²d (in CE10 fuels) from EPA III EPA 40CFR 1060.515 and SAE J2996 (2013-01)
  - Low compression set of 40% at 175°C
  - Resistant to aging effects from ozone exposure (40% elongation in conditions of 40°C after 500 hours)
  - Gaskets in combustion engines must achieve a permeation rate of 1,5g/m²d (in CE10 fuels) for the fuel tank to comply with requirements from EPA III EPA 40CFR 1060.515 and SAE J2996 (2013-01)
- **In batteries:**
  - Customers require power tool **batteries** to have short charging cycles to ensure uninterrupted workflow
  - High power must be available in irregular intervals due to the use profile of power tools
  - High performance and rate capability in both the charging and recharging directions
  - Energy to weight ratio is essential, as power tools are held in hands for extended periods of time

## Identified PFAS Uses

### In the finished product

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| **1. Lithium-ion battery packs** |  <br>Fig. 4, Illustrative picture of the battery pack used in power tools<br>© SERSOLL – stock.adobe.com |
| **PFAS substance/substance group:**<br>• PVDF, PTFE<br>• LiTFSI, $LICF_3SO_3$<br>• PFA<br>• FKM | **PFAS-containing material/component:**<br>• **Binders in active material mass**<br>• **Electrolytes**<br>• **Gaskets**<br>• **Separators** |

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| • HFP<br>• VDF<br>• FEP | • **Valves**<br>• **Washers** |
| **Reason for PFAS Use/ Requirements Profile:**<br>• High performance and rate capability in both the charging and discharging directions<br>• Thermal operating conditions between -20 and 60°C<br>• Resistance against mechanical impact to ensure integrity and safety of the battery cells<br>• Good energy to weight ratio as hand-held power tools must be able to be handled in an ergonomic and safe way over prolonged periods of time<br>• PVDF and PTFE in binders in the active material mass are necessary to ensure the integrity of the electrode and enable a homogenous distribution of the slurry.<br>• In next generation batteries, several kinds of fluoropolymers are used to manufacture very thin high-performance gaskets with sufficient thermal stability and high permeation resistance to provide stability in high temperature and high power cells, withstanding up to 280 amps. | |

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| **2. Combustion engines** |  <br>Fig. 5, Illustrative picture of a chain saw using a combustion engine<br>© BillionPhotos.com – stock.adobe.com |
| **PFAS substance/substance group:**<br>• FKM<br>• Fluoropolymers | **PFAS-containing material/component:**<br>• **Manifolds**<br>• **Fuel hoses**<br>• **Inlet needles for carburretors**<br>• **Gaskets** |
| **Reason for PFAS Use/ Requirements Profile:**<br>• Chemical aggressiveness of fuels and engine oils<br>• Very high temperature and pressure in the engine<br>• Components must stay flexible and reliable over lifetime under these conditions to avoid leakage and safety risks<br>• Withstand thermal operating conditions and stay flexible between -30°C and 200°C<br>• Manifold must withstand vacuum (-350 mbar at 60°C) after contact with fuel or oil<br>• Low swelling rates of >25% when in prolonged contact with fuel or oil<br>• Be immune to shrinkage, hardening and settling effects without the use of plasticiser<br>• Withstand the very high-frequency load on the dynamically loaded components in tools such as chainsaws<br>• Permeation rate of max. 15g/m²d (in CE 10 fuels) for fuel hoses to comply with EPA III EPA 40CFR 1060.515 and SAE J2996 (2013-01)<br>• Permeation rate of 1,5g/m²d (in CE10 fuels) for the fuel tank to comply with requirements from EPA III EPA III 40CFR 1060.515 and SAE J2996 (2013-01) | |

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| **3. Power tools as a whole** |  <br>Fig. 6, Illustrative picture of a power tool<br>(c) Mirka Ltd. |

| PFAS substance/substance group: | PFAS-containing material/component: |
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| • Fluoropolymers<br>• FKM, FPM<br>• PFPE<br>• PTFE | • **Housing, high-performance plastics and rubber materials**<br>• **Sealings**<br>• **Adhesives and lubricants**<br>• **Electronic components**<br>• **Cables and wires**<br>• **Screws and bolts, e.g. for securing lawnmower blades in garden machinery** |
| **Reason for PFAS Use/ Requirements Profile:**<br>• Flame resistance<br>• Resistance against chemically aggressive environments<br>• Water and oil repealance<br>• Thermal resistance<br>• Electric insulation<br>• Dielectric properties<br>• Low coefficient of friction<br>• Mechanical and compression strength | |

## Substitution

- Silicone elastomers (e.g., VMQ) in combustion engines:
  - Lack fuel resistance, leading to swelling rates of 100% and more resulting in the destruction of the component
- Elastomers such as NBR, HNBR, XNBR in combustion engines:
  - Contain plasticisers for flexibility, which are washed out by the fuel mix and lead to hardening of the component over time and as a result breaches and leakage
  - The unsaturated polymer chains of these materials age under ozone exposure and develop cracks
  - Heat resistance too low at 150°C (HNBR) and 120°C (NBR) compared to the 200°C combustion engine temperature
- PTFE and PVDF are not substitutable in the active material mass of batteries, as only these fluoropolymers possess the needed fibrillation, chemical, and hydrophobic properties. Other binder systems degrade and cause cell performance and manufacturability issues.
- PFAS such as LiTFSI or $LICF_3SO_3$ in battery electrolytes are not substitutable; for high-performance batteries these substances prevent 20% of degradation of battery life.
- PFA, VDF, HFP, FKM in gaskets of batteries are not replaceable as they have both the necessary mechanical properties and electrical insulation properties (withstand 280 amps).
- PTFE and PVDF in coatings in battery separators might be replaceable in the long-term, as alternatives are in development – However, more time is required for substitution.
- PTFE, FEP, PFA, VDF, HFP, FKM in valves, gaskets and washers of batteries might be replaceable in the long-term, as alternatives are development – However, more time is required for substitution.

## Safe Use: Prevention and Reduction of Emissions and Exposure

- Emissions of PFAS do not arise during the use or production phases of power tools, as they only contain fluoropolymers bound within their components.
- Not all fluoropolymers are known to be toxic and harmful for the human health and the environment, according to the definition of fluoropolymers of the OECD (*OECD, Reconciling Terminology of the Universe of Per- and Polyfluoroalkyl Substances: Recommendations and Practical Guidance, 2021*).
- Waste collection of power tools and power tool batteries is regulated under the WEEE-Directive and the Batteries Directive and Regulation. Manufacturers of power tools and batteries already make sure to participate in information campaigns and provide recyclers with the needed information to safely disassembly power tools according to the WEEE-Directive. In this regard, they additionally cooperate for example in the framework of the Information for Recyclers platform (I4R).

# Socio-economic Impact

## Consequences of the Proposed Restriction

- Many products would significantly worsen in their performance with the proposed restriction, with some potentially not being able to fulfil their same function, satisfying the needs of construction professionals (e.g., battery charge cycles and power).
- For combustion engines, it is not clear how the same level of safety, user-friendliness and level of environmental protection can be ensured without PFAS. This could lead to almost a complete shutdown of production, with severe consequences for jobs and turnover related to these products.
- Even if substitutes for some applications of fluoropolymers should once become available, it is unclear in which amounts those will be available on the market, and if a sufficient supply can be ensured.
- In complex international supply chains, information on PFAS is nigh impossible to track as they have so far not been subjected to regulatory requirements as a group of substances. Therefore, tracking PFAS and providing information to authorities and other companies in the value chain poses a huge administrative burden.
- If PFAS-free alternatives for components, which are essential for manufacturing power tools, were unavailable even for a limited period after the entry into force of a general restriction of PFAS, power tools could not be sold and marketed anymore. This could subsequently endanger the industry as a whole and the 170.000 employees it represents.
- The industry and its high innovation potential for example regarding batteries, which is a major field of competition in the sector, might be incentivised to move their focus to other jurisdictions, endangering the EU's competitiveness versus other established and emerging markets.
- As a result, innovation in the field of batteries could be severely slowed down in the EU, with research and development being conducted in other countries.
- This would severely threaten the EU's ambition to become strategically resilient and self-sufficient and also create a major conflict with the ambitious aims of the green deal, as power tools are as outlined above essential in the installation and maintenance of alternative energy infrastructure, renewable energy, and the construction of more energy-efficient buildings as well as renovation.
- Due to a lower lifetime of products without components containing fluoropolymers, amounts of waste could increase, with the subsequent negative impacts on the environment and an additional burden for waste handling.

## Burden of Proof and Analytical Aspects

- No reliable methods of measurement exist, which can capture the concentration of PFAS on the necessary level of detail needed to comply with the low concentration limits proposed by the dossier submitters. As a result, suppliers of components containing PFAS must first find ways of quantifying this information. Such methods of quantifying and testing should be established by public authorities to be able to verify compliance with the proposed PFAS limit values.

# Required Transition Period and/or Derogations

- We call upon the European Commission, ECHA, its committees and the competent authorities of Member States to consider a general exemption for fluoropolymers of low concern, due to the low risk to the environment and human health they pose, as stated in the cited OECD guidelines (*OECD, Reconciling Terminology of the Universe of Per- and Polyfluoroalkyl Substances: Recommendations and Practical Guidance, 2021*).
- For the typical use cases within the power tools sector, such as housing, high performance plastics and rubber materials, sealings, adhesives and lubricants, electronic components, cables and wires and bolts and screws, no currently known alternative materials are available on the market. **Therefore, we call upon the European Commission, ECHA, its committees and the competent authorities of Member States to consider a derogation for these applications of fluoropolymers of 13,5 years.**
- For the reasons outlined above, fluoropolymers, specifically **FKM, cannot be substituted in components in combustion engines, and we call upon the European Commission, ECHA, its committees and the competent authorities of Member States to consider a derogation for these applications of fluoropolymers, specifically FKM, of 13,5 years**. This time is needed to be able to identify parts and subcomponents, validate the components with a new material, should it once become available on the market, validate the product with the new components, implement assembly pre-development, and in the

worst-case re-design and develop a product, start-up production, implement it in the machinery fleet, turn the existing inventory and lastly recertify the product.

- As outlined above, fluoropolymers are necessary for several uses in rechargeable lithium-ion batteries and cannot be substituted today, which is why **we would ask ECHA, the European Commission and the competent authorities of Member States to consider granting derogations of 13,5 years for the following uses of PFAS in power tool batteries:**

| PFAS Type | Where used in the battery | Type of battery | Derogation / transition period |
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| PVDF | In binder in active material mass | Li-ion wet process (except for the graphite anode) | 13,5 years because no alternative is available |
| PTFE | In binder in active material mass | Li-ion dry process and semi-dry process | 13,5 years because no alternative is available |
| Various PFAS including LiTFSI, $LICF_3SO_3$ (triflate) | In electrolytes | Li-ion rechargeable | 13,5 years because no alternative is available |
| PFA, VDF, HFP, FKM | In gaskets | High energy density batteries which require very thin high-performance gaskets such as Lithium-ion rechargeable batteries | 13,5 years because no alternative is available |
| PTFE, PVDF | In coatings on separators | Li-ion rechargeable | Transition time of 6,5 years because substitution takes more time |
| PTFE, FEP, PFA, VDF, HFP, FKM | In valves, gaskets, washers | Li-ion rechargeable | Transition time of 6,5 years because substitution takes more time |

**Table:** Request for application specific derogations incl. general transition period, Source: ZVEI Power Tool Section

- Furthermore, we call upon the European Commission, ECHA, its committees and the competent authorities of Member States to grant an additional general transitory derogation period of 24 months in addition to the derogation periods for PFAS uses outlined above, because if PFAS free components such as battery cells should once become available on the market, power tool manufacturers need further time for testing and choosing components such as cells and redesigning and recertifying their battery packs and power tools.

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