

## Factsheet "PFAS in Power Tools"

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



### Product(s):

- **Products:** In the power tools sector, PFAS is used in components, electronics 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 by using an external power source such as electricity or rechargeable batteries. By providing higher speed, precision, and effectiveness, 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 time period.
- Re-designing and recertifying products take at least 4 years, considering 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 and dielectric properties (e.g., in printed circuit boards)
  - Low coefficient of friction (e.g., lubricant coatings)
  - High permeation resistance
  - Mechanical cohesion and strength
  - Resistance to high temperature, moisture, dust
  - 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/m<sup>2</sup>d (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/m<sup>2</sup>d (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

### PFAS Uses in Power Tools

<p><b>PFAS substances/substance group:</b> FKM, FPM, PTFE, PVDF, PFPE Bisphenol AF(1478-61-1)(*O-ring)</p>	<p><b>PFAS-containing material/component:</b> Housing, high-performance plastics and rubber materials, coatings, sealings, electronic components, cables and wires, screws and bolts Label(*PTFE), chip saw blade(*PTFE)</p>
<p><b>Reason for PFAS use/requirements profile:</b></p> <ul style="list-style-type: none"> <li>• Flame resistance</li> <li>• Resistance against chemically aggressive environments</li> <li>• Water and oil repellance</li> <li>• Thermal resistance</li> <li>• Corrosion protection and wear resistance</li> <li>• Electric insulation</li> <li>• Dielectric properties</li> <li>• Low coefficient of friction</li> <li>• Mechanical and compression strength</li> </ul>	

<b>PFAS substances/substance group:</b> PTFE, PFPE, PFHxA, PFBS	<b>PFAS-containing material/component:</b> Lubricants, lubricating oils
<b>Reason for PFAS use/requirements profile:</b>	
<ul style="list-style-type: none"> <li>• Lubricity</li> <li>• Abrasion resistance</li> <li>• Low water absorption</li> <li>• Low moisture permeability</li> <li>• Flame retardancy</li> <li>• Durability</li> </ul>	

## PFAS Uses in Batteries

<b>PFAS substances/substance group:</b> PTFE, PVDF, Li-Triflate, LiTFSI, LiBETI, LiFAP, PFA, FEP, VDF, HFP, FKM	<b>PFAS-containing material/component:</b> Binders in active material mass material, electrolytes, gaskets, valves, washers, membranes, separators
<b>1. Cathode binder</b>	
Both PTFE and PVDF are used as binder materials in the active material masses in electrodes in a wide range of battery technologies e.g., Lithium-ion battery packs.	
<b>Reason for PFAS use/requirements profile:</b>	
PFAS binder materials provide a unique combination of properties that are essential for the manufacturing process as well as the performance, durability and safety of the batteries:	
<ul style="list-style-type: none"> <li>• Good dispersion properties during production process</li> <li>• Good adhesive properties on common current collector materials</li> <li>• Suitable mechanical properties (high toughness, certain flexibility)</li> <li>• Thermal stability for production process and safe use</li> <li>• Chemical and electrochemical stability for high durability</li> <li>• Unique fibrillation properties (small amounts needed)</li> </ul>	
<b>2. Electrolytes</b>	
Lithium salts with PFAS anions such as Li-Triflate, LiTFSI and LiBETI are used in the electrolytes for lithium-ion batteries.	
<b>Reason for PFAS Use/ requirements Profile:</b>	
<ul style="list-style-type: none"> <li>• Increased electrolyte stability through chemical mechanisms such as capturing water and avoiding hydrogen fluoride emissions</li> <li>• Significant increase in lifetime duration of the battery and battery operating temperature range</li> </ul>	
<b>3. Valves, gaskets, washers, membranes, separator coatings</b>	
PTFE, FEP, FKM (for valves, gasket, washers and membranes) and PVDF (as binders in ceramic separator coatings) are important for the tightness of the cells and the insulation between polarities inside the cells. While non-PFAS materials are common, certain batteries and applications require the use of PFAS.	
<b>Reason for PFAS use/requirements profile:</b>	
<ul style="list-style-type: none"> <li>• Chemical stability against chemically aggressive electrochemical systems, such as Li-SOCl<sub>2</sub></li> <li>• Increased safety due to higher stability and durability</li> <li>• Unique hydrophobic and permeability properties</li> <li>• Unique properties as very thin high-performance gaskets needed for high performance rechargeable lithium batteries</li> </ul>	

## PFAS Uses in Combustion Engines

<b>PFAS substances/substance group:</b> FKM	<b>PFAS-containing material/component:</b> Manifolds, fuel hoses, inlet needles for carburetors, gaskets
<b>Reason for PFAS use/requirements profile:</b>	
<ul style="list-style-type: none"> <li>• Chemical aggressiveness of fuels and engine oils</li> <li>• Very high temperature and pressure in the engine</li> <li>• Components must stay flexible and reliable over lifetime under these conditions to avoid leakage and safety risks</li> <li>• Withstand thermal operating conditions and stay flexible between -30°C and 200°C</li> </ul>	

- Manifold must withstand vacuum (-350 mbar at 60°C) after contact with fuel or oil
- Low swelling rates of >25% when in prolonged contact with fuel or oil
- Be immune to shrinkage, hardening and settling effects without the use of plasticiser
- Withstand the very high-frequency load on the dynamically loaded components in tools such as chainsaws
- Permeation rate of max. 15g/m<sup>2</sup>d (in CE 10 fuels) for fuel hoses to comply with EPA III EPA 40CFR 1060.515 and SAE J2996 (2013-01)
- Permeation rate of 1,5g/m<sup>2</sup>d (in CE10 fuels) for the fuel tank to comply with requirements from EPA III EPA III 40CFR 1060.515 and SAE J2996 (2013-01)

## ↔ Substitution

- Tested alternative materials for electrical/electronic components, cables and wires have proved to be less stable and functional, which suggests a shorter service life inevitably leading to negative consequences in terms of energy efficiency, quality, safety and product longevity.
- Alternative materials for specific fluoropolymer-coatings in high-performance materials are currently not available. As developments have only started in the market, they might be replaceable in the future. However, longer transition time is required for substitution.
- Various elastomers e.g., NBR, HNBR, XNBR contain plasticizers for flexibility, which are washed out by the fuel mix and lead to hardening of the component over time resulting in breaches and leakage. Especially at high sliding speeds and small shaft diameters (e.g., in the case of radial shaft seals), fluorine-free elastomers cannot meet the necessary requirements. This is mainly due to the limited temperature stability of these materials e.g., HNBR (150°C) and NBR (120°C), which is too low compared to the combustion engine temperature (200°C), but also to the temperature in the sealing contact in radial shaft seals. Alternative sealing concepts, e.g., labyrinth seals, are either not sufficiently effective or structurally unsuitable.
- A few specific uses of lubricants have no material available other than fluoropolymers that can fulfil the needed properties e.g., flame resistance, chemical resistance, lubricity as well as ensuring the smooth movement of drive or sealed components.
- PTFE and PVDF are not substitutable as binder 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.
- Various PFAS including LiTFSI or LICF<sub>3</sub>SO<sub>3</sub> in battery electrolytes are not substitutable for high performance as these substances prevent 20% of degradation of battery life.
- PFA, VDF, HFP, FKM in gaskets of batteries are not replaceable as they have the necessary mechanical, chemical and electrical insulation properties (withstand 280 amps).
- PTFE and PVDF in coatings in battery separators might be replaceable in the future, as alternatives are in development. However, a reasonable transition time is required for substitution.
- PTFE, FEP, PFA, VDF, HFP, FKM in valves, gaskets and washers of batteries might be replaceable in the future, as alternatives are in development. However, longer transition 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.
- 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

- In complex international supply chains, information on PFAS is 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.

- 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.
- 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.
- For the typical use cases of fluoropolymers (e.g., PTFE) within the power tools sector, such as housing, **high performance plastics** and rubber materials, **coatings**, 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 at least 13,5 years**.
- For the use of fluoropolymers (e.g., PTFE and FKM) in **sealing components** within the power tool sector cannot be substituted. 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 at least 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 are of great importance for performance, durability and safety. We would ask ECHA, the European Commission and the competent authorities of Member States to consider granting **derogations of at least 13,5 years** for the following uses of PFAS in **power tool batteries**<sup>1,2</sup>:

PFAS Substance	Where used in the battery	Type of battery	Derogation
PVDF	In binder in active material mass	Li-ion wet process (except for the graphite anode)	At least 13,5 years
PTFE	In binder in active material mass	Li-ion dry process and semi-dry process	At least 13,5 years
Various PFAS including LiTFSI, LiCF <sub>3</sub> SO <sub>3</sub> (triflate)	In electrolytes	Li-ion rechargeable	At least 13,5 years
PFA, VDF, HFP, FKM	In gaskets	High energy density batteries which require very thin high-performance gaskets such as Lithium-ion rechargeable batteries	At least 13,5 years
PTFE, PVDF	In coatings on separators	Li-ion rechargeable	At least 13,5 years
PTFE, FEP, PFA, VDF, HFP, FKM	In valves, gaskets, washers	Li-ion rechargeable	At least 13,5 years

Table: Request for application specific derogations incl. general transition period. Source: ZVEI Power Tool Section  
<sup>1</sup>Submission of Application for derogations from PFAS REACH restriction for specific uses in batteries by RECHARGE [https://rechargebatteries.org/wp-content/uploads/2023/06/RECHARGE-FIRST-submission\\_.pdf](https://rechargebatteries.org/wp-content/uploads/2023/06/RECHARGE-FIRST-submission_.pdf)  
<sup>2</sup>ZVEI Factsheet "PFAS in batteries"

- Furthermore, we call upon the European Commission, ECHA, its committees and the competent authorities of Member States to grant a general transition period of 4 years in addition to the derogation periods for PFAS uses outlined above. Even if PFAS-free components such as battery cells should 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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