Factsheet/Case Study
"PFAS and Electrical Drive Systems"

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Product(s):

- Electrical drive systems in industrial applications and processes drive machines (e.g. Conveyor belts, pumps, compressors, fans, robots, etc.). Optimized drive systems are the key to efficient drive solutions in process and production automation.
- Electrical drive systems mainly consist of the following components:
  → An electric motor that converts electrical energy into mechanical energy
  → A device for controlling the motor and connecting it to the grid; usually a frequency inverter, soft starter or contactor
  → A gear unit that adapts the mechanical power of the motor to the operating point of the machine, i.e. increases the torque by reducing the speed (or vice versa).

Market Information:

- Sales of electrical drive systems in the industrial environment are more than EUR 20 billion and around 130,000 employees in Europe.
- The drive industry is highly export-oriented. In addition to direct exports, a large proportion of products – as products incorporated in machines – are also exported indirectly.
- The PFAS-containing components are typically sourced directly from manufacturers or distributors in the supply chain and are incorporated in products (e.g. Electric motors and frequency inverters).
- Target industries (sample selection): Transport and logistics, intralogistics, automotive industry, food and beverage industry, pharmaceutical industry, Mining, building materials, recycling industry, water treatment, infrastructure for energy supply

Requirements profile

- Motors and frequency inverters are durable capital goods with service life in the range of 10 to 30 years.
- They are easy to repair and require spare parts for their long service life.
- Capital goods generally have very long development times. In general, the different product series remain for many years and are only redeveloped at intervals of several years.
- They are subject to many globally applicable standards with high testing requirements, especially if they are used under demanding operating conditions (e.g. in potentially explosive atmospheres or in corrosive industrial environments).

Identified PFAS Uses

General information:

- The following lists most likely do not cover all PFAS applications, as they are mainly based on voluntary information from our supply chain.
- The requirements mentioned do not always apply at the same time. For example, the temperature resistance can only be achieved at a significantly smaller interval than the specified interval if the mechanical or chemical stress is very high.

In the finished product

<table>
<tr><td>1. Shaft sealing ring
(dynamic seal)</td><td>Example applications:
 
Figure 1: Shaft sealing rings in gear units and electric motors
© SEW-EURODRIVE GmbH & Co KG</td></tr>
<tr><td>PFAS substance / substance group:
FKM, PTFE</td><td>PFAS-containing material/component:
Shaft sealing ring with elastomer part made of FKM, additionally with sealing lip made of PTFE compound depending on the application; additionally with PTFE-containing fleece depending on the application; depending on the application with PTFE protective disk</td></tr>
<tr><td colspan="2">Reason for PFAS Use / Requirements Profile:

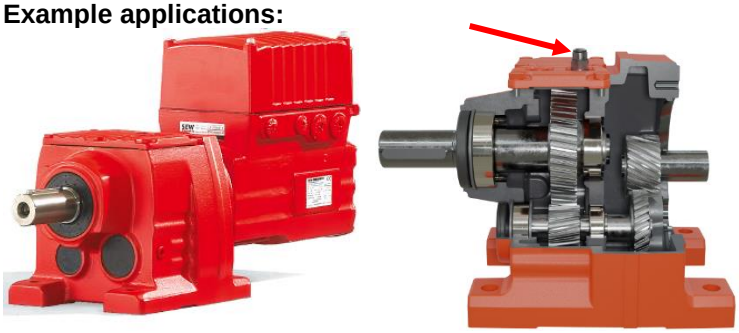
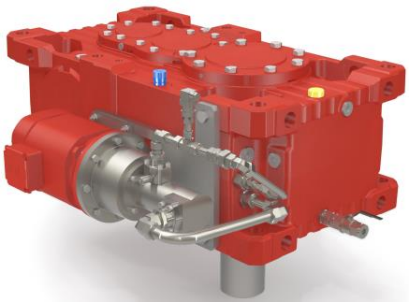
Shaft sealing ring made of FKM
• Only used in demanding situations if NBR is not suitable for technical reasons
• The shaft sealing ring ensures tightness between the housing and the rotating shaft to prevent oil or other lubricants from leaking from the gear unit and at the same time the intrusion of particles that could damage the gear unit. The consequences of oil leakage would be the immediate wear of the gear unit until it fails and the possible contamination of the environment with oil.
• Service life of the shaft sealing ring: At least 10,000, sometimes up to 30,000 operating hours
• Suitable for ambient temperatures from -40°C to +115°C, also up to +200°C depending on application and oil
• Temperature resistance up to a temperature of the gear oil of +150°C.
• Media resistance to gear oils and bearing lubricants as well as, for example, to food, cleaning agents, disinfectants, salt water, waste water
• Resistance to mechanical influences, e.g. due to sand, dust, flour, building materials
• UV resistance</td></tr>
</table>

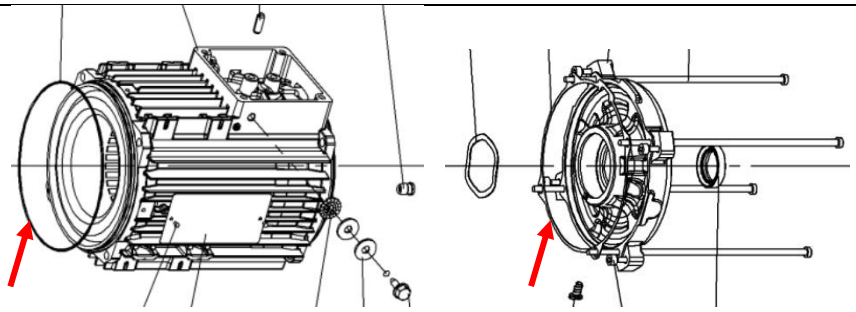
- Low friction coefficient: 0.2 µr or less
- Suitability for varying speeds up to 6,000 min-1 in highly dynamic applications with frequent changes of direction, load changes and high accelerations. NBR shaft sealing rings break at just about 1,800 revolutions per minute.
- For use in potentially explosive atmospheres, the products must meet the applicable Equipment Protection Level (EPL) after passing the climatic storage test according to IEC 60079-0, i.e. the degree of protection IP 5X according to IEC 60529 for equipment groups IIC and EPL Gb or the degree of protection IP6X for equipment groups IIIC and EPL Db.
- Although FKM is more expensive than the standard material NBR, NBR is not suitable for applications in adverse ambient conditions, e.g. in potentially explosive atmospheres or in areas with ambient temperatures of up to +120°C, and also up to +150°C in the short term
- For design with sealing lip made of PTFE compound: Emergency running properties during dry running (relevant for linear movements)

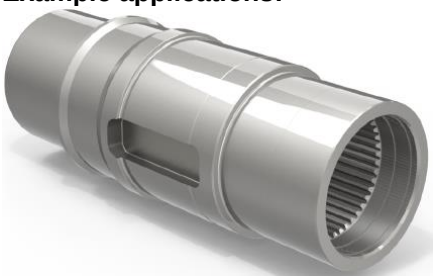
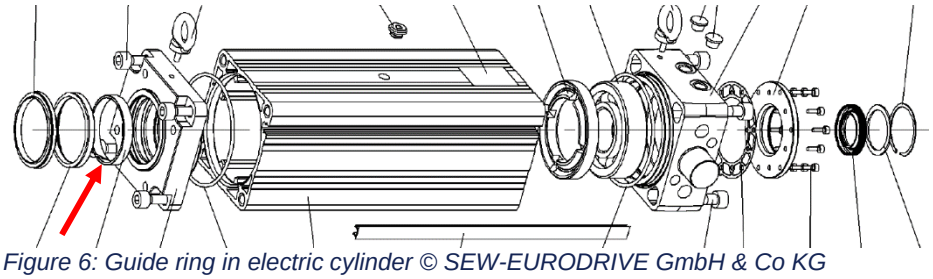
PTFE protective disk
- Sits on the outside of the shaft sealing ring
- Protects the shaft sealing ring against extreme mechanical and chemical influences (e.g. by high-pressure cleaning)
- Suitability for applications in which even FKM shaft sealing rings have proven to be not resistant enough

Protective fleece made of composite material with PTFE
- Sits on the outside of the shaft sealing ring
- Suitable for applications with high contamination and moisture
- Service life: At least 10,000 operating hours
- Suitable for ambient temperatures from -25°C to +115°C.

Electrically conductive fleece made of composite material with PTFE
- Sits on the outside of the shaft sealing ring
- Prevents current passage at the bearings. If current flows through the bearings, electrical erosion occurs and the bearing grease is subjected to extreme stress. The fleece protects the bearings from premature failure.
- Service life: At least 10,000 operating hours
- Suitable for ambient temperatures from -25°C to +115°C.

2. Gasket (E.g. O-ring, flat gasket, sprayed gasket)	**Example applications:**  *Figure 2: Gearmotor with breather valve* *© SEW-EURODRIVE GmbH & Co KG*  *Figure 3: Industrial gear unit with motor pump for pressure lubrication and oil drain valve* *© SEW-EURODRIVE GmbH & Co KG*

	 *Figure 4: Housing of an asynchronous motor with sealing rings* *© SEW-EURODRIVE GmbH & Co KG*
PFAS substance / substance group: FKM, PTFE	**PFAS-containing material/component:** E.g. Gasket on both sides of the motor, on brake mounting, on encoder mounting, on flange; O-rings of plug connectors, Cable glands, screw plugs (e.g. in an oil drain valve, motor flange, motor endshield), union nuts, hydraulic valves, check valves (e.g. in a motor pump); gasket of oil level indicators, flow indicators; PTFE-coated gaskets
Reason for PFAS Use / Requirements Profile: • Used in demanding situations when alternative materials (e.g. EPDM, NBR) are not suitable for technical reasons, e.g. at ambient temperatures ≥ +80°C, surface temperatures up to +150°C, sometimes even up to +200°C. If possible, the cheaper alternative materials are used. • Prevention of moisture and dust intrusion • For gear units: Lubricant compatibility to prevent leakage of gear oil during operation and transport • Suitability for potentially explosive atmospheres (e.g. according to ATEX Directive 2014/34/EU): Suitability for use in potentially explosive atmospheres of category 2 dust and gas, IP degree of protection IP66 after climatic storage according to EN IEC 60079-0 • Suitability for use in hygiene areas (e.g. in the pharmaceutical, cosmetics, food and beverage industry) • Partly assembly-related necessity to reduce the friction of elastomer parts, e.g. with PTFE-coated sealing rings made of NBR. A molybdenum sulfide coating would be unsuitable because it would be rubbed off and does not remain on the part. • Service life: At least 10,000 operating hours	

3. Sliding element	**Example applications:**  *Figure 5: Hollow output shaft of an industrial gear unit with splined inner side and sleeve on opposite shaft end (not shown in the figure) © SEW-EURODRIVE GmbH & Co KG*  *Figure 6: Guide ring in electric cylinder © SEW-EURODRIVE GmbH & Co KG*

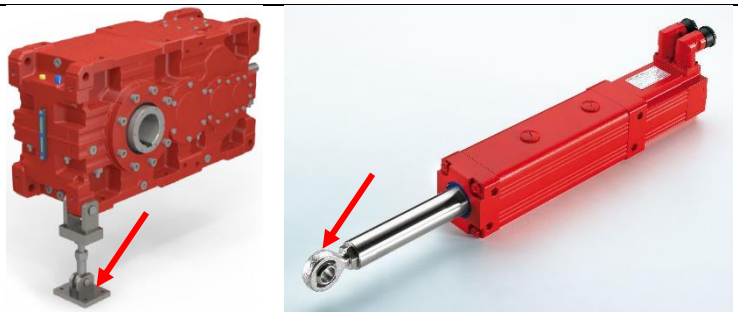


Figure 7: Joint head in the torque arm of an industrial gear unit (left) and in an electric cylinder (right) © SEW-EURODRIVE GmbH & Co KG

Figure 8: Automated guided vehicle with oscillating drive wheels © SEW-EURODRIVE GmbH & Co KG

PFAS substance / substance group: PTFE	**PFAS-containing material/component:** E.g. Plain bearing bushing made of a multi-layer composite material consisting of metal(s) and PTFE-containing coating; plain bearing bushing consisting of a composite material and a PTFE-containing sliding layer; thrust washer made of composite material with PTFE; guide ring made of composite material with PTFE; bearing shell made of composite material with PTFE

Reason for PFAS Use / Requirements Profile:

Plain bearing bushing:

- For hollow output shafts: Sleeve bushing prevents tribological contact corrosion and welding in the hollow shaft
- For automated guided vehicles: Drive wheels are oscillating mounted to compensate for uneven ground (e.g. with plain bearing bushings and thrust washers)
- Sliding properties (low friction coefficient)
- Dimensional stability
- Resistance to mechanical influences, e.g. Wear resistance with uniform or single-sided loads depending on the application
- Service life: At least 10,000 operating hours
- Fixed fit (no migration out of the hollow shaft / bearing during operation)
- For hollow output shafts, additionally:
    - Low wall thickness required. For this reason, bushings made of bronze or plastic are not suitable.
    - Permitted static surface pressure at least 15 N/mm²
    - Temperature resistance from -50°C to +150°C.
    - Wear resistance even in dry running and oscillating movements
    - Maintenance-free
- In case of oscillating mounted drive wheels of automated guided vehicles, additionally:
    - Mechanical load capacity: The oscillating movement leads to significantly more wear locally than with a uniform 360° rotation. The permitted dynamic and static radial load rating of the sleeve bearing bushings must therefore be comparatively high, e.g. the dynamic load rating up to 280.000N and the static load rating up to 400.000N.

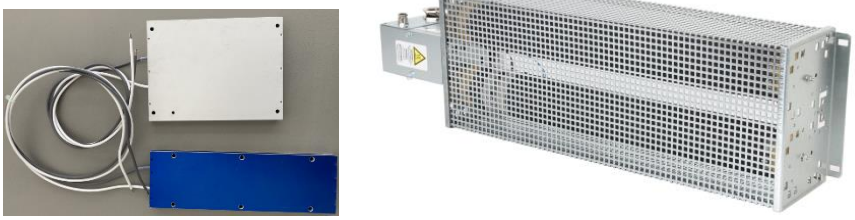
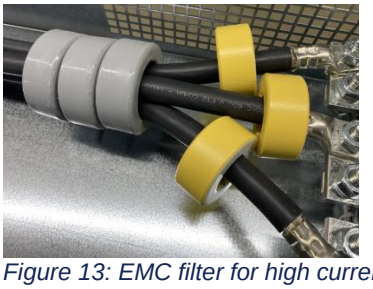
- Maintenance-free

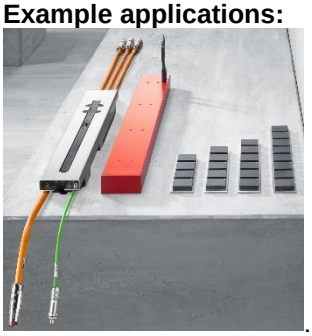
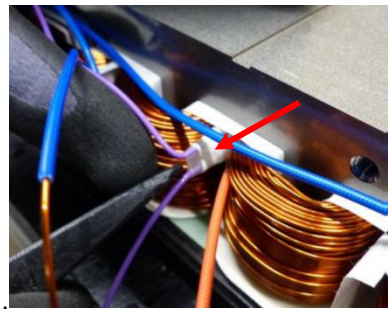
Guide ring
- Sliding properties (low friction coefficient) so that the piston can move freely
- Emergency running characteristics during dry running
- Temperature resistance >+100°C.
- Service life: At least 10,000 operating hours
- Dimensional stability for repeatability
- Lubricant compatibility

Bearing shell (in joint head)
- Sliding properties (low friction coefficient)
- Service life: At least 10,000 operating hours
- Maintenance-free
- High load capacity, even shock loads

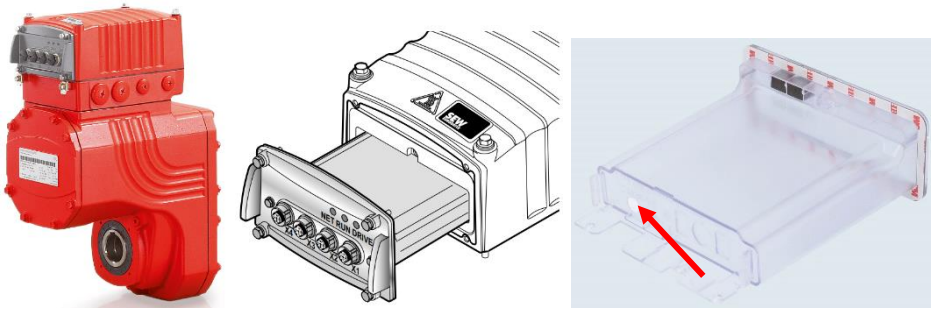
4. Grease	**Example applications:**  *Figure 9: Greased rolling bearings in the electric motor* *© SEW-EURODRIVE GmbH & Co KG*
PFAS substance / substance group: PFPE, PTFE	**PFAS-containing material/component:** Grease

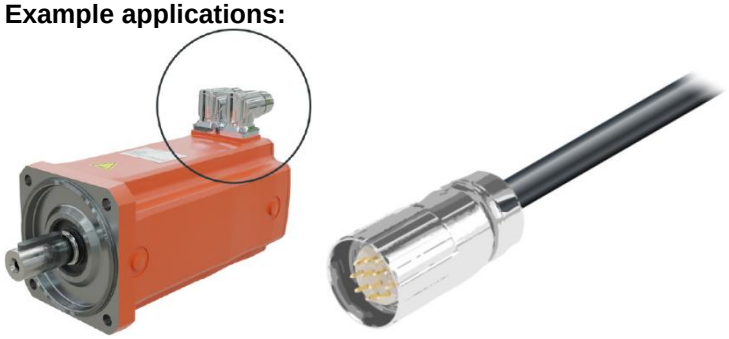
Reason for PFAS Use / Requirements Profile:
- Suitability for particularly high ambient temperatures up to +100°C. PFAS-free grease is only suitable for ambient temperatures up to a maximum of +80°C.
- Compatibility with sealing material
- Temperature resistance up to at least +200°C.
- Low evaporation rate
- Service life lubrication: At least 10,000 operating hours
- Depending on the application: Approval for the food and pharmaceutical industry according to FDA 21 CFR § 178.3570
- Depending on the application: Suitable for use in vacuum environments

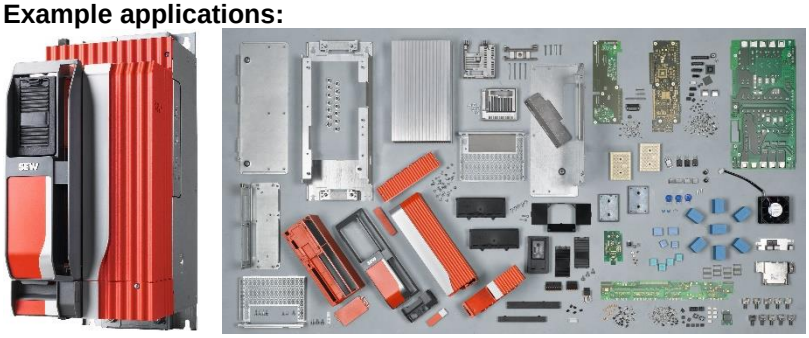
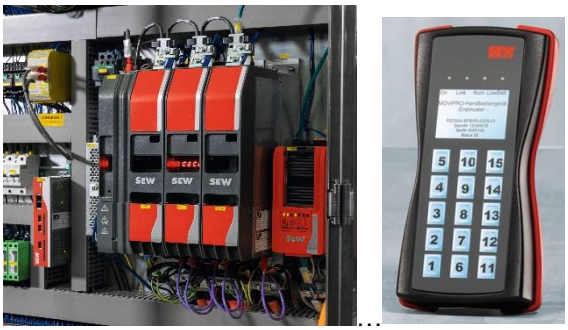
5. Conductor insulation	**Example applications:**  *Figure 10: Conductor in electric motor © SEW-EURODRIVE GmbH & Co KG*  *Figure 11: Left: Rotary encoders in electric motors © SEW-EURODRIVE GmbH & Co KG; right: Mounting brakes for electric motors © KEB Automation KG*  *Figure 12: Braking resistors in various designs; left: © KEB Automation KG; right: © SEW-EURODRIVE GmbH & Co KG*  *Figure 13: EMC filter for high currents © KEB Automation KG*
PFAS substance / substance group: FEP, ETFE, PTFE	**PFAS-containing material/component:** Insulation of the motor winding and conductors of components integrated in the motor housing (e.g. rotary encoder, brake, brake rectifier, brake control, forced cooling fan, sensors (e.g. temperature sensor) and other products that are exposed to high temperatures (e.g. braking resistor, energy storage unit, EMC filter, transformer)
Reason for PFAS Use / Requirements Profile: • Normative requirements for electric motors: ANSI/UL 758; NEMA HP 4, IEC 60034-1 • Temperature resistance at least up to +200°C, housing temperatures of up to +250°C occur with braking resistors, and also up to 350°C in the event of heat accumulation • Suitability for nominal voltages up to AC 690 V. • Electrical dielectric strength (high voltage test of electric motors at up to 2900 V AC and 50 or 60 Hz, of braking resistors at 4000 V AC and 50 Hz, both for a duration of 1 min) • Flexibility and low friction coefficient: The conductor must withstand mechanical influences during assembly, e.g. due to edges, tight space conditions • Chemical resistance and aging stability in aggressive ambient conditions	

6. Heat shrink tubing	**Example applications:**   *Figure 14: Linear drive with temperature sensor © SEW-EURODRIVE GmbH & Co KG*
PFAS substance / substance group: PVDF, PTFE	**PFAS-containing material/component:** Heat shrink tubing in the temperature sensor made of PVDF or PTFE
Reason for using PFAS/requirement profile: • Normative requirement: Thermal protection for rotating electrical machines according to EN 60034-11 • Temperature resistance up to at least +175°C (in shrunken state) • Flexibility and low friction coefficient: The heat shrink tubing must withstand mechanical influences, especially during assembly, e.g. due to tight space	

7. Flame-retardant plastic	**Example applications:**   *Figure 15: Left: Energy storage unit with housing made of flame-retardant plastic © SEW-EURODRIVE GmbH & Co KG* *Right: Frequency inverter with housing made of flame-retardant polycarbonate © KEB Automation KG*
PFAS substance / substance group: E.g. PTFE	**PFAS-containing material/component:** E.g. flame-retardant device housing, e.g. made of polybutylene terephthalate (PBT) or polycarbonate (PC); electrical component (e.g. PCB relay) with component(s) made of flame-retardant plastic
Reason for PFAS Use / Requirements Profile: We have very little information about PFAS in flame-retardant plastics. The requirements listed below are to be understood as an example. PFAS-containing flame protection may already be required for lower requirements. • Flame protection and flame retarding to prevent or Deceleration of fires (UL fire class according to UL94: 5VA; Relative temperature index (RTI) according to UL standard 746B: ≥ 70°C; Hot-wire ignition (HWI) according to UL standard 746A: Performance Level Category (PLC) ≤ 3; High-Current Arc Ignition (HAI) according to UL standard 746A: Performance Level Category (PLC) ≤ 2) • Electrical dielectric strength (Comparative Tracking Index (CTI) according to UL standard 746A: Performance Level Category (PLC) ≤ 3)	

8. Pressure compensation element (DAE)	**Example applications:**  *Figure 16: Pressure compensation element in the electronics cover of a decentralized drive system © SEW-EURODRIVE GmbH & Co KG*
PFAS substance / substance group: PTFE	**PFAS-containing material/component:** PTFE layer on fleece
Reason for PFAS Use / Requirements Profile: • Used to vent housings (pressure compensation) and to prevent the intrusion of damaging media (e.g. dirt) and liquids, which could restrict the function of the electronic components and lead to premature failure of the device • Use mainly in high humidity in the environment and in case of temperature fluctuations • Water tightness • Dust tightness • Air permeability, depending on the application, e.g. at a pressure of 70 mbar: >28 ml/min.	

Cables, E-connectors, plug connectors, plugs, sockets, Cable glands (including PCB plug connectors and terminals)	**Example applications:**  *Figure 17: Plug connector on servomotor © SEW-EURODRIVE GmbH & Co KG*  *Figure 18: Web operator panel (left in the figure) with different connection sockets (e.g. USB) © SEW-EURODRIVE GmbH & Co. KG*
PFAS substance / substance group: **among others: PTFE, FEP, ETFE, PFPE**	**PFAS-containing material/component:** Possibly outer jacket, insulation, dielectric, grease, flame-retardant plastic
Reason for using PFAS/requirement profile: As we do not have comprehensive information on the PFAS-containing materials/components, we refer to the consultation contributions of the manufacturers of these articles and their associations.	

9. Electrical components for PCB assembly	**Example applications:**  *Figure 19: Frequency inverter (left: mounted, right: In individual parts)* *© SEW-EURODRIVE GmbH & Co KG*  … *Figure 20: Left: Control and switch cabinet technology; right: Operator panel* *© SEW-EURODRIVE GmbH & Co KG*
PFAS substance / substance group: i.a. PTFE (We do not have any specific information on this.)	**PFAS-containing material/component:** Component(s) of electrical components such as electrolytic capacitors, microcontrollers and diodes, e.g. PTFE-containing anode in electrolytic capacitors, housing gasket of capacitors consisting of several layers (one of which is made of PTFE)
Reason for PFAS Use / Requirements Profile: As we do not have comprehensive information on the PFAS-containing materials/components, we refer to the consultation contributions of the manufacturers of these articles and their associations.	

10. Lithium-ion battery	 *Figure 21: Industrial conveyor vehicle with integrated lithium-ion battery* *© SEW EURODRIVE GmbH & Co KG*
PFAS substance / substance group: We do not have any specific information on this	**PFAS-containing material/component:** Possibly binder in the cathode, additive in the electrolyte
Reason for PFAS Use / Requirements Profile: As we do not have comprehensive information on the PFAS-containing materials/components, we refer to the consultation contributions of the manufacturers of these articles and their associations.	

In the process

We are only aware of applications of PFAS in our production processes that remain in the product. These are listed in the previous section "In the finished product".
PFAS that are required to operate machines and production systems and that cannot usually be assigned to a specific product type are described in the next section "In machines and systems for production".
Of course, processes that depend on PFAS can take place in our upstream supply chain, such as semiconductor production or the use of PFAS-containing release agents in the manufacture of plastic parts. However, because we do not have any specific information about this, we do not comment on this as the "Electrical Drive Technology" sector.

In machines and systems for production

1. Gasket (E.g. O-ring)	**Example applications:** • O-ring in the valve of the paint pump in the painting system • O-ring in the valve in the ferrite core adhesive system
PFAS substance / substance group: FFKM, FKM, PFA	**PFAS-containing material/component:** Gasket
Reason for PFAS Use / Requirements Profile: • In the ferrite core adhesive system, only the material FFKM has proven to be suitable. For tests with other materials (e.g. NBR, EPDM, FKM), the adhesive hardened anaerobically on the gasket, which prevented the valve from functioning after a short time. • Resistance to the medium processed in the system (e.g. adhesive, paint). The adhesive must not already cure in the machine, but first on the printed circuit board. • Replacement interval: At least 6 months. Since FFKM also hardens over time due to the heavy strain, the O-ring in the valve of the ferrite core adhesive system must be replaced every 6 months. Even shorter maintenance cycles would significantly reduce the cost-effectiveness of production in the EU.	

2. Oil and grease	**Example applications:** • Reflow furnace • Wave soldering system
PFAS substance / substance group: PFPE, PTFE, additionally fluorinated greenhouse gas R-1234ze as spray	**PFAS-containing material/component:** Base oil (PFPE), thickener (PTFE), as spray: Propellant gas
Reason for PFAS Use / Requirements Profile: • Temperature resistance up to +280°C (no decomposition, no evaporation) • Maintenance every 2 months • The use of conventional lubricants would involve significantly higher maintenance costs, as these would decompose or evaporate at the high temperatures in the reflow furnace and the wave soldering system. The machine parts (e.g. chains, guides) would be encrusted and would have to be replaced annually instead of very rarely or not at all. This would not only conflict with the goal of resource efficiency, but also reduce the cost-effectiveness of production in the EU.	

3. Coating	**Example applications:** • Hoses in the ferrite core adhesive system
PFAS substance / substance group: PTFE	**PFAS-containing material/component:** Hose with PTFE coating on the inside
Reason for PFAS Use / Requirements Profile: • Resistance to the medium processed in the system (adhesive). The adhesive must not already cure in the machine, but first on the printed circuit board. • Flexibility of the hoses must be maintained with the coating. • Anti-adhesive effect	

4. Coolant	**Example applications:** • Coolant in the air dryer for generating compressed air
PFAS substance / substance group: R134a, R1234yf	**PFAS-containing material/component:** Gas
Reason for PFAS Use / Requirements Profile: As we do not have comprehensive information on PFAS-containing coolants, we refer to the consultation contributions of the manufacturers of these coolants and their associations.	

Substitution

- In general, manufacturers of electrical drive systems are questioning whether PFAS-free alternatives are available and, if possible, they will use substitutes.
- However, no PFAS substitution is possible for the applications shown. When using PFAS-free substitutes, the drive manufacturers downstream from the supply chain depend on the developments of the upstream suppliers. In other words, manufacturers of drive system components do not have the necessary knowledge, skills and equipment to conduct material research themselves. Unfortunately, the search for **equivalent alternatives** from the suppliers of the preliminary products has not been successful so far.
- The development of new technologies and materials is often an iterative process whose overall duration cannot be accurately predicted. After successful development of a new technology, it usually takes another 5-10 years until new end products are introduced on the market. This time is used for the development of new assemblies or changes to existing assemblies, the development, manufacture and procurement of tools and (new) production and process lines, the qualification of suppliers, for conformity assessments and, if necessary Third-party certifications (e.g. according to ATEX Directive 2014/34/EU), employee training and for selling out stocks.

Safe use: Prevention and Reduction of Emissions and Exposure

During manufacture

- Chemicals are used with care and in accordance with the applicable regulations for hazardous chemicals, health and occupational safety in all production phases of motors and frequency inverters. For this purpose, technical, organizational or personal protective measures are taken to protect people and the environment. The measures are subject to a continuous improvement process.

During use:

- PFAS emissions are not expected during use, or only in negligible quantities, because the PFAS-containing components are in the product.
- If the proposed PFAS restriction enters into force and therefore the "alternative materials" such as NBR or ACM, which are significantly worse in comparison, have to be used, oil leaks would almost be preprogrammed under these conditions of use. However, there are environments in which oil leaks are unacceptable, e.g. outdoors, in potentially explosive areas, in hygiene areas such as pharmaceutical or food and beverage production, or in areas where oil leaks lead to production disruptions, e.g. in the automotive industry due to paint wetting disorders.

During disposal/recycling:

- The disposal or recycling of the drive systems is carried out by professional companies, so we cannot provide any information about possible emissions during this product life phase.

Socio-economic Impact

Consequences of the Proposed Restriction

- Due to the wide range of end applications and industries in which the products are used, we can only qualitatively estimate the socio-economic effects of the proposed PFAS restriction.
- With a blanket ban on PFAS, it would be impossible for manufacturers to manufacture the products in the same quality, durability and performance and to cover certain areas of application (e.g. potentially explosive areas or corrosive industrial environments).

Contradicts sustainability goals

- Ever-increasing energy efficiency requirements (e.g. due to the Eco-Design Directive 2009/125/EC) and the ongoing trend toward miniaturization – not least to avoid wasting resources – have led to electric drive systems becoming smaller and more compact over the years. The more compact an electric motor is built at the same power, the higher temperatures are generated inside. To avoid high-temperature-resistant PFAS, electric motors should no longer become so hot. To do so, electric motors would have to be overdimensioned and/or additionally cooled – both of which would be a waste of energy and resources and would contradict the idea of the green deal.

Productivity of the economy is declining

- A PFAS ban would reduce the productivity of the economy, as machinery and systems will be subject to more frequent maintenance work and unplanned failures (e.g. due to excessive wear on shaft sealing rings).

Sales markets are being destroyed

- Quality: Inferior drive components from EEA countries would not have any sales opportunities on the global market.
- End for second-hand markets in the EEA, since the marketing of used goods is also understood as placing products on the market and would therefore be prohibited under the REACH Regulation.

Relocation of production facilities to non-EEA countries

- Because components and mixtures containing PFAS are partly essential for the functioning of many machines and production systems, components of electrical drive systems could no longer be produced to a large extent in the EEA countries.

Burden of Proof and Analytical Aspects

- Analysis methods are complex due to the practically unlimited list of PFAS substances and the low threshold value.
- Chemical analyses to prove that the limit values have not been met or exceeded would result in high costs and a critical number of analysis requests in the few available laboratories.

Required Transition Period and/or Derogations

- The use of PFAS in drive systems has been identified, among other things, in the sealing, cabling, insulation, sliding elements and greases, mainly to ensure the required sliding properties of the moving parts and to protect the components from heat, aggressive atmospheres and sea water. No technically and economically suitable alternatives are known for these applications.
- We therefore call for an unlimited exclusion of fluoropolymers and perfluoropolymers from the scope of the restriction for use in drive systems and their components, as well as in production machines and systems.
- As it is uncertain whether drop-in alternatives will exist for existing HVACR systems 13.5 years after the entry into force, the exception for the maintenance and refilling of such systems should not be limited in time. Instead, we propose that the EU Commission reviews this exception by this time in the light of new scientific findings and, if necessary, amend the exception accordingly.

Our sector offers:

- In view of the restriction intention and the scientific findings on the effects of different PFAS (groups) on human health and the environment, we question the need for the use of PFAS. Our development departments work closely with suppliers to find alternatives. When developing new technologies and products, we are already using technically and economically suitable PFAS-independent technologies.
- For reasons of environmental protection and scarcity of resources, we strive to reduce thermal recycling and expand material recycling. For example, wear parts such as sealing rings that are replaced by our specialist personnel during repairs and maintenance work could be collected separately and fed into a single-type recycling process. However, it is crucial for establishing such processes that recyclates are competitive with conventional materials in terms of quality and price.

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