JAPIA
Japan Auto Parts Industries Association

Position Paper
PFAS Restriction Public Consultation

Japan Auto Parts Industries Association (JAPIA) Position to Annex XV Restriction report on 22 March 2023 about a proposal for a restriction on Per- and polyfluoroalkyl substances (PFASs)

1. Introduction

The Japan Auto Parts Industries Association (JAPIA) was established in August 1969 as a "public interest incorporated association" for the purpose of promoting the Japanese auto parts industry.
Since reorganizing as a "General Incorporated Association" in December 2011, we have been engaged in various activities to further development of the industry.

For automotive safety and comfortable driving, the high level of quality of each automotive part is a great contribution. In order to maintain the high level of quality, JAPIA is actively working with its member companies to resolve various issues that arise in the automotive parts industry.

There are 6,500 automotive suppliers in Japan, employing 640,000 people directly. The annual sales are 222.2 billion euros. Automotive industry in Japan accounts for 17.5% of the total manufacturing shipment value in Japan. Automotive parts in Japan account for more than 50% of total automotive industry shipment value in Japan and half of them are from JAPIA member companies.

2. Executive Summary

First of all, we would like to inform you that there are two versions of comments that we, JAPIA, are submitting: non-confidential version and confidential version. For review of this opinion, please read the confidential version, which contains all information (the confidential version also includes the contents of the non-confidential version).

JAPIA has been actively promoting activities to comply with the regulations related to chemical substances in each country where our products are used globally, and has implemented effective measures to meet the requirements after its enforcement for the regulations such as REACH.
At this time, we support your intention to limit the discharge of PFAS into the environment in order to minimize the impact on people, the environment, etc. We sincerely respect these efforts to reduce future risks. However, for a variety of reasons, which are discussed below, we express significant concerns about the proposed restriction since they are a departure from previous chemical substance regulations, and we also have significant concerns in assessing the impact of this restriction and in considering future pathways for reductions.

This document is JAPIA's initial response to the proposed restriction on PFAS. Please note that due to time constraints, additional documents will be submitted during this public consultation process regarding additional information not included in this document.

(1)Scope of Restriction

The PFASs covered by the proposed restriction are grouped together and include a wide variety of more than 10,000 substances. However, because risk assessments have not been properly conducted for each individual substance, many PFAS are included for which no risk has been identified. As such, they do not meet the scope of the restriction referred to in Article 68 of REACH, which is "When there is an unacceptable risk to human health or the environment, arising from the manufacture, use or placing on the market of substances, which needs to be addressed on a Community". In other words, contrary to Article 68, the proposed restriction would regulate many PFAS that have not been demonstrated to be unacceptable risks. We understand that persistent applies to many PFASs (but not to PFASs used as some F-gas), but only some PFASs have been identified as having toxicity, bioaccumulation, or other risks. Persistent alone is not enough to determine that a PFAS is an "an unacceptable risk to human health or the environment".
Regarding to the scope of application of the restrictions, we believe that it is necessary to carefully reconsider the scope by identifying unacceptable risks and considering the risk mitigation effects of this restriction, therefore we request a

reconsideration.

(2) Establishing an appropriate transition period that takes into account the uncertainty of the impact assessment and the huge number of components to be covered

A further concern is about the uncertainty of the impact assessment and the relevance of transition period. The automotive supply chain is very diverse and complex. Therefore, well-developed IT systems (e.g. International Material Data System (IMDS)) need to be utilized to assess the entire supply chain for the inclusion of PFAS. However, since there is no reporting obligation at such a low threshold, it is virtually impossible to conduct an accurate and comprehensive impact assessment for the entire product including PFAS. Therefore, it is necessary to take into account that there is uncertainty in the impact assessment under the current system. Moreover, even if it were possible to conduct that impact assessment without omission, the results of the assessment have identified target sectors and products that are unparalleled in previous regulations (automotive products (components) in the transport sector will be discussed later).

Considering these factors, we can say that 18 months is too short as a transition period to promote substitution. To avoid the risk of unforeseen disruptions in the supply chain and negative economic impact on the global automotive industry, including the EU, we ask that you reconsider a transition period of 36 months or longer. A longer transition period will allow for a reliable substitution for safer substances, with benefits for climate protection, industrial development, and consumer. This does not mean, however, that all products (components) can be switched during the transition period. Switchover is possible only in cases where alternative technologies or materials have already been prepared, and where the switchover can be made simply, without requiring design changes and simplifying evaluation and verification.

(3) Proposed "review clauses" to account for uncertainty of substitutes

For many PFAS, no alternative technologies or materials currently exist. In addition, there is no prospect that alternative technologies or materials will be available in the future. Therefore, the appropriateness of the derogation period indicated in paragraphs 5 and 6 of the proposed restriction cannot be determined.

As for automotive components, which will be discussed in detail for each part in Chapter 5 in this document, no alternative technologies or materials have been identified, nor is there a clear path forward for their development. Therefore, we, JAPIA, strongly insist on the decision of the 12 years derogation period in Paragraph 6 o, which was reconsidered after the Public Consultation (except for automotive air-conditioning refrigerants (F-gas), which is discussed in (4) below).

In addition, if the preparation of alternative technologies and materials is delayed significantly (that is quite possible situation because the level of development technology for alternative technologies and materials is very high considering the unique characteristics of PFAS) and the time left for the switchover is shorter, we, the auto parts manufacturers, will not have enough time for evaluation (various quality, safety, reliability, etc.) and redesign, time for verification by the OEMs to whom we supply our auto parts, and time for the switchover afterwards. Furthermore, considering the wide variety of target parts containing the PFAS, it is no longer physically possible. Therefore, it is important to keep a close watch on the availability of alternative technologies or materials. In light of the fact that this cannot be predicted, we request that you consider incorporating a "review clauses" into the proposed restriction in advance that would allow for an extension of the derogation period in the event that appropriate alternative technologies or materials are not prepared by the given date.

(4) Spare Parts

Long-term retention of supply parts (spare parts) for vehicle maintenance and repair is essential.
With the Circular Economy concept gaining momentum, it is not advisable to dispose of vehicles in a short period of time. If many spare parts containing the PFAS are made unusable due to this restriction, it will not only hinder the maintenance and repair of the vehicle, but also reduce its service life. We request an indefinite “exemption” because it is essential for consumers to be able to use spare parts for a long time in order to use their vehicles safely and for a long period of time (details are given in Chapter 3).

(5) Impeding the achievement of other policies and regulations

The proposed restriction contains many PFAS that support current and future technologies. By restricting those PFASs, various technologies in terms of function, safety, and reliability will be degenerated. In other words, we are convinced that the dossier submitter of the proposed restriction do not want the regulation to hinder the realization of global warming countermeasures (reduction of GHG emissions and carbon neutrality) and circular economy, and to hinder policies that will improve the future global environment, such as the European Green Deal and SDGs. To ensure that this regulation does not hinder technological development to improve the global environment in the future, we request that the risks of PFAS emissions and effects of restriction be examined to determine priority areas for progressing reduction and that the regulation will be appropriate scope.

In the field of refrigerants (F-gas), alternative candidate exists, but they are not on the verge of technological development or solutions that can be deployed globally. In addition, the phased reduction of HFCs has already begun to be regulated by the MAC Directive (2006/40/EC) and the F-gas Regulation (EU No. 517/2014) to resist global warming.
That are in progress to comply with the MAC Directive and the F-gas Regulation will be wasted, resulting in on-site disruption and incalculable economic losses. Therefore, we request that an appropriate derogation period be set, taking into consideration the status of technological development of alternative candidates that can be deployed globally (including the status of preparations for mass production), and the responses to the MAC Directive and F-gas Regulations that are being addressed.

In addition, PFHxA, which is under consideration for REACH Restriction, is part of the PFAS, so there is some overlap in the content of the restrictions. This one has been in discussion with dossier submitters and stakeholders for a long time, and we ask that the PFHxA decisions be reflected in this proposed PFASs restriction without omission. We believe that this is a necessary step to avoid confusion in the market due to differences in the content of each Restriction.

(6) Other concerns (to the detriment of consumers)

If this regulation restricts the use of PFASs, with or without alternatives, it will make it extremely difficult to maintain vehicle safety in the future, and at the same time, it will be a major blow to industry workers, consumers, and ultimately the EU economy.

Other possible negative effects on consumers in the EU could include.

- ✓ Increased emissions of other toxic substances
- ✓ Global warming due to delay of EV conversion and delay of CO_2 reduction plan
- ✓ Increased likelihood of harm to occupant and pedestrian safety due to inability to ensure the safety and reliability of the vehicle over the long term
- ✓ Increased financial burden due to more frequent replacement of parts
- ✓ Increased financial burden due to reduced useful life of vehicles

The impact will be worldwide, given the fact that fluorochemical products are installed in almost all automobiles. The negative impact can be expected to be even greater as many components are horizontally deployed in non-automobiles, motorcycles, construction machinery, agricultural machinery, industrial vehicles, and ships.
Therefore, JAPIA submitted our opinion requesting reconsideration of the proposed restriction, concluding that while we agree with the main intention of the restriction, which is to reduce environmental releases (mitigate risk), the scope of the restriction should be carefully reconsidered based on risk.

We wish that this restriction should not hinder the promotion of other policies and regulations (such as the European Green Deal) and that an appropriate balance needs to be found that takes into account all risk mitigation effects, economic impacts, and consumer disadvantages. To this end, we believe that the scope of the restriction needs to be carefully reconsidered, and we request that the proposed restriction be reconsidered.

Some of the above concerns we have expressed are also supported by the Conference of fluoro-Chemical Product Japan (FCJ), an organization of fluorochemical manufacturers (material suppliers) upstream in the supply chain, which has also submitted their comments. JAPIA supports statement.

Notes :
Fluoropolymer(s) in this document are defined to include fluoroplastic(s) and fluoroelastomer(s).

3. Concern about the proposed restriction

As a unique material with its outstanding properties, PFAS is used in a variety of critical applications and is essential for maintaining the primary functionality of products. In the future, PFAS will also be increasingly present in many high-tech applications as they continue to evolve. For example, the industrial use of PFAS in automotive components will enable resource-saving and low-mass designs, longer service life, and less frequent maintenance (longer maintenance intervals). PFAS are therefore an integral part of the current innovation in the global automotive industry, including the European automotive industry.

If PFAS is banned in the EU for many important applications, we strongly fear that the continued use of current products and future innovation based on this technological foundation will no longer be possible.
The industrial use of PFAS also contributes significantly to the further development of technology and climate protection. For example, automotive components can be designed to be more resource efficient and with less mass, thus extending their service life and lengthening the maintenance intervals of vehicles. Thus, PFAS are an essential component of the innovative technological evolution of the automotive industry worldwide. Thus, these benefits are not only enjoyed by consumers in the EU, but also by consumers across the globe.

The proposed restriction will cause great concern and impact to the entire automotive industry.
This position paper describes the impact of the proposed restrictions on the auto parts industry by several applications.

At this time, we have confirmed to upstream chemical manufacturers that there are no alternative technologies or materials for many fluorochemical products. Downstream manufacturers, such as JAPIA, need to discuss alternative technologies with their upstream chemical manufacturers, and we have found this to be extremely difficult. In addition, since the proposed restriction is a PFAS group, it is not possible to replace it with a similar PFAS with less risk. Therefore, we need to prepare innovative alternative technologies or materials for de-fluorination, which must also be less risky than PFAS. This is a very difficult challenge. Therefore, the chemical industry needs the opportunity to develop alternative technologies or materials that are comparable to existing PFASs. Since the PFASs in this regulation include a very wide variety of materials, it is easy to predict that the time frame will

be very long. Even if the chemical industry succeeds in developing alternative technologies or materials, the auto parts industry and the auto industry will need a period of evaluation, which could be very long, given the large number of products containing the PFAS.
More details on alternative technologies and materials are discussed in Chapter 5 by each application.

The impact of the proposed restriction is not limited to the automotive industry. The motorcycle industry, construction machinery industry, agricultural machinery industry, industrial machinery industry, and the marine industry will also be significantly affected. Some of the components for the automotive industry are also horizontally expanded to the motorcycle, construction machinery, agricultural machinery, industrial machinery, and marine industries. Therefore, we request that the relevant derogation not only cover the automotive industry, but also the motorcycle, construction machinery, agricultural machinery, industrial machinery, and marine industries under the same circumstances. (We define "transport vehicles" in the proposed restriction to include not only the automotive industry, but also the motorcycle industry, construction machinery industry, agricultural machinery industry, and industrial machinery industry. However, it does not include the marine industry, so we ask that the marine industry, which also has some of the same parts horizontally deployed, be included in the derogation).
In all of these industries, components containing the PFAS are used in harsh environments to ensure safety, just as in automobiles, and will be irreplaceable in the future unless alternative technologies or materials are available that can match the unique properties of PFAS.

Regarding to the transition period, we believe that the 18 months proposed by dossier submitter is too short due to the anticipated uncertainties in the assessment. Considering that the existing IMDS cannot be used for the evaluation and that the PFAS to be covered are extremely diverse, with a wide variety of products (components) affected, we would prefer 36 months or longer. However, this does not mean that all products (components) can be switched during the transition period. Switching is possible only in cases where alternative technologies have already been prepared, no design changes are required, evaluation and verification can be simplified, and switching can be done simply.

Automobiles are intended to be used for long periods of time and over long ranges, requiring regular maintenance and repair. Therefore, it is essential to have a long-term supply of spare parts for this maintenance and repair. Spare parts are the same parts used to obtain type certification for a vehicle. When the production of a vehicle is terminated, spare parts or their components are manufactured and storage (legacy spare parts) based on future supply forecast, due to maintain, maintenance and management cost issues of the production process and equipment, which includes the supply chain.

Therefore, if the proposed restriction is applied to spare parts as well, spare parts and components that have already been produced will be discarded. This not only goes against the circular economy concept, but also fails to protect the "right to repair" of consumers. In addition, it is not impossible to produce spare parts using alternative technologies and materials when those are available, if the above ideas and economic burdens are ignored, however, it is even more impractical to produce legacy spare parts for automobile that have already been discontinued, as there is no production process for such parts.
For these reasons, the market may not be able to supply the appropriate spare parts, and automobile safety may be compromised due to lack of proper repair and maintenance or early disposal of automobiles may occur.
In order to avoid these problems, we request an indefinite "exemption" for automobile spare parts.

4. Automotive components containing PFASs

Attachment 1 is a non-exhaustive list of auto parts containing PFAS; two versions are attached, Confidential and Non-confidential. the Non-confidential version contains only parts information, while the Confidential version contains the PFASs information (The non-confidential version includes only parts information, while the confidential version includes information on the contained PFAS (substance name, Cas RN).

Attachment 1 : Non-exhaustive list of applications
(Confidential and Non-confidential)

This list includes paragraph6 o (applications that are necessary to ensure vehicle safety and for which there are currently no alternatives), paragraph5 p and q for

refrigerants (F-gas), paragraph5 s for lubricants, and paragraph5 ee for semiconductor manufacturing processes components. This list does not include components that are solely intended to improve comfort, optical enhancements, or design. However, to ensure proper drivability of the car, components that are essential for the driver, such as car air conditioning and interior lighting, are included as necessary components to ensure safety.
In addition, due to assist in understanding the parts, please refer to attachment 2 for pictures of some of auto parts.

Attachment 2 : Non-exhaustive picture list of applications

It is a non-exhaustive list, but it shows that a wide variety of PFASs are used in a very wide variety of auto parts. We have identified more than 80 different PFASs in use. The proposed restriction is a departure from previous chemical substance regulations, which could threaten the manufacture of automobiles themselves.

Most of these components will continue to be used in future electric vehicles to ensure superior quality. Sealing materials around motors (oil seals, bearing seals, etc.), binders for lithium-ion batteries and gaskets and so on are still used today. Furthermore, in electric vehicles and fuel cell vehicles, the development of materials using fluoropolymers is rapidly advancing worldwide, not only for existing lithium-ion batteries but also for next-generation fuel cells and all-solid-state batteries. Automotive batteries are large, and it is not realistic from a cost standpoint to manufacture batteries to be installed in vehicles for Europe outside the EU and export them to the EU. With the spread of environmental-friendly vehicles, it can be predicted that the number of production bases for automotive batteries will increase in Europe, and the demand for fluoropolymers will increase. As you know, the rapid expansion of these environmental-friendly vehicles is driven by the world trend of restricted sales of gasoline and diesel vehicles due to the carbon neutralization policy of each site under the Paris Agreement (e.g. European Green Deal).

Some PFAS is an essential material for all category of vehicles due to its light weight, reduced toxic emissions, and long-term reliability of properties. Its importance will increase as the automobile evolves into a more environmentally friendly and sustainable vehicle.

5. Functions of PFASs used in automotive components and possible alternatives

PFASs, especially fluoropolymers, are not only widely used in existing components, but are also materials that are expected to contribute greatly to the next generation's sustainable development, reduction of CO_2 emissions over their entire life cycle, and the technological innovation needed to achieve a carbon neutral society.

Fluoropolymers are widely used in automobile components because of their excellent properties such as heat resistance, oil and chemical resistances, flame resistance, and wear resistance. Furthermore, they contribute greatly to combustion efficiency and automobile safety.

The superior properties of the fluoropolymers we use are discussed in the descriptions of each of some component groups below, but, first of all, a quantitative comparison with other materials is shown in Attachment 3. The extremely superior physical properties of fluoropolymers compared to other materials that are considered alternative candidates can be seen (this Attachment 3 does not guarantee the numerical values of each property). In addition, a comparison of perfluoropolyethers (PFPEs) with other materials, although not quantitative, will be provided in the "Applications: Greases" section.

Attachment 3 : List of properties
(Comparison of properties of fluoropolymers and other materials)

The various excellent properties of fluoropolymers will greatly contribute to the realization of a sustainable and clean society in the future. Restrictions on many PFAS without clearly identified risks could kill the seeds of many potential new technologies that could make a significant contribution to reducing the environmental impact of the future. We believe that no restrictions should be placed on low-risk PFAS from the perspective of their application to future technologies and their contribution to the global environment over the medium to long term.

This chapter discusses the need for PFAS (e.g., functions and roles) and possible alternatives for each component group.

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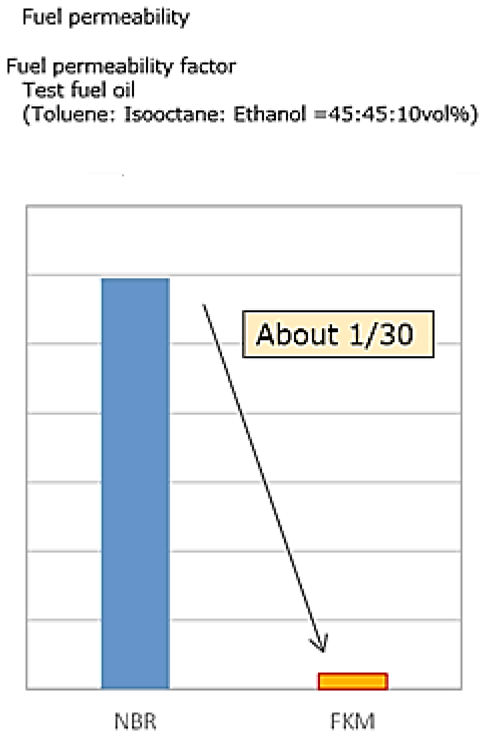
Applications: Hose and Tube



Some information will be included only in the confidential version. Please refer to the confidential version for further details.

■ Product Examples

Fuel hose, fuel tube, air hose, vacuum tube, oil hose, canister hose, evaporative hose, purge hose, trap hose, joint hose, intercooler hose, LPG hose, breather hose, etc.

■ Necessity of using PFAS

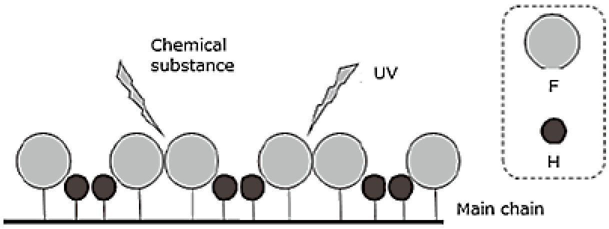
For example, for fuel hose, fuel tube, and air hose that transfer fuel and fuel vapor to the engine form fuel tank or canister (fuel evaporative gas emission prevention device), fluoropolymers such as ETFE and PTFE, or fluoroelastomer FKM, are used to ensure safety in harsh operating environments. These materials are required to provide low fuel permeability, oil resistance, heat resistance, cold resistance, flexibility, durability, long-term reliability, and pressure resistance. Bisphenol AF is one of the PFASs contained in some FKMs and is used as an additive for cross-linking.

■ Concerns about substitution

There are no suitable materials that can be substituted to satisfy the required functions. In particular, excellent fuel permeability, which is one of the most important properties required for these parts due to the short C-F bond spacing, cannot be satisfied by alternative materials (Because other compatible properties must also be considered). In case of PA (polyamide resin) materials, which are considered alternative candidate to ETFE, flexibility is not a problem, but fuel permeability is increased by a factor of 140 (It will be worse). PA/rubber or EVOH (ethylene vinyl alcohol resin) has no problem with fuel permeability, but the elastic modulus increases by a factor of 2, and there is no alternative material that can achieve both. NBR, which is considered an alternative candidate to FKM has a 30-fold increase in fuel permeability, and no alternative material is available.

Replacing existing materials with ones that perform less well will not only fail to ensure safety, but will also lead to a decrease in fuel efficiency, deterioration of other equipment, and failure. In other words, the use of inappropriate materials affects the vehicle's stable operation (running, turning, and stopping), increases the financial burden on consumers due to more frequent parts replacement, increases exposure of passengers and pedestrians to permeated fuel and so on, and is contrary to reducing fuel use.

Structure of fluororubber



Journal of the Society of Rubber Science and Technology, Japan, Volume 93, No. 6 (2020)
Characteristic, recent development trends, and applications of fluororubbers

・CF binding is the most difficult bond to break because the binding distance of CF is short and the binding energy is high.

・CF binding expresses excellent heat resistance and chemical stability because it takes a three-dimensional structure to hide CC and CH bonds.

→ It behaves as a single molecular group and thus exhibits excellent fuel permeability

Application: Tape

■ Product Examples

Adhesive tape, etc.

■ Necessity of using PFAS

Adhesive tapes using base material based on PTFE and other materials satisfy the required characteristics such as heat resistance, sliding wear resistance, corrosion resistance, electrical insulation, oil resistance, and chemical resistance. In automobiles, PTFE-based adhesive tapes are used in areas where heat resistance and oil adhere. For example, adhesive tapes used to protect and bind wire harnesses that transmit electricity and electrical signals to power equipment and control equipment are used in harsh environments such as engine compartments (engine room), and contribute to maintaining functionality over long periods of time.

■ Concerns about substitution

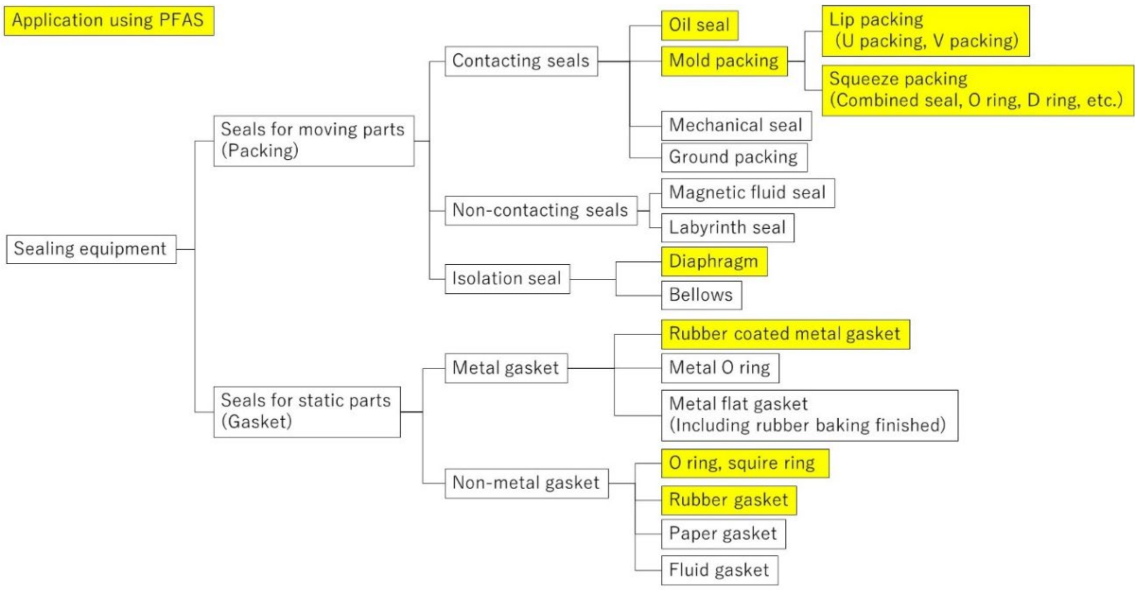
In the vehicle environments where PTFE-based adhesive tapes are currently used, PTFE is the only material that can withstand such environments. If other materials such as PVC, for example, are used, the material will deteriorate in environments with repeated high and low temperatures, causing cracking and peeling, and will not retain its functionality over the long term. As a result, the wires in the wiring harness break, electrical signals cannot reach the electronic components or devices, and safety is threatened by loss of driving control or an accident. CO_2 emissions may also increase due to uncontrolled combustion control systems and combustion substances.

Applications: Seals, Rings and Packing

- Product Examples

Oil seals: for engines (crankshafts, valve stems, fuel injection pumps), chassis and suspension, bearings, motors
O-rings: fuel (fuel tank cap, quick-connect, fuel pump), diaphragm, engine (fuel injector, oil pressure, carburetor, canister), vacuum switching valve, oil pressure switch
Resin packing: seal ring (accumulator switch, CVT pulley, shock absorber), backup ring (shock absorber, injector)

According to JIS (Japanese Industrial Standards) B0116, seals are classified into seals for moving parts (packings) and seals for static parts (gaskets), and lip packings (including oil seals), molded packings (O-rings, plastic packings, etc.), and O-rings as seals for fixation, etc. are widely used in automotive components as seals for moving parts.
In order for a machine to operate, lubricants (oils or greases) are required from the viewpoint of preventing wear of the operating parts. However, if lubricants leak out, the machine cannot be used continuously, so seals are required for operating parts to prevent leakage of lubricants. Typical examples of sealing components are known by names such as O-rings, oil seals, gaskets, and packings. These sealing components are made of relatively flexible materials such as rubber or resin (except in special cases) in order to prevent wear of the sealing performance and the machine actuation parts.



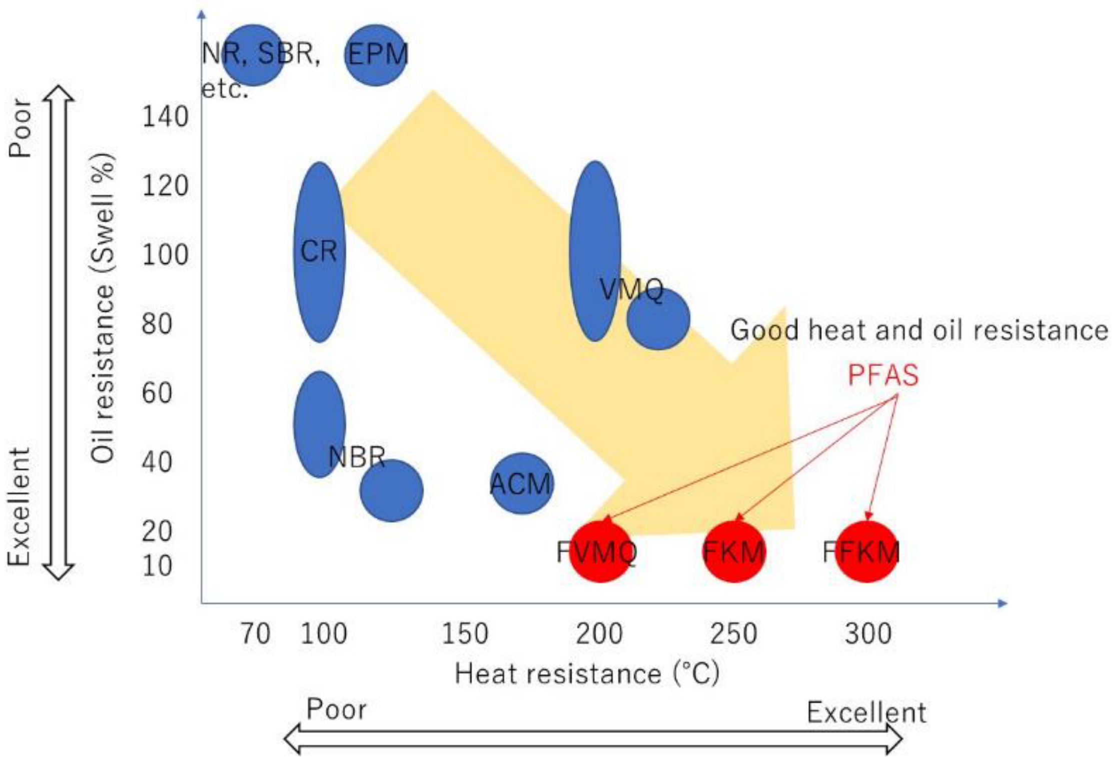
■ Necessity of using PFAS

Fluoropolymers are 5 to 100 times more expensive than other polymers, so fluoropolymers are not the preferred choice from an economic standpoint. Nevertheless, fluoropolymers are chosen because of the high level of performance required due to their unique characteristics such as heat resistance, oil resistance, fuel oil resistance, and fuel oil permeability, and many of them are used in areas that are essential for automotive safety. In other words, almost all automotive components that use fluoropolymers are essential to the safety performance of the automobile, despite the economic disadvantages.
Automobiles, especially engines room, require both heat resistance and oil resistance of fluoropolymers because they operate in high-temperature environments. On the other hand, fuel component related parts require both fuel oil resistance and fuel oil permeability of fluoropolymers.
For example, fluoropolymers such as FKM, FEPM, FFKM, FVMQ and other fluoroelastomers, and such as PTFE, ETFE, PFA, FEP and other fluoroplastics are used. More specifically, JAPIA research has confirmed that the PFAS shown in the below table will be used, but please note that the CAS RNs shown here are non-exhaustive. Please refer to “Attachment 1 Non-exhaustive list of applications (Confidential)” for further details. Bisphenol AF (CAS RN 1478-61-1), a PFAS, and other substances with similar structures (CAS RN 75768-65-9, 577705-90-9, etc.) are used to cross-link FKM in Copolymer.

	GADSL Basic polymer	monomer (Type)	CAS RN (Example)
Fluoroelastomers	FEPM	TFE-P	27029-05-6
		TFE-P-VdF	54675-89-7
	FKM	VdF-HFP (Copolymer)	9011-17-0
		VdF-HFP-TFE (Terpolymer)	25190-89-0
		VdF-TFE-PMVE (Low temperature type polymer)	56357-87-0
	FMQ		?
	FVMQ		?
Fluoroplastics	PTFE	TFE	9002-84-0
	ETFE	E-TFE	68258-85-5 94228-79-2
	PFA	TFE-PMVE	26655-00-5
	FEP	TFE-HFP	25067-11-2

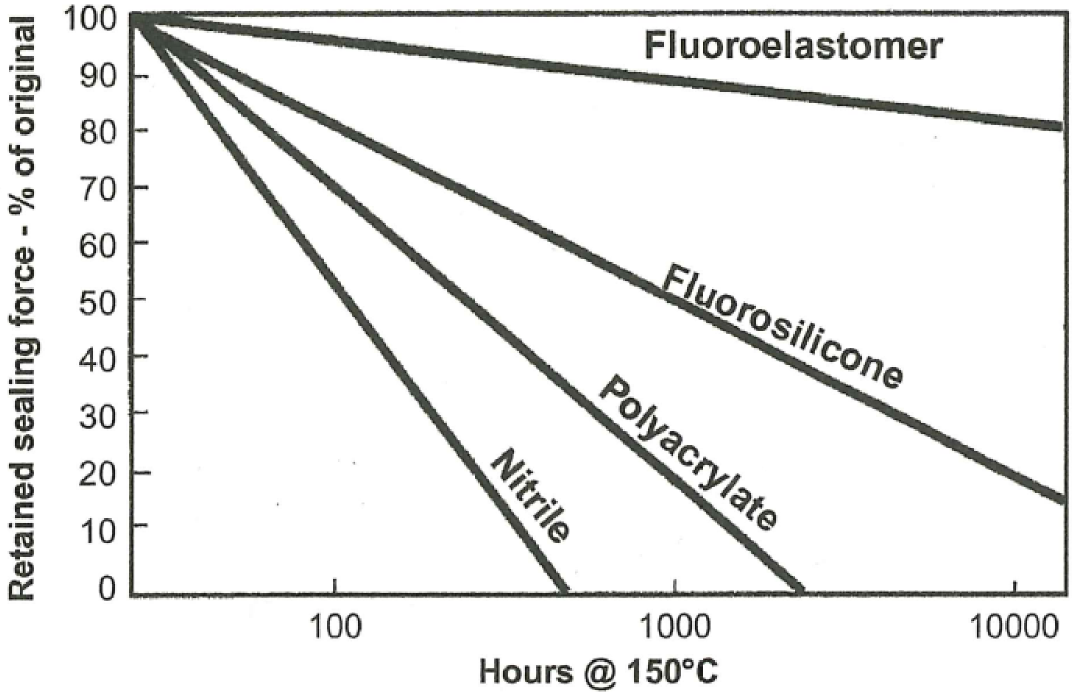
■ Concerns about substitution

There is no substitute for fluoropolymers about these applications. The following are typical examples of sealing parts made with fluoropolymers, their roles, and how they compare to seals made with other materials. First, we will show sealing parts used in high-temperature environments such as engines room. For example, heat resistance and oil resistance are required for sealing parts used in the engine compartments of an automobile. Regarding heat resistance and oil resistance, ASTM D2000 is a common classification method for rubber products used in automotive applications. As an index of heat resistance of rubber, it is necessary to check the change in hardness of rubber, and as an index of oil resistance of rubber, it is necessary to check the change in swelling of rubber, and in both cases, the smaller the change, the better. As shown in the figure, fluoroelastomer is excellent in both heat resistance and oil resistance. The ambient temperature in an engine room is usually around 150°C, but it is known that the temperature in sliding areas (where friction occurs between rubber and metal shafts, etc.) can rise to 150 to 200°C. In terms of oil resistance, NBR, ACM, VMQ, etc. can be selected, but there is no other material other than fluoroelastomer that can withstand the heat resistance of the engine compartment. The same applies to motors required for electrification. The motor is an essential component in BEV, PHEV and so on because it converts electrical energy into kinetic energy and transmits that energy as driving force. Because these motors rotate at very high speeds, the sliding heat generated by the oil seals used in the motor bearings can reach 200°C, in addition sealing materials that can handle the motor's lubricant are required. However, there is no material



other than fluoroelastomer that can satisfy both of these requirements, as shown in ASTM D2000.

Similarly, data from an O-ring sealing test shows that fluoroelastomer retains about 80% of its sealing ability even after 10,000 hours at 150°C. This also confirms that fluoroelastomer has a long service life.



＊Fluoroelastomers Handbook, The Definitive User's Guide, Second Edition (Jiri George Drobny) p4

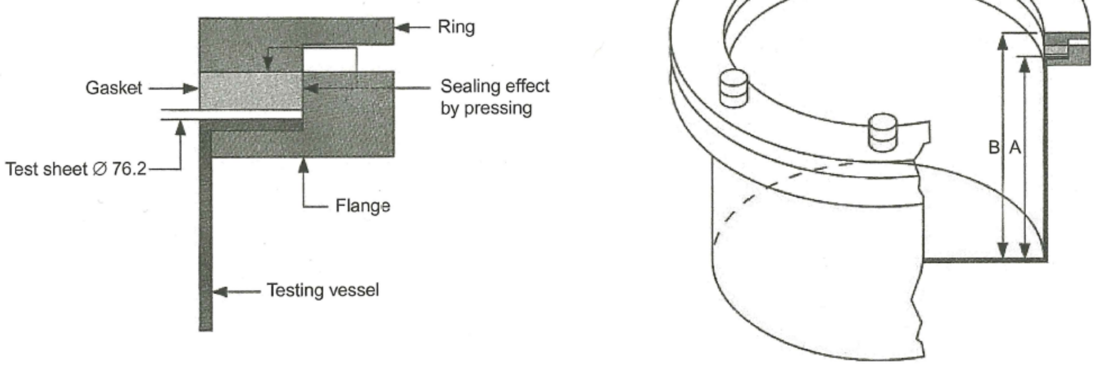
Also, seals related to fuels are presented. The properties required for sealing materials used for fuel include especially fuel oil resistance and fuel oil permeability. For fuel oil resistance, the change in volume of the rubber material when the test fuel oil (Fuel C) and additives are added should be checked. According to this data, there is no significant difference between fluoroelastomer and NBR when tested with Fuel C. However, when the additive MTBE is added to gasoline, or when Ethanol or Methanol, which are assumed to be biofuels, is added to fuel, fluoroelastomers show little volume change, indicating that it is an excellent sealing component. On the other hand, NBR has significant rubber swelling when additives are added, which raises concerns about fuel oil leaks.

Elastomer	Fuel C	Mixtures with Fuel C% Volume Swell (168 h/23°C)			
		MTBE 10%	Ethanol 10%	Methanol	
				10%	15%
NBR	7	49	69	61	
ECO	6	32	45	54	
FVMQ	24	26	28	26	
FKM-A (66% F)	6	8	13	17	31
FKM-B (69% F)	5	6	8	14	16
FKM-F (70% F)	3	3	4	5	7

＊Fluoroelastomers Handbook, The Definitive User’s Guide, Second Edition (Jiri George Drobny) p474

The test data for fuel oil permeation resistance is also described (ASTM E96-66 Thwing Albert permeation test method). This test shows that FKM has superior fuel oil permeation resistance when 15% Methanol is added to Fuel C. If NBR were substituted, up to 530 times more gaseous gasoline would permeate the seal and be released into the atmosphere, compared to FKM.

• Fill in 100 ml liquid
• Seal with test material
• Measure weight
• Invert, store at room temperature
• Measure weight loss during 21–28 days every 3rd day
• After equilibrium evaluate average in g/m²/day



＊Fluoroelastomers Handbook, The Definitive User’s Guide, Second Edition (Jiri George Drobny) P473

As described so far, there is no alternative material that satisfies the required functions. The reasons for this are thought to stem from the short distance between C-F bonds, the high bond energy, and the size of the fluorine atom, and therefore materials with C-H bonds in general-purpose rubber or Si-H bonds in silicone rubber

cannot be substituted.
Sealing components for engines room, especially oil seals, provide functionality and safety for the life of the product (approximately 20 years). If they were to be replaced with other materials, a significant number of part replacements would be required. If NBR is substituted, several parts may need to be replaced in a year, resulting in a significant increase in waste and an immeasurable economic burden on the user. If the engine is used without replacement, oil leakage from the engine may cause engine stoppage, engine damage, and in some cases, engine fire, which may affect human lives. The same can be said for motors, which are required for the conversion to BEV and so on, so the electrification of automobiles would not be possible without PFAS.

Material	Permeability (g mm/m^2 day)
Elastomers	
NBR	1600
HNBR	1100
FVMQ	640
FKM-A	35
FKM-B	12
FKM-GF	3
Thermoplastics	
Nylon 12	85
THV500	0.5
ETFE	0.2
FEP	0.03

In the case of fuel system sealing parts, replacing other rubber materials will cause to swell significantly under situations where fuel additives and alcohol-based liquids are present, and resulting in fuel leaks. Since fuel leaks can lead directly to automobile fires, it must be said that replacing other materials is extremely dangerous. In addition, as mentioned earlier, fuel gas permeates through the sealing parts and is released into the atmosphere as gas, leading to air pollution. It is impossible to design without seals. The complex path from the fuel tank to the engine cannot be integrally molded with metal or other materials, so there must be seals at the joints between these parts. This is true not only for fossil fuels but also for electrofuels. Therefore, sealing parts made of fluoropolymers will continue to be needed in the future for electrofuels.
As described above, there is no substitute for fluoropolymers, and regulating fluoropolymers will undermine vehicle safety and hinder the future shift to electrification and electrofuels. In other words, they are indispensable components for achieving carbon neutrality.

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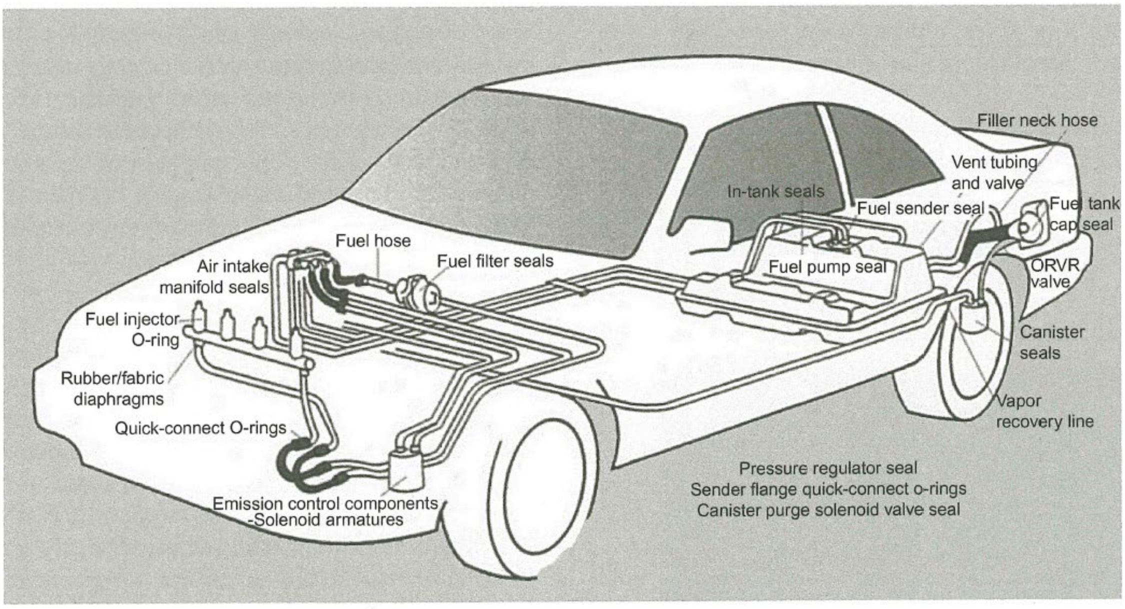


＊Fluoroelastomers Handbook, The Definitive User’s Guide, Second Edition (Jiri George Drobny) p471

Application: Gasket

*Information about gaskets can also be found in "Applications: Seals, Rings, and Packings".

■ Product Examples

Fuel cap gasket, fuel tank gasket, etc.

■ Necessity of using PFAS

Fuel cap gaskets provide a sealing mechanism to prevent fuel vapor from leaking out of fuel tanks. The gaskets used for this purpose are used FKM, fluoroelastomer, because it must be flexible to ensure sealing performance and have good fuel permeability to meet the emission regulations of various countries. In addition to flexibility and fuel permeability, the material must also be fuel oil resistance, cold resistance, low friction, and low compression set. Bisphenol AF contained in some FKMs is a PFAS, which is used as an additive for cross-linking.

■ Concerns about substitution

There are no suitable materials that can be substituted to satisfy the required functions. In particular, excellent fuel permeability, which is one of the most important properties required for these parts due to the short C-F bond distance, cannot be satisfied by alternative materials (since the above properties must also be considered, which should be compatible). Replacing existing materials with ones that offer lower performance will not ensure adequate compliance with national emission regulations and will lead to environmental pollution and even harm to human health.

Applications: grease and lubricant

■ Product Examples

Because of the wide variety of product examples and the fact that the same parts are used in various locations in automobiles, we have noted the location where the part is located at the head of name that are difficult to understand in the following product example explanations. Locations in automobiles are categorized as follows

<Location Classification in automobile>
Body hood, body doors, body trunk lid, body seats, body dashboard/instrument panel, body air conditioning, body roof, body enclosure, drivetrain transmission, drivetrain driveshaft, Drivetrain differential, chassis suspension, chassis steering, chassis tires, chassis wheels

Starter-drive shaft, starter-splines, water valve-ball bearings, water valve-caps, water valve-potentiometers, water heaters, air conditioner-doors, air conditioner-link parts, air conditioner-pins, guides, viscous heater bearings, key less, shift lock solenoid switch, air conditioner-panel knob, meter-stepper motor, power window-regulator, wiper-arm, wiper-blade clip on wiper, press-fit joint on glow plug, plug cap on ignition coil, EGR valve-ball bearing, EGR valve-oil seals, ISCV (idle speed control valve), TGV (tumble generation valve), electric VCT motor bearings, cruise control actuators, throttle body-oilless bearings, drivetrain transmissions-electric oil pumps, drivetrain transmissions-printed circuit boards, drivetrain transmissions-master cylinders, drivetrain transmissions-bearings, drivetrain transmissions-bearings, drivetrain transmissions-housing, drivetrain transmission-release lever support, body engine compartment-actuator, body engine compartment-connector, body engine compartment-wiring harness, body engine compartment-bearings, body engine compartment-push rod spacer, body engine compartment-resin coatings, body engine compartment-motors, springs, body door-weatherstripping, body door-actuators, body door-switches, body door-closers, body door-moldings, body door-latch release gear, Body door-actuator release clutch, body door-roller assembly, body door-sliding door, body door-harness protector cover, body door-protector, body door-protector, body door-wire, body door-protector cover, base, body door-Center protector, body door-rail, body door-latch, body door-inner cable, body door-moly paste, body door-cable, body door-regulator, body door-frame, bell crank, body door-spindle, body door-bracket, body door-cable assembly, body door-control switch, body door-door lock, body door-door closer, body door-locking link, body door-door handle, body door-driven cable, body door-motor, body door-driven motor, body door-bracket, spindle, body door-screw, body trunk lid-lock, body roof-garnish, body roof-lockstop, body roof-housing, body roof-sunroof, body roof-bracket, body roof-show link, body roof-deflector arm, body roof-weather strip, chassis suspension-shock absorbers, chassis steering-steering column, brake-motor-on-caliper, brake-electric parking brake, brake-motor, engine-intake manifold, body seat-limit switches, body seats-seat legs, body seat-frame, body seat-controls, body seat-reclining gear, body seat-link, body seat-motor, body seat-plate, body seat-track, bracket, body seat-bushing gear housing, body seats-track control cables, body seats-support pumps, body seats-locking levers, body seats-back cables, body seats-back locks, body seats-cushion frames, body seats-leg assemblies, body seats-switches, body dashboard/ instrument panel-disc player semiconductor, body dashboard/ instrument panel-disc player, body dashboard/ instrument panel-NAVI, body dashboard/ instrument panel-stepper motor, body dashboard/ instrument panel-stepper motor, insulator cables, stems, body dashboard/ instrument panel-spray coat, body dashboard/ instrument panel-breather filters, actuators, printed circuit board of ECU, windshield moldings, multiplexer identification, ECU-connector, steering column bracket, fluid cup bearing, sensor housing, control valve actuator, regulator actuator, throttle cable assembly, fuel lid lock, metal top hook cables, console latches, exhaust shutters, glove box air damper, motor fan-drive motor, glove box-latches, console lid, glove box-collar, body dashboard/ instrument panel-finisher, body door-pockets, body seat-hooks, body seat-locks, body seat-panels, body seat-spacers, body seat-pins, body seat-cables, body seat-guides, body seat-headrests, body seat-switches, body seat-plates, body seat-belts, etc.

Note that the above list does not include applications such as solid grease for two-wheel chains, which are intended to have a reinforcing effect and for which alternatives are available.

■ Necessity of using PFAS

Grease generally consists of base oil, thickeners, and additives. PTFEs are used as base oils, PFPEs and PTFEs as thickeners, and PTFEs as additives. They are essential for each part of an automobile to operate properly over a long period of time. Important properties of base oils include heat resistance, low temperature resistance, and lubricity. Important properties of thickeners include heat resistance, water resistance, and shear stability. PFPEs and PTFEs are used to maintain functionality over long periods of time, as they are used in the harsh conditions of automobiles.
Base oil is the oil that serves as the base material and can be broadly classified into mineral oil and synthetic oil. Synthetic oils, including PFAS, have excellent high-temperature stability and temperature-viscosity characteristics, etc. Synthetic oils are used under conditions that mineral oils cannot handle. Also, thickeners, one of the components of grease, are substances that act by dispersing to create a three-dimensional structure and a semi-solid state. There are two types of thickeners: soap-based and nonsoap-based, and PTFE is classified as a nonsoap-based thickener. By creating such a structure, it can hold oil and supply oil where it is needed.

■ Concerns about substitution

Because of the harsh conditions in automobiles, other mineral oils and synthetic oils cannot maintain their functionality over long periods of time. As for base oils, general mineral oils are inferior to fluorinated oils in terms of heat resistance and low temperature resistance, and cannot coexist with rubber and resins for a long period of time. In addition, silicone oils have greatly reduced lubricity. Ester oil also cannot coexist with rubber or resin for a long period of time, and polyglycol oil also cannot coexist with resin for a long period of time. Therefore, there are no alternative base oils available at this time. As for thickeners, soaps such as calcium, lithium, aluminum, and barium (including complexes), which are classified as soaps as mentioned above, have inferior heat resistance to PTFE. Other nonsoap-based materials include bentonite and urea, but they do not satisfy the above mentioned heat resistance, water resistance, and shear stability at the same time.

Applications: Wire, Cable, Harness and Optical fiber

Some information will be included only in the confidential version. Please refer to the confidential version for further details.

- Product Examples

Lead wires for condensers in inverters, wires in DCDC converters, wires for alternators, wires for generators, wires for heaters, control cables for air conditioning, wires for radiators, wires for speed sensors, Wires for water level switches and engine oil level switches, wires for injectors, wires for diesel speed sensors, wires for diesel solenoid valves, wires for knock sensors, fuel pump lead wires, wires for fuel sensors, wires for AT valve solenoid sensor, wire for air bag sensor, wire for heat flow center, wire for motor rotation sensor, wire for transmission motor, solenoid wire for transmission, wire for electric oil pump, wire for temperature sensor, harness for stabilizer, wires for rear doors, inner wires for front door locks, wires for sliding doors, wires for water temperature sensors, cables for seats, harnesses for electronic keys, cables for navigation systems, cables for LED controllers, levelers and in-vehicle monitors, wires for crank angle sensors, wires for flywheels ACG, wires for in-vehicle information systems, wires for ETC, wires for oxygen sensors, wires for air-fuel ratio sensors, wires for NOx sensors, wires for wire harnesses, optical fiber, optical cables, etc.

- Necessity of using PFAS

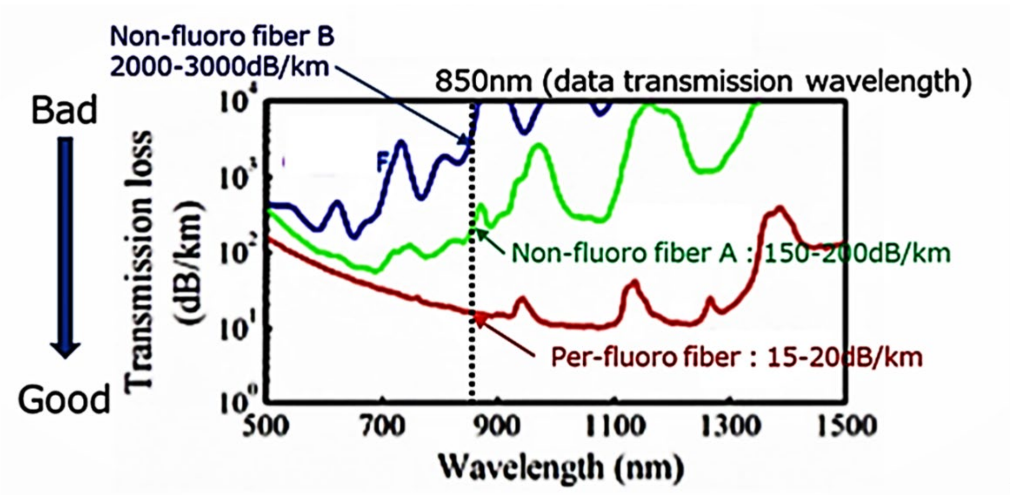
Fluoropolymers such as ETFE, PFA, FEP, FKM, PVDF, PTFE, and FVMQ are used as insulation coatings and heat shrink tubing in areas where heat resistance, electrical insulation, dielectric properties, oil resistance, corrosion resistance, sliding properties, and pressure resistance are required.
Regarding to optical cables for automotive applications, transmission characteristics, flexibility, and reliability are particularly important, and only fluorinated optical fiber and optical cables satisfy all of these characteristics.

- Concerns about substitution

Fluoropolymers are used for wires, cables, and harnesses used in the harsh conditions of automobiles (where the above properties are required for long periods of time), and no alternative materials that can combine the required properties can be identified.

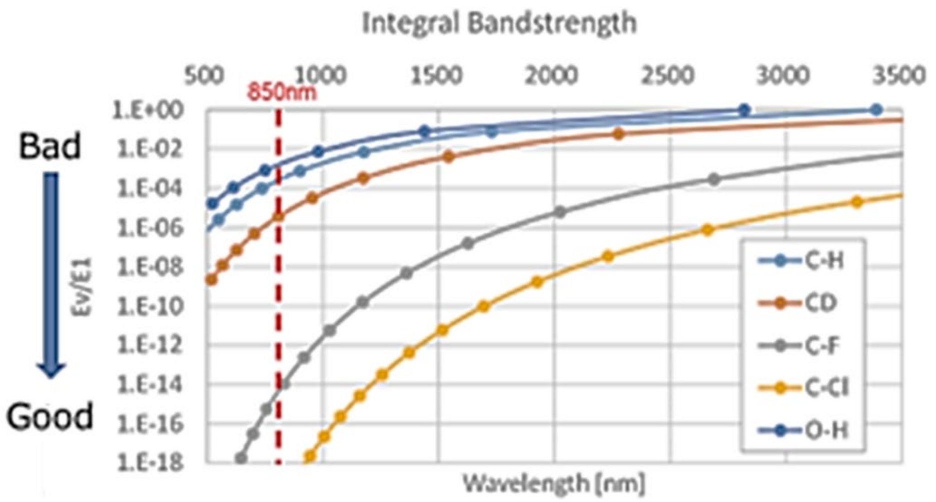
Electrical cables and glass optical cables, which have been mentioned as alternatives to optical cables, do not have sufficient properties for them, and currently only optical fibers made of fluoropolymers are used for automotive communication applications. Furthermore, fluoropolymers are the only materials that can provide sufficient transmission speeds at ever higher speeds in the future.

It is impossible to replace non-fluorinated plastic optical fiber/cables from fluorinated optical fiber/cables due to chemical principles. One of the main characteristics required of optical fiber cables is transmission characteristics, and if transmission characteristics are poor, sufficient information cannot be transmitted. There are several factors that cause poor transmission characteristics, but one of the major factors is absorption loss due to the chemical bonding of the material.
The following figure shows transmission loss for non-fluorinated and fluorinated fibers. The higher the loss, the higher the speed and the less accurate the data transmission. Transmission is required at a wavelength of 850 nm. The fluorine fiber (red line) at that wavelength has a low loss of 15-20 dB/km, while the non-fluorine fiber shows a high loss of 150-200 dB/km (green line) or 2000-3000 dB/km (blue line).



＊Data transmission loss of plastic optical fibers
(http://kpri.keio.ac.jp/research/sub1.html)

This difference in transmission characteristics is an intrinsic difference caused by differences in the chemical bonding (overtone absorption) of the materials. The following figure shows the absorption of each bond: at a wavelength of 850 nm, the C-F bond (gray line) suppresses absorption to $1/10^{10}$ compared to the C-H bond (light blue line), indicating that the fluorinated optical fiber has better transmission properties than the hydrocarbon-based optical fiber. Other chemical bonds, such as the C-Cl bond (yellow line), also suppress absorption in the same way, but it is already known that compounds containing C-Cl bonds have non environmental-friendly. In addition, it has been confirmed that replacing the C-F bond with a C-Cl bond in any compound significantly reduces heat resistance and does not meet the characteristics of an optical fiber. Furthermore, optical fibers with C-D bonds (orange line) are also on the market, but these can only be used in limited applications due to insufficient transmission characteristics. These chemical facts make the use of fluoropolymers a must for optical fibers.



＊Integrated Bandstrength
(Journal of polymer science: Part B: Polymer Physics 2011, 49, 2-17, Fig.5)

As described in Annex A.3.11 and A.3.12, electrical cables are still not used for automotive applications due to insufficient reliability and possible interruption of communication due to electromagnetic interference.
In automotive applications, where glass optical fiber cables are subject to frequent vibration, the brittleness of the glass material can cause a breakage called "flap," which may result in communication failure. In addition, flexibility is also important

for wiring in a limited space, and plastic optical cables have a significant advantage over glass optical cables in permanent bending tests. For these reasons, glass optical cables are still not used for automotive applications.

Application: Valve

- Product Examples

Fuel valves, fuel cap valves, etc.

- Necessity of using PFAS

Fuel valves and fuel cap valves are equipped with a sealing mechanism to prevent fuel vapor from leaking out of the fuel tank. The rubber parts are used of FKM, fluoroelastomer, which must be flexible to ensure sealing performance and have good fuel permeability to meet the emission regulations of various countries. In addition to flexibility and fuel permeability, these materials are required to have fuel oil resistance, cold resistance, low adhesion, and low compression set. Also some FKMs include Bisphenol AF, a PFAS, which is used as an additive for cross-linking.

- Concerns about substitution

There is no suitable alternative material that can satisfy the required functionality. Excellent fuel permeability is one of the most important properties required for these parts, but other properties must also be considered, which cannot be satisfied by alternative materials. Replacing existing materials with ones that perform less well will not ensure adequate compliance with national emission regulations and will lead to environmental pollution and adverse effects on human health.

Application: Millimeter wave radar

- Product Examples

Radar modules (radar substrates), etc.

- Necessity of using PFAS

PTFE and PTFE fiber are used as the substrate material for the antenna.
Materials used for high-frequency transmission are required to have low loss, and low dielectric constant and low dielectric loss tangent are indispensable characteristics for substrate materials. In addition, from the viewpoint of circuit board manufacturability and reliability, it is necessary to combine low linear expansion coefficient, Cupper adhesion, heat resistance, flame resistance, low moisture absorption, etc. Substrate materials based on PTFE, when combined with glass cloth and inorganic fillers, can satisfy all the requirements for high frequency circuit boards with dielectric constant below 3.0 and dielectric loss tangent below 0.001. However, materials based on non-fluorine materials have a dielectric constant of 3.0 or higher and a dielectric loss tangent of 0.002 or higher, resulting in reduced antenna efficiency and increased loss, resulting in shorter radio wave distances and inadequate signal-to-noise ratio.

- Concerns about substitution

PTFE combines the properties required for high-frequency circuit boards, such as low dielectric properties, low moisture absorption, high heat resistance, and non-flammability. No other material has all of these properties, and no alternative PFAS-free technology or potential alternative materials have been identified.

Application: Switch

- Product Examples

Hazard switches, power seat switches, power window switches, sliding door switches, etc.

- Necessity of using PFAS

PTFE is used as a structural material for various switches, and has waterproof and dustproof functions for the contact area and moderate flexibility functions to transmit the ON/OFF feeling to the fingertip when the button is pressed. It also satisfies the reflow resistance required for the component materials during mounting.

The following table shows specific characteristics of PTFE. Each of these properties is found to be superior to the other materials.

: Physical property value not achieved

Feature	Required characteristics	Material					
		PTFE	PET	PE	PP	PI	PPS
water repellency	Contact angle to H_2O 90° or more	**120-130**	65-90	100-115	105-115	65-75	100-110
antifouling property	Must be a non-porous film	✓	✓	✓	✓	✓	✓
Flexibility	Tensile strength 20Mpa or more	**20-35**		19-39	35	82	162
	Elongation 100-500%	**200-400**		10-1200	700	2	1.3
Reflow resistance	Melting point 260℃ or more	**327**	256	120-140	160	＞500(Tg)	277

■ Concerns about substitution

There are no alternatives to PTFE sheets and PTFE-based adhesive tapes that have the flexibility suitable for switches and the necessary functions of water repellency, stain resistance, and reflow resistance. There is no evidence that new materials with these properties will be developed in the future.

Application: Display device

Some information will be included only in the confidential version. Please refer to the confidential version for further details.

■ Product Examples

Display devices for automobile instruments (polarizing plates for flat displays, antireflective plates for instrument panel displays), etc.

■ Necessity of using PFAS

Fluoropoymer is used to prevent surface contamination, which requires water/oil repellency, resistance to finger contact, weather resistance, and resistance to temperature and humidity.

■ Concerns about substitution

The instrument panel and other display devices around the driver's seat are susceptible to deterioration of display quality due to condensation caused by temperature changes during driving, adhesion of dirt and contaminants from human skin and other sources, and adhesion of contaminants from the air. In particular, touch panel displays are at even greater risk of contamination due to repeated finger contact during operation. Fluorinated materials can minimize the risk of contamination due to their water/oil repellency. This property is due to the extremely low intermolecular attraction and surface free energy of the C-F bond, and there are currently no materials other than C-F bonds that can achieve the same performance. In addition to transparency, thermal stability and chemical stability are also required when used on the topmost surfaces of various devices, further increasing the difficulty in finding alternative materials.

Application: Air conditioning

- Product Examples

Air conditioning systems for automobiles, battery temperature control systems, etc.

- Necessity of using PFAS

Hydrofluorocarbons (HFCs), Hydrofluoroolefin (HFO), HFEs, which are classified as fluorinated ethers and alcohols, and Perfluorocarbons (PFCs) are refrigerants used for heat transfer in air conditioning systems such as automotive air conditioning systems (hereinafter referred to as Mobile Air Conditioning System (MAC system)). Some are also used in temperature control systems for vehicle batteries. Temperature control systems for batteries are similar in structure, etc., to MAC systems. For this reason, the temperature control system for batteries is also included in this comment as a MAC system.
In addition, since these refrigerants for air conditioners are used not only in internal combustion engine vehicles that use mechanical compressors, but also in HEV, PHEV, and BEV that use electric compressors, it is necessary to set the same derogation as that for internal combustion engine vehicles to avoid market confusion when switching over. However, this is not to argue that the 5 years derogation period written in paragraph5 p is reasonable.

- Concerns about substitution

CO_2 (R744) and propane (R290) are possible alternatives to R1234yf and R134a, which are currently the primary refrigerants used in MAC systems. Concerns about replacing each of these refrigerants are as follows.

(1) R744

R744 is not a refrigerant that can be used in all countries and environments, although some vehicles already have onboard air conditioning systems that use it. For example, in countries with high temperatures, air conditioning performance and energy efficiency may be reduced due to the properties of the refrigerant.

(2) R290

As for R290 refrigerant, it is expected to have good energy efficiency as a MAC system, as described in the report on this restriction proposal. However, it is highly flammable, and there is no prospect for technological development of MAC systems using R290 refrigerant. In addition, there are currently no safety standards in place for the development of MAC systems using R290 refrigerant, and the industry and related parties will need to establish the necessary safety standards.

Since none of these refrigerants can be used in the current MAC system by filling them as they are, a new MAC system using these refrigerants is required. Therefore, the existing production facilities cannot be used, and new production facilities must be prepared and installed. Since it is unprofitable to have both facilities for air conditioning systems using current refrigerants and facilities for air conditioning systems using alternative refrigerants, it is necessary to select refrigerants for MAC systems from the perspective that they can be used globally, not just in the EU.

The selection of appropriate refrigerants, technological development of new MAC systems using these refrigerants, introduction of new equipment and investment for mass production, and verification of conformity and safety for installation in automobiles are required, so the schedule proposed in the restriction dossier (MAC systems other than mechanical compressors: no derogation, MAC systems with mechanical compressors: 5 year Derogation period) is difficult to replace.

After selecting an appropriate refrigerant, we believe that at least 5 years of technological development will be required. In order to install the refrigerant in all automobiles and place on the market, we believe that it is realistic to apply the refrigerant to new models and new vehicles separately.

Furthermore, there are no viable alternatives for mechanical compressors for both refrigerants, because there is no technology in sight for R744 to prevent refrigerant leakage from sliding parts, and it is too dangerous to be used with a highly flammable refrigerant, R290 in an engine vehicle with hot location. For this reason, we require indefinite derogation for mechanical compressors.

The PFAS restrictions also raise concerns about the reliability, longevity, safety, and leakage control (which increases indirect emissions) of the associated equipment used in MAC systems. In particular, PTFE-based components and lip seals have a significant impact on the performance of MAC systems. The need arises to assess the risks and investigate the degree of impact, and sufficient time is needed to verify them. There are currently no alternatives to the fluoropolymers used. Alternatives must satisfy properties comparable to fluoropolymers, which are necessary to ensure consumer safety and the long-term reliability of the equipment.

Application: Weather stripping

Some information will be included only in the confidential version. Please refer to the confidential version for further details.

- Product Examples

Rubber glass run channel, etc.

- Necessity of using PFAS

The glass run channel holds the left and right window glass of an automobile and smoothly lifts and lowers the window glass. The weather-resistant EPDM rubber has a non-slip on the surface and is coated with a smooth coating where it meets the glass. The role of the coating is to weaken the adhesiveness of the rubber and to make it slippery, and the coating must be tough and durable enough to prevent the rubber from breaking even after thousands of window glass lifts and lowers. These are performed properly by adding PTFE particles as a solid lubricant to the base of the coating, which combines slipperiness and durability.

■ Concerns about substitution

If substituted with resin particles other than PTFE, they cannot withstand being rubbed thousands of times by the edge of window glass. Abrasion interferes with the safe lifting and lowering of glass. There are no alternatives for PTFE particles that can provide the same level of performance. The alternative technology as a product is to change the material from rubber glass run channel to TPV (thermoplastic elastomer) glass run channel, but this would require new extrusion tooling and molds, which would require a large capital investment cost, time, and manpower, and would have a significant impact on the business.

Application: Internal pressure regulator

■ Product Examples

Lamps (headlamps, rear lamps, fog lamps and other automotive lamps), electrical components (engine ECU, EPS, PCU, AC/DC inverters, DC/DC inverters, drive electric motors, OBC, JCB, millimeter wave radar, window motors, ESC, automotive cameras, etc.)

■ Necessity of using PFAS

Filters using PTFE porous membranes are widely used for internal pressure control components that require internal pressure control, water and oil repellency, water resistance, dust resistance, durability, heat resistance, and non-adhesiveness in electrical components, and that can satisfy these required characteristics.

■ Concerns about substitution

The differential pressure between the inside and outside of the electrical components is about 20~35 kPa due to differences in elevation and temperature during driving, driving on flooded roads, and so on. If this internal pressure is generated repeatedly, the seals of the electrical components may break, allowing rainwater or dust to enter through the seals, resulting in deterioration of the electrical components' functions and, in the worst case, failure such as loss of operation while the vehicle is in motion. For this reason, electrical components are provided with ventilation holes, and filters are installed to prevent water and dust from entering through these holes. Filters must be water resistant to prevent water intrusion due to differential pressure. Non-fluorine filters do not have the durability required for electrical components because their surface condition changes when oil or dust adheres to them as surface contamination, clogging occurs after prolonged use, and water can easily penetrate into the interior. The only filter that can meet this requirement is PTFE porous membrane.

- Filters other than PTFE

Polyurethane (PU) porous membranes: PU has a much higher surface tension than fluorine porous membranes (PU: 43, PTFE: 18). Therefore, the water resistance is inferior when differential pressure is generated and when water pressure is applied. Therefore, it is not a substitute for fluoroporous membranes.
Polyacrylonitrile (PAN) porous membrane: Surface tension is much higher than that of fluoroporous membrane (PAN: 52.4, PTFE: about 18). Therefore, water resistance is inferior when differential pressure is generated and when water pressure is applied. Therefore, it is not a substitute for fluoroporous membranes.

Application: Sensor

- Product Examples

Ventilation filter for oxygen sensor, rubber cap for oxygen sensor, rubber cap for full-domain air-fuel ratio sensor, rubber cap for temperature sensor, rubber cap for NOx sensor, separator for oxygen sensor, grommet cover for full-domain air-fuel ratio sensor, grommet cover for NOx sensor, etc.

*For lead wire or wires for sensors, please refer to the section "Applications : Wire, Cable, Harnesse and Fiber Optics".

- Necessity of using PFAS

For ventilation filters, PTFE, FKM, Bisphenol AF, etc. are used for durability, heat resistance, and water resistance, and for other rubber caps, separators, and grommet covers for durability and heat resistance.

- Concerns about substitution

No alternative materials can be identified that can withstand severe environments such as heat resistance.

Application: Shock absorber

This information is only available in the confidential version. For further details, please refer to the confidential version.

Application: Power steering

This information is only available in the confidential version. For further details, please refer to the confidential version.

Application: Hydraulic pump

This information is only available in the Confidential version. For further details, please refer to the Confidential version.

Application: Solvent

This information is only available in the confidential version. For further details, please refer to the Confidential version.

*For information on greases and lubricants, please refer to the "Application: Grease and Lubricant" section.

Applications: Plating and baking coating

Here is why we would like additional derogation for plating and baked-on coatings other than the "hard chrome plating" shown in Paragraph 5 v.

■ Product Examples

Electroless nickel-phosphorus plating with PTFE, Baked zinc flake coating (Geomet treatment)

■ Necessity of using PFAS

In order to improve the hardness of base materials (e.g., ferrous parts), nickel-phosphorus plating is performed by electroless nickel-phosphorus plating. To further add slipperiness, electroless nickel-phosphorus plating with PTFE is available. PTFE powder is dispersed in the plating bath, and when nickel-phosphorus is deposited as a metallic film on the surface of the target substrate, PTFE is co-deposited in the film. In order to disperse PTFE in the plating bath, a dispersant is also required: PTFE can be dispersed in the dispersant and mixed in the plating bath to maintain the desired dispersion state, so that PTFE remains reasonably dispersed in the nickel-phosphorus metal film after the plating process. The dispersant also contains PFAS, which is a necessary formulation to enhance the dispersion of PTFE (to increase the compatibility between the dispersant and PTFE).

The evaluation results for sliding properties and water repellency are shown below. The difference in wear coefficient (an index of sliding property) and contact angle (an index of water repellency) can be seen depending on whether PTFE is used or not.

Dynamic wear coefficient

After plating treatment: 0.19 (without PTFE), 0.08 (with PTFE)

After 320°C-1h treatment: 0.35 (without PTFE), 0.06 (with PTFE)

Static wear coefficient

After plating treatment: 0.30 (without PTFE), 0.10 (with PTFE)

After 320°C-1h treatment: 0.70 (without PTFE), 0.10 (with PTFE)

Contact angle

50-60° (without PTFE), 110° (with PTFE)

On the other hand, in the baked zinc flake coating (Geomet treatment), which is widely used for automotive parts, the object is immersed in a treatment solution containing zinc flakes, etc. and baked to form a strong coating film. This Geomet treatment is widely used as an alternative technology (hexavalent chromium-free) to the Dacrotized treatment that used hexavalent chromium. It can be formed in thin films and has excellent heat and corrosion resistance. The Geomet treated film may be further treated with a film to adjust the coefficient of friction as necessary, and the film contains PTFE.

- Concerns about substitution

Regarding electroless nickel-phosphorus plating with PTFE, our research did not confirm that Japanese plating chemical manufacturers have PFAS-free dispersants on the market for dispersants containing PFAS, but we confirmed that a plating chemical manufacturer in the UK has PFAS-free dispersants on the market. Therefore, we have to answer that there are alternatives to dispersants, but we cannot deny the risk of forced monopolization of the market. We need to keep a close eye on the supply volume of the manufacturer and make an appropriate judgment as to whether a replacement is possible by the end of the deadline. On the other hand, PTFE has a high sliding property, and we have not been able to confirm a substitute that can maintain this property for a long period of time.
On the other hand, only PTFE can maintain the effect of changing the coefficient of friction for a long period of time without adversely affecting the function of the Geomet treated film, and no alternative technology can be identified.

Therefore, regarding to the electroless nickel-phosphorus plating with PTFE and the Geomet treatment, there is no alternative technology or material at present, and there is no prospect of alternative technologies or materials in the future. Therefore, we insist on a 12 years derogation period in Paragraph 5.

Partial contents of optical fiber, shock absorbers, power steering, hydraulic pumps, solvents, and display devices are submitted in a confidential version because they contain confidential information.

Please note that additional documents will be submitted in the course of this public consultation regarding the "semiconductor" and "battery" sections, which were not mentioned in this opinion.

- **Summary of Chapter 5**

These groups of parts are representative examples (for additional details of other components, please refer to the attachment 1 non-exhaustive list of applications). They are part of the applications related to "applications affecting the proper functioning related to the safety of transport vehicles, and affecting the safety of operators, passengers or goods until 13.5 years after EiF".

As mentioned above, with the exception of refrigerants for MAC system, no alternative technologies or materials have been identified, nor is there a clear path forward for their development. Therefore, we, JAPIA, strongly insist on the decision of the 12-year deregulation period in “Paragraph 6 o”, which had been re-discussed after the Public Consultation. Even if alternative technologies or materials are ready, there will be a period for us, the component manufacturer, to verify the safety and reliability of the alternative components for each tremendous number of products, and a period for the automobile manufacturers, the downstream users, to verify them as automobiles, and even after the acceptance is confirmed in both cases, there will be a necessary transition period to switch over. Considering that a necessary transition period is required, even if there is a 12 years derogation period, we, who are responsible for ensuring a reliable switchover, feel very uneasy. The key question is when will alternative technologies or materials be ready. But we do not know when they will be available at this time. Therefore, what we would like to propose is to add a "review clauses" to the proposed restriction that would allow for an extension of the derogation period if suitable alternative technologies or materials are not ready by a given date. This, as you know, has a practical example in the derogation of lead in copper alloys in the EU RoHS Directive, and we would appreciate your consideration of a research project similar to Pack22 and the possibility of a review and possible extension decision by the EU Commission.

6. Environmental release of PFASs

In the case of automobiles, including automobile parts, the ELV Directive has already achieved a recycling rate of over 95%, and it can be judged that disposal to the environment through landfill or other means is extremely unlikely. Therefore, it can be inferred that the release of disposed PFAS into the atmosphere (air), soil, and water (rivers and oceans) is negligible.

In Japan, this is managed under the “Automobile Recycling Law”. From 20% to 45% is removed from end-of-life vehicles (recycled) and the remainder is pressed, of which 40% to 60% is sorted and recycled as ferrous and nonferrous metals. The remaining 20% or less is processed as shredder dust (ASR).
If ASR is considered to be 100%, 96.1% is either thermal recycled or material recycled, and only 3.9% is disposed of by landfill or other means (in terms of weight in FY2020). This is less than 0.8% of the total number of end-of-life vehicles. Since this figure includes various material types (including remaining metals), it can be

said with certainty that the percentage is extremely small when limited to PFAS. Considering the entire automobile, the recycling rate is over 99%.
For these reasons, the amount released into the atmosphere (air), soil, and water (rivers and oceans) by being left in the ground for eternity will be very small.
Since the actual situation by the EU region could not be confirmed, it expects information from submitter in the EU region.

Recycling allows PFAS to be used in a cyclical manner (material recycling, thermal recycling), which will certainly reduce the amount of PFAS landfilled for final disposal compared to the increased use of PFAS without recycling, thus reducing the risk of releasing PFAS into the ground and, ultimately, into rivers and seas. In addition, as the world moves toward a circular economy society and technological innovation advances, the use of further recycling technology (chemical recycling) is expected to further reduce the amount of non-circulating material, further decreasing the risk of environmental degradation.

On the other hand, please note that additional information that could not be discussed in this document due to time constraints, such as environmental releases that are assumed to occur while the vehicle is in motion (use phase), will be provided in additional documents during this public consultation process.

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