



DRIVING ADVANCEMENTS
IN GLOBAL MOBILITY

Powertrain Sealing & Gaskets PFAS Response

September 2023





DRIVING ADVANCEMENTS
IN GLOBAL MOBILITY

Overview



Justification

Introduction

Fluoropolymers are high value polymers that play an essential role in many industrial applications. This is due to their unique characteristics, as they are highly heat resistant, almost chemically inert with excellent ageing resistance, non-flammable, non-stick, low in friction, excellent in dielectric properties and excellent as fuel and hydrogen gas barriers. The fluoropolymer group is composed by extremely stable specialty plastics, elastomers and liquid polymers, for us relevant are PTFE resins and FKM elastomers.

They are part of a broader family of chemicals known as Per- and Poly-Fluorinated Alkylated Substances (PFAS), based on the OECD classification (OECD Classification on PFAS: <https://www.oecd.org/chemicalsafety/portal-perfluorinated-chemicals/aboutpfass>), which in its wider definition may include more than 10,000 chemicals. While fluoropolymers show significantly different properties from the health and environmental hazards perspective to other PFAS, a broad restriction proposal from EU authorities, could have a dramatic impact for our company and our customers.

Fluoropolymers represent a clearly differentiated group within the vast family of PFAS. Fluoropolymers are durable and stable in the environment, properties which are necessary for their application, but are not bio-accumulative or toxic, therefore they do not meet the criteria for restriction. For this reason, we would like to highlight, supported by accurate and verifiable data, the fact that including fluoropolymers in the broad PFAS restriction would not be an efficient and proportionate regulatory option for these polymers, and that alternative procedures to adequately control the very specific situations that may raise concerns from the use of fluoropolymers are possible.

As a key company involved in downstream uses of fluoropolymers, we understand the consequences that a ban on the use of these materials may have. As a Manufacturer of Articles, we are committed to responsible product stewardship practices and will continue to work closely with regulatory authorities and our customers around the globe to ensure that our products continue to provide all the benefits and innovations for which they are used with confidence. Throughout our internal processes of regulatory monitoring and exchanges with our professional organizations and our providers of fluoropolymers, we are responding to this public consultation and we have actively participated in the Call for Evidence.

This document provides our feedback to the public consultation to the PFAS (Per and polyfluoroalkyl substances) REACH restriction proposal. Tenneco Powertrain, Sealing & Gasket business unit, is requesting that the Fluoropolymers FKM and PTFE are not included in the Restriction proposal.

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Company Background





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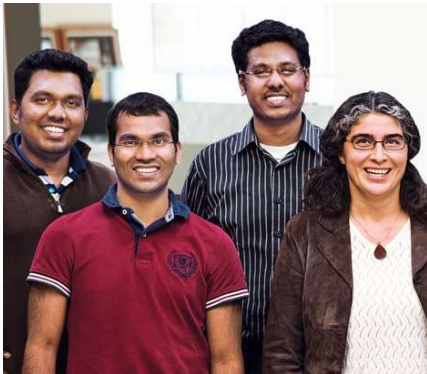
Solutions for cleaner, more efficient, comfortable and reliable performance

Market leading product, technology & brand portfolio

Design, engineering & lifecycle management expertise

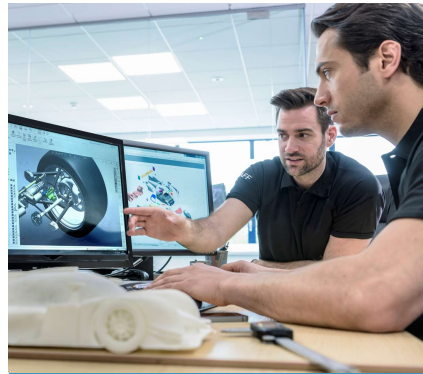
Advantaged global end-to-end supply chain capabilities

Tenneco Today



71,000

Global team
members



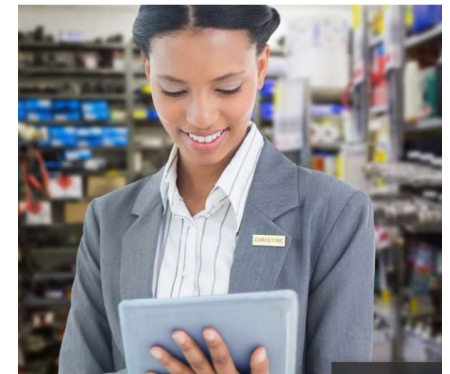
38

Globally networked
engineering &
technical centers



196

Manufacturing
sites worldwide



29

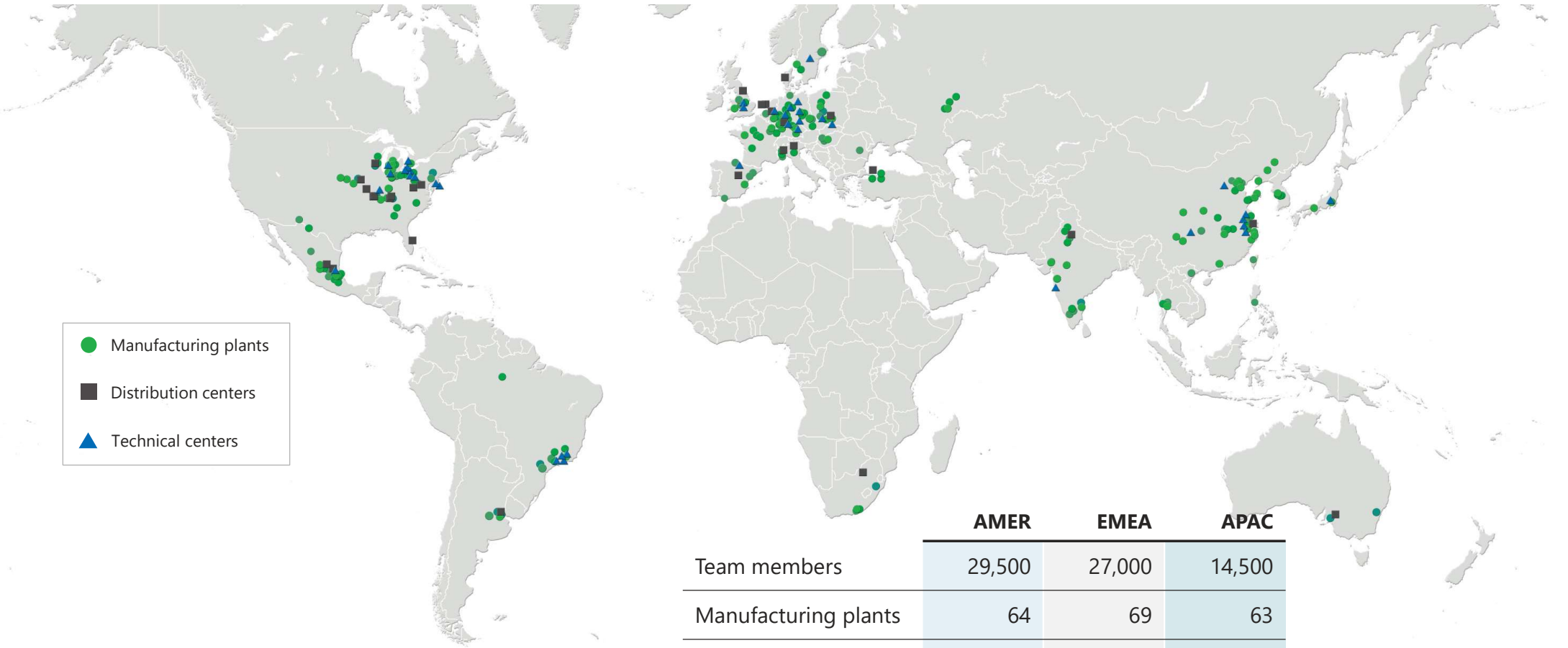
Aftermarket
distribution
centers



Uniquely Strong Global Capabilities

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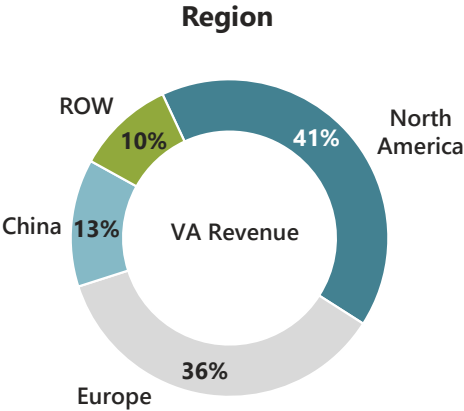
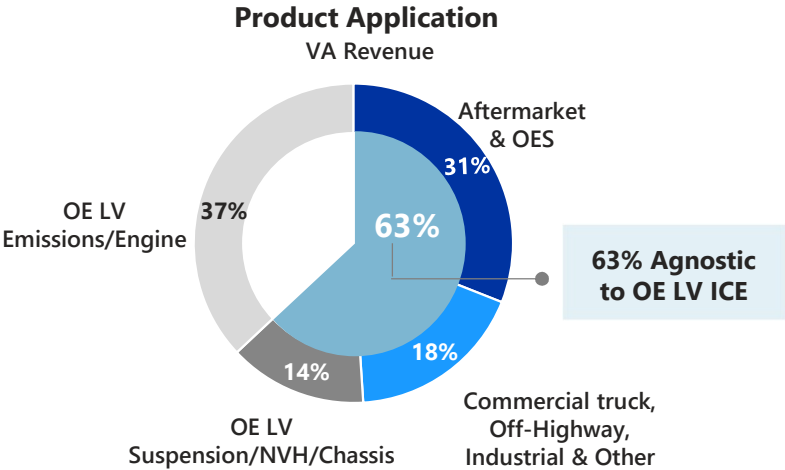
Global Manufacturing and Distribution Facilities



	AMER	EMEA	APAC
Team members	29,500	27,000	14,500
Manufacturing plants	64	69	63
Distribution centers	14	12	3
Technical centers	16	14	8

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2021 Product Range and Geographic Coverage



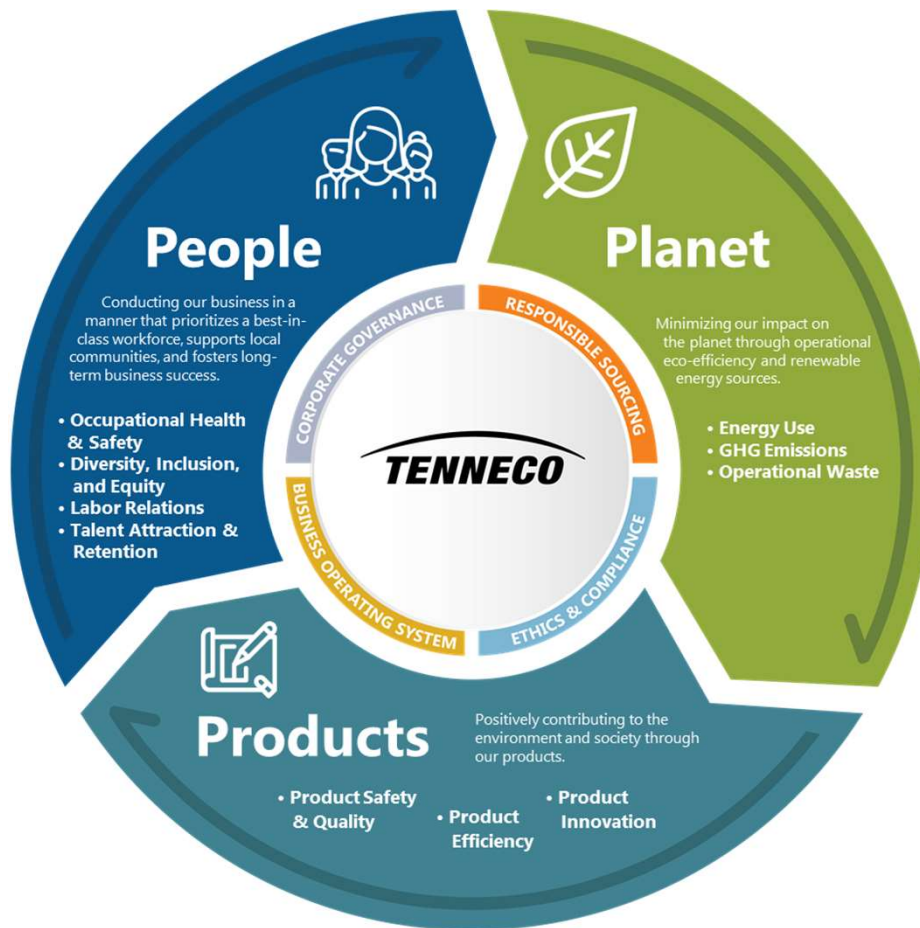
See Tenneco's press release dated February 23, 2022 for certain reconciliations of GAAP to non-GAAP results.

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The Road to Making Tomorrow Better

Environmental Social and Governance (ESG) is an integral part of Tenneco's strategy and operations. We consider it a part of holistic operating excellence and aligned with our values.



ESG Completed Milestones

- ✓ GRI & SASB metric reporting
- ✓ Robust materiality assessment
- ✓ Announced 2030 goals
- ✓ Cross-functional ESG council; sub councils for energy and supply chain
- ✓ Customer awards for supplier diversity and product quality

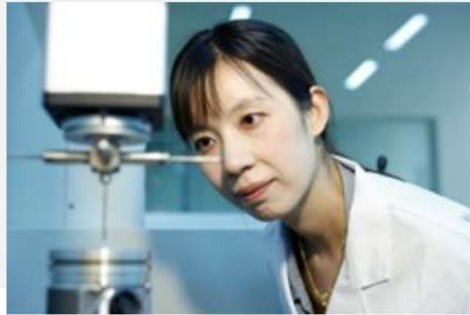
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Tenneco Business Segments



Clean Air

Engine Emission Control
and Acoustic Performance



Powertrain

Engine Components for
Improved Efficiency and Durability



Performance Solutions

Vehicle Ride and
NVH Management



DRIV

Global Automotive
Aftermarket Leader

Powertrain Overview

Tenneco's Powertrain business group designs, develops and manufactures original equipment components and innovative technologies that help engine designers meet increasingly demanding customer, regulatory and market requirements in every region of the world.

Whether for gasoline, diesel, alternative fuel or electric & hybrid applications, across every sector, the company's advanced components and systems, specialized coatings and proprietary manufacturing processes help to reduce emissions, improve fuel economy and enable advances in engine design, from small 25 mm bore to engines with over 1,000 mm bore and more than 100,000 hp.

Tenneco Powertrain is a leader in the OE light vehicle, commercial truck and off-highway markets and also supplies related technologies to the power generation, marine, rail and industrial sectors.

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Fluoropolymer containing products





Powertrain Sealing & Gaskets

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Sealing and Gaskets - Internal Combustion Engine Applications

Heat Shields

Upper Turbo

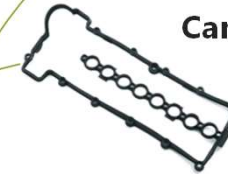


Exhaust Manifold

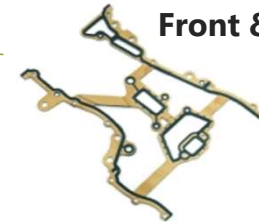


Cold Static Gaskets

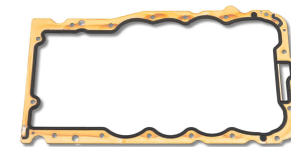
Cam/Valve Cover



Front & Rear Cover



Oil Pan



Hot Gaskets

Cylinder Head



Exhaust Manifold



Turbo



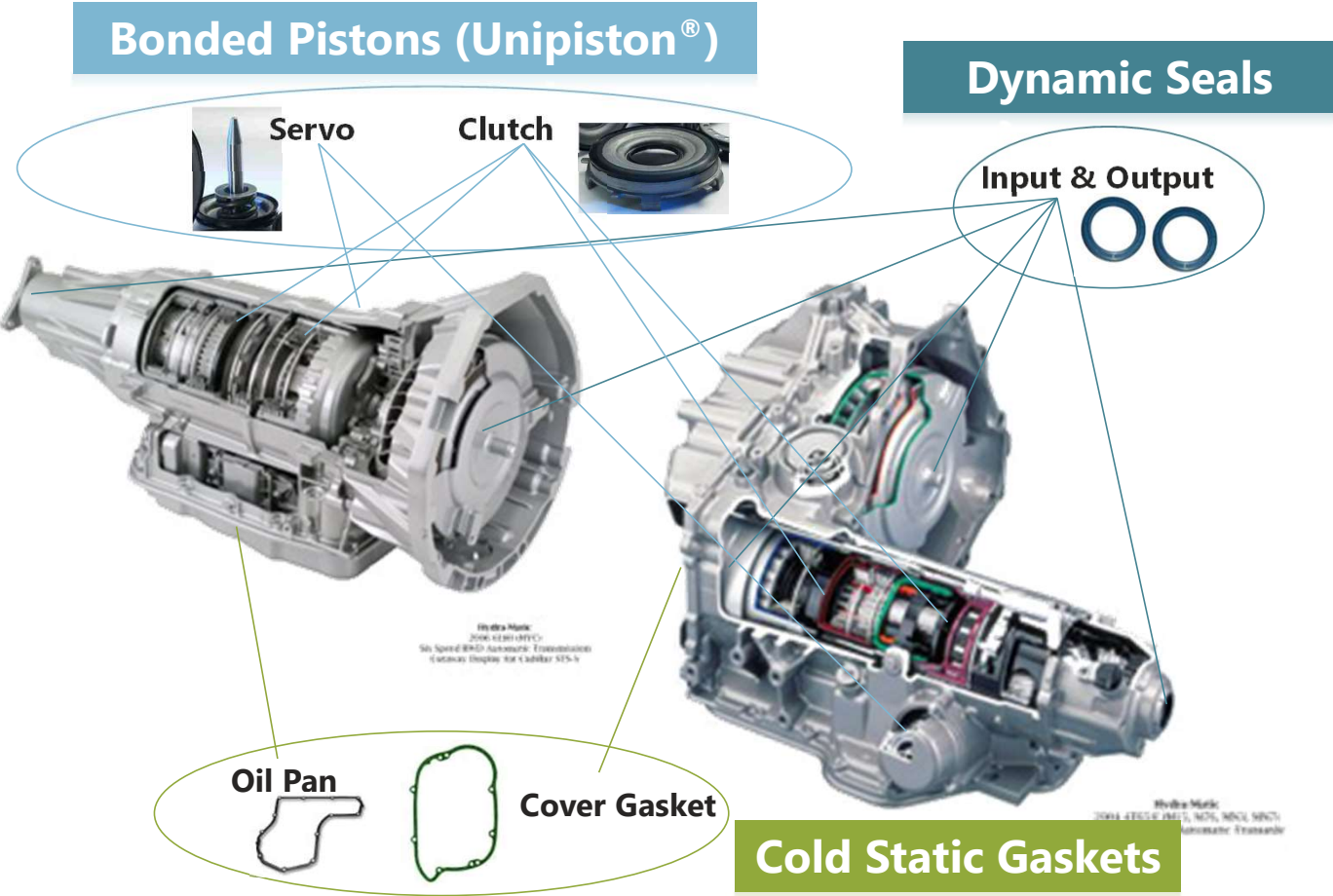
Front & Rear Crankshaft



Dynamic Seals

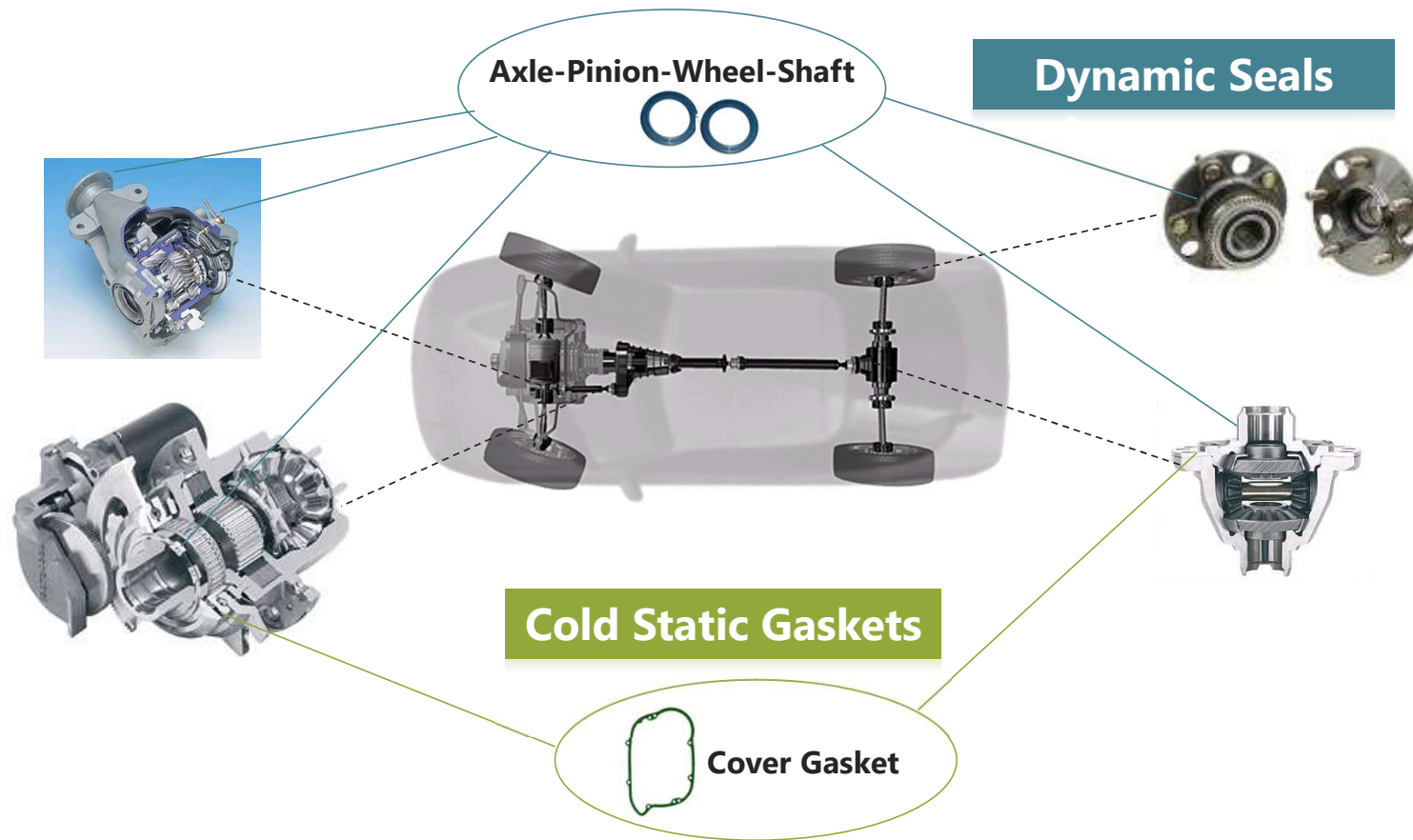
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Sealing and Gaskets - Transmission Applications



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Sealing and Gaskets - Driveline Applications



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Information on Functions and Alternatives



Information on Functions and Alternatives

Fluoropolymers are used when a combination of requirements needs to be met and no other alternative material solutions exists. These requirements include:

- Extreme temperature range use (-40°C to +250°C)
- Outstanding long-term chemical resistance (oils, coolants, water, fuels, acids)
- Non-flammable (UL 94 V0), low in friction
- Excellent dielectric properties (volume resistance $> 10^8$ Ohm)
- Low H₂ and fuel permeation

This combination of properties is only possible due to the chemical structure of fluoropolymers (physico-chemical properties). **It is therefore not possible to obtain them without the existence of C-F bonds.**

Our conclusion is that the potential alter-natives to Fluoropolymers are not actually alternatives, as their performances and technical characteristics are not at the same level as Fluoropolymers. In the best case the use of these other raw materials results in much lower product lifetimes and therefore higher volumes of waste products.

Information on Functions and Alternatives

This is also supported by the UK Health and Safety Executive “Analysis of the most appropriate regulatory management options”, March 2023 <https://www.hse.gov.uk/reach/assets/docs/pfas-rmoa.pdf> which states in respect of fluoropolymers and fluoroelastomers, that the industry view appears to be that for many or most uses there are no alternatives with the requisite performance characteristics.

In addition, it explains that substitution of PFASs may need to take place across different pathways and timescales.

It also highlights that many existing possible alternatives present potential human health and/or environmental hazards which require further investigation.

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IN GLOBAL MOBILITY

Fluoropolymers



Fluoropolymers

- The Restriction proposal follows the OECD definition of PFASs meaning – fluorinated substances that contain at least one fully fluorinated methyl or methylene carbon atom (without any H/CL/Br/I atom attached to it) (with certain limited exclusions).
- The OECD “Reconciling Terminology of the Universe of Per-and Polyfluoroalkyl Substances: recommendations and Practical Guidance” explains (amongst others) that:
 - it should be noted that this general PFAS definition is based only on chemical structure, and the decision to broaden this definition compared to Buck et al. (2011) is not connected to decisions on how PFASs should be grouped in regulatory and voluntary actions.
 - PFAS are a chemical class with diverse molecular structures (e.g. neutral, anionic, cationic or zwitterionic; with or without aromatic rings; non-polymers or polymers; low molecular weight or high molecular weight) and thus diverse physical, chemical and biological properties (e.g. involatile or volatile; water soluble or water insoluble; reactive vs, inert; bioaccumulative or non-bioaccumulative). Therefore it is highly recommended that such diversity be properly recognized and communicated in a clear, specific and descriptive manner.
 - The term “PFASs” is a broad, general, non-specific term, which does not inform whether a compound is harmful or not, but only communicates that the compounds under this term share the same trait for having a fully fluorinated methyl or methylene carbon moiety.
 - in respect of the revised definition of PFASs it does not conclude that all PFASs have the same properties, uses, exposure and risks.

As such, fluoropolymers should not be treated in the same way as other PFASs for which there are known concerns (e.g. PFOA).

Fluoropolymers

- The UK Health and Safety Executive “Analysis of the most appropriate regulatory management options (RMOA)” <https://www.hse.gov.uk/reach/assets/docs/pfas-rmoa.pdf> also considers PFAS. However, it considers a narrower definition on the basis that compounds with a single isolated –CF₂– group are generally understood not to degrade to any of the highly persistent substances that have given rise to the environmental and/or human health concerns about PFAS.
- The UK Health and Safety Executive adopted an approach of grouping PFASs into further subgroups with fluoropolymers being allocated to their own specific sub-group. This is due to the acknowledgement that not all PFASs give rise to the same environmental and/or human health concerns.
- The UK Health and Safety Executive concludes that any restriction it would support under UK REACH need not apply to low hazard groups or low risk uses including fluoroplastics and fluorelastomers.

Tenneco Powertrain, Sealing & Gaskets business unit supports certain of these conclusions, in particular that restriction is not an appropriate option for fluoropolymers.



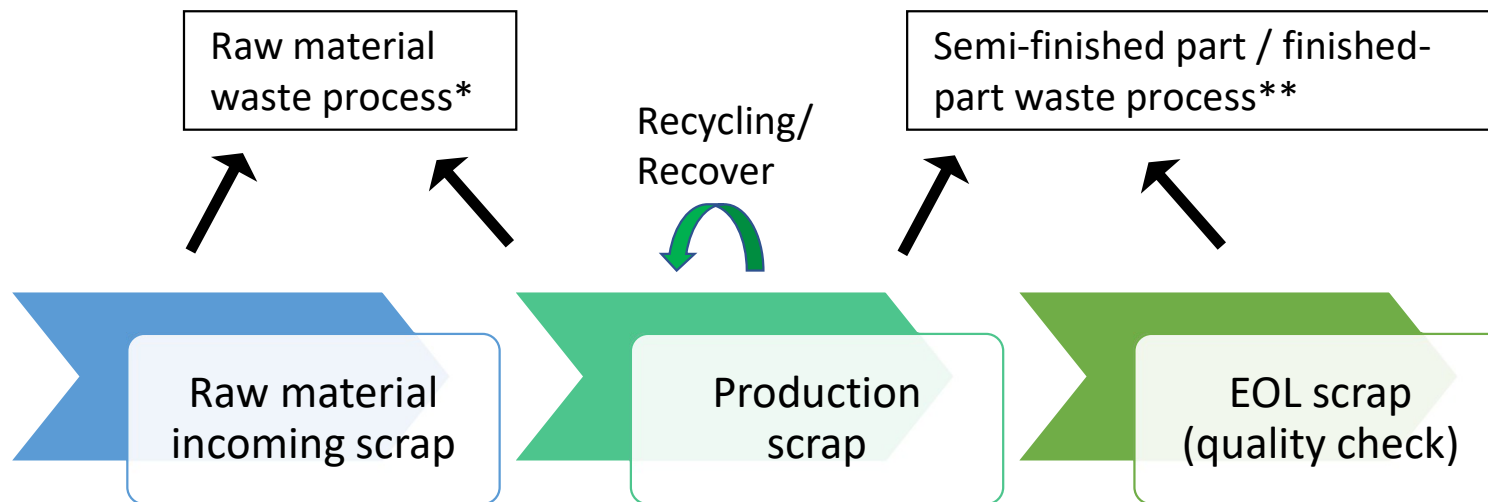
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Minimizing Emissions



Measures of Protection - Emission

PTFE, FKM material is being recycled / separated where possible, and properly disposed of at every step in the process, therefore no uncontrolled release into the environment from Tenneco plants.



*according to local law & further processing by the waste management company

**Further processing by the waste buyer



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Conclusions



Conclusions

Tenneco Powertrain, Sealing & Gaskets business unit, advocates for a balanced environment, based on scientific facts.

As such, Tenneco Powertrain shares the opinion of a large number of scientists, namely, that fluoropolymers (especially FKM and PTFE) must be distinguished from other PFAS. This is particularly true because fluoropolymers have very different toxicological profiles from other PFAS substances.

According to OECD criteria, they are considered "Polymers of low concern (PLC)", "Fluoropolymers are non-toxic, not bioavailable, non-water soluble and non-mobile molecules and are deemed as such to have no significant environmental and human health impacts". They are used in a large number of applications, some of which bring considerable benefits to society, and positively impact meeting the ambitions of the European Union in terms of climate, energy, health and Industry.

Currently, there is no alternative material that can replace fluoropolymers. And there is nothing to suggest that it could be otherwise in the short, medium or long term. Therefore, **Tenneco Powertrain, Sealing & Gaskets business unit is requesting that Fluoropolymers are not included in the Restriction proposal.**