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**Pneurop committee 5 "Vacuum technology" (PN 5)
Draft position paper on the planned restriction of PFAS
Version 2.1**

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1. Executive Summary

Pneurop is the European association of manufacturers of compressors, vacuum pumps, pneumatic tools and related equipment. Pneurop members are national associations, representing more than 200 manufacturers in 7 EU Member States, the United Kingdom and Turkey. The European market turnover of the represented company exceeds 20 billion euros.

Pneurop agrees that PFAS should only be used where strictly necessary and fully supports the restriction of PFAS into the environment. However, as there are no alternatives available today and in the foreseeable future for critical applications, the use of those PFAS containing applications should remain possible in a controlled way (collection, recycling, appropriate disposal).

We must avoid regrettable substitutions for our customers in the medical, food and beverage, energy, and many other sectors.

Even though the amount of PFAS in our products is very small ($\ll 0,1\%$ by weight), there are PFAS containing parts in all of them. The impact of a ban in Europe will imply a closure of the European factories of our members with 100% loss of employment ($\gg 10.000$ people) and revenues ($>20\text{b€}$).

Pneurop is submitting four papers to elaborate in more detail the use, value, and challenges of our major product types.

In this paper we describe the PFAS issue regarding the Vacuum technology

Vacuum technology is a highly developed technology that requires special manufacturing processes and care in handling in order to achieve the desired results in what are sometimes very sensitive processes.

The Vacuum technology is indispensable for many applications in daily life, such as:

- Semiconductor industry
- Energy (Wind, Solar etc.)
- Health care

For more details please see Annex 1

Pneurop supports the fundamental goal of preventing hazardous PFAS from entering the environment.

Problem of this regulation:

- In one fell swoop, many substances will be banned for which there are no substitutes for fluoropolymers today or tomorrow. This will mean that many things can no longer be manufactured in industry, and this will then also affect all consumers. For example, PFAS are used in many seals, especially in the high-temperature range (engines, heating systems, food processing, textile drying). Fluoropolymers are used because they are needed. Not because they are cheap.
- The regulation makes no distinction between applications, i.e., products where PFAS can enter the environment directly, and those where PFAS is built deep inside, say, a machine.
- As a result of the ban on the PFAS group of around 10,000 substances, mechanical and plant engineering is affected across the board: either in the products or in production. Seals, hoses, fittings, pumps, valves, compressors, coatings and Vacuum technology are particularly affected. A ban will force companies to discontinue their products and/or production! All the products mentioned will then no longer be available in this way. The exceptions that exist will then come as products from countries with often lower regulations.

Recommendations:

- Exempt polymers of low concern (OECD definition) and their production from the ban, as also called for in the study by the British Health and Safety Executive (HSE).
- Develop a handling concept for safe production and disposal to prevent these fluoropolymers from entering the environment.
- Consider route of entry into the environment: No ban where there is no risk
- Research fund for the development of alternative concepts in mechanical and plant engineering to minimize the use of PFAS or make it completely unnecessary.
- Transition periods: The planned transition period of 18 months is too short for industrial applications. Even to test the possible alternatives for functionality and safe application, a period of several years is needed.

2. Importance of Vacuum technology for industry and society

Vacuum technology is a technology of the future. Whether in information technology, energy or medical technology, without high-performance vacuum technology with its innovative components tailored to the process, progress in the above-mentioned areas, as well as in the packaging industry, chemical process engineering, surface technology and basic research, would be inconceivable. Vacuum technology gives us an insight into our universe, and at the same time it is the basis for further reducing the structure sizes in semiconductor technology and thus, for example, for ever more powerful computers that have become an indispensable part of our everyday lives. Further details on the customer markets for vacuum technology can be found in the overview "Vacuum Market Segmentation" (Annex 1).

3. Essential functionalities in Vacuum technology

- Oils and lubricants

Oils containing PFAS are used to seal the gaps of the components that generate pressure below 1 bar. Without this gap sealing of the rotating components, the generation of vacuum is much more complex. Furthermore, oils are used as coolants.

Lubricants containing PFAS are used to lubricate the bearings in vacuum components and electric motors, the vacuum pump stages, gearboxes, the crankshafts of the connecting rods.

- Seals / Gaskets

Materials containing PFAS are used for mechanical seals, O-rings, flat and face seals. Due to their higher cost compared to other natural or synthetic elastomers, the use of PFAS materials is limited to absolutely necessary applications and when no other suitable elastomer replacement is available. The main advantage of PFAS elastomers is that they have excellent chemical resistance to many highly aggressive media and they retain their elasticity and sealing properties at temperatures at which other standard elastomers harden.

- Coatings

PTFE coatings are used on surfaces to reduce friction or improve corrosion resistance against process gases. They reduce the power consumption of vacuum pumps and make certain applications possible or drastically increase the lifetime.

4. Conclusions

Pneurop, which represents European compressor, vacuum pump and air tool manufacturers, supports regulations designed to prevent PFAS from entering the environment. However, in some applications, the use of PFASs remains essential for safety, efficiency and functional reasons. Since there are currently no viable substitutes for these applications, the use of PFASs for these described applications should be allowed to continue so that pollution of the environment by other acutely hazardous substances can be prevented.

Dr. Magnus Janicki
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Annex 1 Vacuum Market Segmentation

International Statistics on Vacuum Technology
 JVA (Japan Vacuum Industry Association)
 AVEM (Association of Vacuum Equipment Manufacturers)
 EVTA (European Vacuum Technology Association)
 in co-operation with
 SEM (Semiconductor Equipment and Materials)

Vacuum Market Segmentation

Rough Vacuum	Process Vacuum	Industrial Vacuum	Semiconductor Process Vacuum	Thin Film Deposition (non-Semiconductor)	FPD	Solar	Instrumentation Manufacturers	R&D
Markets - Packaging (except food) - Central Vacuum - Printing and Paper - Handling - Pick and Place - Conveying - Moulding - Air sampling - Medical	Markets - Chemical (Bulk, Fine,...) - Petrochemical - Pharmaceutical - Plastics (Extrusion,...) - Food - Beverage - Textile - Paper - Ceramics - Freeze drying - Energy (Wind, Nuclear, Steam Turbines,...) - Central Vacuum	Markets - Vacuum Metallurgy (Metal Degassing, Melting, Re-melting, E-beam welding, Casting,...) - Vacuum Heat Treatment (Brazing, Carburising, Nitriding, Quenching,...) - Laser Technology - Electron Tubes - TV Tubes - Lamps and Bulbs - Industrial leak detection - Refrigeration and Air Conditioning - Automotive (Dehydration, Charging and Test) - Electrical (Encapsulation,...) - Medical sterilisation - Batteries	Markets - Silicon Semiconductor (Memory, Logic, MEMS,...) - Compound Semiconductor (LEDs,...) - Silicon Crystal Pulling <i>Please note: Above includes both Process Equipment Manufacturers and End Users for PVD, CVD, Etching, Ion Implantation, MBE</i>	Markets - Glass/Web/Optical Coating - Optical Data Storage (CD, DVD, Hi Def Disk,...) - Magnetic Data Storage (HDD) - Thin Film Heads - Surface Coating (wear protection, decorative,...)	Markets - TFT-LCD Displays - Display Coatings (OLED, FED, PDP, SED,...)	Markets - Photovoltaic Solar (c-Si & Thin-Film Deposition, Laminating,...) - Thermal Solar (Water Heaters,...) - Solar Crystal Growth (Pulling, Re-melt,...)	Markets - Mass Spectrometers - Electron Microscopes - Metrology/ Inspection/ Defect Review systems for Semiconductor including Focused Ion Beam systems and Electron Beam systems - Surface Analysis - Gas Analysis - X-Ray Analysis - MRI and NMR - Sample repairation (Driers, Centrifuges, Concentrators,...) - Leak Detectors - Medical accelerators (Linac, Synchrotron, Cyclotron...)	Markets - Universities - Government Labs - Scientific Research Laboratories - Space Simulation
Typical operating pressure (mbar)								
> 1	> 10⁻²	10⁻² – 10⁻⁶	1 – 10⁻⁸	10⁻³ – 10⁻⁸	1 – 10⁻⁸		10⁻⁶ – 10⁻¹⁰	10⁻² – 10⁻¹¹
PVD:	Physical Vapour Deposition			CD:	Compact Disk			
CVD:	Chemical Vapour Deposition			DVD:	Digital Video Disk			
MBE:	Molecular Beam Epitaxy			OLED:	Organic Light Emitting Diode (or OLED: Organic Electro Luminescent Display)			
MEMS:	Micro Electro Mechanical Systems			FED:	Field Emission Display			
TFT-LCD:	Thin-Film Transistor Liquid Crystal Display			PDP:	Plasma Display Panel			
SED:	Surface Emission Display			MRI:	Magnetic Resonance Imaging			
HDD:	Hard Disk Drive			NMR:	Nuclear Magnetic Resonance			
FPD	Flat Panel Display							

This Vacuum Market Segmentation Chart was developed by the Working Group of the International Statistics on Vacuum Technology Program (ISVT), and is published with their permission. Organisations that participate in the program are the Association of Vacuum Equipment Manufacturers International (AVEM), the Japan Vacuum Industry Association (JVIA), the European Vacuum Technology Association (EVTA), and the Semiconductor Equipment and Materials International (SEM).

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