

◆ **List of the functions and properties necessary to electrical and electronic equipment (EEE), which need PFAS materials to attain required performances.**

As of 22 September 2023

	Functions and properties required for EEE	Characteristic of parts and materials to achieve their functions and properties of EEE	Performance requirements for materials (PFAS)	(e.g.) Specific parts or components that accomplish the functions or characteristic of EEE	(e.g.) Typical EEE	Necessary applications of PFAS to attain the functions and properties (Linked with Column E of revised JP4EE Annex 3)
1	Optical function	No interference of light transmission (Transparency)	Low refractive index, High transmissivity + Water and oil repellency, Flexibility, Flame retardancy	Optical fiber, Optical Lens, LED, Monitor/Panel, Fiberglass, Optical adhesive, Protective coating material, Anti-reflective material, etc.	Camera, Lighting, Monitor/Panel, Optical cable, Smartphone, etc. Other products in RoHS categories 1- 11 would need this function if they use optical function in control panels for example.	2) Optical elements. 5) Optical elements for LCD panels. 25) Transparent electronic circuit board and circuit. 27) Optical elements. 29) Functional coatings.
2	High speed communication and transmission function	Low transmission loss at high frequencies and wide frequency range	Low dielectric constant and Low transmission loss + Water and oil repellency, Flame retardancy	Printed circuit boards (Smartphone, PC, Base stations, etc.), Antenna, Cable for High-frequency, Protective coating material, etc.	Smartphone, PC, Antenna, Base stations, etc. Other products in RoHS categories 1- 11 would need this function if they use communication function to operate or update it for example.	6) Electronic circuit boards for high-frequency applications. 29) Functional coatings.
3	Piezoelectric function (Conversion/Inversion between the mechanical power and electrical voltage) Refer to separate sheet "3. Piezoelectric function" for functional explanation.	Piezoelectricity (pressure-sensitive detection) and good workability and durability	High Piezoelectricity (High piezoelectric coefficient) + Heat resistance, Flexibility	Speaker, Touch panel, Sensor, Actuator, etc.	Touch panel, Speaker, Various sensor, etc. Other products in RoHS categories 1- 11 would need this function if they use touch panels or sounds for example.	3) Piezoelectric elements
4	Sliding function in mechanical section Refer to separate sheet "4. Sliding function" for functional explanation.	Lubricity and abrasion resistance, Elasticity, Low water absorption, Low moisture permeability	Lubricity, Abrasion resistance, Machineability + Flame retardancy, Durability, Low water absorption, Low moisture permeability	Sliding parts in mechanical section (Bearing, Gear, Roll), Seal material (Packing, O-ring, etc.), Grease, Lubricant, Protective coating material, Epilame, Sealing material, etc.	Motor, Printer, Industrial equipment, Camera, Display, etc. All the EEE in RoHS categories 1- 11 would need this function.	1) Sliding elements in mechanical section. 8) High performance materials for mold release and protection purposes used in the article molding process. 11) Hermetic sealant requiring low percentage of the compression set as well as simultaneously other functions such as excellent elongation followability, durability, flame resistance, heat and hot water resistance, low water absorption, low moisture permeability, chemical resistance and/or low outgassing. 29) Functional coatings. 30) Lubricants where the use takes place under harsh conditions or the use is needed for safe and intended functioning and/or safety of equipment.
5	Display function(Liquid crystal display / LCD)	Low voltage drive and fast response (Low anisotropic refractive index and low viscosity)	Low anisotropic refractive index, Low viscosity, Low voltage drive + Heat resistance, Durability	Liquid crystal panel (TV, various monitor), etc.	Liquid crystal display panel (TV, Monitor for various device), etc. Other products in RoHS categories 1- 11 would need this function if they use control panels or monitors for example.	26) Liquid crystal display (LCD) elements.
6	Safety and safety functions	Electrical insulation and flame retardancy, Chemical resistance, Heat resistance, Durability, Dripping prevention	Low dielectric constant, Flame retardancy, Machineability, Chemical resistance + Heat resistance, Durability	Cable, Pipe/Tube, Package, Seal material, Enclosure, Encapsulation, Protective coating material, Sealing material, Protection tube, etc.	Cable, Monitor, Medical equipment, Electric appliance, Industrial control equipment, Printer, etc. All the EEE in categories 1- 11 would need this function.	4) Insulating material requiring flame-retardancy and/or heat-resistant, where the use is needed for safe functioning and safety of equipment. 7) Anti-dripping agent used for safety and to enhance flame retardancy. 8) High performance materials for mold release and protection purposes used in the article molding process. 10) Film, sheet or membrane requiring surface performance which ensures multiple functions such as electrical insulation property, chemical resistance, heat resistance, flame resistance, flex resistance and excellent elongation followability at the same time. 12) Fluid tubes and containers requiring chemical resistance, high cleanliness. 16) High performance materials for mold release and protection purposes, which ensures multiple functions such as electrical insulation, heat resistance, chemical resistance or flame resistance, etc. at the same time. 29) Functional coatings. 30) Lubricants where the use takes place under harsh conditions or the use is needed for safe and intended functioning and/or safety of equipment.
7	Functional surface	Releasability and Heat resistance, UV protection, Antifouling, Waterproof	Water and oil repellency, Heat resistance, Weather resistance	Releasing and Protective coating material, Film, etc.	Cooking appliance, Touch panel, Smartphone, Printer, etc. All the EEE in RoHS categories 1- 11 would this function.	8) High performance materials for mold release and protection purposes used in the article molding process. 10) Film, sheet or membrane requiring surface performance which ensures multiple functions such as electrical insulation property, chemical resistance, heat resistance, flame resistance, flex resistance and excellent elongation followability at the same time. 16) High performance materials for mold release and protection purposes, which ensures multiple functions such as electrical insulation, heat resistance, chemical resistance or flame resistance, etc. at the same time. 29) Functional coatings.

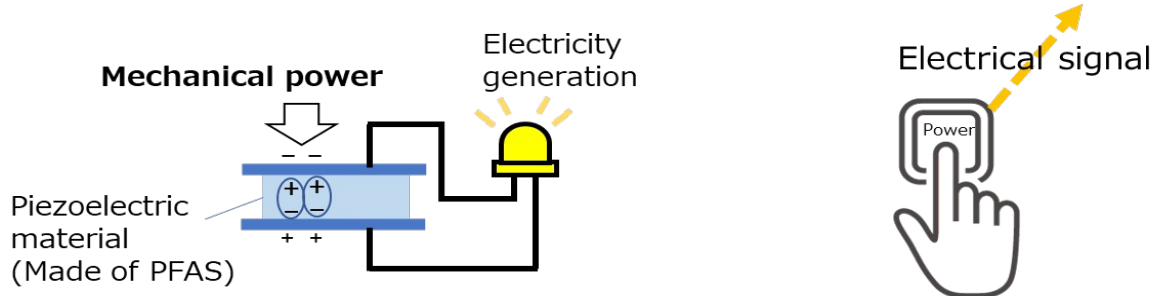
	8Semiconductor	Photoacid Generators (PAG) , Surfactants, anisotropic/isotropic etching and protective layer formation, low dielectric constants, high thermostability, chemical inertness (to acids, bases, and solvents), and low moisture absorption, low electric permittivity /dielectric loss, low water absorption, and low coefficient of thermal expansion(CTE), In heat transfer fluid uses, electrically non-conductive, and usability in very broad temperature range, and non-corrosive in closed-loop systems	Photoacid Generators (PAG) , Surfactants, anisotropic/isotropic etching and protective layer formation, low dielectric constants, high thermostability, chemical inertness (to acids, bases, and solvents), and low moisture absorption, low electric permittivity /dielectric loss, low water absorption, and low coefficient of thermal expansion(CTE), In heat transfer fluid uses, electrically non-conductive, and usability in very broad temperature range, and non-corrosive in closed-loop systems	Photolithography and thin films formed thereby, dry etching, cleaning, heat transfer fluids, resins, manufacturing equipment materials	All the EEE in RoHS categories 1- 11 would use semiconductors.	13) PFAS used for semiconductor manufacturing process, semiconductor manufacturing equipment, and semiconductor. 17) Semiconductor manufacturing process. 21) Refrigerant, coolant, cleaning agent and solvent used for semiconductor process. 23) Chemicals for ultra-fine processing applications, as typified by semiconductor and MEMS manufacturing processes.
	9Thin-film device manufacturing process	Semiconductor manufacturing process and similar microfabrication process Refer to item 8. Semiconductor	Refer to item 8. Semiconductor	Thin-film device such as MEMS(Sensor, Gyroscope, Inkjet head), SAW filter, Angular velocity sensor, Moisture sensitive membrane, Capacitor, Resistor, etc.	Car navigation system, Sphygmomanometer (blood pressure meters), Inkjet printer, Smartphone, PC, etc. Other products in RoHS categories 1- 11 may use thin-film device.	14) PFAS used for thin-film device (Micro Electro Mechanical System/MEMS, SAW device, Capacitor, etc) manufacturing process, thin-film device manufacturing equipment, and thin-film device. 18) Thin-film device (Micro Electro Mechanical Systems/MEMS, SAW, Capacitor, etc) manufacturing process. 22) Refrigerant, coolant, cleaning agent and solvent used for thin-film device (Micro Electro Mechanical Systems/MEMS, SAW etc.) process. 23) Chemicals for ultra-fine processing applications, as typified by semiconductor and MEMS manufacturing processes.
	10Energy supply (Battery)	Refer to Energy section		Battery	All the EEE in RoHS categories 1- 11 would use batteries.	9) Batteries.
	11Cooling function (Refrigerant)	Refer to Fluorinated gases section		Refrigerant	All the EEE in RoHS categories 1- 11 would use refrigerant	20) Refrigerant used in various appliances such as those for Refrigeration, Air Conditioning and Heat Pump (RACHP) products.

Note: "Functional material used in printing process" (No.15, 19, 28 in JP4EE Annex 3) is separately covered by the input from the related industries, such as Japan Business Machine and Information System Industries Association (JBMA), for the concrete details, and is not included in the above table.

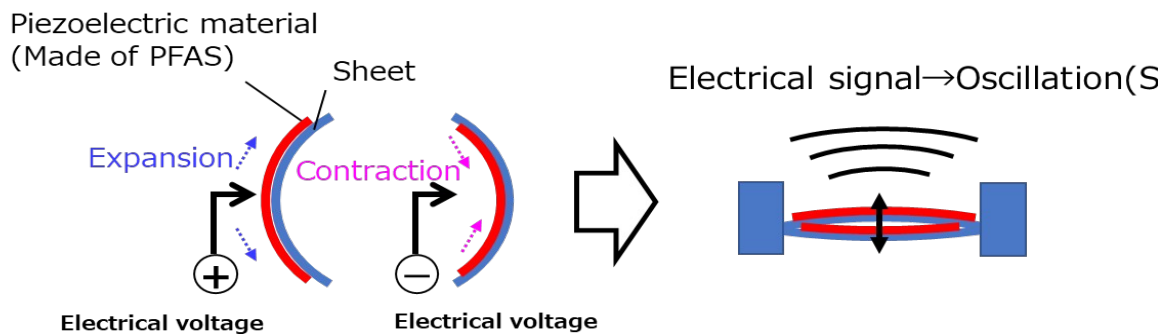
Note 2: The function needing "Fluids for immersion processes (testing, measuring or adding function) in production processes and laboratories (No.24 in JP4EE Annex 3)" is not listed in Column C of JP4EE Annex 4 but in Column C of JP4EE Annex 7, under "1. Immersion process".

3. Piezoelectric function

1) Piezoelectric effect: Convert mechanical power into electricity



2) Inverse piezoelectric effect: Convert electrical voltage into power (Expansion and Contraction)



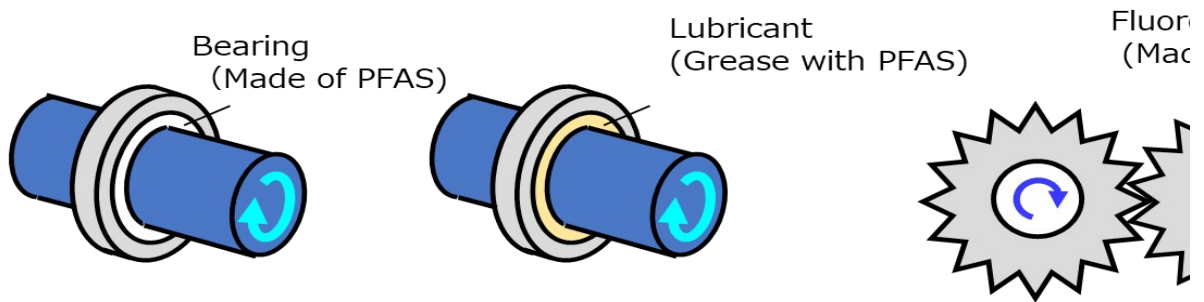
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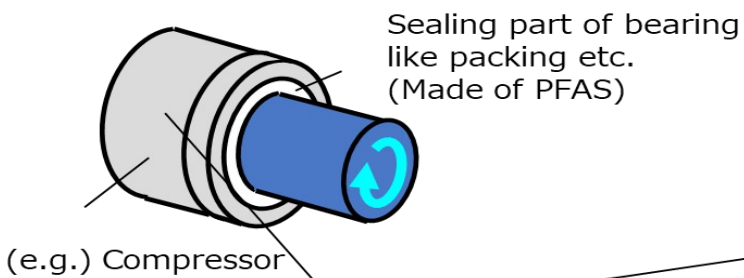
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4. Sliding function

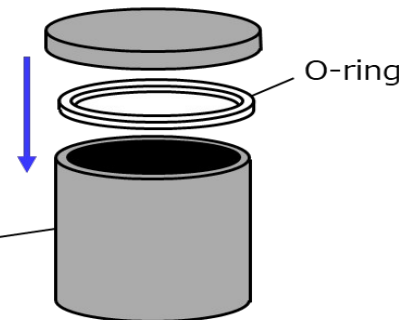
1) Lubrication improvement (Sliding part)



2) Seal improvement (Sliding part)

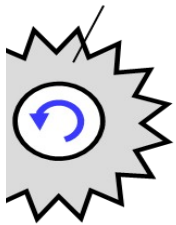


3) Seal improvement



Fluoropolymers, which have excellent sealing properties, are sometimes used for containers.

opolymer gear
de of PFAS)



ent (Fixed part)

|(Made of PFAS)