ABB ELSB contribution to the ECHA consultation on PFAS

Who is ABB Electrification Smart Buildings (ELSB)?

ABB ELSB is part of the ABB Group and is one of the market leaders in the segment of electrical power distribution and data networking in low voltage installations. ABB ELSB serves both the EU and global markets, with products manufactured both in the EU and outside the EU. For a wide range of products, the leading development centers and the leading factories are in Europe. ABB's headquarters are in Switzerland. ABB has about 105,000 employees globally.

ABB ELSB key facts:

- Approx. 14,000 employees.
- $2.75 - $3.25 billion revenues.
- 34 production sites.

ABB ELSB's product portfolio includes a wide range of products needed for the distribution and networking of power and data in buildings and other low voltage installations. These products are very important for the transition of our society to a fully electric and digital society throughout the renewal and expansion of electrical power network and data infrastructure. Given the importance of energy efficient buildings, we expect the segment to grow significantly in the coming years. All this strongly supports the Green Deal as one of the major EU initiatives.

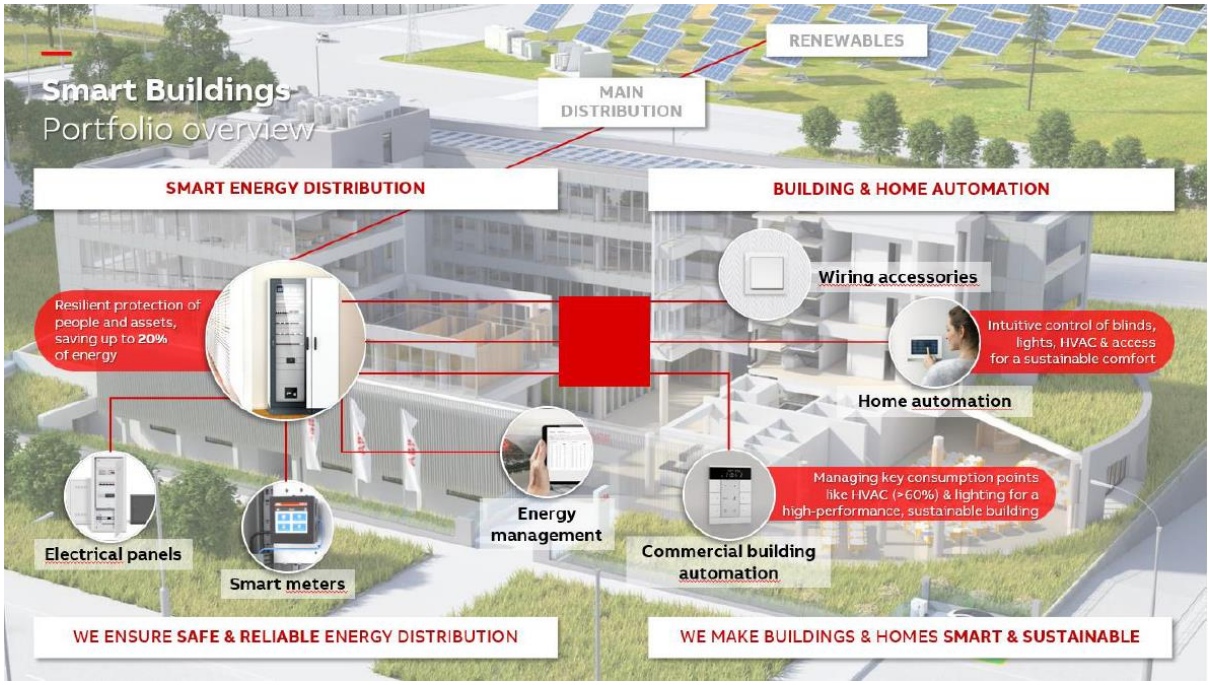

Figure 1: Low voltage energy distribution and building automation infrastructures.

Low-voltage electrical devices are the products in the energy and data network in buildings and other installations with which end users come into direct contact and which must therefore meet special safety requirements. Many products and relevant components are developed and manufactured by ABB itself, like, e.g.:

- Smart home products.
- Building automation & control products.
- Door entry systems.
- HVAC control products.
- Access control & security products.
- Emergency lighting & battery systems.
- Wiring accessories (socket outlets, switches, dimmers, etc.)
- Industrial plugs & sockets
- Protection products (miniature circuit breakers, residual current circuit breakers & monitors, arc fault detection devices, surge protection devices, relays, switches, etc., and accessories thereof)
- Distribution enclosures (main distribution enclosures, sub-distribution enclosures, final distribution enclosures, junction boxes for electrical installations, etc.)
- Energy efficiency products (energy meters, power meters, connectivity solutions, etc.)

The present document is dedicated to the last three product types, namely protection products, distribution enclosures and energy efficiency solutions, that fall under the larger set of low voltage energy distribution products. Figure 2 shows some examples.

The main requirement for the entire product range is the high level of safety, quality, and reliability, as the expected service life of the market is very high (>25 years). The failure rates of the products must be above average. This requires the use of highest quality materials with excellent performance, reliability and for a wide temperature range. All these requirements are partly well supported by PFAS materials or PFAS additives in materials.

During their long time of use, as far as we know electrical installation devices are expected not to spontaneously release PFAS in the environment, unless PFAS is intentionally extracted by external agents, for instance by means of mechanical and/or chemical attacks (which is unrealistic and alien from the expected use of the products).

When electrical installation equipment has reached the end of its service life or even when the entire building must be demolished, laws regulate how to dispose of low voltage electrical installation devices. Considering for instance Germany, electrical installation equipment must be labelled and registered with the EAR, in accordance with the WEEE Directive 2012/19/EU, and disposed of properly at the end of its service life. For batteries and accumulators, disposal is regulated by the Battery Regulation in the EU. National laws such as the German ElektroG and BattG supplement the European legal acts and ensure that electrical installation devices are not disposed of in residual waste. Similar provisions apply in the other EU countries.

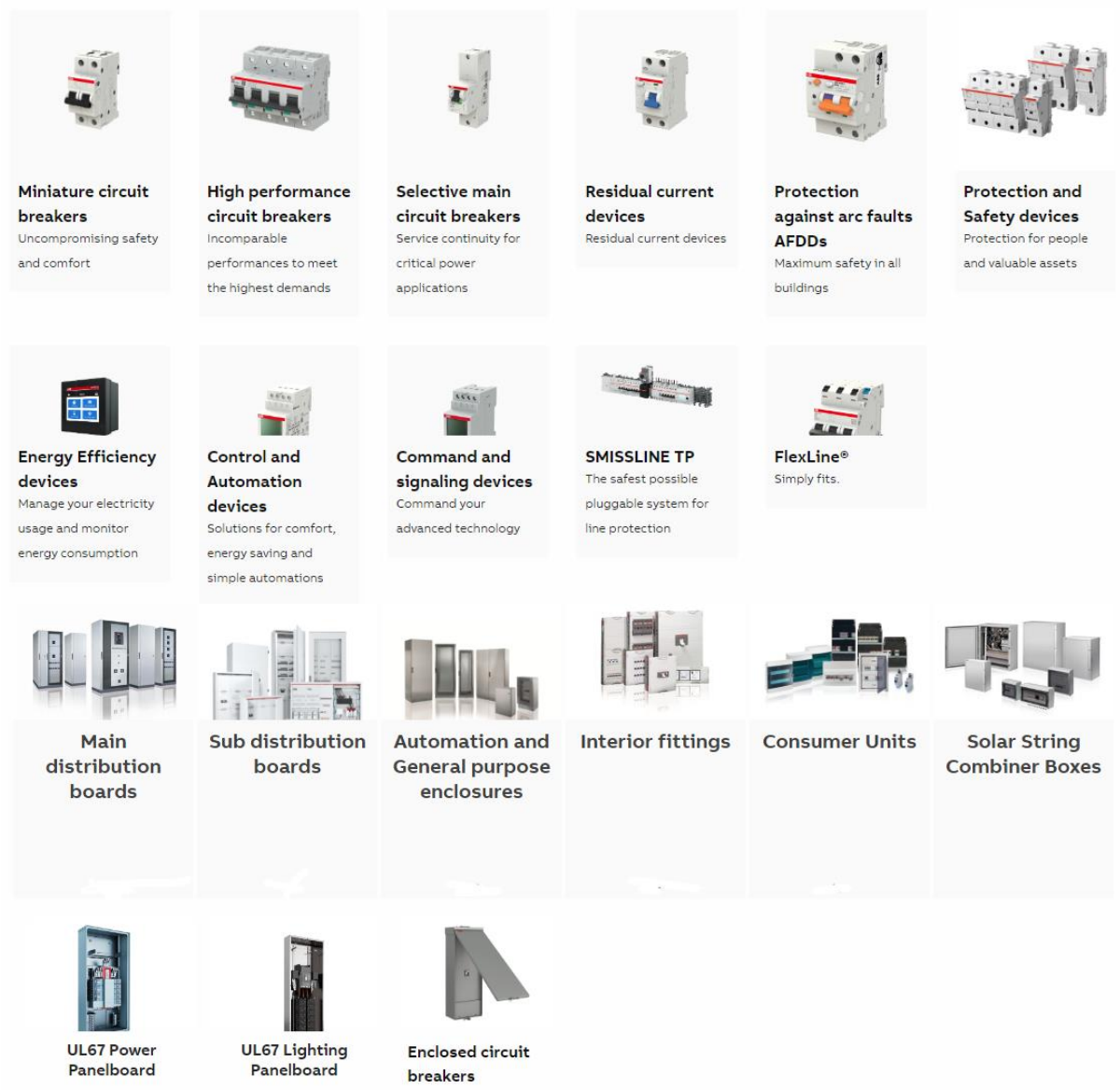

Figure 2: Examples of low voltage energy distribution products.

Why is ABB contributing to the ECHA consultation on PFAS?

As PFAS are widely used in electrical equipment, ABB ELSB, like all other electrical equipment manufacturers, will be greatly affected by the proposed restrictions on PFAS, including the ban at very low concentrations. Without changes to the regulation, this could result in a ban on the manufacture and sale of many low voltage energy distribution and building automation products for ABB and other manufacturers.

ABB is interested and willing to find a compromise to replace PFAS in a realistic timeframe where it is technically feasible, reasonable, and relatively beneficial for the environment and society. To this end, we have prepared and uploaded specific submissions, this being one of them.

We ask ECHA's technical experts to carefully consider these contributions and take them into account when drafting the final regulation.

In case of additional questions, required background information or direct request for discussion, please feel free to contact us, using the contact details at the end of this document.

Contribution 3
Topic: Electrical equipment for low voltage energy distribution - A
Targets: Exemption from the restriction for additional 12 years

Electrical equipment for low voltage energy distribution consists of the above-mentioned **protection** products, **distribution enclosures** and **energy efficiency** products. The three classes of products include very complex products with daily stress and a long service life of more than 25 years. Products are rated for voltage levels up to 1500 V in AC and 1000 V in DC and currents in a broad range up to 125 A. Protection products are safety critical, since their main function is to protect human lives and equipment from electrical faults and their consequences, such as fires. An example familiar to all people are circuit breakers, that everyone must have at home in electric distribution panelboards. They operate rarely, if ever, but must remain vigilant for decades to detect a fault and, in case, they must absolutely work and clear the fault, by opening the concerned electric circuit. More generally, all or almost all products are maintenance free, have to be certified vs. Standards, including severe safety provisions.

To make this possible in combination with high levels of safety and quality, high quality materials are used. For some of the technical functions PFAS materials are intentionally used or they can be used as components of materials from other manufacturers.

Basing on the presence of PFAS, the product and component portfolio for low voltage energy distribution can be divided into the following four groups.

1) Products or components where one or more PFAS has been **intentionally specified** by the equipment manufacturer (i.e., ABB) by design, as a material or as an ingredient of a material mixture, for a specifically defined function.

   Examples include (but are not necessarily limited to):

   a. Protection devices such as circuit breakers (miniature circuit breakers, residual current circuit breakers, arc fault detection devices, relays, switches, etc., and accessories thereof), whose internal mechanisms are mostly constituted by polymeric parts (e.g., polyamide, PA) where PTFE is added to the compound mixture as a lubricant. These products are produced in volumes of the order of 100 million items per annum.
   b. Protection devices, distribution enclosures and energy efficiency devices comprising polymeric parts (e.g., polycarbonate, PC) where PTFE is added to the compound mixture as anti-dripping or flame-retardant agent, which is necessary to grant safety from fires.

2) Products or components where PFAS has **not** been **explicitly specified** by the equipment manufacturer (i.e., ABB) but might be contained as an ingredient of a material mixture, based on the **definition of the material manufacturer** to match the functional requirements specified by the equipment manufacturer.

   Examples may include (but are not necessarily limited to):

   a. Protection devices such a circuit breakers (miniature circuit breakers, residual current circuit breakers, arc fault detection devices, relays, switches, etc., and accessories thereof), whose internal mechanisms are mostly constituted by polymeric parts (e.g., polyamide, PA) where some PFAS can be added to the compound mixture as a lubricant.
   b. Protection devices, distribution enclosures and energy efficiency devices comprising polymeric parts (e.g., polycarbonate, PC) where some PFAS is added to the compound mixture as anti-dripping or flame-retardant agent, which is necessary to grant safety from fires.

3) Components **independently developed and supplied by 3rd party suppliers**. In this case, PFAS have not been specified by the equipment manufacturer (i.e., ABB) but might be contained as ingredients of a material mixture or as materials, based on the **definition of the product/component manufacturer** (i.e., the supplier), **or of the material manufacturer** for the materials used in the component.

   Examples may include (but are not necessarily limited to):

   a. Capacitors.
   b. Relays.
   c. Printed circuit boards.
   d. Displays, including liquid crystal displays.
   e. Other electronic components.

4) Products or components where one or more PFAS is a **contaminant** from the production process. Due to the extremely low threshold level of 25 ppb, contamination is hard to control, especially if the manufacturing of parts or components are outside the EU, where no restriction on PFAS exists.

   Examples may include (but are not necessarily limited to):

   a. PFAS as release agent used in an injection molding process to allow easy demolding.
   b. Surface treatment using PFAS or PFAS containing substances.
   c. Electronic components such as semiconductors, micro-processors, etc.
   d. Contamination of PFAS in the production machine.
   e. Contamination of PFAS due to proximity to the production line of products with PFAS (that could be exempted from the PFAS ban).

For 1) the manufacturer of the electrical equipment (e.g., ABB) is called to identify and search for alternatives. This process has already started.

Case 2) is more complex, for the inquiry on the possible usage of PFAS involves the supply chain, not only ABB.

Case 3) is even more complex and time consuming, as the process is not under ABB ownership and can barely be influenced by the electrical equipment manufacturer (i.e., ABB). The responsibility is totally on the supplier side. The most relevant example is probably electronic components, such as semiconductors or others, where it has been announced from the industry that it is almost impossible to offer PFAS free solution in short- to mid-term.

For 4) it is unclear how a declaration of PFAS-free could be achieved.

A difficult challenge relates to the **time required to find replacement substances**, and to the **possibility that said replacement substance may not exist or may not provide an adequate performance**. The technical background is hereby introduced.

The identification processes involved in cases 2) to 4) have one problem in common: The vast majority of the about 10,000 individual substances covered by the restriction proposal are currently not classified as hazardous in accordance with the CLP Regulation (EC) No. 1272/2008 nor identified as substances of very high concern (SVHCs) under REACH Regulation (EC) No 1907/2006. Thus, information on PFAS contained in mixtures and articles is usually not communicated along the supply chain. Interacting with many suppliers, and their supply chain, is a lengthy process that may take months, or years.

ABB has the target to replace PFAS in products wherever possible by PFAS-free materials. There might be some applications where this is not possible, and they will be addressed separately. In all other

cases, where a replacement is possible, the complex way of identification, finding a replacement, implementing them in products and finally repeating type tests of related products will by far exceed the given transition time of 18 months. As a reference, and assuming to have very large test lab capability (which is by far not the case), only the time required for full type testing of products can be one year or more. As this would not only affect ABB but all manufacturer of electrical equipment, due to the limited number of accredited test laboratories, this will create a bottleneck in type testing, which could cause shortage of electrical equipment with huge financial impact and a delay of the green deal.

Protection products, along with distribution enclosures, are safety critical products, not only because they detect and clear electrical faults in electrical installations, thus protecting human lives, but also because they must withstand critical conditions, such has fires, without contributing to combustion and remaining operational as long as possible. Thus, production Standards apply, including EN Standards and national, harmonized Standards within EU countries. Changes in the materials employed may have impact on many or all functionalities, including safety functionalities, and on the capability to fulfill the severe requirements prescribed by product Standards.

Type tests are mandatory for most markets, including EU, and any material change with impact on the test result requires type tests to be repeated. As certifications are very time consuming and expensive, they can be efficiently done after all PFAS replacements in the product at hand have been completed, to avoid repeated testing of the same product for each identified PFAS.

In addition to certification according to Standards, state of the art products and materials have proved long term reliability on the field, over a decade long service life. Consequently, time is needed for any candidate material to prove on the field comparable adequacy in terms of safety, both for equipment and human protection, including protection from potentially lethal dangers such as electrocution, fires, and indirect causes of death (e.g., falling after electric shock, and the like).

Among protection devices, a vast class of products, termed circuit breakers, trip open the electrical circuit affected by faulty conditions. The mechanisms that separate electrical contacts must have a smooth functioning, proved to work for thousands of duty cycles, which ultimately requires lubrication. Currently, PTFE is added to the compound to provide self-lubricated, polymeric mechanisms. Alternatives such as grease belong to a remote past, for they suffer of severe drawbacks, such as contaminating the inside of the product with vapors that may impair the functionality of other components. Furthermore, the lubricant must withstand high temperatures during the current switching phase, when an electric arc is produced inside the product because of opening electrical contacts under short-circuit conditions. This requirement has historically prevented other lubricants from entering circuit breakers.

The problem of lubrication is particularly relevant for a subclass of circuit breakers that detect and clear current leakage to ground, i.e., the potentially lethal earth fault. To offer full protection in all failure modes, the Standards holding in continental Europe prescribe protection devices (i.e., voltage independent residual current circuit breakers) that do not need the supply of external energy, as opposed to voltage dependent devices, i.e., with active electronics. Voltage independent devices only rely on the energy of the fault to trip the electric circuit open, and since the former is very small, lubrication is essential to minimize frictional losses, or jamming between levers.

In conclusion, for low voltage energy distribution equipment:

- ABB ELSB asks for an **extended transition time of additional minimum 12 years** to complete the transition to PFAS-free solutions. As the investigation along the whole ABB ELSB supply chain is still on-going, we still see the risk that this might be challenging, especially if the low threshold level is kept and the identification is not limited to intentionally added PFAS. In this unfortunate case, the **possibility of a further exemption** should be offered if it is proven that replacement projects have been duly carried out (according to suitably defined criteria), but they are still uncompleted for intrinsic, technological reasons.

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