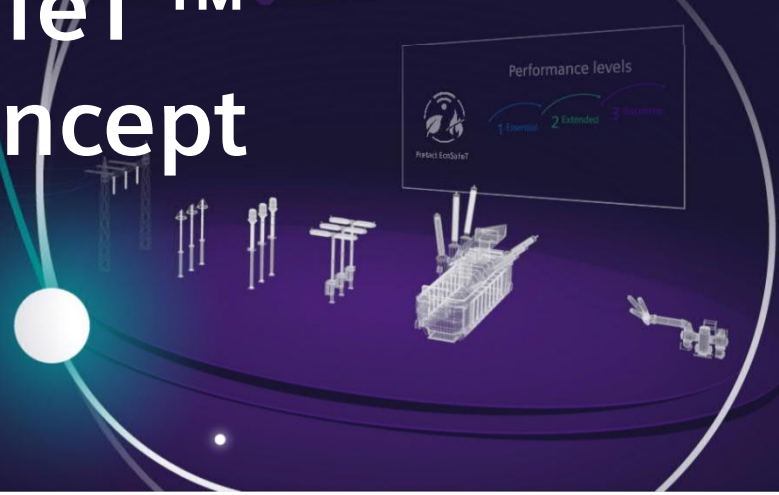


Pretact EcoSafe™ substation concept



Siemens-energy.com/transmission-showroom

The world's first substation concept Pretact EcoSafe™...

... focuses on an explosion- and fire safe substation. It sets new standards in environment, health and safety to achieve a reliable fire safe solution for the entire substation and all its products.

The Pretact EcoSafe™ substation concept is introducing three new performance levels that include:

- (1) **Essential** – a rupture and explosion safe tank design
- (2) **Extended** – **Essential** (1) combined with alternative insulation and switching technologies
- (3) **Supreme** – **Extended** (2) combined with special certification for highest duty and availability

Can you imagine a world without electricity?

There would be no modern life possible without communication, transportation, trading, cooking etc. imagine living in an urban area in a city skyscraper without having access to elevators, heating, water, or electricity.

We still have a rising demand for energy which provokes the electrical systems to operate closer to the design limits. This demand in conjunction with an aging infrastructure and changing patterns of natural phenomena creates a heightened risk to the environment.

Therefore, a safe, sustainable and reliable energy supply is an essential base for our future.

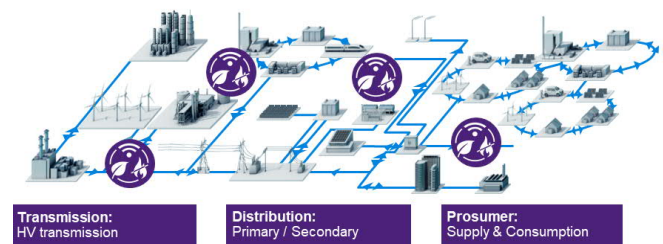


Figure 1 - Applications of Pretact EcoSafe™ products within the electrical power system

Why innovate a safer, sustainable and more reliable solution?

To have an explosion and fire safe solution for the whole substation, it is important that this applies to all individual products. Any major failure, which may involve an explosion of a high-voltage product, presents a high risk to the safety of people. In addition, drastic failures, like explosions lead to long shut down times hurting the operational performance of the grid affecting all customers particularly those, who depend on an uninterrupted energy supply. And finally, it might hurt the environment through the release of CO₂, mineral oil or SF₆.

Failures and explosions which result in a fire, make the impact on safety, grid performance and on the environment significantly worse.

Leading the market with innovative Energy Transmission and Distribution products, systems and solutions, we present the end to end concept of a fire and explosion safe substation including our family of explosion proof and fire safe products – the Pretact EcoSafe™ concept.

Our Pretact EcoSafe™ enhanced products, like composite insulators have the same reliability as our existing Siemens Energy transmission and distribution portfolio, but on top of that we offer:

- significantly enhanced safety
- improved grid availability and performance
- a drive to decarbonization (by avoiding e.g. the use of mineral oil or SF₆)
- avoidance of potential environmental contamination

And finally, all EcoSafe™ products will be delivered as Sensproducts™, like Sensformer® and Sensgear®, that allow for connectivity and digital twin technology and are future ready.

Which solutions are available?

Essential – a rupture and explosion safe tank design

This level ensures, that nobody will be injured by a rupture or explosion and there will be no release of mineral oil or SF₆ for the defined worst-case scenarios. This safety level ensures that neither the surrounding nor any other equipment will be affected by a worst-case malfunction.

To ensure that no rupture occurs in the worst-case scenario we use

- state of the art design tools
- static and dynamic simulations which are verified with tests
- composite insulators and reliable components
- qualified and approved sub-suppliers

Extended – Essential combined with alternative insulation and switching technologies

By applying the measures of the “Essential” level, we increase the safety with alternative insulation and switching technologies. That means we use no mineral oil, SF₆, F-gas or any other greenhouse gas at all. As an alternative, we apply biodegradable ester fluids or clean air in our blue portfolio. And in addition, the safety aspect is further enhanced by e.g. plug-in bushings in RIP or RIS¹ technology. Therefore, this extended level provides a safe and sustainable solution for the energy supply of the future.

Supreme – Extended combined with special certification for highest duty and availability

Based on the known risks (e.g. operational issues, natural disasters, vandalism) the right level of performance and protection must be selected together with our customer. Validated simulations and the verification by tests, even beyond available standards are the base for special certification. This guarantees the highest availability and overall optimized total cost of ownership.

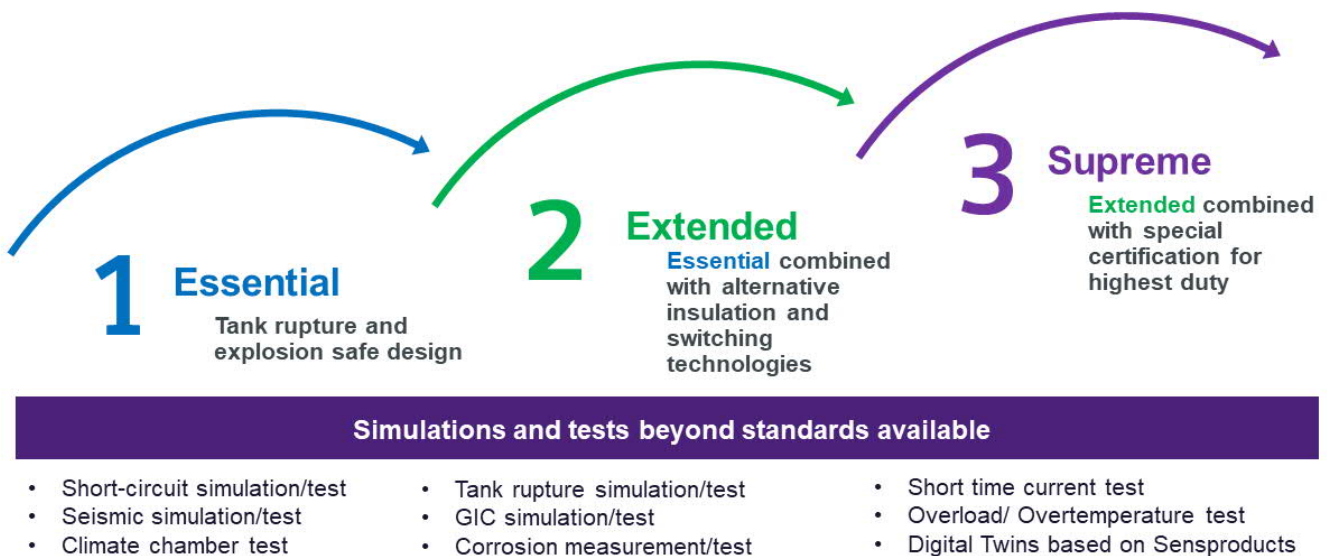


Figure 2 - New performance levels for Pretact EcoSafe™ concept

¹ Resin-impregnated paper or resin-impregnated synthetic

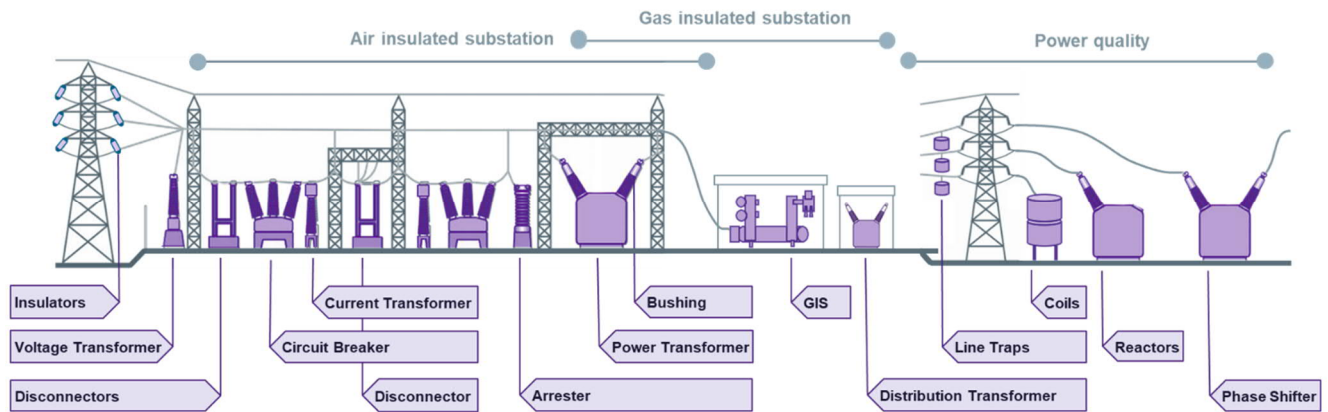


Figure 3 - Pretact EcoSafe™ products within a transmission substation

What are the key take-aways?

Our Pretact EcoSafe™ substation concept offers increasing protection and performance options in three levels for all Siemens Energy Transmission products and solutions.

As the whole concept is a modular one, each product replacement in an existing substation or power plant can be arranged, planned with the right level of performance and protection tailored to a customer’s demands. Restrictions in space footprint or by fire and environmental regulations can be considered as well. Even better, more strict fire and environmental regulations can be fulfilled easily with our Pretact EcoSafe™ concept since no additional permanent firefighting systems are needed.

For a green field substation project, it is recommended to apply the “Supreme” level for all products, i.e. highest safety and environmental protection including certification.

Such a supreme substation concept does not need a permanent firefighting system, has a reduced footprint and allows an overall optimized total cost of ownership based on special certification for highest duties. And it is a sustainable investment in our future.

Like the Pretact® Resilience concept the EcoSafe™ concept is based on a modular architecture. The features offered can be mixed and matched creating a tailored solution to meet the customer’s needs. For example, EcoSafe™ products can be enriched with GIC² withstand capability, DC³ compensation or bullet resistance protections where applicable. Such enhanced products can be designed as mobile solutions including resilience transformers, mobile gas-insulated switchgear or mobile systems. They can include e-houses, skids, or complete mobile substations, to be more flexible and to be ready for the unexpected.



Figure 4 - Pretact EcoSafe™ products can be applied to mobile substations

² Geo-magnetic induced current

³ Direct current

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