

## Electrical Protection and Synchronization

### Protection and Synchronization for the EDG Synchronous Generator

The modular design of the Framatome electrical protection allows easy and efficient integration of comprehensive generator protective function packages into new and existing infrastructures up to the highest safety levels

#### Challenge

Diesel generator protection is divided into mechanical (diesel engine) protection and electrical (generator) protection.

The mechanical protections concerning mechanical values are implemented in the controls, the electrical protections feature this electrical protection cubicle.

The electrical protection panel shall allow operational tests, also in parallel to the grid, but prevent the diesel generator from being damaged in case of electrical failures.

During test runs the protection shall cover all possible failures, whereas in emergency operation the reliable power production has priority, thus only severe failures, which are detected at least via two channels, shall lead to a priority trip.

#### Solution

The Framatome electrical protection system covers the requirements for safe and reliable operation of the emergency generator. It complements the mechanical protections and provides a comprehensive coverage of the operational and safety requirements both during test runs and emergency operation.

Synchronization of the generator to the grid is possible from local and from remote, in automatic or in manual mode. Smooth paralleling is always assured by a dedicated synchro-check device.

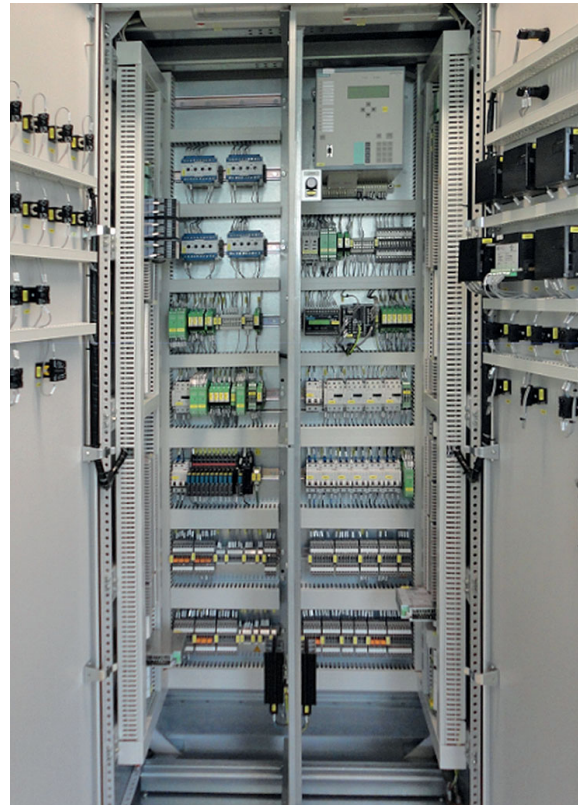
Different available types of multifunctional relays provide complete coverage against internal and external failures. In case of emergency only the safety critical functions in accordance with the applicable nuclear codes are enabled, the remaining functions continue to monitor the generator.

#### Customer benefits

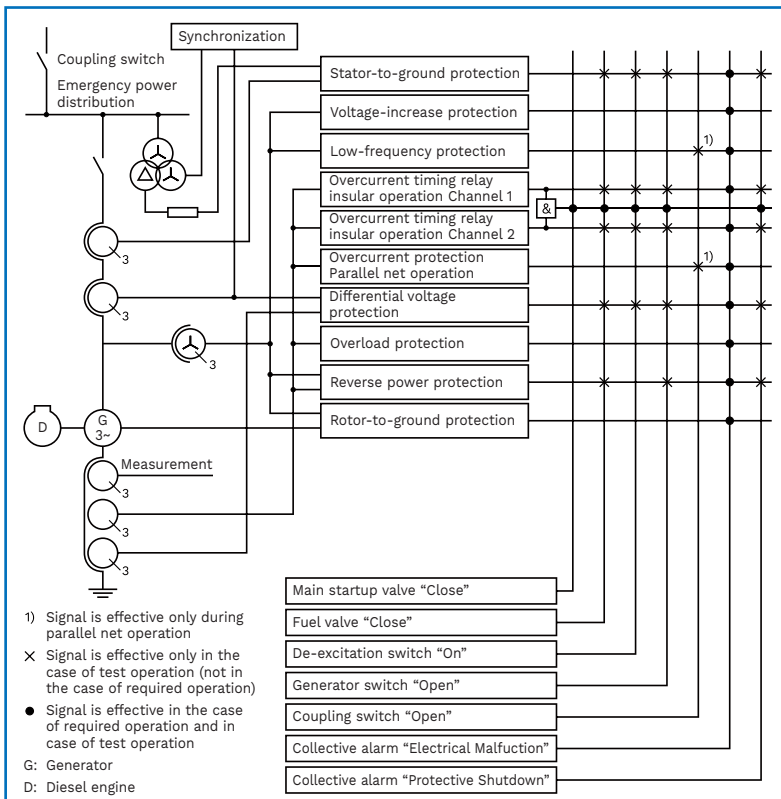
- Customers benefit from Framatome's long-time experience with special nuclear requirement. The wide qualification basis covers RCC-E, IEEE and KTA regulations.
- Comprehensive protection of the synchronous generator
- Competitive standard solution, optional design adaptation
- Fast execution with complete requirement fulfillment
- Compact and easy commissioning
- Operational excellence

## Technical information

- Prolonged qualified lifetime of 20 years according I EEE/RCC-E/KTA
- Separated safety and operational functions (electrically and spatially separated)
- 2-out-of-2 or 2-out-of-3 selection for priority trip functions
- Modular setup = straight forward implementation
- Protective Functions Options: ANSI/IEEE/IEC 27,
- 32R, 40, 46, 47, 49, 50, 51, 51G, 59, 81, 87G and others as required
- Synchronization of generator and coupling breaker- from local or remote panel- in manual or automatic mode
- Door mounted status indications and operation devices for operation condition and synchronization
- Operating conditions: 0-60°C, 95% rel. humidity
- Standard seismic proven double-door cubicle 600x600x2200 mm (wxdxh)



Cabinet with modular structured electrical protection system - front view with doors open (left) and closed (right). Also possibility to separate operational- and safety protection for IEEE market.



Design Example for the Equipment Protection of a Diesel Generator Unit (KTA3702 200-06)

## References

- ANGRA 3 (Brasil)
- PLEX (Sweden)
- Tihange EDG (Belgium)
- OL3 (Finland)
- Tianwan unit 3/4 (China)
- Tianwan unit 5/6 (China)
- YJ unit 1-6 (China)
- FQ unit 1-4 (China)
- KKG-D LETA2 (Swiss)

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