

MAEX

Modular Analogous Excitation System for Emergency Diesel Generators

The modular design of MAEX allows easy integration into new and existing infrastructures at the highest safety level.

Challenge

The excitation of a generator is a key component for reliable provision of emergency power supply. The emergency diesel generator (EDG) short starting times and the acceptance of large load steps must be accomplished within tight tolerances and with the assurance of the proper power quality for the emergency consumers.

The exact harmonization of the EDG output power quality with the overall plant requirements demands a comprehensive knowledge and engineering skills.

Excitation systems must allow variable integration into existing or newly built infrastructures with limited space and plant specific interface conditions.

The authority approval is aggravated by the application of software-based systems with complex and costly configuration.

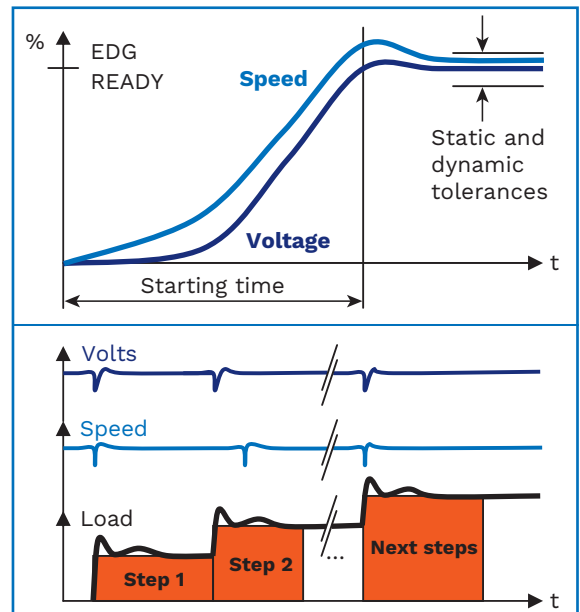
Solution

MAEX is a software-free modular excitation system for brushless generators. It has a highly flexible design, which can easily be applied to existing infrastructures.

The base module fulfills all safety-relevant functions for voltage regulation, operation and signalization. An optional extension module provides a manual control (additional redundancy), and cos φ & reactive load control.

Standard add-ons such as converters for different voltage supply allows flexible designs to consider special customer requests. A standardized power supply interface facilitates different power supplies by a permanent magnet generator (PMG), shunt supply by potential transformers (PT) or different auxiliary supply from an alternating uninterrupted power supply (UPS).

Accelerated start-up of generator voltage is accomplished by field flashing.



Characteristics of start-up and load sequence

Customer benefits

- Qualified product according to IEEE, RCC-E and KTA assures a worldwide field of application and minimal licensing effort with the nuclear authority
- Adaptation to customer needs (only necessary functions) due to the modular structure will be done resulting in optimized hardware costs
- Due to the overall control logic and various interfaces, an easy design adaptation especially for modernizations is possible
- Standard processes and product design including product documentation assures a fast and cost-effective
- Due to simple analog AVR (Automatic Voltage Regulator) structure and experienced commissioning personnel an easy commissioning in short time is possible

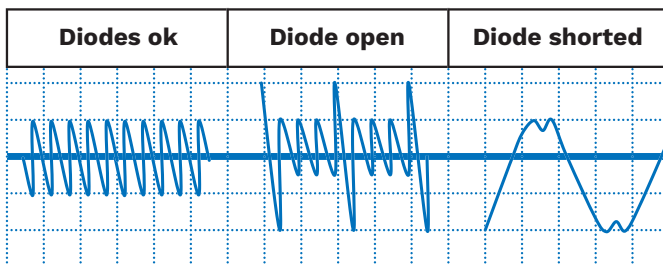
Your performance
is **our** everyday **commitment**

Technical information

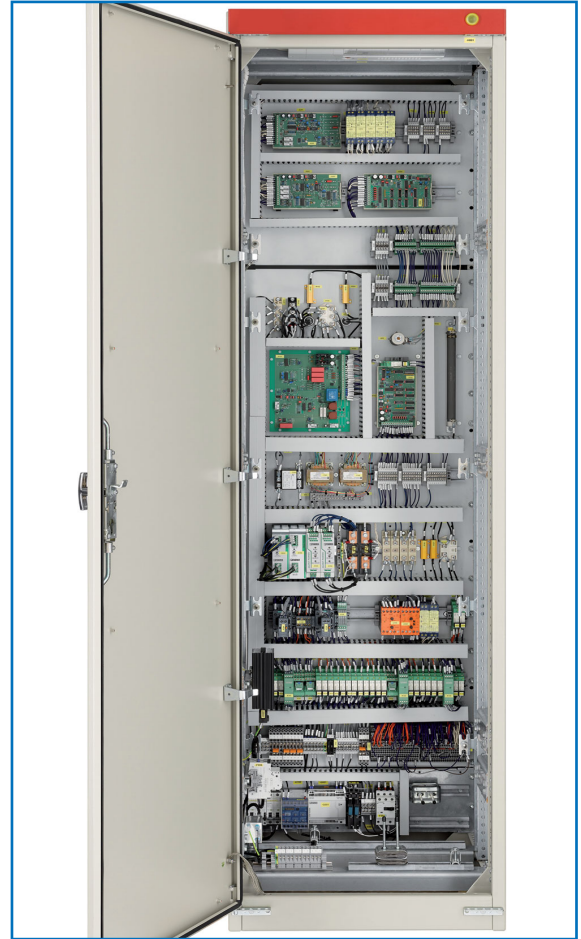
- Prolonged qualified lifetime of 20 years (IEEE/RCC-E/KTA)
- EMC approved
- Standard seismic tested cabinet: 600 x 600 x 2200 (l x w x h in mm)
- Fully qualified MAEX System (Seismic, EMC, aging) for installation in existing or new cabinet
- Operating conditions: 0–60°C, 95% relative humidity
- Base, extension and add-on modules
- Base module
 - Dynamic excitation up to 15 A continuous
 - U=constant regulation and U/f limitation
 - Automatic voltage control
 - Maximum 10 s excitation current up to 20 A
 - Voltage accuracy: $\pm 0,5\%$ of U_n
 - Voltage set point range: $\pm 10\%$ of U_n
 - Fast start-up via onboard field flashing
 - Overshoot limitation during start-up
- Extension module
 - Follow-up control of set point values
 - Manual control (Automatic backup of auto channel)
 - Cos φ & reactive load control
- Rotating diode monitoring (RDM)

Nuclear qualification

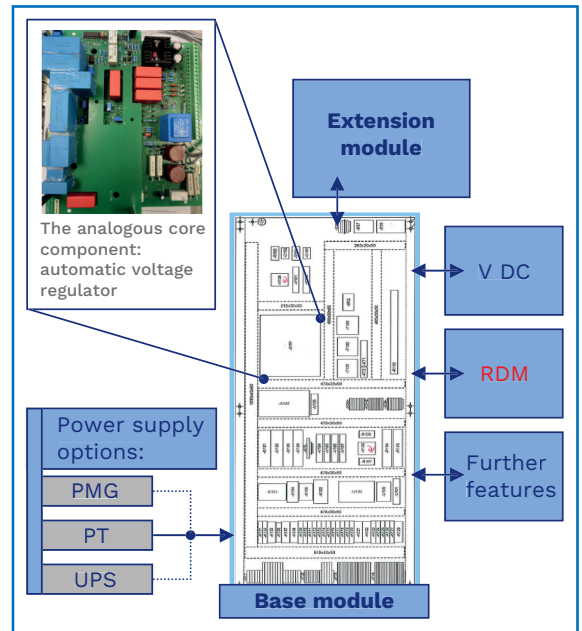
Customers profit from Framatome's long-time experience with special nuclear requirements and qualification. For shorter lead times and reduced risks of qualification, nuclear type tests have been performed as previous effort. Amongst others, this includes EMC tests, aging tests as well as seismic tests for severe earthquake spectra. The qualification procedure assures functional safety and reliability as well as customer satisfaction. The wide qualification basis covers RCC-E, IEEE and KTA regulations.



Examples for excitation current waveforms with induced ripple during diode faults demonstrate the RDM operation principle



MAEX cabinet including base and extension module



Modular structure of MAEX

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