



FEC1900

HIGH EFFICIENCY 1900 KVA BACK-TO-BACK CONVERTER

The four-quadrant converter FEC1900 is designed as a building block for power conversion in the multi-megawatt range. The typical application is as full converter for large (offshore) wind turbines. Normally, multiple FEC1900 converters run in parallel as outlined in the schematic below. This topology offers redundancy and the amount of harmonic currents fed into the grid is drastically reduced by means of shifted pulse patterns. This reduces also size of the filters and leads to a high power density.

The FEC1900 cabinet comprises all devices needed to build up a modular converter system:

- Pulse rectifier and inverter based on IGBT modules on water-cooled, easy-to-change power stacks
- DC-link made of film-capacitors
- Break chopper and break resistor
- Controller boards linked via fast bus system (EtherCAT)
- Generator contactor, main contactor and precharge-circuit
- Generator-side filter (du/dt) and grid-side filter
- Heat exchanger air-to-water for cooling of all passive parts: cabinet has IP54

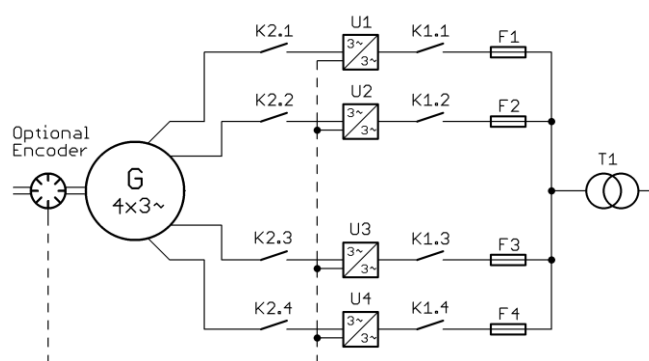
The modular concept is suitable for electrical as well as permanent magnet excited synchronous generators and offers many benefits, compared to single converter solutions. For example, in case of a device failure, power generation can go on with only a small reduction in peak power because the defective module can be completely electrically separated. Under partial load, some of the modules can be switched off in order to reduce losses and to extend their lifetime. The dimensions of a single cabinet are rather small, so the converter can be installed after the erection of the tower.

The main advantages can be summarised as follows:

- Combines high power density with reasonable costs.
- Protection class and cooling type allow offshore use.
- Inherent redundancy.
- All serviceable parts are easy to replace.
- Reduced grid current harmonics.
- New control algorithm allows managing symmetric and asymmetric voltage drops.



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Schematic of the modular 6.0 MW converter system



PRELIMINARY TECHNICAL DATA OF THE FEC1900

Inverter (grid side)

Rated power	1550 kW	
Rated voltage	690 V, 3-phase, 50 Hz	Other values on request.
Rated output current	1300 A	
Maximum apparent power	1900 kVA	At rated voltage.
Maximum output current	1600 A	
Switching frequency	2.5 kHz	

DC-link

Rated DC-link voltage	1050 V	
Operating DC-link voltage	1000 V...1150 V	IGBTs are released.
Maximum DC-link voltage	1400 V	IGBTs are blocked.
Maximum breaking energy	2000 kJ	Other values on request.

Pulse Rectifier (generator side)

Rated input power	1592 kW	
Generator voltage	typical 620 V, 3-phase	Other values on request.
Rated Frequency	typical 50 Hz	
Rated input current	typical 1650 A	
Maximum input current	1850 A	For 1 minute.
cos ϕ	typical -0.90	
Switching frequency	2.5 kHz	

General Data

Rated losses	42 kW	At rated power and cos ϕ = 1.0
Rated efficiency	97.4 %	At rated conditions
Maximum losses	47 kW	At minimum voltage and cos ϕ = 0.9
Cooling type	Water cooling	
Temperature range	-20 °C...+50 °C	Other values on request.
Storage temperature range	-30 °C...+60 °C	
Water temperature range	-20 °C...+50 °C	Other values on request.
Coolant medium	Water-Glycol (50 %/50 %)	
Rate of flow	80 ℓ /min	
Pressure loss	1.3 bar	
Dimensions (H \times W \times T)	(2005 \times 1405 \times 805) mm	
Weight	< 1700 kg	