



Extended Grid Compatibility Requirements of Wind Turbines

The percentage of wind power supplied to the grid is increasing continuously. From the point of view of the grid operators, this requires that some of the tasks traditionally carried out by conventional power plants must now be taken over by wind turbines. This includes grid support during voltage dips and an extended frequency and voltage operating range.

Due to the increased percentage of wind power in electric power production, leading German grid operators (especially E.ON) have issued new regulations for the grid compatibility of wind turbines.

Existing regulations cover the following subjects

- Minimum harmonics
- Prompt disconnection from the grid in the event of grid faults
- Minimum inrush current

New requirements for extended grid compatibility of wind turbines regarding grid connection points at voltages greater than or equal to 60 kV and at medium voltage busbars of transformer stations have come into effect.

New requirements for extended grid compatibility

- Short-term power limitation by the grid operator
- Regulation of reactive power by the grid operator
- Reduced active power in the event of a frequency rise
- Extended voltage range: 80 to 110% nominal voltage
- Extended frequency range: 47.5 to 51.5 Hz
- No disconnection at voltage drops of up to 3 seconds (fault ride-through capability)
- Support for the grid in the event of voltage dips



Optimal Grid Compatibility of REpower Wind Turbines

REpower wind turbines have been modified to ensure optimal grid compatibility. In this process all electrical components in the wind turbines were examined.

This applies in particular to requirements for a wider range of operation: 80 to 110 % nominal voltage and an extended frequency range of 47.5 to 51.5 Hz, both of which affect all electrical components.

The controls and the converter have been redesigned in order to fulfil the new requirements regarding active and reactive power.

The possibility of voltage dips as a result of grid faults also required modifications to the control system, the converter and the pitch control mechanism to ensure that voltage dips with durations of up to 3 seconds do not result in disconnection from the grid or shutdown of the wind turbine.

Summary of Requirements for Extended Grid Compatibility

Requirement	Fulfillment by REpower Wind Turbines
Inrush current < 120 % nominal current	fulfilled by standard equipment
Limit power rise after power failure to 10 % nominal power per minute	fulfilled by standard equipment
Possibility of automatic power reduction if frequency limits are exceeded	fulfilled by standard equipment
Extended voltage range: 80 to 110 % nominal voltage	fulfilled by standard equipment
Extended frequency range: 47.5 to 51.5 Hz	fulfilled by standard equipment
Specification of a fixed $\cos \varphi$ at the grid connection point	fulfilled by standard equipment
Specification of $\cos \varphi$ at the grid connection point by the grid operator	fulfilled by optional Extended Grid Compatibility Package
Active power limitation at the grid connection point by the grid operator in the event of mains interference	fulfilled by optional Extended Grid Compatibility Package
Wind turbine does not disconnect during grid faults of up to 3 seconds	fulfilled by optional Extended Grid Compatibility Package

REpower MD70, MD77, MM70 and MM82 wind turbines can be supplied with the optional Extended Grid Compatibility Package. These turbines also come with corresponding certificates issued by Windtest KWK GmbH. In addition, REpower can offer a detailed analysis of the grid connection in co-operation with the local grid operator.

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