Solutions for wind energy

Low and medium voltage components and systems

ABB in wind industry
Low and medium voltage product portfolio

ABB is driven by a continuous search for innovation.
That is why many of our ideas have revolutionized the electrical industry.

Often recognized as a provider of single, high-quality products, the extent of ABB's solution offering is often forgotten. ABB pioneered the wind and solar industry and has worked closely with the largest OEMs manufacturers for a long time. We are known for our individual products, but our solutions are what really stands apart.

This document shows our offering for the wind industry. From the much appreciated AF contactors that help save energy and terminal blocks for simplified and quick assembly, up to medium voltage switchgear, Intelligent electronic devices and apparatus for the safe collection and connection of power to the grid, we offer products for applications throughout the whole wind energy production value chain.

—
A comprehensive range of motor protection, controls and starting solutions, backed by a full range of high-quality services.

—
Emax 2 all-in-one matches all grid requirements. It enables a direct communication to the new energy management cloud-computing platform ABB Ability™ Electrical Distribution Control System.

—
System pro M range offer a complete range of first-class quality products such as miniature circuit breakers, residual current devices, surge protection devices, control, signaling, measuring and smart accessories

—
Medium voltage primary and secondary switchgears up to 42kV for safe and reliable power collection and connection.

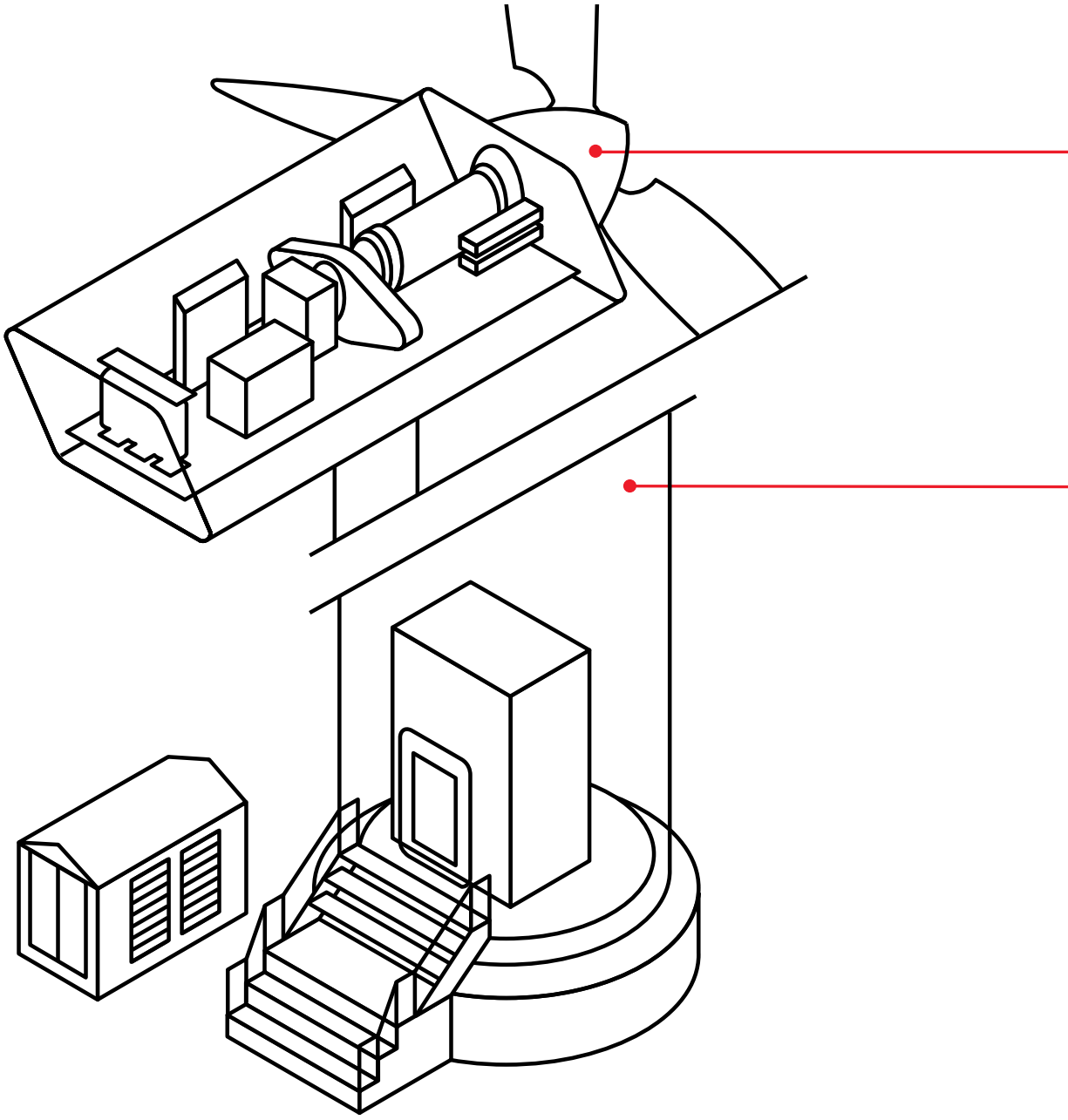
—
Broad portfolio of medium voltage apparatus for overhead line power collection inside the wind farm.

—
Color Keyed Lugs, a unique termination solution with lugs and colored die tools for error free connections.

ABB in wind industry
Deliveries from A to Z into the wind industry

ABB supplies products and services to the wind industry, from what is needed inside the wind turbines down to power transmission and distribution systems of the wind power plant.

Products at the edge of technology for the pitch and yaw systems, for the auxiliary and supply systems, for the hydraulic and cooling systems, as well as solutions for power collection and grid connection.



Components and systems inside the nacelle

—
Generators
Doubly-fed/full converter concepts
(up to 8 MW, 690 V – 12 kV
Medium voltage (up to 10MW, 3.3kV).

—
Turbine control and protection products
For drivetrain and other sub-systems.

—
Wind turbine converters
Doubly-fed/full power low voltage (up to 6 MW, 690 V)
Medium voltage (up to 10MW, 3.3kV).

—
Motors and drives
Brake motors for yaw & pitch control
AC motors for generator cooling, fans and hydraulic systems.
Variable speed motor control.

—
Connection & cable management
Lugs: improving connection for error free interface.
Conduits & Wiring ducts: ensuring cable protection for communications.
Flexible conduits and fittings: unsurpassed protection for wires and cables.
Cable ties: advanced fastening solutions.
Earthing & Lightning protection: making safe operating environment.

Components and systems inside the tower

—
Compact Secondary Substation
Equipped with SF6 or air insulated switchgear up to 40,5kV, oil or dry type transformer up to 5000 kVA.

—
Switchgear
Medium voltage secondary switchgear (12-40.5 kV).
Medium voltage primary switchgear (12-42kV).

—
Transformers
Dry-type/Liquid-filled
(up to 72.5 kV and 40 MVA).
From 100 kVA ancillary equipment to 63 MVA 72,5 kV voltage insulation class.

—
Recloser
Up to 38kV, 1200A and 16kA.
Applicable for overhead line Power Collection networks.

Let's write the future. Together

ABB in wind industry.
The best solution in low and medium voltage products

Wind power engineered into each megawatt.
The most efficient systems at every turn of the wind turbine.
Edge technologies to exploit wind from every direction.

We help to increase reliability, safety and performance of the wind turbines through:

- the longest experience on the market and a deep understanding of the wind power industry specific needs
- the largest portfolio that includes dedicated and unique products and solutions for all wind turbine sub-systems
- a full portfolio of solutions for wind power collection and safe connection to the grid.

We are the most reliable long term partner because we are:

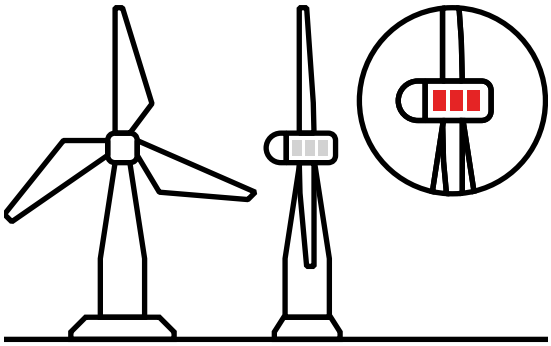
- an independent supplier, not manufacturing wind turbines
- recognized as market leader with highly reliable and proven solutions
- able to achieve high technological challenges at the lowest cost energy (LCOE).

We offer global support on a local level through:

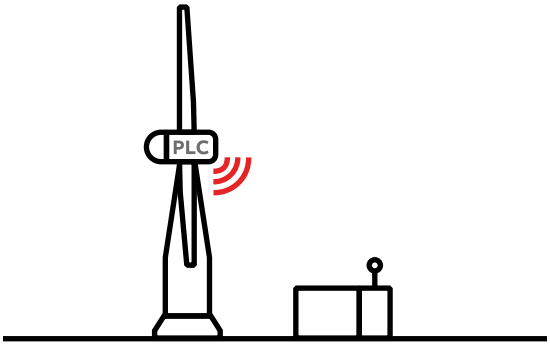
- presence in more then 100 countries
- global and local wind experts
- products and services available in all markets, 24/7.

ABB in wind industry
Sub systems in wind turbines

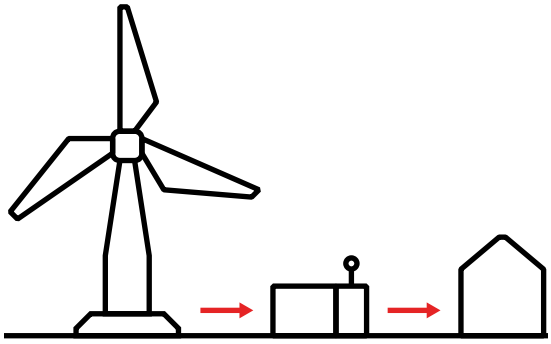
The following two pages introduce you to the most common applications inside a wind turbine, its subsystems and the connection of the wind farm to the grid. Our solutions help these applications to work in the most reliable and safe way. See in the following pages how exactly we can match any need all along the energy production chain of a wind turbine and plant.



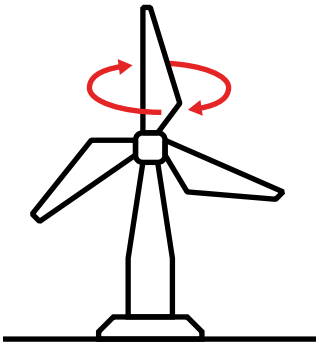
Drivetrain
This is the power circuit, where input is the power from generator and output is power to the grid. Since high powers are involved, typical components are Air Circuit Breakers (ACBs) and large contactors. Other key products are involved in overvoltage protection: OVRs and SPDs. Modern drivetrains normally includes a converter. In addition to the main circuit, the converter itself has several functions that need low voltage components.



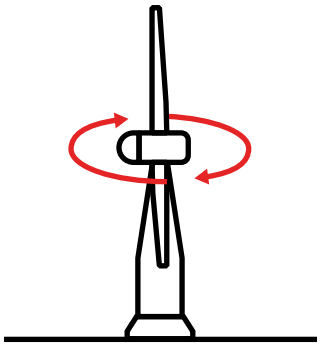
Main controller
The main controller is the brain of the turbine, taking care of overall decisions, control, monitoring and communication. The main component is a PLC. Around it several products are needed, e.g. for power supply, protection and communication.



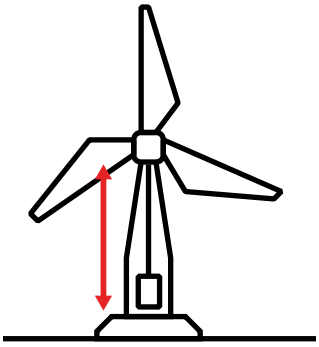
Power collection and grid connection
Electrical energy from the wind turbine is collected inside the wind plant and connected to the grid. Main components are transformers as well as MV switchgear and apparatus. On the LV side of the transformer, circuit breakers, switch disconnectors as well as overvoltage protection are relevant.



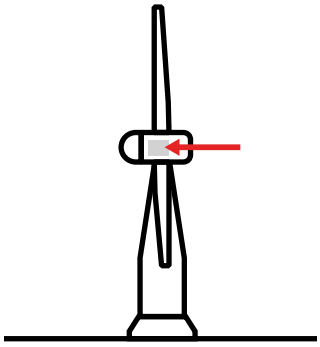
Pitch system
Pitching refers to changing angle of the turbine blades. The function is to maximize output power from the wind turbine as well as protect the turbine from high wind speeds (pitching out to reduce or stop rotation speed). Main components are the motors for each blade and their controls. Other main functions are related to communication and safety.



Yaw system
The yaw system is turning the complete nacelle so that the rotor (with the blades) is always facing the wind. This is to maximize power output from the turbine. Main components are motors and its controls. Typically 3 to 8 motors are used.



Auxiliary and supply systems
These are internal systems of the turbine like lightning, elevator and cooling systems (air or liquid).



Hydraulic and cooling system
Hydraulic and cooling systems are supported by hydraulic pumping systems which transfer heat losses from equipments such as generators, gearboxes and converters. Hydraulic systems are also used in safety circuits such as yaw, pitch and brake systems.

ABB in wind industry
Low voltage products and systems

Products		Subsystems									Turbine size		
Product data (typical, range, example)	**Product name**	**Drivetrain - full converter types**	**Drivetrain - doubly-fed type**	**Drivetrain - fixed speed types**	**Pitch system**	**Yaw system**	**Main turbine control**	**Other Aux. systems**	**Hydraulic and cooling systems**	**Grid connection**	**Small Wind (city & rural - up to 100kW)**	**Community wind (around 100-approx 500kW)**	**Utility scale turbines (MW & multi MW)**
Circuit-breaker													
MCCB - Molded Case Circuit Breakers up to 250A	Tmax XT		C	x	x	x	x	x	x	x	x	x	x
MCCB - Molded Case Circuit Breakers 400-1600A	Tmax		C/Gr	x						x		x	x
ACB - Air Circuit Breakers up to 6300A	Emax	Gr	Gr							x			x
MCCB - Variable frequency versions up to 1600A	Tmax VF	Ge	Ge									x	x
ACB - Variable frequency versions up to 4000A	Emax VF	Ge	Ge										x
Switches & Fusegear													
Fusible switches	Easyline	x	x	x				x	x		x	x	x
Switch fuse	OS	x	x	x				x	x		x	x	x
Load break switches	OT				x	x	x	x	x	x	x	x	x
Current limiting fuses	Hi-Tech	x	x	x	x	x	x	x	x	x	x	x	x
Contactors & motor Control													
Block contactors up to 40A (AC3) / 15kW	AF (A)	C	C		x	x		x	x		x	x	x
Block contactors 40-400A	AF (A)		C					x	x		x		x
Block contactors up to 2650A (AC1)		Ge/ (Gr)	x	x								x	x
Overload relays	TAF, EAF				x	x						x	x
Manual motor starters	MS116, MS132 (MO325)	C	C		x	x		x	x				
Mini contactors	B6, B7	C	C		x			x	x			x	x
Softstarters up to 40A / 15kW	PSR, PSE												x
Softstarters up to 1200A	PST(B)			x								x	x

Products		Subsystems									Turbine size		
Product data (typical, range, example)	**Product name**	**Drivetrain - full converter types**	**Drivetrain - doubly-fed type**	**Drivetrain - fixed speed types**	**Pitch system**	**Yaw system**	**Main turbine control**	**Other Aux. systems**	**Hydraulic and cooling systems**	**Grid connection**	**Small Wind (city & rural - up to 100kW)**	**Community wind (around 100-approx 500kW)**	**Utility scale turbines (MW & multi MW)**
Safety and protection													
Safety PLC	Pluto				x		x					x	x
Safety relays	RT, JSB	C	C		x	x	x	x	x		x	x	x
Safety labels, tags, signs, barricade tapes								x	x		x	x	x
Emergency exit lighting								x	x				x
Arc guard system	TVOC-2									x			x
Limit switches - safety applications	LS											x	x
RCD/RCBO - Residual current devices	DS200, F200, DS951	C	C	C	x	x	x	x	x		x	x	x
Pluggable system (compact power distribution)	SMISSLINE TP				x	x	x	x	x				
Short circuit current limiter	S800-SCL-SR				x	x		x	x				
MCB - Miniature circuit breakers up to 63 A	S200	C	C		x	x	x	x	x	x			
HPCB - Miniature circuit breakers up to 125 A	S800				x	x	x	x	x	x			
RCD - Residual current devices	DS200, F200, DS951	C	C		x	x	x	x	x				
SPD - Surge protection devices, Tipe 1 (DIN-rail)	OVR T1	Gr	Gr						x				
SPD - Surge protection devices, Tipe 2 (DIN-rail)	OVR T2	Ge/ Gr/C	Ge/ Gr/C		x	x	x	x	x	x			
DIN-rail fuseholders	E90	C	C		x	x	x	x	x	x			
Metering, monitoring and signaling													
Electricity meters	A-, B-, C- series	Gr											
CMS - Circuit monitoring system	CMS-	x	x										
Enclosure, connection and installation equipment													
Distribution switchboard	System Pro E Energy - TwinLine S 43	x	x		x	x	x	x	x	x			
Automation board	IS2	x	x	x	x	x	x	x	x			x	x
Switchgear	MNS									x			x
Industrial plugs and sockets, 400 V or 690 V								x	x				
DIN-rail socket outlet	M1xxx	C	C		x	x	x	x	x				
Grounding													
Mechanical grounding system	Blackburn	x	x	x	x	x	x	x	x	x	x	x	x
Exotermic grounding system	Blackburn	x	x	x	x	x	x	x	x	x	x	x	x

Legend
x yes
Ge generator side of the converter
Gr grid side of the converter
C not part of drivetrain, but in converter panel

ABB in wind industry
Low voltage products and systems

Products		**Subsystems**									**Turbine size**		
Product data (typical, range, example)	**Product name**	**Drivetrain - full converter types**	**Drivetrain - doubly-fed type**	**Drivetrain - fixed speed types**	**Pitch system**	**Yaw system**	**Main turbine control**	**Other Aux. systems**	**Hydraulic and cooling systems**	**Grid connection**	**Small Wind (city & rural - up to 100kW)**	**Community wind (around 100-approx 500kW)**	**Utility scale turbines (MW & multi MW)**
Connection and cable management													
Terminal blocks 4-240 mm² (screw clamp / spring / ADO)	SNK, SNA	x	x	x	x	x	x	x	x	x	x	x	x
Cable ties	Ty-Rap, Ty-Fast	x	x	x	x	x	x	x	x	x	x	x	x
Stainless steel cable ties	Ty-Met	x	x	x	x	x	x	x	x	x	x	x	x
Flexible conduit and fittings	NCG, BEM, Liquidtight	x	x	x	x	x	x	x	x	x	x	x	x
Compression connectors	Color-Keyed, Blackburn, Spec-Kon Lugs	x	x	x	x	x	x	x	x	x	x	x	x
Conduit bodies	BlueKote	x	x	x	x	x	x	x	x	x	x	x	x
PVC-coated conduit	OCAL-BLUE	x	x	x	x	x	x	x	x	x	x	x	x
ATX liquid-tight flexible metal conduit and fittings, T&B fittings	T&B fittings	x	x	x	x	x	x	x	x	x	x	x	x
High temperature wire terminals	Spec-Kon	x	x	x	x	x	x	x	x	x	x	x	x
Wiring Ducts	Q-Ducts, halogen-free range	x	x	x	x	x	x	x	x	x	x	x	x
Other and various products													
Power supplies (1- 3- phase) up to 40 A	CP range	C	C		x		x	x	x		x	x	x
Interface relays	CR range, R500/600	C	C		x		x	x	x		x	x	x
Temperature monitors	CM range				x		x				x	x	x
Signal converters	CC range, ILPH	C	C		x		x				x	x	x
Current sensors	ES	C	C		x		x				x	x	x
Steel modular framing	Kindorf	C	C	x	x	x	x	x	x	x	x	x	x
Pilot devices - pilot lights (various types and colors)	Compact/CE, Modular/ MPE	C	C		x	x	x	x			x	x	x
Pilot devices - push buttons (various types and colors)	Compact, Modular ranges	C	C		x	x	x	x	x		x	x	x
Pilot devices - selector switches (various types)	C..S, M..S	C	C		x	x	x	x	x		x	x	x

Products		Subsystems									Turbine size		
Product data (typical, range, example)	**Product name**	**Drivetrain - full converter types**	**Drivetrain - doubly-fed type**	**Drivetrain - fixed speed types**	**Pitch system**	**Yaw system**	**Main turbine control**	**Other Aux. systems**	**Hydraulic and cooling systems**	**Grid connection**	**Small Wind (city & rural - up to 100kW)**	**Community wind (around 100-approx 500kW)**	**Utility scale turbines (MW & multi MW)**
Service													
Replacement products	All	x	x	x	x	x	x	x	x	x	x	x	x
Spare parts and consumables	All	x	x	x	x	x	x	x	x	x	x	x	x
Service training	Circuit breakers (ACB, MCCB)												
Service training	Contactors, softstarters, arc guard												
Maintenance	Circuit breakers (ACB, MCCB)												
Repair	Circuit breakers (ACB, MCCB)												
Repair	Contactors, softstarters												
Engineering and consulting	All										x	x	x
Extension, upgrades and retrofits	All										x	x	x
Complete service offer	Switchgear											x	x

Legend
x yes
Ge generator side of the converter
Gr grid side of the converter
C not part of drivetrain, but in converter panel

ABB in wind industry
Medium voltage products and systems

Products		**Subsystems**										**Turbine size**		
Product data (typical, range, example)	**Product name**	**Drivetrain - full converter types**	**Drivetrain - doubly-fed type**	**Drivetrain - fixed speed types**	**Pitch system**	**Yaw system**	**Main turbine controller**	**Other Aux. systems**	**Hydraulic and cooling systems**	**Power Collection**	**Grid connection**	**Small Wind (city & rural - up to 100kW)**	**Community wind (around 100-approx 500kW)**	**Utility scale turbines (MW & multi MW)**
Medium voltage - Modular substations														
eHouse											x			x
Skid-mounted substations											x			x
Compact Secondary Substation (CSS)	UniPack									x			x	x
Secondary Skid Unit (SSU)										x			x	x
Secondary Enclosed Unit (SEU)										x			x	x
Product packaging										x	x		x	x
Medium voltage - Primary distribution														
Gas-insulated primary switchgear ZX product family	ZX0.2, ZX1.2, ZX2										x			x
Air-insulated primary switchgear UniGear product family	UG 550, UG 500R, UG ZS1, UG ZS2, UG ZS3.2										x			x
Air-insulated primary switchgear UniGear Digital											x			x
VD4 (ADVAC) medium voltage circuit breakers	VD4									x	x		x	x
Outdoor circuit breakers	R-MAG, OVB-VBF										x		x	x
Medium voltage secondary distribution														
Gas-insulated secondary switchgear	SafeRing, SafePlus									x	x		x	x
Air-insulated secondary switchgear	UniSec									x	x		x	x
Recloser	GridShield									x	x		x	x
Air-insulated switch-disconnector	NalfWind, NAL									x			x	x
Medium voltage safety, protection & control														
Protection relays Relion® family	REJ603, REF601, REG615, REF615, REF620, REF630									x	x		x	x
Instrument transformers										x	x		x	x
Sensors										x	x		x	x
Fuses										x	x		x	x
Medium voltage advanced services														
MyRemoteCare: analytics, reporting and remote support										x	x			x
MySiteCare: capturing data and diagnosis										x	x			x
Relay Retrofit Program										x	x		x	x
Upgrades of the protection										x	x		x	x
Replacement of the protection										x	x		x	x

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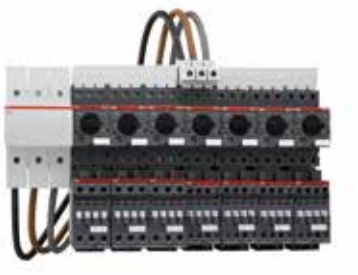
ABB in wind industry
Low and medium voltage solutions

To be able to follow the wind market changes we offer specif products for wind application increasing perfomance, efficency and reliability of the whole system, lowering operating cost.



Coordinated solution for the main drivetrain circuit

- Electrical coordination of contactors and circuit breakers improves system availability and reliability and minimizes damage of components in case of short circuit.
- We offer complete coordination tables for contactors with ACBs and MCCBs. Type 1 and Type 2 coordination according to IEC 60947.
- In the table below you see a few examples of coordination, according to different ratings of a turbine.

Power	Voltage	Circuit-breaker	Contactor	Coordination
1.2 MW	690 V	T7 V	AF1250	Type 2
1.5 MW	690 V	E2	AF1650	Type 2
2.0 MW	690 V	E3	AF2050	Type 2
2.5 MW	690 V	E3	AF2650	Type 2

Motor control solution

- Several auxiliary systems of the turbine, such as pitch, yaw or hydraulic systems, use motors at 400V and 690V. Motor control and protection products are therefore widely used.
- We offer different innovative alternatives for complete motor protection solutions up to 690V, such as circuit breakers, short-circuit current limiters, manual motor starters, contactors, thermal overload relays and preassembled starters adaptable on Smissline system for higher flexibility and reliability.

ABB in wind industry
Low and medium voltage solutions

Power Collection and Grid Connection
- The generated electric power is collected and combined so that it can be most efficiently transported to the substation where it will be passed on to the transmission grid.
- For applications inside the tower our solution is the extremely compact SafePlus switchgear. Outside the tower we have a complete portfolio of secondary substations meeting all requirements about operators and public safety. With GridShield reclosers we offer a solution for overhead lines.
- About grid connection substation, we offer a complete range of gas- and air-insulated switchgear suitable for all local market requirements, as well as outdoor apparatus solutions.

Earthing, lightning and overvoltage protection
- Because of their height and exposed location wind turbines are prone to direct lightning. Transient overvoltages due to lightning current can cause severe damage to wind turbine installation, equipment and also create expensive downtimes.
- We offer complete solutions to design full lightning protection systems (LPS), including low voltage surge protection devices (SPDs), medium and high voltage surge arresters (SAs) and earthing and lightning protection (ELP).

Wire Management & Connectivity
- Our broad offering of wire & cable management solutions is designed to make the task of fastening, protecting, insulating and connecting wires easier and quicker for industrial applications.
- An electrical system is as reliable as its conductors and conduit systems & fittings, which provide unsurpassed protection for wire and cables in the most demanding applications as in wind industry.
- When strength, reliability and performance are required, professionals turn to our best wire & cable management solutions.

Safety

- Wind turbines, as any machinery, has a high level of requirements in terms of safety and protection. Although products are installed in each sub system, it's important to have a complete and coordinated turbine approach.
- We have a complete range of safety products for people protection and wind turbine reliability (specific for machine safety), but also products such as the Arc Guard System. We can also provide coordination tables for the discrimination and back-up between different circuit breakers (ACB, MCCB, MCB) to ensure reliability, simplicity and cost effectiveness.
- Our medium voltage products and systems fulfill the highest safety standards, SafePlus could be equipped with an arc suppressor limiting the effects of an arc fault withing milliseconds.
  Our Compact Secondary Substation (CSS) is tested for internal arcs and guarantees the highest safety levels, specific for public installations.
- SMISSLINE TP, load-free plugging in and unplugging of live devices and components without additional personal safety equipment for protection against electrical hazards.

Remote monitoring, control and communication

- Wind industry is facing a growing request of information management, such as real-time measurements, status, alarms, warnings, trips, protection trip data (why, when, how much) and maintenance data to be brought to supervision systems like SCADA. This is according to the IEC61850 standard for the design of electrical automation substations.
- Our breaking solutions includes either one external converter unit (RTU560CMG10 or RTU560CIG10) in association with one Emax or Tmax circuit breaker or, in alternative, an integrated solution within the Emax 2 ACB range.
- Our supporting state-of-the-art communication protocols such as IEC61850, enabling remote monitoring and control of the medium voltage side of the installation.

ABB in wind industry
Energy and asset management
Service and Maintenance

Energy and asset management - ABB Ability™ Electrical Distribution Control System

ABB Ability™ Electrical Distribution Control System is the innovative solution for energy and asset management of low voltage power distribution systems. It has been designed to monitor optimize and control the electrical systems, simplifying procedures and activities through profiling users' experience and access. It is a webapp with scalable and always up to date services to suit customers' need. ABB Ability™ Electrical Distribution Control System is available everywhere at any time, via smartphone, tablet and personal computer.

- Monitor
  - Discover plant performance, supervise the electrical system and allocate costs
- Optimize
  - Analyze the relevant information, improve the use of your assets and take the right business decision
- Control
  - Remotely implement an effective power management strategy to simply achieve energy savings

For more information visit
http://new.abb.com/low-voltage/launches/abb-ability-edcs

Service and Maintenance

- Wind turbines need to be able to produce as much electricity as possible during their lifetime which can exceed 20 years. Preventive and condition based maintenance is key to ensure optimal asset performance and an increased overall lifetime.
- MyRemoteCare and MySiteCare are our solutions that provide advanced monitoring and diagnostics, both local and remote, of the critical electrical system. These products are supported and enhanced by our complete service lifecycle portfolio and cover both ABB and third party installed base.
- The Lifecycle Management Service portfolio can be packaged to incorporate the complete MV and LV system and include such services as maintenance repair, spare parts and training. Our Service can also offer upgrades, extensions and retrofits to ensure your assets are in prime condition regardless of the age or manufacturer.

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