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, while Tmax XT range is designed to maximize ease of use, integration and connectivity, while reliably delivering safety and quality. They enable a direct communication to the 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

—
ABB switch-disconnectors are designed to be virtually maintenance-free across their entire extended lifespan and offer reliable performance in any environmental condition. Durability ensured according to IEC60947- 3, UL508, UL98 and CSA Standards.

—
The EasyLine XLP fuse switch-disconnectors fulfil the highest requirements with a total safety concept. The fuse switches are tested according to EN 60947-3 Standard with more stringent requirements for isolation, making, performance and safety

—
ABB motor starters with fuseless protection save space and ensure a quick reaction under overload or short-circuit, switching off the motor within milliseconds. They offer protection from 0.1A up to 100A, a harmonized range of accessories and are easily connectable to ABB contactors or soft starters through dedicated accessories.

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

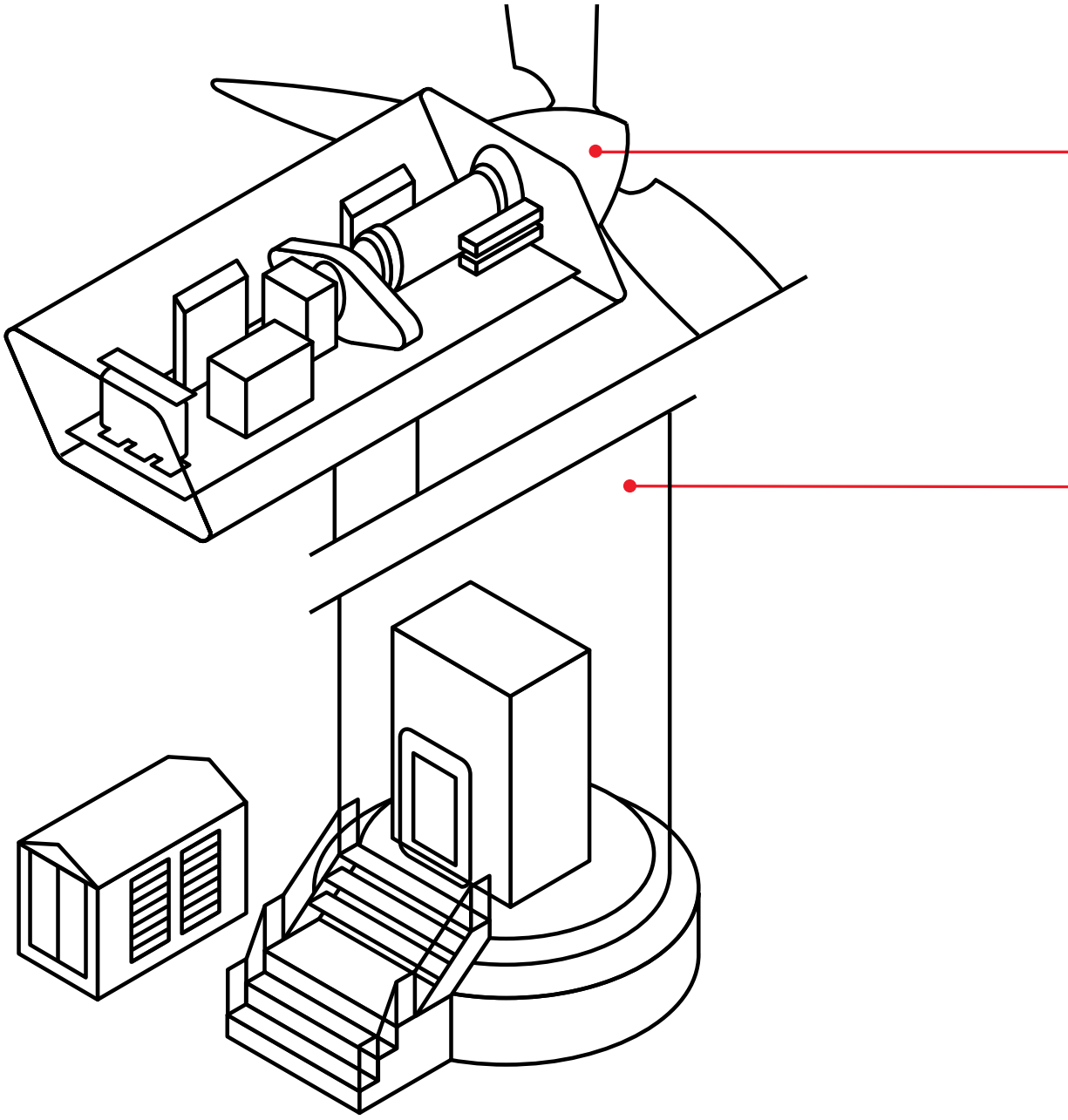
—
Broad portfolio of medium voltage apparatus for overhead line power collection inside the wind farm.

—
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:

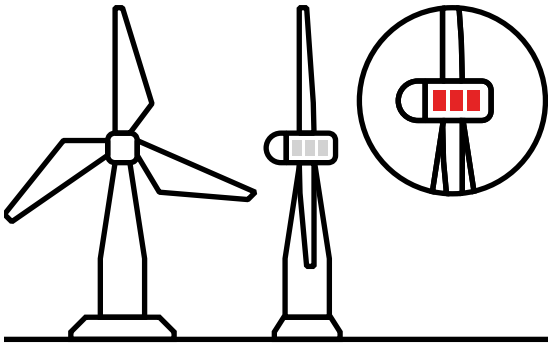
- an independent supplier, not manufacturing wind turbines
- recognized as market leader with highly reliable and proven solutions
- able to achieve high technological challenges at the lowest cost energy (LCOE).

We offer global support on a local level through:

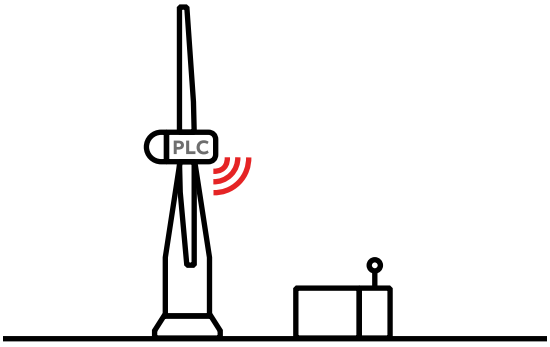
- presence in more then 100 countries
- global and local wind experts
- products and services available in all markets, 24/7.

ABB in wind industry
Sub systems in wind turbines

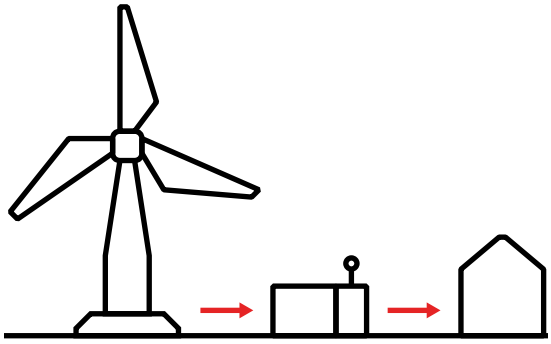
The following two pages introduce you to the most common applications inside a wind turbine, its subsystems and the connection of the wind farm to the grid. Our solutions help these applications to work in the most reliable and safe way. See in the following pages how exactly we can match any need all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



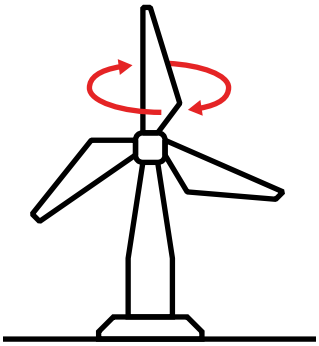
Drivetrain
This is the power circuit, where input is the power from generator and output is power to the grid. Since high powers are involved, typical components are Air Circuit Breakers (ACBs) and large contactors. Other key products are involved in overvoltage protection: OVRs and SPDs. Modern drivetrains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



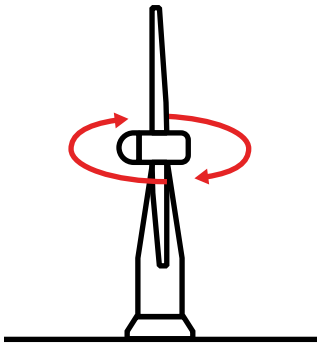
Main controller
The main controller is the brain of the turbine, taking care of overall decisions, control, monitoring and communication. The main component is a PLC. Around it several products are needed, e.g. for power supply, protection and communication.



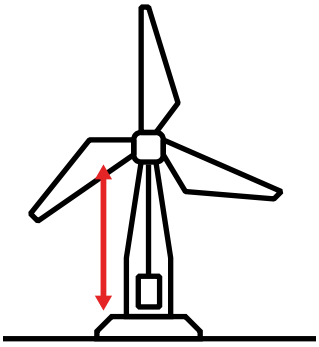
Power collection and grid connection
Electrical energy from the wind turbine is collected inside the wind plant and connected to the grid. Main components are transformers as well as MV switchgear and apparatus. On the LV side of the transformer, circuit breakers, switch disconnectors as well as overvoltage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



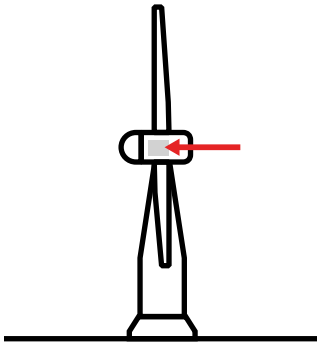
Pitch system
Pitching refers to changing angle of the turbine blades. The function is to maximize output power from the wind turbine as well as protect the turbine from high wind speeds (pitching out to reduce or stop rotation speed). Main components are the motors for each blade and their controls.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

Voltage installation constrains

The continuous growth of the share of energy generated through renewables, reducing the rotating power reserve in case of fault and voltage perturbation, jeopardizes the ability of the grid to manage disturbances. To avoid black out, wind turbines need to withstand the voltage grid transitory without disconnecting, but also to operate actively to compensate these transitory effects, supplying or absorbing reactive current. To fulfill these requirements, reported in the mandatory Codes for grid connection, the electrical components must be able to withstand voltage transitory (Fault Ride Through specification) but also operate and protect correctly in case of internal or not forecasted external faults (e.g. transitory longer than specified) without reducing the turbine safety level. Because of the diffusion of wind-based sources all around the world, the need to install wind parks in low populated areas and the need to supply remote areas, the interest to install wind turbines in high altitude is increasing more and more.

At altitudes higher than 2000m above sea level, the atmospheric properties change in terms of composition, dielectric capacity, cooling power and pressure.
The performance of protection and control components therefore undergoes derating in parameters such as the maximum operating voltage and its related breaking capacity.
In addition, the need to increase the rated power of the turbine and its efficiency leads designers to increase the rated voltage of the renewable energy source: 800V starts to be a reference value in many different applications.
ABB components design and coordination can manage correctly and safely this operating condition, e.g with 800, 900, 1000 and 1150V devices versions.
Furthermore, increasing the rated voltage to 800V AC or more gives the chance to design low-voltage systems for a higher range of energy production up to 10 or 12 MW instead of the usual range between 4 and 5 MW. That allows ABB solutions to be tailored following customers needs, preserving the performance, the efficiency of the system and resulting in lower maintenance cost.

Voltage Ride-Through Requirements

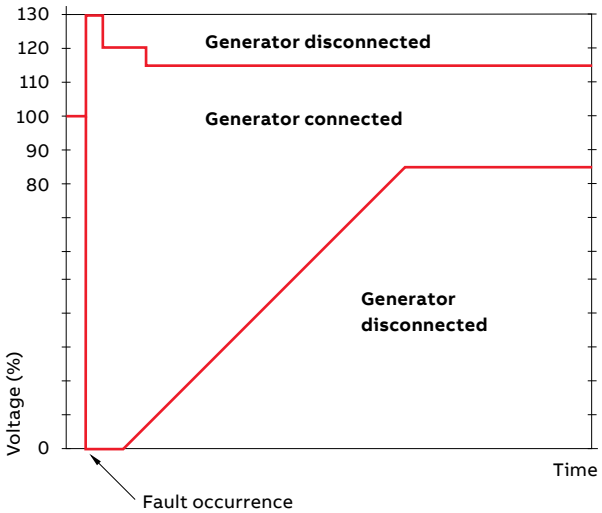
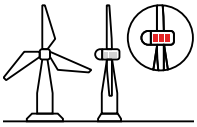


ABB in wind industry
Low and medium voltage solutions

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.

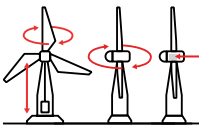


Coordinated solution for the main drivetrain circuit

- 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.

Coordination table at 690V

Coordinated combination	Power [MW]	Ik [kA]	Type
Tmax T7V + AF 1250	1	50	2
Emax E2.2 + AF 2050	1.5	50	2
Emax E2.2 + AF1350 (inside delta)	2	50	2
Emax E2.2 + AF1650 (inside delta)	2.25	50	2
Emax E4.2 + AF 2650	2.25	50	2
Emax E4.2 + AF 2850	2.5	50	2
Emax E4.2 + AF 2050 (inside delta)	2.75	50	2
Emax E4.2 + AF 2650 (inside delta)	3.5	50	2
Emax E6.2 + AF 2850 (inside delta)	4.5	50	2

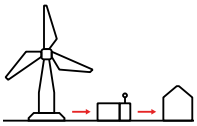


Motor control solution

- 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.

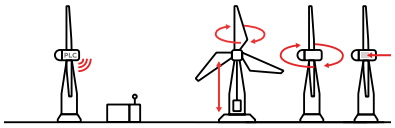
- We offer different innovative alternatives for complete motor protection solutions up to 690V, such as circuit breakers, short-circuit current limiters, manual motor starters, contactors, thermal overload relays and preassembled starters adaptable on Smissline system for higher flexibility and reliability.

ABB in wind industry
Low and Medium voltage solutions



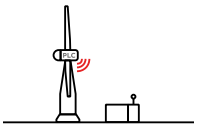
Power Collection and Grid Connection

- 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.



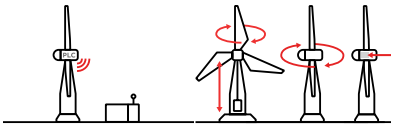
Safety

- 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.



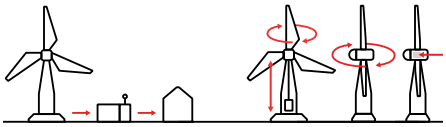
Remote monitoring, control and communication

- 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 supporting state-of-the-art communication protocols such as IEC61850, enable remote monitoring and control of the medium voltage side of the installation.
- Our breaking solutions includes one external converter unit (RTU560CMG10 or RTU560CIG10) in association with one Emax or Tmax circuit breaker.
- In alternative, through ABB Ability™ Electrical Distribution Control System, we can supply an integrated solution with low-voltage circuit breakers Emax 2 or Tmax XT for the remote supervision of the entire wind farm (multi-site) in addition to predictive maintenance capabilities.



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.

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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new.abb.com/windpower

Additional information
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