Proven technology for wind energy

Generators, drives and low voltage power components

Maximum production with the

In-depth know-how, long experience and thorough understanding of the application have made ABB the world's leading manufacturer of automation products. Today our products are widely used in power generation, process industries and marine applications.

Experience and global resources guarantee the optimal solution for every application

ABB has been designing and manufacturing generators for wind turbines for over twenty years. All generator types are specifically designed for wind turbine applications. The electrical performance of an individual generator is optimized in cooperation with the wind turbine manufacturer. This close co-operation ensures a superior generator design, with high electrical performance at full and partial load.

ABB offers a comprehensive range of low and medium voltage drives. They are based on premium frequency converter technology and are especially designed for harsh operating environments. The converters ensure continuous operation even during times of grid fault. The converter control principle, Direct Torque Control (DTC), has advantages that are of prime importance for wind turbine applications, including fast control, robustness, high availability and good quality of generated power.

ABB is one of the leading suppliers of low voltage products, offering a full range of products for various industries and OEMs. A variety of LV products are used in windmills for both the power and control circuits. Long experience of co-operating with windmill manufacturers worldwide has resulted in unique and optimized solutions that, in many cases, have been included in the standard ABB LV products.

Global support

ABB's global network ensures that engineering and service support is always within easy reach of customers anywhere in the world. At the same time our local presence enables us to provide lifetime customer support. This covers installation, commissioning, training, spare parts, repair, contract-based maintenance and technical support with a specific knowledge of local conditions and application requirements.

world leading technology

All electrical components for wind power

A comprehensive offering by one supplier: from generators to grid connection. ABB is your guarantee of a safe and reliable solution. Our global experience and resources enable us to supply you with components of the latest technology to maximize your production.

- Generators and motors
- LV and MV drives
- MV switchgears
- Transformers
- Low voltage products
- Control and protection
- Electrical sub-stations
- Grid connection and other electrical infrastructure projects

Drives
ABB offers reliable and optimized converter designs for different types of wind power concepts. Our solutions have been proven in the most challenging conditions worldwide. The modular and expandable converter systems are available from 300 kW to multi-megawatts.

Generators
ABB offers proven technology with over 100 years of experience. A long-term customer commitment has made us the leading supplier to the largest turbine companies, with well over 14,000 references. Today ABB is also the leader in the ultimate technology of large permanent magnet generators.

Low voltage products
ABB offers a modern and comprehensive range of low voltage products, meeting all essential international and national standards. The product range includes: circuit breakers, control products, connection devices, enclosures and cable systems, switches and fusegear etc.

Induction generators and

ABB supplies generators for both stall and pitch regulated wind turbines with outputs ranging up to 5 MW and more. We offer all main concepts from fixed speed and doubly fed to permanent magnet generators.

Reliable operation and high availability is maximized by using the same high voltage F-class insulation technology that we use in our high voltage generators.
This ensures a long lifetime and provides a high momentary overload capacity. Our long experience of demanding bearing designs for different applications keeps your turbine running without interruptions.

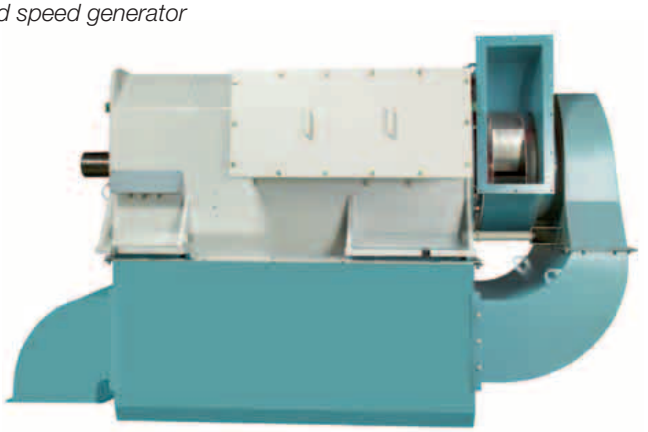
Fixed speed generator

Fixed speed generators

The traditional stall concept with the generator directly coupled to the grid.

We offer various designs: from single- to two-speed, air- and water-cooling to cast iron and welded housings.

- Simple and robust
- Proven design



Fixed speed generator

Doubly fed, semi-variable speed generator

A mainstream pitch concept where the rotor is also connected to the grid using a small converter to utilize the wind gusts.

The system allows the speed to increase with the wind. At a partial load the generator torque is regulated by the converter, which guarantees a constant frequency and enables a higher energy yield with good power quality. At peak load the power is limited by the blade pitch.

- Economical concept to obtain a variable speed and reactive power, and to increase the energy yield
- Simple turbine construction and increased reliability by reduced torque loads in the drive train

5 MW-class doubly fed generator

doubly fed converter systems

Low voltage converters for doubly fed systems

ABB has over three decades of experience with AC converters, and our solid know-how gathered from thousands of deliveries gives a competitive edge for our customers. The reliability of our converters has been proven in the most challenging conditions worldwide. ABB uses premium DTC technology, which provides a reliable control for different types of wind power concepts. The doubly fed concept is the mainstream at the moment.

- Compact, optimized converter size
- Modular, expandable system from 800 kW to multi-megawatts
- High-quality power with low harmonics level
- Voltage disturbance ride-through using active crowbar

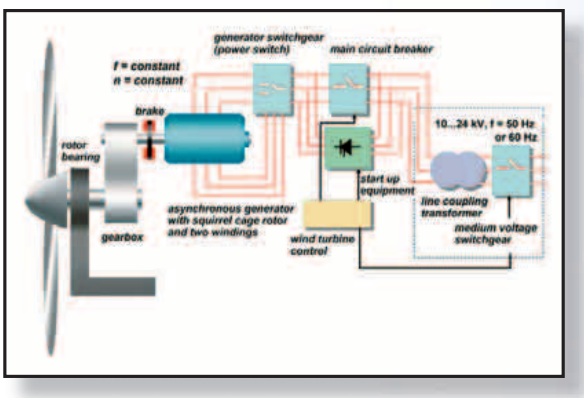
2 MW doubly fed converter

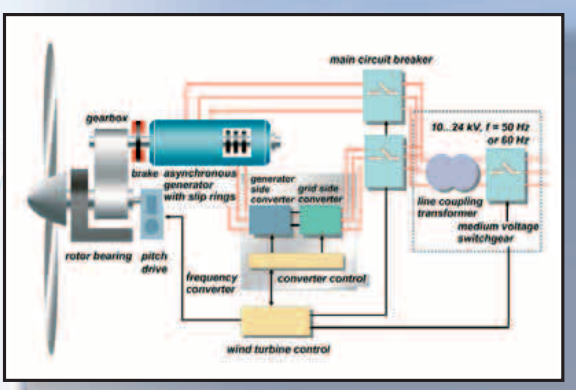
Remote monitoring and data access

ABB AC drives provide various fieldbus communications options for monitoring and controlling the drive. Up-to-date PC-tools are used for commissioning and service. Remote maintenance and monitoring is possible via a secure Internet connection using ABB's intelligent Ethernet module, a compact web server, providing access via modem, network cable or wireless connection.

Remote access to the drive reduces maintenance cost and wind turbine downtime.

Intelligent Ethernet module





Permanent magnet generators

The PM generator system is fully controllable in different grid conditions and provides the highest efficiency and power quality for the end user.

The powerful NdFeB magnets used in the rotor construction eliminate the need for any separate excitation resulting in:

- No excitation losses - highest efficiency
- High power intensity - smaller size and weight
- Small rotor losses – cooler generator and bearings
- Fewer parts – maximum reliability

With experience of various large PM applications in serial production, ABB offers three different concepts:

Low speed - robust gearless system

In a direct drive application the turbine and the PM generator form a structurally integrated unit. The design needs no separate cooling and offers free access to all parts.

- Simple and robust
- Lowest maintenance requirements

Low speed

Medium speed - compact design

The turbine main bearing and the PM generator are integrated to a low speed gear for a compact design. Lower speed means low wear and long lifetime.

- Small size for multi-megawatt powers
- Low maintenance requirement

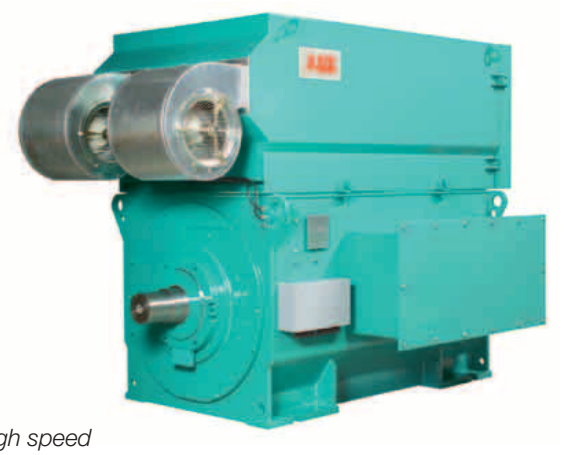
ABB delivers medium speed PM generators even in the kilowatt range for applications using multiple-stage gear with a lower speed ratio.

Medium speed

High speed - a small power pack

The system is mechanically similar to the doubly fed type using a six- or eight-pole generator.

- Extremely high power from a small size
- No slip rings – less maintenance



High speed

and full converter systems

Low voltage converters for PM systems

ABB has long experience of speed-controlled systems with PM machine from various applications. Today the number of wind turbine types with PM technology is clearly growing. ABB can offer an optimized solution package for different types of wind turbine solutions.

ABB converters for the PM systems offer:

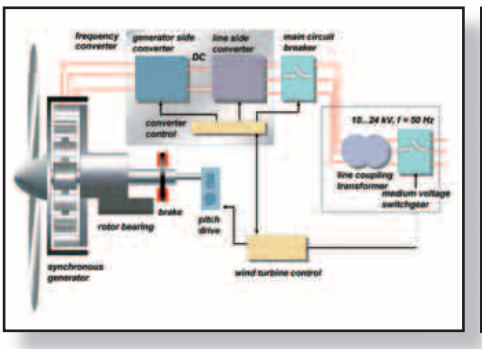
- Fully controllable system during grid transients
- Compact, optimized converter design
- Modular and expandable system
- Power range from 300 kW to multi-megawatts
- Full reactive power control
- Totally enclosed IP 54 liquid-cooled converter for the most demanding applications

Redundancy for ultimate availability

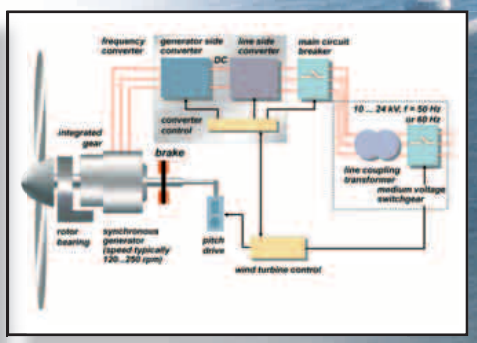
The ABB configurable converter is built of independent subconverter units. In this new converter concept subunits are automatically taken into use according to the demand, which means that in low wind only part of the converter is used. This unique feature gives improved efficiency and a better quality of the generated power in partial loads. High availability is also guaranteed because the turbine can run even when only part of the system is operating.

1 MW water-cooled converter

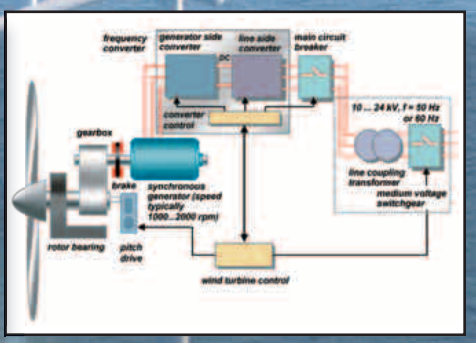
3 MW full size converter



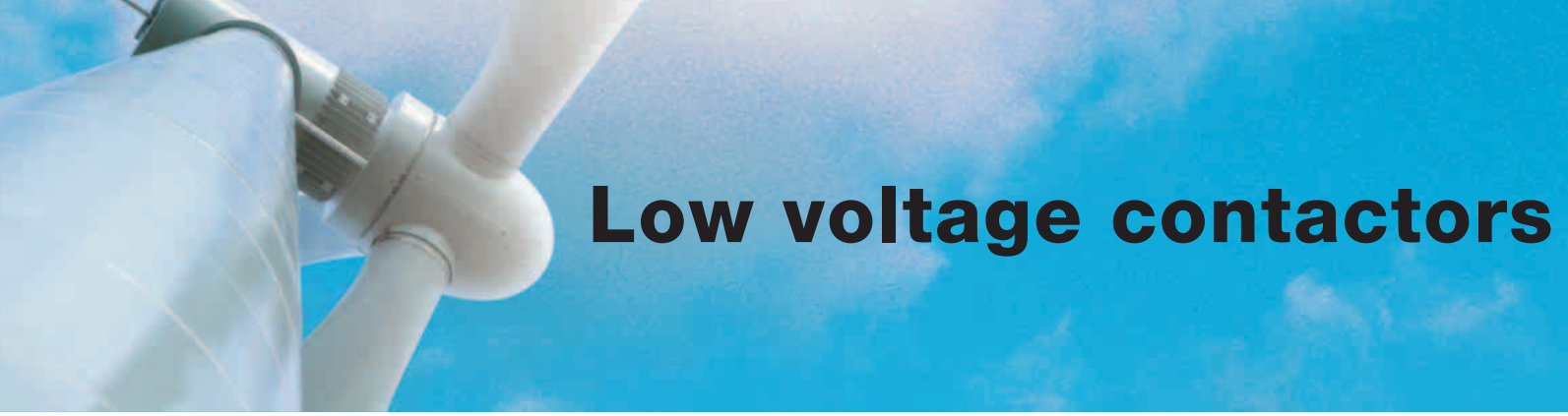
Low speed



Medium speed



High speed



Low voltage contactors

ABB has been the main supplier of large contactors for power circuit switching to the wind power segment for over 15 years. In close co-operation with the wind power industry, ABB has developed large contactors in accordance with special requirements from the different generator types and control configurations.

Large contactors are used for the control of the power circuit in all standard wind power configurations such as fixed speed, doubly fed and permanent magnet. The contactor range AF400-AF1650 provides the ideal solution for this purpose, offering the same high thermal rating for 1000 V as for 400 V and 690 V.

The design of the AF contactor range makes it possible to reduce the control panel size and minimizes the need for service and maintenance. The range is UL listed and conforms with IEC60947, as well as all essential national standards.

- Suitable for generator power from 250 kW to multi-megawatts
- Mechanical performance exceeding the life of the windmill
- Small physical dimensions and easy maintenance on installed contactors due to the unique design with connecting terminals on the same level as ABB molded case circuit breakers. Electrical co-ordination, Type 1 and Type 2, in accordance with IEC60974-4-1.

AF1250 and AF1650

Electronically controlled AF400-AF1650 contactors

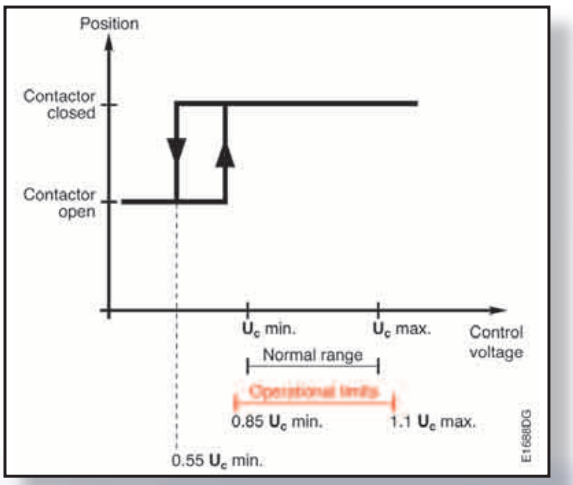
for power circuit switching

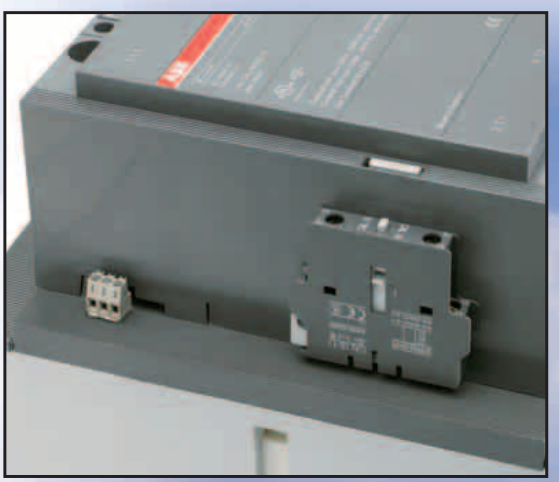
Wide voltage range and PLC control

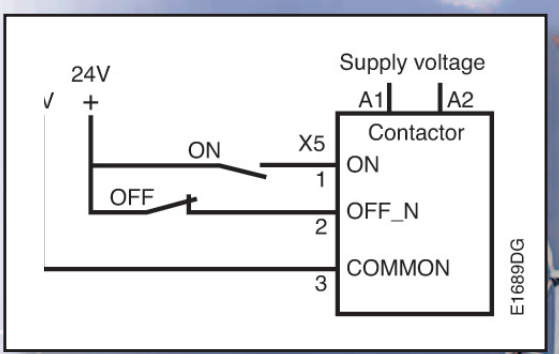
The AF400-1650 contactor range has electronically controlled coils, providing several advantages compared with traditional contactors. With the electronic coils it is possible to cover control voltages from 24 V to 500 V AC/DC with only four different versions, enabling customers to stock fewer versions than with conventional contactors, both for manufacturing and at the end user for service purposes.

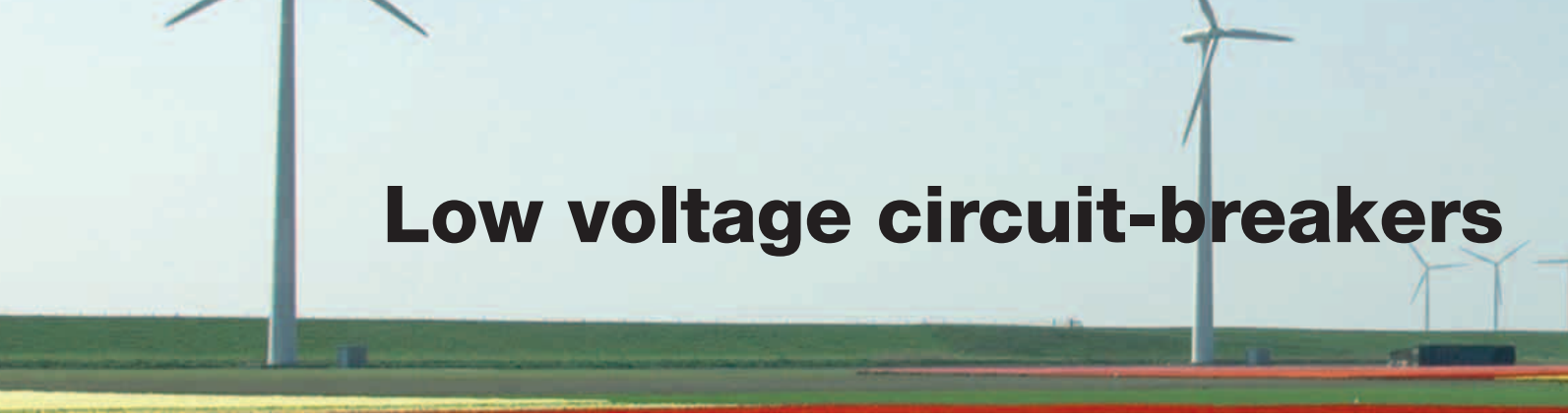
The electronically controlled contactors offer unique solutions for wind power applications such as:

- Withstand ability to supply voltage interruptions up to 20 ms
- Insensitive to voltage drops caused by short circuits and weak networks. Operation possible at control voltages as low as 25% of the nominal level, meeting high requirements for voltage sags and dips
- The AF 400-AF1650 contactor range can be directly controlled with 24 V low power signals from PLC control systems, suitable for use in combination with the CEL low energy auxiliary contacts (3 V/1 mA)









Low voltage circuit-breakers

Tmax and Isomax molded-case and Emax air circuit-breakers can be used for protection of the main power circuits and the generator auxiliary circuits in all the main configurations for wind power generation.

The ABB SACE molded-case (MCCB) and air (ACB) circuit-breakers provide the optimal solution for applications up to 6300 A and with voltages up to 1000 V AC and DC for MCCBs and up to 1150 V AC and DC for ACBs. Both types of circuit-breakers are suitable for use in severe climatic conditions - in accordance with the climatograph 8 of IEC60721-2-1 and resistance to impacts according to IEC 60068-9-27 and vibrations according to IEC 60068-2-6.

The possibility of having dialogue makes them particularly suitable in all conditions where the state of the circuit-breaker, data on the occurrence of tripping, and many other pieces of information need to be transmitted remotely.

- Conforming to IEC 60947 and certified according to UL and CSA and major Naval Registers
- Voltages up to 1150 V AC and DC
- High breaking capacity

The circuit-breakers can be fitted with thermomagnetic or electronic releases:

- The thermomagnetic releases are suitable for protecting both alternating and direct current networks.
- The electronic releases use microprocessor technology to detect the fault currents and are only suitable for alternating current networks. Apart from the protection functions, the releases provide:
  - Measurements of the main characteristics of the plant: current, voltage, power, power factor, frequency, peak factor, energy
  - Serial communication with remote control for complete management of the plant.

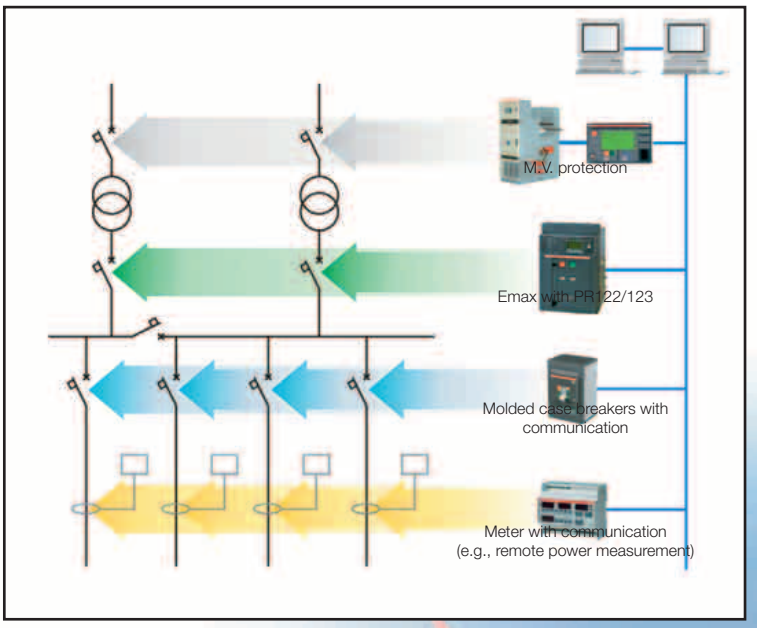
Dialogue

The electronic releases can be fitted with dialogue modules, which allow them to exchange data with other electronic apparatus over a communication network. The basic communication protocol used is Modbus RTU - one of the most widely used standards in industrial automation and power distribution. The releases with a Modbus RTU dialogue module can be connected immediately and exchange data with the whole vast range of industrial apparatus which uses the same protocol. Should other communication protocols be needed, the ABB Fieldbus Plug system is available, which makes the new advanced protocols, such as Profibus-DP and DeviceNet, immediately available.

The communication network can be used to read all the data available in the release, in real time and from any place provided with a connection to the bus.

Such data includes the status of the circuit-breaker (open/closed/protection tripped), measurements, release alarms and pre-alarms and fault data in cases of protection trip.

The communication bus can also be used to remotely control circuit-breaker opening and closing, so as to make them fully integrated in any control or automation system.



Some application examples of the circuit-breakers with dialogue are:

- Plant supervision with continuous collection of the data regarding currents, operations, faults, and protection trips
- Maintenance planning on the basis of the trip history of each piece of apparatus
- Automation of circuit-breaker opening and closing, for example for automatic opening and closing of loads with higher or lower priority, with control from a PLC or computer.

A bluetooth wireless communication module is also available, which enables communication with a PDA or Notebook with a Bluetooth port. It is possible in a very easy way to:

- Configure the protection threshold functions
- Monitor measurement functions, including reading of data recorded in Data Logger
- Verify the status of the circuit-breaker

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