



More power

New ABB motors make their mark



The new additions extend ABB's Ex and safe area portfolio covering different installations and safety and power requirements.

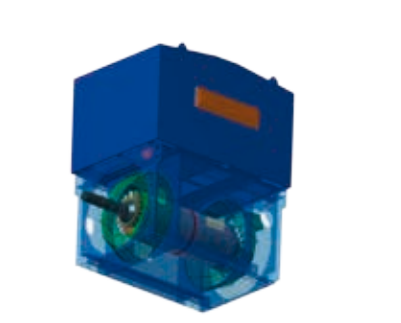
ANDREA CASIRAGHI, ANDREA LAMPUGNANI, SAMI MYLLYKOSKI, DAN STELZNER – The chemical, oil and gas industries face huge challenges: As the source of the basic raw materials that underpin our daily lives, they have to deliver a wide range of highly competitive products at enormous volumes while managing multiple processes in extremely harsh and increasingly difficult environments. All along the production chain, from exploration and extraction to refining and processing, ABB has a wide range of motors and generators, mechanical power transmission products and services that help meet these increasing production demands safely, cost-effectively, and efficiently. ABB's two new motors, the HV flameproof motor AMD 900 and the HV modular induction motor AMI 800 2-pole, were developed to meet the requests of customers for more powerful motors.

Title picture

ABB has a wide range of motors and generators, mechanical power transmission products and services that help meet the increasing production demands of chemical, oil and gas industry safely, cost-effectively and efficiently.



1a The HV flameproof induction motor
AMD 900



1b The 2-pole HV modular induction motor
AMI 800

ABB motors are powering pumps, compressors and drilling equipment used in all chemical, oil and gas production processes. These industries are seeing a global trend towards large-scale plants requiring motors with higher output to drive bigger machines. This is true for new plants being built in emerging markets as well as for expansion projects in existing plants. In drilling and offshore sectors, keeping size and weight down is essential to keep operating costs down. To meet these trends, motor and generator technical developments are moving towards increased power density; i.e., high voltage, higher output motors that offer the ability to reduce weight and size while delivering more power and speed. And of course all of this has to be achieved while meeting stringent safety standards.

A versatile portfolio

ABB motors meet all national and international standards and requirements – including IEC, European (EN) and NEMA. All withstand demanding process requirements, including onshore or offshore, oil and gas pipelines, refineries or petrochemical plants, floating production storage and offloading oil platforms, or liquefied natural gas (LNG) plants. The motors also operate in harsh environ-

ments such as explosive atmospheres, extreme temperatures, corrosive dust or humidity.

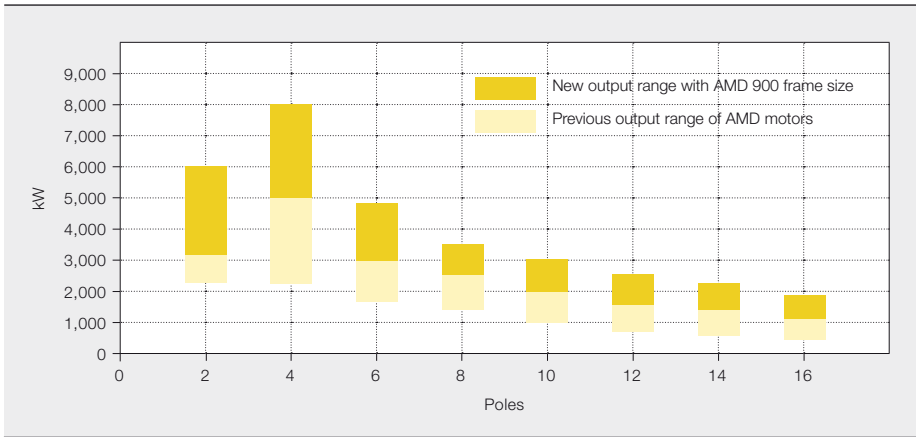
ABB develops solutions to improve customers' processes over the entire product lifecycle. The initial purchase price and installation of a motor often represents a small percentage of the overall cost of ownership. Running costs, maintenance and repair bills can outstrip the original costs of a motor, so therefore selection of the right product can lower the total cost of ownership by avoiding downtime.

Powerful and cutting-edge motors

To better meet the needs of these industries, ABB has introduced two high-powered motors – the high-voltage (HV) flameproof induction motor AMD 900 and the 2-pole HV modular induction motor AMI 800 → 1. The new additions extend ABB's Ex and safe area motors portfolio covering different installations and safety and power requirements.

The HV flameproof motor AMD 900 is ideal for driving pumps and compressors where higher processing capacity is needed, a refiner, for example. The HV modular induction motor AMI 800 2-pole is designed for driving water injection pumps on floating production, storage and offloading units (FPSOs) and main oil pipeline pumps in addition to other broad applications in chemical, oil and gas installations and wastewater treatment plants.

The HV flameproof motor AMD 900 is intended for fixed and variable speed applications from 333 rpm (18 poles) to 3000 rpm (2 poles), with 20-pole motors



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also available. Operating voltages are 3 to 11 kV, 50 Hz or 60 Hz. The motors are tube cooled either by IC511 or IC516 methods¹ and can be supplied for horizontal or vertical mounting. These motors do not require purging before starting, nor a pressurization system or inert gas. They can also be VSD fed. There is no thermal limitation for the “t_E” time²,

family. The new frame size simply means more power → 2.

Combining higher power with the requirements of flameproof protection (Ex d) involved considerable technical challenges. Internal clearances, referring to the minimum clearance distance between the joints in the frame and

the labyrinth seal in mm, were optimized on the labyrinth seals and enclosure. Advanced finite element method (FEM) techniques were used to ensure that the new labyrinth seal design and thicker enclosure met all

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and no need for a system test in VSD applications – individual certification is not required.

safety demands. Full compliance with all requirements has been confirmed by extensive testing, and both ATEX and IECEx certifications are available.

Its low vibration levels increases the reliability for an extended lifetime, which, together with its reduced maintenance requirements, means lower cost of ownership. The motor is certified up to IEC frame size³ 900 and rated up to 8 MW. The HV flameproof motor AMD 900 is an extension of ABB’s HV flameproof motor

The high voltage modular induction AMI 800 2-pole motor expands ABB’s Ex and safe area motor range and extends the IEC frame size from 400 to 800 for the 2-pole construction. Because of low vibration levels, rugged construction, low maintenance requirements and excellent reliability, the new motor provides a very low overall cost of ownership. High efficiency, along with a range of ventilation technologies, results in considerable energy savings over the life of the motor.

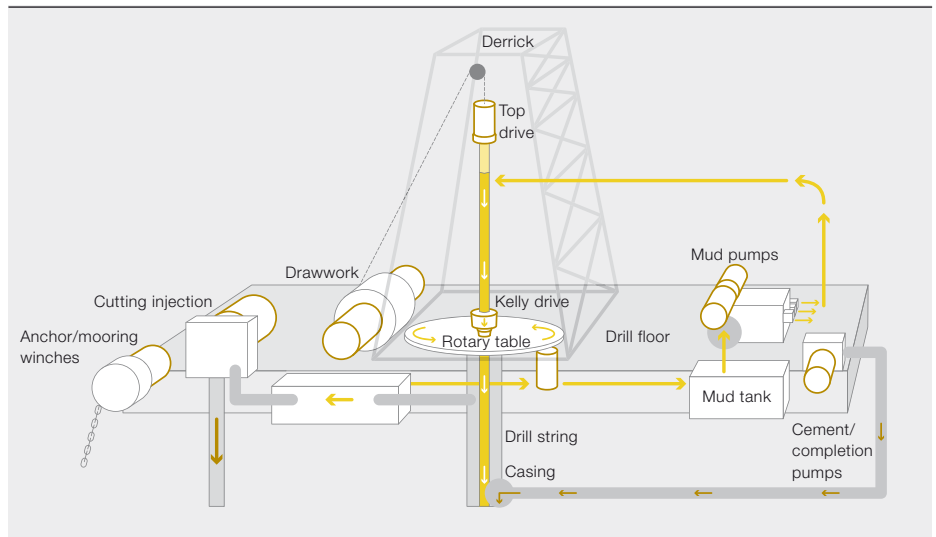
ABB met the challenge of cooling and stresses in the modular induction AMI 800 2-pole motor when implementing a combination of axial and radial ventila-

Footnotes

- 1 <http://electrical-engineering-portal.com/cooling-and-ventilation-of-electric-motors-ic>
- 2 t_E = stalled rotor time, in seconds, taken for an a.c. rotor or stator winding, when carrying the initial starting current, to be heated up to the limiting temperature from the temperature reached in rated service at the maximum ambient temperature (IEC 60079-7)
- 3 Frame size refers to the distance from the center line of the shaft to the bottom of the feet.

By employing VSDs instead of throttling or using by-pass vanes, energy costs can be reduced by as much as 60 percent.

3 ABB's drilling drives system



tion. The rotor has a new bar construction to resist the axial and radial stresses that are generated in such a powerful motor, especially during start-up. The shaft is solid, ensuring the necessary rigidity with the rotor core shrink-fitted on. The motor can be operated with supply voltage from 6 to 13.8kV and is intended for fixed speed applications up to 3000rpm, with a direct on line (DOL) connection, and is initially available for 50Hz. VSD (variable speed drive) operation is possible, but the speed range is fixed on a case-by-case basis for each application. The motor is designed for horizontal mounting and is equipped with sleeve bearings. Available protection types are non-sparking (Ex n) and pressurized (Ex p).

ABB's range of 2-pole HV modular induction motors are available in IEC frame sizes 400, 450, 500, 560, 630 and 710 mm with a maximum output of 8 MW.

AC motors are compact in size, supplied with a flange connection, and are foot supported.

This motor family has a standardized platform with options enabling production efficiency for almost all industrial applications. The addition of the new 800 frame size means more output power. The new target output for the 2 poles is set to 13.5MW (10kV – 50Hz – IC81W)

and 12 MW (10kV – 50Hz – IC616). The HV modular induction 2-pole motors can be horizontally aligned, and cooling types are weather protected (IPW24) or totally enclosed, equipped with air-to-air (IC611, TEAAC) or with water-to-air (IC81W, TEWAC) heat exchangers.

Comprehensive systems dig deep

A complete AC drilling rig system is a complex mix of transformers, drives and motors. ABB knows the challenges of each application and has the right motor for each one.

ABB supplies Ex certified drilling motors for top drive, mud pump, drawworks (DW), cement pump, rotary table, cutting injection, hex pumps and winches → 3. The motors output extend up to 1,655kW or 2,250 hp. IEC frame sizes vary from 280, 315, 400, 423, 450 up to 500. Typical operating voltages for VSDs are between 575 and 690 VAC at 50/60Hz, and

the motors are designed to work at ambient operating temperatures that range from –45°C to 55°C.

ABB VSDs, together with ABB's drilling motors, are

helping to lower the total cost of ownership through energy savings and reducing environmental impact. By employing VSDs instead of throttling or using by-pass vanes, energy costs can be reduced by as much as 60 percent. ABB electric drives reduce emissions (such as

NO_x and CO₂) onsite that could delay granting of a permit and incur penalties.

The new generation of top drives drilling systems, and the largest ones, rotate by AC motors and typically are connected to a gearing bit without the use of the conventional rotary table and kelly drive. In addition, the top drive can drill at a wider angle than a rotary table with swivel. Generally, top drive motors in drilling rigs need to withstand higher acceleration forces than standard motors in other rugged industry environments. This equipment has to function in hazardous and corrosive environments. For onshore applications, typical power ratings range from 295 to 590 kW (400 – 800 HP), and for offshore are between 660 and 880 kW (900 – 1200 HP), with a speed range of 0 to 2600 rpm. The associated bearing needs to be able to carry the high axial force created by the swivel movement. One or two vertical AC top drive motors are used to drive the gearbox. The top drive is operated from a control console on the rig floor. Usually, top drive motors are controlled by VSDs, using either ducted air or a water cooling solution. The benefits of VSDs are magnified when the driller controls the operating speed and power while enabling motor efficiency, but also keeps tripping pipe downtime smooth and safe. ABB top drive motors are designed, tested and certified for on- and offshore and VSD applications, optimizing total running costs. Together with modern AC technology they provide the optimum solution for drilling extremely deviated wellbores. The foot-mounted and flange-supported construction delivers a mechanically rigid solution. The specially selected bearing solution for vertical motors gives reliable operation and a long lifetime.

Mud pumps circulate the drilling fluid and maintain the correct pressure in the drilling well. Typical installations have two AC motors per pump, or one large AC motor with two shaft extensions. Normally they are VSD driven and suitable for hazardous and corrosive environments. They are mounted horizontally on top of the pump. Power ratings can be between 800 – 1,620 kW (1,100 – 2,200 HP) with typical speeds between 0 – 1,800 rpm and could experience a radial force <80 kN (kiloNewton) at the shaft end, and are either cooled by air or water. The power required to run a pump

is roughly proportional to the cube of the speed. So a pump running at half speed can consume as little as one-eighth of the energy compared with one running at full speed. A small reduction in speed can make a big difference in energy consumption. As many pump systems often run at partial load, the use of a VSD can produce huge savings. The high performance and reliability increases plant availability and decreases maintenance costs. Smooth torque over the entire speed range reduces noise and vibration levels, which minimizes mechanical stress.

The DW is the heart of the electrically driven hoisting mechanism on a drilling rig. The DW reels the drilling line in and out to raise and lower the drill stem and bit. This equipment uses a VSD driven motor with a typical intermittent torque duty cycle between 0 and 800 rpm of 12,500 Nm, working in an intermittent speed range that could occasionally be as high as 2,400 rpm. ABB offers a complete drive package with a tested and optimized motor and drive solution for the DW. AC motors are compact in size, supplied with a flange connection, and are foot supported. Special bearing solutions are available for those situations where there are radial forces acting on the motor shaft.

Design, service, savings

ABB motors are engineered with the total running cost of motors as a priority and optimized for the application in which they will be used. They are available both as cast iron or rigid welded steel frame construction; the shaft design is high-fatigue-resistant material; and the special bearings can be either antifriction or sleeve. Both the shaft design and bearings are capable of carrying high radial and axial forces. To withstand harsh weather conditions corrosion treatment is done with the offshore industry's approved painting system.

ABB top drive motors are designed, tested, and certified for on- and offshore and VSD applications, optimizing total running costs.

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