MV Drives, ATD, October 2009

ACS 6000

Medium voltage drive for single or multi-motor applications, 3 – 27 MW

Features and benefits

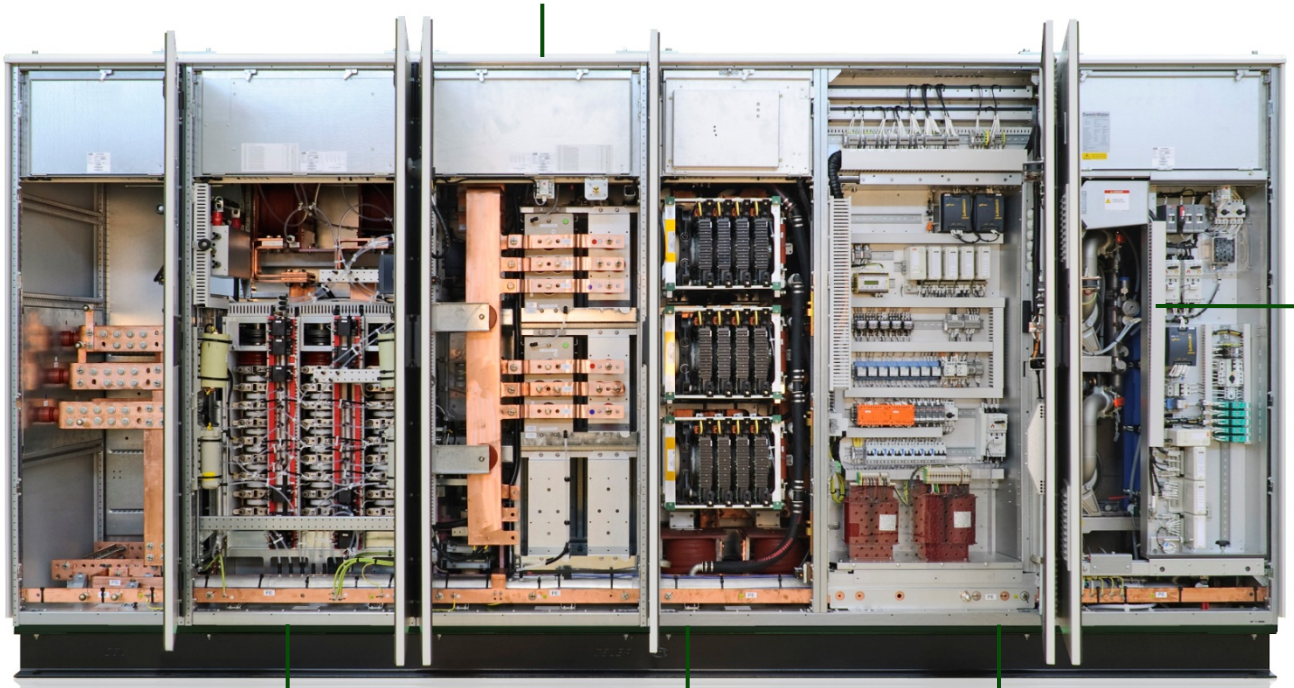
- Modular drive for single or multi-motor applications,
  3 – 27 MW
- For induction, synchronous and/or permanent magnet motors
- DTC control platform for exceptionally high torque and speed performance
- Common DC bus for single and multi-motor operation and energy recuperation
- Modular design for optimum configurations
- Line Supply Unit (LSU) for two-quadrant operation with a constant power factor of 0.96 over the whole speed range
- Active Rectifier Unit (ARU) for four-quadrant operation and reduced harmonics, adjustable power factor

Primary fields of application

Industries	Applications
Cement, mining and minerals	Mine hoists, conveyors, crushers and mills
Chemical, oil and gas	Pumps, compressors, extruders, mixers and blowers
Marine	Main propulsion, thrusters, pumps and compressors
Metals	Rolling mills, coilers, fans and pumps
Pulp and paper	Fans, pumps, refiners and chippers
Power generation	Fans and pumps
Water	Pumps
Other applications	Test stands and wind tunnels

ACS 6000 water cooled
3 – 27 MW

Capacitor Bank Unit
DC capacitors for smoothing the intermediate DC voltage



Water Cooling Unit
Supplies the closed cooling system with deionized water for the main power components

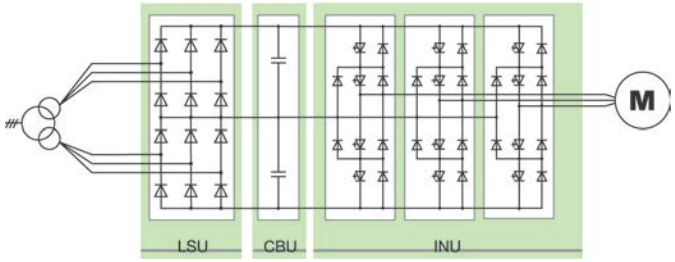
Line Supply Unit
6- or 12-pulse diode rectifier unit

Inverter Unit
Self-commutated, 6-pulse, 3-level voltage source inverter with IGCT technology

Terminal and Control Unit
Contains the power terminals and the control swing frame

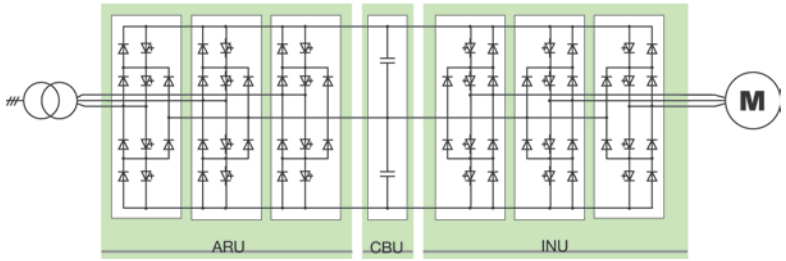
Inverter topology

12-pulse LSU single drive



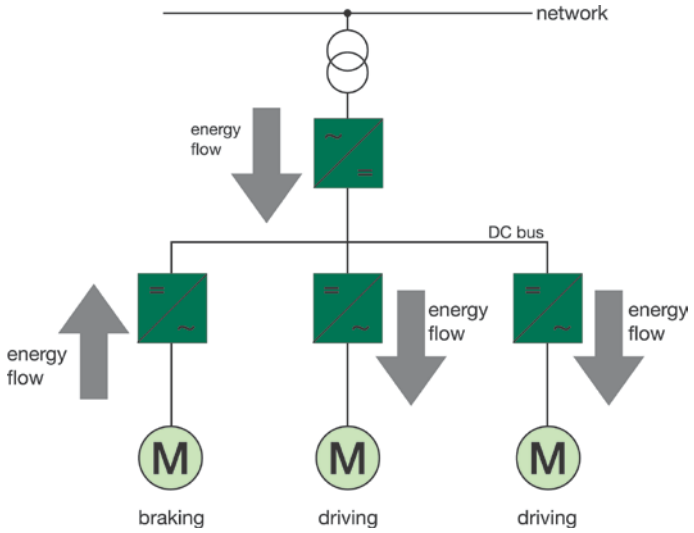
- Voltage Source Inverter
  - Fuseless: The ACS 6000 uses IGCTs for fast and reliable protection of power components instead of unreliable medium voltage power fuses

6-pulse ARU single drive



Common DC bus

Optimized energy flow with common DC bus, e.g. cold reversing steel mill



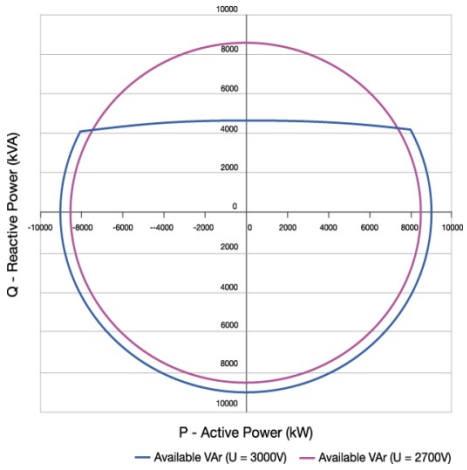
- Several motors (induction and synchronous) can be connected to the same DC bus -> optimized energy flow
  - Braking energy generated in one motor can be transferred to other inverters via common DC bus without power consumption from supply network
- Optimum configuration can be reached by combining the inverter modules (3, 5, 7, 9, and 11 MVA)

ACS 6000 modules
ARU, INU

- Active Rectifier Unit (ARU) rectifies the AC line voltage and charges the DC link capacitors
- Inverter Unit (INU) inverts the DC voltage to the AC motor voltage
- ARU and INU have identical layout and equipment
  - 6-pulse, 3-level voltage source inverters
  - Incorporating IGCT technology

ACS 6000 modules
ARU

Diagram showing the available active and reactive power of the ARU



- Allows four-quadrant operation for regenerative braking which reduces energy consumption
- Controls power factor to unity in the whole speed range
- Optional: ARU can be dimensioned to compensate reactive power generated by other loads connected to the same network

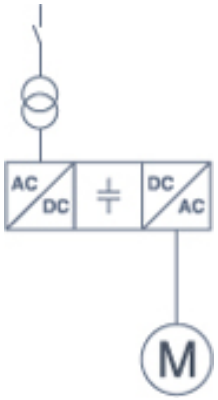
ACS 6000 modules
LSU

- Line Supply Unit (LSU) is designed for two-quadrant operation
- Maintains power factor at 0.96 in the whole operating range
- If short-term braking capability is needed, a Resistor Braking Unit with internal or external resistors can be installed

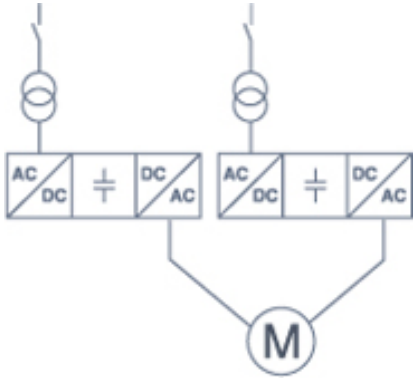
Modular use, one design

- The ACS 6000 is designed as a set of modules
- The modules can be arranged according to the required output power, motor configuration and process needs
- Benefits
  - Optimal adaptation of converter rating to customer requirements
  - Each configuration consists of well-proven components → minimizing risk of design errors even when extensive systems are engineered
  - Compact, standardized design reduces space requirements
  - Multidrive topologies with common DC bus are possible
  - Reduced installation and commissioning time

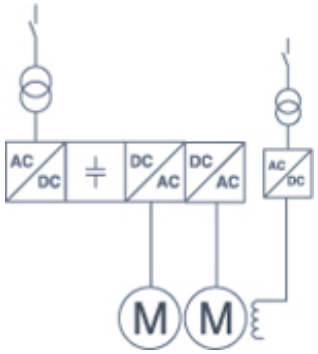
Basic types of configurations



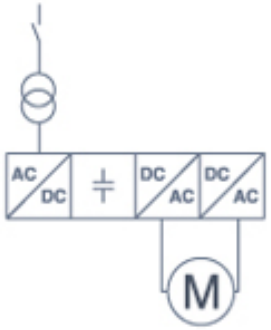
Single-motor drive configuration



Redundant drive configuration



Multi-motor drive configuration

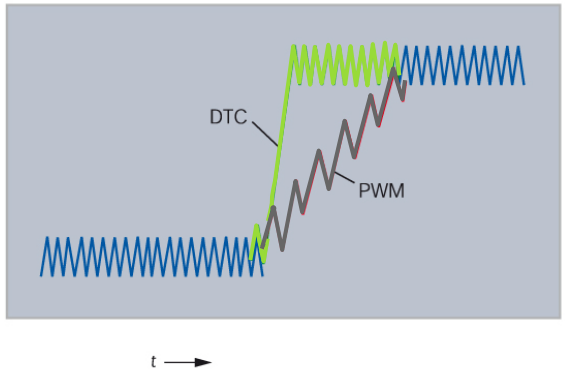


Twin configuration

Reliability

- IGCT semiconductors
  - An ideal switch for high-powered medium voltage applications
  - Low parts count
  - High efficiency and reliability
- Fuseless design
  - Faster and better protection than medium voltage power fuses
- Long-life capacitors
  - Advanced, environmental friendly, oil-filled foil capacitors have a substantially longer lifetime than electrolytic capacitors
  - Lower lifetime costs

Powerful performance
Direct Torque Control (DTC)



Typical torque response (t) of a DTC drive, compared with flux vector control and open loop pulse width modulation (PWM)

- Provides fast, accurate and stepless control from zero to full speed
- Full torque with optimal speed accuracy over the whole speed range
- Negligible low torque ripple
- Minimal inverter switching losses at maximal control performance
- No speed encoders needed

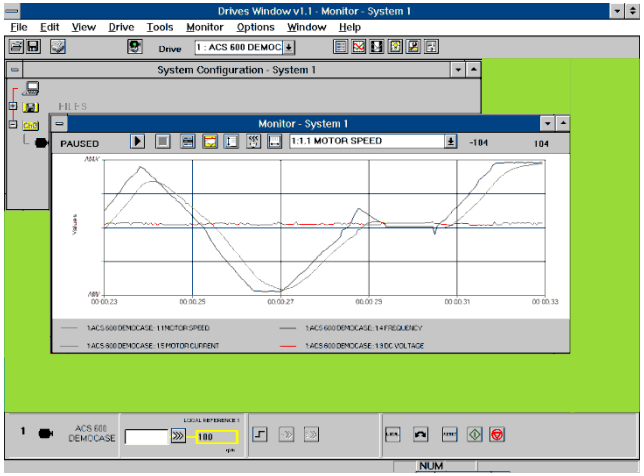
Powerful performance

- Power loss ride through
  - One second (i.e. 50 / 60 cycles) ride through capability for supply voltage dips down to zero
- Flying start and automatic restart
  - Catches a spinning load and smoothly takes it back to set speed
- Critical speed avoidance bands
  - Skips operation at critical speeds

Smooth and simple system integration

- Commissioning
  - Easy commissioning
  - Faster installation of multidrive configuration than equivalent number of single drives
- Control system
  - Connection to higher-level process controllers
  - Flexible hardware I/Os for remote control, allowing easy customization
  - Large variety of available fieldbus interfaces
- Applicable standards
  - Compliance with the most stringent requirements for current and voltage harmonic distortion
    - EN, IEEE, IEC
    - Marine standards optional

Drive*Ware*, the tools to increase productivity



The ACS 6000 incorporates the same set of user-friendly tools as other drives of the ACS drives family.

Drive*OPC*

- for communication between ABB drives and customer's Windows® applications

Drive*Window*

- Advanced, easy-to-use tool for commissioning and maintenance of ABB drive systems
- Remote diagnostics and monitoring of ABB drives

DriveMonitor™ (option)

- Remote and real-time monitoring and diagnostics of ABB drives from any location in the world

DriveMonitor™
Intelligent monitoring and control

Benefits

- Early diagnostics to avoid costly repairs
- Reduction of process-critical faults
- Optimization of maintenance costs and schedule
- Predictive (when necessary) instead of preventive (time based) maintenance
- Optimization of process performance
- Easier root cause analysis – reduced Mean Time To Repair (MTTR)

Testing

ABB is committed to ensuring the reliability of every drive they deliver.

- **Routine tests**
  Visual and mechanical checks, water pressure tests, insulation tests, auxiliary, control and protection devices checks, rated current and temperature rise tests of inverter unit
- **ACS 6000 single drive**
  Additional load and functional tests on the test lab motor
- **ACS 6000 multidrive**
  The multidrive modules are tested separately one by one as well as in line-up, where the control functionality of the entire drive system is tested

Worldwide service and support

- Supervision of installation and commissioning
- Local support
- Worldwide service network
- Spare parts and logistics network
- Training
- Remote diagnostics
- 24 x 365 support line
- Customized maintenance contracts

Power and productivity
for a better world™