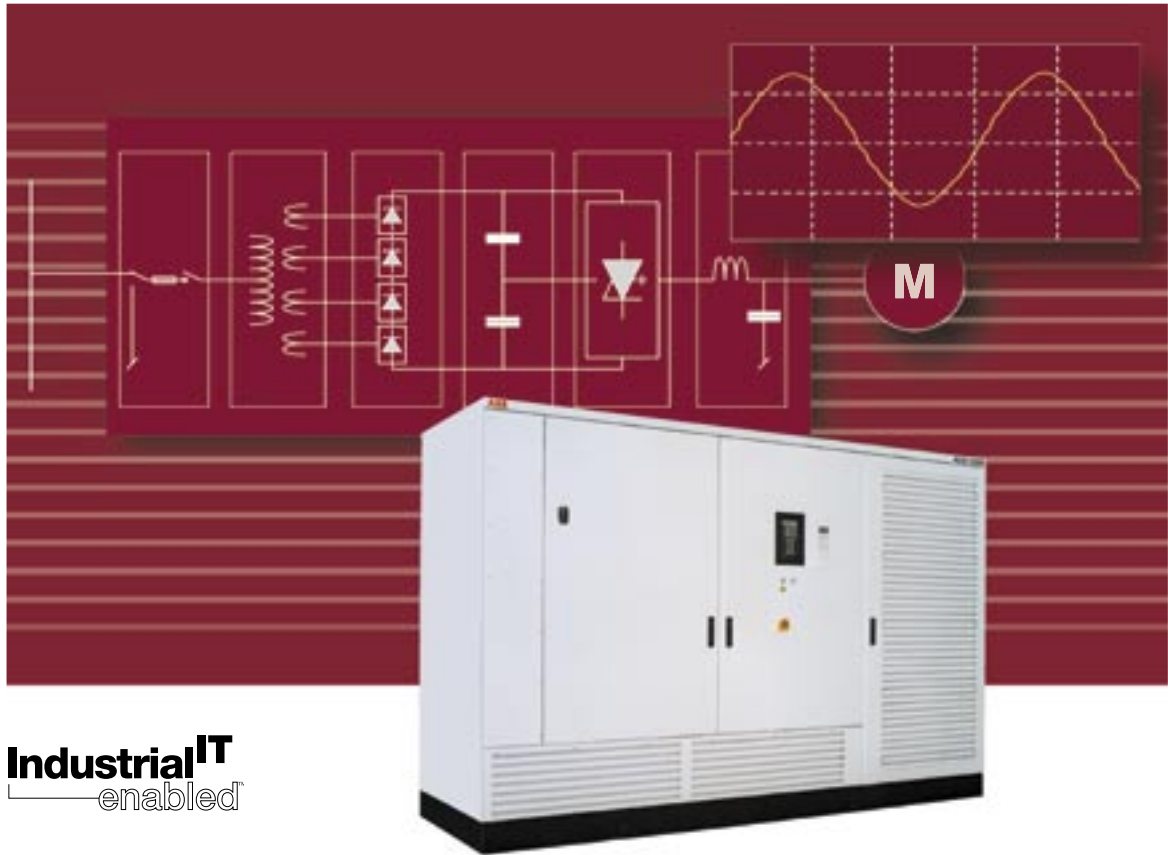


ACS 1000i

Integrated Medium Voltage AC Drive



IndustrialIT
enabled

ABB



ACS 1000i - Reliability runs in the family

A medium voltage AC drive that integrates an input transformer and input contactor, is the latest member of the ACS 1000 product family – one of the most successful variable speed drives in its class.

Integrated design combined with operational experience

For those applications where a motor already exists, space is often limited. Using a drive cubicle which has the input transformer and input contactor already integrated, while maintaining the compact footprint of its predecessor, the ACS 1000i is an unbeatable solution.

But it is not just existing installations that can benefit. New motor applications can also take advantage of the small size of the ACS 1000i along with a host of other world beating features including:

- Compatibility with new or existing equipment
- Simplified installation
- Motor and network friendliness
- Reliability
- Compact design
- Easy commissioning and maintenance

Key product features & benefits

- Integrated transformer and input contactor
 - compact design; reduced installation costs
- On-board auxiliary power supply
 - no separate auxiliary supply needed
- Three cables in/three cables out
 - allows quick installation and commissioning
- 24-pulse rectifier design
 - network friendly; compliant to all common standards for line harmonics
- Built-in input surge protection
 - tolerant to network disturbances
- Output sine filter
 - compatible with existing or new motors
- Tested as an integrated system
 - minimizes on-site start-up time

Fields of Application

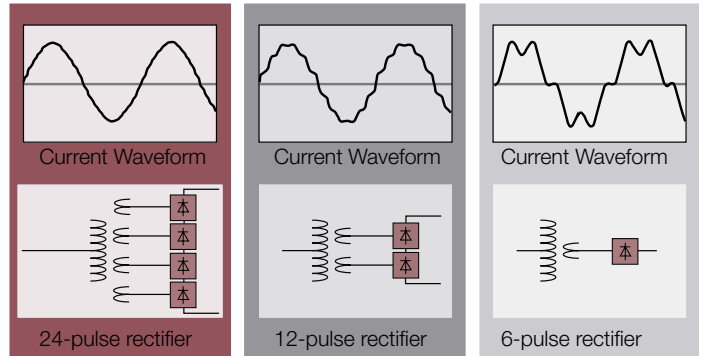
Industries	Applications
Cement, Mining and Minerals	Conveyors, crushers, mills, fans and pumps
Chemical, Oil and Gas	Pumps, compressors, extruders, mixers and blowers
Metals	Fans and pumps
Pulp and Paper	Fans, pumps, LC refiners, vacuum pumps and chippers
Power Generation	Fans, pumps, conveyors and coal mills
Water and Waste Water	Pump applications, fresh water and waste water
Other Applications	Test stands and wind tunnels

ACS 1000i – network and motor friendly ...

ABB's engineers have developed a combination of features that make the ACS 1000i the most motor and network friendly drive on the marketplace.

Network friendly

The ACS 1000i is equipped with a 24-pulse diode rectifier which meets the stringent requirements for current and voltage harmonic distortion as defined by IEEE, IEC and EN. This eliminates the need for costly harmonics analysis or installation of network filters when applying a new drive.



Different rectifier designs generate different line currents. A 24-pulse rectifier is the superior way to minimize harmonics.

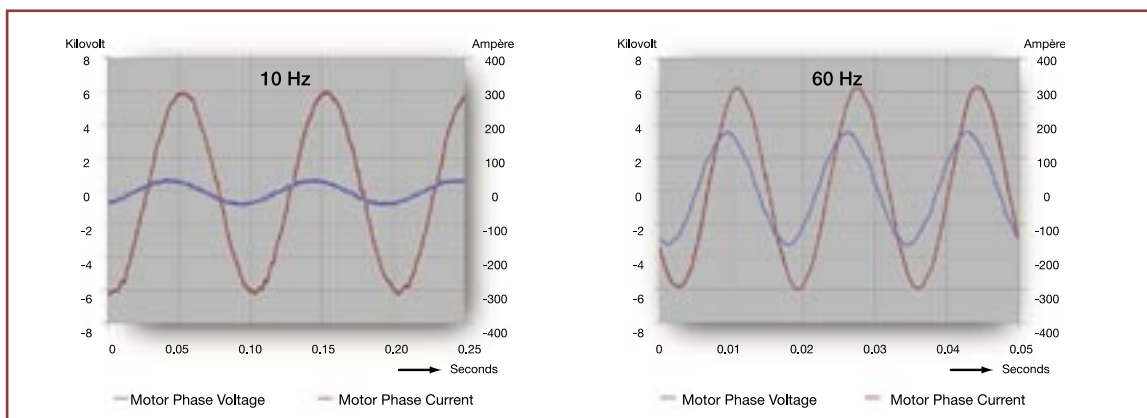
Output sine filter – perfect for standard motors and retrofit applications

Voltage reflections and common mode voltages, caused by any inverter topology, are a real concern for medium voltage motors. They cause excessive stress to a standard motor insulation and create harmful bearing currents, both with potentially disastrous consequences. Furthermore, the motor is subjected to additional harmonic heating generated by the inverter switching if no further precautions are taken.

With an ACS 1000i, all these detrimental effects are totally eliminated by its unique output sine filter, being an integral part of the drive. The result is an excellent waveform of voltage and current, supplied to the motor.

Benefits

- Compatibility with standard induction motors without derating
- Retrofitability with existing motors
- Motor efficiency same as Direct-On-Line (DOL) operation
- Reduced motor noise
- Use of standard cables
- No limitation of motor cable length



The ACS 1000i provides smooth and accurate motor control even at low speed and full torque (left diagram: 10 Hz, 100 % torque) throughout the full operating range of speed and load (right diagram: 60 Hz, 100 % torque).

... reliable, efficient, powerful, compact

Reliable components

IGCT semiconductors

The ACS 1000i uses an advanced and proven power semiconductor switching device known as IGCT (Integrated Gate Commutated Thyristor). It combines the best of two traditional semiconductor technologies: the fast switching of the IGBT with the proven reliability of the GTO.

The use of IGCTs results in low parts count, providing an intrinsically less complex, more efficient and reliable drive.

Fuseless

The converter design does not require any medium voltage power fuses, which are known to be unreliable, costly and subject to aging. The ACS 1000i uses dedicated IGCTs, instead, which provide faster and better protection for the power components.

Long-life capacitors

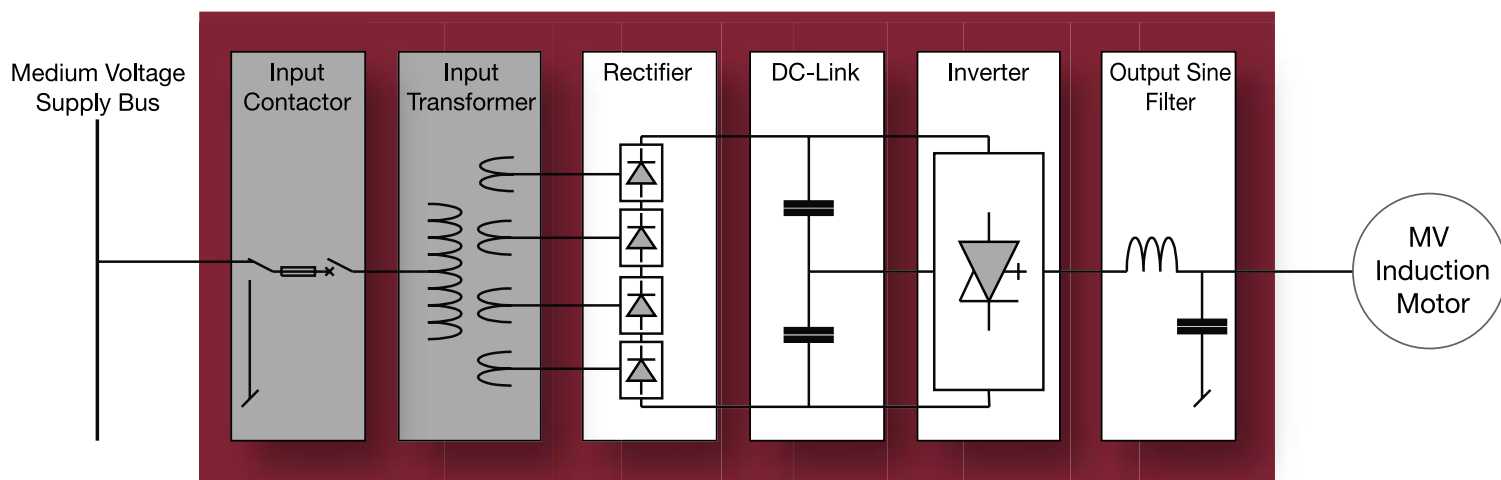
Also electrolytic capacitors, which have a poor life expectancy, are not used in the ACS 1000i. Advanced, environmental friendly, oil-filled foil capacitors, designed for a long lifetime, are used instead.

A powerful motor control platform

The motor control platform of the ACS 1000i is ABB's award-winning Direct Torque Control (DTC). This provides rapid, accurate and stepless control from zero to full speed. It can deliver full torque with optimal speed accuracy over the whole speed range, even without encoder.

Compact

A simple, compact design brings a small footprint, high reliability, fast installation and minimum maintenance.

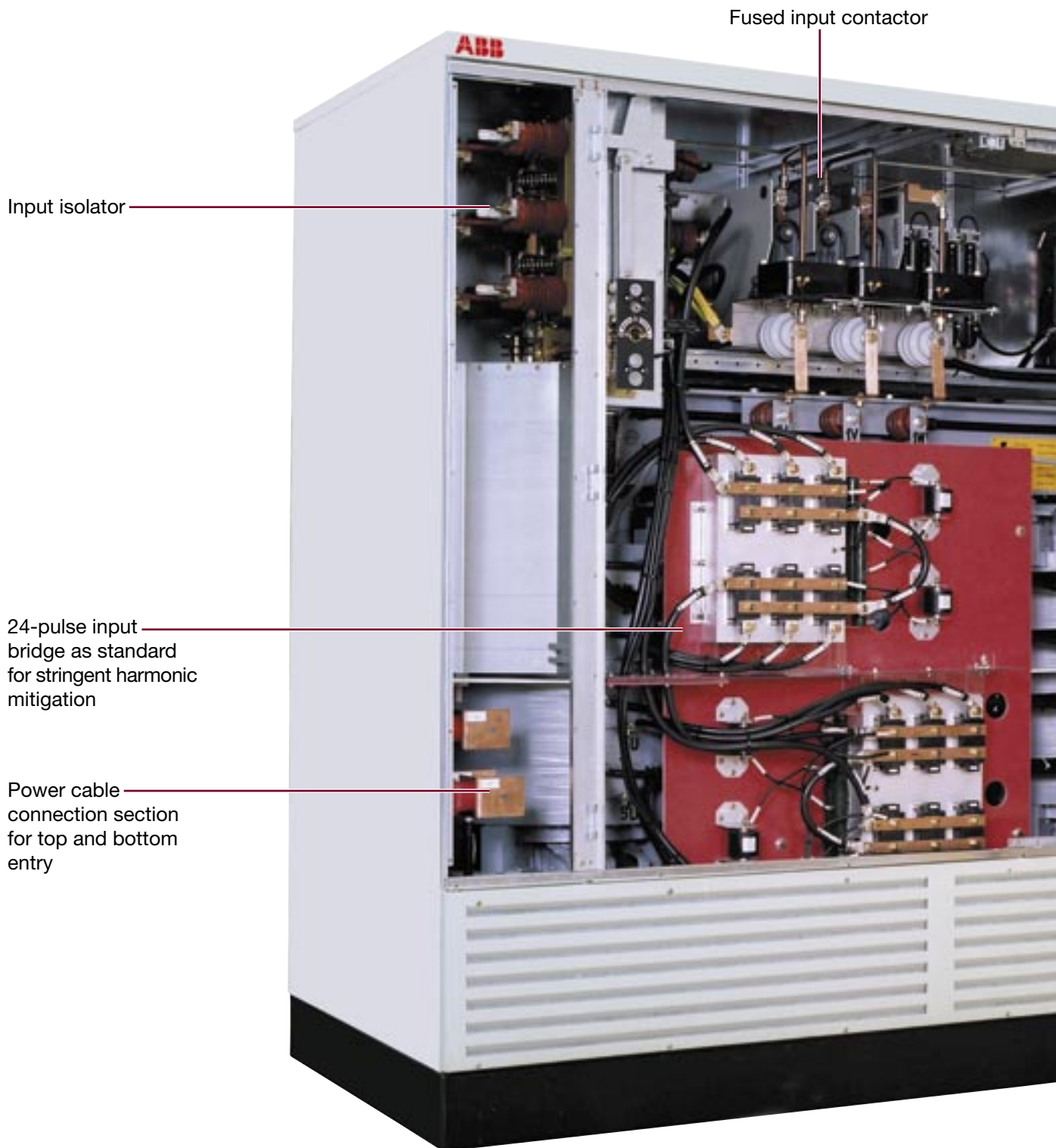


The ACS 1000i's well proven three-level inverter, without series or parallel connected power semiconductors, is the least complex, most robust and efficient topology in the modern world of medium voltage drives.

The ACS 1000i Medium Voltage AC Drive

Understanding the constraints of space in retrofit applications has enabled ABB to design a compact drive incorporating all the key components in an EMC compliant cabinet, to ensure trouble-free operation.





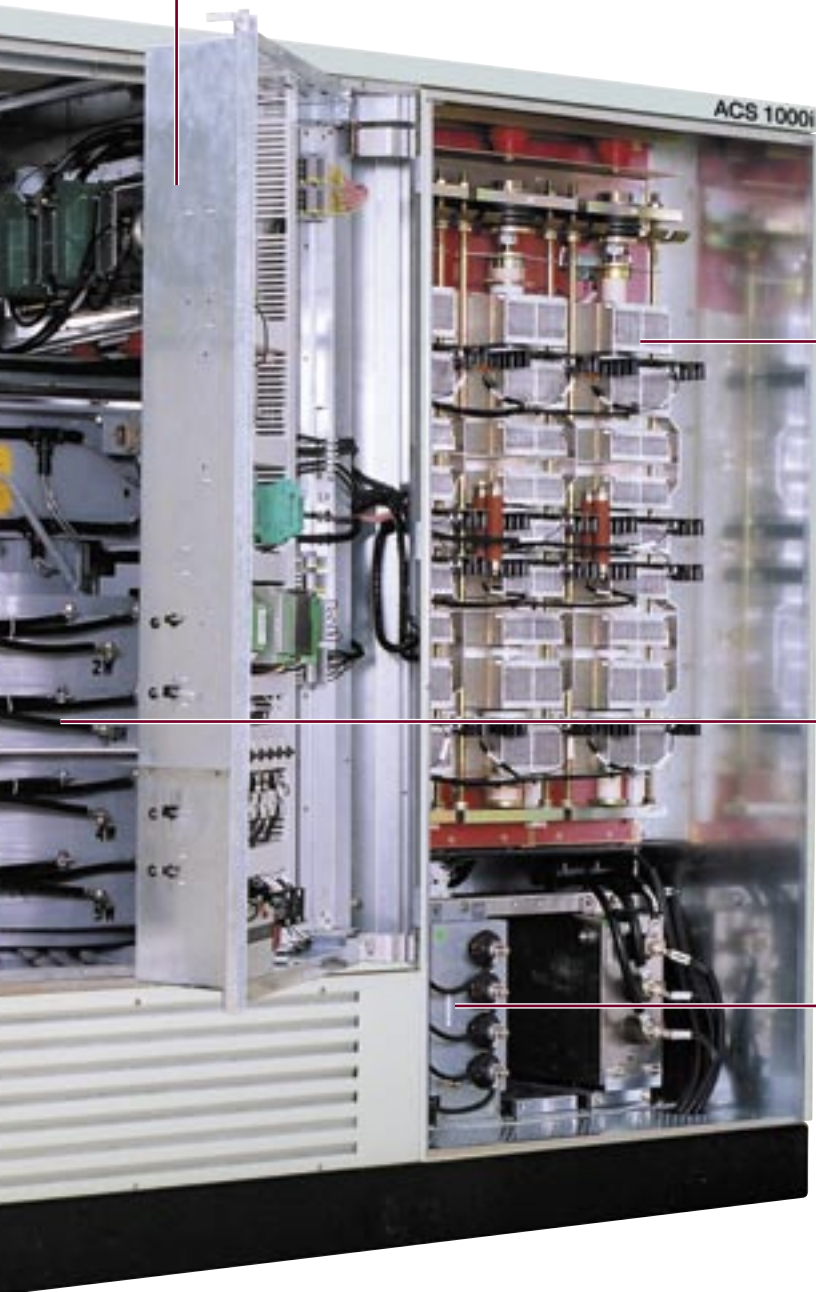
Fused input contactor

Input isolator

24-pulse input
bridge as standard
for stringent harmonic
mitigation

Power cable
connection section
for top and bottom
entry

Control electronics
mounted on swing
frame for easy access



Inverter unit
3-level voltage source
inverter using
IGCT power
semiconductors for
highest reliability and
performance

24-pulse input
isolation transformer

Output filter for
smooth sinusoidal
current and voltage
waveform, supplied
to the motor

Features and Benefits

Benefits	Features
Easy installation for lowest possible downtime.	The ACS 1000i contains input transformer, input contactor, on-board auxiliary power supply and a wide range of options in a single cabinet, allowing a three cables in/three cables out installation.
Elimination of voltage stresses for a longer lifetime of the motor. Motors can be used without derating and long cable runs between motor and drive are not a problem.	The ACS 1000i sine filter gives an excellent output waveform, eliminating harmonics and common mode voltage and reducing stress on the motor.
Elimination of network harmonics to avoid penalties and system interferences.	The ACS 1000i 24-pulse rectifier meets the most stringent requirements of international standards for current and voltage harmonic distortion.
Highest reliability for minimum downtime.	ABB's revolutionary IGCT power switching device results in lowest parts count, providing a less complex, more efficient and reliable converter.
Fast, accurate and robust process control for constant product quality, minimum raw material waste and minimum machinery wear.	The fast control provided by Direct Torque Control (DTC) allows optimum process control and exact motor performance with minimum torque ripple and lowest energy consumption.
User-friendly drive monitoring and remote diagnostics.	A Windows-based software package provides monitoring and control access to the drive even from remote locations.
Around the clock access to drive specialists and spare parts.	ABB, the largest drives supplier worldwide, has a global support network, which provides assistance and spare parts 24 hours/day, 365 days/year.

ACS 1000i – the most efficient way to drive a load

Electric variable speed drive – a smart investment

There are different methods to control applications driven by electrical motors such as pumps – either by mechanical solutions, like throttling valves or hydraulic couplings, or by electric variable speed drives (VSDs). A VSD is much more efficient than a mechanical solution. It allows a pump to operate at maximum efficiency under a variety of flow conditions.

The diagram (fig.1) illustrates the impact of investment costs and energy losses of different solutions for a 1300 kW (1740 hp) pump application, calculated for three years operation.*

Choosing the right electric variable speed drive

As downtime and low efficiencies can lead to enormous additional costs, ABB has been committed to develop medium voltage drives, which are the most reliable and efficient on the marketplace.

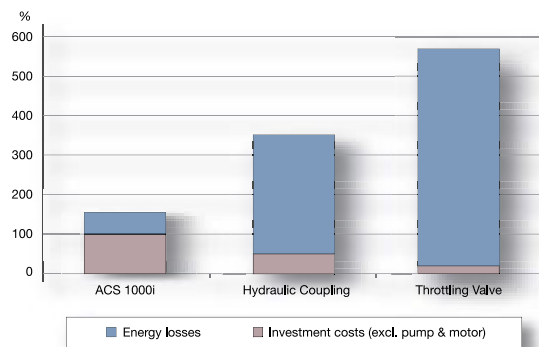
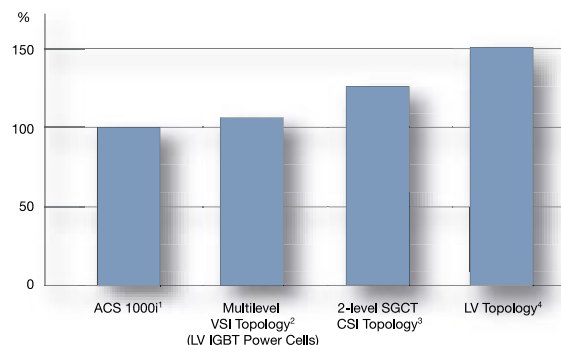


Fig. 1: The ACS 1000i is by far the most economical solution, even though initial investment costs are higher compared to mechanical solutions.

For a comparison of different electric drive solutions it is important that all components, including harmonic filters, transformer, converter, motor and auxiliaries, are considered. Also harmonic losses need to be taken into account. The diagram (fig.2) illustrates the yearly energy losses for a 1300 kW (1740 hp) pump application for various common VSD solutions.*



- ¹ Best efficiency due to 3-level VSI topology, using IGCTs
- ² Less efficient due to increased IGBT losses, high number of semiconductors and complex input transformer
- ³ Less efficient due to CSI topology and complex input section
- ⁴ Lowest investment costs, but increased system losses due to higher current ratings, compared to MV

Fig. 2: Comparison of energy losses for different drive system topologies.

*Based on 8760 h/y operation, an average flow demand of 80 %, 0.05 USD/kWh, 6 % interest rate

Simple system integration

With its integrated transformer, input contactor and on-board auxiliary power supply, the ACS 1000i allows smooth and simple system integration into any industrial environment.

Open control system

ABB offers an open communication strategy, enabling connection to higher-level process controllers. The ACS 1000i can be installed with all major fieldbus adapters for smooth integration, monitoring and controlling of different processes, according to customer requirements.

DriveOPC

DriveOPC is a software package which allows communication between ABB drives and the customer's Windows®-based applications.

Benefits

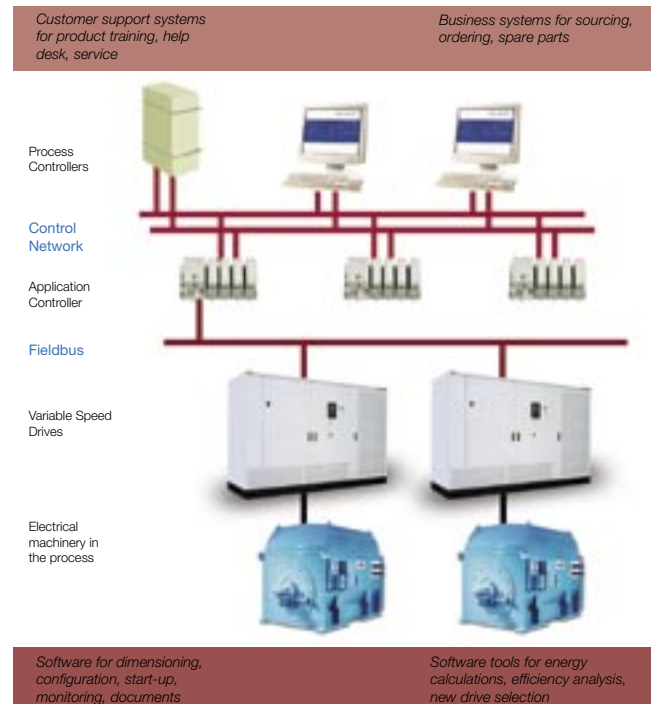
- Controlling and monitoring with Windows®-based process control software
- Standard interface
- Remote connection via LAN (Local Area Network)
- Access to:
 - drive control
 - signals and parameters
 - data and fault loggers

IndustrialIT

ABB's IndustrialIT means increased standardization and seamless interaction of different ABB products. The ACS 1000i is certified to bear the IndustrialIT Enabled symbol, a special mark indicating that the drive can be easily integrated into the IndustrialIT architecture in a 'plug & produce' manner.

Benefits

- Easy integration of the drive into customer's industrial environment
- All drive information readily available in electronic form
- Drive communication with the environment through control panels, standardized fieldbus adapters and interfaces (OPC, OLE for Process Control)
- Easy to use start-up and maintenance tools



Principle of IndustrialIT

Service and support

The ACS 1000i is backed by unrivalled service and support from the customer's initial inquiry throughout the entire lifecycle of the drive system.

Technical advice

As originators of AC drives technology in the late 1960s, ABB has over 30 years of application know-how in all industrial sectors, in virtually every country. ABB's specialists are located around the world to offer advice that ensures trouble-free operation of its drives.

Testing

ABB knows how important reliability is to its customer's success. ABB is committed to ensuring the reliability of every drive it delivers. To this end, every ACS 1000i is tested as a total drive system, including input contactor and input isolation transformer, driving a real motor load before being delivered to the customer.

This ensures a smooth and trouble-free integration into the customer's facility.

Commissioning

With its three cables in/ three cables out principle, on-board macros and user-friendly software tools, commissioning the ACS 1000i is extremely fast, thereby minimizing plant downtime.

DriveWindow

DriveWindow is an advanced, easy-to-use tool for commissioning, maintenance, remote diagnostics and monitoring of ABB drive systems.

Benefits

- Access to all drives connected to the same network
- Graphical presentation of signal values
- Monitoring and editing of drive signals and parameters off-line and on-line
- Back-up of drive parameters – file can be easily re-loaded
- Fault diagnosis with indication of drive status and fault history



ABB has the largest drives service organization worldwide offering:

- Technical advice
- Installation and commissioning
- On-board diagnostics
- Remote diagnostics
- Customized service programs
- Local technical support
- Local service support
- Spare parts and logistics network
- Worldwide service network
- 24 x 365 support line
- Training

Start-up

An enhanced motor identification routine simplifies the start-up procedure by determining all key motor parameters automatically. Simply enter the motor name plate data and the ACS 1000i does the rest.

Training

Extensive training for ABB's medium voltage drives can be provided at the ABB University. A range of training is offered from basic tutorials to programs tailored to the customer's specific needs.

www.abb.com/abbuniversity

ACS 1000i data sheet

Motors

Induction motors; 315 – 2000 kW, 400 – 2700 hp

Standards

All common standards including EN, IEC, CE, UL, cUL

Inverter type

Three-level Voltage Source Inverter (VSI) with fast-switching power semiconductors – Integrated Gate Commutated Thyristors (IGCTs), without parallel or series connected devices

Input

Medium voltage input isolator, followed by a fused contactor, integrated transformer for 24-pulse diode rectifier

Voltage Range: 4.16 – 7.2 kV, 60 Hz / 6.0 – 6.6 kV, 50 Hz, on request up to 11 kV

Variation: ±10% of nominal voltage as normal operating range, down to –25% safe operation with derated output

Auxiliary voltage

400 VAC ±10 %, 50 Hz / 460 VAC ±10%, 60 Hz, 3 phase
Optionally directly derived from mains, i.e. no separate auxiliary supply required

UPS (Uninterruptable Power Supply)

If available, a UPS can be connected for control power supply, 110–240 VAC ±10 %, single phase. Alternatively the drive can be equipped with back-up batteries.

Output voltage

Standard: Sinusoidal, 0–3.3 kV, 0–4.16 kV

Optional: 6.0/6.6 kV with step-up transformer, higher voltages on request

Output frequency

0 to ±66 Hz (±82.5 Hz optional)

Efficiency

Typically >96.5 % (incl. input isolation transformer, sine filter and auxiliaries)

Input power factor

Fundamental: >0.97 (Total: >0.96)

Overload capacity

Standard: Normal use, 10 % short term overload capacity allowed for one minute every 10 minutes

Optional: For higher overload capacity contact ABB

Ambient temperature

+1°C to 40°C (higher with derating)

34°F to 104°F (higher with derating)

Enclosure classes

IP21, IP42

Bus interface

All common fieldbuses including Profibus, Modbus, Interbus S, DeviceNet, LonWorks, Ethernet, ControlNet, CAN Open, ABB CS31, ABB AF100

IndustrialIT

Compatible (Level 1)

External I/O

Digital I/O: 11 (+18)* digital inputs, 6 (+8)* digital outputs

Analog I/O: 7 (+8)* analog inputs, 4 (+4)* analog outputs

*additional optional I/O shown in brackets

Protective functions

Overcurrent, short circuit, earth fault, input phase loss, output phase loss, overvoltage, undervoltage, over-temperature, motor overload, motor underload, motor stall protection, and others

Optional

- Redundant cooling fan for enhanced reliability
- Manual back-up bypass
- Start-up bypass for synchronous transfer of up to 4 motors to the line

Motor voltage (kV)	Cooling	ACS 1000i type for 50 Hz supply	Maximum continuous power (kVA)	Motor power** (kW) (hp)	Rated output current** (A)	Dimensions and weights*			
						Length (mm) (in)	Depth (mm) (in)	Height*** (mm) (in)	Weight (kg) (lbs)
3.3	Air	ACS1043-A2-J0-00	950	800 1000	166	3300 130"	1100 43"	2700 106"	5100 11200
		ACS1043-A2-K0-00	1100	900 1250	192	3300 130"	1100 43"	2700 106"	5100 11200
		ACS1043-A2-L0-00	1200	1000 1350	210	3300 130"	1100 43"	2700 106"	5100 11200
		ACS1043-A3-M0-00	1350	1120 1500	236	3300 130"	1100 43"	2700 106"	5700 12600
		ACS1043-A3-N0-00	1500	1250 1650	262	3300 130"	1100 43"	2700 106"	5700 12600
		ACS1043-A3-P0-00	1700	1400 1750	297	3300 130"	1100 43"	2700 106"	5700 12600
		ACS1043-A3-Q0-00	1850	1500 2000	318	3300 130"	1100 43"	2700 106"	5800 12800

Notes: * Dimensions and weights are approximate, based on 6.0–6.6kV/50Hz line supply voltage. Higher input voltage rating leads to a higher weight.

** Based on typical 4-pole motor data, under nominal supply voltage conditions

*** Dimensions incl. top mounted cooling fans, IP21 (minimum 500mm top clearance for outgoing air flow recommended)

Motor voltage (kV)	Cooling	ACS 1000i type for 60 Hz supply	Maximum continuous power (kVA)	Motor power** (kW) (hp)	Rated output current** (A)	Dimensions and weights*			
						Length (mm) (in)	Depth (mm) (in)	Height*** (mm) (in)	Weight (kg) (lbs)
4.0 / 4.16	Air	ACS1044-A1-A0-00	400	- 400	58	3300 130"	1100 43"	2700 106"	4200 9300
		ACS1044-A1-B0-00	400	315 450	58	3300 130"	1100 43"	2700 106"	4200 9300
		ACS1044-A1-C0-00	450	355 500	65	3300 130"	1100 43"	2700 106"	4200 9300
		ACS1044-A1-D0-00	550	450 600	79	3300 130"	1100 43"	2700 106"	4200 9300
		ACS1044-A1-E0-00	650	500 700	94	3300 130"	1100 43"	2700 106"	4300 9500
		ACS1044-A1-F0-00	750	560 800	108	3300 130"	1100 43"	2700 106"	4300 9500
		ACS1044-A1-G0-00	800	630 900	115	3300 130"	1100 43"	2700 106"	4300 9500
		ACS1044-A1-H0-00	900	710 1000	130	3300 130"	1100 43"	2700 106"	4300 9500
		ACS1044-A2-J0-00	1150	900 1250	166	3300 130"	1100 43"	2700 106"	4900 10800
		ACS1044-A2-K0-00	1350	1120 1500	195	3300 130"	1100 43"	2700 106"	4900 10800
		ACS1044-A3-L0-00	1550	1250 1750	224	3300 130"	1100 43"	2700 106"	5500 12100
		ACS1044-A3-M0-00	1800	1400 2000	260	3300 130"	1100 43"	2700 106"	5500 12100
		ACS1044-A3-N0-00	2000	1600 2250	289	3300 130"	1100 43"	2700 106"	5600 12300
		ACS1044-A3-P0-00	2400	2000 2700	347	3300 130"	1100 43"	2700 106"	5600 12300

Notes: * Dimensions and weights are approximate, based on 4.16–7.2kV/60Hz line supply voltage. Higher input voltage rating leads to a higher weight.

** Based on typical 4-pole motor data, under nominal supply voltage conditions

*** Dimensions incl. top mounted cooling fans, IP21 (minimum 500mm top clearance for outgoing air flow recommended)

Motor voltage (kV)	Cooling	ACS 1000i type for 50 Hz supply	Maximum continuous power (kVA)	Motor power** (kW) (hp)	Rated output current** (A)	Dimensions and weights*			
						Length (mm) (in)	Depth (mm) (in)	Height*** (mm) (in)	Weight (kg) (lbs)
6.0/ 6.6	Air	ACS1046-A2-J0-00	950	800 1000	83	5300 209"	1100 43"	2700 106"	7200 15900
		ACS1046-A2-K0-00	1100	900 1250	96	5300 209"	1100 43"	2700 106"	7200 15900
		ACS1046-A2-L0-00	1200	1000 1350	105	5300 209"	1100 43"	2700 106"	7200 15900
		ACS1046-A3-M0-00	1350	1120 1500	118	5300 209"	1100 43"	2700 106"	8400 18500
		ACS1046-A3-N0-00	1500	1250 1650	131	5500 217"	1400 55"	2700 106"	8400 18500
		ACS1046-A3-P0-00	1700	1400 1750	149	5500 217"	1400 55"	2700 106"	8400 18500
		ACS1046-A3-Q0-00	1850	1500 2000	160	5500 217"	1400 55"	2700 106"	8500 18700

Notes: * Dimensions and weights are approximate, based on 6.0–6.6kV/50Hz line supply voltage. Higher input voltage rating leads to a higher weight.

** Based on typical 4-pole motor data, under nominal supply voltage conditions

*** Dimensions incl. top mounted cooling fans, IP21 (minimum 500mm top clearance for outgoing air flow recommended)

The ACS 1000i is a member of the ACS 1000 product family, which is available for motor powers up to 5 MW (6700 hp), with air or water cooling and with separate input transformer, input contactor and auxiliary power supply. For more information, please refer to brochure no. 3BHT 490 400 R0001.



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