Product brochure

Medium voltage AC drive
ACS 2000, 4kV – 6.9kV
300-2000 HP

Power and productivity
for a better world™

ACS 2000 – simple and reliable motor control

The ACS 2000 medium voltage AC drive provides reliable motor control for a wide range of applications.

The ACS 2000 is designed for high reliability, easy installation and fast commissioning, reducing the total cost of ownership.

With the integration of an Active Front End (AFE) combined with multilevel control, the ACS 2000 is an Ultra Low Harmonic (ULH) design that minimizes line side harmonics. This technology eliminates expensive, specialized transformers, while offering the added benefit of a smaller overall package.

With its compact packaging, the ACS 2000 can be retrofitted to control standard induction motors via a direct connection to the line supply (direct-to-line). Alternatively, a simple two-winding input isolation transformer can be applied to allow for connection to various line side supply voltages.

The ACS 2000 direct-to-line configuration combines the cost savings of a transformerless variable speed drive system with the benefits of Voltage Source Inverters (VSIs), including excellent availability and reliability, high and constant power factor and superior dynamic control performance.

The heritage of ABB's VSI topology, along with a patented HV-IGBT-based multi-level control, provides a proven track record for reliable and motor friendly medium voltage AC drive performance.

Key product features

- Suitable for use with or without an input isolation transformer
- Meets IEEE 519 and IEC 61000-2-4
- Direct-to-line configuration (transformerless) allows 3 in and 3 out power cabling for quick and easy installation
- Multi-level switching topology and built-in dv/dt filtering enables use with new or existing induction motors
- Regenerative option and ability to maintain near unity power factor across the entire speed range provides additional energy savings
- Modular construction provides high reliability and low maintenance costs

Fields of application

Industries	Applications
Water	Pumps, blowers
HVAC	Chillers, pumps, fans
Power generation	Fans, pumps, conveyors and coal mills
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, refiners, vacuum pumps and chippers
Other applications	Test stands

Key features

The ACS 2000 general purpose drive offers unique features which provide superior application flexibility with a standard solution.

Line supply connection flexibility

Depending on the user preference or the existing installation, the ACS 2000 is available for connection to an external input isolation transformer or for use without a transformer, the latter allowing a direct connection to the industrial line supply (direct-to-line).

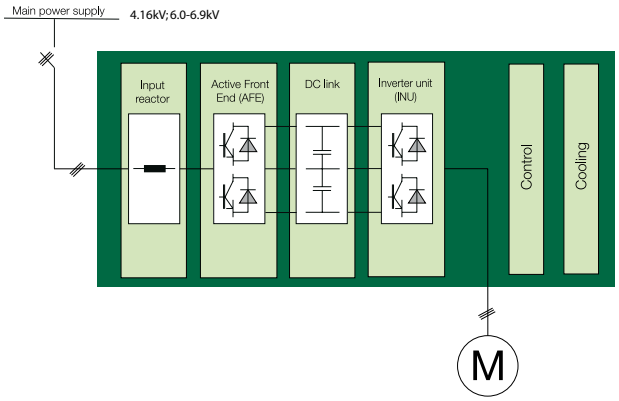
Direct-to-line connection

The ACS 2000 direct-to-line configuration can lower investment costs substantially. Due to its compact size and lighter weight compared to a drive requiring a transformer, it also results in lower transportation costs and requires less space in the electrical room.

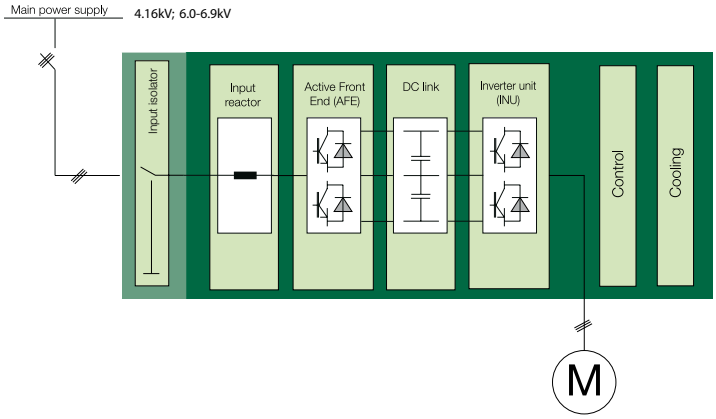
The ACS 2000 can be easily retrofitted to existing motors while the direct-to-line technology results in quick and easy installation and commissioning.

Configurable disconnect

ABB can also offer a configurable disconnect option package for a flexible, self contained switchgear solution where no control coordination is required upstream. It provides a visible blade switch disconnect and integral input contactor with options such as as motor protection relay, control power transformer and other customer controls.



Topology of the ACS 2000 with direct-to-line connection



Topology of the ACS 2000 with direct-to-line connection with configurable disconnect

Active Front End for network friendly and energy efficient operation

The ACS 2000 is equipped with an Active Front End (AFE) which can be used in conjunction with a simple input isolation transformer or for direct connection to the line supply. It provides low harmonics and enables optional regenerative capability for increased energy savings.

Ultra Low Harmonic Design

The AFE provides an ultra low harmonic (ULH) footprint which meets the most stringent requirements for harmonic distortion as defined by IEEE 519 and IEC 61000-2-4. This avoids the need for harmonic analysis or the installation of additional harmonic filters.

Reduced energy consumption

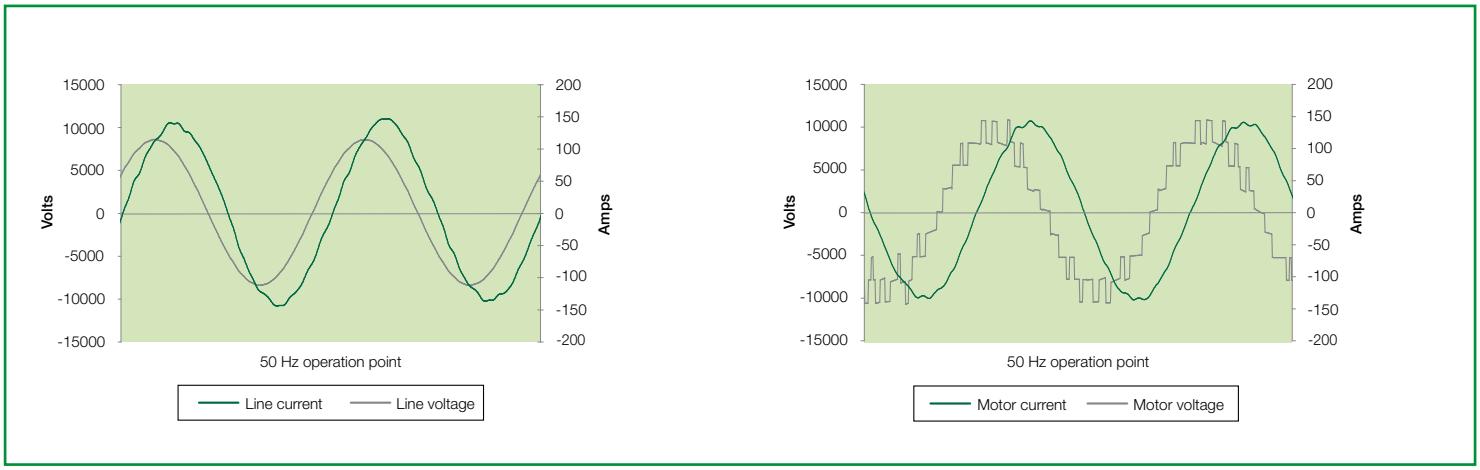
For applications with high braking energy, the ACS 2000 is available with optional Regeneration capability, which feeds back braking energy to the line supply and reduces overall energy consumption.

Powerful performance with DTC

Precise and reliable process control, together with low energy consumption, results in high performance. The ACS 2000 control platform uses ABB's award-winning Direct Torque Control (DTC), resulting in the highest torque and speed performance as well as the lowest losses ever achieved in medium voltage AC drives. Control of the drive is immediate and smooth under all conditions.

Motor friendly output waveform for use with new or existing motors

The ACS 2000 provides near sinusoidal current and voltage waveform making it compatible for use with existing motors. This is achieved with ABB's patented multilevel topology which utilizes one DC link enabling a multi-level output waveform with a minimum number of power components.



Line and motor current and voltage at 6kV operation

ACS 2000

The air-cooled general purpose drive provides simple and reliable motor control for a wide range of applications.

ACS 2000, 1000 hp, 4 kV
Frame 1

Electromechanically interlocked doors for safety

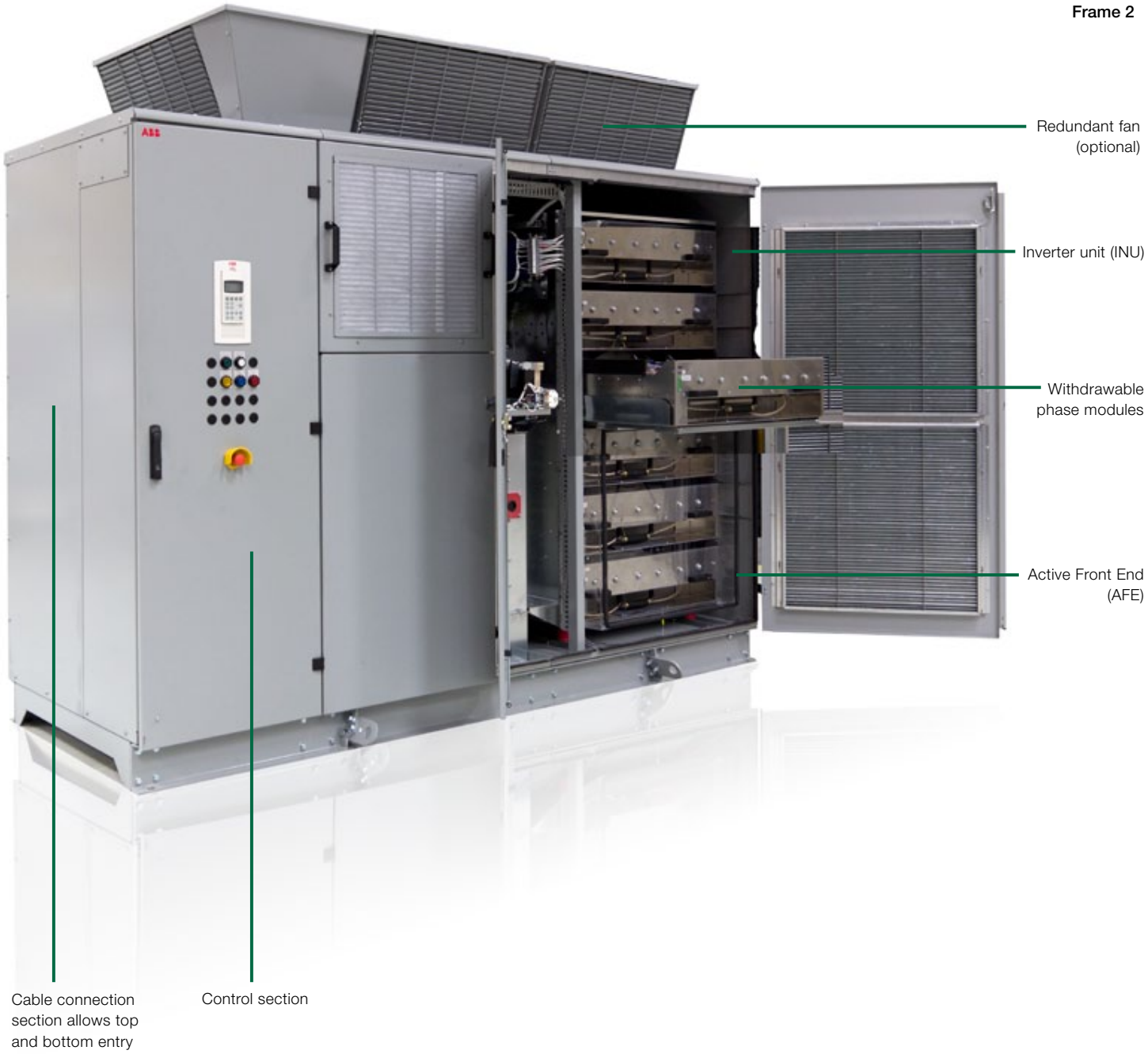
DC bus grounding switch for safety

Input reactor with common mode filter for direct-to-line connection

User-friendly drive control panel for local operation
- Keypad with multi-language display
- Main supply on/off pushbuttons
- Emergency off pushbutton

Designed for easy installation, fast commissioning and efficient maintenance reducing the total cost of ownership.

ACS 2000, 2000 hp, 4 kV
Frame 2



Features and benefits

Features	Advantages	Benefits
Operation without transformer (direct-to-line)		
	No transformer required	Reduces capital expenditure, light weight, compact
	Easy retrofit to existing motors	Minimizes investment
	Easy and fast commissioning	Reduces overall cost of project
	Compact and light drive system	Lowers transportation costs; less space required in electrical room
Active Front End (AFE)		
	Ultra low harmonic (ULH) footprint	Harmonic emissions compliant with all relevant standards
	Allows operation with an input isolation transformer or for direct connection to the line supply	Flexibility of installation
Energy savings		
	Maintains near unity power factor across the entire speed range	Reduces energy loss in distribution system, avoiding utility penalties and the need for larger cables
	Regenerative braking option	Minimizes energy consumption
Multilevel topology		
	Patented multilevel topology	Low parts count boosts drive availability
	Provides near sinusoidal current and voltage waveforms	Compatible with new or existing motors
Voltage Source Inverter (VSI) topology		
	Excellent availability, reliability and efficiency	Higher uptime of plant or process
	High and constant power factor	Eliminates utility penalties
	Superior dynamic control performance	Safe ride through during supply voltage dips and better process control
Direct Torque Control (DTC)		
	Precise and reliable process control with superior performance	Higher productivity
Compact size		
	Requires less space in electrical room	Frees up valuable floorspace

Simple drive system integration

Installing a medium voltage AC drive could not be easier with ABB's ACS 2000 ultra low harmonic drive.

Along with its flexible line supply connection options and advanced software tools the ACS 2000 allows smooth and simple drive system integration into any industrial environment.

Flexible control interface

ABB offers an open communication strategy, enabling connection to higher-level process controllers. The ACS 2000 can be installed with all major fieldbus adapters for smooth integration, monitoring and controlling of different processes, according to customer requirements.

Commissioning wizard

The commissioning wizard is an advanced tool which simplifies and speeds-up commissioning, considerably reducing plant downtime.

DriveWindow

ABB's DriveWindow is an advanced, yet easy-to-use PC software tool for the start-up and maintenance of ABB industrial drives. Its host of features and clear, graphical presentation of the operation make it a valuable addition to your system, providing information necessary for troubleshooting, maintenance and service, as well as training.

With DriveWindow the user is able to follow the operation of several drives simultaneously by collecting the actual values from the drives onto a single screen or printout.

Additionally, the client part of DriveWindow may reside on one intranet PC, and the server on another PC closer to the drives. This enables easy plant-wide monitoring with two PCs.

Maintenance

Simple and efficient maintenance is an important factor in keeping operating costs down.

The ACS 2000 is designed to maximize uptime as well as to facilitate quick repair. The modular design lends itself to quick and effective replacement of components, resulting in industry leading Mean Time to Repair (MTTR).

Reliable components

ABB drive technologies, such as the multilevel VSI topology, provide a low parts count, which increases reliability, extends Mean Time Between Failures (MTBF) and improves availability.

Easy access

The ACS 2000 has been designed to allow easy front access to all drive components.

Redundant cooling

The ACS 2000 is available with a redundant fan option which increases availability.

Data sheet ACS 2000
4kV direct-to-line configuration

Motor data			Drive	Drive data			
Voltage *	Shaft power **		Type code ***	Power	Current ****	Length	Approx. weight
kV	hp	kW		kVA	A	in (mm)	lbs (kg)
			4,160 V Input				
4.0	300	224	ACS 2040-1x-AN1-a-0C	280	40	76" (1940)	5500 (2495)
4.0	350	261	ACS 2040-1x-AN1-a-0D	326	47	76" (1940)	5500 (2495)
4.0	400	298	ACS 2040-1x-AN1-a-0E	373	54	76" (1940)	5500 (2495)
4.0	450	336	ACS 2040-1x-AN1-a-0F	420	61	76" (1940)	5500 (2495)
4.0	500	373	ACS 2040-1x-AN1-a-0H	466	67	76" (1940)	5500 (2495)
4.0	600	447	ACS 2040-1x-AN1-a-0L	560	81	76" (1940)	5500 (2495)
4.0	700	522	ACS 2040-1x-AN1-a-0Q	653	94	76" (1940)	5500 (2495)
4.0	800	597	ACS 2040-1x-AN1-a-0R	746	108	76" (1940)	5500 (2495)
4.0	900	671	ACS 2040-1x-AN1-a-0T	839	121	76" (1940)	5500 (2495)
4.0	1000	746	ACS 2040-1x-AN1-a-0V	933	135	76" (1940)	5500 (2495)
4.0	1250	933	ACS 2040-2x-AN1-a-0Z	1166	168	115" (2915)	6200 (2810)
4.0	1500	1119	ACS 2040-2x-AN1-a-1C	1399	202	115" (2915)	6200 (2810)
4.0	1750	1306	ACS 2040-2x-AN1-a-1F	1632	236	115" (2915)	6200 (2810)
4.0	2000	1492	ACS 2040-2x-AN1-a-1H	1865	269	115" (2915)	6200 (2810)

Notes

* 4 kV according to ANSI/NEMA, UL, IEC

** Typical 4-pole motor, under nominal supply voltage conditions.

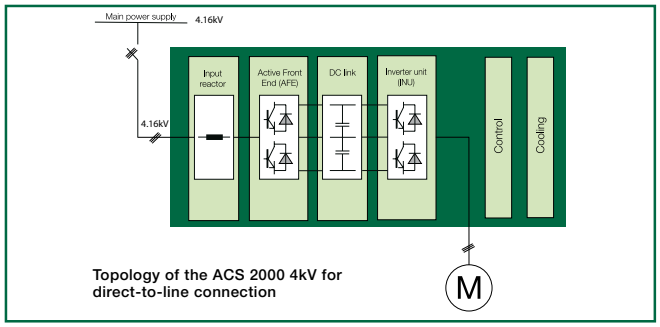
*** 'x' indicates the different converter types
L=ULH non-regenerative
T= ULH regenerative

**** Continuous current rating allowing 110% overload for 1 minute, every 10 minutes

Dimensions

Depth: 46" (1185mm)

Height:
Frame 1 = 83" (2110mm) cabinet height
90" (2285mm) with cooling fan
99" (2515mm) with redundant cooling fans
Frame 2 = 83" (2110mm) cabinet height
98" (2490mm) with cooling/redundant fan



Topology of the ACS 2000 4kV for direct-to-line connection

Data sheet ACS 2000
6kV direct-to-line configuration

Motor data			Drive	Drive data			
Voltage *	Shaft power **		Type code ***	Power	Current ****	Length	Approx. weight
kV	kW	hp		kVA	A	in (mm)	lbs (kg)
			6,000 V				
6.0	250	335	ACS 2060-1x-AN1-a-0D	344	30	87” (2,200)	4400 (2000)
6.0	315	423	ACS 2060-1x-AN1-a-0E	434	38	87” (2,200)	4400 (2000)
6.0	355	475	ACS 2060-1x-AN1-a-0G	488	43	87” (2,200)	4400 (2000)
6.0	400	536	ACS 2060-1x-AN1-a-0J	550	48	87” (2,200)	4400 (2000)
6.0	450	603	ACS 2060-1x-AN1-a-0L	619	54	87” (2,200)	4400 (2000)
6.0	500	670	ACS 2060-1x-AN1-a-0N	688	60	87” (2,200)	4400 (2000)
6.0	560	751	ACS 2060-1x-AN1-a-0Q	770	67	87” (2,200)	4400 (2000)
6.0	630	845	ACS 2060-1x-AN1-a-0S	866	76	87” (2,200)	4400 (2000)
6.0	710	952	ACS 2060-1x-AN1-a-0U	976	85	87” (2,200)	4400 (2000)
6.0	730	978	ACS 2060-1x-AN1-a-0V	1000	87	87” (2,200)	4400 (2000)
6.0	800	1072	ACS 2060-2x-AN1-a-0W	1100	96	150” (3,800)	9460 (4300)
6.0	900	1206	ACS 2060-2x-AN1-a-0Y	1238	108	150” (3,800)	9460 (4300)
6.0	1000	1340	ACS 2060-2x-AN1-a-1A	1375	120	150” (3,800)	9460 (4300)
6.0	1120	1501	ACS 2060-2x-AN1-a-1C	1540	135	150” (3,800)	9460 (4300)
6.0	1260	1689	ACS 2060-2x-AN1-a-1E	1733	152	150” (3,800)	9460 (4300)
6.0	1420	1903	ACS 2060-2x-AN1-a-1G	1953	171	150” (3,800)	9460 (4300)

Notes

* 6.0 according to IEC

** Typical 4-pole motor, under nominal supply voltage conditions.

*** ‘x’ indicates the different converter types

L=ULH non-regenerative

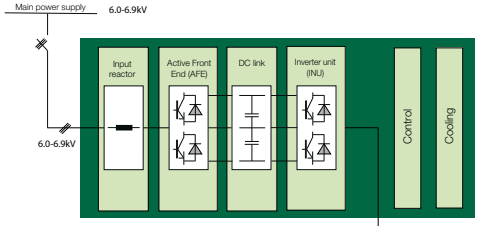
T= ULH regenerative

**** Continuous current rating allowing 110% overload for 1 minute, every 10 minutes

Dimensions

Height: 83” (2100mm) cabinet height
98” (2490mm) with cooling fan
106” (2700mm) with redundant cooling fans

Depth: 45” (1140mm)



Topology of the ACS 2000 6kV for direct-to-line connection

Data sheet ACS 2000
6.6kV direct-to-line configuration

Motor data			Drive	Drive data			
Voltage *	Shaft power **		Type code ***	Power	Current ****	Length	Approx. weight
kV	kW	hp		kVA	A	in (mm)	lbs (kg)
			6,600 V				
6.6	250	335	ACS 2066-1x-AN1-a-0D	344	27	87” (2,200)	4400 (2000)
6.6	315	423	ACS 2066-1x-AN1-a-0E	434	34	87” (2,200)	4400 (2000)
6.6	355	475	ACS 2066-1x-AN1-a-0G	488	39	87” (2,200)	4400 (2000)
6.6	400	536	ACS 2066-1x-AN1-a-0J	550	44	87” (2,200)	4400 (2000)
6.6	450	603	ACS 2066-1x-AN1-a-0L	619	49	87” (2,200)	4400 (2000)
6.6	500	670	ACS 2066-1x-AN1-a-0N	688	55	87” (2,200)	4400 (2000)
6.6	560	751	ACS 2066-1x-AN1-a-0Q	770	61	87” (2,200)	4400 (2000)
6.6	630	845	ACS 2066-1x-AN1-a-0S	866	69	87” (2,200)	4400 (2000)
6.6	710	952	ACS 2066-1x-AN1-a-0U	976	78	87” (2,200)	4400 (2000)
6.6	800	1072	ACS 2066-1x-AN1-a-0W	1100	87	87” (2,200)	4400 (2000)
6.6	900	1206	ACS 2066-2x-AN1-a-0Y	1238	98	150” (3,800)	9460 (4300)
6.6	1000	1340	ACS 2066-2x-AN1-a-1A	1375	109	150” (3,800)	9460 (4300)
6.6	1120	1501	ACS 2066-2x-AN1-a-1C	1540	122	150” (3,800)	9460 (4300)
6.6	1260	1689	ACS 2066-2x-AN1-a-1E	1733	138	150” (3,800)	9460 (4300)
6.6	1420	1903	ACS 2066-2x-AN1-a-1G	1953	155	150” (3,800)	9460 (4300)
6.6	1500	2011	ACS 2066-2x-AN1-a-1H	2063	164	150” (3,800)	9460 (4300)

Notes

* 6.6 kV according to IEC

** Typical 4-pole motor, under nominal supply voltage conditions.

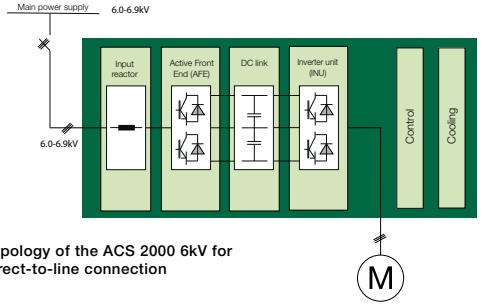
*** ‘x‘ indicates the different converter types
L=ULH non-regenerative
T= ULH regenerative

**** Continuous current rating allowing 110% overload for 1 minute, every 10 minutes

Dimensions

Height: 83” (2100mm) cabinet height
98” (2490mm) with cooling fan
106” (2700mm) with redundant cooling fans

Depth: 45” (1140mm)



Topology of the ACS 2000 6kV for direct-to-line connection

Data sheet ACS 2000
6.9kV direct-to-line configuration

Motor data			Drive	Drive data			
Voltage *	Shaft power **		Type code ***	Power	Current ****	Length	Approx. weight
kV	kW	hp		kVA	A	in (mm)	lbs (kg)
			6,900 V				
6.9	250	335	ACS 2069-1x-AN1-a-0D	344	27	87" (2,200)	4400 (2000)
6.9	315	423	ACS 2069-1x-AN1-a-0E	434	34	87" (2,200)	4400 (2000)
6.9	355	475	ACS 2069-1x-AN1-a-0G	488	39	87" (2,200)	4400 (2000)
6.9	400	536	ACS 2069-1x-AN1-a-0J	550	44	87" (2,200)	4400 (2000)
6.9	450	603	ACS 2069-1x-AN1-a-0L	619	49	87" (2,200)	4400 (2000)
6.9	500	670	ACS 2069-1x-AN1-a-0N	688	55	87" (2,200)	4400 (2000)
6.9	560	751	ACS 2069-1x-AN1-a-0Q	770	61	87" (2,200)	4400 (2000)
6.9	630	845	ACS 2069-1x-AN1-a-0S	866	69	87" (2,200)	4400 (2000)
6.9	710	952	ACS 2069-1x-AN1-a-0U	976	78	87" (2,200)	4400 (2000)
6.9	800	1072	ACS 2069-1x-AN1-a-0W	1100	87	87" (2,200)	4400 (2000)
6.9	900	1206	ACS 2069-2x-AN1-a-0Y	1238	98	150" (3,800)	9460 (4300)
6.9	1000	1340	ACS 2069-2x-AN1-a-1A	1375	109	150" (3,800)	9460 (4300)
6.9	1120	1501	ACS 2069-2x-AN1-a-1C	1540	122	150" (3,800)	9460 (4300)
6.9	1260	1689	ACS 2069-2x-AN1-a-1E	1733	138	150" (3,800)	9460 (4300)
6.9	1420	1903	ACS 2069-2x-AN1-a-1G	1953	155	150" (3,800)	9460 (4300)
6.9	1500	2011	ACS 2069-2x-AN1-a-1H	2063	164	150" (3,800)	9460 (4300)

Notes

* 6.9 kV according to ANSI/NEMA

** Typical 4-pole motor, under nominal supply voltage conditions.

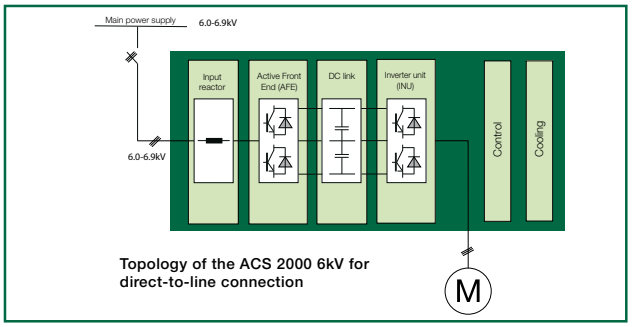
*** 'x' indicates the different converter types
L=ULH non-regenerative
T= ULH regenerative

**** Continuous current rating allowing 110% overload for 1 minute, every 10 minutes

Dimensions

Height: 83" (2100mm) cabinet height
98" (2490mm) with cooling fan
106" (2700mm) with redundant cooling fans

Depth: 45" (1140mm)



Topology of the ACS 2000 6kV for direct-to-line connection

Data sheet ACS 2000

Input
5-level self-commutated IGBT Active Front End (AFE) for operation with two-winding input isolation transformer or direct-to-line (DTL), i.e. without transformer

Rated input voltages
4160 / 6000 / 6600 V, +10% to -10% (-30% with derating)
6900 V, +5% to -15% (-35% with derating)

Input frequency
50 / 60 Hz

Input power factor
Controlled to 1.

Inverter type
Voltage Source Inverter (VSI), 9 levels line-to-line, with high voltage IGBT (Insulated Gate Bipolar Transistor) power semiconductors

Output frequency
0 to 75 Hz

Rated output voltage
4.0; 6.0 to 6.9 kV

Efficiency of drive
Typically 97.5%

Ambient temperature
34 °F to 104 °F , 1 °C to 40 °C (higher with derating)

Enclosure classes
NEMA 1 gasketed (IP21)

Motors
Induction motors

Standards and certifications
EN, IEC, CE
cUL, NEMA, IEEE (4kV)

Standard protection functions
Auxiliary voltage fault, over temperature supervision, overcurrent, short circuit detection, motor overload, motor stall and overspeed protection, communication fault (I/O watchdog), ground fault, main circuit breaker supervision/tripping, emergency off signal supervision, DC bus ground switch

Standard control functions
- Hardwired signals for remote drive control
  - References: start/stop, speed/torque etc.
  - Status feedback signals: ready/running
  - Analog signals: current/voltage/power etc.

Example options
- Motor supervision I/O
  - Fault/alarm: overtemperature, vibration of bearings
  - PT 100: winding and bearing temperatures
- Transformer supervision I/O
  - Fault/alarm: overtemperature, Buchholz
  - PT 100: winding temperatures
- Redundant cooling fans with automatic switch over for duty cycling or in the event of fan failure
- ABB DriveWindow service and diagnostic software
- ABB DriveMonitor™ for remote monitoring and diagnostics
- Configurable disconnect package

Auxiliary supply voltage
Common 400, 480 or 600 VAC, 3-phase, 50 Hz/60 Hz

Control interface (optional)
All common fieldbus including Profibus, Modbus, DeviceNet, Ethernet, others

Service and support

The ACS 2000 is backed by comprehensive service and support from initial inquiry throughout the entire life cycle of the drive system.

Installation and commissioning

Proper installation and commissioning of the equipment, done by qualified and certified commissioning engineers, reduces start-up time, increases safety and reliability and decreases life cycle costs. In addition, operators can be given practical training by experienced specialists on site.

With its three in - three out principle, flexible line supply connection options and advanced software tools, such as the commissioning wizard, start-up of the ACS 2000 is easy and fast, thereby minimizing plant downtime.

Life cycle management

ABB's drive life cycle management model maximizes the value of the equipment and maintenance investment by maintaining high availability, eliminating unplanned repair costs and extending the lifetime of the drive.

Life cycle management includes:

- providing spare parts and expertise throughout the life cycle
- providing efficient product support and maintenance for improved reliability
- providing functionality upgrades to the initial product

Training

ABB provides extensive training for its medium voltage AC drives. A range of training programs is offered from basic tutorials to programs tailored to the customer's specific needs.

Global network, local presence

After-sales service is an integral part of providing the customer with a reliable and efficient drive system. The ABB Group of companies operates in more than 100 countries and has a worldwide network of service operations.

Services for ABB's medium voltage AC drives

- 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

Contact us

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Power and productivity
for a better world™