ACS5000 drives

The power you require. The reliability you expect.

3BHT490521 E01 REVD
ACS5000 drives

ACS5000 medium voltage drives are tailored to meet the needs of demanding applications that require high power, reliability and safety. In addition to an advanced control technology, an ACS5000 has easy-to-use interfaces for simplified operation as well as ABB Ability™ remote condition monitoring, which ensures that the drive is accessible and maintainable anywhere in the world.

The ACS5000 is a reliable solution for controlling induction, synchronous and permanent magnet motors and for driving your high power applications, such as compressors, pumps and fans. Industry-specific functions and unique features ensure reliable control of your processes and systems.
ACS5000 drives
Based on long-term experience and in-depth knowledge

> 45 years experience

1969 AC drive development started
1979 Megastar 3-level PWM MV drive with vector control
1993 Self-healing capacitors
1995 Direct Torque Control (DTC)
1997 ACS1000 first IGCT-based MV drive
1999 ACS6000 first MV multidrive with PEBB technology
2005 ACS5000 first MV drive with VSI-MF topology
2009 ACS2000 MV drive for direct-to-line connection
2012 ACS5000 second generation Power extension
2014 ACS580MV introduction in China
2017 ACS6080 all-compatible MV multidrive

©ABB
**ACS5000 drives**
Complementing our broad portfolio of drive solutions

<table>
<thead>
<tr>
<th>ACS580MV</th>
<th>ACS5000 / MEGADRIVE-LCI</th>
<th>ACS1000 / ACS2000</th>
<th>ACS6080 / PCS6000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Applications:</strong></td>
<td></td>
<td><strong>Applications:</strong></td>
<td><strong>Applications:</strong></td>
</tr>
<tr>
<td>• pumps, fans</td>
<td>• Large compressors, pumps, fans, GT starters,</td>
<td>• Pumps, fans, mills, conveyors, extruders, mixers, hoists,..</td>
<td>• Mills, conveyors, propulsion, wind mills, hoists,..</td>
</tr>
<tr>
<td><strong>Segments:</strong></td>
<td></td>
<td><strong>Segments:</strong></td>
<td><strong>Segments:</strong></td>
</tr>
<tr>
<td>• Infrastructure, water, HVAC</td>
<td>• Oil &amp; gas</td>
<td>• Mining, Cement</td>
<td>• Metals, mining, marine</td>
</tr>
<tr>
<td>• Auxiliary applications in heavy industry, metals, cement, power generation,..</td>
<td>• Power generation</td>
<td>• Oil&amp;gas, petrochem</td>
<td>• Test stands, special applications</td>
</tr>
<tr>
<td><strong>Focus:</strong></td>
<td></td>
<td>• Water</td>
<td>• Renewable power gen.</td>
</tr>
<tr>
<td>• Non-specification driven</td>
<td>• Test stands, wind tunnels</td>
<td>• Marine, offshore</td>
<td><strong>Focus:</strong></td>
</tr>
<tr>
<td>• Non-critical applications (can run without drive in bypass mode)</td>
<td></td>
<td>• Power generation, water</td>
<td>• Flexible to configure for specific needs</td>
</tr>
<tr>
<td>• Capex – energy savings made affordable</td>
<td></td>
<td></td>
<td>• High performance</td>
</tr>
</tbody>
</table>

Energy efficiency – emission reduction

Process Control

Focus:
• High power
• High reliability and availability
• Highest level of personal safety

Focus:
• Flexible to configure for the specific needs
• High reliability and availability
• Highest level of personal safety

Focus:
• Flexible to configure for specific needs
• High performance
• High reliability and availability
• Highest level of personal safety
## ACS5000 air-cooled drives

### At a glance

### Highlights

- Voltage source inverter, multilevel-fuseless (VSI-MF)
- Voltage range: $6 - 6.9 \text{kV}^1$
- Power range: $1.5 - 7 \text{ MW}$
- 36-pulse rectifier
- Based on ABB’s well proven IGCT $^2$ semiconductor platform

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$^1$ Lower output voltages with power derating. Higher output voltage can be supported by using a step-up transformer
$^2$ IGCT: Integrated gate-commutated thyristor
ACS5000 water-cooled drives

At a glance

**Highlights**

- Voltage source inverter, multilevel-fuseless (VSI-MF)

- Voltage range: 6 – 6.9 kV (13.8 kV) \(^1\)

- Power range: 5 – 36 MW (70 MW) \(^2\)

- 18- or 36-pulse rectifier

- Based on ABB’s well proven IGCT \(^3\) semiconductor platform

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\(^1\) Output voltage up to 13.8 kV available on demand for power > 20MW
\(^2\) Higher power available on demand by paralleling two drives
\(^3\) IGCT: Integrated gate-commutated thyristor
ACS5000 drives

At a glance

Highlights

- Non-aging, high voltage, thyristor-based semiconductors (IGCT) for the highest level of safety, reliability and efficiency

- Control of synchronous and induction motors

- Air-cooled available with external or integrated, water-cooled with external or combined transformer

- Advanced control method with the ability to ride-through main supply voltage interruptions

1 IGCT: Integrated gate-commutated thyristor
Picture shows frame size 2 for 1500 A
ACS5000 drives

Technical overview

- Output filter for limitation of motor stress - retrofit of DOL motors possible
- 36-pulse rectifier meeting the most stringent requirements for current and voltage harmonic distortion as defined by IEEE, IEC and EN
ACS5000 drives
Product overview (air-cooled with external transformer)

Terminal and control compartment
Contains the power terminals for the transformer as well as the motor connection and the control swing frame

Rectifier-inverter compartment
Contains the diode rectifier and the inverter (three power cells)

DC-link capacitor compartment
ACS5000 drives
Product overview (air-cooled with integrated transformer)

Transformer compartment
Contains the integrated input transformer, including transformer protection

Terminal and control compartment
Contains the power terminals for the transformer, motor connection and the control swing frame

Rectifier-inverter compartment
Contains the diode rectifier and the inverter (three power cells)

DC-link capacitor compartment
ACS5000 drives
Product overview (water-cooled)

- **Terminal and Control Unit**: Contains the power terminals for the motor connection and the control swing frame.

- **Water Cooling Unit**: Supplies deionized water for cooling the main power components.

- **3x Phase Converter Unit (PCU)**: Contains the diode rectifier, the dc-link capacitors, the inverter phase module and the transformer cable connection.
ACS5000 drives

Reliable and safe operation of high-power applications

Modularity and flexibility

– Built to order - every drive is customized to fit your needs
– Choose from a broad range of configurations with flexible transformer and cooling arrangement

Performance and usability

– Smooth integration and easier operation throughout your entire installation
– Advanced process control
– Large variety of available fieldbus interfaces

Highest level of safety

– Arc resistant design based on “arc prevention” and for the water-cooled version “fast elimination”
– Electromechanically interlocked doors with DC grounding switch
– Certified functional safety

Reliability and availability

– ABB Ability™ condition monitoring for drives to monitor your drive condition all the time, anywhere in the world.
– Low parts count and fuseless design - ABB IGCT technology proven to be the best choice for high power applications
ACS5000 drives
Benefits that add value to your operations

<table>
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<th>Benefits and features</th>
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<tr>
<td><strong>Highest level of personal safety</strong></td>
</tr>
<tr>
<td>Arc resistant design (certified by 3rd party) with fast arc elimination ¹</td>
</tr>
<tr>
<td>Integrated DC grounding switch</td>
</tr>
<tr>
<td>Electromechanically interlocked doors to all MV compartments</td>
</tr>
<tr>
<td>Certified functional safety features (E-off, E-stop, Safe Stop 1, STO, POUS)</td>
</tr>
<tr>
<td><strong>High reliability and availability</strong></td>
</tr>
<tr>
<td>Each configuration consists of very well-proven components and simple power circuit</td>
</tr>
<tr>
<td>Low part count</td>
</tr>
<tr>
<td>Fuseless design</td>
</tr>
<tr>
<td>Self healing capacitors</td>
</tr>
<tr>
<td>Highest availability during supply network disturbances</td>
</tr>
<tr>
<td>ABB Ability and cloud connection for remote condition monitoring and remote assistance</td>
</tr>
<tr>
<td><strong>Increase productivity</strong></td>
</tr>
<tr>
<td>High system efficiency due to multilevel-fuseless topology, IGCTs and DTC</td>
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<tr>
<td>Smoother integration and easier operation throughout your entire installation</td>
</tr>
<tr>
<td>Best-in-class control in terms of dynamic performance and power quality</td>
</tr>
<tr>
<td>Precise process control</td>
</tr>
<tr>
<td><strong>Custom-made solutions</strong></td>
</tr>
<tr>
<td>For an optimized cooling system the air-cooled ACS5000 is available with integrated or external transformer</td>
</tr>
<tr>
<td>The water-cooled ACS5000 can be customized with a dry-cooler and combined transformer connected to the same cooling system</td>
</tr>
<tr>
<td>ACS5000 can be adapted for applications with very long motor cable or high output frequencies ≤ 250 Hz</td>
</tr>
</tbody>
</table>

¹: Arc resistant design, IAC certified according to IEC62271-200 / IEC 62477-2 available for the water-cooled version only
Water-cooled solutions for highest level of safety
ACS5000 drives
Highest safety for your people and equipment
Arc resistant design with fast arc elimination

Description

Electric arcs are hazardous to personnel and equipment.

The water-cooled ACS5000 offers the highest possible level of personnel safety by detecting the arc and eliminating before it even occurs.

The drive comes with an arc proof design and is certified according to IAC (internal arc classification).

The water-cooled ACS5000 is equipped with ABB’s Arc Guard System™ for a superior/redundant protection function.
## Arc proof classes

Personnel safety & equipment availability

<table>
<thead>
<tr>
<th>ARC PROOF CLASS</th>
<th>CLASS I</th>
<th>CLASS II</th>
<th>CLASS III</th>
<th>CLASS IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERSONNEL SAFETY BASED ON</td>
<td>ARC PREVENTION</td>
<td>ARC PREVENTION + PROTECTION</td>
<td>ARC PREVENTION + ELIMINATION</td>
<td>ARC PREVENTION + FAST ELIMINATION</td>
</tr>
<tr>
<td>BASED ON DESIGN ACC. TO IEC 60146-1-1 IEC 61800-4</td>
<td>BASED ON ARC RESISTANT ENCLOSURE</td>
<td>BASED ON HV-FUSES</td>
<td>BASED ON PROTECTION FIRING AND/OR FAST DETECTION</td>
<td></td>
</tr>
<tr>
<td>EQUIPMENT DAMAGE IN CASE OF ARC</td>
<td>SEVERE</td>
<td>SEVERE</td>
<td>MODERATE</td>
<td>NEGLIGIBLE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Non-ABB Medium Voltage Drives</th>
<th>ACS5000 water-cooled</th>
</tr>
</thead>
<tbody>
<tr>
<td>CERTIFIED ACC. TO IEC 62271-200: IAC AFLR / IEC 62477-2</td>
<td></td>
</tr>
</tbody>
</table>
## Arc fault safety

### ABB’s approach - the 4 safety classes

<table>
<thead>
<tr>
<th>CLASS I</th>
<th>CLASS II</th>
<th>CLASS III</th>
<th>CLASS IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>protection based on arc prevention</td>
<td>protection based on arc resistant cabinet structure</td>
<td>protection based on external arc fault limitation and elimination</td>
<td>fast arc elimination</td>
</tr>
</tbody>
</table>

- **CLASS I**
  - Design of insulation systems in accordance with relevant IEC and NEMA standards to prevent arcs and provide personnel safety
  - Class I is not a certified arc resistant design, it is mainly focusing on arc fault prevention

- **CLASS II**
  - The cabinet is designed to withstand the pressure of an arc flash
  - Arc fault is contained in the cabinet or guided through pressure relief vents
  - The drive will be face severe damage after an event

- **CLASS III**
  - HV Fuses are applied externally to the drive in order to limit the arc fault current to less than half cycle of the fundamental AC frequency (<10ms in case of 50Hz supply)
  - This method is only used to reach arc resistant designs for MV drives connected without external drive transformer to the mains (integrated transformer solutions and DTL solutions)

- **CLASS IV**
  - This is a ABB patented method, ABB MV drives “protection firing” system. The arc fault is detected and converted into a non severe bolted short circuit
  - For an even faster detection and elimination an optical ABB arc fault detection system is available
  - Provides highest level of personal safety and the equipment remains undamaged and can be immediately restarted after inspection and elimination of the arc ignition cause

### Standard Medium Voltage Drives

- **Class I**
  - Design of insulation systems in accordance with relevant IEC and NEMA standards to prevent arcs and provide personnel safety
  - Class I is not a certified arc resistant design, it is mainly focusing on arc fault prevention

- **Class II**
  - The cabinet is designed to withstand the pressure of an arc flash
  - Arc fault is contained in the cabinet or guided through pressure relief vents
  - The drive will be face severe damage after an event

- **Class III**
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<table>
<thead>
<tr>
<th>Arc resistant design</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAC Certified according IEC62271-200 / IEC 62477-2</td>
</tr>
</tbody>
</table>
Arc proof testing
Internal arc classification – Impressions

Classification test (IP42): 28kA, 0.5s

Additional classification tests
IP54: 56kA, 0.5s
IP00: 56kA, 0.5s
Certified functional safety features
For a safe and reliable system integration into your process

The ACS5000 water-cooled is equipped with safety integrity level 3 (SIL3) and performance level e (PL e) to provide the following safety functions:

– **Emergency off** - stop category 0 according to IEC 60204-1
– **Emergency stop** - stop category 1 according to IEC 60204-1
– **Safe torque-off (STO)** - according to IEC 61800-5-2
**Door interlocking system**

Integrated DC grounding switch and door interlock

The grounding switch is a safety switch to ground the DC bus of the drive. When the drive is grounded, the door safety switches of the medium voltage units are released and the doors can be opened.

It is electromechanically interlocked with a discharge monitoring circuit that prevents the switch from closing when the DC-link capacitors are still charged.

Grounding the drive is only possible after main power supply is disconnected and the DC link has been discharged.
Reliability and availability
ACS5000 drives
Reliability and availability at the core of your application
Well-proven ABB IGCT-technology

Low part count and best-in-quality components

The main module of the drive is the Phase Converter Unit (PCU). Electrical and mechanical design principles are common for PCUs. PCUs can be arranged depending on the power requirements and contain the rectifier, DC-link and converter for one phase.

Their very compact cores are well proven power stacks based on IGCT-semiconductors.

IGCT semiconductors are non-aging and enable highly efficient and reliable operation. They are the ideal switch for high power applications and have proven to be the most robust devices on the market.
Reliability and availability at the core of your application
Simple and robust design

**Features for reaching highest availability**

- Lower lifetime costs and higher reliability is assured by advanced, environmental friendly, oil-filled foil capacitors which have a substantially longer lifetime than electrolytic capacitors (10 vs 3 years)

- Fuseless design for faster and better protection than medium voltage power fuses

- 5-level VSI topology for an optimum considering the quality of the output waveform and the converter simplicity

- Easy front access to the drive’s components

- Redundancy options for cooling fans/pumps, connection of external redundant power supplies, internal power supplies, sensors (e.g. pressure, temperature, conductivity)
Reliability and availability at the core of your application
Advanced control method enables superior supply power loss ride-through capability

No tripping when main power supply lost

- Energy stored in the rotating system of machine and load keeps DC-link charged
- When the DC-link voltage is too low, the drive enters ride-through mode in which the machine is used as a generator to compensate for converter internal losses
- The ACS5000 stays in ride-through mode until either the main power is back to normal conditions or the machine speed reaches 10% rated speed
Special features for industry-specific solutions
ACS5000 drives
Combined transformer for cooling based on dry-cooler (FinFan)
ACS5000 water-cooled

Simple solution if external cooling water is not available

- Combined water-cooling circuit in converter and input transformer:
  - Only 1 water-cooling unit for the transformer-converter system
  - Typical configuration on site: “single-loop cooling” → only one dry-cooler (FinFan) system needed

- Available for
  - Frame size 1 and 2 ≤ 18 MVA
Energy efficient solution considering system cooling
ACS5000 water-cooled

**IP54 for extreme environment**

- Efficiency > 99%

- IP42 direct air-cooling
  - Approx. 92% of the drive losses dissipated into water
  - 8% of the losses dissipated into ambient air of the electrical room

- IP54 air to water (deionized) heat exchanger
  - Completely sealed cabinet making it suitable for operation in harsh environments
  - High ambient temperatures acceptable
  - Losses into air < 2% (via the cabinet)
Industry specific solutions
ACS5000 water-cooled

Flexibility for individual needs

- Certification for marine and offshore available
  - ABS (American Bureau of Shipping), USA
  - DNV (Det Norske Veritas), Norway

- Fast startup of hot stand-by systems for critical applications supported

- VSD starting with bumpless transfer (make before break) for direct-online operated motors supported
ABB Drives Services
Long-term commitment to maintain your assets
You choose, we respond. Globally and locally.

ABB is a reliable service partner

- Over 600 ABB field service engineers
- Services in more than 60 countries
- 500 service partners
- 30 service workshops
- Providing services for drives
- 40 years of service
- Covered by closest Regional Service Center
- Global Service Center (4)
- Regional Service Center (8)
- ABB or partner service
Your needs

Rapid response
We promise fast and flexible service response to restore your production or process to full working order within the agreed timeframe.

Performance improvements
We help you optimize the availability and efficiency of your equipment and improve the profitability of your assets.

Lifecycle management
We provide you powerful tools and our knowledge base to analyze, optimize and extend the lifecycle of your drives.

Operational excellence
We offer you a strategic partnership in improving productivity, safety, cost and energy efficiency of your equipment.

Our services

Service Agreements - ABB Drive Care

Training  Installation and Commissioning  Spares and Consumables  Maintenance  Repairs

Engineering and Consulting  Advanced Services  Extensions, Upgrades and Retrofits  End-of-Life Services  Replacements
A lifetime of peak performance
Lifecycle management

**Our approach to lifecycle management**

**Being committed**
We are committed to serve customers throughout the entire lifecycle of the drive.

At the heart of drive services is a four-phase product lifecycle management model. This model defines the availability of the product and the availability of lifecycle support throughout the product lifespan.

**Keeping you informed**
We notify you every step of the way using life cycle status statements and announcements.

Your benefit is clear information about your drives’ status and precise services available. It helps you plan the preferred service actions ahead of time and make sure that continuous support is always available.

<table>
<thead>
<tr>
<th>Product</th>
<th>Services</th>
<th>Active</th>
<th>Classic</th>
<th>Limited</th>
<th>Obsolete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full range of life cycle services and support</td>
<td>Full Lifecycle support is guaranteed. Product enhancements may be available through modernization services.</td>
<td>Serial production has ceased. Product may be available for plant extensions, as a spare or for installed base renewal</td>
<td>Limited lifecycle support is available. Spare parts availability is limited to available stock.</td>
<td>Replacement and end-of-life services are available.</td>
<td></td>
</tr>
</tbody>
</table>
Digital-aided on-site services

ABB Drives’ digital-aided on-site services makes sure that your drive is serviced efficiently and effectively.

Our service engineers have always latest equipment information at hand, including:

- Service history
- Service instructions
- Recommended services

Customer support - Follow the sun

ABB Drives’ customer support is close to customer site, provided in local language and guarantees quick response time.

Regional sales and technical customer support hubs located around the world are offering service around the clock and every day of the year.

Our follow-the sun concept ensures

- Unified high-quality support for all countries
- Quick response time as service is provided in the same time zone
- Effective escalation of issues
- Seamless flow of support
- Possibility to purchase 24x7 remote assistance

myABB – Your gateway to services

Find the right information, saving time & money

- Installed base information
- Quick and easy access to expert contacts
- One-stop-shop for drive-specific parts

Optimize capital outlays & operational budgets

- Identify upgrades and replacement
- Set maintenance and make end of life decisions

Plan maintenance operations and minimize downtime

- Review recommended service options
- Explore service history
- Access product and technical documentation

Make the right operational decisions

- Identify relevant training offerings
- Retrieve latest maintenance information and updates
- Review your equipment criticality

Knowledge base

Installed base information

1. Local ABB

2. Global support 24/7

3. R&D, Product Engineering
Modernization

Upgrade your ACS5000 drive to extend its life cycle

Why upgrade your ACS5000 drive

- Controlled costs
- Guaranteed life-cycle services
- Optimized availability of your drives
- Digitalization with ABB Ability™ (Condition Monitoring, Remote Assistance)

ABB offers various upgrade services for its ACS5000 drives. The main board upgrade for ACS5000A air-cooled (Generation 1) drives updates the control platform to the latest version. At the same time, hardware improvements can be implemented. As a result of this upgrade, the drive life cycle support by ABB is extended.

<table>
<thead>
<tr>
<th>Product to modernize</th>
<th>Old control platform</th>
<th>Modernization variants</th>
<th>New platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACS5000 air-cooled (Generation 1)</td>
<td>AMC (AMC33/PECTINT)</td>
<td>Main board upgrade</td>
<td>AMC (AMC34)</td>
</tr>
<tr>
<td>ACS5000 water-cooled (Generation 1)</td>
<td>Various upgrade kits</td>
<td>Various upgrade kits</td>
<td></td>
</tr>
<tr>
<td>ACS5000 water-cooled (Generation 2)</td>
<td>Various upgrade kits</td>
<td>Various upgrade kits</td>
<td></td>
</tr>
</tbody>
</table>

Modernize your drive to extend its life cycle support by ABB
Drive System Engineering and Consulting
Expert Support to optimize your drive, system, and process performance

ABB provides consultation with leading-edge drive system expertise to help you develop customized solutions to optimize your drive system assets.

**Digital Twins**
A digital twin is a complete and operational virtual representation of your drive system that helps you to boost your plant performance and de-risk your installation.

**Failure mode and effect analysis**
FMEA is a specific method to measure and evaluate the robustness of a drive system, design, or process for potential failure mechanisms.

**Electromechanical system interaction (EMSI) study**
EMSI is a specialized study to identify potential critical installation points in a complex driveline (drive, rotating equipment, process) and provide guidelines on how to mitigate vibration issues.

Increase reliability, availability and performance of your system
ABB Ability™ for Drives
Digitalization opens new opportunities

Smart, connected drives... send data to secure cloud... where analysis turns data into knowledge...

Knowledge turns into predictive actions

Key performance indicators show where to focus the actions.

Detailed report gives more information on the issue.

Expert can recommend and support the actions needed.

Condition based predictive alerts ease follow up.
ABB Ability™ Remote Assistance for Drives

Remote connectivity + Expert support upon request

Rapid solution in case of problems
Should a fault be detected within a drive, ABB specialist provides rapid support by using the drive’s data which is stored remotely.

ABB Ability™ Condition Monitoring for Drives

Remote or Local connectivity + Condition Monitoring Portal

Alerts and information, for customer to react
ABB Ability Condition Monitoring for Drives is a service that delivers you accurate, real-time information about drive condition and events to ensure your equipment is available, reliable and maintainable.
**Initial Care – More than warranty**

Initial Care is a free of charge service available to a newly purchased ABB Medium Voltage Drive during the first year of the warranty period.

It complements the warranty support with ABB Ability™ for Drives, including...

- ABB Ability™ Remote Assistance for Drives
- ABB Ability™ Remote Condition Monitoring for Drives

Explore ABB’s digital offering free of charge for a limited time of one year and decide afterwards, whether you want to enter the ABB Ability™ contract.

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**Complete Care – Long-term lifecycle agreement**

ABB Drive Care agreement is designed to let you focus on your core business. With a fixed-price lifecycle agreement matching your needs you gain efficiency in handling routine and emergency maintenance and have improved cost control.

ABB Drives Complete Care contract includes:

- Maintenance & repair parts
- Labor for on-site service actions
- Biennial on-site inspection
- ABB Ability™ Remote Assistance for Drives

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**Highlights**

<table>
<thead>
<tr>
<th>ABB Drives Warranty Condition</th>
<th>+</th>
<th>ABB Ability™ for Drives</th>
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</table>

Initial Care

<table>
<thead>
<tr>
<th>Service budget</th>
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<tbody>
<tr>
<td>$</td>
</tr>
<tr>
<td>1</td>
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</table>