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**[new.abb.com/drives](https://new.abb.com/drives)**

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ABB FOR GREEN HYDROGEN

# DC power supply for electrolyzers

Safe and cost-efficient green hydrogen generation

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## We are your best partner to co-create a greener future

– with solutions that effectively address the key challenges of water electrolysis

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We are seeing promising growth opportunities in hydrogen market. However, the cost target under the strong competition must be addressed.

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In addition, technical challenges should be cleverly managed in such way that rapid scale-up to meet exponential market demand can be possible.

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Long term service needs in various regions of the world must be considered and planned for.

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## Relief for your pain points

**ABB has broad capabilities that address and resolve key challenges. Together, we can help you:**



Bring down the cost of hydrogen, via our superior power supplies that give the highest efficiency – and lowest OPEX costs, year after year.



Meet grid challenges using our flexible portfolio – all based on the same simple user interface – to serve fast changing and even undiscovered future needs, as the technology matures and markets develop.



As an established global supplier we can provide you solutions, based on complete power supply packages from MV to electrolyzer input.



Engineer your electrification solution to co-create the most effective solution, fully considering the TCO, total cost of ownership.



Comfortably and confidently rely on our worldwide local and online support for installation, commissioning and 24/7 service.







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# ABB's unique technology options, engineering support, track record and service offering can help you build electrolysis systems that meet all of your customers' needs

## 1. Safety & Reliability

ABB makes no compromises on safety, with long and successful experience in managing hazardous industrial environments, including hydrogen, and using low-maintenance solutions that reduce both dangers and risks.

To ensure high uptime, ABB offers recognized best-in-class reliability and robustness, and factory testing of every converter, to prevent risk of outages.

## 2. Efficiency & Network Quality

ABB's power supply systems help you get optimal uptime and efficiency, optimizing your profitability. Our rectifier delivers system efficiency of over 98%, while managing DC ripples in the voltage to reduce wear on electrodes.

Harmonics can cause significant disturbance to the grid. We offer low harmonic 3% harmonics, thus exceeding all standards.

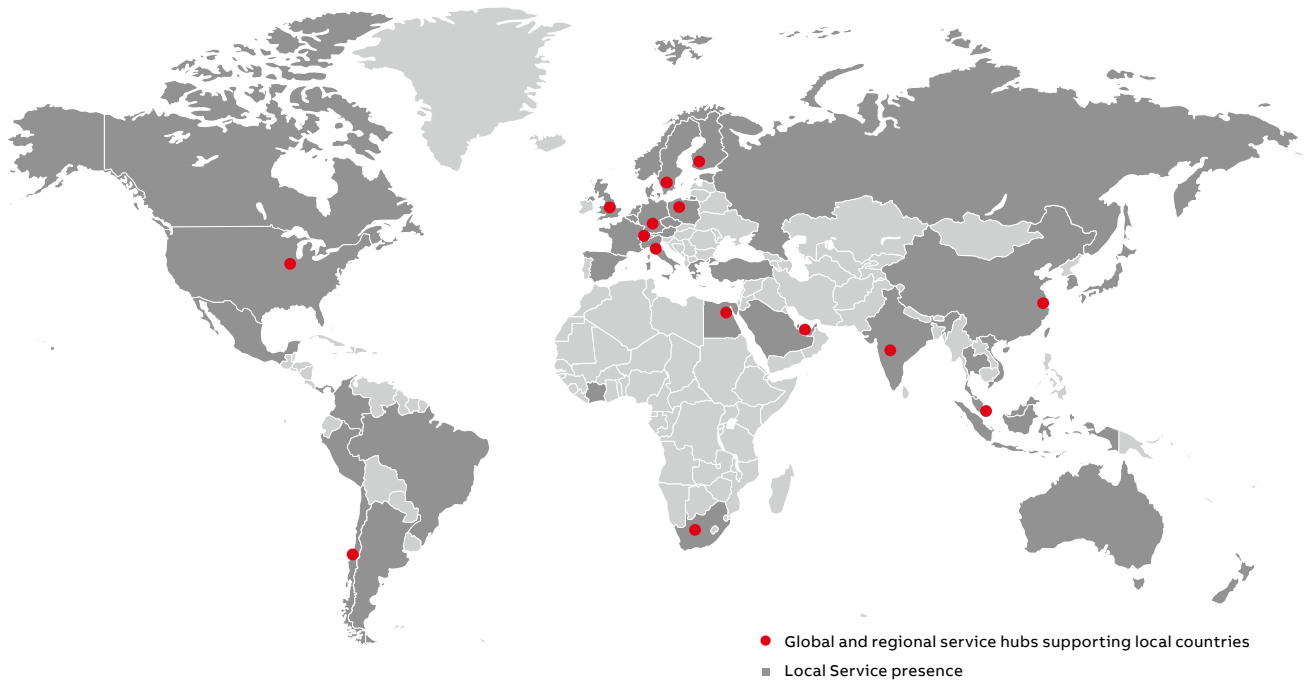
In addition to harmonics, electrical grid operators do not like reactive power. ABB's IGBT based solution has a power factor of 1, with no reactive power content and thus no need for any compensation. Thyristor and diode based solutions can achieve high power factors, so they will meet grid regulations.

## 3. Flexible portfolio with customized engineering support

Our flexible portfolio covering a wide DC voltage range and using a variety of technologies – thyristor, diode and IGBT – means we have the right technical solution to meet whatever needs you may have.

In case you have special requirements, our Order-Based Engineering team can customize the solution to suit any specific demands.

All ABB converter products offer unprecedented levels of compatibility, flexibility and quality with proven field performance. Our 'all-compatible' philosophy means our products can be seamlessly integrated with any other components in the plant.



#### 4. Industry know-how & global service network

With world-class domain expertise in almost all process industries, ABB adds more than 100 years of experience and in-depth understanding for optimizing many industrial processes.

In case it is ever required, getting rapid and qualified service wherever the equipment may be

installed is a crucial consideration. To support you, we have over 1,200 highly-trained field service engineers in more than 70 countries and a further network of 600 service partners globally. Our digital services are available at your finger tips 24/7.



## Simplify your electrolyzers and your life . . . without limiting your flexibility

DCS880 thyristor converters and ACS880 diode and IGBT converters can meet any technical and market requirements you may face.



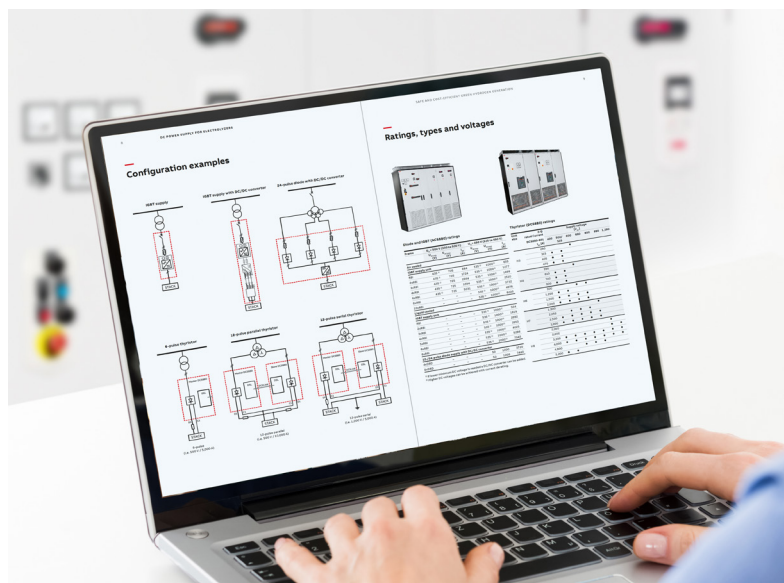
- DCS880 in electrolysis application with reliable thyristor-based power supply for precise current and voltage control of electrolysis processes. Offering a wide range of configurations, 12-pulse, 24-pulse, serial and parallel up to 20 kA<sub>DC</sub> and 1500 V<sub>DC</sub>
- ACS880 in electrolysis application, consisting of IGBT or 12-/24-pulse diode modules, and optional DC/DC converter and DC smoothing choke units. With six modules in parallel, current can go up to 7,200 A and DC voltage up to 1,100 V
- Ease of engineering, commissioning, and use
- Engineered to order for simplified installation
- Comprehensive connectivity, communication and remote monitoring
- Nine-year maintenance interval
- High reliability with minimized downtime
- Worldwide service and support
- Remote monitoring made easy and secure
- All cabinets up to IP54



## Three DC power supply solutions to choose from – depending on specific needs – for superior water electrolysis

### Selection of supply voltage

The AC voltage is derived by the required electrolyzer DC voltage, the technology used and the power factor of the device. Power factor is also dependent on dimensioning of supply transformer and converter supply voltage in relation to DC output voltage.



## Voltage and current quality – harmonics and ripple effects

**Harmonics** can be reduced with an IGBT converter or correct selection of supply transformer (i.e. 12-, 24-pulse) for thyristor and diode supplies. The grid operator defines the allowable harmonics level and there are often fines for exceeding these limits.

**DC current ripple** negatively affects the lifetime of the electrolyzer's electrodes. Ripple depends on load current, supply voltage, DC choke and configuration.

- 12-pulse thyristor solution have typically a DC current ripple (rms) limit of 5 to 8 %, which allows to use a very small DC choke hardware or even avoids it completely.
- Diode and IGBT power supplies have <1% current ripple.

### DC/DC converter (DDC)

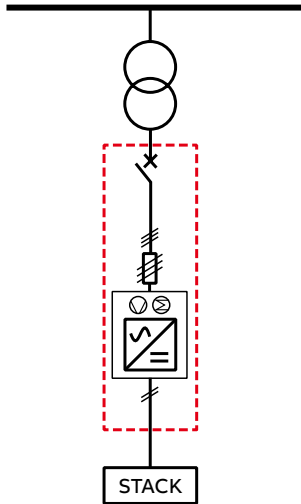
This converter option can transfer energy from a diode or IGBT converter into an electrolytic cell. If the DC voltage required by the electrolyzer doesn't match the conversion ratio of the converter performance curve (see graph), a DC/DC converter can be used to provide suitable voltage level in the range from 50 V to 95% of the DC voltage from the diode or IGBT supply unit.

### Benefits you get from ABB's broad technical offering:

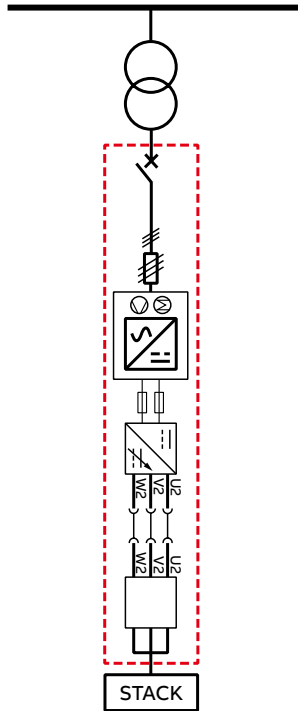
- Possibility to choose optimal solution
  - 12- or 24- pulse thyristor-based solution with optional dedicated transformer, T-Reactor and DC-choke
  - 12- or 24-pulse diode solution with DC/DC converter
  - IGBT solution with optional DC/DC converter
- High efficiency and power quality
- Modular and easy-to-integrate
- Suitable solutions for all electrolyzer technologies
- Converters can be engineered to order
- Protection of stacks can be done with programming features
- User-defined accessories like separate connection to PLC or automation systems via fieldbus available
- Market leading series production solutions, for easy upscaling
- Digital native with modern connectivity options
- Multiple IP classes suitable for various environment conditions
- All major class approvals and certifications
- Air- or liquid-cooled solutions
- Power up to 20 MW electrolyzer with thyristor, and 10 MW electrolyzer with diode and IGBT

## Configuration examples

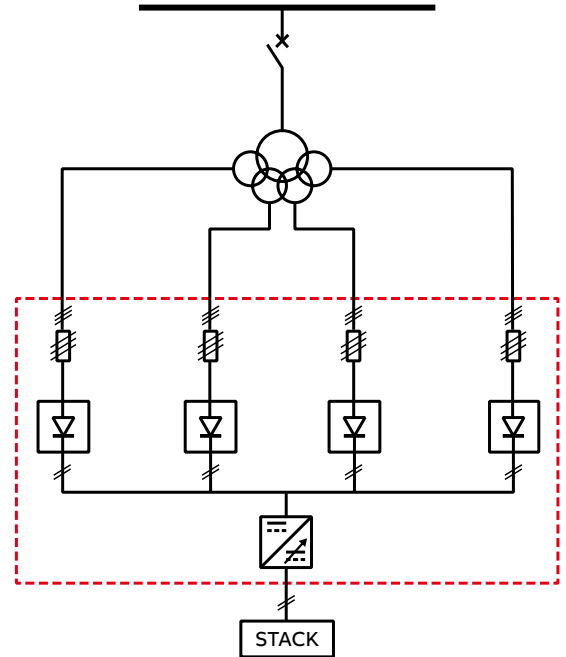
IGBT supply



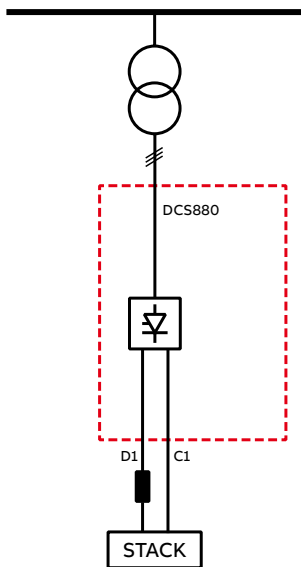
IGBT supply with DC/DC converter



24-pulse diode with DC/DC converter

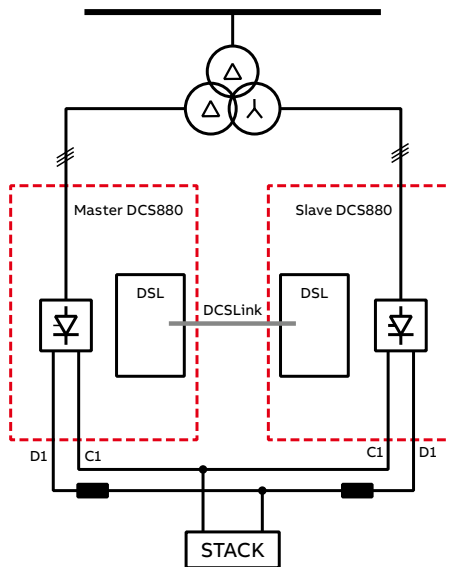


6-pulse thyristor



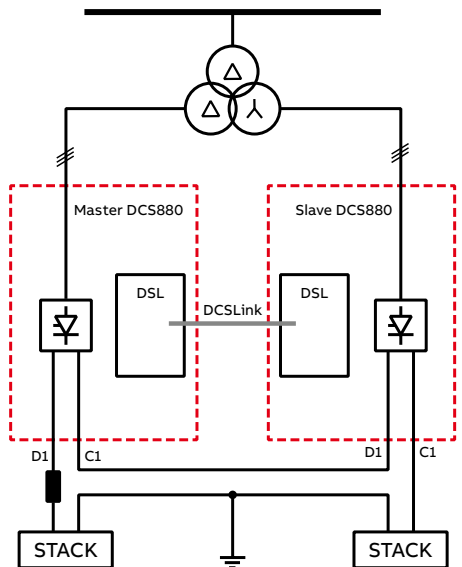
6-pulse  
(i.e. 500 V / 5,000 A)

12-pulse parallel thyristor



12-pulse parallel  
(i.e. 500 V / 10,000 A)

12-pulse serial thyristor



12-pulse serial  
(i.e. 1,000 V / 5,000 A)

# Ratings, types and voltages



## Diode and IGBT (ACS880) ratings

Frame	U <sub>N</sub> = 500 V (300 to 500 V)			U <sub>N</sub> = 690 V (525 to 690 V)		
	U <sub>DCmin</sub> (V)	U <sub>DCmax</sub> (V)	I <sub>DC</sub> (A)	U <sub>DCmin</sub> (V)	U <sub>DCmax</sub> (V)	I <sub>DC</sub> (A)
<b>Air cooled</b>						
<b>IGBT supply unit</b>						
R8i	435 <sup>1)</sup>	725	884	535 <sup>1)</sup>	1000 <sup>2)</sup>	655
2xR8i	435 <sup>1)</sup>	725	1724	535 <sup>1)</sup>	1000 <sup>2)</sup>	1277
3xR8i	435 <sup>1)</sup>	725	2564	535 <sup>1)</sup>	1000 <sup>2)</sup>	1899
4xR8i	435 <sup>1)</sup>	725	3394	535 <sup>1)</sup>	1000 <sup>2)</sup>	2510
6xR8i	435 <sup>1)</sup>	725	5031	535 <sup>1)</sup>	1000 <sup>2)</sup>	3732
8xR8i	–	–	–	535 <sup>1)</sup>	1000 <sup>2)</sup>	4976
10xR8i	–	–	–	535 <sup>1)</sup>	1000 <sup>2)</sup>	6220
<b>Liquid cooled</b>						
<b>IGBT supply unit</b>						
R8i	–	–	–	535 <sup>1)</sup>	1000 <sup>2)</sup>	934
2xR8i	–	–	–	535 <sup>1)</sup>	1000 <sup>2)</sup>	1819
3xR8i	–	–	–	535 <sup>1)</sup>	1000 <sup>2)</sup>	2692
4xR8i	–	–	–	535 <sup>1)</sup>	1000 <sup>2)</sup>	3553
5xR8i	–	–	–	535 <sup>1)</sup>	1000 <sup>2)</sup>	4025
6xR8i	–	–	–	535 <sup>1)</sup>	1000 <sup>2)</sup>	5286
8xR8i	–	–	–	535 <sup>1)</sup>	1000 <sup>2)</sup>	7045
<b>12-/24-pulse diode supply with DC/DC converter</b>						
4xD8D	–	–	–	50	1000	3720
8xD8D	–	–	–	50	1000	7440

<sup>1)</sup> If lower minimum DC voltage is needed a DC/DC converter can be added.

<sup>2)</sup> Higher DC voltages can be achieved with current derating.

## Thyristor (DCS880) ratings

Unit size	2-Q rated Current DCS880-S01 I <sub>DC</sub> [A]	Supply voltage [V <sub>AC</sub> ]						
		400	500/ 525	600	690	800	990	1,190
H3	290			•				
	315	•	•					
	405	•	•					
	470	•	•					
H4	590			•				
	610	•	•					
	740	•	•					
	900	•	•					
H6	900			•	•			
	1,200	•	•					
	1,500	•	•	•	•			
	2,000	•	•	•	•			
H7	1,900						•	
	2,050		•	•	•			
	2,500	•	•	•	•	•		
	3,000	•	•	•	•	•		
H8	2,050							•
	2,600							•
	3,300	•	•	•	•	•	•	•
	4,000	•	•	•	•	•	•	•
	4,800			•	•	•		
	4,830							•
	5,200	•	•					
	5,230		•		•	•		





## Our performance package solution – engineered perfectly to your needs

The aim of our packaging concept is to make your life easier. That is why we offer a packaged electrification solution designed for perfect fit, including third party products, to give a high-quality and complete performance package.

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The packaging concept reduces the complexity of the project for the customer/OEM by delivering many components packaged together, providing a single point of contact and one contract for the entire electrification package. The containerized cost-optimized solution, based on ABB's deep technical competence, is easy to install and provides considerable savings in both cost and footprint.

As the container solution is factory tested and ready for connection, you will save costs and effort in the bidding, project management and engineering processes. To ensure smooth

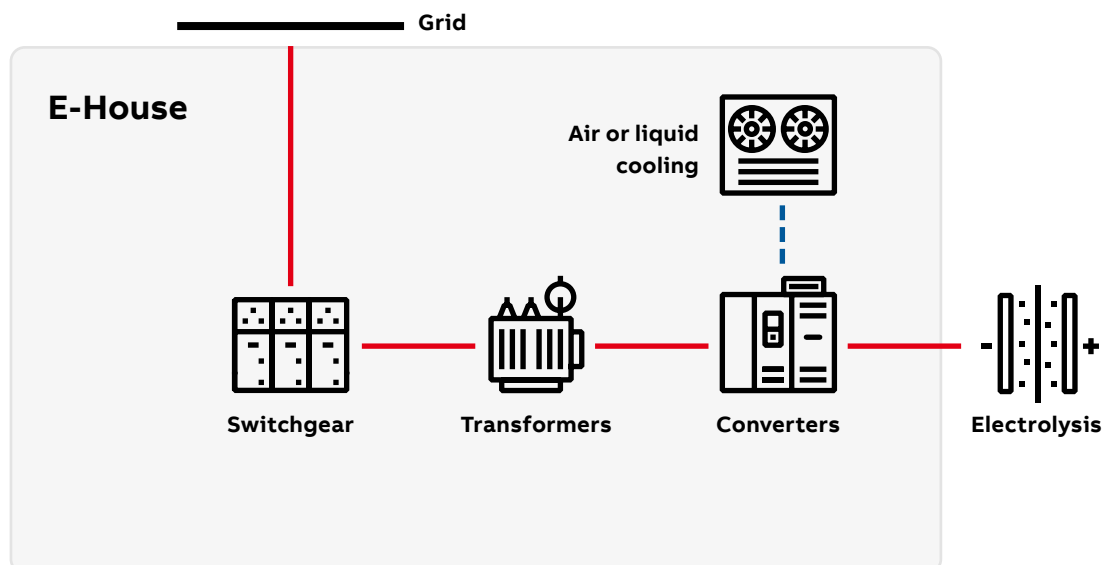
logistics and installation for you, we can coordinate delivery, design interface and commissioning of all elements.

### Engineered to order

ACS880 and DCS880 cabinet converters are always engineered to order. This ensures that the customer's and application's demands are taken as the basis for our design, and even complex requirements can be included to create a unique solution. Our dedicated team takes care to ensure the maximum performance, uptime and quality in daily processes.

Our converters can be programmed with custom functionalities and protections to safeguard the electrolyzer stacks. ACS880 and DCS880 converters use the same all-compatible control platform that supports all major fieldbuses.

**We customize every part of the H<sub>2</sub> electrolysis package to meet your and your customers' needs.**



## Our service expertise, your advantage

ABB Motion Services helps customers around the globe by maximizing uptime, extending product life cycle, and enhancing the performance and energy efficiency of electrical motion solutions. We enable innovation and success through digitalization by securely connecting and monitoring our customers' motors and drives, increasing operational uptime, and improving efficiency. We make the difference for our customers and partners every day by keeping their operations running profitably, safely and reliably.

With a service offering tailored to your needs, ABB Motion Services maximizes the uptime and extends the life cycle of your electrical motion solutions, while optimizing their performance and maximizing your energy efficiency gains throughout the entire lifetime of your applications. We help to keep your applications turning profitably, safely, and reliably.

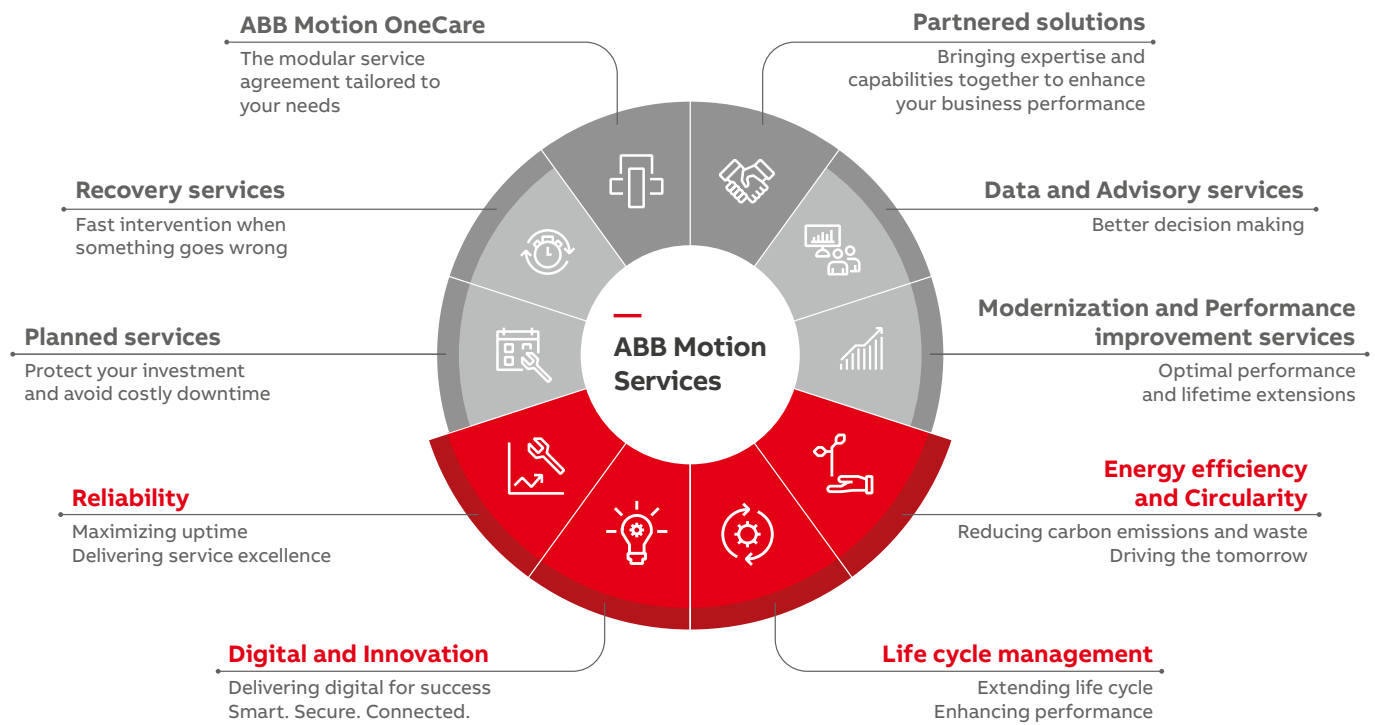
Digitalization enables new smart and secured ways to prevent unexpected downtime while optimizing the operation and maintenance of your assets. We securely connect and monitor your motors, drives or your entire powertrain to our easy to use cloud service solutions. Connecting your applications also gives you access to our in-depth service domain expertise.

We quickly respond to your service needs. Together with our partners, local field service experts, and service workshop networks, we provide and install original spare parts to help resolve any issues and minimize the impact of unexpected disruptions.

Our tailored to your needs service offerings and digital solutions will enable you to unlock new possibilities. Not only are we your premier supplier of motion equipment, we are your trusted partner and advisor offering support throughout the entire life cycle of your assets. We ensure your operations run profitably, safely and reliably and continue to drive real world results, now and in the future. Our service teams work with you, delivering the expertise needed to keep your world turning while saving energy every day.







**OUR EXPERTISE**  
**YOUR ADVANTAGE**

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## Want the best green hydrogen costs at the highest uptime?

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We can help make sure your DC power supply for electrolyzers is safe, perfectly matched and totally reliable.





