New energy for marine applications

Into the future with electrified drive systems

Bosch Engineering

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The trend towards electrification

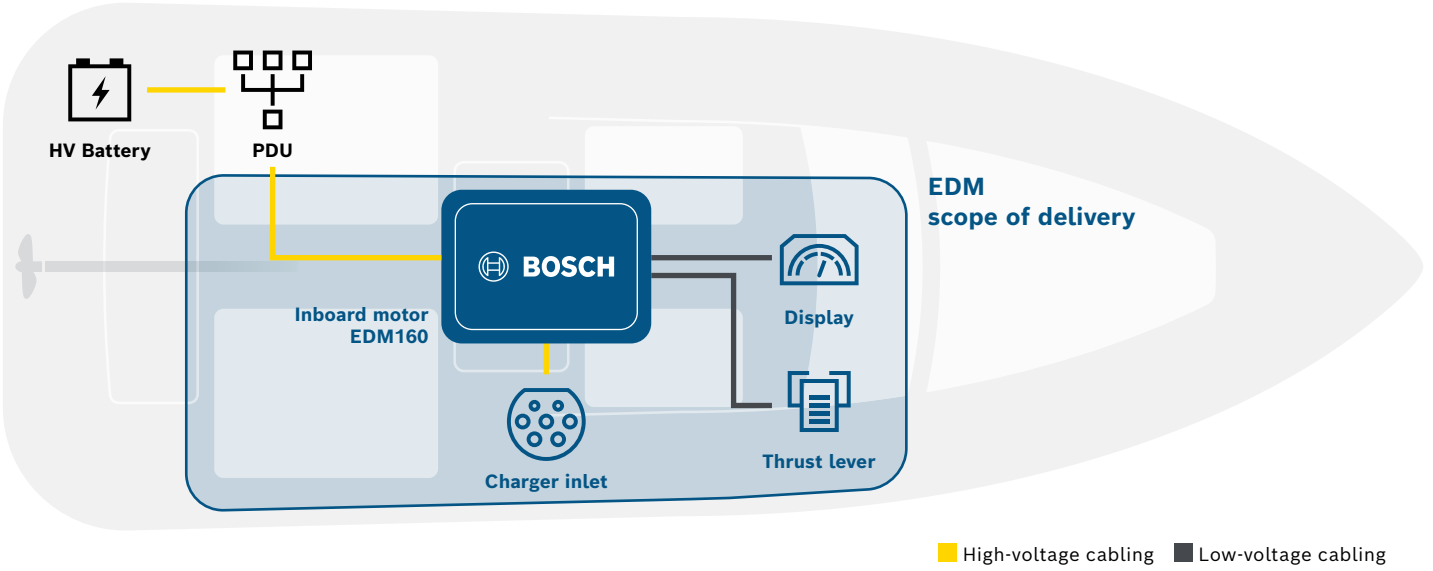
Bosch Engineering offers electric drive systems for a wide range of marine applications, covering both planing and displacement craft. This provides shipbuilders, system integrators, and naval architects with a quick and simple means of electrifying their boat drives.

In many regions of the world, new environmental laws for inland and recreational boats will come into force in the coming years. This trend not only affects shipyards and many boat manufacturers: the increasing customer demands for more environmentally friendly and quieter drive systems are also driving the industry in this context. With its sophisticated electrification solutions, Bosch Engineering intends to play a decisive role in shaping the transformation of maritime applications by providing boat manufacturers with drive components and system solutions to suit their exact requirements.

The new plug-and-play complete solution: electric drive for marine applications (EDM)

The integration of an electric inboard motor into recreational boats or commercial vessels involves considerable engineering effort and requires a high level of understanding of the overall system. With the new complete system, the electric drive for marine applications (EDM), Bosch Engineering now supports the quick and straightforward high-voltage electrification of boats and small ships. Bosch Engineering supports EDM customers from the initial installation concept to the eventual commissioning of the drive.

The system sets new standards in terms of performance, efficiency, and sustainability.



Scope of delivery of the electric drive for marine applications:

- Electric motor
- Gearbox
- Inverter
- DC/DC converter (400V/12V)
- On-board charger
- Cooling system for the battery
- Cooling system for the drive
- E-box including control unit
- All necessary cables
- Charger inlet
- Upon request: display and thrust lever

Flexible with high-voltage battery selection:

- The HV battery was deliberately omitted from the scope of delivery of the EDM. This ensures a high degree of flexibility, depending on the specific requirements of the application with regard to capacity, form factor, commercial aspects, etc.
- Bosch Engineering supports the EDM customer with the important matter of battery selection and will recommend suitable solutions.
- Thanks to a standardized communication interface, the EDM is compatible with various batteries available on the market.
- The battery charging and cooling functions are covered by the EDM.

EDM160 inboard motor

Continuous power output[1]	120 kW / 160 hp
Peak power[1]	140 kW / 190 hp
Speed with gearbox at 120 kW	1,000 – 1,500 rpm
Speed without gearbox at 120 kW	6,000 rpm
Maximum speed without gearbox	15,000 rpm
Total weight	Approx. 180 kg
Overall efficiency$_{Peak}$	94 %
Cooling type	Open seawater circulation
Compatible HV battery	Customer-specific, depending on application
Drive configuration	Single and twin
Installation configuration	EDM inboard motor or distributed (components supplied individually for customer-specific integration)
Application	Inboard, direct drive

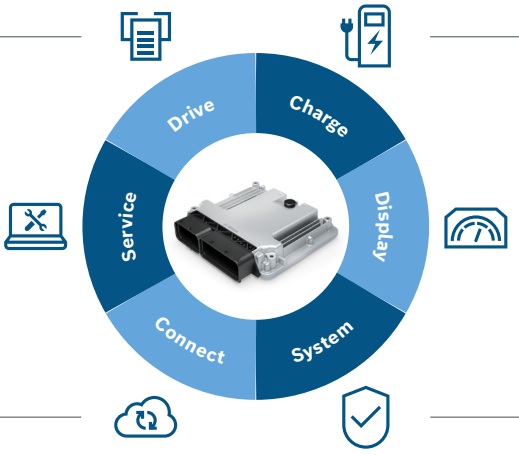
[1] $T_{Coolant}$ 45 °C; power/torque at 400 V_{DC} continuous, peak ≙ 10 sec.

Product images for illustration purposes only. Final product design may vary.

Comprehensive software features

- Single and twin drive
- Cruise and maneuvering mode
- Drive characteristics configurable by the customer

- AC and DC charging with 22 kW / >100 kW
- Charging in dry condition
- Charging in sleep mode



- PC-based service tool
- Guided troubleshooting
- Secure access protection

- Support of NMEA displays
- Provision of cockpit and state values

- Over-the-air flash programming
- Over-the-air data acquisition
- Basis for mobile app, fleet management, etc.

- Self-protecting system
- Automatic state coordination
- Supports safety according to ISO 25197

Benefits at a glance

Everything from a single source[2]: fully integrated plug-and-play solution for reliable operation and convincing performance.

Sophisticated drive system design: result of decades of experience and innovation in the field of drive technologies.

Straightforward replacement of internal-combustion engines: engineered for seamless integration and straightforward switch to zero-emission propulsion.

Light and powerful: optimized for high efficiency and performance combined with low weight for maximum range.

Compact dimensions and design: space-saving and flexible integration into diverse ship architectures.

State-of-the-art control software: for precision maneuvering, optimum energy efficiency, and high operational reliability.

High-quality volume-production components: tried-and-tested quality and robustness of our large-volume production in the passenger car and commercial vehicle sector.

[2] Excl. battery

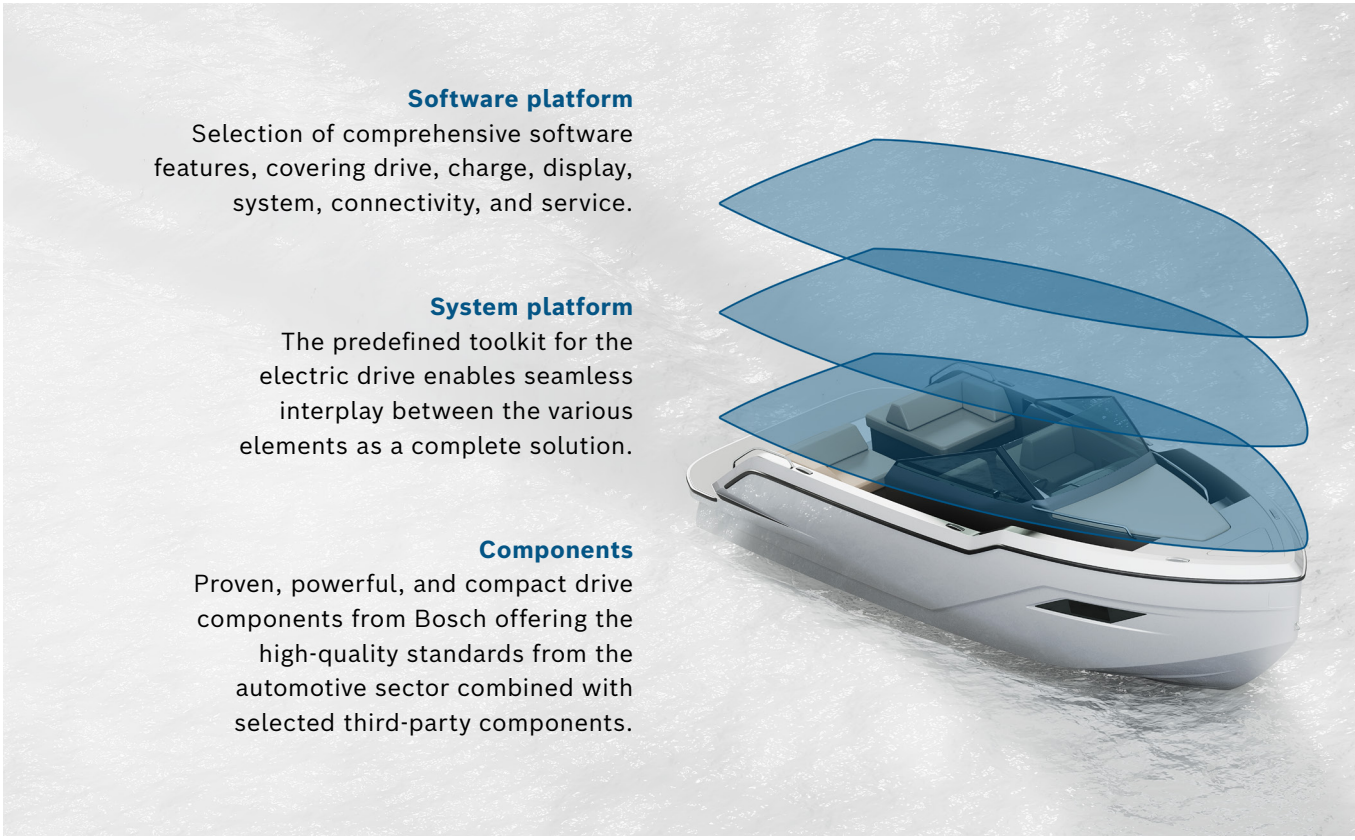
Electric drive system platform: flexible integration with platform approach

With the electric drive system platform (EDSP), Bosch Engineering offers boat manufacturers a high-quality, predefined solution for electric drives in marine applications.

This includes Bosch‘s own drive components, such as electric motors, inverters, and gearboxes, as well as solutions for all other relevant components, including high-voltage batteries, chargers, and cable harnesses. Along with the EDSP, users also receive a description of all the essential information required for integration into the boat. This includes a system manual, component specification, ECU software, as well as a commissioning package.

The EDSP system guideline and software make it easier for users to create a high-voltage drive system that not only meets the requirements of the European Recreational Craft Directive but also represents the latest state of the art with regard to functional safety and cybersecurity.

The EDSP is available in two (peak) power levels of 90 and 140 kW.



Benefits at a glance

Predefined solution: less in-depth expertise required on the part of the customer.

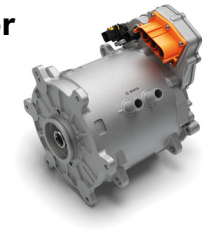
Sophisticated and flexible drive design: based on decades of experience and innovation in the field of drive technologies.

Easier and faster projects: significant reduction in the time to market.

Greatly reduced project costs: easier, faster, and more cost-effective integration into a wide range of marine applications, covering both planing and displacement craft.

High flexibility: selection of third-party components such as battery packs, thrust levers, and displays.

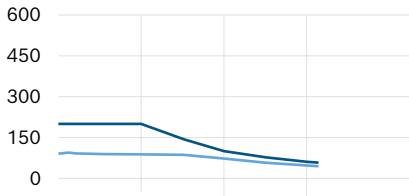
Electric motor



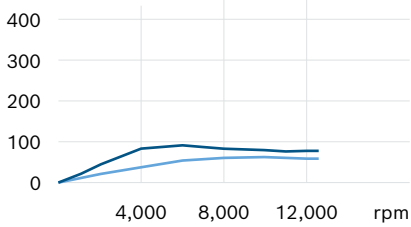
SMG180-OHW

Voltage range	< 425 V_{DC}
Power peak[1]	90 kW / 120 hp
Power continuous[1]	60 kW / 80 hp
Torque peak[1]	200 Nm
Torque continuous[1]	95 Nm
Efficiency$_{peak}$[4]	94 %
Coolant flowrate	8 l/min
Weight	30 kg
Dimensions	~Ø 260 × 270 mm
Max. speed	12,000 rpm

Torque (400 V) [Nm]



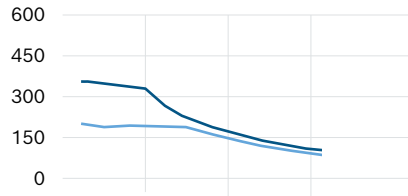
Power (400 V) [kW]



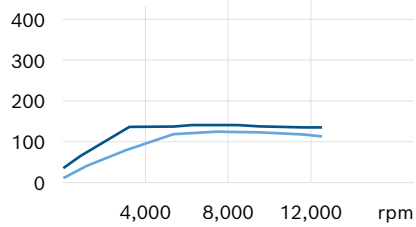
SMG220-OHW

Voltage range	< 425 V_{DC}
Power peak[2]	140 kW / 190 hp
Power continuous[2]	120 kW / 160 hp
Torque peak[2]	350 Nm
Torque continuous[2]	200 Nm
Efficiency$_{peak}$[4]	96 %
Coolant flowrate	8 l/min
Weight	63 kg
Dimensions	~Ø 286 × 337 mm
Max speed	15,000 rpm

Torque (400 V) [Nm]



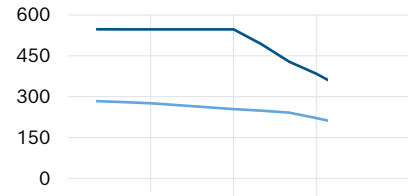
Power (400 V) [kW]



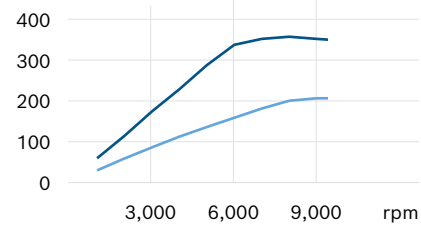
SMG230-OHW

Voltage range	< 850 V_{DC}
Power peak[3]	360 kW / 490 hp
Power continuous[3]	200 kW / 270 hp
Torque peak[3]	550 Nm
Torque continuous[3]	284 Nm
Efficiency$_{peak}$[4]	97 %
Coolant flowrate	10 l/min
Weight	60 kg
Dimensions	~Ø 345 × 283 mm
Max speed	12,000 rpm

Torque (800 V) [Nm]



Power (800 V) [kW]



Peak power Nominal power

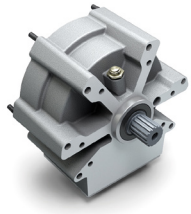
[1] $T_{Coolant}$ 65 °C; power/torque at 400 V_{DC} continuous, peak ≙ 10 sec.

[2] $T_{Coolant}$ 45 °C; power/torque at 400 V_{DC} continuous, peak ≙ 10 sec.

[3] $T_{Coolant}$ 40 °C; power/torque at 800 V_{DC} continuous, peak ≙ 30 sec.

[4] Motor and inverter

Gearbox



EDT180

1 speed planetary gear box

Ratio	3.086; 4.318
Torque peak (out)	615 Nm
Power peak	90 kW
Speed max (in)	12,800 rpm
Efficiency	up to 98 %
Cooling	Water glycol mixture
Oil pump	Internal active oil cooling/lubrication
Weight	15 kg
Dimensions	259 × 140 × 263 mm
Compatible motor	SMG180

eGFZ9125

1 speed spur gear box

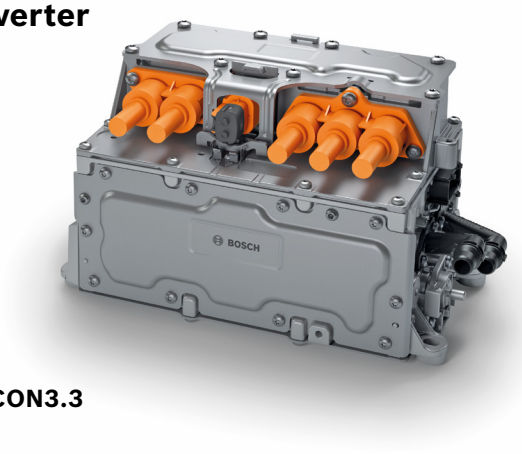
Ratio	4.6 (optional available: 4; 5; 6)
Torque peak (out)	3,800 Nm
Power peak	140 kW
Speed max (in)	16,000 rpm
Efficiency	up to 98 %
Cooling	Water glycol mixture
Oil pump	Integrated (CAN controlled)
Weight	49 kg
Dimensions	329 × 457 × 336 mm
Compatible motor	SMG220

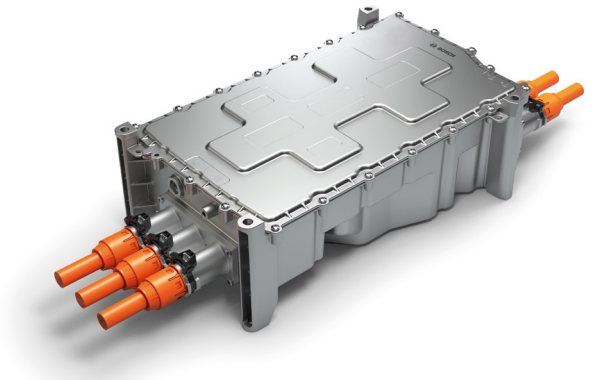
eGFV9120

1 speed planetary gear box

Ratio	3.77; 4.34
Torque peak (out)	2,100 Nm
Power peak	360 kW
Speed max (in)	12,000 rpm
Efficiency	tbc.
Cooling	Water glycol mixture
Oil pump	Splash lubrication
Weight	~26 kg (tbc)
Dimensions	Ø 335 × 220 mm
Compatible motor	SMG230

Inverter





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Typ. power	140 kW
Voltage range	205 – 425 V_{DC}
Supply voltage	12 V
Current peak	480 A_{rms}
Current continuous	250 A_{rms}
DCDC power (12 V)	2.8 kW
Water cooled	8 l/min, 65 °C
Protection	IP6K6K, IP6K9K
Software	Control software with config. interface (UDS, BODAS Service) and CAN 2.0 A (500 kbit/s); trq- & n-control
Weight	10 kg
Dimensions	352 × 192 × 194 mm
Compatible motor	SMG180, SMG220

Inverter Gen4

Typ. power	360 kW
Voltage range	400 – 845 V_{DC}
Supply voltage	12/24 V
Current peak	550 A_{rms}
Current continuous	307 A_{rms}
DCDC power (12 V)	–
Water cooled	10 l/min, 65 °C
Protection	IP6K6K, IP6K9K
Software	Control software with config. interface (UDS, BODAS Service) and J1939; trq-, n- and U-control
Weight	17 kg
Dimensions	533 × 343 × 160 mm
Compatible motor	SMG230

For the electrification of marine applications, Bosch Engineering offers three different solution approaches:

Plug-and-Play complete solution: The new electric drive for marine applications (EDM), featuring an electric inboard motor and further system components from a single source.

Pre-defined modular solution: The Electric Drive System Platform (EDSP), where various drive components can be flexibly and modularly combined.

Individual drive components: Robust drive components, proven through technology transfer from automotive large-scale production, for independent integration.

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