

**BALLARD™**

**FCwave™**

# Fuel Cell Power Module for Marine Applications

Ballard's 200kW system, FCwave™, is designed to provide zero-emission power to vessels. The culmination of product development and field experience based on more than 100 million kilometers of heavy-duty vehicle operation, FCwave™ uses proven technology from Ballard's heavy duty module portfolio to deliver reliable performance, high power density and favorable economics.

Ballard's FCwave™ is developed and tested for marine environments, and is the world's first DNV Type Approved Fuel Cell for marine applications. The system is scalable from 200kW to MWs to suit a broad range of vessels operating on short or longer and demanding routes.



## Features

### Modular, Scalable Power

Available in 200kW increments, FCwave™ facilitates scalable power output and flexible integration onto the vessel.

### Low Lifecycle Cost

Low total-cost-of-ownership, achieved through product performance optimization, common components across product platforms and low maintenance requirements.

### Long Lifetime

Powered by Ballard's FCgen®-LCS heavy duty liquid cooled stack and designed to deliver long term performance.

### Ease of Integration

The system is integrated into a clean-lined cabinet with easy access doors and all interfaces accessible from the front for service and maintenance.

### Safe Operation

Designed hand-in-hand with the industry to withstand the rigors of the marine environment, FCwave™ is developed, tested and prepared for installation with an uncompromising focus on safety.

### Remote Diagnostics

Diagnostics connection allows the customer to monitor performance data remotely and plan for preventative maintenance.

### Technology Leadership

The same Ballard fuel cell technology powering FCwave™ is already proving itself in more than 3,600 fuel cell electric trucks and busses deployed in China, Europe and North America.

Approved by:



## Product Specifications

### Performance

Rated power	200kW
Minimum power	55kW
Peak fuel efficiency	53.5%
Operating voltage	350 - 720 V DC
Rated current <sup>1</sup>	2 x 300 A or 1 x 550 A
System cooling output	Max 65° C

### Stack technology

Heat management	Liquid cooled
H <sub>2</sub> Pressure	3.5 - 6.5 barg

### Physical

Dimensions (L x w x h) <sup>2</sup>	1209 mm x 741 mm x 2195 mm
Weight (estimate) <sup>3</sup>	1000 kg
Environmental protection	IP44
Engine room (DNV CG-0339)	+0°C - +45°C
Minimum start-up temperature	0°C
Short-term storage temperature	-40°C - +60°C

### Reactants and Coolant

Type	Gaseous hydrogen
Composition	As per SAE spec. J2719 and ISO 14687:2019 Type I, Type II - Grade D
Oxidant	Air
Composition	Particulate, Chemical and Salt filtered
Coolant <sup>4</sup>	Water or 50/50 glycol

### Safety Compliance

Certifications	DNV-Type Approval , Lloyds Register Approval and ABS (American Bureau of Shipping) Approval
Enclosure	Sealed secondary barrier for hydrogen

### Monitoring

Control interface	Ethernet, CAN
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### Emissions

Exhaust	Zero-emission
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<sup>1</sup> System Output (1x550A output pending tests). <sup>2</sup> Target size. <sup>3</sup> Includes: framed skid base, fuel cell stacks, plumbing and wiring, H<sub>2</sub> enclosure, cooling system, air system, electrical panel, and miscellaneous (sensors, cable tray, etc.). <sup>4</sup> Customer coolant type.