



Power to change the world®

## Fuel Cell Power Module for Marine Applications

### Description

Ballard's 200 kW system, FCwave™, is specifically designed to provide zero-emission power to vessels. The culmination of product development and field experience based on more than 50 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™ fuel cell system is tested and certified for operation in marine environments. The system is scalable from 200kW to MWs to suit a broad range of vessels including ferries, barges and hotel load for cruise ships.

### Features

#### Modular, Scalable Power

Available in 200 kW 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 industry to withstand the rigors of the marine environment and meet the most stringent safety standards.

#### Remote Diagnostics

Direct 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 3,000 fuel cell electric trucks and buses deployed in China, Europe and North America.





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## PRODUCT SPECIFICATIONS

	FCwave™
<b>Performance</b>	
Rated power	200 kW
Minimum power	30 kW
Peak fuel Efficiency	56 %
Operating voltage	350 - 720 V DC
Rated current <sup>1</sup>	2 x 300 A 1 x 550
System cooling output	Max 65° C
<b>Stack technology</b>	
Heat management	Liquid cooled
H2 Pressure	3,5 - 5 Barg
<b>Physical</b>	
Dimensions (l x w x h) <sup>2</sup>	1220 mm x 738 mm x 2200 mm
Weight (estimate) <sup>3</sup>	875 kg
Environmental protection	IP44
Engine room (DNV GL CG-0339)	+0° C - +45° C
Minimum start-up temperature	0° C
Short-term storage temp	-40° C - +80° C
<b>Reactants and Coolant</b>	
Type	Gaseous hydrogen
Composition	As per SAE spec. J2719
Oxidant	Air
Composition	Particulate, Chemical and Salt filtered
Coolant <sup>4</sup>	Water or 50/50 glycol
<b>Safety Compliance</b>	
Certifications	DNV-GL compliant
Enclosure	Hydrogen safe enclosure
<b>Monitoring</b>	
Control interface	Ethernet, Can
<b>Emissions</b>	
Exhaust	Zero-emission

<sup>1</sup> System output is 2 x 300 A (1 x 550A output still under development). <sup>2</sup> Target size. <sup>3</sup> Includes: framed skid base, fuel cell stacks, plumbing and wiring, H2 enclosure, cooling system, air system, electrical panel, and miscellaneous (sensors, cable tray, etc.). <sup>4</sup> Customer coolant type.