Hydrogenics HD Power Modules:

Flexible, Rugged And Streamlined
Hydrogenics merges its stack with a balance-of-plant into a fully integrated, streamlined unit, resulting in our easy-to-implement HD Power Modules. Our award-winning stack technology together with a flexible balance-of-plant allows for end-to-end integration of a turnkey system.

Our HD Power Modules are designed to deliver superior performance, durability and reliability. We bring our integration experience to help you get the most out of your fuel cell system.

A Track Record Of Success:
Proven Technology
Our engineering, design and customer service teams work closely with customers to ensure that their needs are met. We use our experience and expertise to design adaptable hydrogen solutions that are flexible enough to fit multiple applications, while remaining cost-competitive with generic solutions.

Innovative use of modular power, modular and systems technology drives our global market expansion. Our engineering experience and our ability to design adaptable hydrogen solutions are key to our success. Our commitment to innovative and adaptable technology ensures that we can meet the needs of a wide range of industries and applications.

The Human Factor:
Putting Customers First
At Hydrogenics, we are in the business of helping our customers succeed. Our customer service team has decades of hydrogen experience failure-free. From the first hydrogen-powered passenger train to the first fuel cell-powered airplane and more, we put customers first.

THE INDUSTRY BENCHMARK FOR DURABLE, ZERO EMISSION MOBILITY

For light and heavy duty mobility
WHY CHOOSE HYDROGENICS HD POWER MODULES?

Tried, tested and proven solutions for zero-emission mobility.

Liquid-cooled advanced MEA PEM stack
- Unique balance of plant
- Advanced technology and robustness
- 60 kW module design capability
- Local exhaust and no re-pressuring
- Unintended start and stop capability
- Power: 50% or more available
- More power, less current
- No water required for humidification
- No nitrogen purge requirement
- Designed for ease of UL and CE system certifications

Additional "inside the box" features reduce challenges for integrators
- Air delivery sub-systems
- Integrated hydrogen regulation
- Anti-flood/dry protection

And useful options:
- Overall system controller
- Busbar/contactor kit
- Thermal management sub-system
- Fluid heating for multi-unit configurations

Our HD Power Modules are cost-effective and reliable for battery electric mobility applications

- Low Temperature Starts
- Can be stored and operated in temperatures as low as -40°C degrees without fear of damage or failure.

Fully Integrated System
- One compact fuel cell system for easy, seamless integration, without the need for additional components.

Water-Free Operation
- Our fuel cells do not require water for humidification. With no residual water, there’s no risk of freezing or moisture issues.

Unlimited Start/Stop Cycles
- Hydrogenics’ fuel cells can be turned on and off as needed without degradation.

Flexible, rugged and streamlined
- Next generation OS: Intelligent Fuel Cell Management System (FCMS)
- Streamlined, rugged recirculation pump and controller
- Improved durability in sub-zero, high-vibration, and high stress environments
- Improved electrical isolation
- Streamlined piping for pressure stability and sub-zero performance
- Flexible heating options (electric and fluid-based)

HD 30
- Improved 3rd Generation HD Power Modules
- Flexible, rugged and streamlined
- Next generation OS: Intelligent Fuel Cell Management System (FCMS)
- Streamlined, rugged recirculation pump and controller
- Improved durability in sub-zero, high-vibration, and high stress environments
- Improved electrical isolation
- Streamlined piping for pressure stability and sub-zero performance
- Flexible heating options (electric and fluid-based)

Built on our industry-leading architecture
- High output, single stack
- 60 kW net power
- Increased thermal efficiency and reliability
- Streamlined high power architecture
- Industry leading small footprint, high power density
- Combine units for higher output with fewer stacks
- Available in single-blower, 45kW configuration (HD45)

Introducing the HD 50
- High output, single stack
- 50 kW net power
- Increased thermal efficiency and reliability
- Streamlined high power architecture
- Industry leading small footprint, high power density
- Combine units for higher output with fewer stacks
- Available in single-blower, 45kW configuration (HD45)
WHY CHOOSE HYDROGENICS HD POWER MODULES?

Tried, tested and proven solutions for zero-emission mobility.

- Liquid-cooled advanced MEA PEM stack
- Integral Balance of Plant
- Advanced onboard controls and diagnostics
- +40°C cell warm-up capability
- Rapid start-up and dynamic response
- Unrealized exact fuel economy
- Zero purge requirement
- No water required for humidification
- No nitrogen purge requirement
- Designed for ease of UL and CE system certifications

Additional ‘inside the box’ features reduce challenges for integrators

- Air delivery sub-systems
- Integrated hydrogen regulation
- Anti-flood/dry protection

And useful options:

- Overall system controller
- Busbar/contactor kit
- Thermal management sub-system
- Fluid heating for multi-unit configurations

Our HD Power Modules are cost-effective and reliable for battery electric mobility applications

- Low Temperature Starts
- Can be stored and operated in temperatures as low as -40°C degrees without fear of damage or failure.

- Fully Integrated System
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- Unlimited Start/Stop Cycles
- Hydrogenics’ fuel cells can be turned on and off as needed without degradation.

- Compact size for space constrained applications

- Fuel Cell Management System (FCMS)
- Our proprietary operating software maximizes performance and optimizes lifespan.

Introducing the HD 50

- Built on our industry-leading architecture
- High output, single stack
- Increased net power
- Streamlined high power architecture
- Industry leading small footprint, high power density
- Combine units for higher output with fewer stacks
- Available in single-blower, 45kW configuration (HD45)

Improved 3rd Generation HD Power Modules

- Flexible, rugged and streamlined
- Next generation OS: Intelligent Fuel Cell Management System (FCMS)
- Streamlined, rugged recirculation pump and controller
- Improved durability in sub-zero, high elevation, and high stress environments
- Improved efficiency in multi-unit configurations (thermal and sub-zero performance)
- Flexible heating options (electrical and fluid-based)

HD 30

- Improved 3rd Generation HD Power Modules
- Flexible, rugged and streamlined
- Next generation OS: intelligent Fuel Cell Management System (FCMS)
- Streamlined, rugged recirculation pump and controller
- Improved durability in sub-zero, high vibration, and high stress environments
- Improved electrical isolation
- Streamlined piping for pressure stability and sub-zero performance
- Flexible heating options (electrical- and fluid-based)
WHY CHOOSE HYDROGENICS HD POWER MODULES?

Tried, tested and proven solutions for zero-emission mobility.

- Liquid-cooled advanced MEA PEM stack
- Integral Balance of Plant
- Advanced onboard controls and diagnostics
- -40°C sub-zero shutdown capability
- Rapid start-up and dynamic response
- Unlimited start and stop cycles
- No water required (for humidification)
- Anti-flood/dry protection

Additional ‘inside the box’ features reduce challenges for integrators

- Air delivery sub-systems
- Integrated hydrogen regulation

And useful options:

- Overall system controller
- Busbar/contactor kit
- Thermal management sub-system

Our HD Power Modules are cost-effective and reliable for battery electric mobility applications

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Hydrogenics HD Power Modules:

Flexible, Rugged And Streamlined

Hydrogenics merges its stack with a balance-of-plant into a fully integrated, streamlined unit, resulting in our easy-to-implement HD Power Modules. Our proven low-pressure Proton Exchange Membrane (PEM) fuel cell architecture is at the core of our HD lineup. Our HD Power Modules are designed to deliver superior performance, durability and reliability, along with our integration expertise to help you get the most out of your fuel cell system.

A Track Record Of Success:

Proven Technology

Our award-winning design and delivery practices are proven with over 100 applications worldwide, providing the infrastructure for hydrogen-fueled vehicles. Our team of experts have the experience to design reliable systems with a minimum of service and maintenance issues, retaining cost-competition with generic solutions.

In the end it’s all about proven, reliable and standards-based technology. With a global market presence, our design and engineering expertise offers you proven technology and world-class service excellence. HD Power Modules, like any Hydrogenics solution is not a case of ‘plug and play’.

The Human Factor:

Putting Customers First

At Hydrogenics, we are in the business of helping our customers succeed. For us, customer success has always been the key driver behind everything we do. Our hydrogen solutions are designed from our first customer’s unique needs to have reliable, efficient and cost-effective fuel cell electricity systems that produce clean, safe and reliable fuel cell electricity for commercial transportation.

TECHNICAL SPECIFICATIONS

<table>
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<th>Model</th>
<th>Continuous Power (kW)</th>
<th>Dimensions (LxWxH) (mm)</th>
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<th>Mass (kg)</th>
<th>Operating Current (A)</th>
<th>Operating Voltage (V)</th>
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<td>HD 8</td>
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*Note: The above data is for reference only and is subject to change without notice. © Hydrogenics 02-2019.*

Available in lightweight, higher voltage and aerospace configurations

Available in 45kW configuration (HD 45)

For light and heavy duty mobility
THE INDUSTRY BENCHMARK FOR DURABLE, ZERO EMISSION MOBILITY

World-leading fuel cells for the world’s first hydrogen commuter train.

Delivered equipment for over 55 hydrogen fueling stations to support the growth in fuel cell electric vehicles.

HD 50
Not including externally powered blower

For light and heavy duty mobility
THE INDUSTRY BENCHMARK FOR DURABLE, ZERO EMISSION MOBILITY

We’re ready.
Hydrogenics HD Power Modules:

Flexible, Rugged And Streamlined

Hydrogenics merges its stack with a balance-of-plant into a fully integrated, streamlined unit, resulting in our easy-to-implement HD Power Modules. Our HD Power Modules are designed to deliver superior performance, durability and reliability. We bring our integration experience to help you get the most out of your fuel cell system.

A Track Record Of Success:

Proven Technology

Our award-winning design allows our customers to work with a proven, reliable source. What you get is a hydrogen solution that is tuned to your operations, using our experience and expertise to design adaptable hydrogen solutions for any environment. Our design allows for the operation of multiple HD Power Modules in parallel, maintaining ease of use while remaining cost competitive with generic solutions.

The Human Factor:

Putting Customers First

At Hydrogenics, we are in the business of helping our customers succeed. Our focus is on our customers and how we deliver solutions that allow them to achieve their goals. We deliver a broad range of hydrogen solutions, from the first hydrogen-powered passenger train to the first fuel cell-powered airplane and more, putting customers first.