





# Fuel Cell Power for Rail applications

Ballard's FCrail™ –HD+ is specifically designed for rail applications that require zero-emission power. The culmination of our product development and field experience exceeds 50 million kilometers of vehicle operation and FCrail™–HD+ leverages Ballard's proven technology to deliver reliable performance, high power density, and provide economical zero-emission solutions for rail.

# **Features**

# Lower Life Cycle Cost

When compared to previous products, our newest generation can provide better fuel economy and fewer maintenance requirements, reducing the total cost of ownership by 35%.

#### **Subsystem Integration**

Completely integrated with system controller, hydrogen shutoff, pressure regulation, recirculation pump, purge valve assembly, and water seperator. All interfaces designed on one panel for simplicity and to provide easier access for connections and maintenance.

#### **Robust Components**

Designed with a new generation of more robust balance of plant components to improve reliability.

# System Integration Flexibility

Rooftop design enables greater flexibility in rail applications from an enhanced low-profile power module.

# Freeze-Start Capability

Freeze start from -25°C, with no need to plug in the vehicle or use special start procedures.

## Humidification

Integrated humidification system is maintenance free and provides maximum system performance and durability through a wide range of environmental conditions.

#### **High Performance**

Robust PEM fuel cells deliver the power, range, and efficiency demanded by rail operators.

# Proven Reliability & Durability

Demonstrated through exceptional fuel cell stack lifetime, with >30,000 hours of operation and 97% module availability in service.

#### **High Temperature Operation**

Permits a smaller cooling package for integration flexibility and generates HVAC heating, significantly improving overall vehicle fuel economy.

#### Climate Protection

IP6K9K – rated enclosure system guards against premature deterioration of key module components in extreme climates.

### **High Pressure System**

Ensures better performance, fuel efficiency and durability by preventing degradation of the fuel cell power module.

#### **Fuel Efficiency**

Two to three times more efficient than CNG/ diesel engines, which reduces overall fuel consumption.

# **Remote Diagnostics**

Direct or wireless connections allows customers to monitor performance data remotely, and anticipate preventative maintenance.

#### Safety Features

Integrated safety system with ventilation fans, high voltage disconnect, and hydrogen sensor built into the module to ensure highest safety and ease of installation.

# Product Specifications\*

Net system power         100 ± 2 kM           Operating system current         60 – 360 A           Operating system voltage         280 – 560 V           Idle power         9 kW           Physical System voltage           Physical System voltage           Divisions (x w k h mm, excluding air filter         1704 × 808 x 395           Divisions (x w k h mm, excluding air filter         1704 × 808 x 395           Division mental protection         196 K9K           Environmental protection         196 K9K           Minimum start-up temperature         -25° C           Minimum start-up temperature         -25° C           Short-tern storage temp         36 seous hydrogen           Fuel Type         As per SAE J2719, ISO 14687:2019 grade D           Fuel Type         57%           Such supply pressure         8 barg nominal           Oxidant         57%           Oxidant         57%           Oxidant         60 cy nominal           Experimentative frequency         60°C nominal           Assety Compliance         57%           Experimentative frequency         60°C nominal           Experimentative frequency         60°C nominal           Experimentative frequency         60°C	Performance	
Operating system voltage     280 - 560 V       Idle power     9 kW       Physical       Dimensions (l x w x h) mm, excluding air filter     1704 x 808 x 395       Dry Weight, excluding air filter     295 kg       Environmental protection     18649K       Operating temperature     -30°C + 50°C       Minimum start-up temperature     -25°C       Khort-term storage temp     440°C + 80°C       Reactants and Coolant       Fuel Type     Gaseous hydrogen       Fuel purity     As per SAE J2719, ISO 14687:2019 grade D       Fuel supply pressure     8 barg nominal       Peak fuel efficiency     57%       Oxidant     Air       Coolant     60°C nominal       Safety Compliance     60°C nominal       Certifications     BISO23273 2013, ISO6469-3 2011, ISO6469-2 2009, SAE J2578, UN ECE Reg 18, ISO535, IEC 60077-1, ISO 3744, EN 50153, EN 50343, EN 61373       Monitoring     CELTRANS/ISO/Add/13, REACH, EN 50657, DIN 2520, VDI 2230, EN 50126, EN 50155, IEC 60077-1, ISO 3744, EN 50153, EN 50343, EN 61373       Control Interface     AN bus, Ethernet       Emissions	Net system power	100 ± 2 kW
Idle power     9 kW       Physical     1704 x 808 x 395       Dimensions (I x w x h) mm, excluding air filter     1704 x 808 x 395       Dry Weight, excluding air filter     295 kg       Environmental protection     IP6K9K       Operating temperature     -30°C - +50°C       Minimum start-up temperature     -25°C       Short-term storage temp     -40°C - +80°C       Reactants and Coolant       Fuel Type     Gaseous hydrogen       Fuel purity     As per SAE JZ719, ISO 14687-2019 grade D       Fuel supply pressure     8 barg nominal       Peak fuel efficiency     57%       Oxidant     Air       Goolant     Ethylene glycol 50% to 60% by volume, balance DI water       Radiator coolant outlet temperature     60°C nominal       Safety Compliance       Erifications       Bristions     IISO23273 2013, ISO6469-3 2011, ISO6469-2 2009, SAE J2578, UN ECE Reg 10, ECE/TRANS/180/Add13, REACH, EN 50637, DIN 25201, VDI 2230, EN 50126, ECE/TRANS/180/Add13, REACH, EN 50637, DIN 25201, VDI 2230, EN 50126, ECE/TRANS/180/Add13, REACH, EN 50637, DIN 25201, VDI 2230, EN 50126, ECE/TRANS/180/Add13, REACH, EN 50637, DIN 25201, VDI 2230, EN 50126, ECE/TRANS/180/Add13, REACH, EN 50637, DIN 25201, VDI 2230, EN 50126, ECE/TRANS/180/Add13, REACH, EN 50637, DIN 25201, VDI 2230, EN 50126, ECE/TRANS/180/Add13, REACH, EN 50637, DIN 25201, VDI 2230, EN 50126, ECE/TRANS/180/Add13, REACH, EN 50637, DIN 25201, VDI 2230, EN 50126, ECE/TRANS/180/Add13, REACH, EN 50637, D	Operating system current	60 - 360 A
Physical  Dimensions (I x w x h) mm, excluding air filter 1704 x 808 x 395  Dimensions (I x w x h) mm, excluding air filter 295 kg  Environmental protection 186K9K  Operating temperature 295°C  Minimum start-up temperature 25°C  Short-term storage temp 40°C - +80°C  Reactants and Coolant  Fuel Type Gaseous hydrogen 57%  Fuel supply pressure 8 barg nominal 98 barg nominal 99 barg problem 99 barg	Operating system voltage	280 - 560 V
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Coolant  Radiator coolant outlet temperature  60°C nominal  Safety Compliance  Certifications  IISO23273 2013, ISO6469-3 2011, ISO6469-2 2009, SAE J2578, UN ECE Reg 10, ECE/TRANS/180/Add.13, REACH, EN 50657, DIN 25201, VDI 2230, EN 50126, EN 50155, IEC 60077-1, ISO 3744, EN 50153, EN 50343, EN 61373  Monitoring  Control Interface  CANbus, Ethernet  Emissions	Peak fuel efficiency	57%
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Emissions	Monitoring	
	Control Interface	CANbus, Ethernet
Exhaust Zero-emissions (no PM, NOx, SOx, CO or CO2)	Emissions	
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1Specific clauses within each standard \* Specifications are subject to change without notice

