PureCell® Model 400 H2

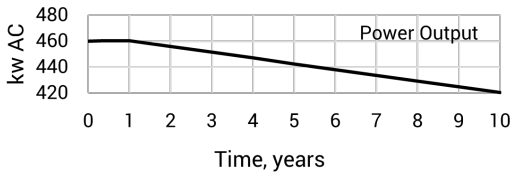
THE CLEAN ENERGY YOU COUNT ON™

PureCell® M400 is a clean reliable stationary power and heat source for facilities and utilities. The heart of the system is a phosphoric acid fuel cell (PAFC) which safely converts hydrogen and air electrochemically with an efficiency of up to 90% CHP. The PureCell® unit helps customers meet rigorous emissions requirements by generating power without combustion, eliminating the formation of NOx. It also provides heat that can be used for space heating, hot water, or driving absorption chillers.

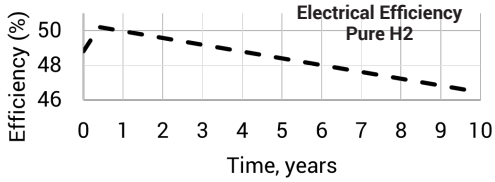
PRODUCT SPECIFICATIONS

ELECTRIC OUTPUT

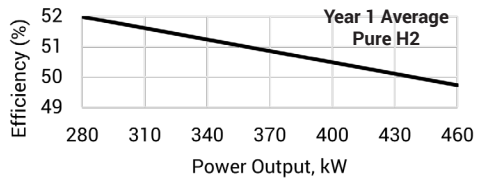
460 kW/unit, maximum at year 1 (532 kVA with 0.865 power factor), 420 kW at year 10



Pure H2: Average lifetime efficiency of 48.3 ±1.3% at max power based on LHV. Average year 1 efficiency 49.7%.



Operating at lower power levels will offer increased efficiency:



480 Volts, 3-Phase, 3-Wire, 60 Hz

Distributed Generation with Grid Independent Options for Backup Power

Electrical Load-Following Control

Harmonics: Compliant with IEEE 1547 Section 4.3.3 Table 3

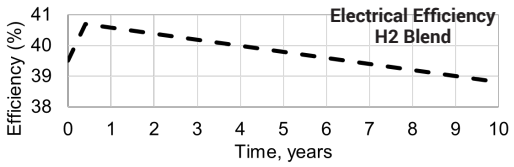
Protection: In accordance with UL1741SB and IEEE1547

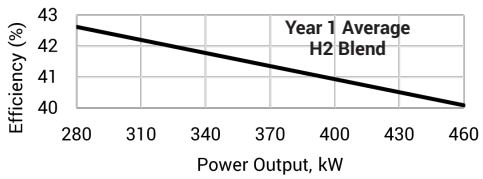
Transition times

- Full power in 15 minutes
- 10 kW/sec load setpoint change

Time Since Start (Minutes)	AC Power (kW)
10	10
11	112
12	232
13	353
14	428
15	460

H2 Blend: Average lifetime efficiency of 39.8 ±1.3% at max power based on LHV of hydrogen. Average year 1 efficiency 40.3% (33.1% of fuel power is returned to the customer).





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LIFE and RELIABILITY
20 yr Product Life
97% + Availability

EMISSIONS COMPLIANCE
Zero emissions: CO, CO2, NOx, SOx

SAFETY
Certified to FC 1-2021 North American Standard for Stationary Fuel Cell Power Systems

NOISE
Powerplant: <60 dBA @ 10 m
Dry Cooler: <69 dBA @ 10 m
Total Noise: <70 dBA @ 10 m

PRODUCT SPECIFICATIONS (HEAT MAP)

Nominal average heat in 1st year of operation in table below:

Cooling:

Up to 75 RT, assuming absorption chiller COP 0.83

Flow	Inlet Temp		Heat Available		Outlet Temp	
GPM	°C	°F	kW	MMBTU/hr	°C	°F
30	30	86	451	1.54	87	189
30	60	140	324	1.10	101	215
30	90	194	238	0.81	121	250
50	30	86	465	1.59	65	150
50	60	140	325	1.11	85	185
50	90	194	291	0.99	113	235
90	30	86	470	1.60	50	122
90	60	140	326	1.11	74	165
90	90	194	298	1.02	103	217

INPUT REQUIREMENTS

FUEL SOURCE

Fuel Composition: Hydrogen, Hydrogen Mix

- **Supply pressure:** 5+/- 0.25 bar(g), Particle Size: <1µm
- **Max Design Flow:** 4.42 MMBTU/hr (20,380 SCFH)
- **Average consumption in first year in Pure H2 mode:** 3.8 MMBTU/hr (1109 kW) based on HHV when operating at 460 kW/ 532 kVA

1. Some accommodations can be made for fuel standards that do not meet this specification. Contact HyAxiom for further discussion if the site fuel composition exceeds any of these limits.

Fuel Component	Standard Allowable Content Limit [1]
Hydrogen	H2 blend > 80%, Pure H2 > 97%
Total Sulfur	H2 blend < 1.0 ppm (single path) Pure H2 < 0.01 ppm
NH_3	< 0.5 ppm
Halides	< 1 ppm
CO	H2 blend < 3000 ppm, Pure H2 < 30 ppm
O_2	< 2000 ppm

HEAT TRANSFER FLUID

- **Fluid:** Water, glycol/water mix can be used instead, standard derate applies
- **The chloride content** must be less than 0.5 ppmw and free chlorine content less than 0.25 ppmw

FILL WATER SUPPLY

Pressure Range: 40 psig (275 kPag) - 80 psig (550 kPag)
Water is only required for startup and select servicing events.

Condition	Max Allowable Level
Total Dissolved Solids (TDS)	500 mg/L [1]
Turbidity (NTU)	<1.0
Silica (Si, all forms)	<25 ppmw, mg/L[1]

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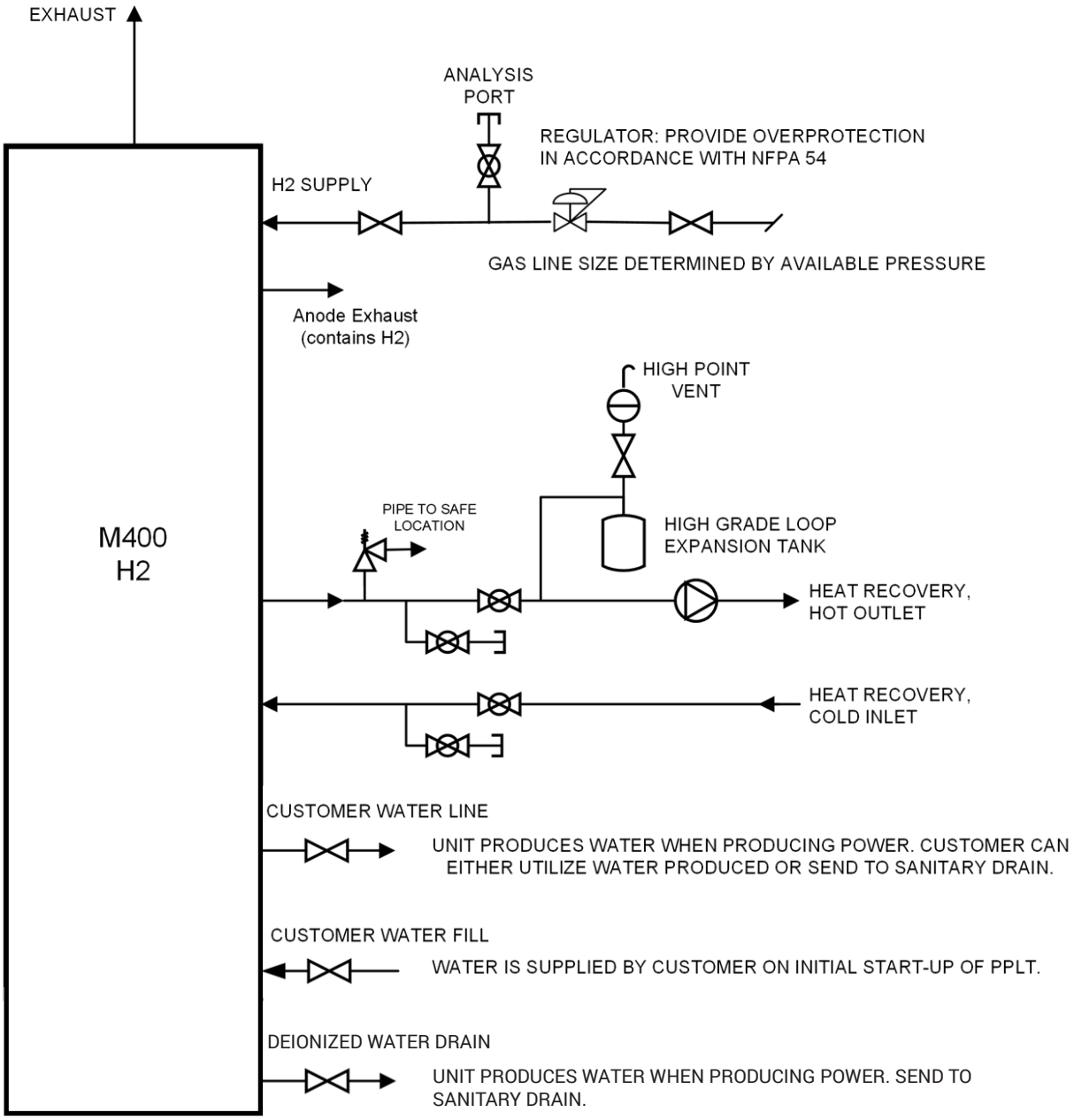
PRODUCT WATER DRAIN

Permanently installed drain per local code requirements will accommodate overflow water: pH 6-9, temperature <140°F (60°C) flow is 0 to 36 GPH (136 L/h). Drain should be sized to accommodate maximum water production rate. The unit has the capability of producing up to 36 GPH of liquid water for use by the customer. If desired, the system can be configured to direct this water as per the customer site needs.

INPUT REQUIREMENTS

CUSTOMER FLUID INTERFACES

Diagram shows typical hardware that interfaces with the PureCell® Model 400 and would be owned by the customer.



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INPUT REQUIREMENTS

REMOTE MONITORING SYSTEM (RMS)

Industry-leading servicing and maintenance reporting provides 24/7 monitoring of systems. HyAxiom maintains remote access to each Model 400 to initiate startups, power output setpoints and shutdown commands. The RMS provides HyAxiom notification if any service is needed to the unit. An internet connection is needed via a customer-provided secured ethernet connection. Customer access to remote data is available upon request.

CONTROLLER CONNECTIONS

Optional. Real time data available through RMS Customer Portal

- Power Output
- Operating Mode
- Operating Hours
- Cumulative Electricity Generated
- Return and Supply Temperatures
- Fuel Flowrate
- Cumulative Fuel Consumed
- Instantaneous Electricity Efficiency
- Instantaneous Heat Recovery
- Heat Recovery Flowrate
- Cumulative Heat Recovery

Optional. Customer-provided control devices and wiring can interface with the M400 to collect additional data and issue commands

ENVIRONMENTAL CONDITIONS

Ideal environmental conditions are given below; conditions outside of those specified can be evaluated for feasibility.

Elevation

Up to 365 meters (1200 ft) to achieve maximum power production and efficiency, derating at higher elevations.

Temperature Range

-29ºC to 40ºC (-20°F to 104°F). The unit is capable of operating at temperatures exceeding 40°C with a derate. Please consult HyAxiom for further details.

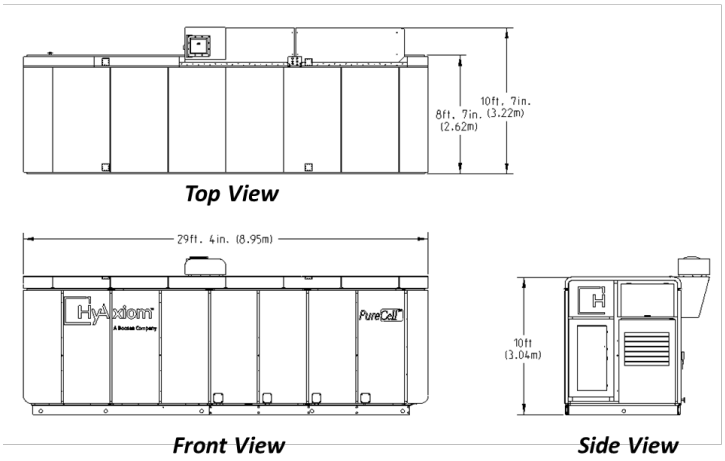
Seismic Parameters

M400 is designed to ASCE 7-05 Occupancy Category IV, Site Class D, Ss=3.0, S1=1.3, I=1.5, Ip=1.5.

SITE INSTALL

Outdoor, roof, and indoor installation possible with the following clearances for installation and servicing: I.5 m (5ft) of clearance on all sides of the unit, 3m (10ft) of clearance on the long non-hooded side of the unit, 1.8 m (6ft) of clearance above the unit.

System Dimensions

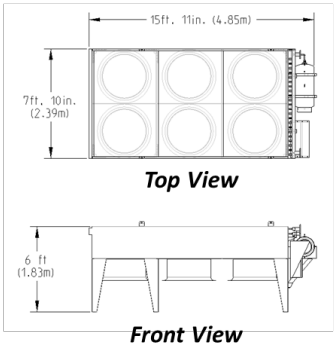


Top View

Front View

Side View

Power Module



Top View

Front View

Cooling Module (can be sited remotely from the power module or on top of Power Module roof)

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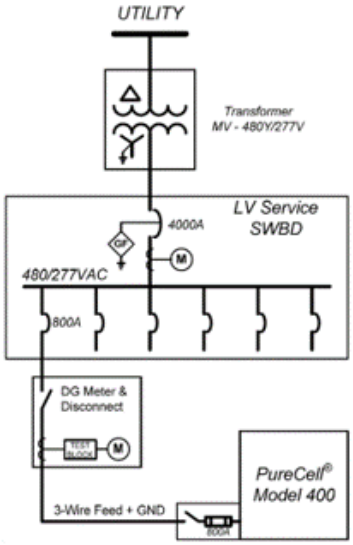
INPUT REQUIREMENTS

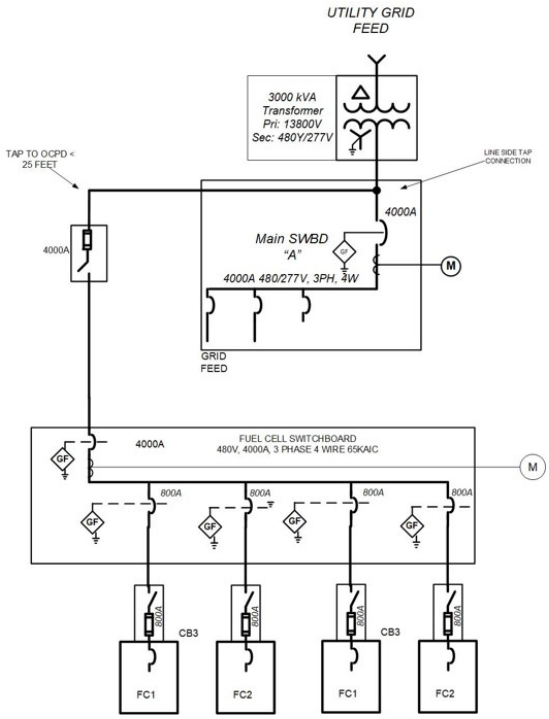
POWER INTERFACES

Connection: 4-wire grounded Wye power distribution with dedicated feeder circuit breaker or fused switch connects to the M400

480 VAC, 3-phase, 3-wire plus ground, 60 Hz electrical input/output



Single -Unit Site



PRODUCT OPTIONS

GRID INDEPENDENT (GI) OPERATION

- Automatic synchronization with facility grid; no additional synchronizing equipment required
- 400 kW/471 kVA
- Transition from grid to GI mode occurs within 10 seconds

ENERGY STORAGE SYSTEM (ESS)

An option for more seamless Grid to Grid Independent operation transition, offering a near-instantaneous transition.

MULTI UNIT LOAD SHARING (MULS)

Applicable to sites that include multiple units that are operating together as a single-generation entity in grid independent mode. This option utilizes an energy storage system (ESS) combined with an energy management system to facilitate near-instantaneous load transitions and provide complete microgrid solution.

PRODUCT WATER

The M400 H2 has the capability of producing up to 36 GPH of liquid water for use by the customer. If desired, the system can be configured to direct this water as per the customer site needs or sent to sanitary drain. Otherwise, the system will be programmed to exhaust product water as vapor.

PRODUCT LIFE

20 years with cell stack design life of 10 years.

FREQUENCY

The unit can be configured to operate at 50 Hz or 60 Hz.

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