



# Product Specification

## Capstone Microturbine<sup>®</sup> Model C200S

---



**Capstone Turbine Corporation**

16640 Stagg Street • Van Nuys • CA 91406 • USA

Telephone: +1 (818) 407-3600

Facsimile: +1 (818) 734-5382

Website: [capstoneturbine.com](http://capstoneturbine.com)

Document Library: [documents.capstoneturbine.com](http://documents.capstoneturbine.com)

**Capstone Technical Support**

Telephone: +1 (866) 4-CAPSTONE or (866) 422-7786

E-mail: [service@capstoneturbine.com](mailto:service@capstoneturbine.com)

Copyright © 2017 Capstone Turbine Corporation. All Rights Reserved.

## Table of Contents

1. Summary .....	4
2. Available Model Types.....	4
3. Specifications .....	6
4. Fuel Input Requirements at Full Load Power .....	8
5. Performance Derating .....	9
6. Certification Information.....	11
7. Disclaimer Statement .....	11

## List of Figures

Figure 1. C200S Net Power Output vs. Ambient Temperature .....	9
Figure 2. C200S Net Efficiency vs. Ambient Temperature.....	10

## List of Tables

Table 1. C200S Model Designations .....	5
Table 2. Nominal C200S Microturbine Specifications .....	6
Table 3. Fuel Input Requirements .....	8

## 1. Summary

This Product Specification describes the Capstone model C200S microturbine system. The microturbine is a stationary power generating system that provides on-site electrical power for primary or standby applications, and for base loading and/or capacity additions. A microturbine can generate power in parallel with an electrical utility (Grid Connect mode), or isolated from the utility (Stand Alone mode). The system consists of a turbine engine, solid-state power electronics, fuel system, and an outdoor-rated enclosure.

Major turbine engine components include a compressor, a recuperator (exhaust gas heat exchanger), a combustor, a turbine, and a generator. The turbine engine is air cooled and supported on air-lubricated foil bearings (air bearings). The compressor impeller, turbine rotor, and generator rotor are mounted on a single shaft. The power electronics are solid-state, double conversion type, producing three-phase alternating current output power from the high-frequency alternating current engine output.

## 2. Available Model Types

Capstone C200S microturbine systems are available with several optional configurations. The available model and configuration options covered by this Product Specification are summarized in Table 1. Refer to Capstone Fuel Requirements Technical Reference (410002) for additional information regarding Capstone fuel definitions and requirements.

The baseline microturbine model is equipped with the ability to operate in Grid Connect mode (i.e., grid parallel), and contains no additional exhaust after-treatment. All C200S microturbines provide the features of the baseline model, including power electronics that are certified for UL1741, and basic protective relay functionality. Additional configurations can be added to the baseline model as follows:

- Dual Mode (DM) – Incorporates internal battery packs and battery controllers that allow the microturbine to operate without a utility grid (i.e., Stand Alone mode). Microturbine systems utilizing the DM configuration are capable of operation in either Grid Connect mode or Stand Alone mode.
- Low Emissions (LE) – A microturbine enclosure configuration that incorporates a Catalyst Reduction Module (CRM) for reduced carbon monoxide (CO) emissions when operating on pipeline quality natural gas. The CRM consists of an internally installed CO reduction catalyst.

**Table 1. C200S Model Types**

Model <sup>(1)</sup>	Fuel <sup>(2)</sup>	Configurations		Certifications <sup>(3)(4)</sup>					
		DM	LE	UL 2200	UL 1741	CE	VDE	BDEW	CEI
200S-Fx4-BC0x-0x00	Natural Gas:	✓	✓		✓	✓	✓	✓	✓
200S-Fx4-BU0x-0x00	Low Pressure <sup>(5)</sup>	✓	✓	✓	✓				
200S-Hx4-BC0x-0x00	Natural Gas:	✓	✓		✓	✓	✓	✓	✓
200S-Hx4-BU0x-0x00	High Pressure	✓	✓	✓	✓				

**Table 1 Notes:**

- (1) Microturbine models are expressed in this product specification by Capstone’s general catalog structure. For simplicity, a lower-case “x” denotes a character that will vary with configurations and certifications. Not all combinations of configurations and certifications are available. Consult your local Capstone Sales representative for available catalog numbers.
- (2) Capstone microturbine models are generally designated by their fuel type. Refer to Capstone Fuel Requirements Technical Reference (410002) for additional information regarding these fuel types.
- (3) All systems within a UL designation are certified for both UL1741 and UL2200.
- (4) CE certified microturbines comply with VDE rule VDE-AR-N 4105: 2011-08, BDEW FGW TR3, and CEI 0-16, grid interconnect regulations for power generation systems. The VDE regulation is applicable for connection to a low voltage grid, which is defined as a 3-phase grid network with a nominal voltage less than 1 kV. The BDEW and CEI 0-16 regulations are applicable for connection to a medium voltage grid, which is defined as between 1 and 35 kV.
- (5) The use of Low Pressure Natural Gas (LPNG) with the C200S microturbine requires the incorporation of an internal Fuel Gas Booster (FGB). The FGB utilizes power directly from the microturbine, reducing overall electrical efficiency and power available for external use. The FGB is only intended for use with pipeline quality natural gas.

### 3. Specifications

Table 2 summarizes the specifications for the C200S microturbine.

**Table 2. Nominal C200S Microturbine Specifications**

Parameter	Grid Connect	Stand Alone (Dual Mode)
<b>ISO Performance Ratings</b>		
Net Power Output <sup>(2)</sup>		
Low Pressure Natural Gas		190 kW
All Other C200		200 kW
Net Efficiency (LHV) <sup>(2)</sup>		
Low Pressure Natural Gas		31%
All Other C200		33%
Net Heat Rate (LHV)		
Low Pressure Natural Gas		11.6 MJ/kWh (11,000 Btu/kWh)
All Other C200		10.9 MJ/kWh (10,300 Btu/kWh)
<b>Electrical Performance Ratings</b>		
Voltage Operating Range	400/480 VAC	
Frequency Operating Range	50/60 Hz	
Output Voltage Connection	3-phase, 4 wire Wye, L1, L2, L3 (Neutral grounded with solid connection to earth ground in a single location).	3-phase, 4 wire Wye, L1, L2, L3 and Neutral / 3 wire Delta, L1, L2, L3 (Neutral grounded with solid connection to earth ground in a single location).
Maximum Output Current <sup>(3)</sup>	300 A <sub>RMS</sub>	
Total Harmonic Distortion (THD)	IEEE 519 compliant, 5% for current	IEEE 519 Compliant, 5% for voltage
<b>Exhaust Output Ratings<sup>(4)</sup></b>		
Exhaust Gas Temperature	280 °C (535 °F)	
Exhaust Mass Flow	1.33 kg/s (2.93 lbm/s)	
Maximum Allowable Back Pressure		
Low Emissions		5 in WC
All Other		8 in WC
<b>Air Flow Requirements</b>		
Engine Inlet Air Flow	73,600 slpm (2,600 scfm)	
Electronics Inlet Air Flow	102,000 slpm (3,600 scfm)	

**Table 2. Nominal C200S Microturbine Specifications (Continued)**

Parameter	Grid Connect	Stand Alone (Dual Mode)
<b>Environmental</b>		
Temperature Operating <sup>(5)(6)</sup> Storage	-20 to 50 °C (-4 to 122 °F) -40 to 65 °C (-40 to 149 °F)	
Average Annual Relative Humidity Installed – Standard Enclosure Storage <sup>(7)</sup>	5 to 80%, non-condensing 90% maximum, non-condensing	
Enclosure Rating	NEMA 3R / IP24	
Altitude <sup>(8)</sup>	< 3050 m (10,000 ft)	
Seismic Rating	IBC 2006, Category D	
<b>Dimensional</b>		
Height <sup>(10)</sup>	2.90 m (114 in)	
Width	2.98 m (117 in)	
Depth	3.83 m (100 in)	
Weight Low Pressure Natural Gas All Other C200	5,350 kg (11,800 lb) 5,100 kg (11,200 lb)	3,685 kg (13,300 lb) 5,800 kg (12,700 lb)

**Table 2 Notes:**

- 1 Ratings are at full load power and ISO conditions with zero backpressure. Values do not include parasitic losses from any accessories. The nominal values contained in this table do not reflect tolerance ranges. Deviation from the nominal value can occur due to differences between microturbines, measurement inaccuracies, and other factors.
- (2) See Figure 1 and Figure 2 for nominal power and efficiency charts with typical unit-to-unit variation.
- (3) In Stand Alone mode, maximum output current value assumes linear load.
- (4) Refer to the Capstone Emissions Technical Reference (410065) for exhaust constituent information.
- (5) The electronics inlet air temperature must be within 2 °C (3.6 °F) of the engine inlet air temperature.
- (6) The minimum operating temperature of the microturbine may be higher due to the properties of the fuel. Proper operation of the microturbine may require a higher minimum ambient temperature to ensure that the fuel remains in an acceptable state/condition. Refer to the Fuel Requirements Technical Reference (410002) for additional information.
- (7) The microturbine must be stored in a dry, climate controlled storage facility. For long term storage, refer to Microturbine Standard Maintenance Schedule (440386).
- (8) Engine-based performance characteristics derate at altitudes above sea level. IEC 60034-1 only covers products up to a maximum altitude of 1,000 m (3,281 ft). Consult Capstone for additional information.
- (9) Overall acoustic emissions values represent “A” weighted values at full rated output power taken at a distance of 10 m (33 ft). The overall value consists of an average of multiple sound pressure readings at specific locations around the unit at 10 m (33 ft) and is not necessarily a maximum value. On-site sound levels can vary due to a variety of factors such as background noise, environmental conditions and reflective surfaces.
- (10) Height dimensions are to the roofline. Exhaust outlet extends at least 136 mm (5.35 in) above the roofline.

## 4. Fuel Input Requirements at Full Load Power

Table 3 presents fuel input requirements at full load power and ISO conditions.

**Table 3. Fuel Input Requirements**

Microturbine Model <sup>(2)</sup>	Fuel	Inlet Pressure Range	Fuel Heat Content Range (HHV)	Fuel Flow (HHV) <sup>(3)(4)</sup>	Max Fuel Temp <sup>(5)</sup>	Max H <sub>2</sub> S/Sulfur
200S-Fx4-Bx0x-0x00	Natural Gas: Low Pressure	18.1 ± 16.4 kPag (2.63 ± 2.38 psig)	35.4 – 42.8 MJ/m <sup>3</sup> (950 – 1,150 Btu/scf)	2,430 MJ/hr (2.30 MMBtu/hr)	50 °C (122 °F)	5 ppmv
200S-Hx4-Bx0x-0x00	Natural Gas: High Pressure	534 ± 17.2 kPag (77.5 ± 2.5 psig)	30.7 – 47.5 MJ/m <sup>3</sup> (825 – 1,275 Btu/scf)	2,400 MJ/hr (2.28 MMBtu/hr)	65 °C (149 °F)	5 ppmv

**Table 3 Notes:**

- 1 Refer to Fuel Requirements Technical Reference (410002) for additional information regarding microturbine fuel requirements and definitions.
- (2) Microturbine models are expressed in this product specification by Capstone’s general catalog structure. For simplicity, a lower-case “x” denotes a character that will vary with configurations and certifications. Not all combinations of configurations and certifications are available. Consult your local Capstone Sales representative for available catalog numbers.
- (3) The ratio of Higher Heating Value (HHV) to Lower Heating Value (LHV) is assumed to be 1.1.
- (4) Onload fuel flows and cold starts can be approximately 1.5 times higher than the steady state values.
- (5) The minimum fuel temperature depends on fuel type. Unless stated otherwise, for gaseous fuels, the minimum fuel temperature is 0 °C (32 °F), or 10 °C (18 °F) above the saturation temperature of the fuel at the operating



## 5. Performance Derating

Microturbine performance, like all gas turbine technology, is affected by intake air mass density. The performance ratings listed above are at full load power at ISO (International Organization for Standardization) conditions. ISO conditions are defined as 15 °C (59 °F), 60% relative humidity, and sea level pressure of 101.3 kPa (14.696 psia). Performance derating may occur at ambient temperatures and elevations above ISO conditions. Other derating factors include air inlet pressure drop (e.g. air inlet ducting), back pressure, and system parasitic loads (e.g. fuel gas compressor, battery charging).

The microturbine nominal net power rating and minimum/maximum nominal net power output versus ambient temperature is provided below for all applicable microturbine configurations. Likewise, the nominal net efficiency and minimum/maximum net efficiency versus ambient temperature is also provided. Note that the following figures show typical curves at sea level with no external parasitic loads, no inlet air restrictions, no exhaust back pressure, and no catalyst reduction module.

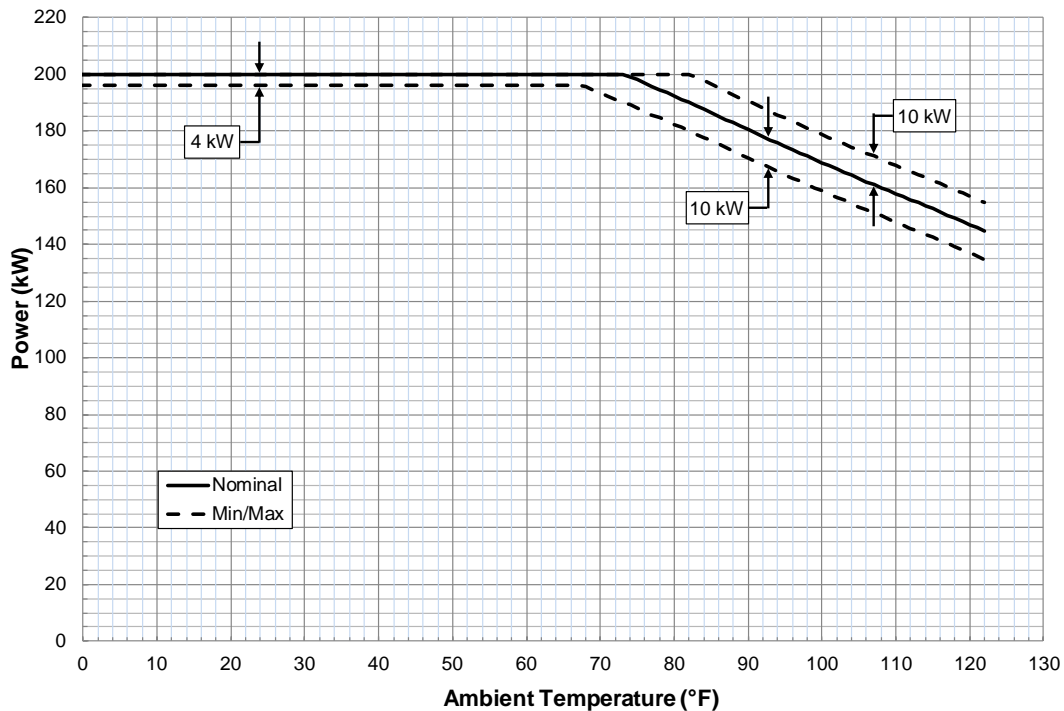


Figure 1. C200S Net Power Output vs. Ambient Temperature

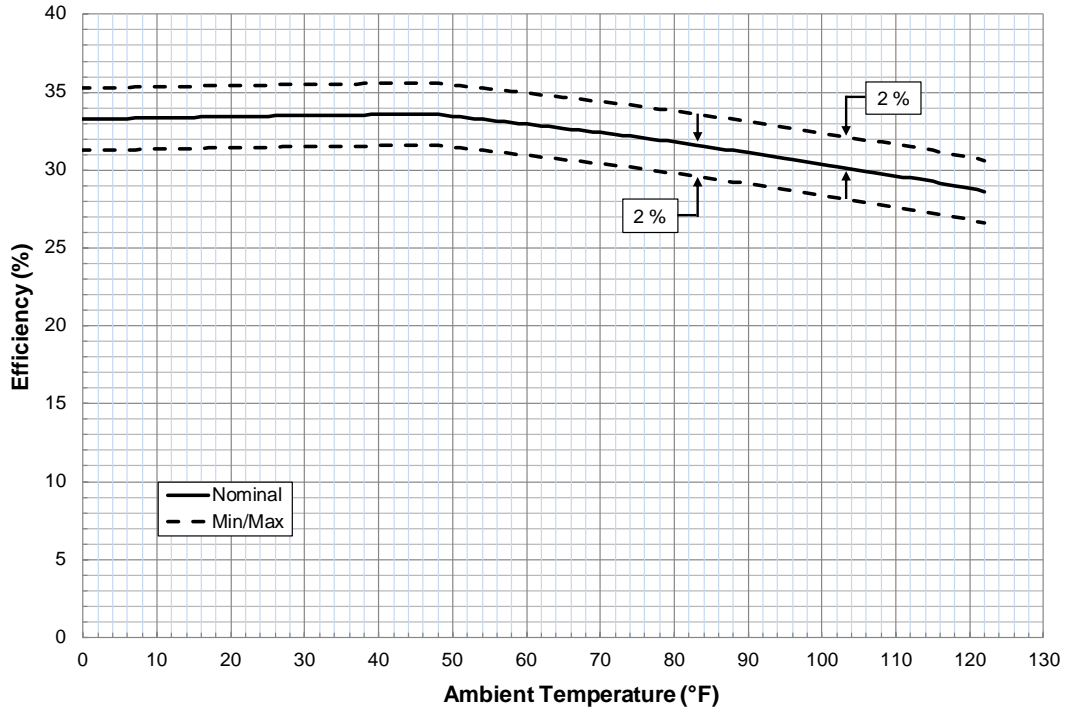


Figure 2. C200S Net Efficiency vs. Ambient Temperature

## **6. Certification Information**

Please contact Capstone for the latest certification information.

## **7. Disclaimer Statement**

All information contained in this document is subject to change without notice. The products described in this document are NOT intended for use in applications where malfunction may result in injury or death to persons. The information contained in this document does not affect or change Capstone's warranties. Nothing in this document shall operate as an express or implied license or indemnity under the intellectual property rights of Capstone or third parties. All information contained in this document was obtained in specific environments and is presented as an illustration. The results obtained in other environments may vary.

THE INFORMATION CONTAINED IN THIS DOCUMENT IS PROVIDED ON AS "AS IS" BASIS. In no event will Capstone be liable for damages arising directly or indirectly from any use of the information contained in this document.