Bloomenergy

Bloom Energy Server

Biogas Specification

Post cleanup, this biogas specification must be used for proper Energy Server contracting and operation

Specifications

Hydrocarbon Composition[1,2]	Limit (mol %)
Methane (CH_4)	Min 50[3]
Ethylene (C_2H_4)	Max 0.1
Ethane (C_2H_6)	Max 0.1
Propylene (C_3H_6)	Max 0.1
Propane (C_3H_8)	Max 0.1
iButane + nButane (C_4H_{10})	Max 0.1
Sum of C_{5+}	Max 0.1

[1] Hydrocarbon composition transients within the above specification ranges will change at less than 1% per hour.
[2] Composition lab data collected shall be per EPA 3C.
[3] If O_2 present in the gas: $\%CH_4 - 0.5 * \%O_2 > 50$ mol%

Contaminant	Limit
Siloxanes	< 0.12 mg/m^3
Arsenic (AsH_3 &/or As)	< 0.05 ppmV
Halogens (CH_3Cl, HCl, etc.)	< 0.28 µg/m^3
Mercury	< 2.0 ppmV
Cadmium	< 2.0 ppmV
Zinc	< 2.0 ppmV
Ammonia	< 40 ppmV
Phosphorous/PH_3	< 2.0 ppmV
Sodium	< 2.0 ppmV

Trace component	Limit
N_2	No limit, provided $\%CH_4 - 0.5*\%O_2 > 50$ mol%
O_2	No limit, provided $\%CH_4 - 0.5*\%O_2 > 50$ mol%
CO_2	No limit, provided $\%CH_4 - 0.5*\%O_2 > 50$ mol%
H_2	< 1.0 mol%
CO	< 100 ppm

Sulfur Species	Average (ppbV)	Maximum (ppbV)
H_2S (Hydrogen Sulfide)	1,000	2,000
COS (Carbonyl Sulfide)	200	500
CS_2 (Carbon Disulfide)	50	150
Mercaptans[1]	100	200
Thiophenes[2]	100	200
Others[3]	100	200
Total Sulfurs (sum of all)	1,500	2,000

[1] TBM is the primary Mercaptan
[2] THT is the primary Thiophene
[3] Other sulfides and disulfides

- Contaminant and Sulfur species limits shall be measured by Draeger tubes, bag sampling, or online gas analyzers at site.
- The gas composition requirements of this specification were verified by historical data of site gas sampling per: ASTM D8230 Siloxanes, EPS TO-15 Halogens, EPS29 Arsenic, Mercury, Cadmium, Zinc, NIOSH 6015 Ammonia and ASTM D 5504 Sulfur
- The Gas pressure must be in the range of 14-18 psig
- Pressure transients: <0.1 psi/min at steady flow
- Moisture content needs to be less than 278 lbs H_2O/mmscf

NOTES:

1. Overall composition of theoretical cleaned gas, wherein cleaned gas is defined as gas composition after removal of sulfur-bearing species, siloxanes and moisture, must still meet the above standards.
2. Sufficient gas to be available at all times to allow the system to operate continuously. Emergency flare capable of handling 100% of the biogas to be made available
3. All gas polishing media handling and disposal not included in Bloom scope
4. Wastewater handling and remediation not included in Bloom scope
5. Site permitting, and site construction of gas polishing system not included in Bloom scope
6. Customer is expected to provide the hydrocarbon composition during contracting.

Bloom Energy Headquarters
4353 North First Street
San Jose, CA 95134 USA
bloomenergy.com