

CUSTOM DESIGNED GREEN ENERGY SYSTEMS

LANDFILL GAS DIGESTER GAS COALBED METHANE

Pioneer Air Systems specializes in turn-key systems for the compression, filtration, drying and contaminant removal of all forms of biogas.

Biogas is produced from the anaerobic digestion of organic matter – food waste, solid waste in landfills, animal waste or wastewater/sewage, for example. Biogas will normally have from 50 -60% methane (CH₄) content with the balance being carbon dioxide (CO₂), sulfur compounds, siloxanes, nitrogen/oxygen and moisture.

When released uncontrolled into the atmosphere, biogas is a significant contributor to global warming. CO₂ levels are a key barometer of climate change. However, methane is 21 times more effective than carbon dioxide with regard to global warming by trapping radiation while allowing the Sun's energy to pass through the atmosphere.

Treated biogas is a key element of renewable or Green energy. The product of anaerobic digestion (bacteria consuming organic matter in absence of oxygen) is truly a renewable resource which continues uninterrupted as long as additional organic material is added to the digester.

While not truly 'renewable', methane captured in closed or abandoned underground coal mines, "Coalbed Methane", is an additional source of energy from non-traditional extraction methods. All coal seams also contain methane, being carbon sources buried millions of years ago which did not become solid and remain gaseous in the strata of the coal. When mines are closed this methane seeps into the cavities where the coal was removed and remains there as the mines have been sealed. Without introduction of oxygen for combustion the coalbed methane does not pose an explosive risk and is a latent source of clean energy.

Biogas and coalbed methane are good non-traditional sources of fuel for boilers, engines for electricity generation and, with significant treatment, motor fuel. However, as all of these are fully saturated with moisture they must, at least, be dehydrated to an acceptable level in order to be used commercially.

The basic treatment of biogas/coalbed methane is a Refrigerant Dryer which achieves 35° F to 40°F Pressure Dew Point (PDP). There are two types of this equipment:

Direct Expansion: In this design, the refrigerant directly cools the gas in the gas to refrigerant heat exchanger. For energy efficiency, a gas-to-gas heat exchanger is often used to pre-cool the incoming gas and concurrently reheat the outgoing gas streams. Units using this system will have a "D" following the model number.

Glycol Chilling: A more precise cooling where the heat load and the ambient temperature are expected to have a high variance utilizes the refrigerant to directly chill a glycol mixture which, in turn, cools the biogas in a heat exchanger. This is well suited for larger capacity systems with multiple compressors. The refrigerant compressors may cycle as needed which saves energy and provides better system stability and improved heat load to capacity ratio. Units using this system will have a "C" following the model number.

Quality Features:

- 4" stainless steel inlet/outlet pressure gauges
- 4" stainless steel refrigeration suction and discharge pressure gauges
- 4" stainless steel inlet, outlet and dew point temperature gauges
- Process gas flow through 316SS
- Sandblasted, primed and epoxy coated
- Pump down cycle
- Freeze protection
- NEMA 7 enclosures and wiring, Class 1, Div 1 or Div 2, Group D
- Chilled separator
- Water cooled condenser with water regulating valve or Air cooled condenser with fan cycling
- NEMA 7 motors
- Separate motor(s) and compressor(s), belt or direct drive

Inlet Temperature Correction Factors for Direct Expansion and Glycol Biogas Chillers

110°F	1.15x
120°F	1.30x
130°F	1.40x

(To determine the required capacity, multiply actual flow with the correction factor above)

Pioneer can also design and build Continuous Duty Regenerative gas drying systems for low pressure and high pressure up to 5000psig and Super Deliquescent Dryers for 40°F to 70°F Dew Point Suppression. Using Veri-Dry 40 Plus deliquescent desiccant 70°F pressure dew point suppression is normal. This media absorbs up to four times its weight in water and continues to absorb moisture in a liquid state.

Applying the temperature correction factor to the specified inlet volume of biogas the following chart will identify the correct R Model to achieve the desired outlet conditioned biogas.

Specifications and Dimensions:

Model	Compressor HP	Capacity -				Dimensions <u>L x W x H inches</u>	In/Out <u>FLG inches</u>	Approx. <u>Wt. lbs</u>
		<u>ps</u>	<u>ig</u>	<u>scfm@100 F</u>	<u>5</u>			
R400D/C	3	400	240	160	100	80 x 42 x 60	2	950
R600D/C	5	600	360	240	150	80 x 42 x 60	3	1550
R1000D/C	7.5	1000	600	400	250	90 x 60 x 60	3	2350
R1200D/C	7.5	1200	720	480	300	90 x 60 x 70	4	2750
R1400D/C	10	1400	840	560	350	132 x 68 x 76	4	3150
R1600D/C	10	1600	960	840	400	132 x 68 x 76	4	3700
R1800D/C	15	1800	1080	720	450	136 x 70 x 78	6	4100
R2000D/C	15	2000	1200	800	500	136 x 70 x 78	6	4500
R2250D/C	15	2250	1350	900	565	136 x 70 x 78	6	5000
R2500D/C	15	2500	1500	1000	625	136 x 70 x 78	6	5900
R3000D/C	20	3000	1800	1200	750	136 x 70 x 78	6	6800
R3500D/C	25	3500	2100	1400	875	140 x 80 x 90	8	7700
R4000D/C	25	4000	2400	1600	1000	140 x 80 x 90	8	8600
R4500D/C	30	4500	2700	1800	1125	150 x 80 x 90	8	9500
R5000D/C	40	5000	3000	2000	1250	150 x 90 x 90	8	10500
R5500D/C	40	5500	3300	2200	1375	150 x 90 x 90	10	11500
R6000D/C	40	6000	3600	2400	1500	160 x 90 x 90	10	12500
R6500D/C	50	6500	3900	2600	1650	160 x 94 x 95	10	13000
R7000D/C	50	7000	4200	2800	1750	160 x 94 x 95	10	13800
R7500D/C	50	7500	4500	3000	1876	160 x 94 x 95	10	14500
R8000D/C	50	8000	4800	3200	2000	180 x 94 x 95	10	15200
R8500D/C	60	8500	5100	3400	2125	180 x 94 x 95	10	16000
R9000D/C	60	9000	5400	3600	2250	180 x 94 x 95	10	16500
R9500D/C	60	9500	5700	3800	2375	180 x 94 x 95	10	17000
R10000D/C	60	10000	6000	4000	2500	200 x 94 x 95	10	18000