GAS CHILLERS

Gas chillers are employed to reduce the moisture content of process gas streams. As well as removing moisture, chillers will also reduce the concentration of chemical compounds such as ammonia and Volatile Organic Compounds (VOCs).

It is a well demonstrated fact that biogas, and partciularly landfill gas, flows can contain a wide range of potentially corrosive substances. These may be deposited out with condensate in the engine manifold or charge-cooler. The resultant damage has resulted in engine failures, varying in severity from terminal corrosion in charge-coolers to complete, catastrophic engine failure. Similar concerns apply to the use of biogas to fire boilers.

By use of a gas chiller, operated at pressures of up to 6 bar gauge, it is possible to significantly reduce the scope for damage by moisture or corrosive trace gases.

Chillers may be operated with electrical power to provide the energy for cooling or with biogas driving an adsorption cooling cycle. This latter reduces electrical parasitic-load to a minimum.

KEY FEATURES

STAINLESS STEEL HEADERS AND TUBES FOR MAXIMUM LONGEVITY

CHOICE OF ELECTRICAL POWERED OF FLAME POWERED REFRIGERATION CYCLES

STANDARD PRESSURE RANGES FROM 100MBAR G TO 6 BAR G. HIGHER PRESSURES AVAILABLE

COMPLETE COMPRESSION AND COOLING PACKAGES, COMPLETE WITH DEWATERING FACILITIES

CRYOGENIC TEMPERATURE RANGE COOLING PACKAGES AVAILABLE

OPTIONS FOR INTEGRATION WITH MAIN FACILITY CONTROLS

QMS ISO 9001 REGISTERED FIRM

SPECIFICATION DATA

Industries
Biogas utilisation
Landfill gas utilisation
Air-stream drying
Biogas upgrading

Flow rates available:
50 to 20,000 cubic metres per hour

Pressure ranges:
Units may operate from under a vacuum to a standard maximum pressure of 6 bar g. Higher pressures are available as special-builds.

Temperature ranges:
Units may operate from a minimum chill, to ensure that condensation does not form prior to combustion, to sub-zero dewpoints. The standard is an exit temperature of approximately 2ºC.

Materials:
Stainless steel headers and tubes as standard. Explosion-bonded headers and tubes for heavy duties available as an option.

Cooling power sources:
Electrical energy and fuel sources, such as biogas and landfill gas

Chemicals required
Glycol for cooling water, subject to the cooling water temperature

Pre-treatment requirements
Demisting and filtration recommended

A refrigeration cycle is a process of using energy, in the form of electrical power or heat, to create cooling. The degree of cooling achieved is a function of the process employed and the amount of energy utilised.

The moisture content of a gas is related to the pressure and temperature of the gas. At 90ºC and 1 atmosphere, for example, air will hold a maximum of 1.416 kg of water for every kg of air. At 10ºC this drops to 0.0076 kg of water for every kg of air, or a 99.45% reduction.

A problem with moisture will occur if the dew point (the temperature at which condensate formation will commence) of a gas stream is higher than the ambient temperatures at any point within the process.

For example, landfill gas usually emerges from a landfill site saturated with moisture at the temperature within the landfill. This temperature can beas much as 50ºC. This is, therefore, the dew point. The quantity of moisture will be approximately 0.09 kg per kg of gas.

On a windless sunny day with overland pipework, this dew point may not decrease. In fact, the temperature of the gas may actually rise in the pipework. Should the gas, upon arriving at the point of use, be reduced to (say) 20ºC, the amount of moisture dropped out as condensate will be around 0.07 kg per kg of gas. In a gas flow of 600 Nm^3/hr, this will equate to a condensate flow of 54 litres per hour.

An additional problem with this condensate is that if the ammonia levels in the gas are high, a significant proportion of this ammonia will be carried over into the condensate. Ammonia levels of up to 4,000 mg/l have been measured in biogas condensate, generated at an engine intercooler. This level of ammonia makes the condensate highly corrosive to, for example,copper and brass fittings.

The reduction in moisture loadings within a gas stream is related to both the temperature and the pressure. As pressure increases, the moisture-holding capacity of a gas is reduced. An increase in pressure, therefore, will reduce the cooling load requirement whilst increasing the energy required for compression. At near-zero temperatures a gas at 3 bar g will hold less moisture than a gas at ambient pressure.

Many applications have unique characteristics which must be accounted for at the design and specification stage. The staff of Organics have considerable experience with the issues related to moisture in landfill gas. Please contact us for further information.

Organics Limited
Sovereign Court II
University of Warwick Science Park
Coventry CV4 7EZ,
United Kingdom
T: +44 (0)2476 692141
F: +44 (0)2476 692238
E: comms@organics.com
W: www.organics.com