METHANE LIQUEFACTION SYSTEMS

The liquefaction of methane from landfill gas, digester gas as well as coal-mines gas provides an opportunity to recover energy from fuel sources that might otherwise be wasted.

Compact gas cleaning and liquefaction systems can be employed to take such sources and convert them into a cryogenic liquid fuel that may be stored in bulk and dispensed in measured quantities.

Organics offers mobile liquefaction units ranging in size from 2 tonnes per day up to 10 tonnes per day. Larger, fixed installation systems can also be provided to cater for production rates of up to 100 tonnes per day.

KEY FEATURES

OPTIMUM USE OF ENERGY RESOURCES BY INTEGRATED USE OF COOLING SYSTEMS

INDUSTRIAL GRADE CARBON DIOXIDE RECOVERY AS AN OPTIONAL BY-PRODUCT

MOBILE PACKAGED UNITS AVAILABLE FOR FLEXIBILITY OF USE

FULLY INTEGRATED CRYOGENIC SUPPORT SYSTEMS

HIGH-PURITY METHANE GASEOUS PRODUCT

PURIFIED COMPRESSED GAS TAKE-OFF POINTS

IDEAL FOR TRANSPORT FROM POINT OF PRODUCTION TO POINT OF USE

DESIGNED SPECIFICALLY FOR USE WITH BIOGAS AND MINES GAS

REMOVAL OF OXYGEN, NITROGEN AND TRACE GASES INTEGRATED WITHIN THE STANDARD SYSTEM

SPECIFICATION DATA

Standard mobile units:
2 to 15 tonnes methane per day
(≈250 Nm^3/hr to 1,750 Nm^3/hr)

By-product carbon dioxide:
4 to 30 tonnes per day in standard range

Standard fixed installations:
30 to 400 tonnes methane per day
(≈1,750 Nm^3/hr to 50,000 Nm^3/hr)

By-product carbon dioxide:
30 to 800 tonnes per day in standard range

There are a wide number of options available for the liquefaction cycle to drive the liquefaction process. These options, however, can be rapidly reduced in number to two: nitrogen and methane refrigeration systems. The use of multi-stage or cascading cycles, often employed for large plant is not appropriate for either the mobile or full-scale plants.

The basic difference between the two cycles is that the former involves using nitrogen in a separate circuit to deliver the cooling necessary to liquefy methane. In this case nitrogen will be compressed and passed through an expansion engine to obtain the necessary temperatures within the fractionation column. In the methane-as-refrigerant option, methane from landfill gas will be recycled through the system to obtain the necessary cooling for liquefaction.

There are number of advantages and disadvantages for each cycle. The main advantage of the methane cycle is cost.

Nitrogen refrigeration cycle

The advantages of a nitrogen cycle are as follows:

• A separately contained cycle with pure nitrogen will operate for many years without any problems being created by the nature of the gas itself.

• It is possible to employ standard equipment, readily available for small liquid nitrogen plants

The disadvantages are:

• The use of a separate nitrogen cycle will require a separate compressor to compress the nitrogen. Another compressor will be required to compress the landfill gas. This has an energy consumption and a capital plant cost implication.

Methane refrigeration cycle

The advantages of a methane cycle are as follows:

• The main landfill gas compressor can be used to provide the pressure required for the expansion engine to obtain cooling. This results in capital cost savings.

• The product of the plant is purified methane so a separate gas handling circuit does not need to be built.

The disadvantages are:

• The purified gaseous methane stream from the main heat exchanger is run back into the unpurified landfill gas feed at the inlet to the main compressor.

• There is a small methane loss in the purification process (~5%). The recycling of methane gas increases the overall losses.

• There may be some build-up of trace contaminants over the years. The removal of such traces gases may be expected to be very good (c. 99%). This is an issue that may be addressed with appropriate maintenance procedures.

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