Membrane Units for Natural Gas Dehydration

Air Liquide

A packaged PEEK-Sep™ Membrane Unit

Membrane systems are used extensively for CO_2 removal from natural gas however, the use of membrane technology for other natural gas treating applications historically has been limited. Air Liquide's PEEK-Sep™ membrane technology has significantly expanded the spectrum of natural gas treatment applications to include water and hydrocarbon dew point control, acid gas removal (both CO_2 and H_2S), nitrogen removal and Natural Gas Liquids Recovery (NGL's).

To meet pipeline specifications, natural gas must contain water levels in the 4 to 10 lb/MMscf range. Traditionally, TEG glycol units have been used for this purpose. The EPA estimates that over 35,000 glycol units are in operation in the USA alone. Though widely used, glycol dehydration faces increasing environmental restrictions since the units can emit VOCs, hazardous air pollutants (BTEX) and NOx from the regeneration reboiler. Pneumatic control devices typically deployed in glycol systems also emit methane and VOCs. Handling of chemicals and maintenance requirements can make operation of glycol units in remote locations challenging. Glycol evaporation and condensation in downstream pipelines has been reported to lead to corrosion and can cause foaming problems in downstream amine plants.

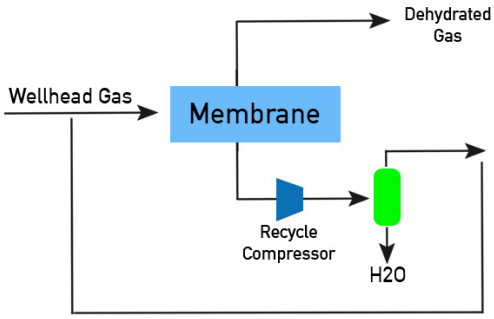
How it Works

Membrane systems dehydrate the gas by passing a high pressure feed over a selective gas permeable membrane with the permeate side of the membrane maintained at a lower pressure. As gas flows across the membrane, the highly permeable gas components are removed selectively to the low pressure side. Water vapor is one of the most permeable gases. The high permeability of water allows membrane units to reduce water content of the feed gas to low levels required by pipeline specifications. A PEEK-Sep™ membrane system for dehydration is compact, highly durable and operates continuously without regeneration and concomitant emissions.

The unique capability of the PEEK-Sep membrane allows system optimization for site specific needs as shown in the examples below:

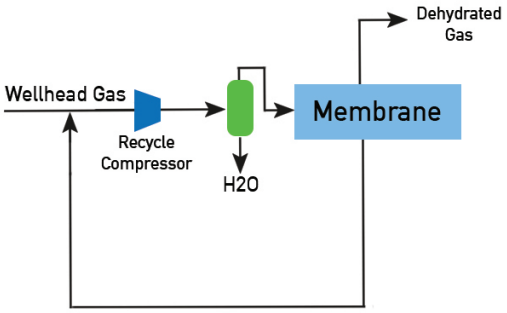
- The wet gas stream from the well is available at pressure.

The gas requires dehydration but does not require additional compression prior to delivery to the customer. Dehydrated product is at pressure and water vapor is removed as a low pressure permeate/tail gas. The tail gas can be used as on site fuel gas or recompressed to be combined with the main feed stream. The recompressed gas is cooled and the condensed water is separated as a liquid before the tail gas is recycled to the front end of membrane system. This process configuration eliminates fugitive emissions and hydrocarbon losses.



- The gas stream at the well is available at a low pressure and must be dehydrated and compressed prior to injection.

The membrane dehydration system is installed following feed gas compression to condition product gas. The membrane system will generate high pressure product gas to the targeted water dew point. The water vapor is removed as the low pressure permeate/tail gas. The tail gas is recycled to front end of the compressor and combined with the feed gas stream. The compressed gas is cooled and the condensed water separated as liquid. Again, the closed loop system eliminates fugitive air emissions and maximizes hydrocarbon recovery.



- An alternate design is to use a moderate vacuum on the permeate side to increase the separation efficiency and to lower hydrocarbon losses to the tail gas stream. This design is most economical wherein the rejected water rich stream can be used as fuel or flared.

PEEK-Sep membranes are highly durable and do not require extensive pre-treatment. Membranes are not affected by natural gas components including condensed liquids and methanol.

Key Membrane Attributes

- No special pretreatment required
- Zero BTEX emissions
- No consumables
- Unattended operation
- Hollow fiber membrane configuration provides for small system

Air Liquide would be pleased to provide a performance and cost estimate for your process conditions. To obtain a budgetary quotation, please complete the information below and return to:

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Name _____ Company _____

Address _____

City _____ State _____ Zip Code _____ Country _____

Phone _____

Email _____

Feed Conditions

Feed flow rate _____

Feed pressure available _____

Feed temperature _____

Feed source _____

Product Requirements

Required Pressure _____

Required Dew Point _____

Maximum inerts permitted, % _____

Feed Compositions, Vol. %

Methane _____

Nitrogen _____

Carbon Dioxide _____

Oxygen _____

Hydrogen Sulfide _____

Ethane _____

Propane _____

Butane _____

Pentane _____

C6+ _____

Other _____

Other _____

Comments

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