Schlumberger

PUREMEG

Monoethylene glycol reclamation
and regeneration system

Monoethylene glycol (MEG) is widely used by the oil and gas markets in wellheads and pipelines to prevent hydrate formation at pipeline conditions. In offshore deepwater gas production facilities, where the exposure to lower temperatures in subsea pipelines is common, MEG is used for hydrate inhibition.

Hydrate inhibition is achieved by injecting MEG to decrease the hydrate formation temperature below the operating temperature, thereby preventing hydrate blockage of the pipeline. During the gas production process, the lean glycol mixes with the produced water from the formation.

The production fluid containing natural gas with associated condensate, produced water, and the injected MEG enters the production facility, where the fluids undergo phase separation. The produced fluids pass through a slug catcher and are then flashed in a three-phase production separator to separate gas, hydrocarbon liquids, and the produced water and MEG mixture, commonly known as rich MEG. The produced gas and hydrocarbon liquids are routed onshore for sales and further processing.

The rich MEG is regenerated by the PUREMEG* MEG reclamation and regeneration system into a lean, high-purity, salt-free MEG for reuse. Separated salts are sent to disposal.

MEG reclamation

MEG reclamation is used to recover the MEG and water components from a MEG-water-salt mixture by contacting the MEG-water-salt stream with a heated recycle stream of MEG. The MEG and water components are vaporized and subsequently separated by distillation. Salt accumulates in the concentrated recycle stream, crystallizes, and is discharged from the process. MEG reclamation is unusual compared with other equipment used in gas processing in that it occurs under a considerable vacuum to reduce the processing temperatures and the consequential risk of MEG degradation, which, if allowed to occur, leads to a sharp increase in MEG losses and equipment fouling.

PUREMEG system pilot plant installed at our dedicated MEG Reclamation R&D facility at the University of Manchester in England.

Optimized MEG processing with the PUREMEG system

The PUREMEG system is designed to deliver hydrocarbon and salt-free MEG for hydrate inhibition. The process reduces MEG losses by decreasing the MEG content in the disposed salt. Up to 99.5% MEG recovery can be achieved—a recovery rate that is unmatched in the industry.

The PUREMEG unit applies specialist experience and patented design features, including

- use of spiral-type heat exchangers that are more tolerant of salty conditions compared with other types of exchangers
- patented design of the flash separator to reduce the population of salt crystals in the heated recycle stream
- extraction and cleanup of the salt using a patented salt-management technology.

The result is a design that is best practice in extracting large quantities of salt with reduced MEG losses, environmental impact, and down time.

The PUREMEG system process comprises five sections:

Pretreatment—In the pretreatment stage, the rich MEG containing some dissolved gas and hydrocarbon liquids must pass through a three-phase separator vessel. The gas is flashed, and recovered hydrocarbon liquids are sent to the production separator. The rich MEG is sent to the flash separator.

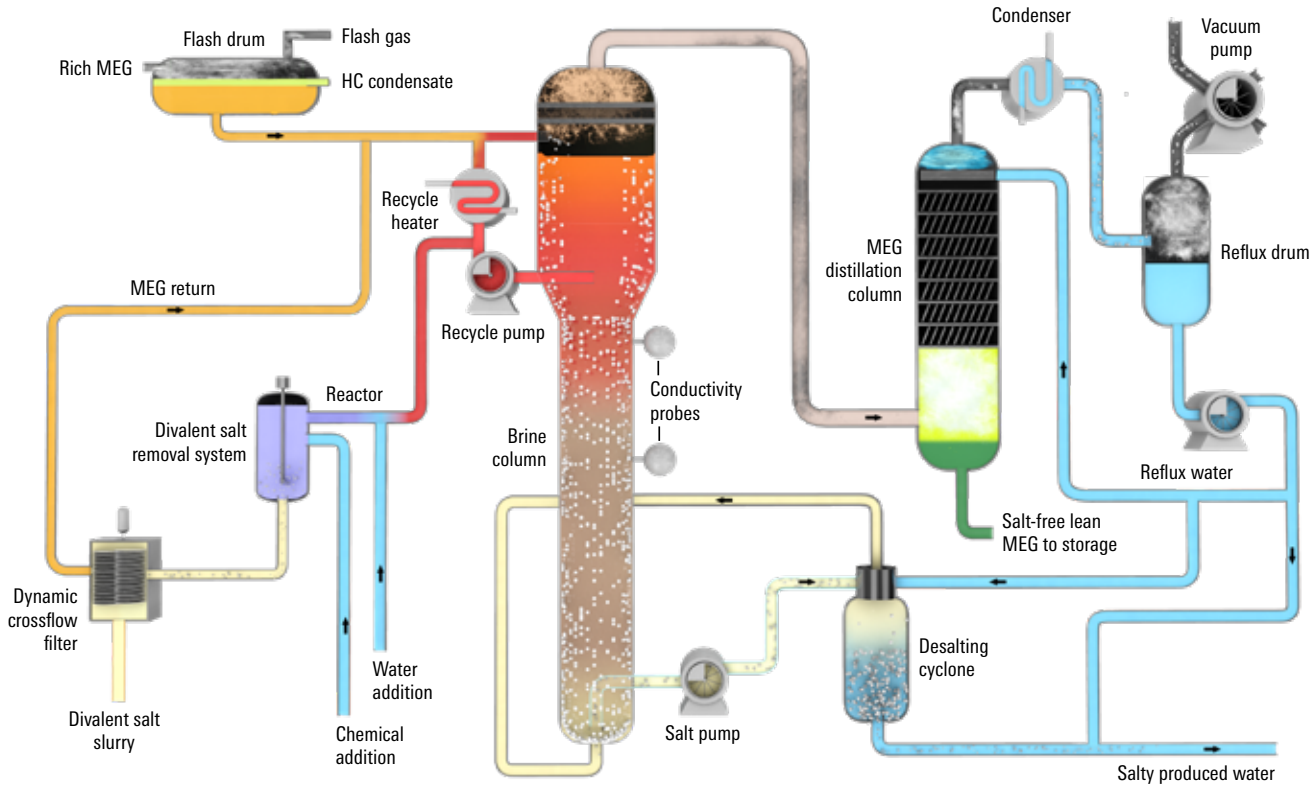
The PUREMEG system applies specialist experience and patented design features to optimize the extraction of large quantities of salt with reduced MEG losses, environmental impact, and down time.

Flash separation—The rich MEG stream composed of produced water and MEG is fed to the flash separator where it is brought into contact with a hot recycle stream of MEG. The flash separator operates under vacuum. The MEG and water components of the rich MEG stream are flashed and exit through the top of the flash separator where they are sent to the MEG distillation column for regeneration. The salt components of the rich MEG stream precipitate in the flash separator.

MEG regeneration—The MEG regeneration section of the PUREMEG system is a refluxed distillation column. The distillation column also operates under a vacuum and distills the water from the MEG-water vapors coming off the top of the flash separator. The salt-free, lean MEG produced at the bottom of the distillation column is pumped to storage for reuse. The vaporized water passes overhead from the distillation column. The water is condensed and collected in the reflux drum. A small amount is returned to the distillation column as reflux, and the remaining is routed to treatment.

Salt management—The salt crystals that precipitate in the flash separator are separated by gravity to the bottom of the brine column, where they are transferred to the salt tank. There, the salts are concentrated before removal through a hydrocyclone. The salts in produced water cover a variety of species but are generally categorized into monovalent salts (typically sodium and potassium) and divalent salts (typically calcium and magnesium).

Calcium removal—The divalent salts cannot be effectively precipitated in the same manner as the monovalent salts, so a separate calcium removal process is installed in the PUREMEG system. Effective calcium control is accomplished as the divalent salts are collected, reacted, and removed through a filter, with the filtrate overflow returning to the process.



Typical PUREMEG system with full-stream reclamation.

Key process differentiations

Reduced population of salt particles in recycle loops (patented)

- Solids content is reduced by approximately 80% to 95% in the recycle circuit.
- Lower particle content reduces erosion and fouling, resulting in reduced operating and maintenance costs and longer service life.

Removal of salt crystals

- Salt particles that descend below the drawoff level settle at the bottom of the flash separator and enter the salt removal system where they are stripped of MEG.
- Glycol-depleted waste salt can be disposed of directly into the sea using either a batch or continuous process, or dried and disposed of as a cake.
- Low overall MEG losses, below 1% by mass, in the waste salt are typically 10 times better than competing designs.
- The PUREMEG system uses HSE best practices by operating the centrifuge at ambient temperature.

Divalent salt removal system

Schlumberger offers optional modularized divalent salt removal systems that provide better reliability and higher MEG recovery overall.

Chemical dosing

Our system of chemical dosing controls pH, reduces oxygen, inhibits corrosion, and has the following results:

- significantly less auto-oxidation, which can otherwise cause the glycol to breakdown into organic acids
- control of the precipitation and removal of calcium and iron compounds and other contaminants to reduce the fouling of heat exchangers and other equipment
- use of lower-cost construction materials.

High-flux heat exchangers

Our recycle heater uses a low-fouling-, low-scaling-type heat exchanger to heat the high-flow salty recycle MEG without fouling, without allowing suspended particulate matter to settle and without exposing the recycled MEG to high skin temperatures that might promote thermal degradation.

Rich-MEG-flow 5-m^3/h, 300-tonUK PUREMEG system module for offshore Brazil application.

Schlumberger has a pool of highly trained technicians that operate around the world.

Training

As part of our commitment to providing full-service solutions, we also offer a diverse educational services program for the oil- and gas-processing markets. Our training capabilities include both open enrollment and custom courses that can be designed to meet our customers' specific needs as well as hands-on training.

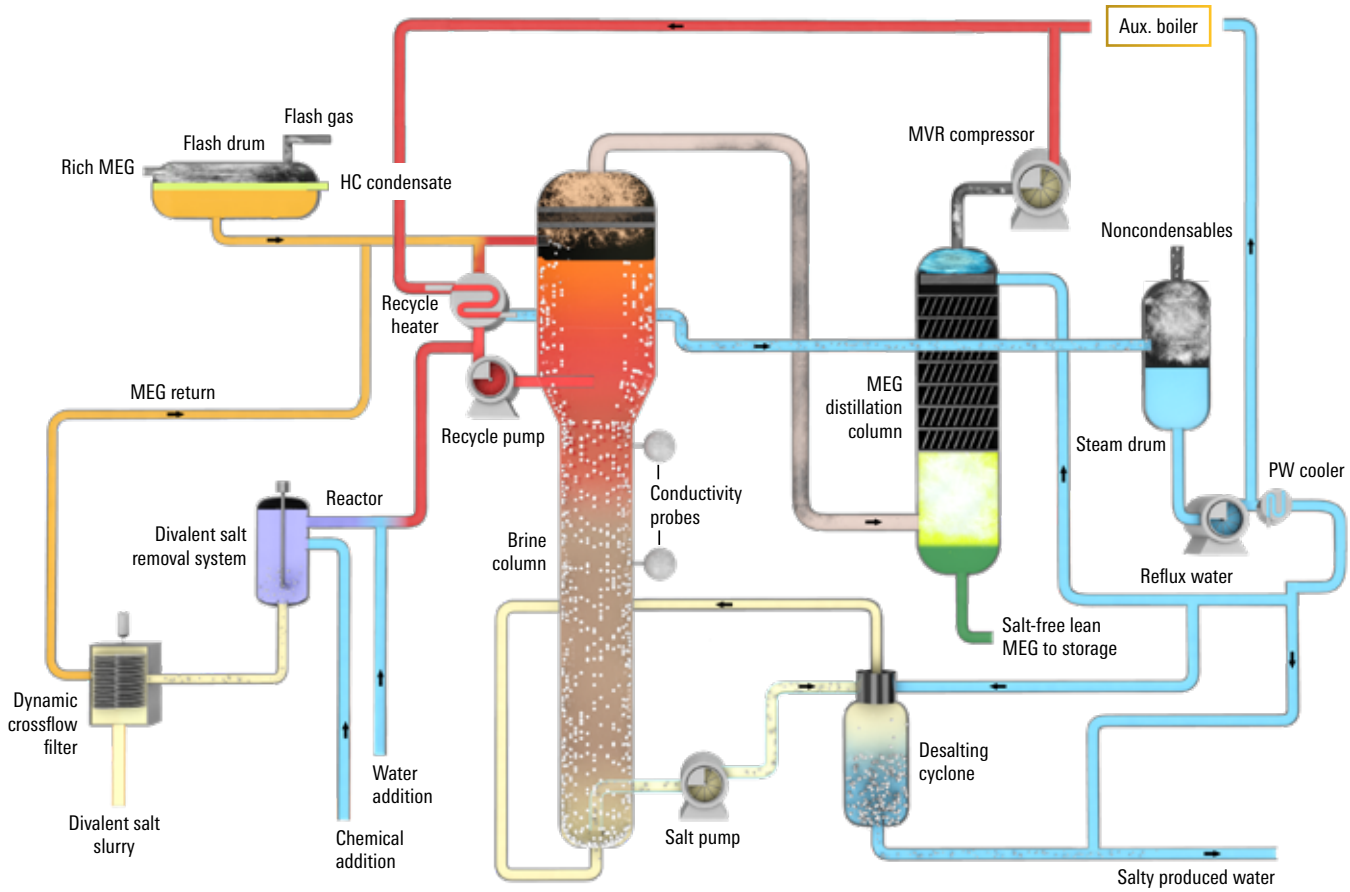
Process solutions

An industry-recognized provider of process solutions, Schlumberger provides in-house consulting services with an integrated team of technology and product specialists that routinely deliver solutions for challenging customer process problems. This unique group of specialists is available to work with customers to design efficient solutions that meet project requirements.

Life-of-field support

Schlumberger provides site support using a dedicated team of experienced service and project representatives. Strategically located throughout the globe, this network provides turnkey expertise and support for customers for the duration of a project, from commissioning to operation. From replacement parts and spares, field service contracts to equipment repair, our mission is to provide the highest quality support to ensure our customers' satisfaction.

The PUREMEG system applies our engineering expertise to the core principles of safety, availability, and operability.



Typical PUREMEG system with mechanical vapor recompression.

Key process benefits

- Reduce energy consumption by up to 80%
- Reduce carbon footprint by up to 80%
- Reduce heating-medium system size by more than 80%
- Reduce cooling-medium system size by more than 80%

Process overview

The MEG regeneration and reclamation system often demands the largest heating duty in a gas facility. Efficiency improvements in heat integration can significantly affect facility opex for heating and capex for the heating medium system.

The Schlumberger advanced heat integration process uses mechanical vapor recompression (MVR) to transform waste heat from the MEG regeneration overheads into a usable heating medium for the process.

The MVR compressor boosts overhead vapor from the MEG regeneration column, a low-grade steam, to a useable low-pressure steam, reducing heating medium demand by more than 80% which in turn reduces capex, opex, and greenhouse gas (GHG) emissions associated with the heating medium system. The compressor increases electrical demand slightly, <10% of heat duty, with the actual usage engineered for maximum savings for a specific facility.

The MVR compressor can benefit both slipstream and full-stream MEG regeneration and reclamation systems. Other industries have proved that the concept can improve process economics and sustainability.

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