Seawater Electrochlorination systems are developed as the go-to solution for control of marine biological fouling in the offshore oil and gas industry. They provide the most effective and environmentally safe method for the prevention of biofouling that would negatively affect the seawater systems within an offshore facility. Frames designs, manufactures and supplies custom-built seawater electrochlorination systems for a broad range of seawater process applications.

Product Description

Seawater electrochlorination systems typically consist of a core electrolyser cell arrangement with associated transformer/rectifier, dosing pumps, storage tanks and process piping. The system produces in-situ, a dilute, safe solution of sodium hypochlorite for direct injection into the seawater circuit. Frames can advise on sparing philosophy for each application in order to optimize the design. Our systems include the always clean Concentric Tubular Electrode design which does not require acid washing or other electrode cleaning methods.

Optionally, we can deliver a seawater electrochlorination system as part of an integrated solution, thus reducing onsite installation and commissioning time. Thanks to years of experience in designing and assembling equipment for flow assurance, Frames offers the valuable know-how required for advising effective solutions. Our in-house multidisciplinary engineering capability ensures that each seawater electrochlorination system is designed in accordance with client specifications and local legislation. Being supplier-independent, Frames is in an excellent position to select the best solutions, striking a balance between capital investment (CAPEX) and operating costs (OPEX).

Project Management

With our broad vision and multidisciplinary experience in providing solutions for applications, we know what it takes to integrate project, process and mechanical challenges. From the conceptual design to detailed engineering, fabrication and final client acceptance, our dedicated teams master every detail of the contract. After commissioning and startup total process guarantee and final “as-built” documentation is provided to the client.
Process Description

One of the main challenges in the upstream processes of the oil and gas industry is to protect pipeline and process equipment against biological fouling. The engineering disciplines involved in protecting seawater processes play an essential part in the prevention of production downtime due to the effects of macro and micro fouling. Restriction of cooling water flows, acceleration of corrosion and a reduction in the overall life of process equipment can all be controlled by the effective design of your electrochlorination package. Frames Seawater Electrochlorination Packages play an effective role in optimizing flow assurance.

Raw seawater is fed into the package at the designed flowrate via a side stream from the main seawater process line. Depending on pressure available this seawater flow will be pressure controlled or boosted to provide the optimum operating pressure and flowrate (required for the chosen electrolyser cell configuration).

Once controlled, the seawater is passed through the electrolyser cells which are fed an electrical supply from the package transformer/rectifier. The transformer/rectifier is designed specifically for the requirements of the installed electrolyser. It converts the AC platform input voltage into the required low voltage DC current and regulates this output to a selected and controlled level.

Electrolysis takes place within the electrolyser cells as per the following equation:

At the anode: \[ 2 \text{Cl}^- - 2 \text{e} \rightarrow \text{Cl}_2 \]
At the cathode: \[ 2 \text{Na}^+ + 2 \text{H}_2\text{O} + 2 \text{e} \rightarrow 2 \text{NaOH} + \text{H}_2 \]
Overall: \[ 2 \text{NaCl} + 2 \text{H}_2\text{O} \rightarrow 2 \text{NaOCl} + 2 \text{H}_2 \]

Via the electrolysis process the package produces the required amount of sodium hypochlorite together with the by-product, hydrogen gas. The produced hydrogen remains entrained in the seawater until it becomes depressurised.

The solution is fed into a hydrogen disengagement tank which allows the fluid to return to atmospheric pressure and the hydrogen to disengage from the fluid. The hydrogen is then diluted by forced air to a ratio of less than 4% (v/v) in air, which is a lower explosive limit of hydrogen in air then vented to safe location.

The hydrogen free solution containing sodium hypochlorite is then dosed into the seawater circuit via pressurized dosing pumps or via gravity.

Seawater Electrochlorination Package

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Technical Benefits

OEM Electrolyser
Working with the major worldwide anode and specialty coating manufacturer, we have access to the leading industry electrolysers with over 30 years’ service that are packaged using Frames knowledge of global oil and gas specifications.

In-Situ Production
Producing sodium hypochlorite in-situ offshore reduces the requirement for use of liquid chlorine solutions. The impracticality of shipping, storing and dosing large volumes of bulk hypochlorite on offshore sites means electrochlorination is the industry preferred method of bio-fouling control.

Self-cleaning
By selecting only partners that provide concentric tubular electrode designs we can provide packages that are self-cleaning. As a result the system is more compact, requires less maintenance and does not require any electrode cleaning processes for example acid washing.

Full Output Availability
By only supplying self-cleaning electrolyser designs the packages do not require any scheduled downtime for cleaning. This provides the opportunity for clients to remove any duty/standby requirements for the electrolysers and thus reducing footprint and CAPEX.

Added Value

- Self-cleaning design which eliminates requirements of using chemical cleaning
- Skid mounted equipment configuration
- Environmentally friendly
- Optimization of design with similar project packages
- ATEX/IECex rated for hazardous area installation
- Multi skid system available for retrofit units with limited platform access

References

- FPSO Pioneiro de Libra, Jurong - Brazil

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Frames
a family of oil & gas solutions
Frames Family Tree

Onshore

Oil & Water
- Multiphase Separation
  - Production Separators (High & Low Pressure)
  - Test Separator
  - Degasser & Knock-Out Drum
  - Water Oil Separator (WODEP)
- Compact Inline Separation
  - SwirlSep
- Electrostatic Coalescers
  - Dehydrator
  - Desalter
- Produced Water Treatment
  - Deoiling & Desanding
  - Hydrcyclones
  - Gas Floatation
  - Media Filtration
  - Solids Removal & Cleaning
  - Stripping
- Separation Internals
- Heat Exchangers

Gas
- Gas Separation
  - Demisting
  - Scrubbers
  - Filters
  - SwirlSep
- Heat Exchangers
  - Shell & Tube Heat Exchangers
- Air-Cooled Coolers
- Gas Sweetening (H₂S & CO₂)
  - Amines
  - Thiopaq O&G
  - Solid Bed Scavenger
  - Membrane
  - Molecular Sieve
- Gas Dehydration
  - Glycol (TEG)
  - Molecular Sieve
- Dew Point Control
  - Low Temperature Separation (LTS)
  - Solid Desiccant
- Hydrate Inhibition
  - MEG/DEG Recovery
  - Methanol Recovery
  - MEG/DEG Desalination
- Light Hydrocarbon Recovery
  - Condensate Stabilization
  - Fractionation

Flow Control & Safeguarding
- Hydraulic Systems
  - Wellhead Control
  - Subsea Hydraulic Power Units
  - Hydraulic Power Units
  - IWOCs (Intervention Workover Control Systems)
  - TUTU (Topside Umbilical Termination Unit)
  - Cargo Ballasting Systems
- Safety Instrumented Systems
  - High Integrity Protection Systems (HIPS)
- Chemical Injection Systems
  - Chemical Injection Systems
  - Chemical Distribution Systems
  - Seawater Electrochlorination Systems
- Valve Automation Center
  - Actuators and Actuated Valve Packages
  - Control Systems
- Automation
  - Buoy Control
  - Tank Farm Control & Safeguarding

Offshore

Floaters

Integrated Solutions

Total Plant Solutions
- Industrial CO₂
- Modules
- Early Production Facilities
- Wellsite Packages
- Biogas

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Services

Asset Life Cycle Management
Maintenance & Field Services
Commissioning
Spare Parts
Operator Training
Engineering Studies
- Conceptual
- FEED and Basic

Frames - a family of oil & gas solutions
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