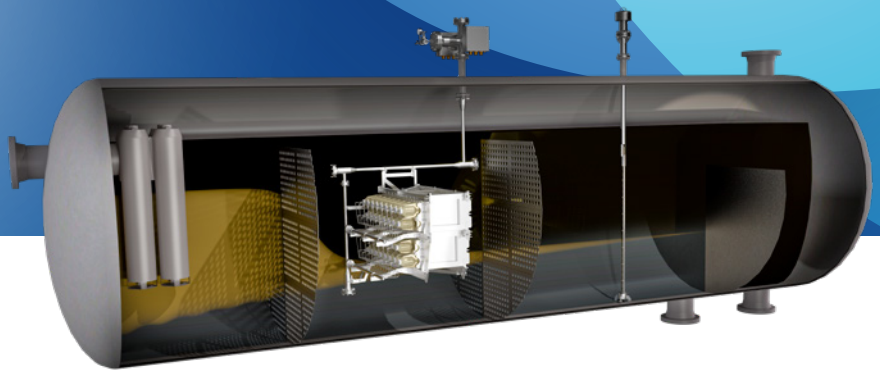


- Increased performance
- Increased production
- Reduced heating
- Reduced weight & space
- Reduced chemical consumption

VIEC™ Vessel Internal Electrostatic Coalescer

VIEC™, Vessel Internal Electrostatic Coalescer, is a technology using alternating high voltage electrical fields for enhancing liquid-liquid separation and thereby helping oil companies increase production capacity on existing assets as well as reducing investment cost for new assets.

Background

VIEC™ is a recently acquired technology and field proven solution for substantial increase of oil-water separation efficiency, improving production capacity, eliminating emulsion issues, reducing heating and chemical dosage demand as well as space and weight requirements.

Technology

The separation is achieved by using alternating high voltage electrical fields. It is a modular construction consisting of several electrodes, where each electrode is electrically insulated and has its own dedicated transformer for transforming a low voltage feed to high voltage.

Tolerates 100% water and 100% gas without short circuiting or arcing, making it ideally suited for use in any three-phase separator to speed up separation of water dispersed in oil and/or to resolve stable oil continuous emulsions.

The VIEC™ can be installed in new separators or retrofitted into existing three-phase separators with no hot work required.

Pairs of energized electrodes are supplied by a low voltage feed from dedicated external VIEC™ frequency cards, giving excellent reliability and robustness.

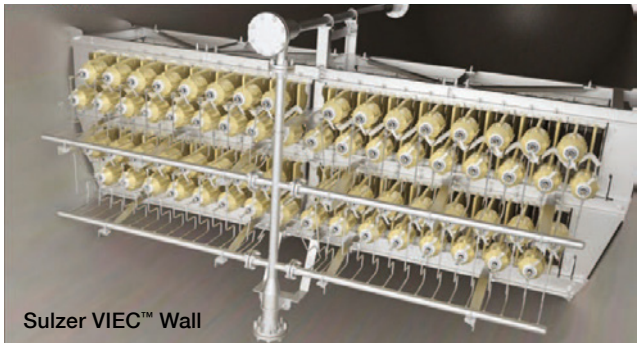
Applications and client benefits

The VIEC™ technology offers a wide range of applications for optimizing and/or de-bottlenecking oil separation trains, depending on the process scenarios and client requirements. Typical applications include the following:

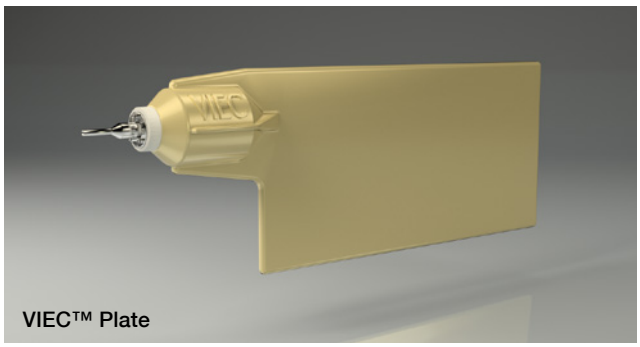
Tie-ins/capacity increase: The enhanced separation effect offered by the VIEC™ reduces the required retention time in the separator to achieve specification.

Thus, by retrofitting the VIEC™ into existing production separators, the throughput can be significantly increased without compromising oil quality.

Heavy oil: Conventional processes for heavy crudes require higher temperatures than medium and light crudes due to higher viscosity. With VIEC™, heavy crudes can be separated at significantly higher viscosities since the positive effect of enhanced droplet growth outweighs the negative effect of high viscosity. This allows for a significant reduction



Sulzer VIEC™ Wall



VIEC™ Plate

in process temperatures. The benefits can be substantial energy savings and a reduction in the operational complexity of the process.

Desalting: Conventional desalting is performed using conventional two-phase electro-coalescers in the final stage, after all the gas has been removed and the water content reduced sufficiently. Using VIEC™ technology, desalting can start earlier in the process train at higher water cuts with gas present. By achieving low water contents in the oil stream early in the process, the number of required desalters downstream can be reduced in process schemes where a conventional approach calls for two or more desalters. Additionally, the required injection rate of wash water can be reduced significantly.

Light oil: For light oils, the VIEC™ can contribute to a more compact process with savings in both process equipment, weight and space. Due to lower viscosities, export quality can be achieved with less electrostatic treatment time than for heavier crudes. Since VIEC™ technology can be applied in any three-phase separator where there is gas present and high water contents, final separation of the crude can be performed further upstream with VIEC™ technology than in a conventional process. This could potentially remove the need for a conventional dehydrator downstream, providing a more compact separation scheme.

Pre-treatment skid: VIEC™ technology can be used in pre-treatment skids upstream of existing process facilities to ensure that the existing facilities are not overloaded as the rate of produced water and/or crude increases. This allows for a minimally invasive intervention that minimizes the interruption to the existing facilities, while at the same time increasing its capacity for processing crude.

Emulsion breaking/de-bottlenecking: The presence of, for example, surfactants, a high viscosity or the mixing of incompatible well streams could lead to stable emulsions that severely limit the capacity of separators.

Electrostatic-coalescence is a well proven technology for breaking stable emulsions. Thus, by installing VIEC™ walls at the appropriate stage in the separation train, difficulties related to emulsions are resolved, which ensures optimal operation and performance of the separation facilities.

All major operators have utilized our expertise when optimizing the design in their assets. Today, over 50 separation vessels, worldwide, are enhanced with the VIEC™ technology.

References

The Sulzer VIEC™ technology has been installed in more than 50 production/test separators worldwide and is approved by most major owner/operators.

Field/Vessel	Delivered	Owner
Troll C	2003	Statoil
FPSO Munin	2004	Bluewater
Al Shaheen	2005	Maersk Oil Qatar
Grane	2005	Statoil
Jubarte Field, FPSO P-34	2005	Petrobras
Marlim Field, FPSO P-35	2006	Petrobras
Fram East	2006	Statoil
Marlim Field, FPSO P-37	2006	Petrobras
Volve, Jack-up Rig	2006	Statoil
Heidrun TLP	2007	Statoil
Vincent Field, FPSO Ngujima-Yin	2007	Woodside
Gjøa	2007	Statoil
Valhall	2007	BP
Schiehallion	2008	BP
Badejo Field (Membro-Siri), FPSO Petrojarl Cidade de Rio das Ostras	2009	Teekay/Petrobras
Andrew	2009	BP
Ofon	2009	Total
Waimea, FPSO OSX-1	2011	OGX/OSX
Gudrun	2011	Statoil
Goliat	2011	ENI
Dukhan	2012	Qatar Petroleum
Eldfisk	2012	ConocoPhilips
Auger TLP	2013	Shell
Norne	2013	Statoil
Hebron	2013	ExxonMobil
Ivar Aasen	2014	Det Norske
Mariner	2014	Statoil
Gina Krog	2014	Statoil
Johan Sverdrup	2016	Statoil
MENA (TBA), ongoing	2018	TBA
MENA (TBA), ongoing	2019	TBA
MENA (TBA), ongoing	2019	TBA
UK (TBA), ongoing	2019	TBA

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