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# Compact Electrostatic Separation Process

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## Abstract

Crude oils from mature fields are routinely associated with high water cuts and high operating costs. High water cuts increase the process heat requirements, chemical requirements, overall vessel volumes, equipment footprints and weights. If a significant quantity of water can be removed at lower temperatures, the subsequent production equipment size, weight and cost can be reduced or eliminated. A method to accomplish this ambitious separation goal is being developed by NATCO.

This separation process includes a compact treatment vessel that combines electrostatic coalescence and separation in either a series or parallel process. The vessel design permits both capacity expansions as well as performance improvement by the addition of more coalescing / separating stages. The overall oil-water separation process includes a series of processing steps for:

1) Free gas removal
2) Preliminary free-water separation
3) Electrostatic water coalescence
4) Oil dehydration, and
5) Separated water treatment.

This paper will concentrate on steps 3 and 4 of this 5-part scheme.

In laboratory equipment using a pipe vessel, NATCO has processed up to 3000 bfpd/ft$^2$ of fluids and achieved an 85 - 95% water removal from oil streams containing as much as 40% water. This compact separation technology has the potential to be applied to either surface or subsea facilities. Using this compact electrostatic separation technology in a subsea environment can provide huge process and economic advantages in deep water applications.

## Introduction

Weight and space are at a premium in the offshore environment. The compact electrostatic separator combines several advantages to work well offshore. The separator vessel is “pipe size”; therefore it has a small footprint and weight. In addition the operation is simple with minimal and conventional controls.

## Description of Electrostatic Technologies Evaluated

### Alternating Current (AC)

Alternating Current (AC) is an older Electrostatic Dehydration technology. The AC process used here applies an alternating electric field at 60 Hz. The voltage can be varied to optimize the emulsion oscillation, which causes the water droplets to deform and accelerates their coalescence. See Figure 1.

### Bimodal AC

Bimodal AC is a newer technology that utilizes a higher AC carrier frequency. The potential is modulated between lower and higher voltages at a slower frequency. This additional modulation facilitates additional drop coalescence.