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## A Cyclone-Based Low Shear Valve for Enhanced Oil-Water Separation

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### Abstract

Turbulence and shear in conventional choke and control valves do mix and emulsify petroleum fluids. A typical consequence is reduced separation efficiency of downstream gravity separators, resulting in retarded oil-water separation. A new cyclone-based low shear valve is developed, enhancing oil-water separation and reducing environmental impacts from petroleum activities. Five years of experimental and theoretical studies are reviewed, including recent tests involving six different North Sea crude oils. For a majority of oils the cyclonic valve has a significant positive effect on oil-water separation. Moreover, it is documented that the cyclonic valve has an overall positive effect on both oil-in-water and water-in-oil concentrations, across a large range of water cuts. The cyclonic valve has a consistent positive effect on oil droplet size for all crude oils in produced water. Typically, oil droplet effluent from a cyclonic valve has twice the size of droplets exiting a standard valve. The effect is largest for the smallest volumetric fraction of droplets. This new valve technology is realizing great potential in petroleum processing; i.e., less droplet break-up and less fluid emulsification. This paper demonstrates quality improvements for both crude oil and produced water. Replacing choke valves might be the ultimate application for cyclonic valves. However, experimental results demonstrate that control valves upstream any gravity-based separator are potential targeted applications for cyclonic valves.

### Introduction

#### Valves in Petroleum Production

Valves are widely distributed in petroleum production and hydrocarbon processing facilities (Figure 1). In their operation throttling valves possess an effective restriction to flow. Choke valves and control valves are typical throttling valves used to regulate flowrates and pressures of fluids in a petroleum process.

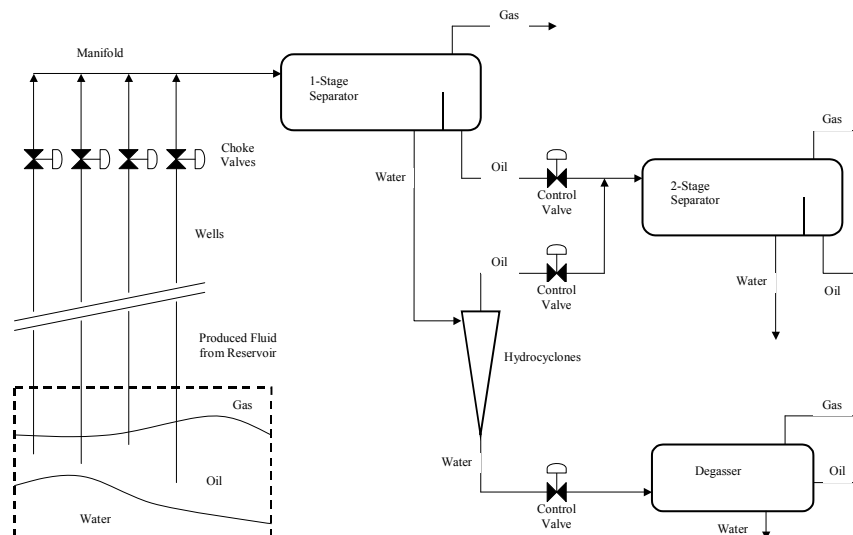


Figure 1. Schematics of petroleum production and hydrocarbon processing.