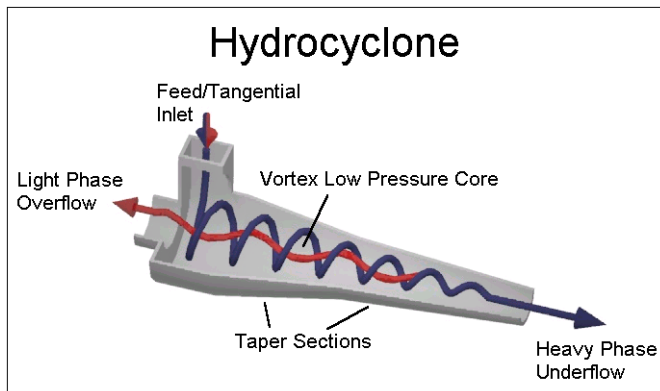


## **P-klone™ - Hydrocyclones**

### Hydrocyclones - Principle of Operation

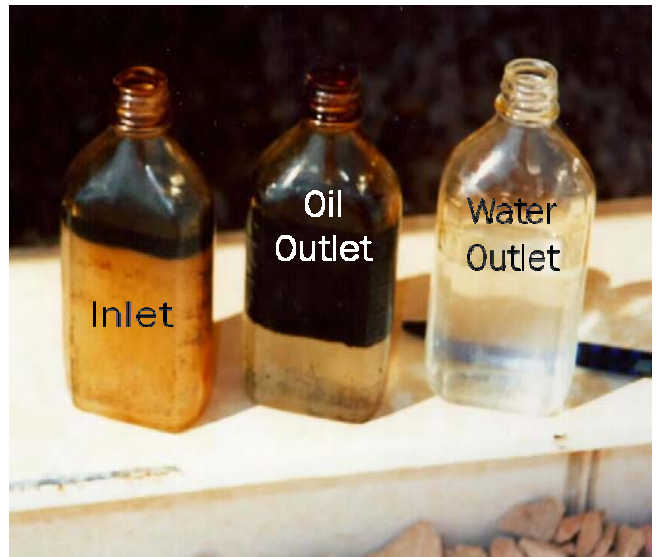
Exterran's **P-klone™** hydrocyclone operates by converting pressure energy into centrifugal force. The oily water feed stream enters the individual hydrocyclone liners through multiple tangential inlets designed to



direct the fluid into a helical flow pattern, creating a free vortex. As the liquid progresses through the hydrocyclone tapered sections, rotational velocity of the liquid increases. Rotational velocity and subsequent centrifugal forces are maintained throughout the length of the liner; frictional losses being offset by a gradual reduction in cross sectional area throughout the section. The centrifugal force generated by the rotational flow forces the denser water phase to the outside wall of the hydrocyclone, displacing the lighter oil phase towards the central core. Water continues its helical flow path down the outer walls and exits at

the clean water outlet. Oil collects in the low-pressure core and flows counter-current to the water phase. The strong centrifugal force generated promotes rapid separation. Liquid residence time in the hydrocyclone is less than two seconds.

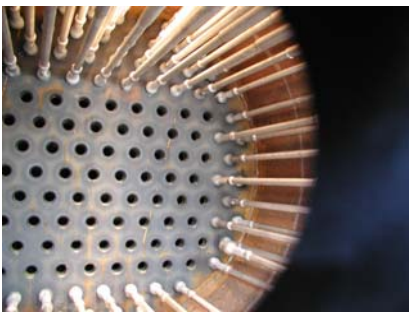
The Hydrocyclone is used primarily to remove small concentrations of oil (200 to 2,000 ppm) from water. (Note that in some processes the maximum oil concentration can be quite large – often greater than 10% of inlet liquid flow.) Separation performance is governed primarily by the bulk fluid (water) viscosity and dispersed particle (oil droplet) density. Generally, oil specific gravity must be 0.05 less than the water s.g. for efficient operation. Hydrocyclone separation efficiency deteriorates rapidly with increasing fluid viscosity (>2.0 cP). For this reason, the hydrocyclone normally becomes ineffective once the inlet fluid mixture contains enough oil to significantly increase the viscosity of the oil/water mixture. This phase change can occur at different oil/water ratios for specific conditions and fluid properties but is usually seen with greater than 40% oil concentrations.



Light Phase Outlet, or Overflow, is sometimes referred to as the "Reject". An oil rich stream exits the Overflow, usually containing from 5% to 20% oil by volume, depending upon feed concentration and overflow rates

## **P-klone** Hydrocyclones -

**P-klone**<sup>™</sup> Hydrocyclone separators are compact, centrifugal separators with no moving parts. They are insensitive to motion and are unmatched in their small size and high capacity. These devices can be used for deoiling and desanding produced water streams. Hydrocyclones require differential pressure to operate, and can be installed where at least 25psig is available. Higher pressures reduce the size and cost of the equipment, as well as improve the turn-down performance. Hydrocyclones are used to pre-treat produced water before polishing with a Skimmer/Degasser or with Gas Flotation Equipment.



The **P-klone** Hydrocyclone utilizes a unique tapered liner to force a helical pattern in the liquid. The centrifugal force generated by the rotational flow forces the denser water phase to the outside wall of the hydrocyclone, displacing the lighter oil phase towards the central core. Water continues its helical flow path down the outer walls and exits at the clean water outlet. Oil collects in the low-pressure core and flows counter-current to the water phase. The strong centrifugal force that is generated promotes rapid separation. Liquid residence time in the hydrocyclone is less than two seconds.

