PAN AMERICA ENVIRONMENTAL, INC.

Oil Water Separator Sizing Criteria

The discussion on oil water separator (ows) sizing is inextricably tied to the nature and characteristics of an oil in general and its droplets in particular. The typical core criteria required for sizing a separator are: oil specific gravity, droplet size, oil viscosity, water temperature and wastestream flow rate.

In ows design the API421 guide is used to determine mathematical formulas to ascertain tank size, coalescing media volume and other particular design elements. The primary formula used is Stoke's Law which establishes the rise rate of a droplet. The analysis and development of current separator designs can be attributed to the American Petroleum Institute criteria which was established starting in 1948, updated in 1969 and reviewed in 1985 with the last API421 guide having been published in 1990. Since 1985 The greatest changes have been in the coalescing media designs, but the API hasn't kept pace with current design and so you must review the variety of ows manufacturers in order to get a feel for the state of the technology.

Separators can remove free & dispersed oils, emulsified oils will pass right through these designs.

Oil droplet sizes & Descriptions

- Free:	Oil droplets 150 microns in diameter and larger
- Dispersed:	Oil droplets from 20 to 150 microns in diameter
- Mechanically emulsified:	Oil droplets less than 20 microns in diameter
- Chemically emulsified:	Oil droplets less than 20 microns in diameter with a chemical bond to other molecules.
- Dissolved and/or stable emulsion:	Oil in solution with its carrier

Performance and Efficiency

An ows performance statement encapsulates the ability of the equipment to attain a certain effluent concentration.

Our performance statement states: 10 mg/l or less, 30-micron, non-emulsified, free & dispersed oil droplets. In dissection we're saying the effluent oil concentration will contain 10 mg/L or less of oil droplets 30-micron in size (or greater) of non-emulsified, free & dispersed oils.

The 1st part of the statement tells you performance the 2nd part of the statement tells you efficiency. The efficiency tells you how small of a droplet the system can capture. In calculating droplet size removal it's fairly easy to mathematically show 20 micron droplet removal.

However, in practical application and in the real world a 20 micron droplet isn't that simple to remove as its mass is greatly reduced and behavior similar to a Brownian or pre-Brownian movement of a particle in a liquid could have effect. Thus mass & size reduction can lead to the instantaneous imbalance in the combined forces exerted by collisions of the droplet with a variety of other sized particles & liquid droplets surrounding and randomly acting on the droplet, so separation theory can break down under real-world conditions. The surface tension of the droplet can also create a droplet repulsion of coalescence upon collision with each other or with the coalescing media surface as there is insufficient force due to mass to overcome the surface tension resistance.