

## D.01

## Hydrocyclones

### Deoiling

#### Introduction

Deoiler Hydrocyclones were developed for the offshore oil industry in the 1980's and are established as the primary equipment used for recovery of oil from Produced Water streams.

Deoiler Hydrocyclones exhibit the following benefits:

- Compact design,
- Cost effective with low OPEX costs,
- No moving parts with little maintenance required,
- Highly consistent performance,
- Proven technology,
- Suitable for use on FPSO's,
- Range of material selections.

#### Description

SUEZ's CYCLONIXX® range of Deoiler Cyclones are used to recover liquid hydrocarbons from oily-water streams. These Cyclones are mostly installed in pressure vessels in a cluster, with the required number (1-400) of Cyclones Liners to match the water flow rate.

Cyclone Liners are made in a range of sizes, (30-70 mm diameter) and constructed from Duplex Stainless Steel, with other material options available on request.

The photo at right shows how the Deoiler Cyclone Liners are installed into the vessel by hand. Liners can be removed for inspection, or replaced with Liner Blanks by using simple hand tools.

Liner Blanks are used where water rates vary over time, and the number of Deoiler Cyclone Liners needs to be varied accordingly.

Additionally, vessels can be built with internal partitions or zones to allow a wide range of flow rates to be handled.

#### Operating Principles

Deoiler cyclones are driven by inlet water pressure and utilise a pressure drop across the Cyclone to provide the energy or driving force to cause oil-water separation.

Normally, system pressure is used to provide the driving pressure, but if too low (<75 psig / 5 Barg), a pump can be used to boost the feed pressure. Typically, single stage centrifugal pumps are used, where pressures are too low.



CYCLONIXX® Cyclone Liner Installation into a 36"/ 900 mm Vessel

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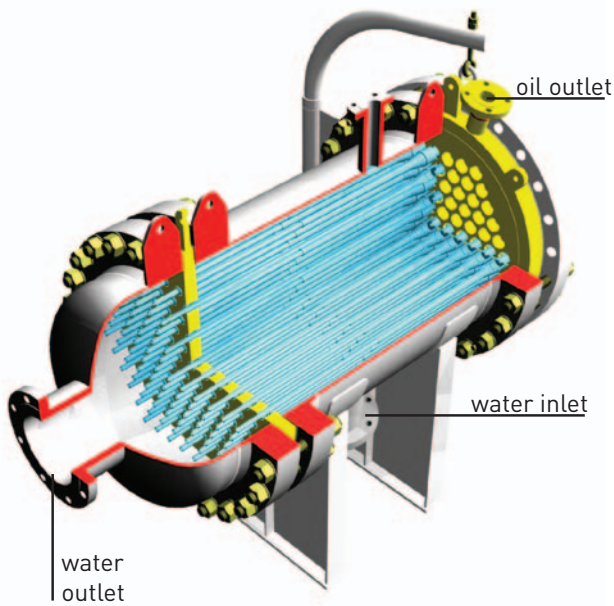
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## Hydrocyclones

### Deoiling



View of Deoiler Hydrocyclone Vessel:



Each CYCLONIXX® Deoiler Cyclone Liner includes a tangential Inlet Section where the water enters, and is forced to spin rapidly, generating high centrifugal forces. These forces, combined with the tapering shape of the internal profile, accelerate the spinning. This effectively forces the water away from the centre axis to the outer walls, and forces the lower density oil to the central core that forms along the axis of the Deoiler Cyclone.

The water spirals down the tapered section of the Cyclone and exits via the clean Water Outlet nozzle. The central oil core is forced in the reverse direction by back-pressure on the Water Outlet, and exits via a small orifice as the Oil Reject Outlet. The Oil Reject stream flow is largely controlled by this orifice size, but can also be regulated by an outlet control valve, and is typically set to allow a flow at 2-4% of the inlet flow.

The gravitational forces generated within each CYCLONIXX Deoiler Cyclone Liner are very high, and therefore these Deoiler Cyclones can be installed vertically, horizontally or on moving structures (eg: FPSO's).

### Technical

There are a few important factors involved in the process design and selection of a Deoiler Cyclone Liner type, and these are:

- Available pressure/Pressure Drop,
- Oil droplet size & distribution,
- Liquid Viscosity/Temperature,
- Cyclone diameter,
- Required Oil Recovery.

### System Pressure

If there is adequate system pressure available ( $\rightarrow 75$  psig), this is used to drive Deoiler Cyclones to maximise oil recovery and throughput. The preferred site to locate Cyclones in a process is on the water outlet line from the Separator or Water Knock-out Vessel, upstream of the Level Control Valves. This generally provides the highest Deoiler Cyclone capacity with minimal oil droplet shearing.

### Pumped Systems

If the system pressure available is too low (typically  $\leftarrow 75$  psig), a pump will need to be installed to raise the inlet pressure to the Deoiler Cyclone.

When a pump is installed, the pump type and size will need to be carefully selected to minimise oil droplet shear.

However, SUEZ has many years experience at designing pump-fed Deoiler Cyclones, and can readily provide a solution while meeting discharge targets.

A benefit of pump-fed systems is that very high turn-down rates are achievable, as water is recycled to maintain pump flowrates. This ensures that high oil-removal is maintained regardless of the water throughput.

### Oil Droplet Size /Distribution

The Oil droplet size range has a major impact on the Deoiler Cyclone's performance, and it is important to maintain as little shearing of oil droplets as possible prior to the Cyclone.

### Deoiler Unit Sizing

SUEZ manufactures a number of Deoiler Cyclone types as Spare Parts for most common brands of Deoiler Cyclones.