ToreTrap

Cyclonic produced water desander

Protect your equipment and reservoir from solids

The Tore™Trap is a cyclonic desander that removes solids from produced water without frequent manual interventions or creating additional waste. Each vessel contains multiple cyclonic liners that spin the water to create forces that promote drop out of the solids into the lower section of the vessel without an increasing pressure drop. Once the vessels are full the sand can be fluidized and transported to a sand handling package for cleaning and disposal without taking the desander offline. The wide operating range means that turndown can generally be accommodated without manual interventions. If the baseline flow has changed over time, the capacity of the vessels can be rapidly adjusted by opening the offline vessel and pulling and blanking the excess liners without disturbing the other liners, minimizing down time.

Benefits:

- Lowest OPEX solids removal technology
- Low maintenance
- NOV's high performance cyclonic liners with cut point of 10-30 micron depending on selection
- Liners are quick to remove and replace individually
- Can be emptied safely with vessel remaining online
- Reliable Tore™ sand fluidizer installed as standard

Design specifications

Parameter	Value
Max flow per vessel	>1500 m^3/h
Flow range	30-100% of vessel max capacity
Min/max particle size removed	10-2500 micron (depending on liner selection)
Sand holding capacity	0.5-1.0 m^3 (typical)
Fluidizer technology	Tore

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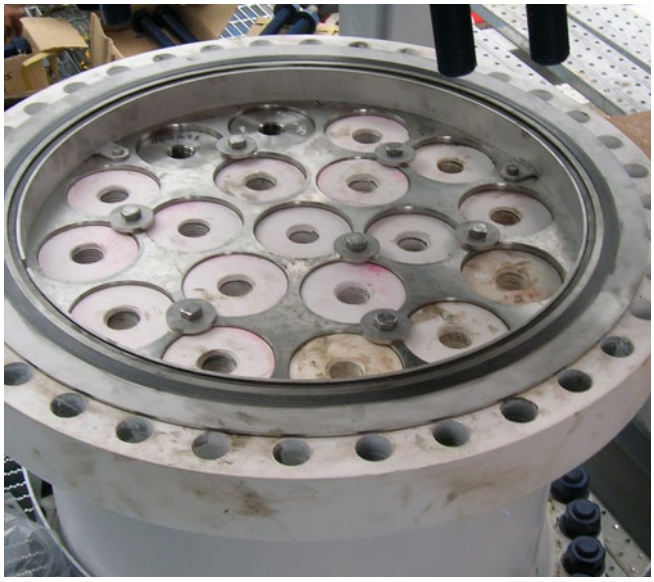
ToreTrap



Operation and separation efficiency

Inside the vessel ceramic cyclone liners are arranged between overflow and underflow plates. Water enters the vessel between the plates and the individual ceramic cyclone liners through tangential inlet ports. The tangential inlets impart a spin on the water flow that forces the solids to the outer edges of the cyclone liner. As the desanded water passes through the liner outlets to the top of the vessel, the sand falls into the accumulation section at the base of the vessel where it settles.

The efficiency of the cyclone is determined primarily by the temperature of the water and the diameter of the cyclones. The most selected cyclone sizes, 2" and 4", are chosen for their good separation efficiency, robust design, ease of handling, and cost-effective vessel designs.

Liners are very robust to erosion and require no maintenance. The design of liner and vessel allows for individual liners to be removed and replaced after the vessel is opened and doesn't require lifting of the entire set of cyclones. This eliminates the risk of accidentally damaging multiple cyclones and therefore spares inventory can be smaller.

Applications and business case

Cyclonic desanders are compact, low maintenance, and tolerant of high solids concentration in produced water.

Applications offshore:

Removal of 10-2500 micron solids from produced water

- Placed early in produced water treatment system to reduce equipment erosion and to catch sand carryover from jetting operations.
- Placed after deoiling hydrocyclones to reduce oil in water associated with solids.
- Placed after injection booster pumps to retain injectivity of reservoirs, reduce maintenance, and by avoiding use of cartridges.

Applications onshore:

Removal of 10-2500 micron solids from produced water

- Placed after separators where solids risk overwhelming plate packs.
- Placed after induced gas flotation units to reduce oil associated with solids or for protecting the injection reservoir from solids.
- Placed after injection booster pumps to retain injectivity of reservoirs, reduce maintenance, and by avoiding use of cartridges.

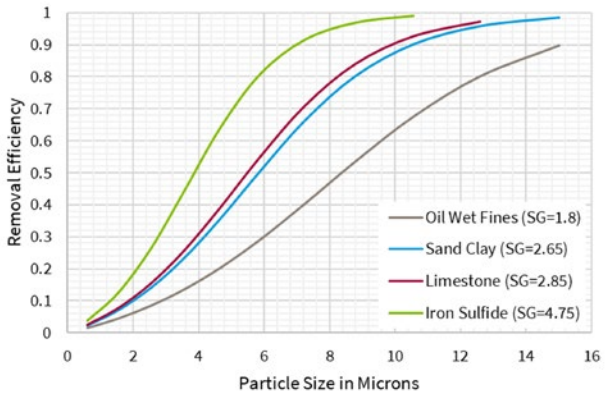


Figure: Typical solids removal efficiency for 2" liners.

Figure: Tore fluidizer, used to remove solids from the ToreTrap vessel and upstream separators.

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