Schlumberger

CDX

Compact deoxygenation system

APPLICATIONS

- Removal of oxygen from seawater
- Water injection systems

BENEFITS

- Fits between decks
- Reduces space and weight compared with conventional technologies
- Decreases structural steel requirements because of dynamic motion and bending moments
- Simplifies retrofitting and reduces site installation requirements
- Minimizes or eliminates oxygen scavenger requirement
- Eliminates dynamic motion performance issues and antifoam requirement
- Potentially eliminates pump requirement

FEATURES

- Compact skid package design
- Reduced flooded weight and lower flooded center of gravity
- Zero oxygen and chlorine outlet concentration without the use of chemicals
- Motion insensitivity
- Flooded operation
- Pressurized operation
- Chemical reaction process instead of mass transfer process

To prevent equipment corrosion and reservoir contamination, most operators remove oxygen from seawater aboard floating production, storage, and offloading (FPSO) vessels or on fixed offshore platforms traditionally using a vacuum deaeration system with a tower that has an approximate flooded weight of more than 368,000 lbm [167,000 kg] and a height of 85 ft [26 m]. Systems of this size require a large number of structural steel design accommodations.

The Schlumberger CDX* compact deoxygenation system enables removing oxygen from seawater in a footprint that is up to 40% smaller and 60% lighter compared with conventional systems.

How it works

The CDX system treats incoming seawater by first measuring it with a flowmeter, which produces a flow rate value that is registered by the system's controls. Based on this value, the system produces and injects a proportional amount of hydrogen gas into the water upstream of the system's inline mixer. The mixer ensures the dissolution of the hydrogen into the water. The resulting water-hydrogen mixture is then routed to the catalyst vessel, where it contacts the palladium catalyst. Once there, the oxygen in the water reacts with the dissolved hydrogen, producing water with oxygen levels that are below 10 ppb and suitable for reservoir injection.

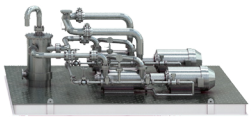
Pilot test

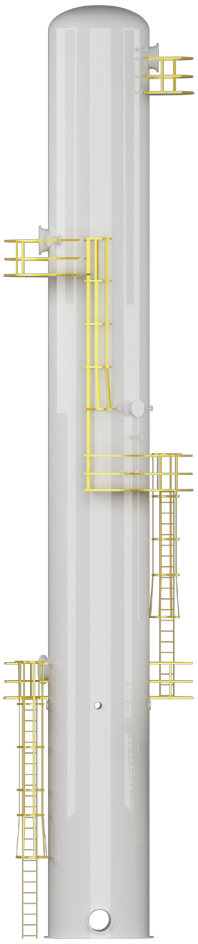
A pilot test of the CDX system was undertaken to assess the system's processing functionality from pretreatment through hydrogen generation and mixing to catalytic reaction, where deoxygenation occurs. For the test, a prototype at the Texas A&M Galveston campus treated Galveston Bay seawater, which typically has >100 ppm of total suspended solids. Using prefiltration, engineers set an outlet dissolved oxygen concentration goal of 20–50 ppb. After operating the system 24/7 for 8 months, the CDX system consistently reduced the outlet dissolved oxygen concentration of the seawater to between 2.5 and 10 ppb with a hydrogen generation cycle of only 3 minutes.

Commercial CDX system including hydrogen generation unit.

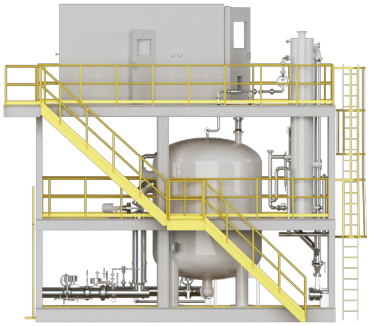
CDX

Traditional deoxygenation tower extends through multiple platform decks, increasing costs for construction.





The CDX system fits between platform decks, making space available for additional processing equipment.



Simplified side-by-side comparison of a vacuum pump package (left) and tower (center) with the CDX system (right).

120,000-bbl/d [800-m^3/h] Comparison	Dry Weight, lbm [kg]	Operating Weight, lbm [kg]	Flooded Weight, lbm [kg]	Deck Space, ft^2 [m^2]	Height, ft [m]
CDX system					
Skid package	54,234 [24,600]	126,986 [57,600]	128,309 [58,200]	404.7 [37.6]	27.9 [8.5]
Hydrogen generator	12,125 [5,500]	12,346 [5,600]	12,346 [5,600]		
Total	**66,359 [30,100]**	**139,332 [63,200]**	**140,655 [63,800]**	**404.7 [37.6]**	**27.9 [8.5]**
Vacuum deaeration system					
Deaeration tower assembly	95,240 [43,200]	168,433 [76,400]	346,567 [157,200]	542.5 [50.4]†	85.3 [26.0]
Vacuum pump assembly	22,046 [10,000]	22,046 [10,000]	23,149 [10,500]	90.4 [8.4]	
Total	**117,286 [53,200]**	**190,479 [86,400]**	**369,716 [167,700]**	**632.9 [58.8]†**	**85.3 [26.0]**

†Deck space requirement assumes penetrations through upper decks (occupying three platform levels).

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