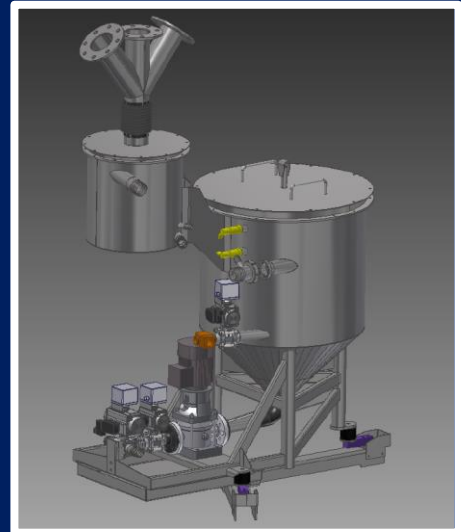


SODIUM POWDER AND WATER MIXING UNIT FOR WASHING OUT SO_x FROM EXHAUST GAS

Up to now this has always been the liquid additive Sodium Hydroxide (caustic soda), but in this unit a powder like sodium carbonate can be used instead. Taken aboard dry and loaded into a silo, the powder is mixed with water before entering the closed-loop circuit. **This reduces the potential onboard hazard**



Sodium carbonate is injected in the process water as the reacting agent to remove SO_x in the exhaust gas. This applies to both closed-loop and hybrid configurations. When running in closed-loop mode, the circulation water must be dosed with an alkaline additive.

The Alkaline is automatically added to the scrubbing water circulation to maintain the process pH and consequently, the SO_x removal efficiency.

INNOVATION

ME Production has won the Environmental Performance Award for our sodium carbonate dosing unit for scrubber systems

Onboard powder dosing system.

It is consisting of three different units, a buffer tank unit with integrated cyclone, a screw conveyor unit and a silo unit.

Buffer tank unit with integrated cyclone. The Buffer tank/cyclone mixing unit consists of a cyclone, and one buffer tank, performing the mixing process. Sodium powder is being delivered, by a screw conveyor unit, from included 3-piece manifold of cyclone, while fresh water is circulating, mixing is ongoing. The mixed process water will, when cyclone is full, continuously drain out and back into the buffer tank, and a dedicated pump, pumps the process water back into the cyclone. Mixing/ circulation is ongoing. When the mixed batch is ready, it will be pump to scrubber and process start over.

Screw conveyor unit.

The screw conveyor unit is consisting of three screw conveyors, one for each cyclone, and can be used only one at a time, and must be connected to the cyclone 3-piece manifold.

Storage tank unit.

The silo is containing the sodium powder, delivered to mixing process by the Screw conveyor unit, mounted underneath. A radar unit placed on top, determines the instantaneous load.

Onboard storage capacity is dictated by the following parameters: vessel design, alkaline consumption and vessels operation profile and area.

For vessels that are operating in regular routes or in specific areas, the storage capacity could be equal to the fuel bunkering interval. To minimize the transportation costs and ease the bunkering arrangement, tank capacity should be adequate to receive the total volume from one delivery truck. The ideal storage capacity should be at least 1.5 times the volume of the truck.

Sodium Carbonate Dense

The sodium powder must be in good quality, and must not, at any time have been exposed to any kind of moisture, before loading up the Silo unit.

Control unit

Control system is a PLC based 24V electronic remote control system designed for implementation onboard ships, full Ethernet communicated.

Equipped with a AE main board and HMI 12" touch panel, placed together with the Buffer tank unit. A slave display indicating weight, is picking up signals from load cells.

Connecting

Buffer tank unit and cyclone mixing unit is designed to be connected by flexible hose. If desired the connections between units, can be retrofitted with various types of flanges, pipes etc.

TECHNICAL STANDARD DATA – 40 ton

Buffer tank unit with integrated cyclone

Dimension: LxWxH	1430 x 1020 x 2000 mm
Weight dry:	230 kg
Fresh water supply:	Hot water min. 60 L/min Cold water min. 60 L/min



Silo unit.

Dimension: LxWxH	4500 x 2300 x 4000 mm
Capacity:	adding approx. 40 kg each batch mixture (approx. 20 % mixture)
Dimension: LxWxH	4750 x 2750 x 3950 mm
Weight:	4500 kg (unloaded)
Powder capacity:	app.: 40 Ton.



Tailor-made

The solution is a custom-built dosing / monitoring system, and the size is depending on the requirements of the preferred vessel profile.

Na₂CO₃ Consumptions.

Alkaline consumption depends on the concentration of the solution, engine operating power, engine specific fuel oil consumption and fuel sulphur content. The alkaline supply is automatically controlled based on these parameters.

Fuel: HFO 3,5% sulfur

Engine Load: 100 %

Engine power 1 MW ~ 17 kg/Hour

Engine power 10 MW ~170 kg/Hour



Sodium Carbonate Powder specification.

Na₂CO₃ - Density approx. 0,95 – 1,05 g/ml

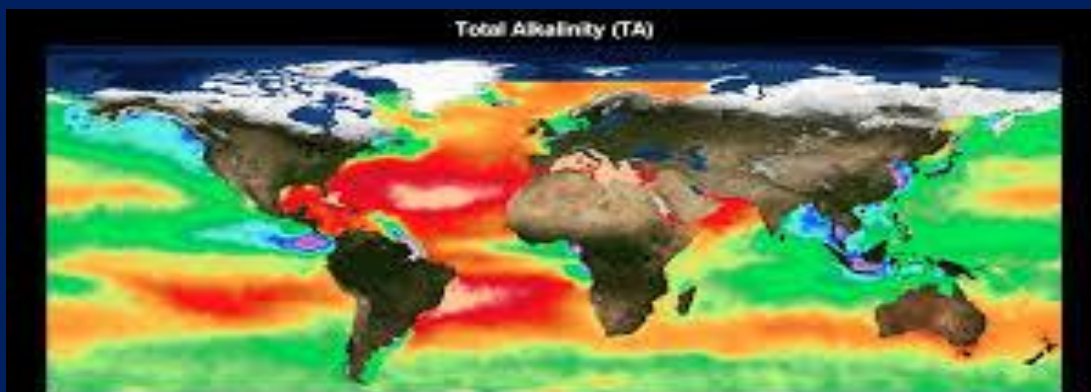
Na₂CO₃ – molecular weight: 105.99 g/mol

Water temperature: Operational water temp is specified to a range from min 21 C. to max 40 C. Recommended temp of operational water is approx. 40 C.

Worldwide Seawater alkalinity

The alkalinity minimum value, defines the operating areas of where open loop is effective. Dimensioning a scrubber system with 2000 $\mu\text{mol/l}$ will prohibit operation in - for example - Gulf of Bothnia, unless a neutralizing agent is added in the configuration.

PORTS Alkalinity			PORTS Alkalinity			
Location	Min	Maks	Location	Min	Maks	Estuary
Arabian Sea	2300		Ansterdan	2200		
Baltic Sea	500	2000	Antwerpen	2200	4500	Scheldt
Bay of Bengal	2300		Bilbao	2200		
Black Sea	2500		Bordeaux	2300	2400	Gironde
Caribbean Sea	2250		Calais	2800	3100	
Coral Sea	2150		Dover	1100	1300	
Gulf of Alaska	2000		El Ferrol	2280		
Gulf of California	2150		Hamburg	2050	2400	Elbe
Gulf of Mexico	2250		Hanko	1600		
Gulf of Thailand	2000		Helsinki	1250	1500	
Indian Ocean	2200		Hull	1350		Humber
Mediterranean Sea	2400		Krota	900	1000	Kymijoki
North Atlantic Ocean	2300		Miami	2300		
North Pacific Ocean	2100		Moss	850	2000	
North Sea	2200		New Orleans	2400	3000	Mississippi
Norwegian Sea	2300		Oslo	1350		
Panama	1800		Rotterdam	2200	2700	Rhine
Panama Canal	1000		St. Petersburg	490		Neva
Persian Gulf	2500		Travemünd	1800		
Philippine Sea	2100					
Red Sea	2400					
South Atlantic Ocean	2300					$\mu\text{mol/l}$



Onshore powder mixing system.

The system is adaptable for vessels/ferries that entering the same port/destination frequently, and has limited space for dosing system onboard.

System:

The system can handle sodium carbonate powder, through a mixing process with sea water. The mixture can be used as reaction medium in closed loop scrubber systems.

Silo/storage room.

Pipe-system, heat exchanger, in feed screw conveyor, mixing system, Compressed air system, decentral control board, electric heater.

Container unit.

Pipe-system, Store tank for mixed Sodium Carbonate, main control panel, electric heater.

Function:

The silo for the sodium carbonate powder is formed so that a tanker truck can blow the powder directly into the top of the silo trough a pipe-system. Silo design makes the powder runs continuously towards the outlet where it gradually passed screw conveyors to the mixing cyclone.

The sea water is pumped directly from a seawater inlet through heated pipeline at the quayside into the system, where it is circulated until it has reached the accurate temperature.

Then continue to the next mixing cyclone, which is the final mixing process before being drained into the storage tank

Tailor-made

The solution is a custom-built dosing / monitoring system, and the size is depending on the requirements of the preferred vessel profile.

