

# THE DRY SCRUBBER

## NO SULPHUR RELOCATION, BUT RECOVERY AND RECYCLING

**The dry scrubber method developed for vessels uses the unique ability of hydrated lime to absorb the sulphur compounds in flue gases. Lime is in the form of granules, which makes the absorbent easy to handle and minimises dusting. The marine modification is adapted from proven land-based applications.**

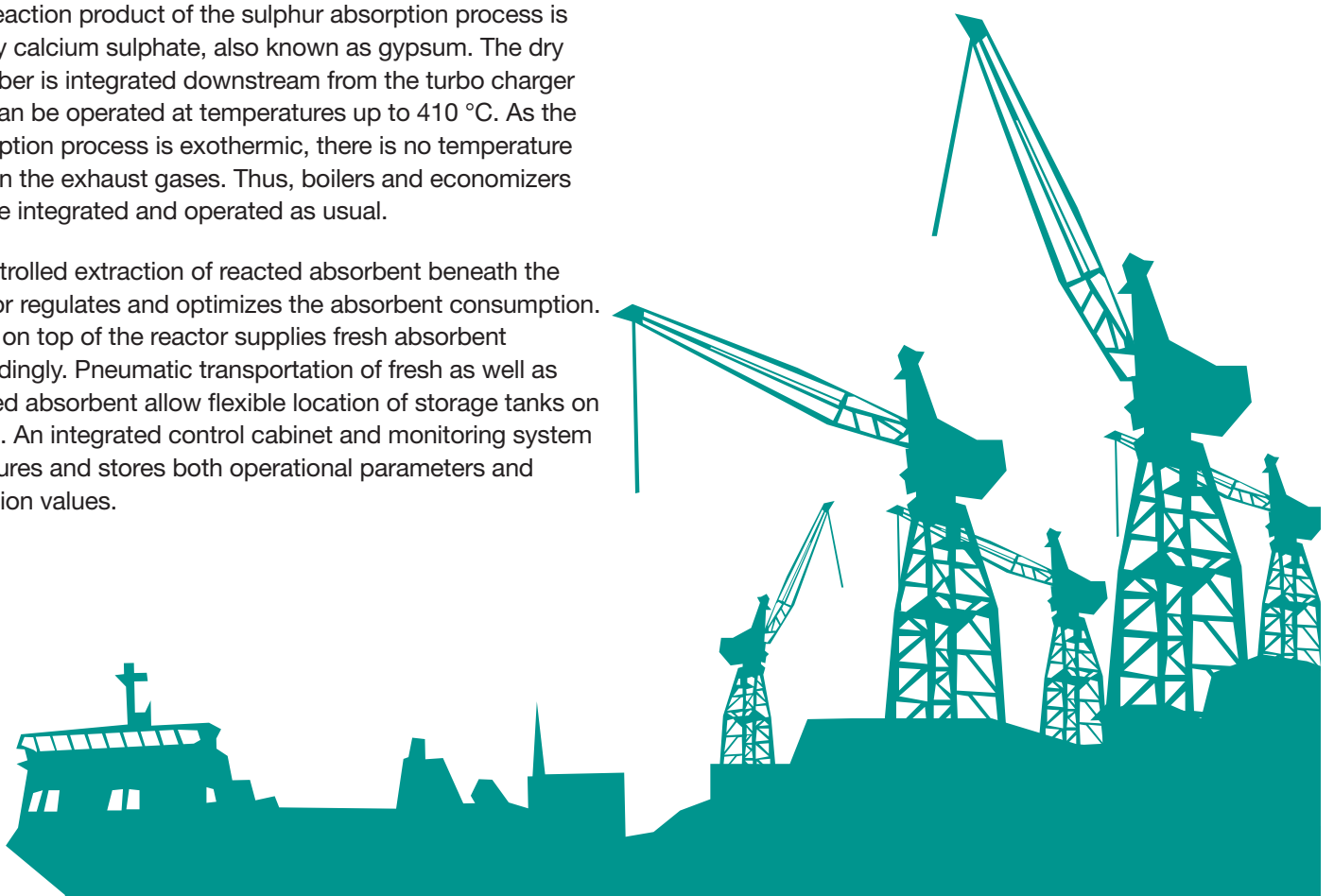
### THE DRY DESULPHURISATION METHOD

In a reactor filled with granulated hydrated lime the sulphur oxides in the exhaust gases react chemically with the absorbent:



The reaction product of the sulphur absorption process is mainly calcium sulphate, also known as gypsum. The dry scrubber is integrated downstream from the turbo charger and can be operated at temperatures up to 410 °C. As the absorption process is exothermic, there is no temperature drop in the exhaust gases. Thus, boilers and economizers can be integrated and operated as usual.

A controlled extraction of reacted absorbent beneath the reactor regulates and optimizes the absorbent consumption. A silo on top of the reactor supplies fresh absorbent accordingly. Pneumatic transportation of fresh as well as reacted absorbent allow flexible location of storage tanks on board. An integrated control cabinet and monitoring system measures and stores both operational parameters and emission values.





## ENVIRONMENTALLY SOUND AND EFFICIENT METHOD

- Cleaning of flue gases complies with the sulphur directive.
- Economic efficiency: the dry scrubber generates significant savings by allowing the vessel to run on cheaper sulphur containing fuel. The return on investment is low when operating within sulphur emission controlled areas (SECAs).
- Environmental sustainability: the method does not cause any emissions into air or sea, and the used absorbent can be recycled.
- Relatively simple process: low maintenance need and costs.
- In addition to sulphur, also particulate matter is removed efficiently in the dry scrubber.
- The dry scrubber has a low power requirement, only around 0,1% of engine power.
- The dry scrubber solution enables downstream installation of selective catalytic reduction (SCR) for NOx removal without reheating of the flue gases.

## TURNKEY ABSORBENT SUPPLY SERVICE FOR VESSELS WITH DRY SCRUBBERS

- Nordkalk secures the availability of hydrated lime granules for the shipping industry in the Baltic and North Sea area.
- Nordkalk is committed to an innovative turnkey solution that includes production and delivery of absorbent as well as recovery of the used absorbent. Short lead times as well as just on time deliveries are a must to fulfil customer needs.
- The used absorbent, containing mainly gypsum and calcium carbonate, is collected directly after the ship is reloaded with fresh absorbent. The material can be recycled, with several identified reuse areas such as agro technology, different earth works and the cement industry. The goal is 100% recycling.

## REFERENCES

- Two ships equipped with dry scrubbers have been operating in the Baltic Sea and the North Sea since early 2015. Nordkalk supplies the absorbent.
- The dry scrubbers were certified by DNV GL in July 2015.



Nordkalk has made a commitment with the Baltic Sea Action Group (BSAG) to support the activities for a cleaner Baltic Sea. We have developed the Fostop® concept to tackle the challenge of agricultural phosphorous runoff. The concept consists of FOSTOP Structure, FOSTOP Drains, FOSTOP Sludge and FOSTOP Filters.



**FURTHER INFORMATION:**  
[kjell.weppling@nordkalk.com](mailto:kjell.weppling@nordkalk.com)  
**+ 358 20 753 7376**



**NORDKALK CORPORATION**  
Tel. +358 20 753 7000  
[dryscrubber.nordkalk.com](http://dryscrubber.nordkalk.com)

