



## Technical News

A brief technical update on the fuel issues

### Bunker Delivery Notes (BDN)

*Effective 1st of January 2019 the Bunker Delivery Notes change...*

The sulphur 2020 requirement looms or it is *ante portas*, and a first step has already been in force. Since 1 January 2019 the BDNs are modified, and it shall include a declaration, signed and certified by the fuel oil supplier's representative, that the fuel oil supplied is in conformity with Regulation 18.3 of MARPOL Annex VI and that the sulphur (S) content of the fuel oil supplied does not exceed:

- the limit outside ECAS, the Emission Control Areas that it is currently 3.50% S, falling to 0.50% S from 1 January 2020, under MARPOL Regulation 14.1;
- the limit in ECAS, 0.10% S, under MARPOL Regulation 14.4;
- or the purchaser's specified limit value, on the basis of the purchaser's notification that the fuel oil is intended to be used in combination with an equivalent means of compliance or it is subject to a relevant exemption for a ship to conduct trials for sulphur oxides emission reduction and control technology research.

Needless to accept that, primarily, the "equivalent" means **a scrubber installation**. We also note that the 0.10% S limit applies in the four established ECAS, namely the Baltic Sea area, the North Sea area, the North American area (covering designated coastal areas off the United States and Canada) and the United States Caribbean Sea area (around Puerto Rico and the United States Virgin Islands).

### Emission Control SO<sub>x</sub>-NO<sub>x</sub> *ante portas*

A Global Sulphur Cap is implemented in 2020



The agreed in the IMO's MEPC 70 meeting, 0.50% global sulphur cap (briefly S) on marine fuel oil will be implemented in January 2020.

Apparently, **less than a year time from now!**

There are also in place additional regional directives, mandate the ships to use low sulphur fuels. Very clearly, the ships and maritime industry will be placed within new challenges and operational practices. The *wet scrubbing technology* is not new, it is in widespread use on land and it has implemented on the tankers since the era of the Inert Gas Systems (IGS) installations; however, it is now applied to the cleaning of the exhaust gases of the ships' fuel oil combustion machineries and to all kind of ships, no matter when they are trading within a SECA (Special Emission Control Area) or outside. The ships will be operated burning fuels of 0.5% S outside SECAs and within SECAs 0.1% S, so that the exhaust, critical, emissions of SO<sub>x</sub> and NO<sub>x</sub> are no greater than predetermined limits.

In other words, the HFO fuels with 3.5% S are considered as NOT appropriate for marine use, unless



Studio Navale is a certified firm against the ISO 9000:2015 standard for provision of naval architecture, marine and industrial engineering services, design and consulting services and provision of ship repairs management services.



an ALTERNATIVE is installed, through of which the emissions are identical to burning fuel 0.5% S or 0.1% S when in terms with SECA locations.

It is **our** opinion that the Sulphur Cap 2020 will be implemented almost immediately upon due date, early 2020. This is because of the fact that the oil companies and their terminals will be ready to deliver marine fuels with 0.5% S, cutting with this way any links with possible waiving, due to shortage of the fuel.

Exhaust Gas Cleaning Systems (EGCS), known broadly as “Scrubbers” seems to be the most common solution for those who won’t use fuel with 0.5% S or less. With this mechanism, the exhaust gases will be treated prior to discharge to the atmosphere. On the scrubber, the main engine, the diesel auxiliary engines (generators) and the boilers may be connected. Some installations leave the boilers outside the loop, using them with HFO 0.5% S. The majority of the scrubbers are working on two modes, one for exhaust gases cleaning to correspond to 0.1% S, for SECAs, and one to correspond to 0.5% S.

The installation of the scrubber requires use of sea water, chemically treated fresh water or dry substances. It is also requires steel works, piping works, electrical works, insulation works, tanks re-arrangement works and more,

requiring a class plan approval and attendance. Apart from the engineering plan approval, the approval of the scrubbers themselves is achieved through two (2) individual schemes, the **Scheme A** and **Scheme B**, as follows:

- **Scheme A**: Is based on **initial** emission performance unit certification, together with a continuous check of operating parameters and daily exhaust emission monitoring.

- **Scheme B**: Is based on **continuous** exhaust emission monitoring together with a daily check of operating parameters.

Just to highlight that the majority of the scrubbing devices orders,

deliveries and retrofitting, so far, are being approved with the Scheme B. Note that in both cases, the condition of the discharged wash water used in the scrubbing process is to be monitored and recorded.

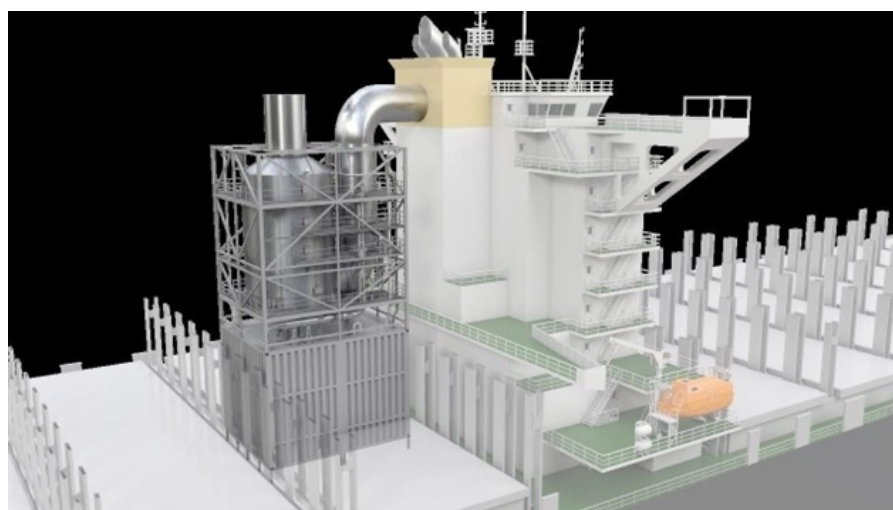
## The scrubber installation and systems’ modification

We would like to share with the industry **our experience** in the scrubbers installations, as per now. We have

Sulphur Emission Limits, SO<sub>x</sub>

Specific dates	Outside SECA	Inside SECA
On or after 1 January 2012	(it was 4.5% m/m) <b>3.5% m/m</b>	(it was 1.0% m/m)
On and after 1 January 2015	-	<b>0.1% m/m</b>
On and after 1 January 2020	<b>0.5% m/m</b>	<b>still 0.1% m/m</b>

read may “advices” of various specialists or experts (or not at all!) on what the installers have to follow for securing an effective final product! It is quite strange that some of these named “specialists” or “experts” have no, or only very few, ships’ modifications -of any kind- in their technical records; however, with the opportunity of the



An artist impression of a Wartsila<sup>®</sup> scrubber installation. Similar installations are expected with almost all other scrubber makers, being all in request of additional space, afterward or aside of the funnel. The size of the scrubber and the associated installations follow the ship's size.



scrubbers installations (and same for the ballast water treatment systems) are self-placed in a position to advise industry for such a technically demanding and, -why not- individual, specific, unusual, unique and atypical modification! Don't forget that apart from the cleaning of the flue gases, a scrubber tower is an additional unit, being added close to funnel (quite higher and enough afterward of the ship's VCG), weighted, say, more of 10-15TN at minimum, which is prone to follow the ship's moves and, therefore, requesting special engineering solutions. Or, in other words a "pendulum" is being fitted close to funnel and higher the main deck.

From Studio Navale perception, just to highlight that the scrubber unit installation, more-or-less, is not the problem! The location of the scrubber tower is almost predetermined, solely because of its size; at Studio Navale with analytical structural models and use of Finite Elements Methods software, we secure a solid and concrete support of the tower on the existing ship's structure. The technical issues are emerged when you come in terms of an appropriate installation for the associated parts. Hull penetrations, pumps, foundations, piping, supports, switchboards, cabling trays installations and/or extensions of existing and more. And all these items should be installed and are fully cooperated with existing installations and arrangements.

During our onboard inspections, 3D scanning of engine rooms and engineering studies, of demanding scrubbers installations and associated systems, we faced some difficulties. We may start from the lack of information or not accurate

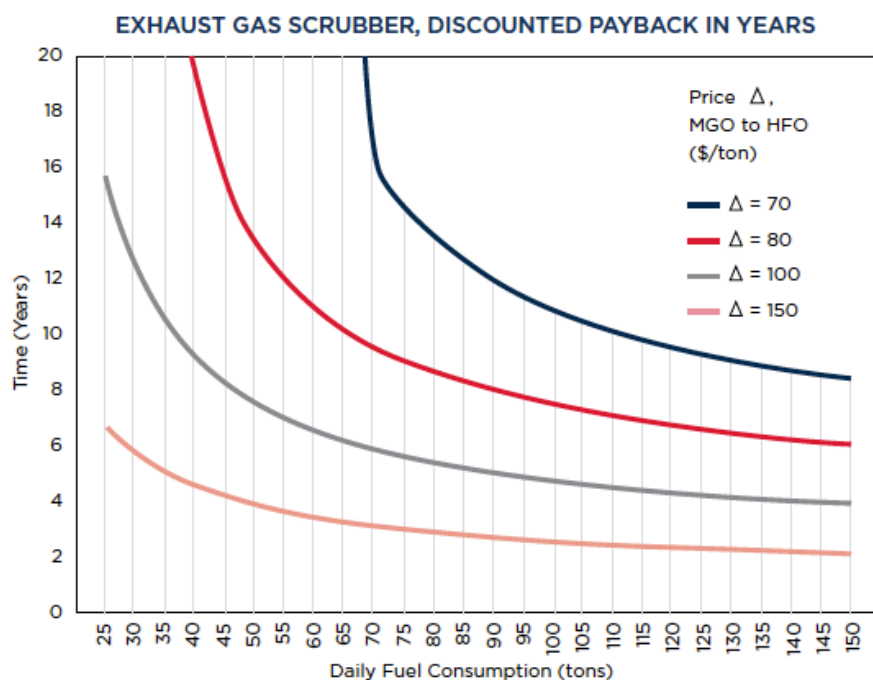
description of the systems and required sub-systems, assuming that the operational profile of the ship has been cleared at the very preliminary stages of the modification.

It is important for everyone that deals with such an installation, to get comprehensible technical, operational and other types documentation from the maker of the scrubber. The design parameters of the scrubbers should be clearly stated in the documentation, namely the ability of the units to deal with the total flue gases' production that are connected to the scrubber (at full production or percentage of this, as contractually agreed). No doubt that pragmatic cases should be included, in order for the design of the scrubber to be confirmed. The same should be verified during the trials, as also required by the approval schemes!

**Studio Navale** is the Shipping Partner for Engineering, Concept Development, Conversion Design and any demanding modification a ship may need!

The complexity of the engineering approach is more demanding when we have retrofitting on new building ships, delivered as "scrubber-fitted". sometimes this is a much more demanding work, requiring huge engineering job to be done, just because the initial data, during the contractual phase, have been changed! Some of the initially ordered scrubbers are changing or the owners' final choose is a totally different unit, in size and/or principles!

The cooperation with the maker's representative, during the installation phase, is also a very vital issue as well. It should be the owners of the ship request to the maker the attendance of the installation by a senior technical



In this very representative graph, the payback period of a scrubber installation is given against the daily fuel consumption, based on specific difference of the prices between MGO and HFO.





person, with knowledge of the peculiarities of retrofitting installations and naturally the details of the scrubber. As the time goes by, the installations of scrubbers will emerge in terms of concurrently units' installations, and, with no doubts, the experienced and skilful technical personnel will be running out. Once again, a smart and appropriate scheduling is the solution!

Least but not last, the shipyard and subcontractors chosen are vital parameters, since there are many issues emerged during the installation of a scrubber and associated items, requiring a team-working from various persons or entities. A Technical Leader, who will attend the project from A to Z, is always a good answer to mitigate problems, expenses and time consuming.

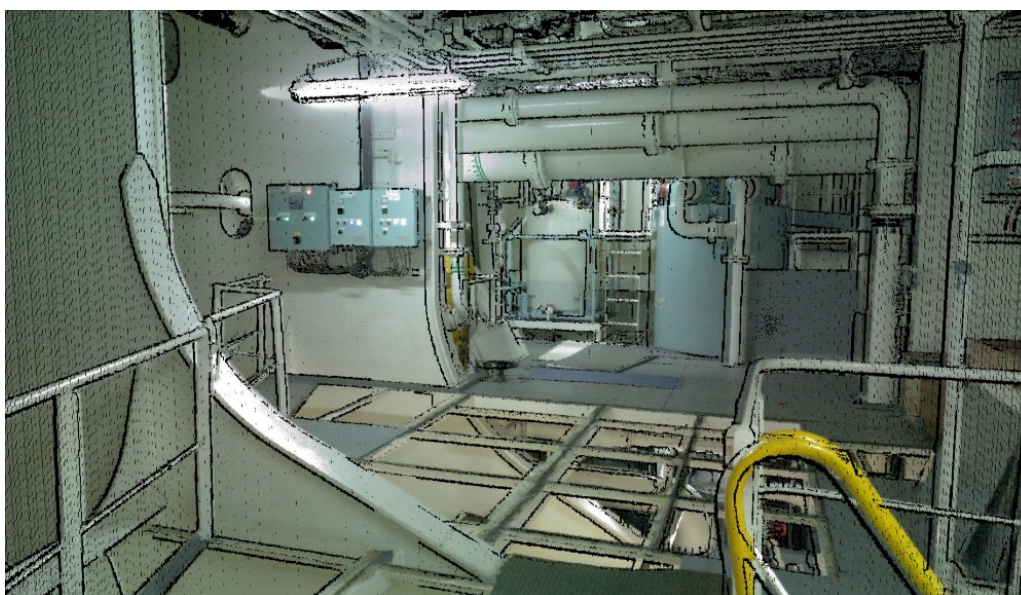
### *Costs involved*

Per the current information, it seems that the installation and use of a scrubber, **potentially** is the lower cost involved, in order for the required SOx limits not to be breached. The cost involved in the modification of a ship to carry a scrubber, is the **capital cost**, the **installation cost** and the **operational cost**. In other words, very roughly, for an Aframax tanker, the capital and installation cost may be US\$2.0-2.5mio, excluding off-hire cost of the ship. A really big amount that it is very difficult to be added at 100% to the ship's "fair value", especially when the ship is, say older than 8-10 years. Increased operational cost should be expected as well (e.g. fuel and consumables). It is the Studio Navale technical opinion that a comprehensible, real approach of the costs involved into a scrubber installation can only be estimated at the **Technical Feasibility Study**, as appropriately be done during the initial stages, where pragmatic data and information are used. There are many approaches of the installation costs per the ships types and/or sizes; they are offered as some indications. However, the reality has shown that an accurate, and concrete budget, can only be confirmed at a Technical Feasibility Study, where all parameters have been taken into consideration. Further, these costs may be assessed against the alternatives costs, e.g. use of LNG or use of the "expensive" HFO throughout the ship's live expectancy. It is a demanding work though!

We found an interesting graph at the ABS edition "Global Sulphur Cap 2020", as seen in the previous page. It is a clever approach the indication of the scrubber installation costs' depreciation, as a function of the fuel price difference and not the actual prices. As clearly seen, the higher difference of the price of the HFO and MGO

the more viable solution is the installation of a scrubber. Apparently, the assumptions of the data of such a graph are the core of the reality or not and are based on what information is known so far.

Having in mind this graph, say that a ship's average HFO consumption is about 30-35TN/day (main engine, generators and boilers), then if the price difference between the two qualities of the fuels is not as high as 120-150US\$, the payback period would be 20-25 years and more,



View of a typical 3D scanning shot, of an engine room, where the floor panels have been removed. An accurate demonstration of the engine room is a key factor for a complete and proper engineering work for the scrubbers and associated machineries installations.



making such an investment financially meaningless.

We all know that there are rumours as for the future prices of the HFO 0.5% S, say something 300-350US\$ over the current price of the HFO 3.5% S or so. There are certainly variations and the horizon is not clear! We would like to place the fact that the **desulphurisation** of the crude oil is the most expensive exercise for producing low sulphur marine fuels and some of the refineries won't willing to deal with this, unless the HFO price soars. That's why the refineries are struggling to find better crude oils, in terms of sulphur content.

### *3D scanning of the engine room and other critical spaces*

Studio Navale deals with 3D scanning for several years! It was early time of scanners adoption and Studio Navale was a pioneer in implementation of 3D scanning in ship repairs and collection of ship hull data. Now, the use of 3D scanning is considered a very required part of a scrubber's installation, sometimes much more for commercial reasons rather technicality. In other words, we may don't need a scanning section when we are dealing with a huge engine room, where there is plenty of time for installation of necessary piping. Knowledge of piping work, survey onboard and appropriate measurements of the available spaces, is the answer. Have a glance at the picture of the previous page and note that this is NOT a photograph of the engine room. It is actually a 3D scanning, through of which all dimensions can be measured with an accuracy of less than 0.5mm. The large pipes seen in the background may be easily fitted without a 3D model of the engine room! However, the 3D model is a very useful tool at hands of engineers, in order for some difficulties during the engineering stage to be overcome.

We have to highlight that the lower levels of the engine room are very critical for the completion of the 3D model. Therefore, the crew of the ship SHOULD be prepared to remove almost ALL floor panels of the engine room. Same, for the floors of the pump room, if any, should be taken into consideration. Needless to mention that during the 3D scanning absolutely no works are allowed to be done in the scanned areas.

The funnel's internal spaces are very difficult to be scanned, not say quite impossible, unless several items are removed, which is not the case!

### *Ship-specific implementation plan*

Among the acceptances within MEPC.73, circulated as MEPC.1/Circ.878 was the **ship-specific implementation plan for the consistent implementation of the 0.50% S cap**, which was recommended.

This is a great tool for the ships, in preparing for the 2020 0.50% S cap and may be served as a documentation towards any Port State Controls, when verifying compliance. Note that

At Studio Navale we are proud of being certified by **Lloyd's Register** against the new standard **ISO 9000:2015**. Apart from our **Engineering Services**, we are certified for provision of **"Ship Repairs Management Services"**!

It was and it is our core that makes the difference!

the plan is NOT mandatory, however it is recommended having such a plan onboard.

Therefore, when preparing for the 2020, a ship-specific implementation plan should be considered. Classification societies have launched electronic applications, so a follow on their sites will give answers.



**Studio Navale** has absolutely **NO commercial** or other business relationships with any makers or suppliers of scrubbers and it does **NOT represent** any scrubbers firm. Studio Navale's Feasibility Studies and suggestions are **totally independent** of such a business relationships.



## Technical support by Studio Navale

At Studio Navale, we have the **knowledge, experience and technology** to deal with such an important and technically demanding task, like the **installation of a scrubber unit on a ship**. The Studio Navale management, naval architects, marine engineers and personnel, among a specific understanding of the ships design and construction, carry significant experience in ships' operations, regulatory compliance and technologies for modification and retrofit installations, from cutting second decks in small commuters up to new Panama Canal modification on shuttle tankers.

Studio Navale management and engineers are available to discuss any options of a scrubber installations and support the Shipping Companies in this very crucial decision making.

The Studio Navale services may vary to any levels, from a **Feasibility Study** up to **Detailed Engineering and Application Study**. The sub-tasks of these services may be an onboard inspection and visual survey, with 3D scanning of the engine room and the associated spaces, evaluation of a scrubber or a group of scrubbers (including potential costs), production of drawings and data (including gas flow analysis, steel and piping modifications, electrical installations and whatever is required, on a case-by-case basis. Studio Navale is an authorised user of hi-end 3D software for structural design, flow analysis, finite elements analysis, piping design and analysis and drafting software. More, Studio Navale is the owner of 3D scanners that are easily movable (with no any insurance, custom and air fare cost), while the accuracy of the scanning result is imperative.

Undoubtedly, during the walks of life of Studio Navale we had the opportunity to deal and materialise with many ships' modifications, of different potential to the scrubbers installation, which however has created a very solid background for the coming days!

### Studio Navale...

... has been established in 1987 in Piraeus, by the Naval Architect and Marine Engineer Alex Kouros with the scope of providing the ultimate available level of services, to shipping and industrial Clients.

Studio Navale is now operating from the brand new, ergonomic and well designed premises in the Industrial Park of Schisto, the VIPAS or, in other words, the heart of the shipping and industrial technical businesses of Greece, in the characteristic building of **Turbomed**, just at the entrance of the Park.

Studio Navale negotiates with all kind of ship design, ship construction and ship repairs from the very basics to a turn-key project and assists with tender, production design, operational support scheduling, quality and profitability as well as day-to-day ship management operations.



### Management Team

The Studio Navale management team is ready to join any case with regard to a scrubber installation, so to get a first hand indications and provide good advices to clients.



**Alex Kouros and Pantelis Kalipetis** jointly carry an experience in the field, of quite several years! Supported by a brilliant Team of Engineers and

Administrators in Studio Navale, they may offer a solid background for any ship's technical problems' solutions, especially when in terms to such a demanding requirements, like the retrofitting installation of a scrubber! Alex and Pantelis are naval architects and marine engineers, having an outstanding experience with ships, shipping, classification societies and shipyards, dealing with technically challenging, extreme and special projects every other day! Both, are in the first line of the projects and are working closely with the ships' representatives to come up with the best possible solution, assisting clients for the "right decision"!

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