Exhaust gas cleaning thecnologies for ships

There is currently a large global consensus that greenhouse gas emissions are one of the main causes of global warming that affects the planet, in addition to being harmful to the health of its inhabitants, so the number of countries trying to limit them is increasing. The emissions of greenhouse gases (GHG) caused by transport are one of its major parts (In Spain about 25% of total emissions. Out of that figure road transport accounts for 73% and in cities are mainly controlled CO2, CO, NOx SOx, and suspended particles emissions).

World maritime transport is the most efficient in terms of CO2 emissions, because despite being the means of transport for 80% of world trade, its contribution to CO2 emissions accounts only between 2-3% of total. However, it has significant sulfur oxides contamination. (One of the largest container ships can contaminate with this type of emissions an equivalent of between 20 to 50 million vehicles on land roads). The reason is that type of heavy fuel-oil used so far as fuel for most of the world's maritime transport, for people or merchandises, carries sulfur content much higher than that allowed for land passenger vehicle fuels.

In some European ports / USA, with SECA / ECA controlled areas, since 2015 that percentage of sulfur was limited to 0.1% (1000ppm), but not outside those areas or for international waters. As of 1st Jan2020, the Global IMO regulation enters into force reducing the sulpure content of marine fuel oil ,worldwide ,from 3.5%, (limited since 2012), to 0.5% . In Scandinavian countries, the control by drones and heavy penalties for non-compliance are already expected.

Despite of the reduction, the new 0.5% or 5000ppm limit will still be much higher than the current sulfur allowed, 10ppm for road vehicle fuels.

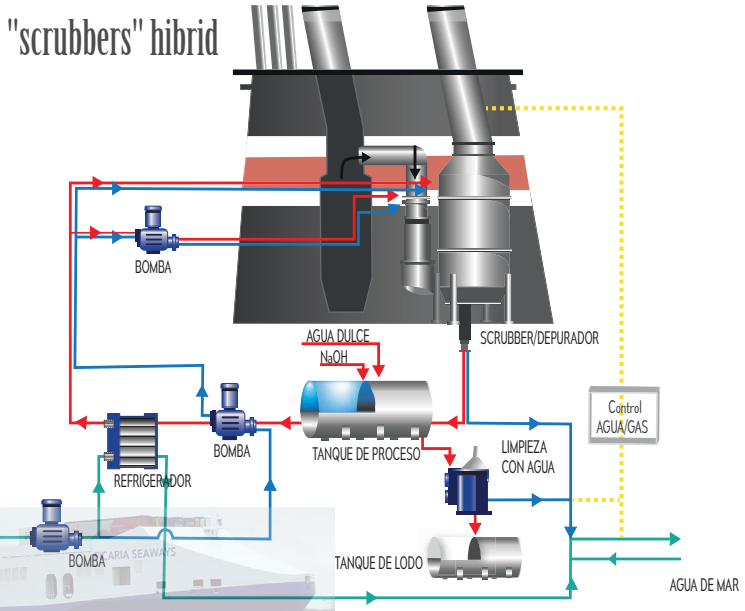
The current cost difference between a HFO 3.5% S, (heavy marine fuel oil) and a low sulfur 0.5% S, varies by country between $ 160-320/m Ton. An average price difference of $ 200 / Ton, for the largest current container ships of 20,000TEU (20ft containers), it will mean an operating extra-cost of $ 50,000/day. It is estimated that for the container lines worldwide it will reach a total extra-cost of $ 10,000 million per year, and that difference in cost between those fuels is likely to increase more in the following years.

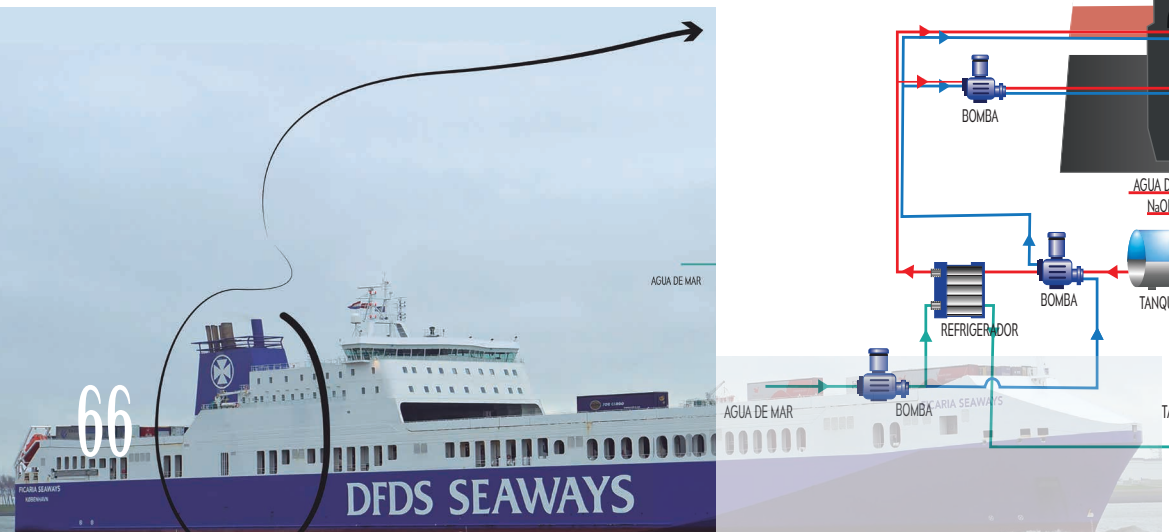
The use of scrubbers of the exhaust gases, will allow to continue using heavy fuel oil, complying with the new IMO Global regulations, even within the SECA / ECA controlled areas, and with a cost of retro-fitting of the ships applying these systems that will allow its pay-back between 1-2 years, what should facilitate the installations in coming years.

According to data available from various sources, as of Dec2017 between 240-300 ships were equipped with scrubbers. As of October 2018, the figure already amounted to 1,509 units, with 665 for installation on newly built ships and 844 for retro-fit. Potentially it´s estimated that by 2025 up to 25% of the global fleet will become equipped with these systems.

Everything will depend on the evolution of the difference in fuel costs, type, size, age and useful life of each vessel, and it´s possible amortization according to the calculated time of use in each case.

"scrubbers" hibrid





This new global regulation of immediate implementation is expected to result in a rapid increase of these marine gas purification systems. For newly manufactured ships there are other alternative fuels, such as liquefied natural gas (LNG), liquefied petroleum gas (LPG), or compressed natural gas (CNG), but those already in service may opt for retrofit with installation of these purification systems, of fast pay-back, or the use of the more expensive low sulfur fuel-oil. The still limited number of manufacturers of these scrubber purification systems and shipyards available for repairs ,which can take 4 to 6 weeks per ship , can be both also a barrier that limits the growth of the installations .

The operation of these systems consists in the treatment of exhaust gases with a variety of substances that can be seawater, chemically treated fresh water or dry substances that remove sulfur oxides SO2 / SO3 from fumes while reducing the amount of suspended particles released.

The main types of marine scrubbers are:

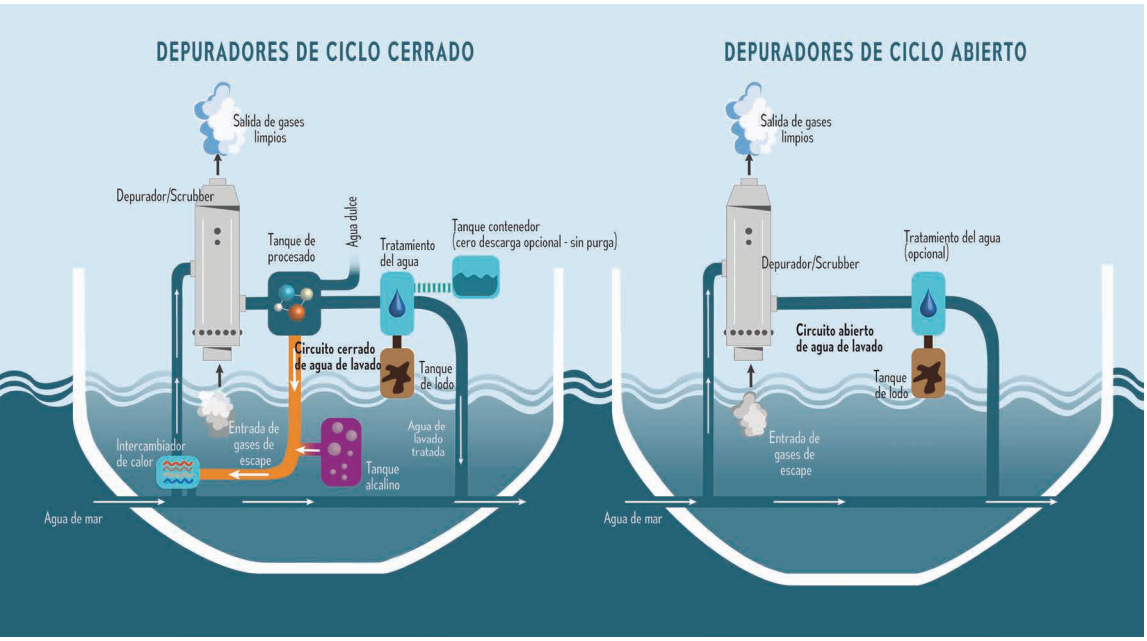
Open-loop system, Those that use sea salt water, mixing it counterblow with the exhaust gases, and are only effective for waters with enough alkalinity (pH 7,.8-8.3). After performing the basic wash, the exhaust mixture is passed through a gas water particle separator. The water mixture is directed to a wet sump where it is treated to meet the water discharge IMO quality requirements, and its alkalinity, according to existing local or national restrictions.

Closed-loop system. In these, treated fresh water circulates through the scrubber, allowing a process of purification independent of the water chemistry that the ship is sailing through. Generally, caustic soda, sodium hydroxide (NaOH), dosed for the alkalinity control of water is used. Dirty water resulting from purification is recycled undergoing a process of elimination of waste that is stored, capable of zero discharge requirements, and it is necessary to replenish water losses and the necessary NaOH.

Hybrid type system. It has the advantage of combining both systems. The more economical open-loop system can be used with seawater, in open sea areas and sufficiently alkaline water (pH 7.8-8.3) without the use of NaOH ,where discharge is allowed, while the closed-loop system allows to operate with equal efficiency regardless of where the vessel sails, for example in more sensitive areas with restrictions, or waters of low alkalinity, pH. The expected sulfur oxides removal efficiency is at least 96%, dependent on that alkalinity, and the removal of emitted suspended particles of 30-60%. (With the removal of 97.1% of sulfur oxides from the emissions of a fuel with 3.5% S, the emission produced by a fuel with 0.1% S is already equalized)

The treatment of gases with condensation, and especially in open and hybrid cycle systems, which use seawater in contact with the equipment, forces the use of stainless steels of high corrosion resistance such as the dúplex EN 1.4462-2205, the super duplex or the 6Mo super-austenitic.

The further development of these systems will contribute to a significant growth in demand for these specialtypes. For the rest of the pipes that conduct dry exhaust fumes, at high temperature, the use of special stainless steel types is not required but in combination with those systems and in a marine environment with chlorides, stainless steel types such as 1.4404-T316 / 316L are recommended .



MATERIAL:
Acero inoxidable
AISI 316/316L

FUENTE / *SOURCE*:
www.cedinox.es