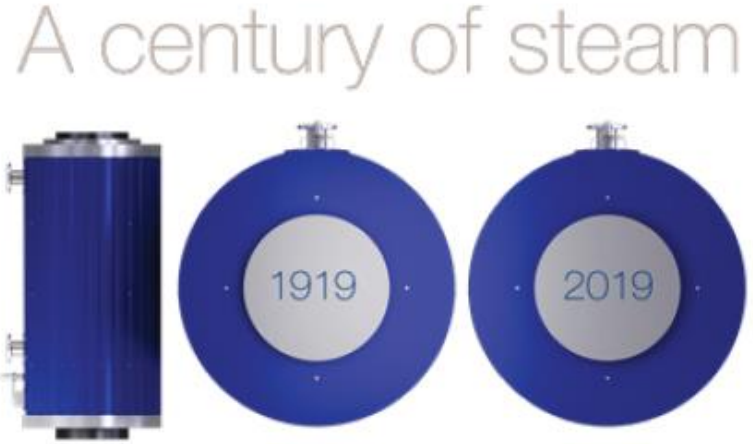
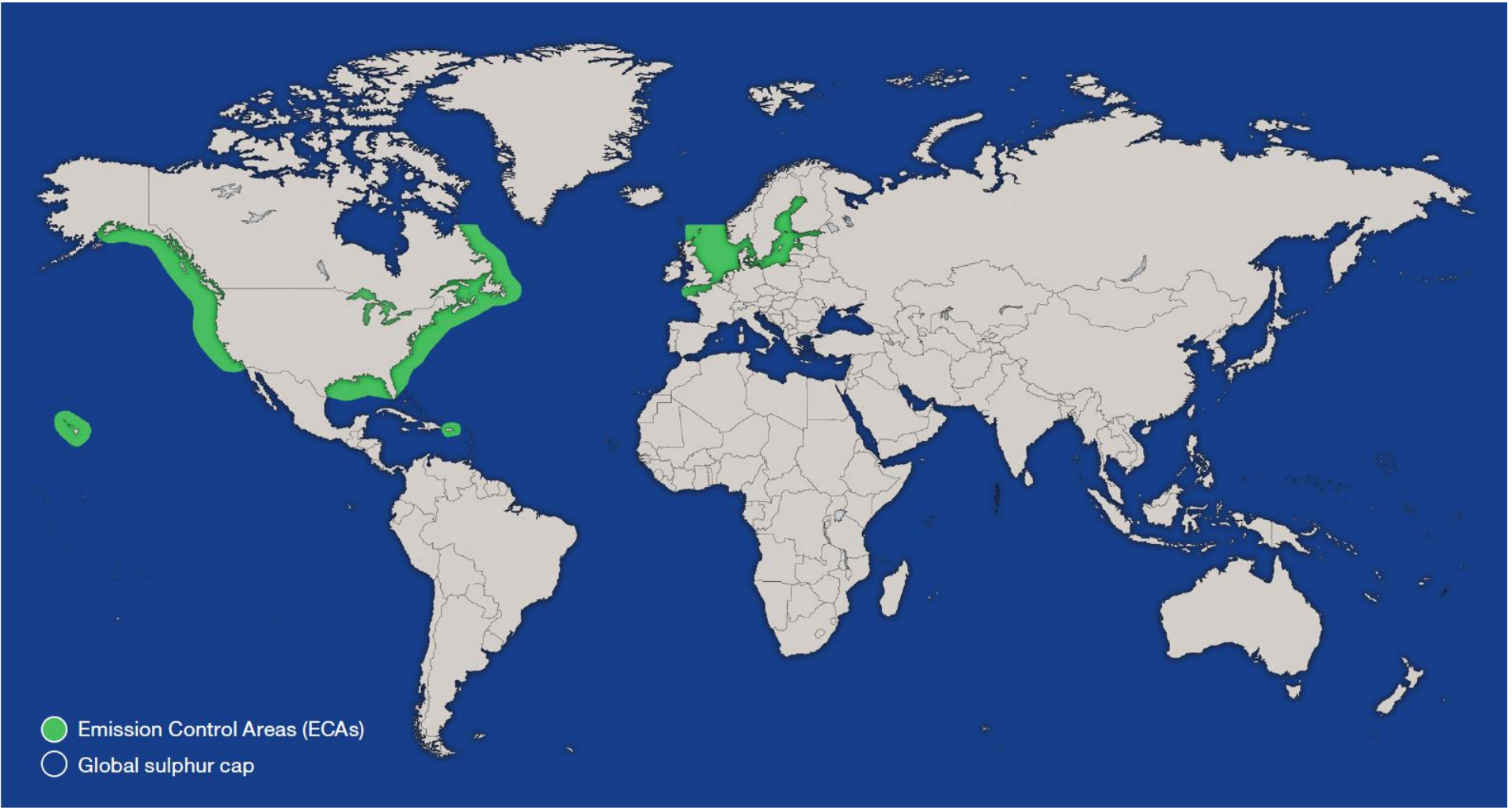
2020 Sulphur cap

Prepare your boilers



MARPOL Annex VI



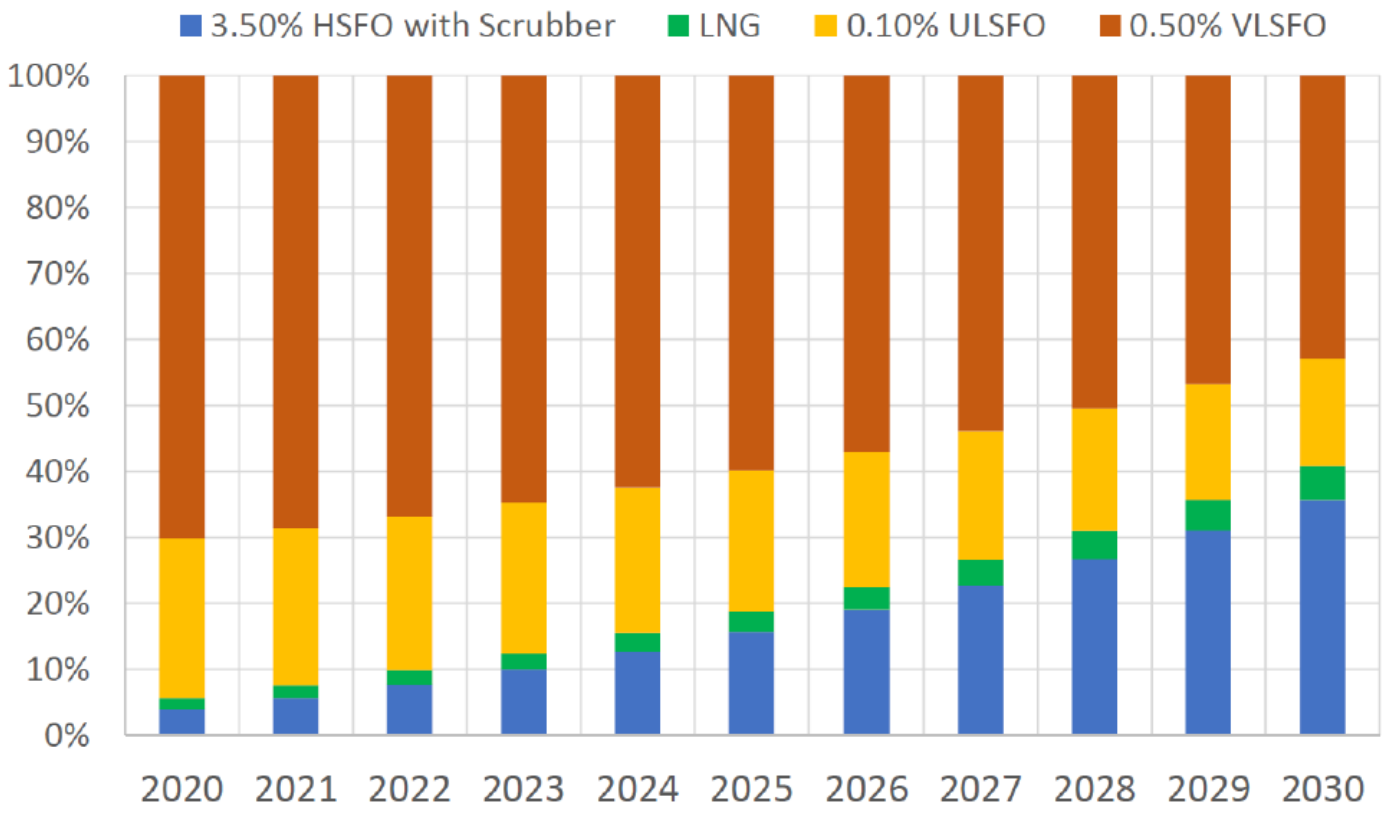
As of January 2015, the limit applicable in ECAs is

0.1%S

As of January 2020, the global limit applicable outside of ECAs is

0.5%S

Marine fuel demand post 2020



Source: Alfa Laval

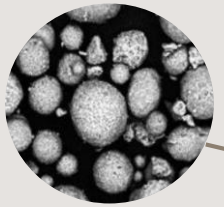
How will a 0.50% sulphur fuel look like?

Considerations with the new compliant fuels

- seen from a boiler perspective

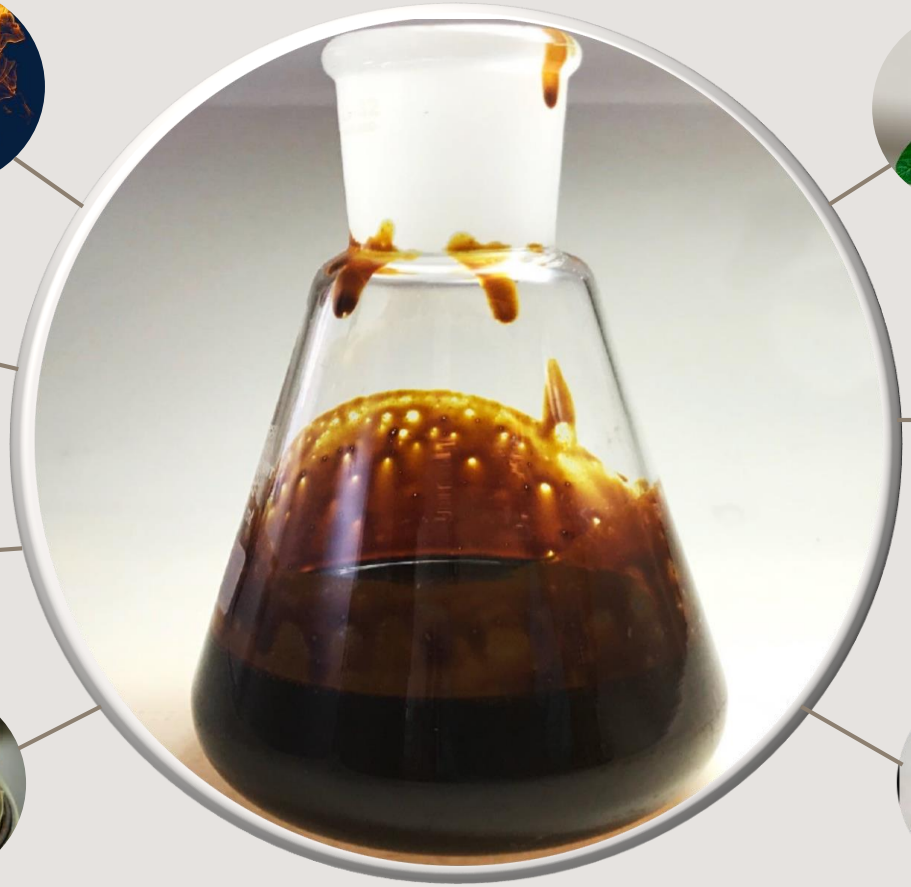
Viscosity

Catfines



Density

Pour point



Fatty acid

Sulphur contamination

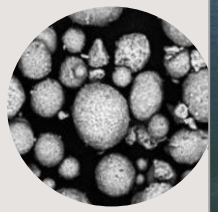
Mixability

Considera compliant fuels

- seen from a boiler pers

Viscosity

Catfines



Density

Pour point

Technical paper

Fuel and operational considerations for 2020

Fuel oil system: 1.5 KBSD single line
Fuel strategy: VLSFO

March 2019

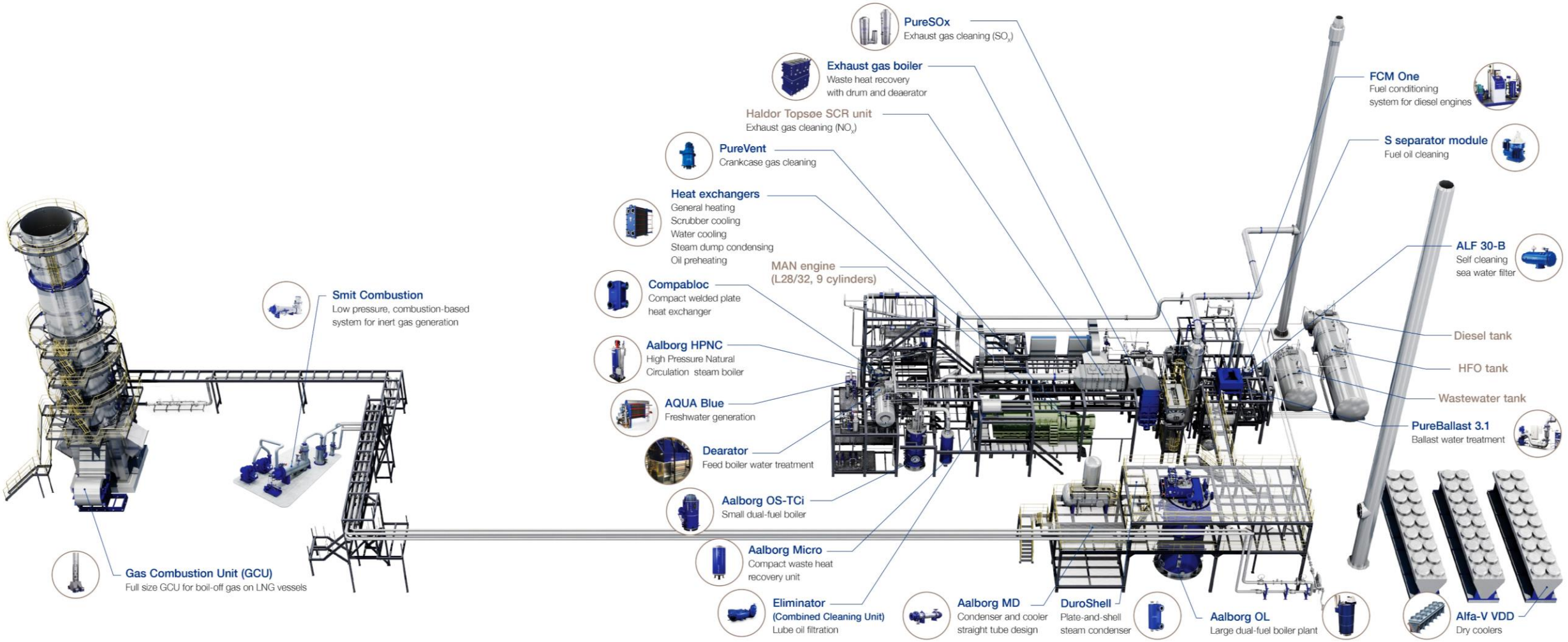
Fatty acid

Sulphur contamination

Mixability

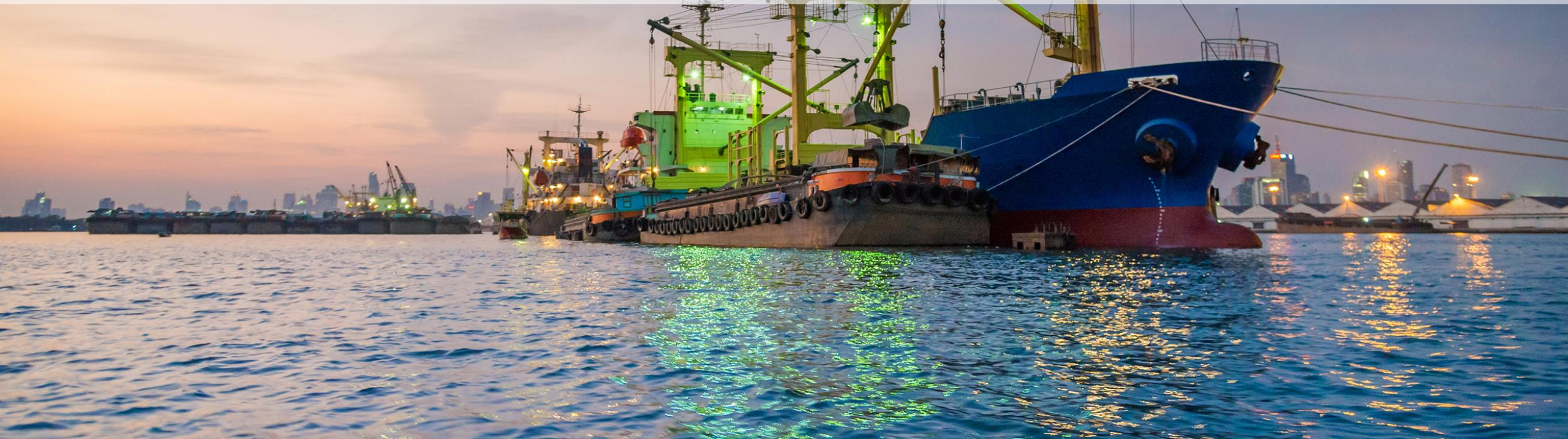
Developing the future

Alfa Laval
Test & Training Centre

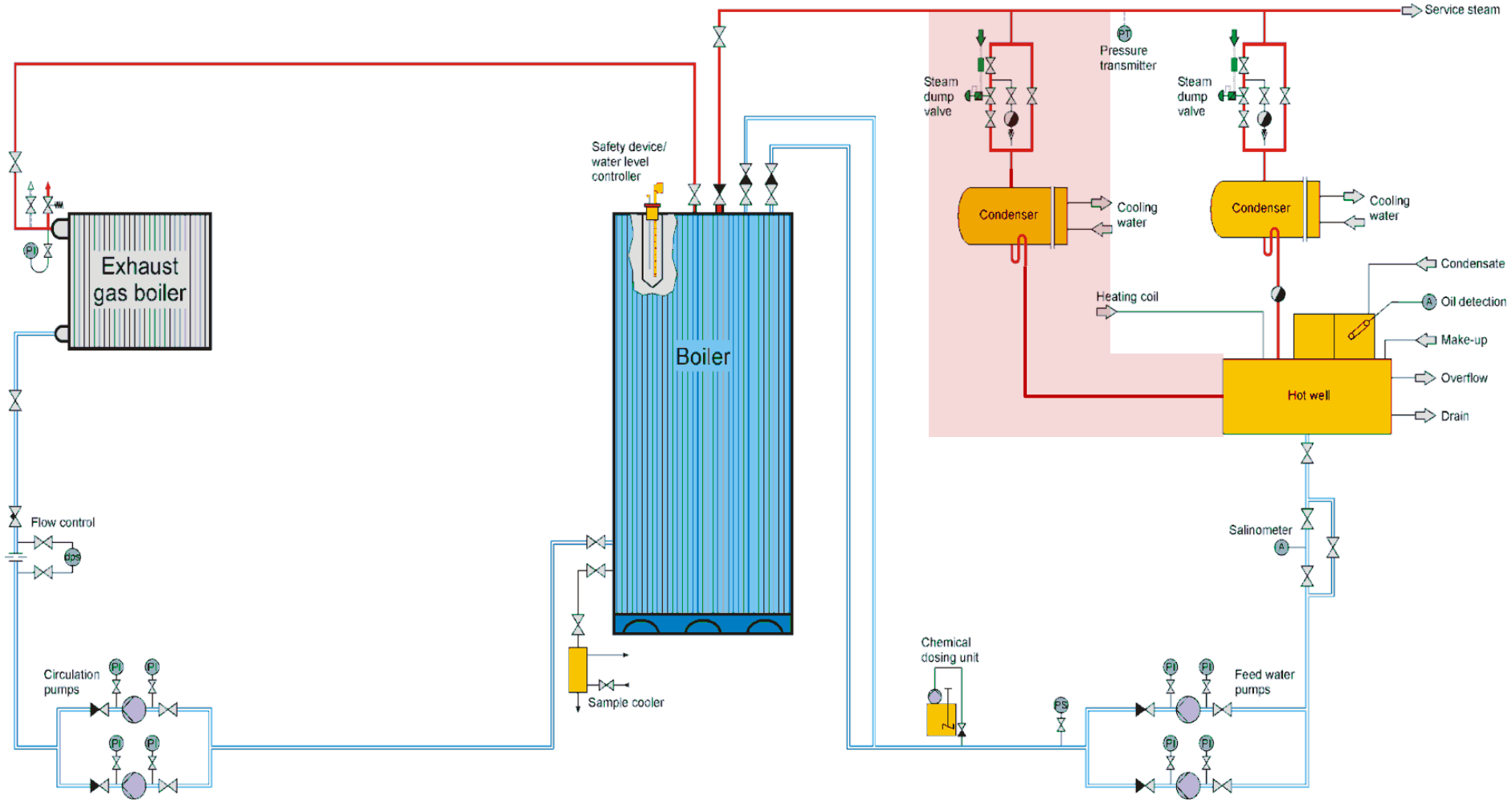


Important consideration

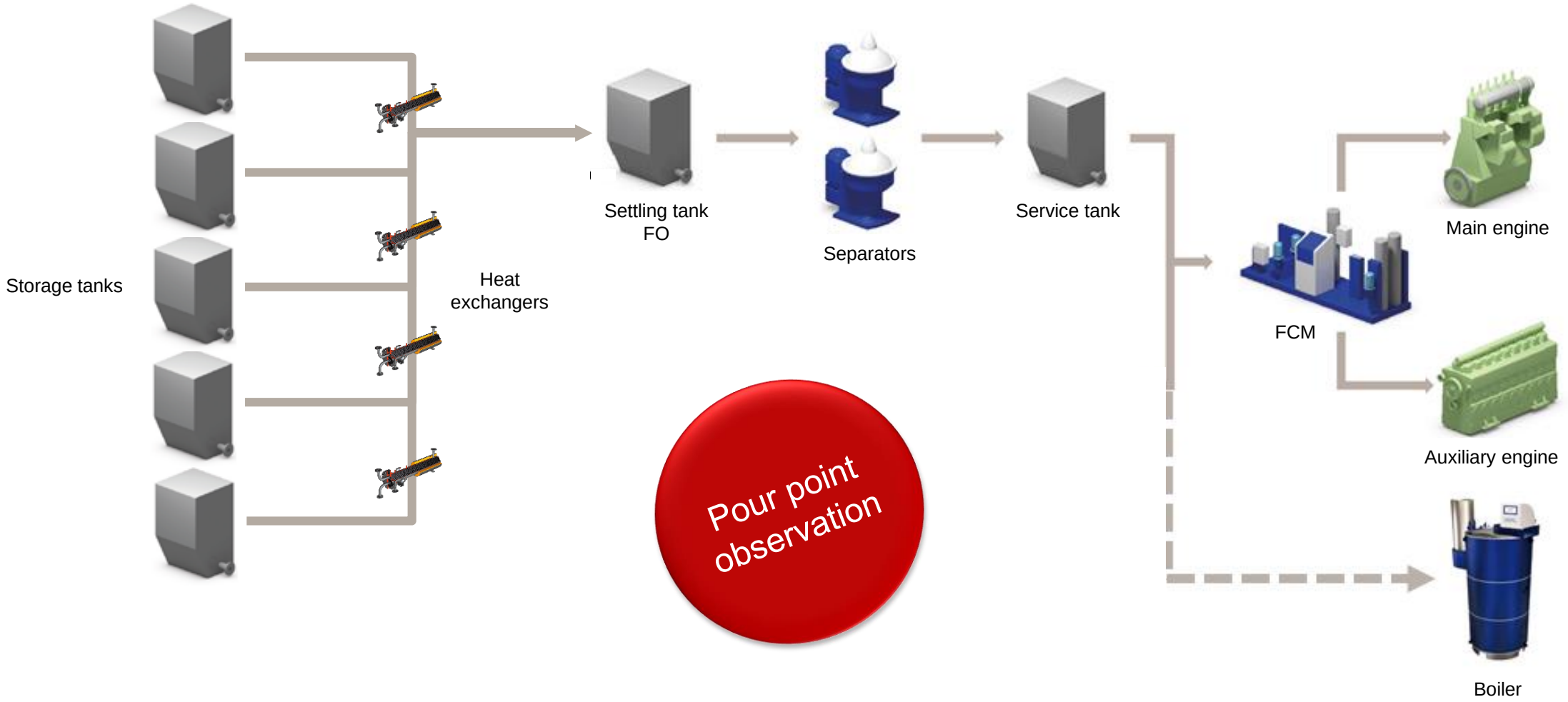
- Your steam balance?



Excess of steam?



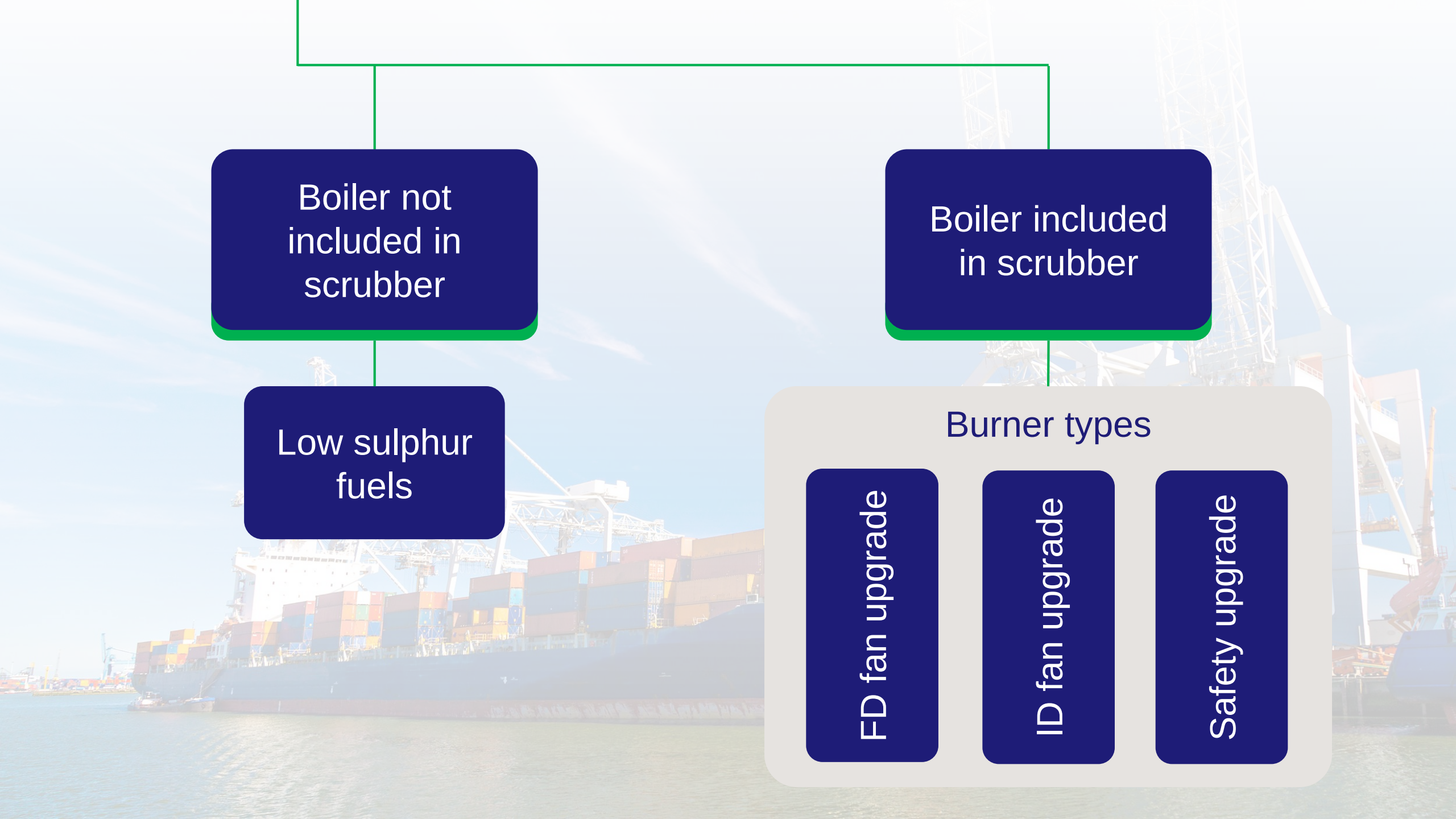
Lack of steam?



Your compliant strategy

- what do you do with your boilers?


Scrubber
Low sulphur fuels
LNG


Boiler not included in scrubber
Boiler included in scrubber
Low sulphur fuels
Burner types
FD fan upgrade
ID fan upgrade
Safety upgrade

Boiler included in scrubber

Observations

- Restriction in natural draught in the boiler
- Increased back pressure
- Mounting flaps in exhaust gas
- Safety interlock

Burner types

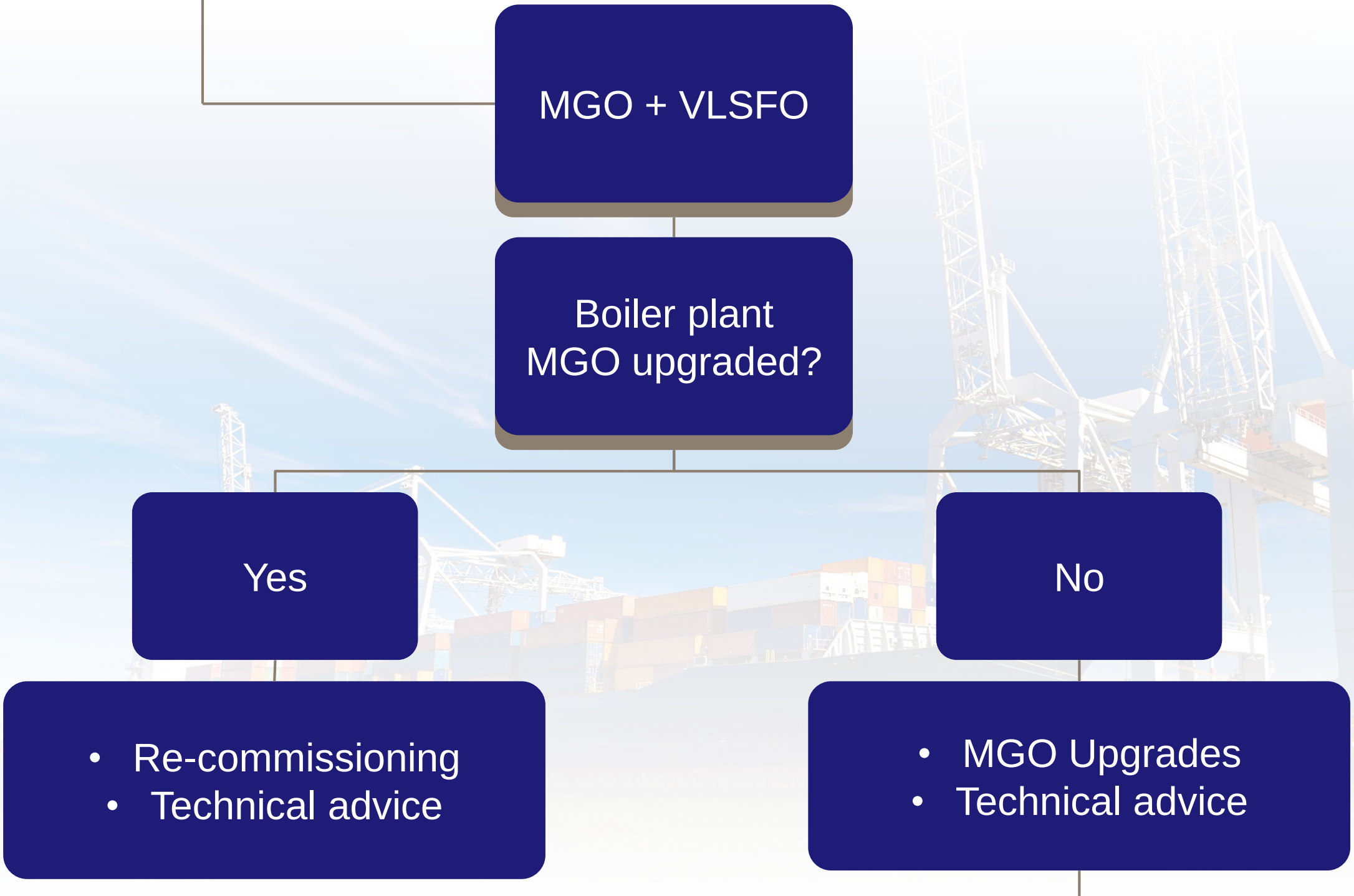
- FD fan upgrade
- ID fan upgrade
- Safety upgrade


Scrubber
Low sulphur fuels
LNG

MGO + VLSFO

MGO only

What fuel strategy for the boilers?


MGO + VLSFO
Boiler plant
MGO upgraded?
Yes
No
• Re-commissioning
• Technical advice
• MGO Upgrades
• Technical advice

- MGO Upgrades
- Technical advice

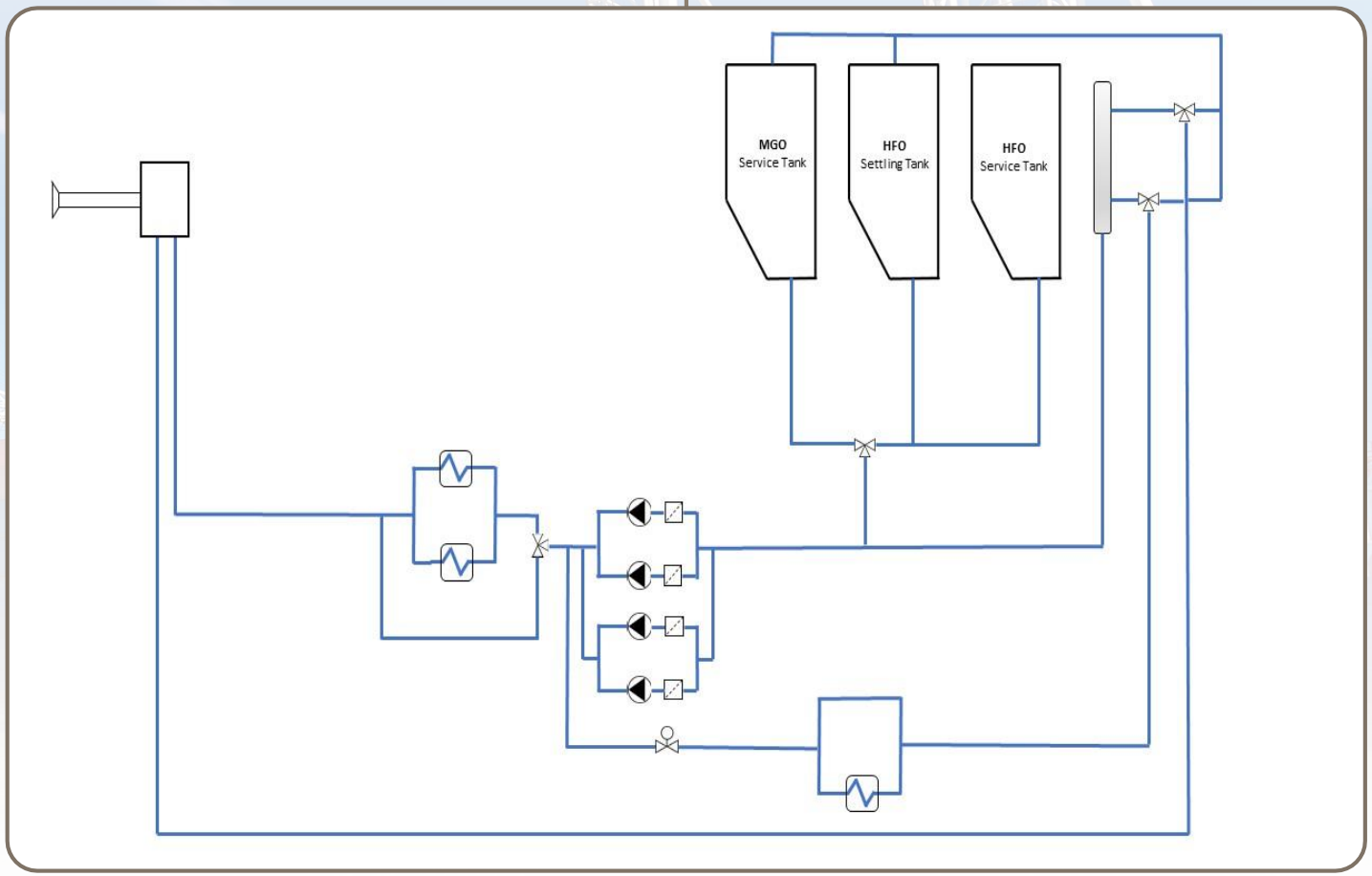
Single-Line Fuel System

Included

- Flushing
- MGO Cooler
- MGO Temp
- MGO Press
- Post purge
- Flame scan

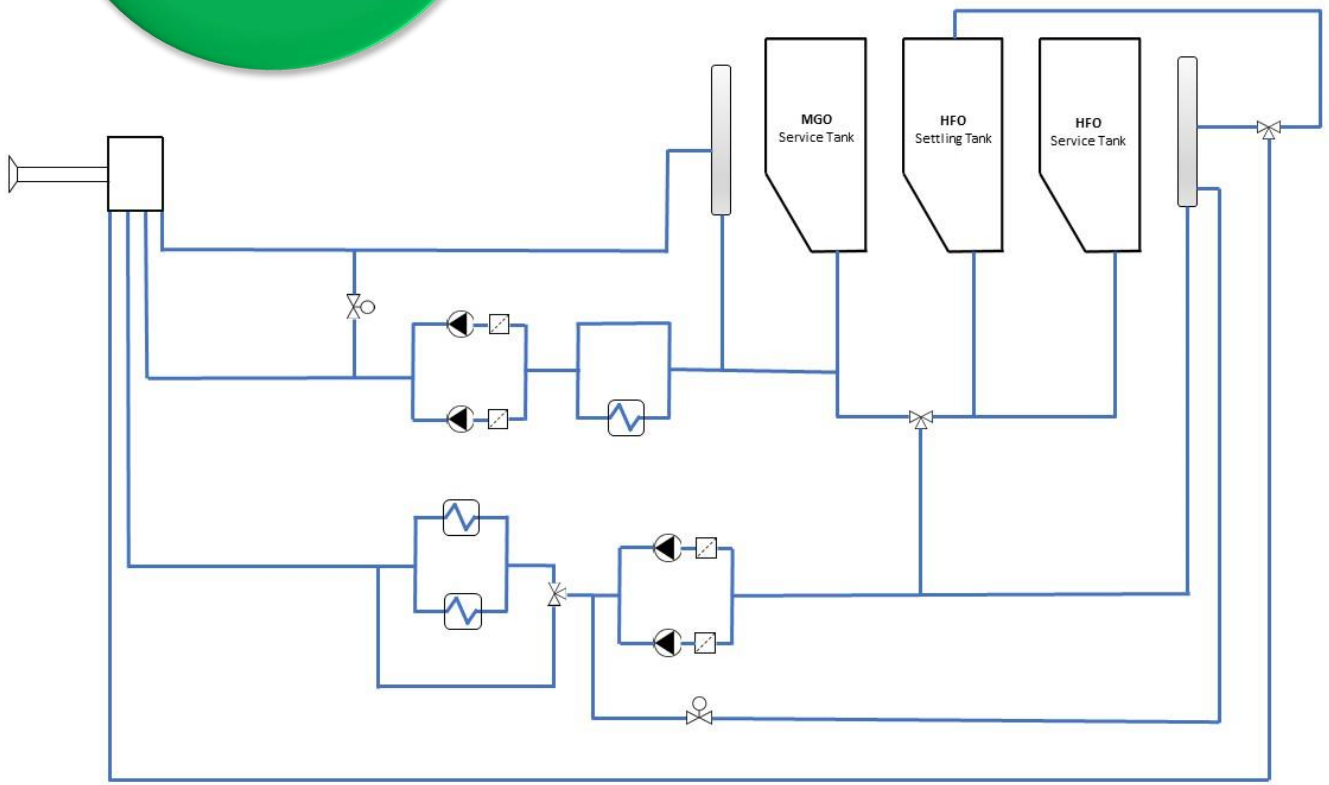
Considerations

- Trading route
- Flushing
- Fuels mixable?
- Paraffins
- OPEX cost



- MGO Upgrades
- Technical advice

Alfa Laval's recommended 2020 solution



Double-line Fuel System

Included

- Flushing
- MGO Cooler
- MGO Temp
- MGO Press
- Post purge
- Flame scan
- No mixing

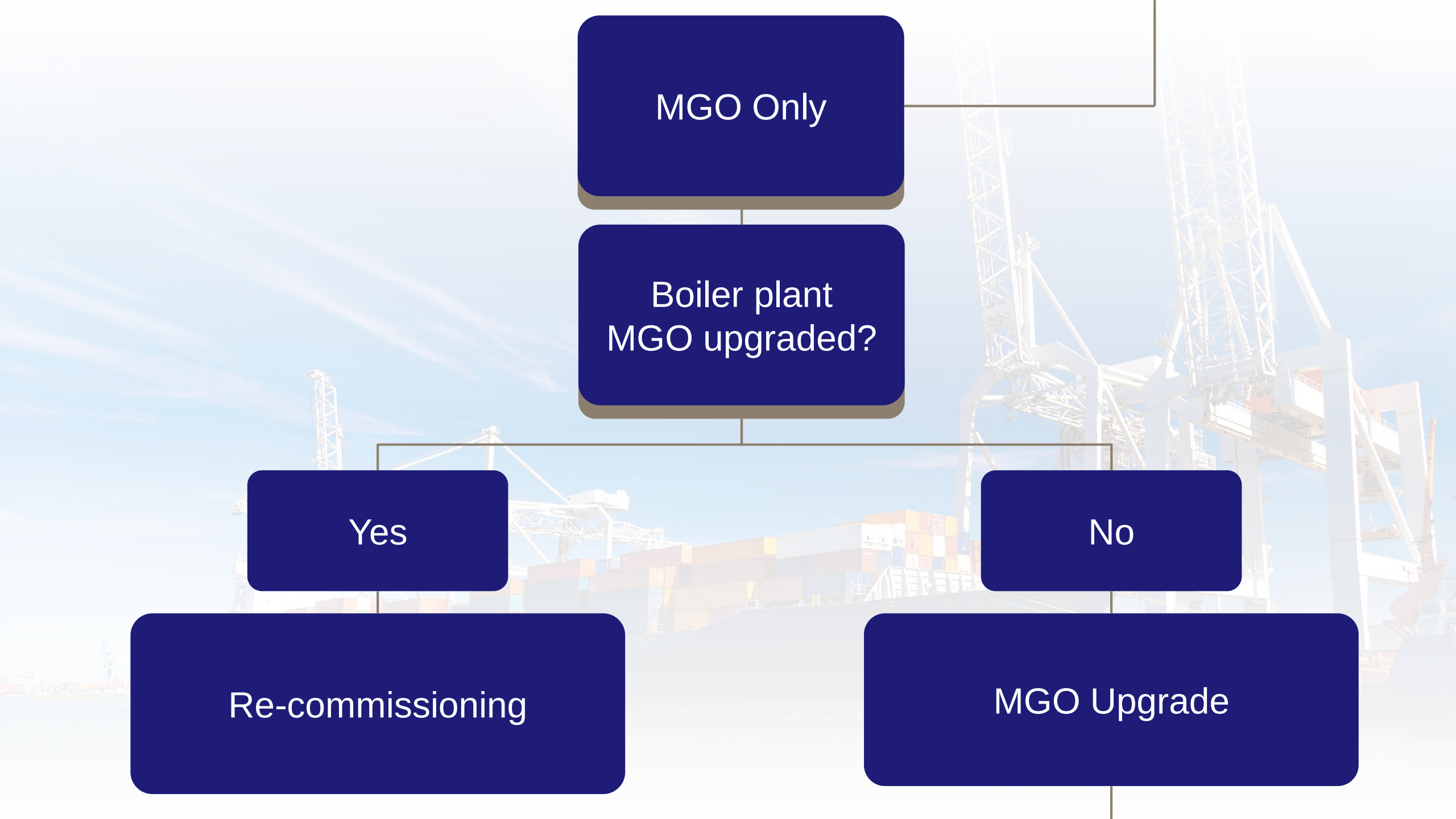
Considerations

- Trading route
- CAPEX

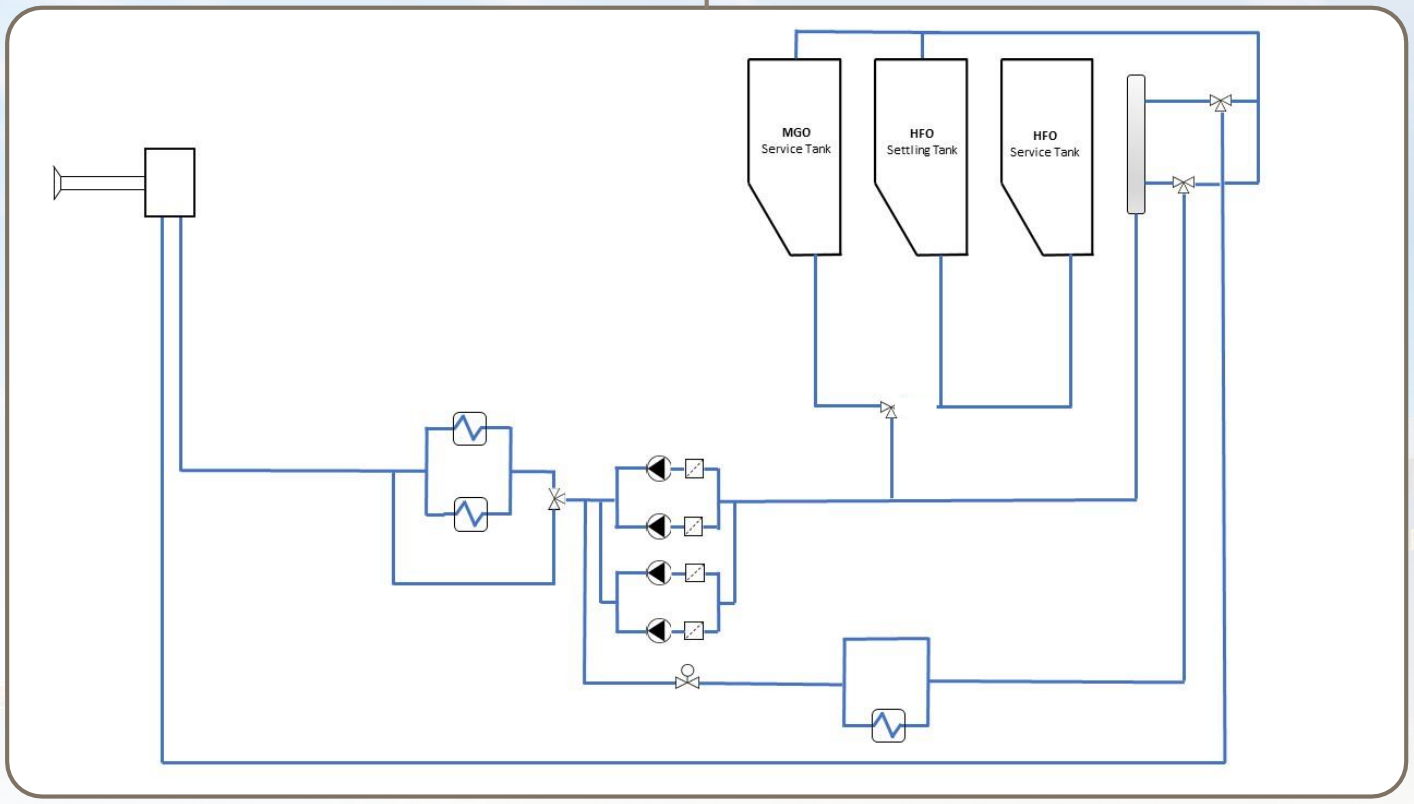
MGO + VLSFO

MGO Only

What fuel strategy for the boilers?


MGO Only
Boiler plant
MGO upgraded?
Yes
No
Re-commissioning
MGO Upgrade

Boiler plant MGO upgraded?



MGO Upgrade

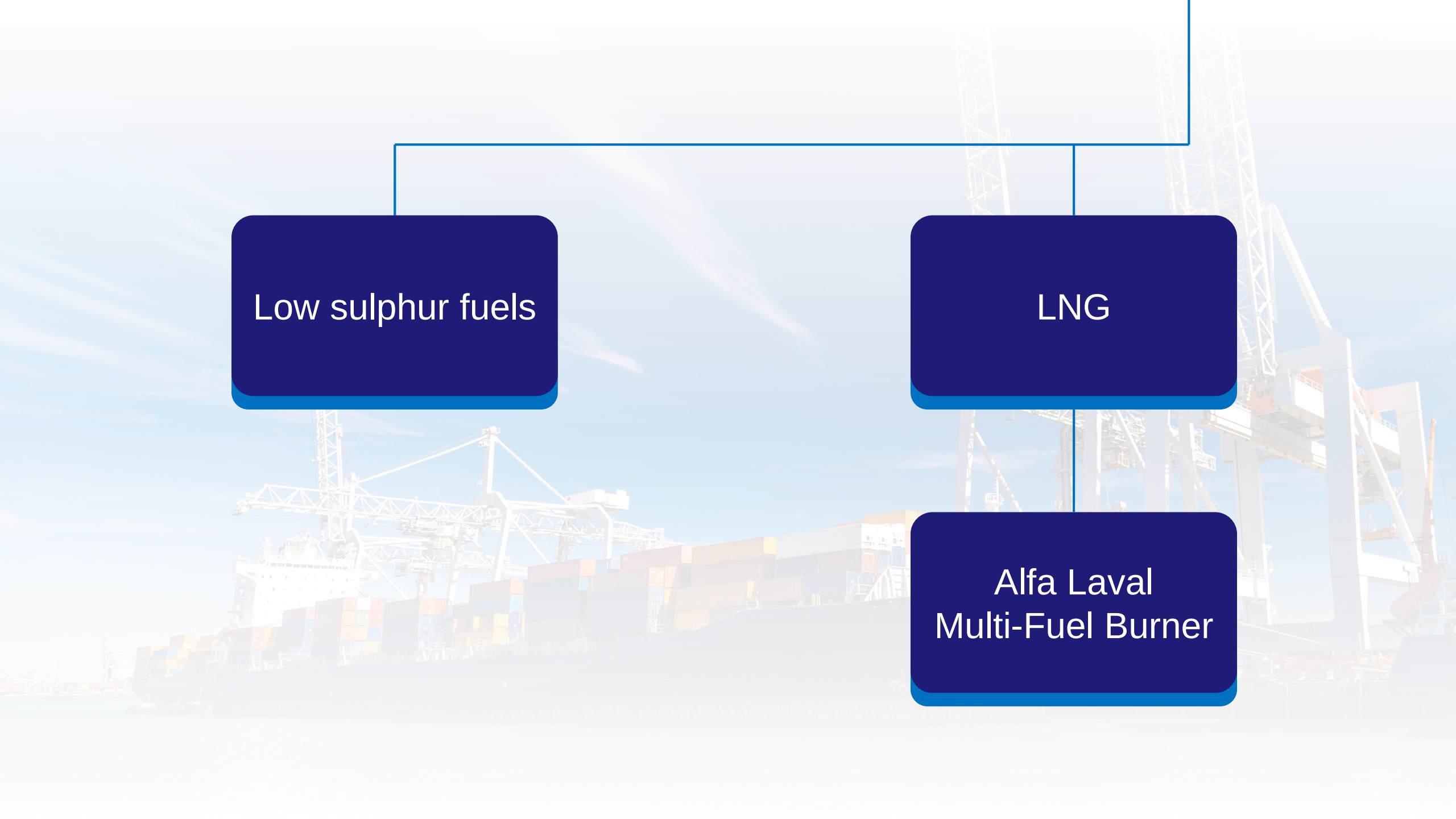
Included

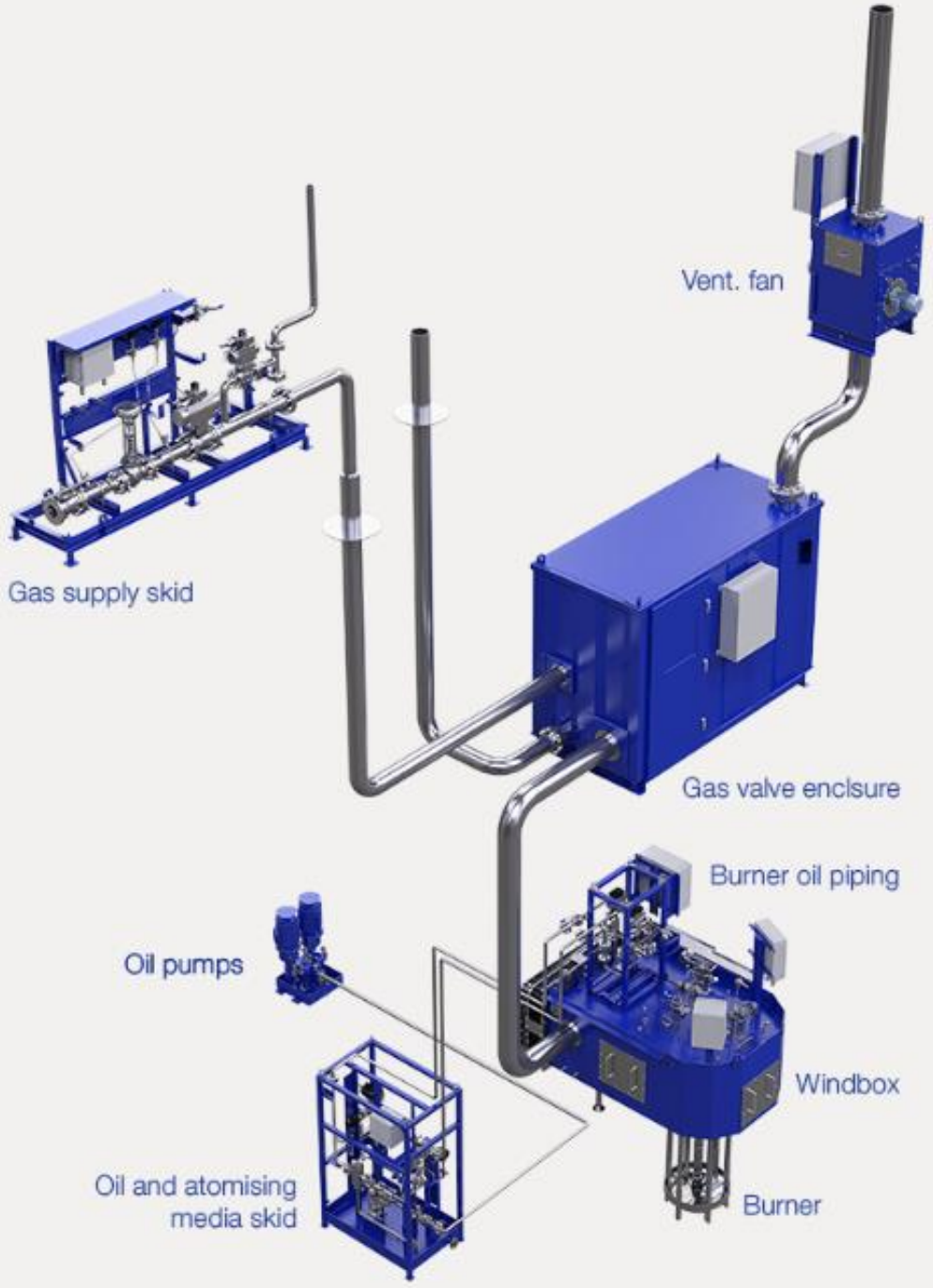
- MGO Cooler
- MGO Temp
- MGO Press
- Post purge
- Flame scan
- No HFO

Considerations

- Trading route
- CAPEX


Scrubber
Low sulphur fuels
LNG


Low sulphur fuels
LNG
Alfa Laval
Multi-Fuel Burner



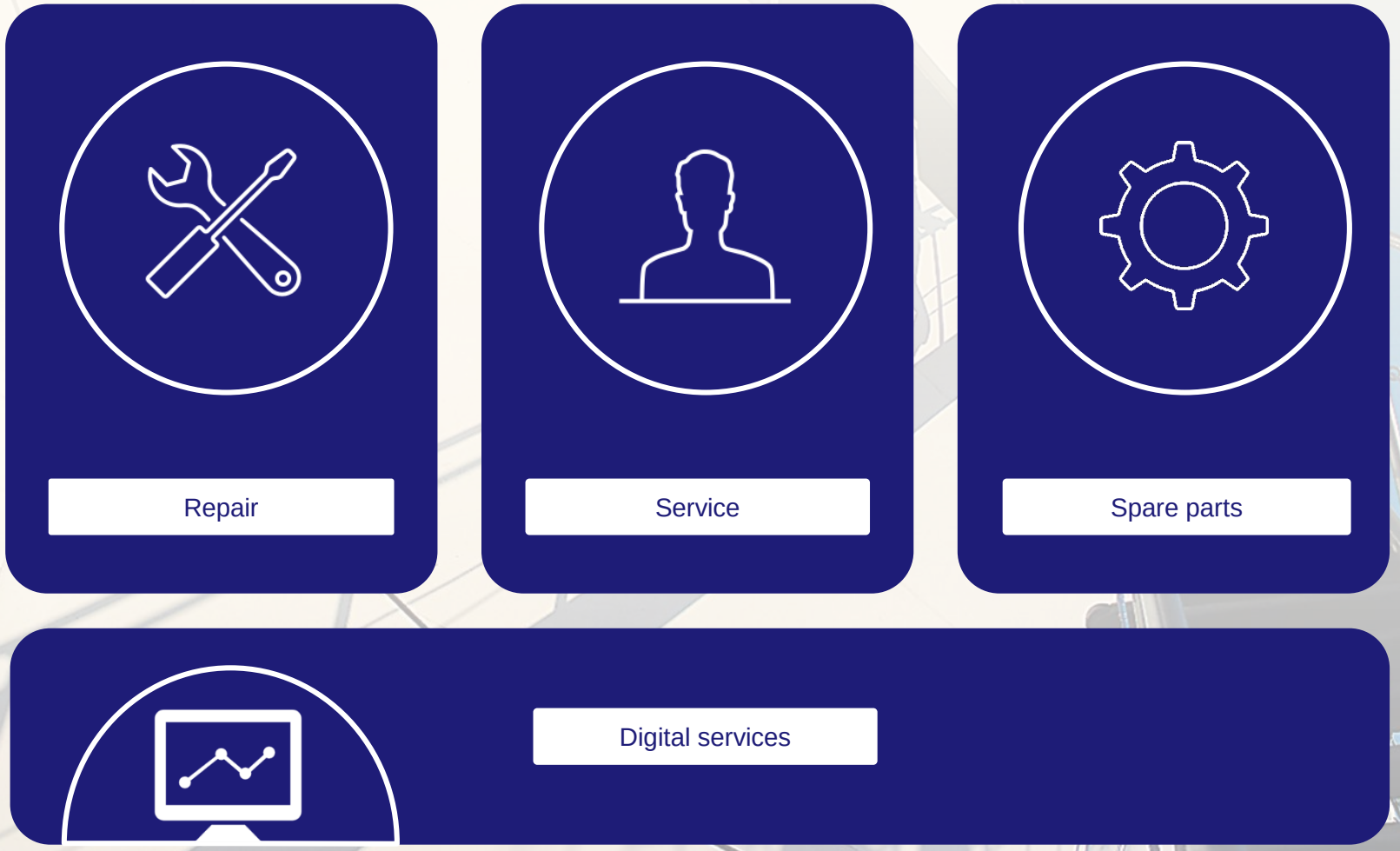
LNG

Alfa Laval Multi-Fuel Burner

Regardless of what solution
– remember to check your steam balance!

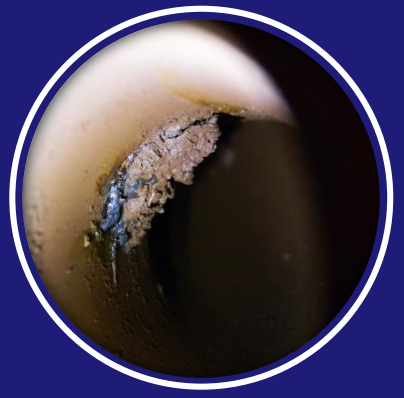
Alfa Laval Aalborg Boiler Service

Alfa Laval Boiler Service

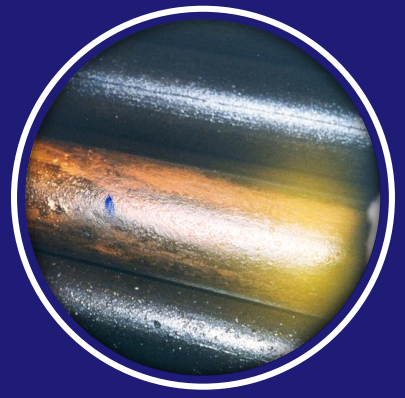


Repair

Repair



Oxygen corrosion

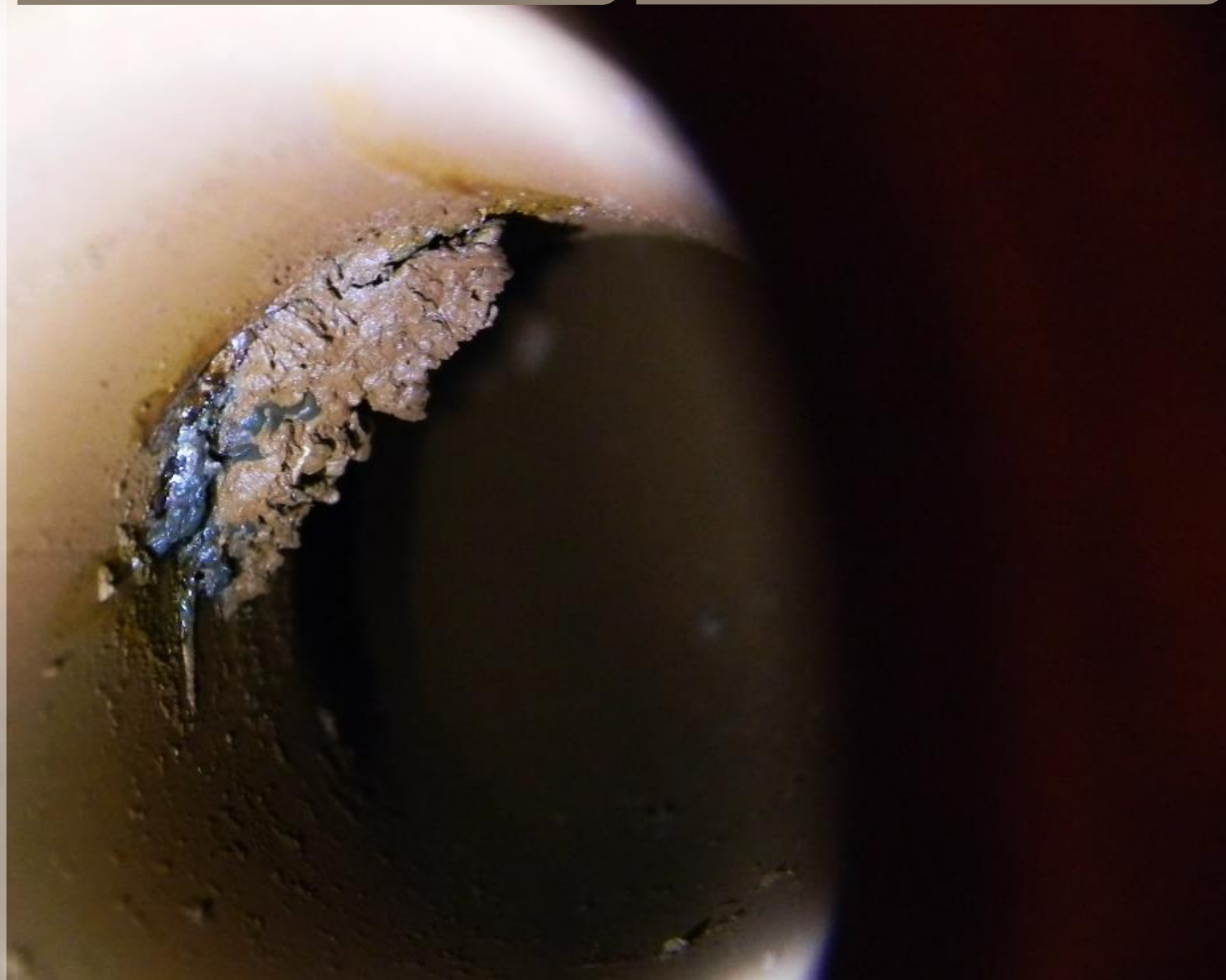


Oil contamination

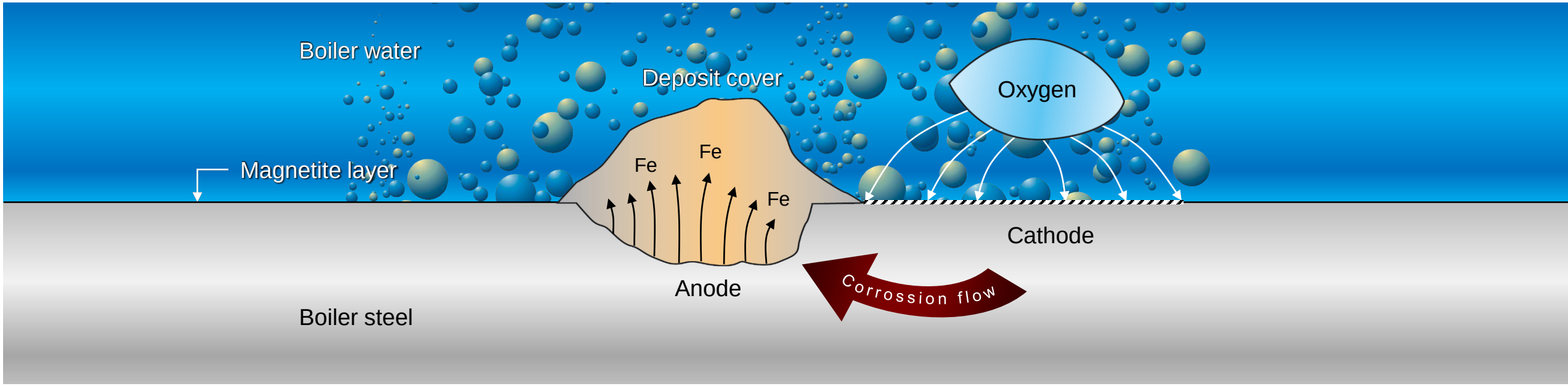
Sludge and scaling

Preventive maintenance

Oxygen corrosion

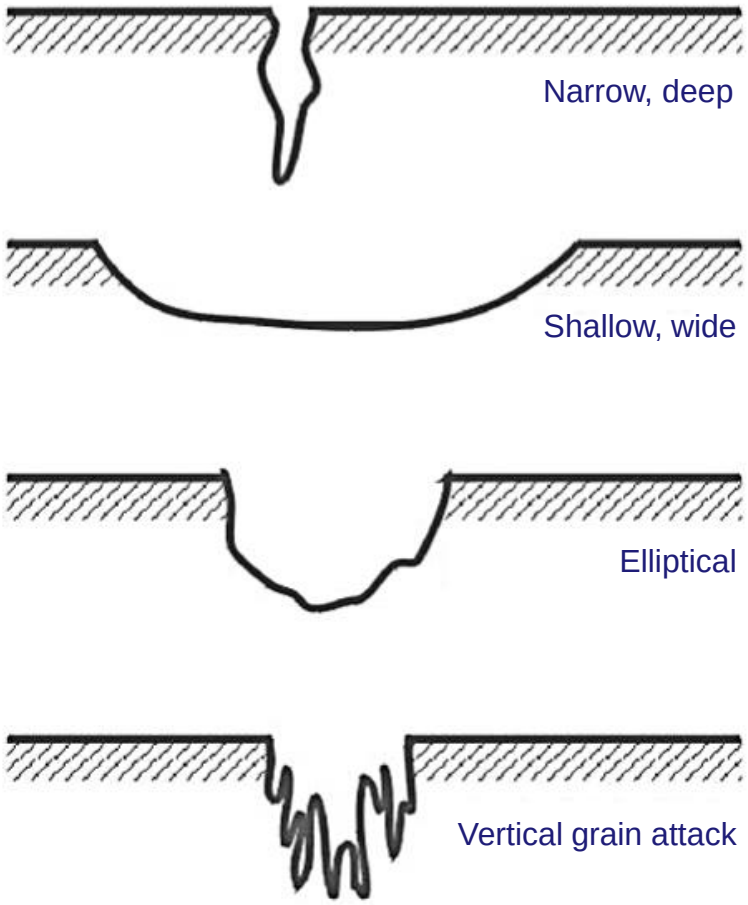


Oxygen corrosion

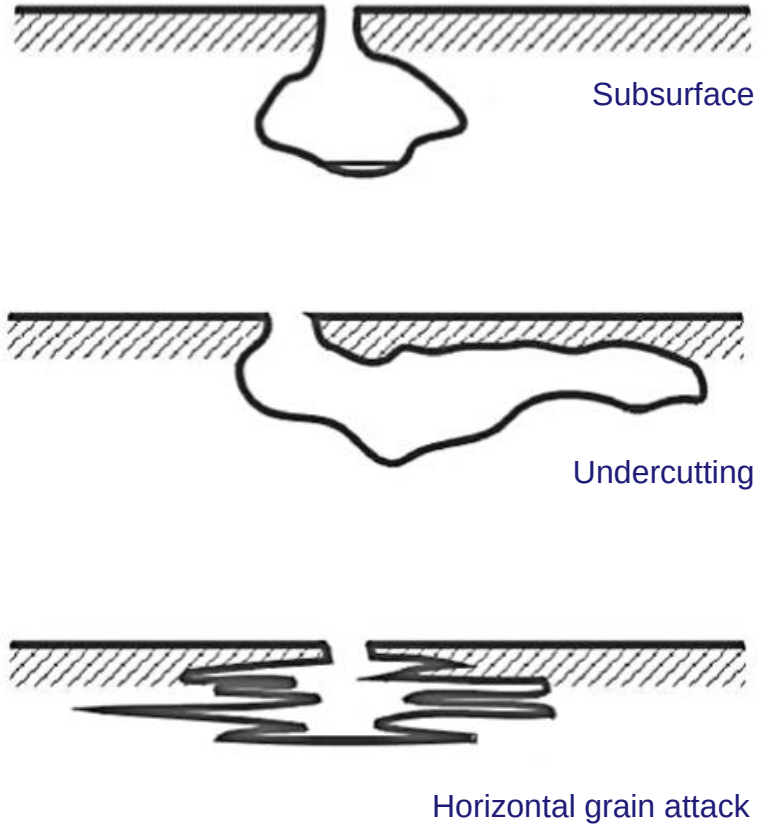


Pitting as a consequence of oxygen corrosion

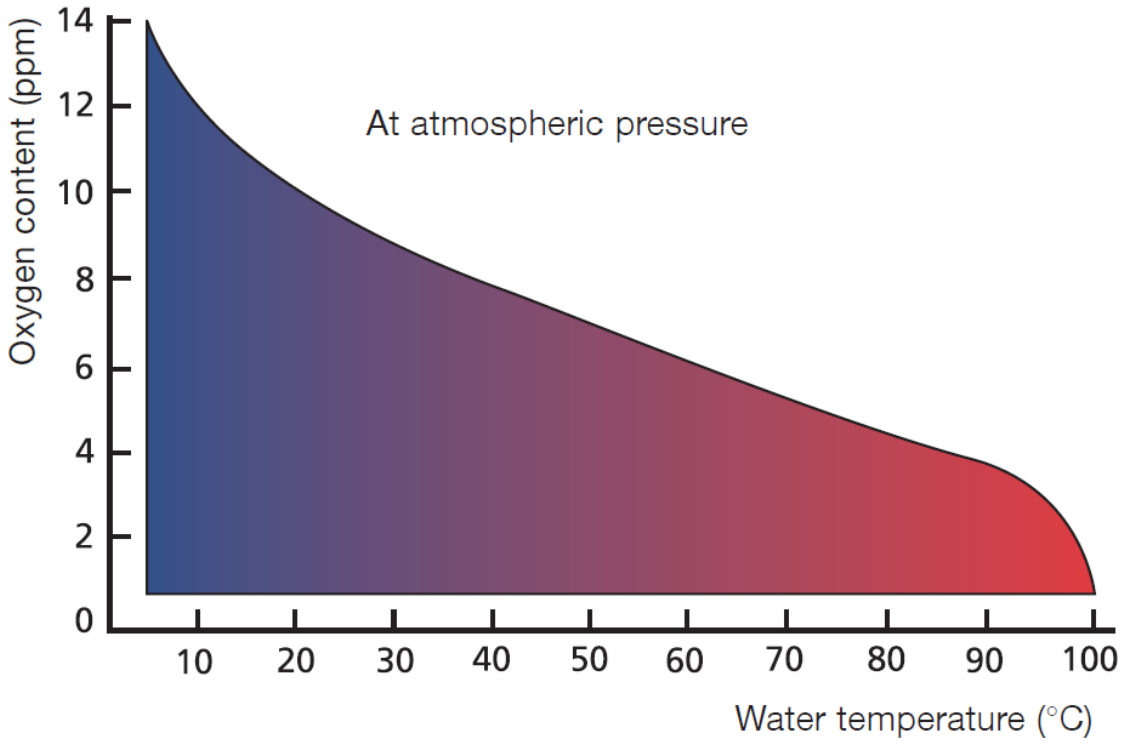
Through pits

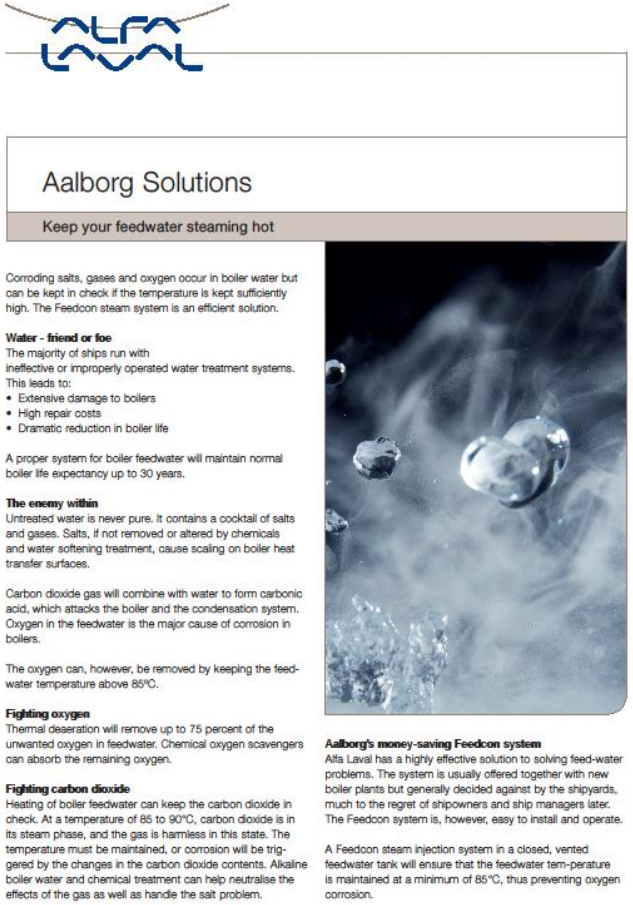


Sideway pits



Pitting as a consequence of oxygen corrosion - how to avoid it?





ALFA LAVAL

Aalborg Solutions

Keep your feedwater steaming hot

Corroding salts, gases and oxygen occur in boiler water but can be kept in check if the temperature is kept sufficiently high. The Feedcon steam system is an efficient solution.

Water - friend or foe
The majority of ships run with ineffective or improperly operated water treatment systems. This leads to:
- Extensive damage to boilers
- High repair costs
- Dramatic reduction in boiler life

A proper system for boiler feedwater will maintain normal boiler life expectancy up to 30 years.

The enemy within
Untreated water is never pure. It contains a cocktail of salts and gases. Salts, if not removed or altered by chemicals and water softening treatment, cause scaling on boiler heat transfer surfaces.

Carbon dioxide gas will combine with water to form carbonic acid, which attacks the boiler and the condensation system. Oxygen in the feedwater is the major cause of corrosion in boilers.

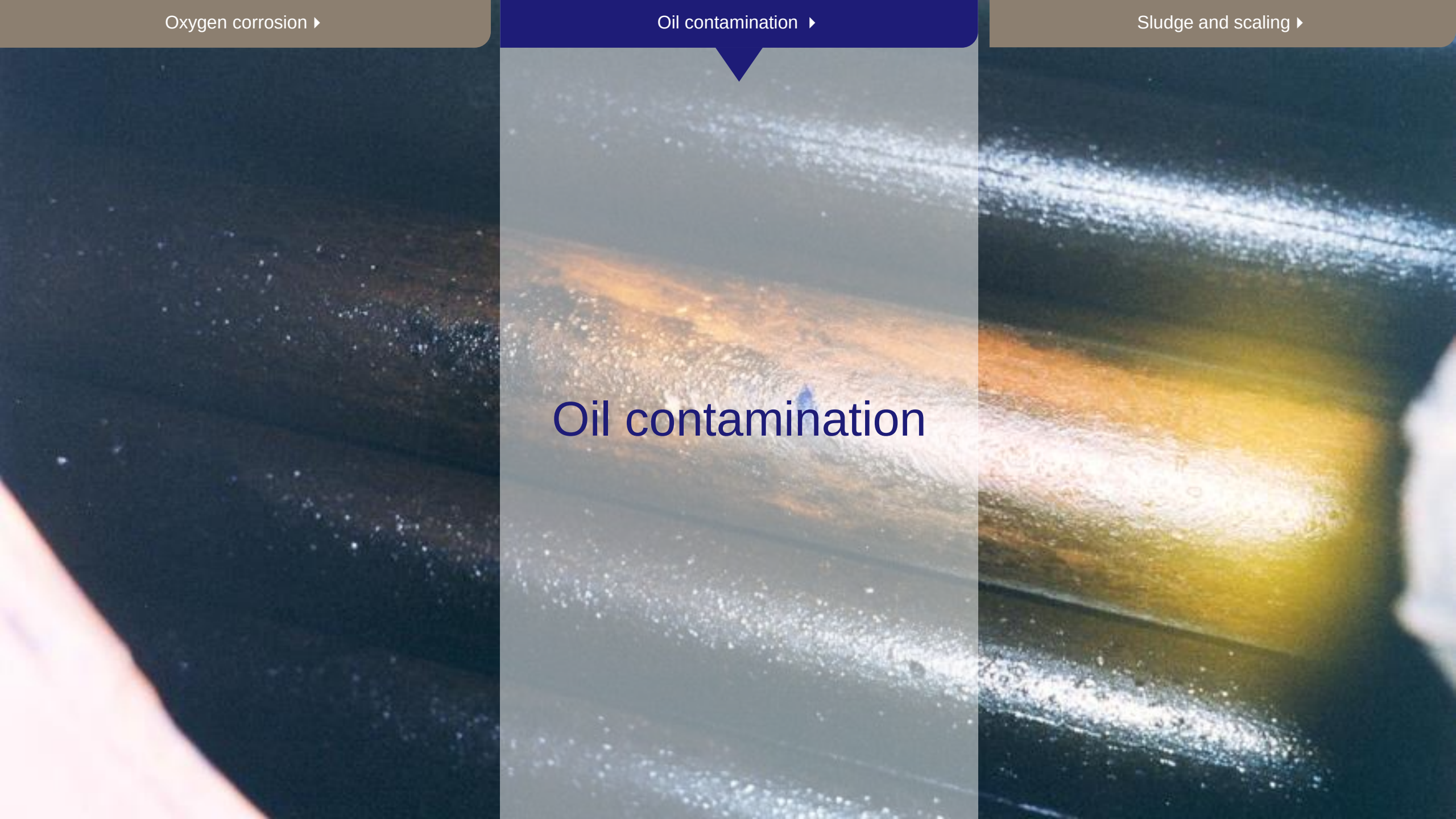
The oxygen can, however, be removed by keeping the feed-water temperature above 85°C.

Fighting oxygen
Thermal deaeration will remove up to 75 percent of the unwanted oxygen in feedwater. Chemical oxygen scavengers can absorb the remaining oxygen.

Fighting carbon dioxide
Heating of boiler feedwater can keep the carbon dioxide in check. At a temperature of 85 to 90°C, carbon dioxide is in its steam phase, and the gas is harmless in this state. The temperature must be maintained, or corrosion will be trig-gered by the changes in the carbon dioxide contents. Alkaline boiler water and chemical treatment can help neutralise the effects of the gas as well as handle the salt problem.

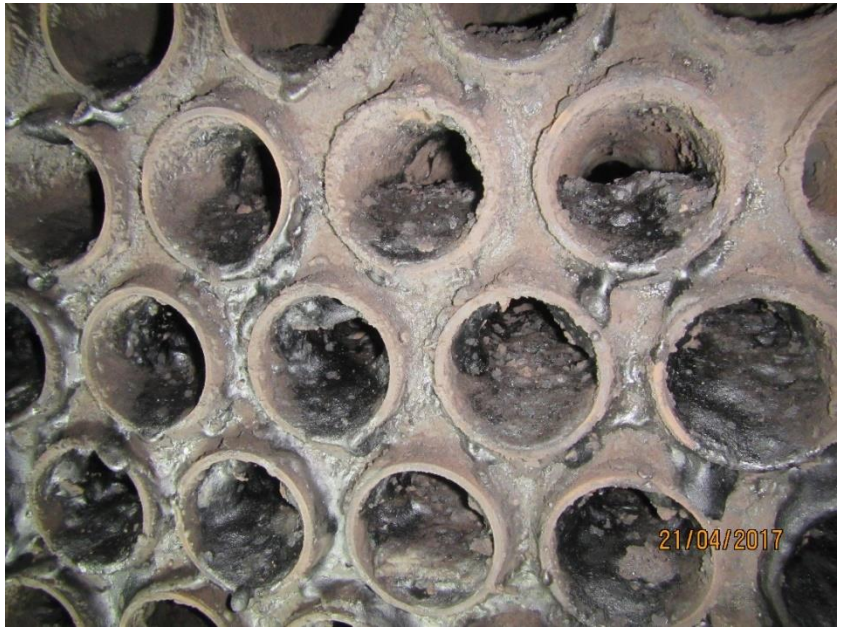
Aalborg's money-saving Feedcon system
Alfa Laval has a highly effective solution to solving feed-water problems. The system is usually offered together with new boiler plants but generally decided against by the shipyards, much to the regret of shipowners and ship managers later. The Feedcon system is, however, easy to install and operate.

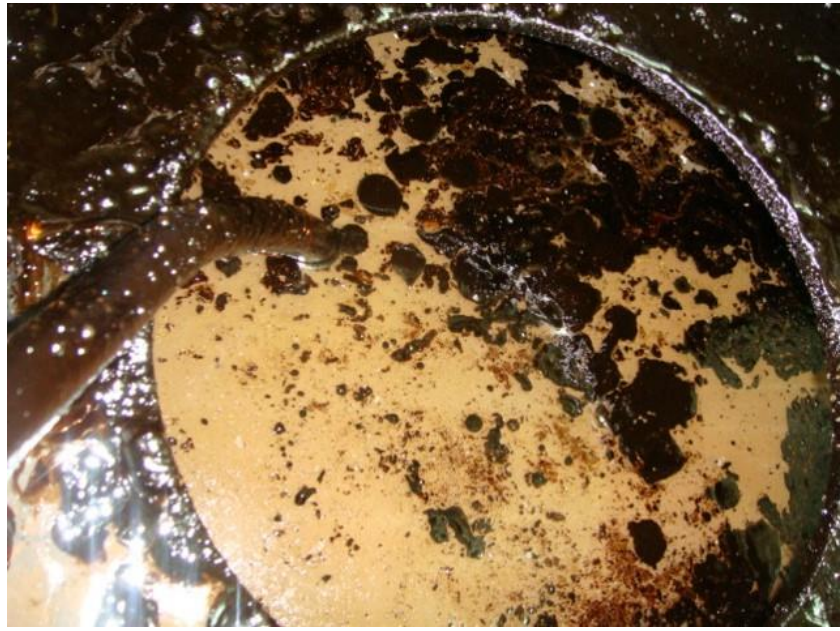
A Feedcon steam injection system in a closed, vented feedwater tank will ensure that the feedwater tem-perature is maintained at a minimum of 85°C, thus preventing oxygen corrosion.



Oil contamination

Oil Contamination

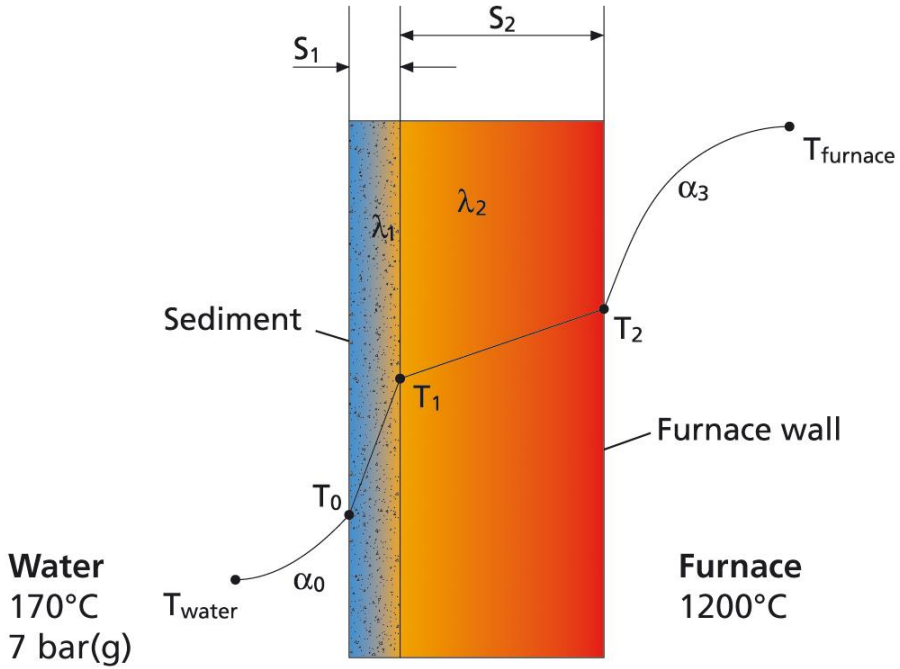




Oil Contamination

Three examples are made to illustrate the increase in temperature of the furnace wall when the waterside of the furnace is fouled with sediments of 2 mm carbonate, 0.5 mm silica, or 0.5 mm oil film:

	No sediment	2 mm carbonate	0.5 mm silica	0.5 mm oil film
a0 [W/(m2 x K)]	10,000	10,000	10,000	10,000
l1 [W/(m x K)]	-	1.72	0.172	0.10
l2 [W/(m x K)]	38	38	38	38
a3 [W/(m2 x K)]	145	145	145	145
S1 [mm]	-	2	0.5	0.5
S2 [mm]	20	20	20	20
atotal[W/(m2 x K)]	133	115	95.8	79.9
Q [kW/m2]	137	119	98.7	82.3
T0 [°C]	-	181.9	179.9	178.2
T1 [°C]	184	320	467	590
T2 [°C]	256	382	519	633

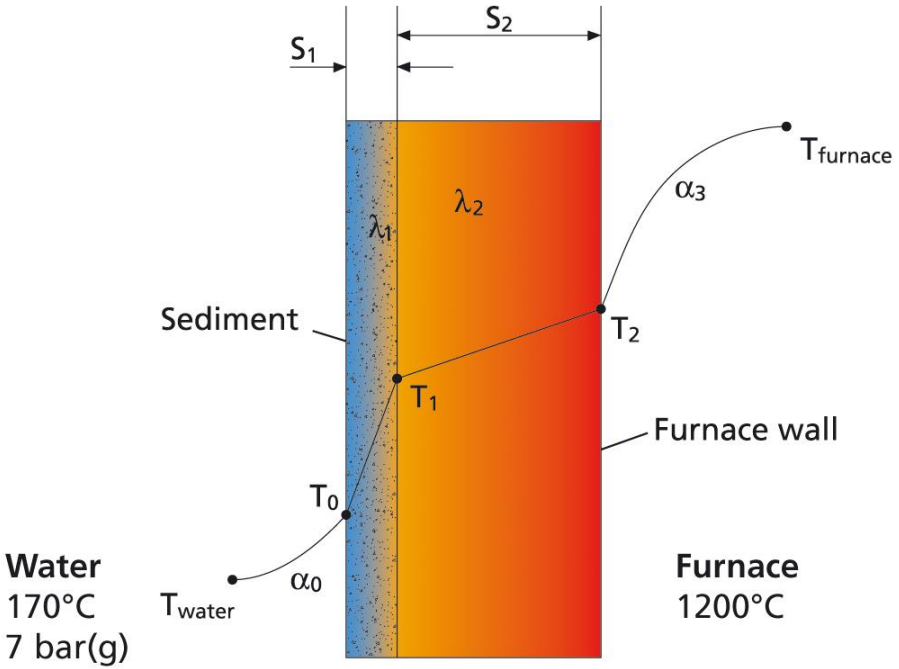


In conclusion, the maximum temperature of the furnace wall is increased from 256°C to 633°C with an oil film of just 0.5 mm. Furthermore, the transferred heat is reduced from 137 kW/m² to just 82.3 kW/m², a reduction of 40%.

If the waterside of a furnace wall is fouled with e.g. carbonate, silica, or oil film, the temperature of the furnace wall increases due to added thermal resistance.

Oil Contamination - how to avoid it?

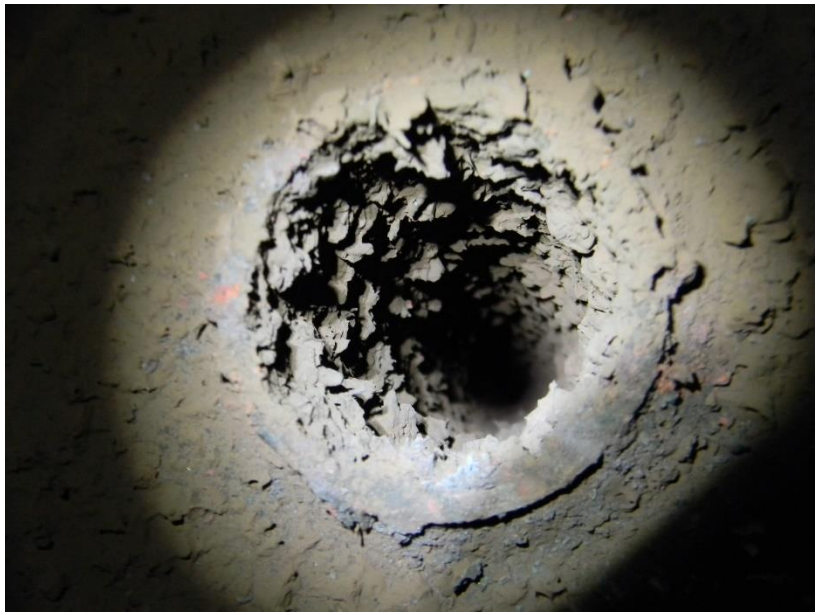
- Monitor hotwell frequently
- Oil detection equipment in the hotwell



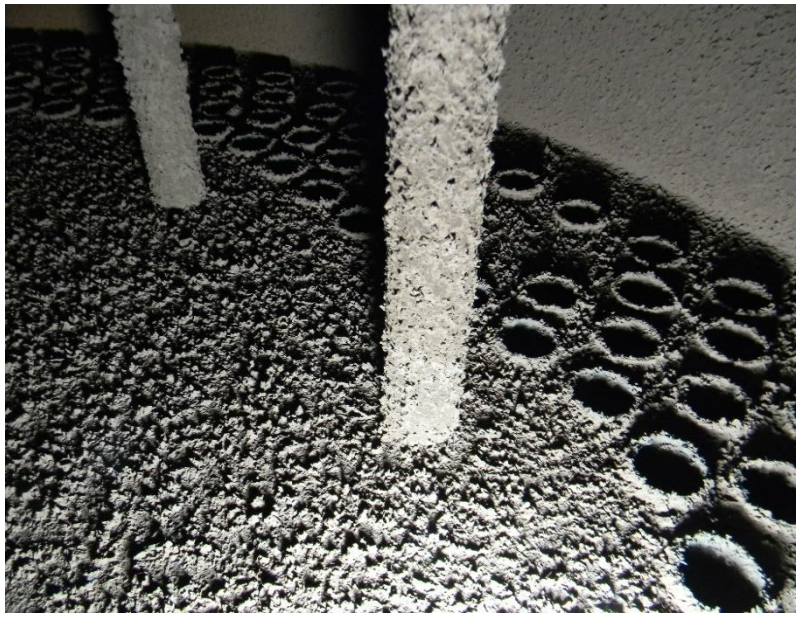
Sludge and scaling

Sludge and scaling

- Excessive chemical treatment
- Boiler water hardness



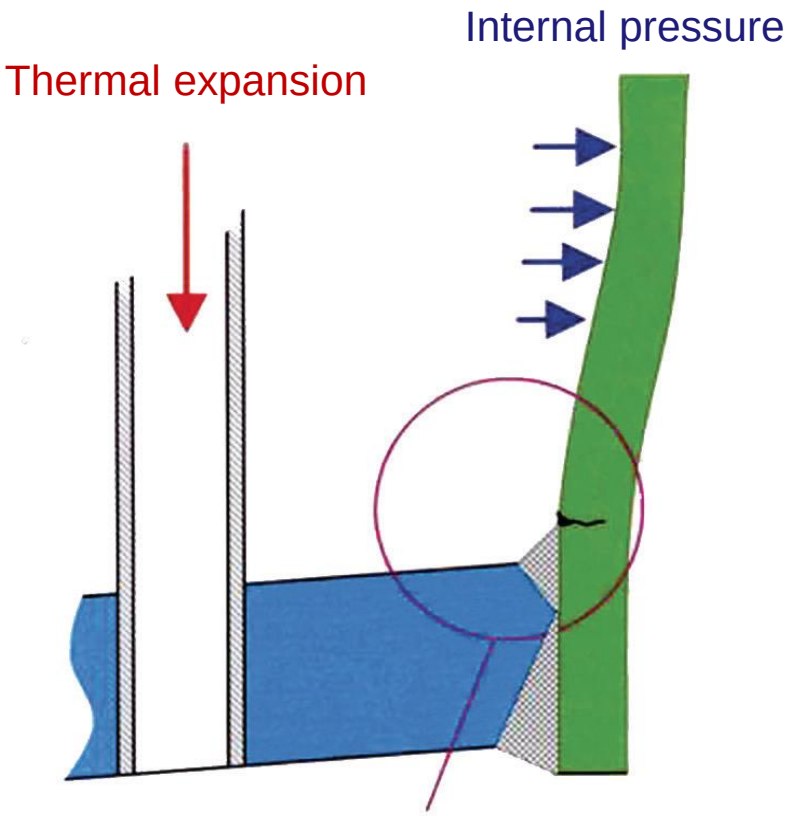
Limestone

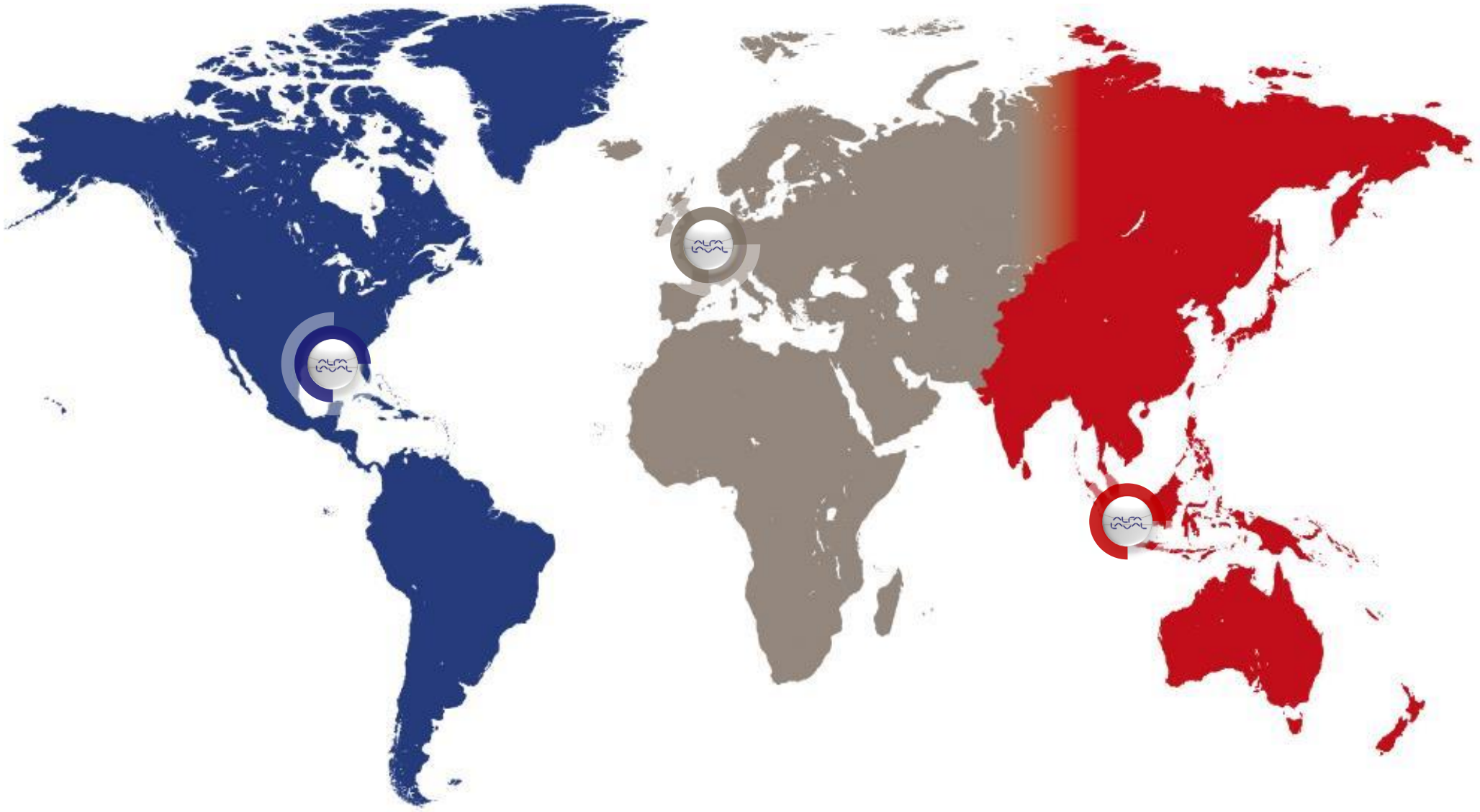


Salt

Hardness

Thermal stress





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