Fuji Electric
Innovating Energy Technology

# Fuji Electric EGCS Exhaust Gas Cleaning System

# SaveBlue



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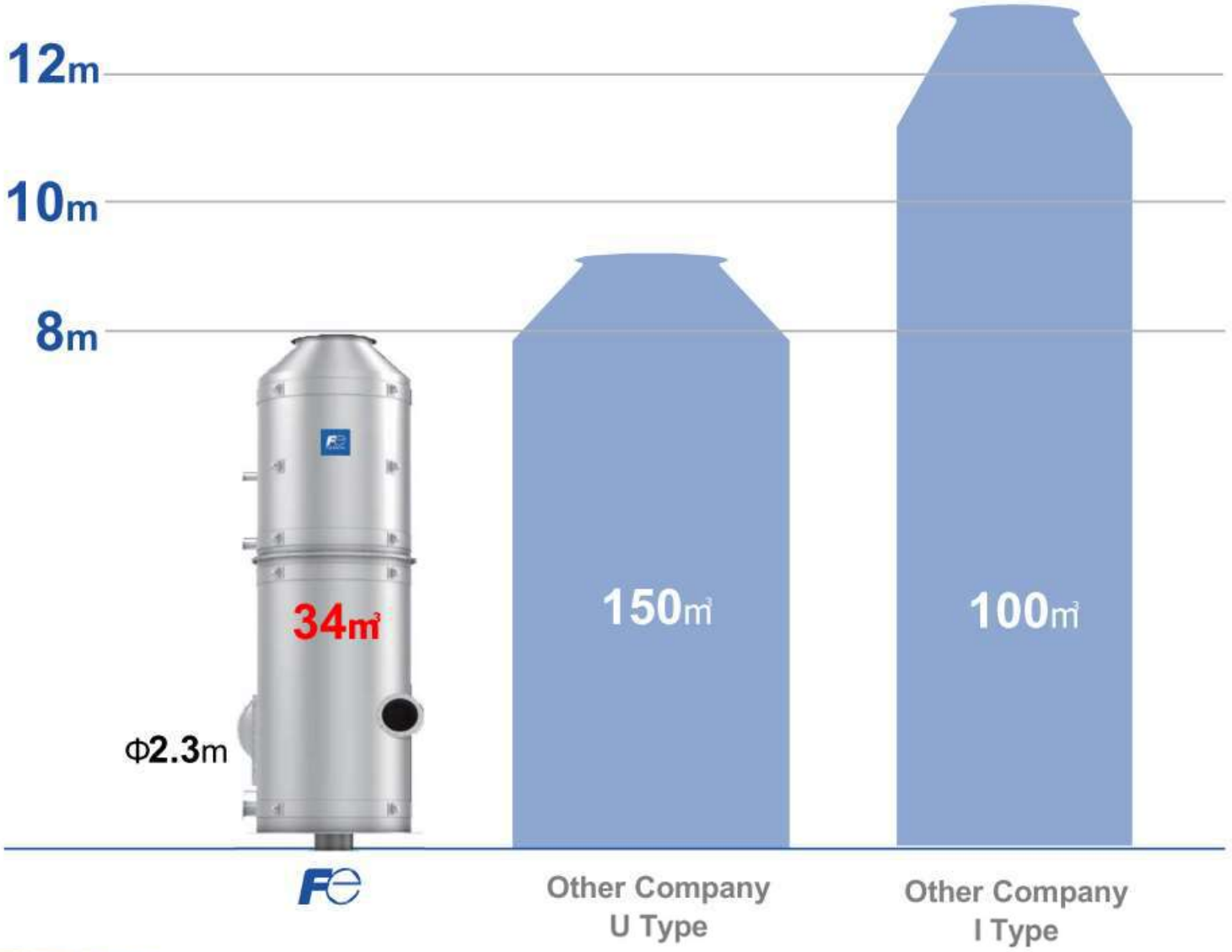
Save the blue sky, save the blue ocean, save the blue Earth

# Introduction Movie

# Size

## World Smallest Size




（for 10MW engine）

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# Line-Up


New builds

Retrofit projects

**Delivered 130 Units / 120 Vessels have been operated**

| Size | Engine Capacity |
|---|---|
| S | 5 to 8 MW |
| M | 8 to 12 MW |
| L | 12 to 16 MW |
| 2L | 16 to 20 MW |
| XL | 20 to 24 MW |




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# System / Desulfurization Technology

- **Developed for marine use by Fuji**
- **Cyclone technology ***
- **No moving parts (contains only nozzles ** )**
  - ✓Simple structure
  - ✓Minimum footprint
  - ✓Low pressure loss
- **High desulfurization ratio: >98%**

PATENTED

***Spray nozzle arrangement**

JP 5998915 B
EP 2905062 A
US 9770690 B
KR 10-1570466 B

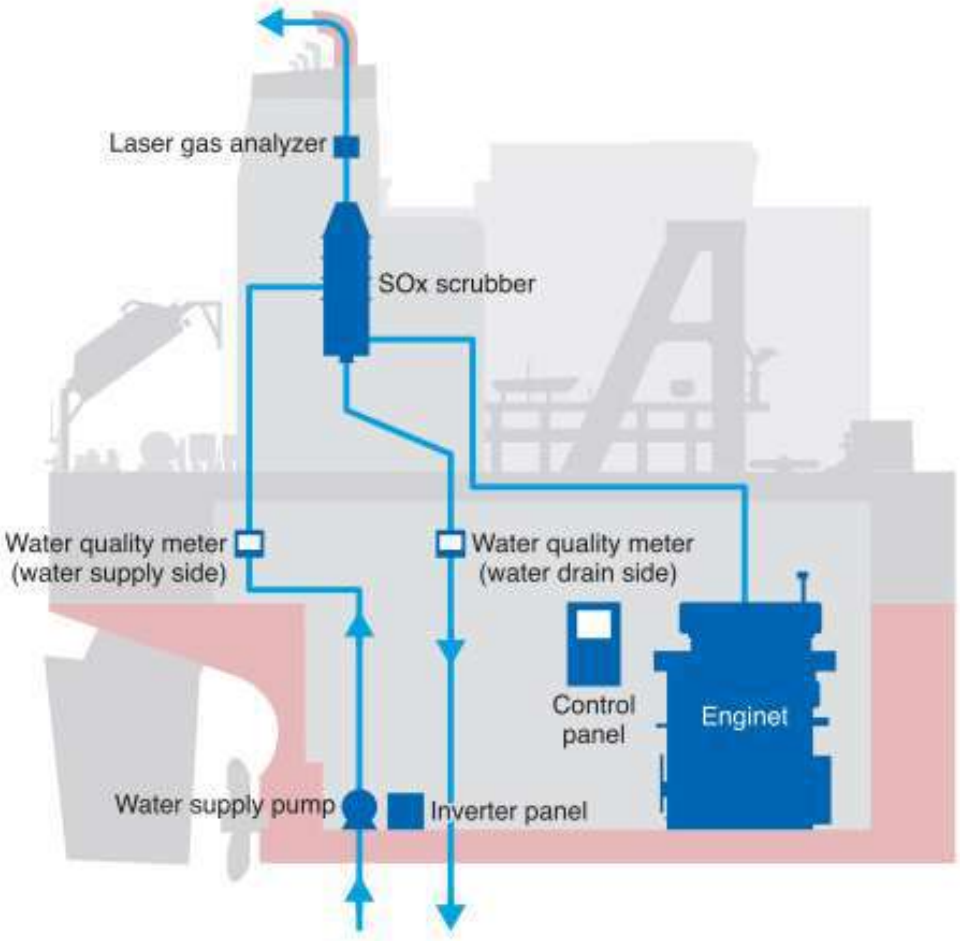
****Branch pipe spiral structure**

JP 5983802 B
EP 3165272 A
US 10252786 B
US 9957029 B
KR 10-1822570 B
KR 10-1768671 B
CN ZL201680002135.9

# System / Type

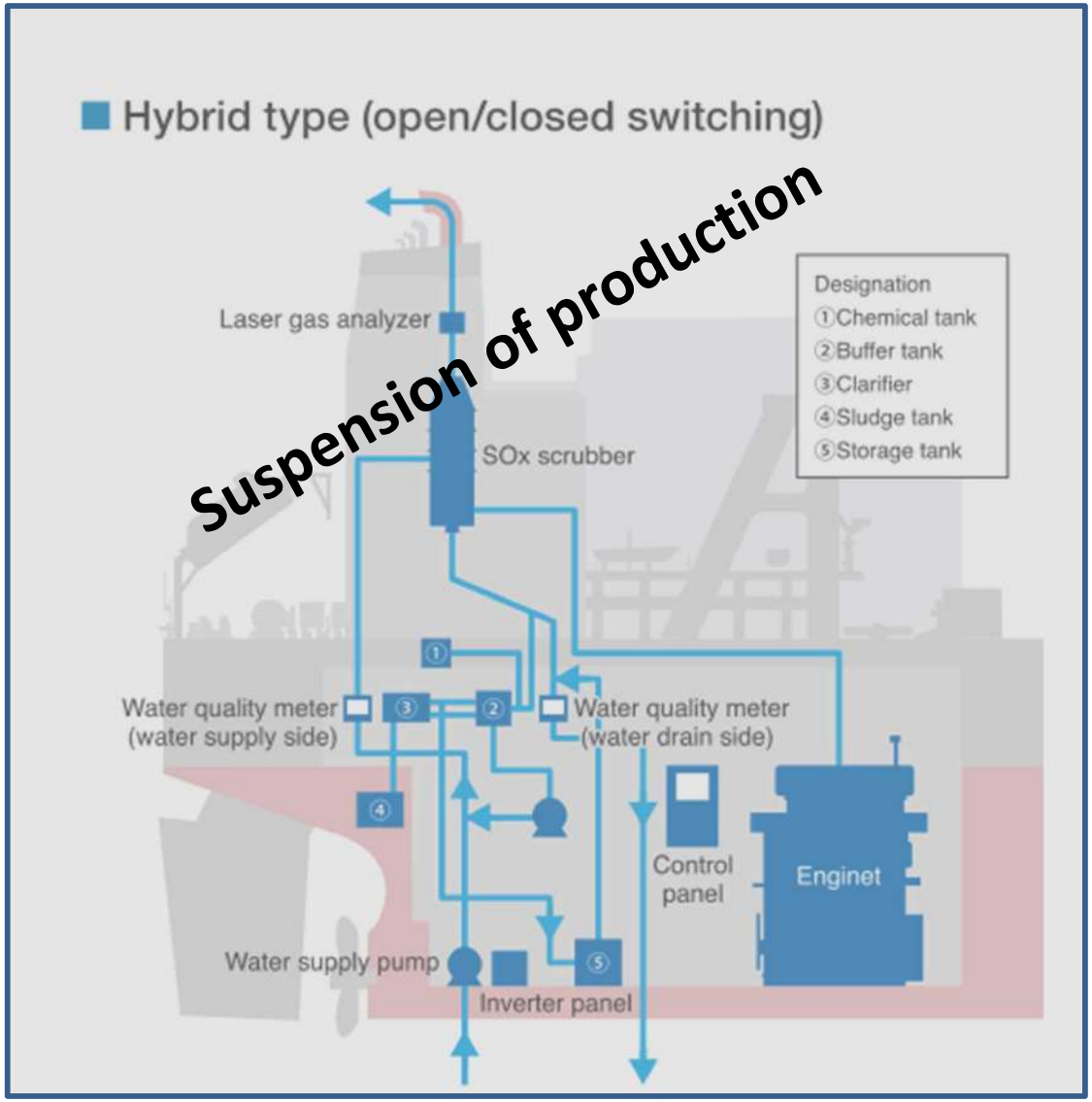
## Operates in all sea areas

■ Open type




■ Hybrid type (open/closed switching)

Suspension of production



# Production / Manufacture

**Compliant with the latest guidelines MEPC.77**

| Type | Product | Made by |
|---|---|---|
| Open Loop | SOx scrubber | Fuji Electric |
| | Gas analyzer | Fuji Electric |
| | Water Quality Mater | Fuji Electric |
| | Control panel | Fuji Electric |

**ZVS**
**Water Quality Mater**

Ph, Turbidity and PAH Sensors are designed and manufactured by own brand, Fuji Electric

**ZQS**
**Laser Type Exhaust Gas Analyzer**

Manufactured by own brand, Fuji Electric

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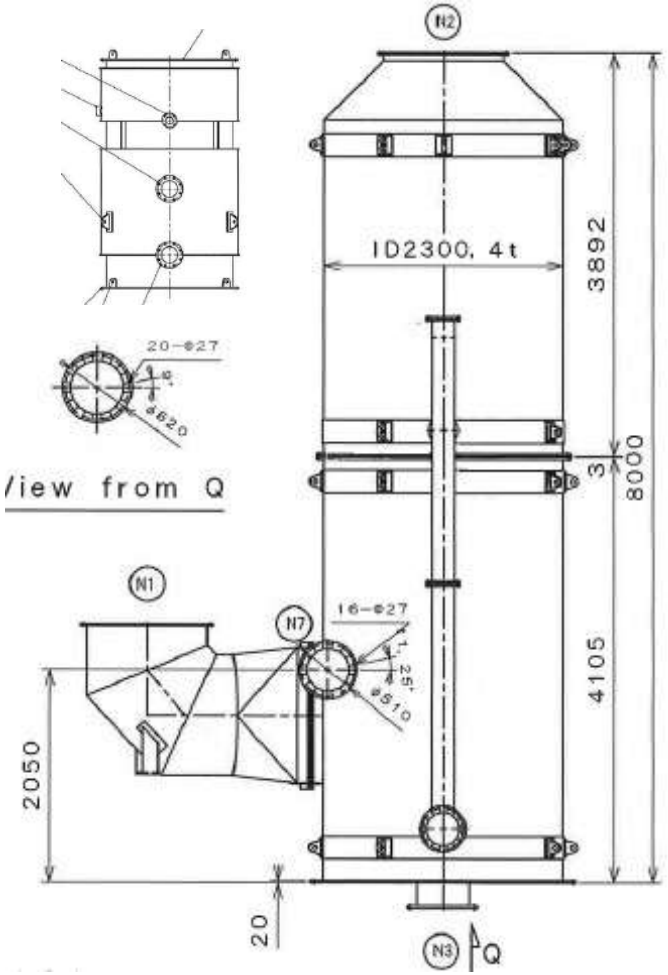
# New Version 3.5G

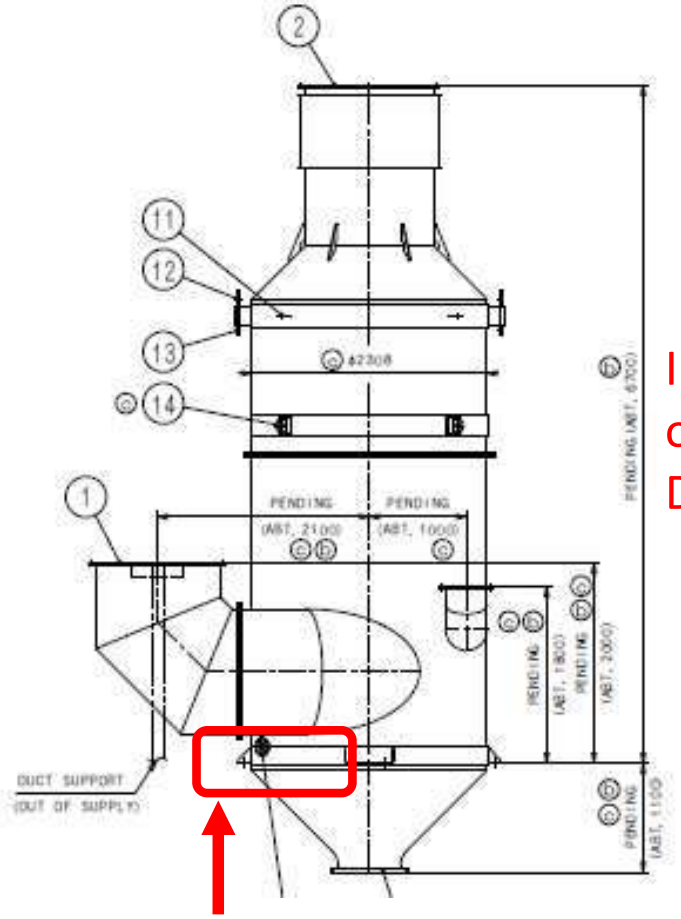
## Dimension

2G




Swirler is not fitted in body

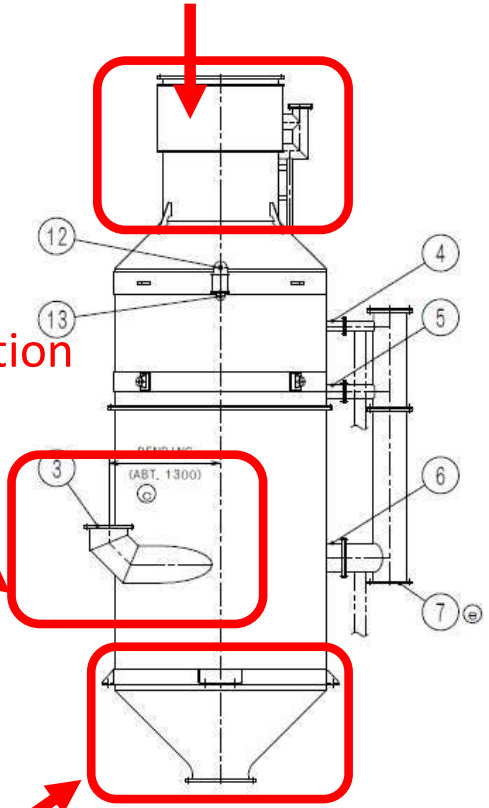
New Version 3.5G




Inside : lining by Special alloy

Swirler is fitted in body

Integration of G/E Duct




Decrease length and improve discharging wash water by Mortar Shape

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# New Version 3.5G

## Advantage Points

■ **Decrease length & Weight**

→ Easy to fit　(Big point for Retrofit )
Reducing material / Weight
Keep the Space of Cargo / Container

■ **Lining / Special Alloy**

→ High corrosion resistance
No Maintenance for Scrubber Body (No consumption parts)

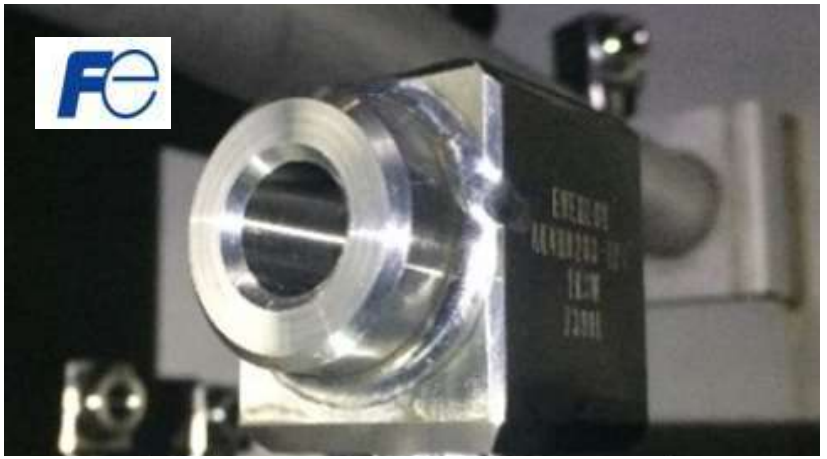
■ **100% Made in Japan / In house Development**

→ High reliability
Prompt reply & Action

# New Version 3.5G

## Maintenance

| Equipment | | 2G | 3.5G |
|---|---|---|---|
| Scrubber Body | | No Maintenance | ← |
| Gas Analyzer | Maintenance | Filter Replacement | ← |
| | Calibration | Annual calibration by SV | ← |
| Water Quality Mater | p H | Replace every year with new one | ← |
| | PAH | Calibration for every two years at Factory. Replace with spare on board | **Calibration on board by crew.** Replace with new one for every 2.5 years |
| | Turbidity | Calibration for every two years at Factory. Replace with spare on board | **Calibration on board by crew.** Replace with new one for every 5 years |



Nozzle condition / Operating for three years

**＜Improve Maintenance point＞**
**PAH & Turbidity Sensors**

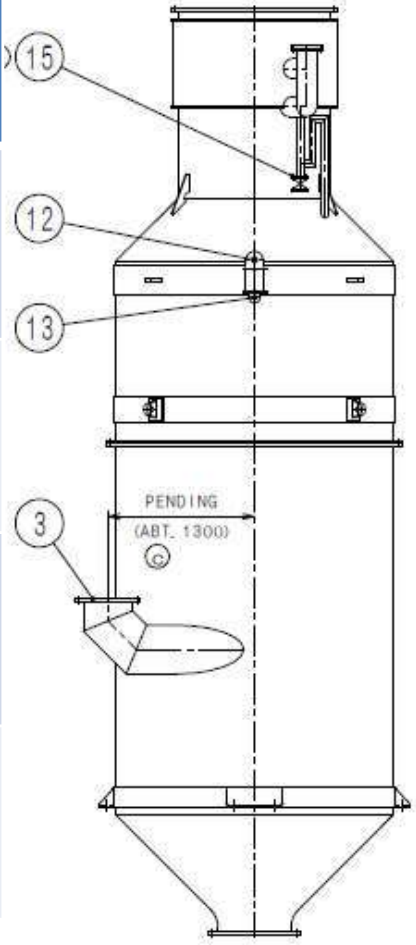
**⇒No need to send sensor to land / Factory Calibration can be done by crew on board**

# New Version 3.5G

## Size Lineup

Improve points are shown **by Blue**

| Size | Capacity(Reference only) | Gas Volume | | Diameter (D) | Height (H) | Approximate Weight |
|---|---|---|---|---|---|---|
| **S** | ~9MW | ~18kg/s | ~49850 CMH | 2.0m | 7.0m →6.0m | 5ton →3.0 ton |
| **M** | ~12MW | ~25 kg/s | ~69230 CMH | 2.3m | 8.0m | 6ton →4.5 ton |
| **L** | ~16MW | ~36 kg/s | ~99700 CMH | 2.7m | 9.2m →9.0m | 7ton →6.5 ton |
| **2L** | ~20MW | ~44 kg/s | ~121850 CMH | 2.7m | 11.5m | 9.0 ton |




※Delivery time: 3-6 Months after receiving order / fixed specification

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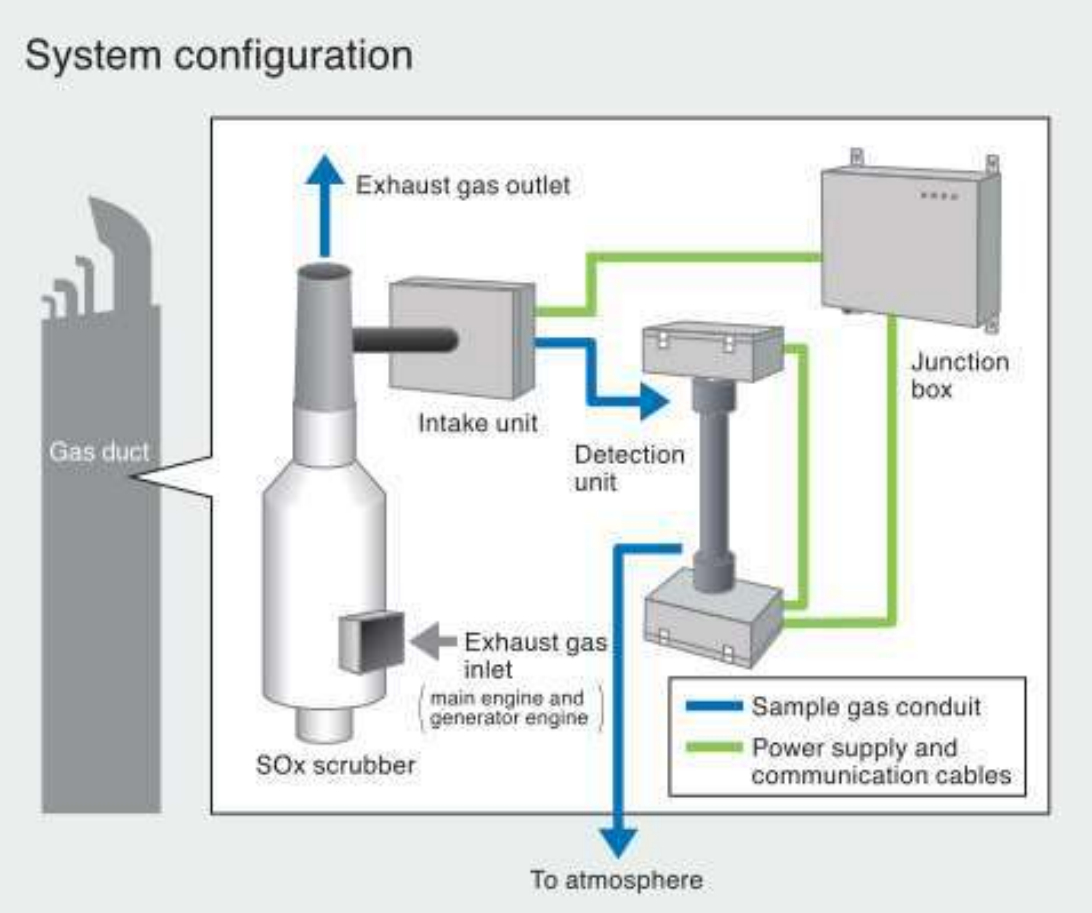
# Production / Laser Gas Analyzer / Fuji Own design & Production





NIPPON KAIJI KYOKAI
TYPE APPROVAL CERTIFICATE
FOR AUTOMATIC DEVICES AND EQUIPMENT


NIPPON KAIJI KYOKAI
STATEMENT
for
Exhaust Gas Monitoring System


DNV·GL
TYPE APPROVAL CERTIFICATE

## Features

- Easy installation and replacement due to compact size
- Less maintenance (filter exchange a few times a year)
- Long-term stability (only one calibration per year)
- No gas cylinder required on board

## Specifications

- Measurement range: $SO_2$ 0 to 300 ppm/$CO_2$ 0 to 10%
- Zero drift & span drift: <±2.0 % FS over 6 months
- Certification: ClassNK, DNV-GL

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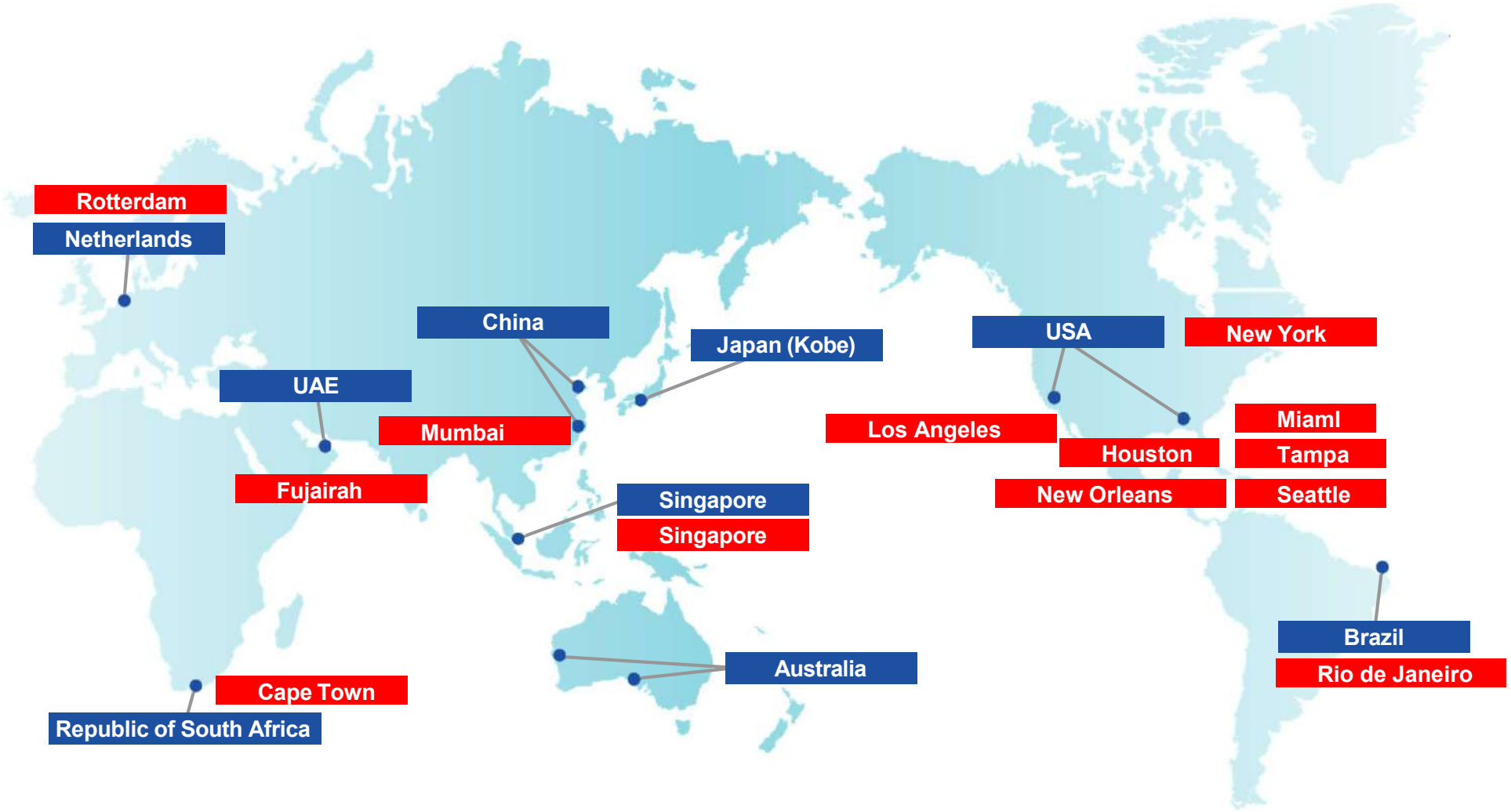
# Service Network







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# Advantage Point

- High Desulfurization
- High pH ( **4-5** ) **/ No corrosion** of distance piece of discharge line
- World's smallest Size
- Own design & Production ( **Laser type Gas Analyzer and Water Quality Mater / Fuji Original** )
- Calibration is simple and easy: Crew can be done on board)
- Service Network
- Rich Experience for Feeder Container ( Standard maker of Imabari Group)
- Reliable & Experienced maker, **Fuji Electric** Production

# Disadvantage Point

- Volume of Sea Water ( 1.5 times)
- Line Up : up to 24MW for single fitting

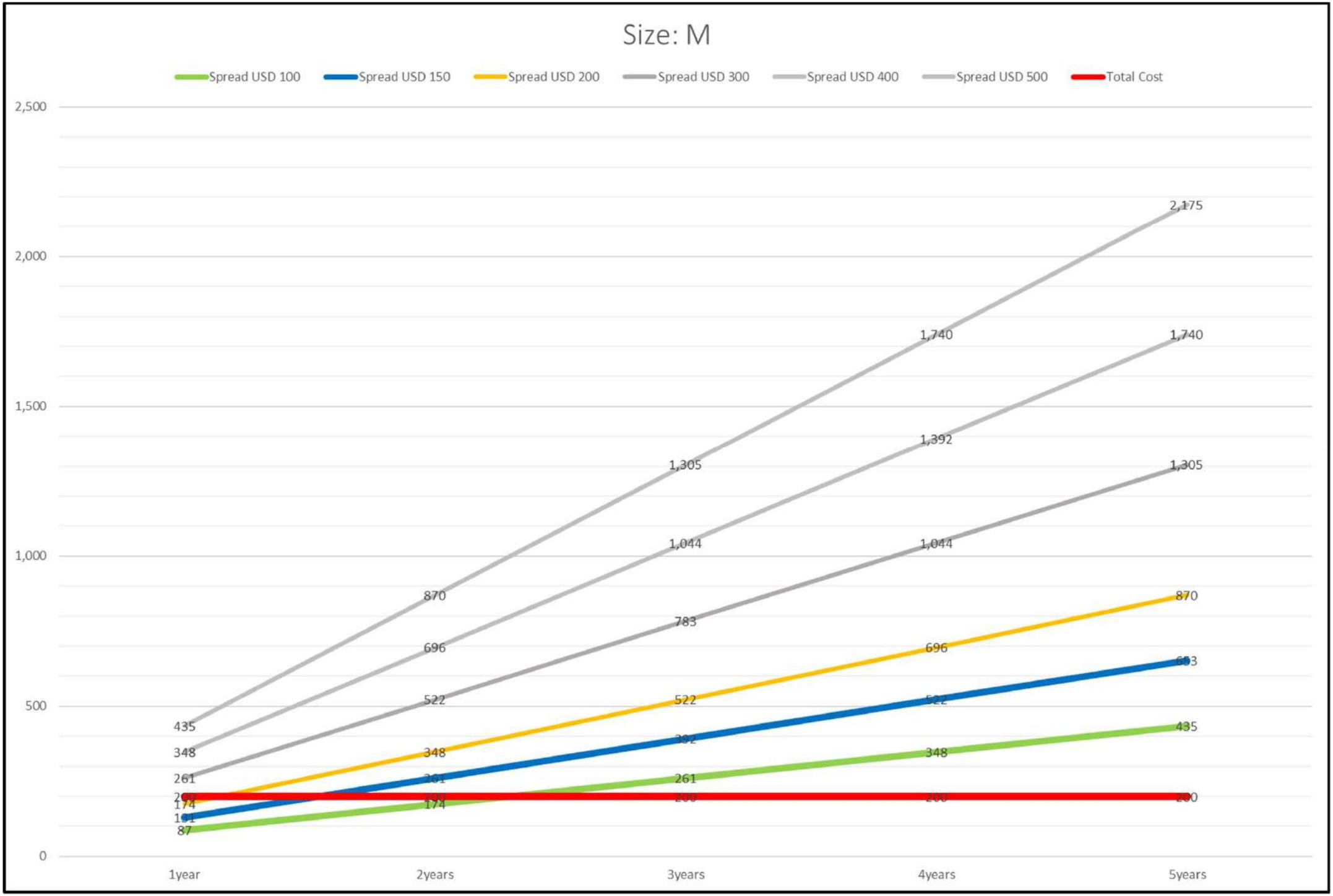
# Depreciation Trend

Pana-Max （M Size)

| | | |
|---|---|---|
| Fuel Cconsumption | 30 | Ton/Day |
| Annual Voyage days | 200 | Days per Year |
| EGCS Price | 100 | Mil Yen |
| Installation Cost | 100 | Equal to equipment cost |
| Exchange rate JPY | 145 | per USD$1 |

Unit: Mil Yen

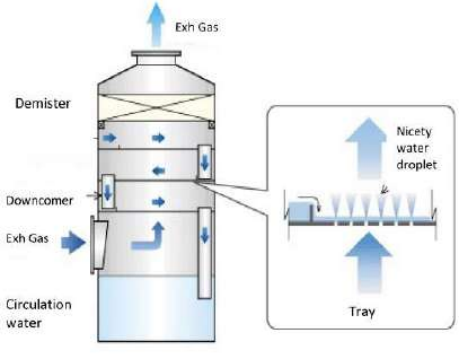
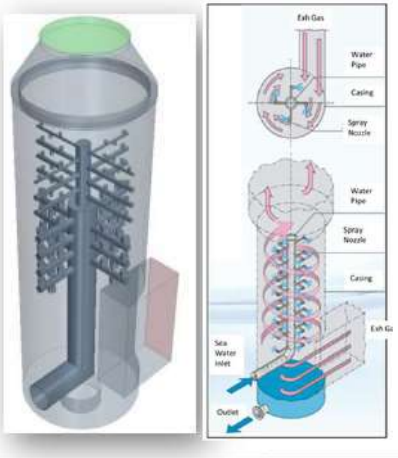
| Fuel Spread/VLSFO&HFO | 1year | 2years | 3years | 4years | 5years |
|---|---|---|---|---|---|
| **Spread USD 100** | **87** | **174** | **261** | **348** | **435** |
| **Spread USD 150** | **131** | **261** | **392** | **522** | **653** |
| **Spread USD 200** | **174** | **348** | **522** | **696** | **870** |
| Spread USD 300 | 261 | 522 | 783 | 1,044 | 1,305 |
| Spread USD 400 | 348 | 696 | 1,044 | 1,392 | 1,740 |
| Spread USD 500 | 435 | 870 | 1,305 | 1,740 | 2,175 |
| **Total Cost** | **200** | **200** | **200** | **200** | **200** |


Size: M
Spread USD 100
Spread USD 150
Spread USD 200
Spread USD 300
Spread USD 400
Spread USD 500
Total Cost
2,500
2,000
1,500
1,000
500
0
1year
2years
3years
4years
5years
435
348
261
174
87
870
696
522
348
174
1,305
1,044
783
522
261
1,740
1,392
1,044
696
348
2,175
1,740
1,305
870
435
200

# Additional Documents

# -Comparison-

# Comparison

| | Other Maker | Fuji Electric |
|---|---|---|
| |  Draft Fan needs to install for getting more strong pressure |  Fuji is able to treat the exhaust gas by aire preessure from engine <u>without any additional Draft Fan.</u> |
| Inside of Scrubber |   2 sets of Packed bed is consumable parts so that need to replace sometimes. |  <u>Consumable parts is not installed inside.</u> |
| Capacity | 6-70MW | 8-24MW |
| Open/Closed/Hybrid | O,C,H, | O,C,H, |
| Factory location | China | Japan |
| Pressure loss | ≦1.5kPa | ≦1.5kPa |
| Volume | 100-150m3 | **34m3** |
| Remote monitoring system | | EGCS IoT System |

# Corrosion

Delivered 120 vessels **without any corrosion of distance piece** of discharge water line.

⇒ **pH Value is 4-5**

Subject

Corrosion of distance pieces associated with SOx scrubber discharge waterlines (Part 2)

**ClassNK**
***Technical Information***

No. TEC-1214
Date 4 November 2020

To whom it may concern

As previously noted in ClassNK Technical Information (TEC-1205), ClassNK received several reports of cases of sea water leakage being detected in damaged distance pieces (due to corrosion) of SOx scrubber discharge waterlines fitted to hull structures (see 3 in Figure 1). Since similar incidents are still being reported, ClassNK has decided to publish this Technical Information not only to remind our clients that this remains an ongoing concern, but also to provide the following related information.

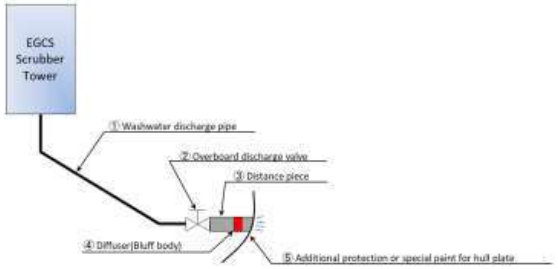



Figure 1 SOx scrubber discharge water line

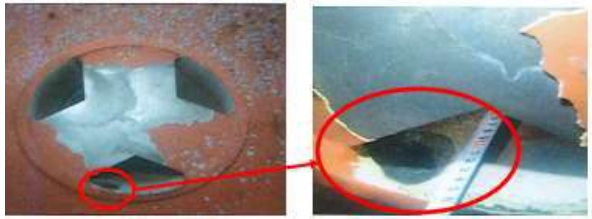
According to damage reports received to date, sea water leakage has been observed either on or adjacent to welded parts between distance pieces and their associated flanges (see Picture 1) as well as between distance pieces and bluff bodies (see Picture 2). The reports indicate that the corrosion apparently initiates at the welded parts and then continues to progress until it finally leads to sea water leakage into engine rooms. A peeling of the painted surfaces of the butt-welded parts of distance pieces (see Picture 3) has also been observed.

(To be continued)





Picture 1 Damage on/around welded parts between distance pieces and flanges



Picture 2 Corrosion on/around welded parts between distance pieces and bluff bodies

Picture 3 Paint peeled off at butt-welded parts of distance pieces

l on the circumstances of the situation, the damage is assumed to begin at locations on welded parts : the paint has been peeled off. The underlying surface is thus directly exposed to discharge water, causes corrosion that then spreads over the distance pieces over time.

NK believes that one of the effective ways to prevent this type of incident is to apply pre-treatment o the painting of welded parts in order to ensure proper paint performance, and some specific pre- ients are introduced below as examples. In addition, please be sure to comply with the pre- ent procedures specified by paint manufacturers, if any.

(To be continued)





ufficient local paint thickness and non-uniform paint thickness

and any remaining welding material components
lirt from the welded parts

'esistance material such as stainless steel for distance pieces is another
d. Please note that welding procedure specification (WPS) approval is,
eel materials prior to any welding work.

ncidents to be serious, and feels that the information contained in this
iseful reference for shipowners and ship management companies, etc.
ve actions as needed. In this regard, please let us note that the above-
nce purposes only, and their effectiveness is not guaranteed in all cases.
ted to independently investigate their effectiveness on a case-by-case
when such measures are applied.

1205, ClassNK recommends that shipowners and ship management

information with the masters of your vessels on which SOx scrubbers
iem to pay more attention to their external inspections of discharge
iround distance pieces from engine room, and carry out said periodical

of distance pieces when the opportunity presents itself, e.g. arranging

ary countermeasures (e.g. covering the affected distance pieces with
should be taken immediately, and an Occasional Survey by a Society
ie soonest opportunity.

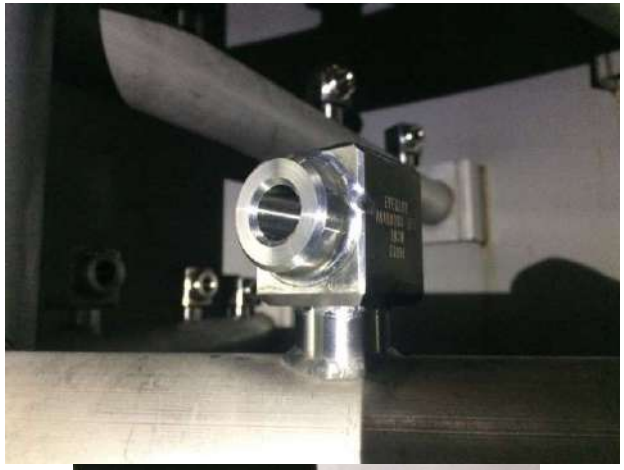
e, please contact:

NK)
on Center Annex, Head Office
da-ku, Tokyo 102-0094 Japan

# Spray Nozzle:  High Quality & Maintenance Free

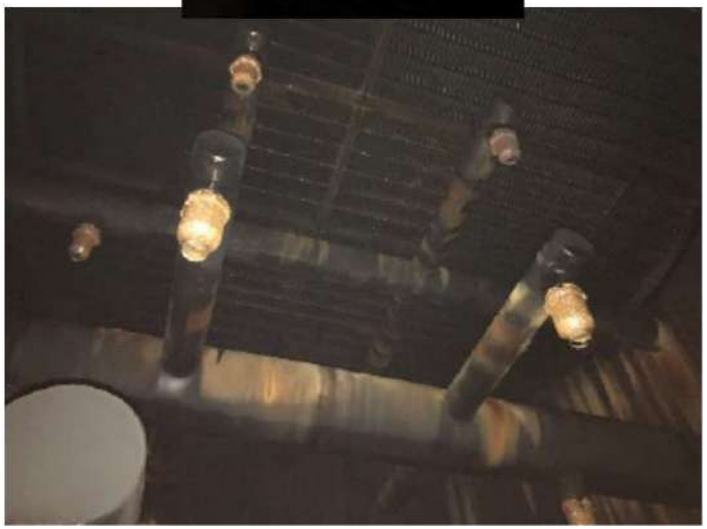
Fuji's spray nozzle:

- Same material as scrubber main body (Duplex stainless steel)
- Bore size of sea water spray: a few CM => **No choking**



Other spray nozzle: General stainless steel＝＞easy to be corroded

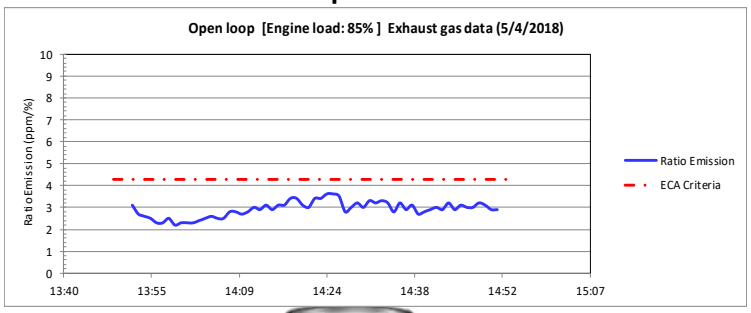
- Bore size of sea water spray:  less than 1 mm=> Risk of choking



＊Photos in the scrubber body of manufacturer A after a few year operation

# Fuji's scrubber is complied with 0.1%S(ECA) regulation

Operation mode can be changed from 0.5%S to 0.1%S by switching on the control panel.




A manufacturer offers only 0.5%S compliance (Fuel has to be changed in ECA) with open loop system.

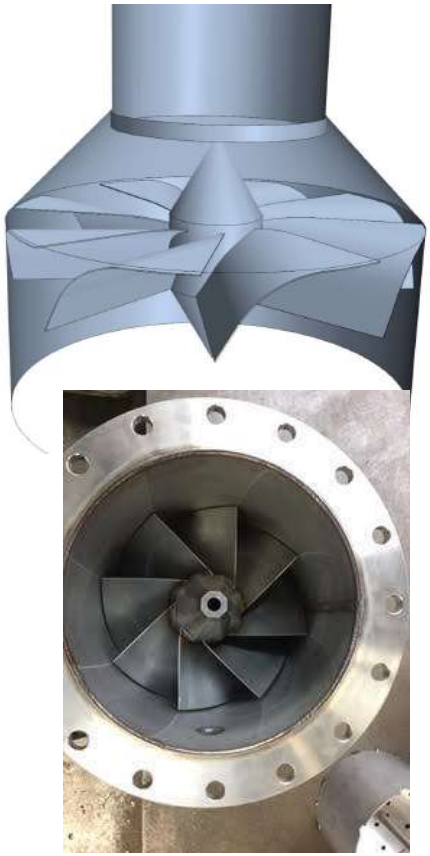
Most of cargo ships operate majority of time (about 90%) in open sea and HI AIR I-Type Open Loop Scrubbers optimized for 0.5% Sulphur requirement in Open Sea (Outside ECA) shall make the most of benefits :

**In the limited area, just switch over to compliant fuel oil.**

# Fuji's scrubber does not need demister. Water droplet from funnel can be prevented by inner Swirler.

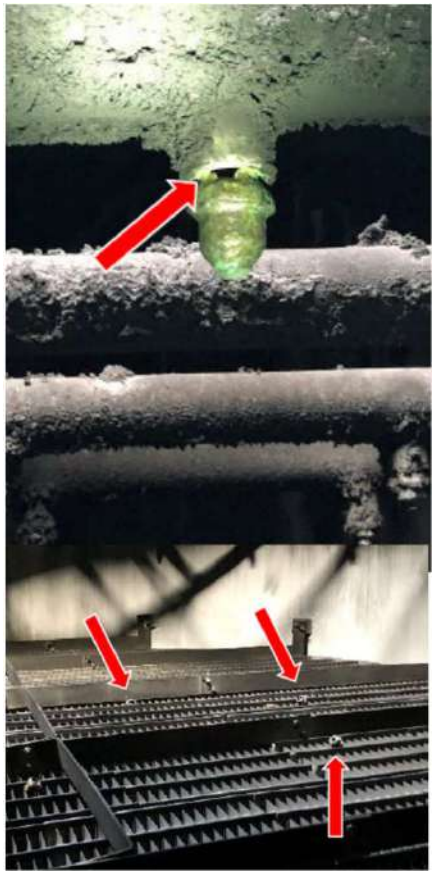
Inner swirler

- **Cleaning spray is not necessary.**
- Same material as scrubber main body (**Duplex SS**)



Demister

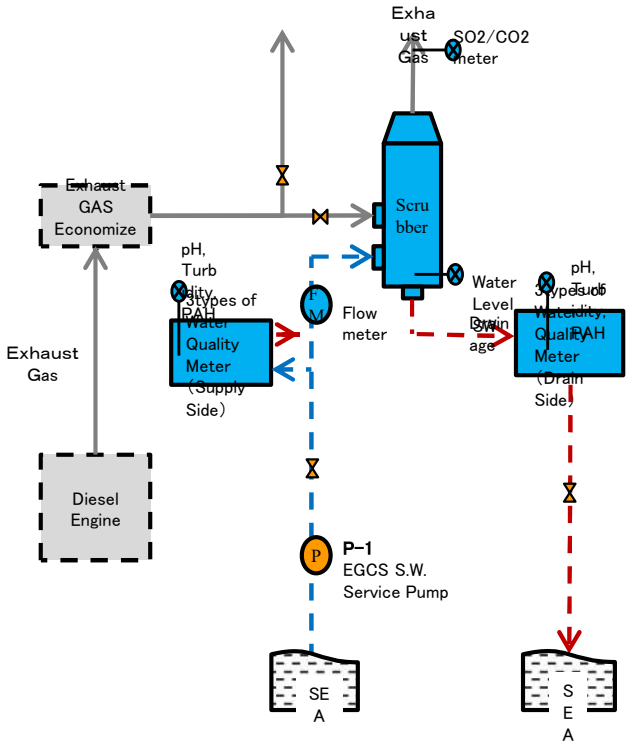
- Cleaning spray is required.
- Spray has a risk to be corroded.



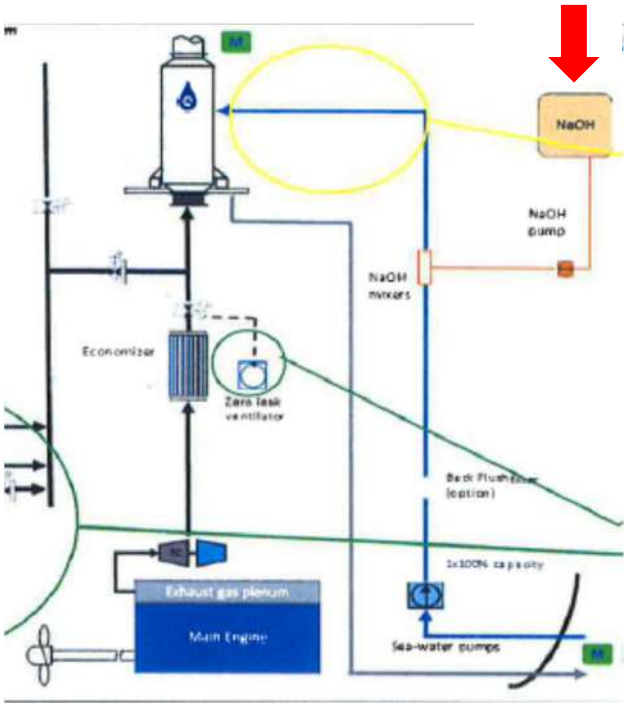
∗ The demister's photo after a few year operation. The spray nozzles are missing. (lost by corrosion)

# Fuji's open loop scrubber does not need alkali additive (NaOH) and comply with 0.1%S (ECA) regulation.

Fuji's open loop scrubber:
**No need of NaOH**

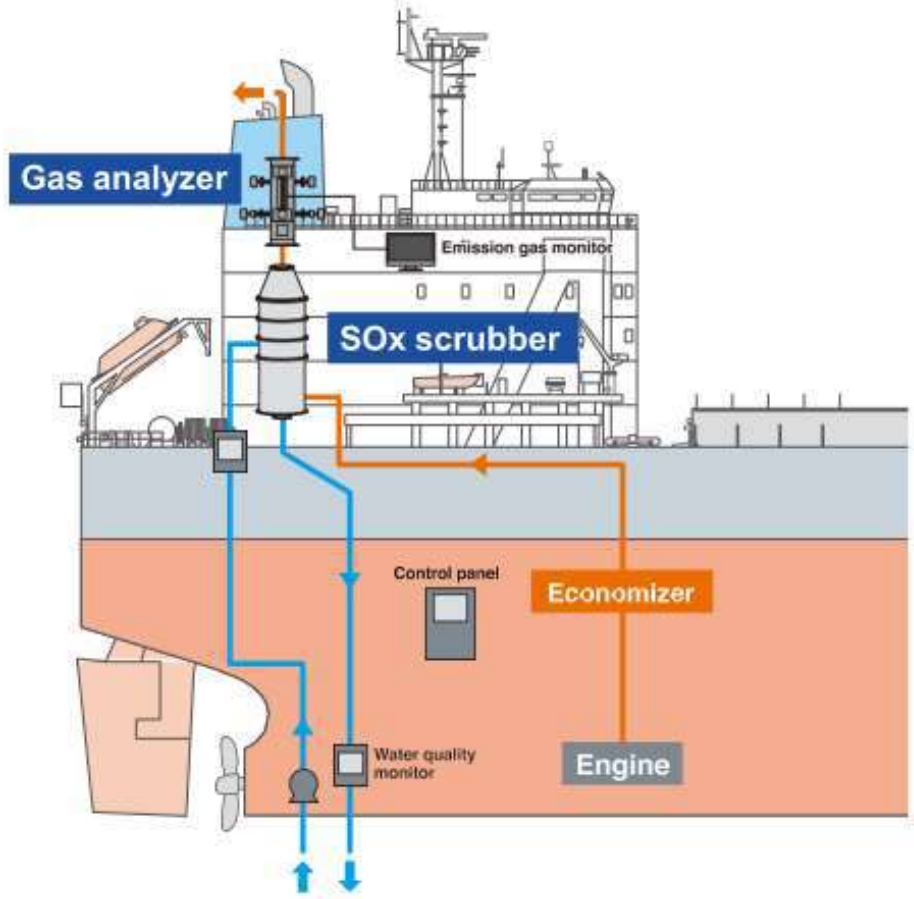



A manufacturer's open loop scrubber:
NaOH is required to desulfurize the exhaust gas enough.



# Water discharge line :  GRE is not required.

Discharge water after scrubber still has approx. PH 4 unlike the other scrubber (PH 2 to 3).  It is not so corrosive as the other one.
**Polyethylene lining only is good enough.**




Most of scrubbers need GRE line for water discharge line because of high oxidization (PH 2 to 3)

# Retrofit Installation:  Inui Kisen “Ken Shin” 38BC