

Mitsubishi Auxiliary Boiler : MAC-B



Meaning of MAC-B
M : Mitsubishi
A : Auxiliary
C : Compact
B : Type

December, 2007

History of Mitsubishi Marine Boiler

-More than 120 years history

*** 1885 : The first Marine Boiler manufactured**

*** 1964 : The first Two-drum water-walled MAC Boiler**

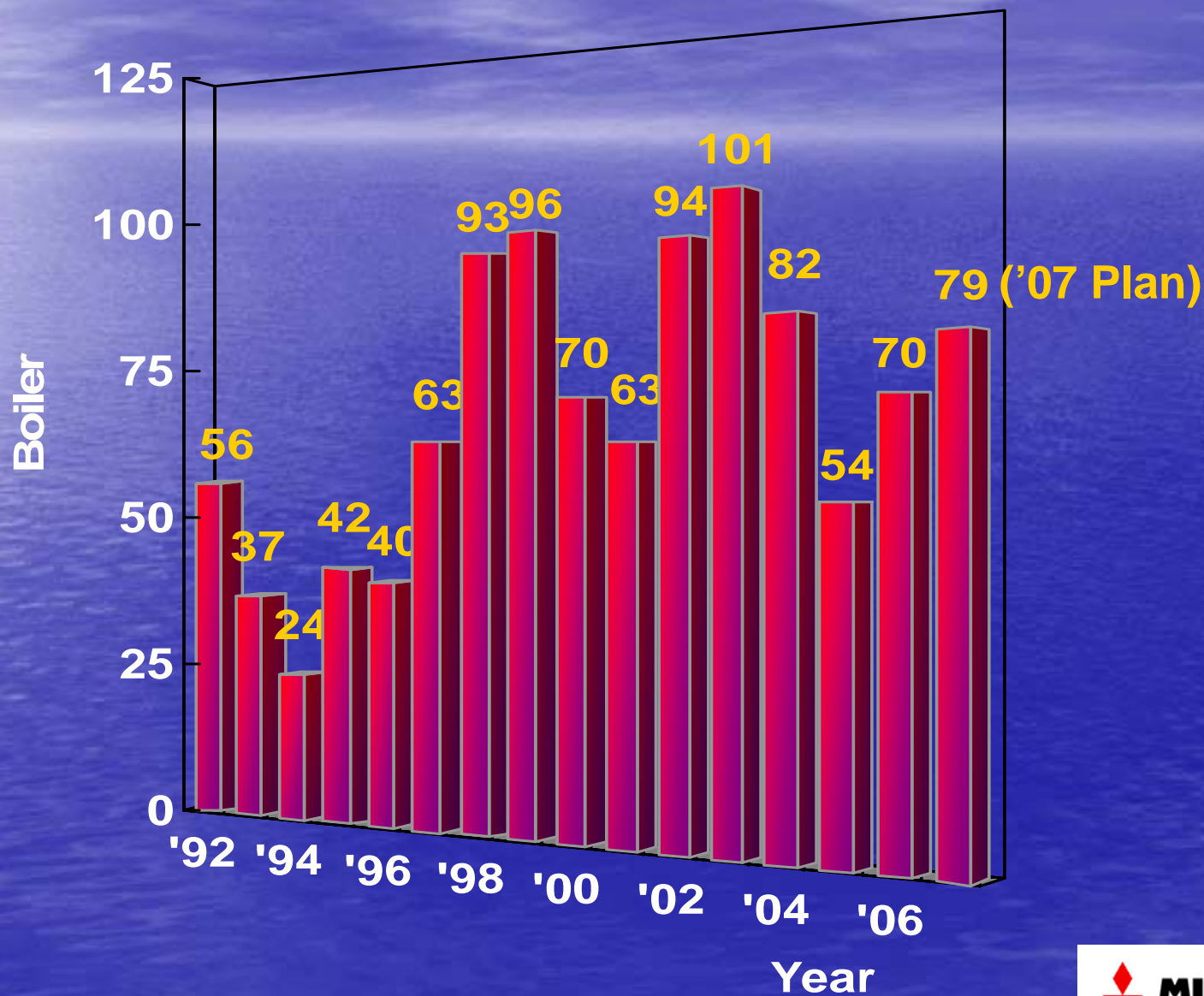
*** 1983 : The first MAC-B manufactured**

-Total 5000 Boilers (including Main Boiler)

*** Two-Drum Water-Tube MAC Boiler : Total 1,393**

*** MAC-B Boiler : Total 1,227 (As of Nov. 2007)**

Production Record (MAC-B Type Boiler)

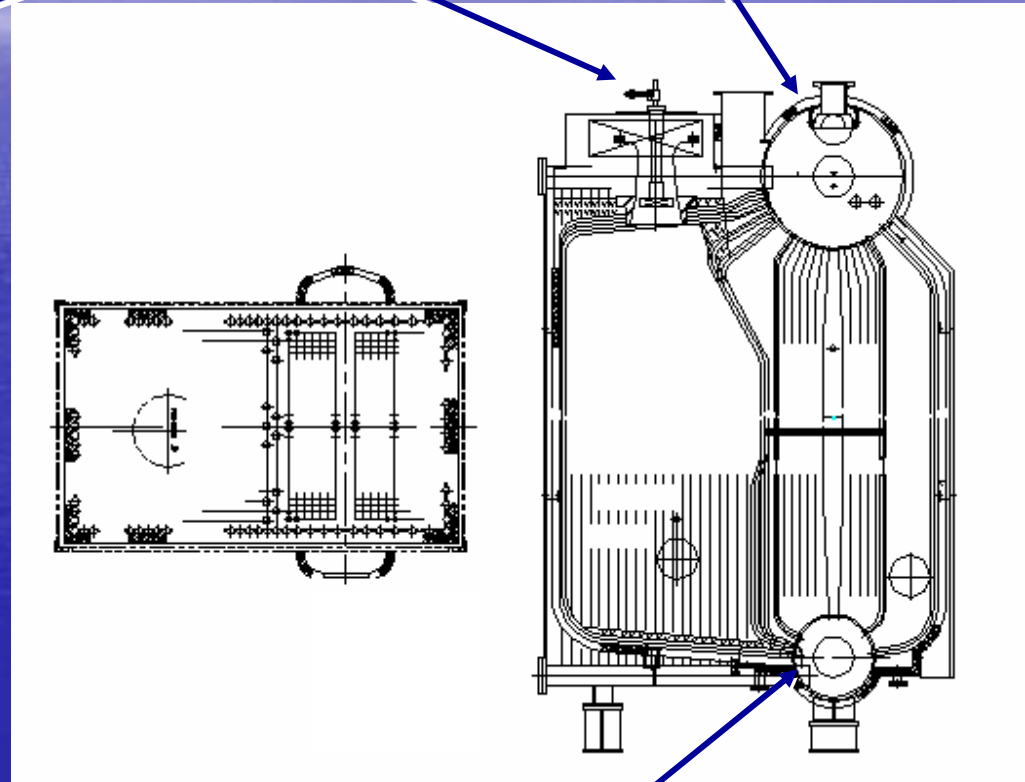


Appearance



F.O. Burner

Steam Drum



Water Drum

Standard Specification

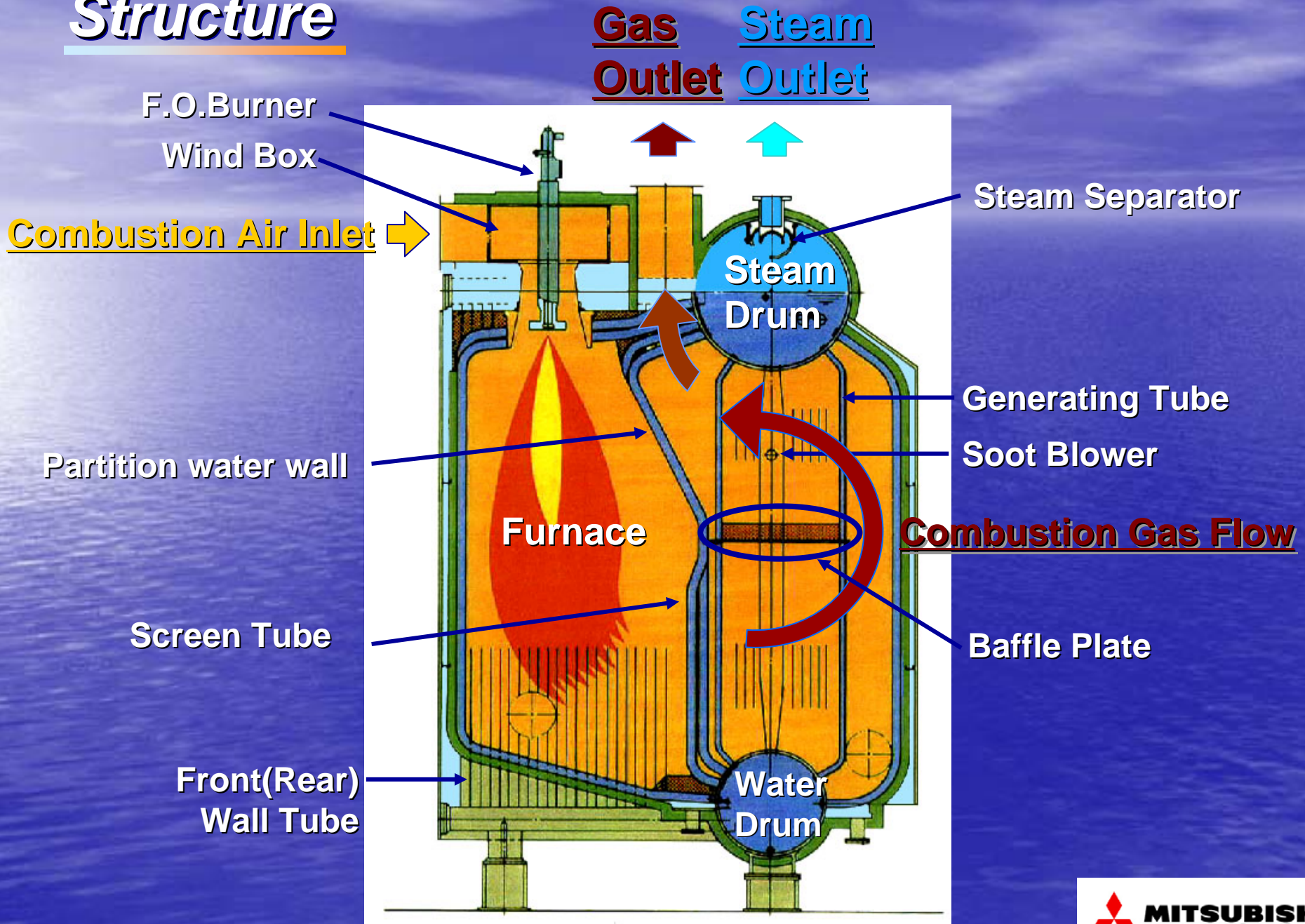
MAC - **B

Ex) 40t/h boiler → MAC-40B

Type	MAC-	20B	25B	30B	35B	40B	45B	50B	55B	60B	70B	80B	90B	100B	110B	
Max. Evap.	t/h	20	25	30	35	40	45	50	55	60	70	80	90	100	110	
Design/ Working Press.	kg/cm ² g	18/16 (1.77/1.57MPa)★														
Steam Temp.	°C	Saturated														
Boiler Efficiency	%	80.5					82.5									
Feed water/ Air temp.	°C	60/38														
No. of burner	-	1									2 or 3					
Soot blower	-	1														
FOC	kg/h	1552	1940	2328	2716	3029	3407	3787	4165	4543	5300	6058	6815	7572	8329	
Dry weight	ton	26	28	31	35	44	47	49	54	67	72	73	75	98	114	
Water weight	ton	10	10	11	13	19	20	20	22	29	30	34	34	37	43	

★ Design/Working Press is changeable according to request

Structure



Advantages of MAC-B

-Two-drum water-walled type

- Long lifetime due to furnace surrounded by water wall tubes and no thermal stress construction
- Stable Combustion with large furnace
- Pure steam

-Easy inspection and maintenance

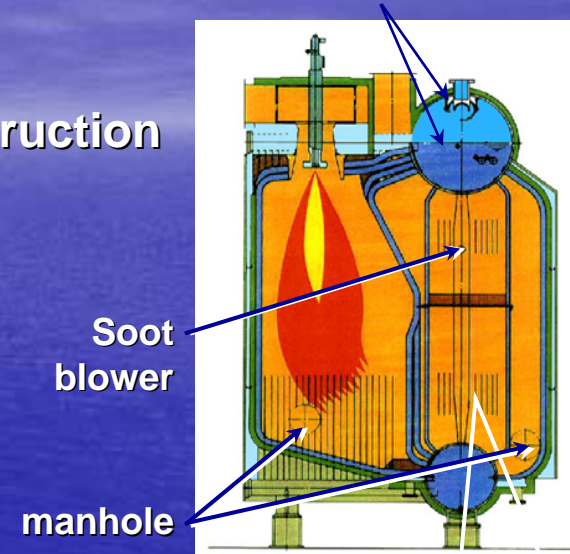
- Two manholes
- In-line tube arrangement
- Less soot deposit using bare tubes
- Applicable soot blower during boiler operation
(Soot blower is standard equipment)

-Safe Operation

- Easy operation and monitoring using Graphic panel
- Stable water level
- Back fire protection of boiler control system

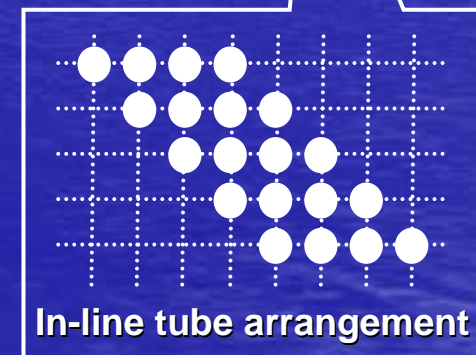
-Production Capacity : 120 boilers/year

Steam separator & baffle plate



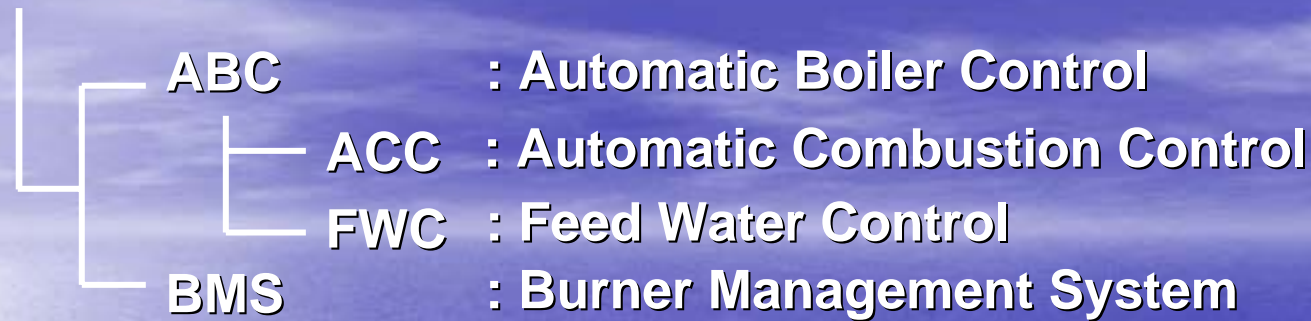
Soot blower

manhole



In-line tube arrangement

Boiler Control System



Steam press. control : Control FO flow to reduce the deviation with setting pressure by detecting Drum pressure

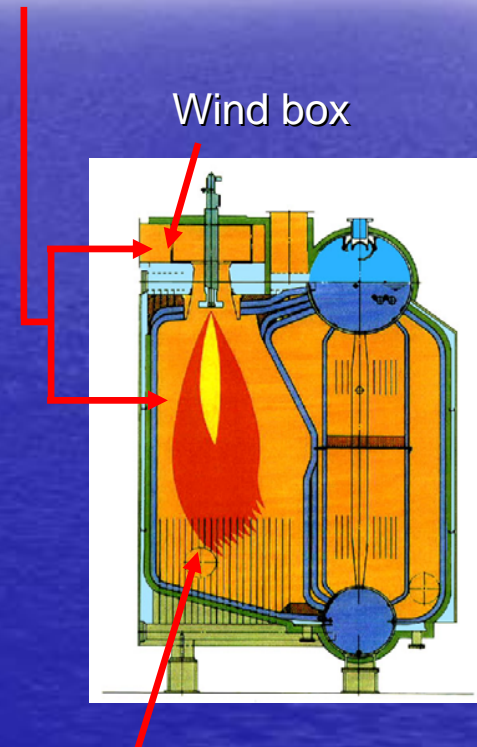
FO Flow control : Control FO control valve by detecting FO pressure at FO header

Air Flow control : Control F.D.FAN inlet vane by detecting burner draft loss (between wind box and furnace)

(Burner draft loss)
= (Wind box press.) – (Furnace press.)

FW flow control : ① Control FW control V/V by detecting drum water level (1 element type)
② Use Steam Flow as Feed Forward signal when there are 2 boiler control (2 elements type)

Differential Pressure
= Burner draft loss



Furnace

-Boiler Mode

Boiler Mode	Condition	Steam Press.	Burner Auto Start/Stop
Tanker Service	COPT operation	16k (1.57MPa)	12k/16.5k (1.18/1.62MPa)
ECO Back up	Exh. Eco. Back up during voyage	6k (0.59MPa)	5.5k/7k (0.54/0.69MPa)
IGS Top Up	IGS Topping-up (interlock with soot blower)	-	N/A
Repose	Cancel unnecessary alarm while Boiler Stops	-	N/A

-Automatic Operation

Burner Auto Start/Stop	Depend on Steam Pressure
Master/Slave Operation	Auto start/stop of Slave boiler according to Master boiler load

Start : Steam Press. 12k
(1.18MPa)
Stop : Steam Press. 16.5k
(1.62MPa)

Start : Boiler load 60%
Stop : Boiler load 25%

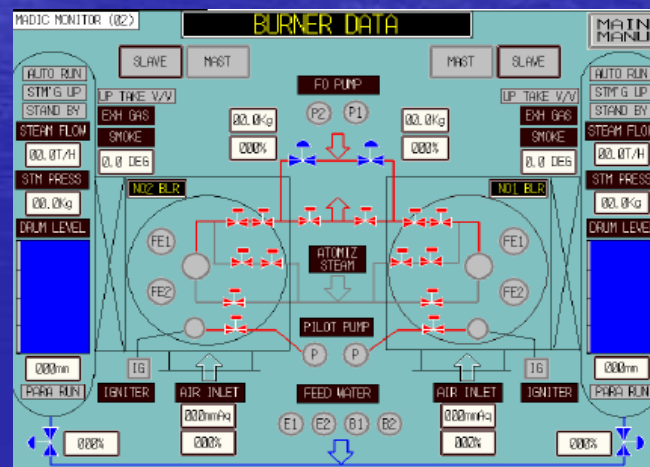
Boiler Control Panel



Local Boiler Control Panel

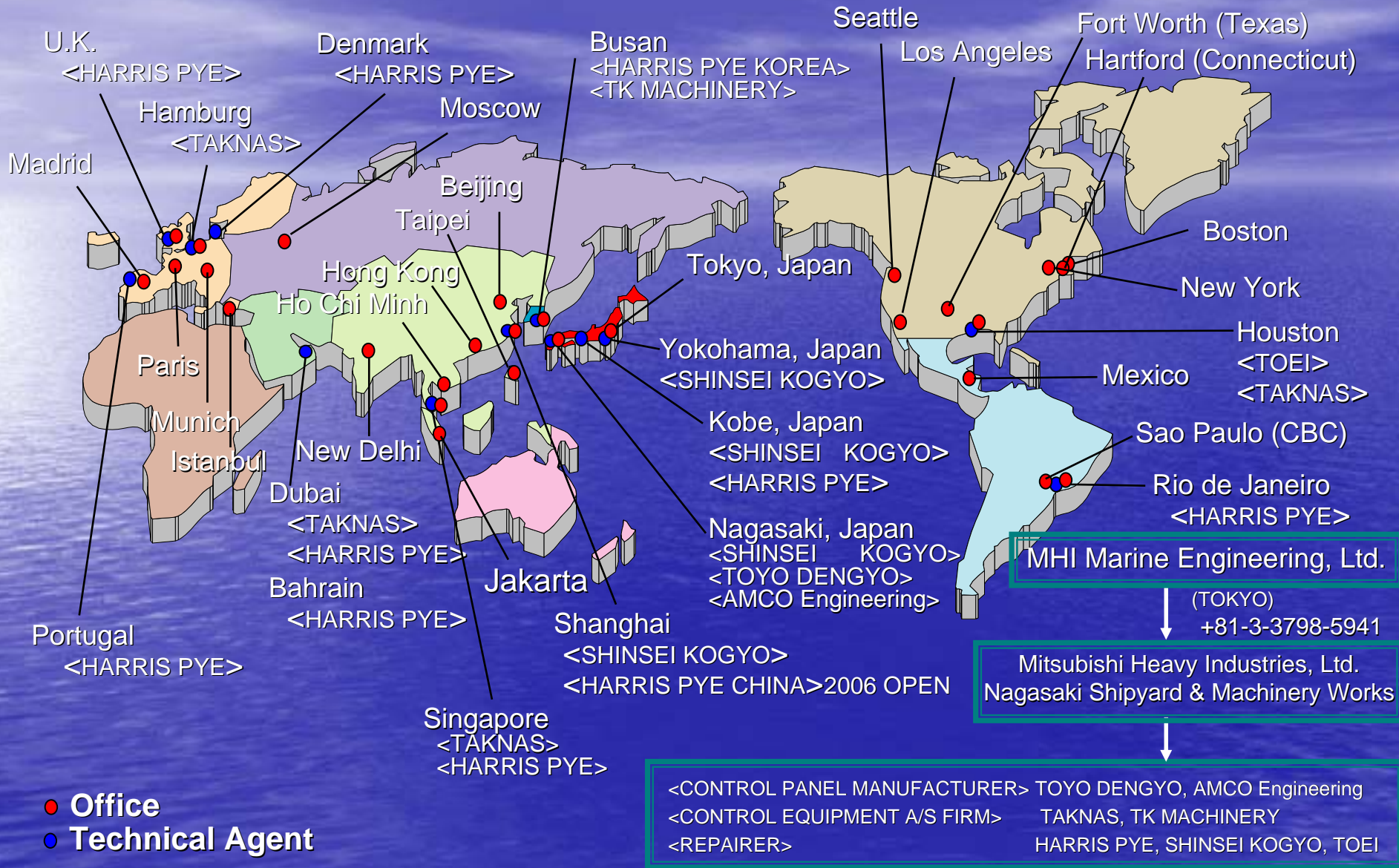


Graphic Panel



Condition Monitor

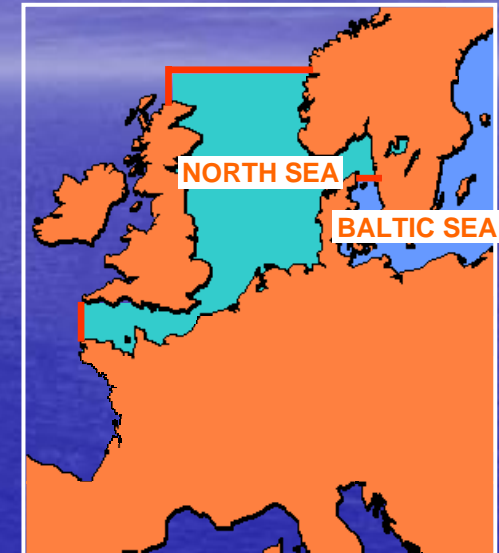
After-sales Service Network in the World



GO Firing for SOx Emission Control (1/3)

- SOx Emission Control in EU

Sulfur content of fuel oil	Area	Operation
1.5%	Baltic Sea	2006.5~
	North Sea	2007.11~
4.5%	Other Sea	
0.1%	All Ports in EU	2010.1.1~



By CraftMAP



The only measure is . . .

**Applying “Low-Sulfur Fuel Oil (Gas Oil)”
: DMA Grade of ISO 8217**

GO Firing for SOx Emission Control (2/3)

- Indispensable Item for applying GAS OIL

Item	Remarks
1) Additional fuel oil pump for Gas Oil	<u>Gas Oil Viscosity</u> · > 2.5 cSt : MHI standard FO pump (option) is available. · < 2.5 cSt : Additional FO pump for Gas Oil is necessary. <u>*Viscosity criteria may be changed by pump maker.</u> Discharge pressure can not be taken for Gas Oil with low viscosity by fuel oil pump planned only for HFO.
2) Change of atomizing medium or atomizer itself Modification of control system	<u>Atomizing medium</u> · Air : Burner performance can be kept . · Steam : Burner turn down ratio decrease. Atomizer must be changed to keep burner performance. Combustion control is also necessary to change according to the above modification.
3) Additional interlock	Boiler trip by “ Heat trace on ” “ FO temp. high ”

GO Firing for SOx Emission Control (3/3)

- Recommendation Item for applying GAS OIL

Item	Remarks
1) GO mode	Additional operation mode for GO firing · Combustion control change for GO firing · Activate additional interlock - Boiler trip by “ Heat trace on ” , “ FO temp. high ”
2) Independent fuel oil piping	· Independent FO piping of Heavy Fuel Oil and Gas Oil to the FO control valve · Avoid mixing Gas Oil with high temperature Heavy Fuel Oil in case of bunker change
3) Igniter for all burners	· For multi-burner boiler · Shorten ignition time at increasing firing burner