大连船舶重工集团有限公司
DALIAN SHIPBUILDING INDUSTRY CO., LTD.

Technology of Design and Construction for Green AFRAMAX Tanker

绿色阿芙拉精品新船型的设计和建造技术研究

DSIC – Cai Zhuyi，Guan Yinghua

Dec. 3, 2009

Content

1. Green Shipbuilding Conception

   绿色造船的概念
2. General Design

   总体方案设计
3. CSR Structure Design

   满足CSR新规范的结构设计
4. Ballast Water Treatment System

   压载水处理系统
5. Decreasing Emission from Ships

   减少船舶排放
6. Green Shipbuilding Technology

   绿色建造技术

1. Green Shipbuilding Conception

Three areas to be considered for green ships

- Design and Construction
- Operation
- Scrapping

1. Green Shipbuilding Conception

Following areas to be considered during design

- Emission of NOx and SOx
- Emission of CO_2
- Type approved incinerator
- Reasonable structure design to reduce vibration and noise
- Environment-friendly material
- Treatment of garbage, bilge water and sewage
- Ballast water treatment system
- Environment-friendly painting
- ODME and vapor emission control for tanker
- Low-resistance hullform and energy-saving application
- New technology of energy efficiency and emission reduction

1. Green Shipbuilding Conception

Following areas to be considered during construction

- Material
- Emission of CO_2
- Minimize exhaust of sewage
- Dry process
- Piping flushing
- New welding technology

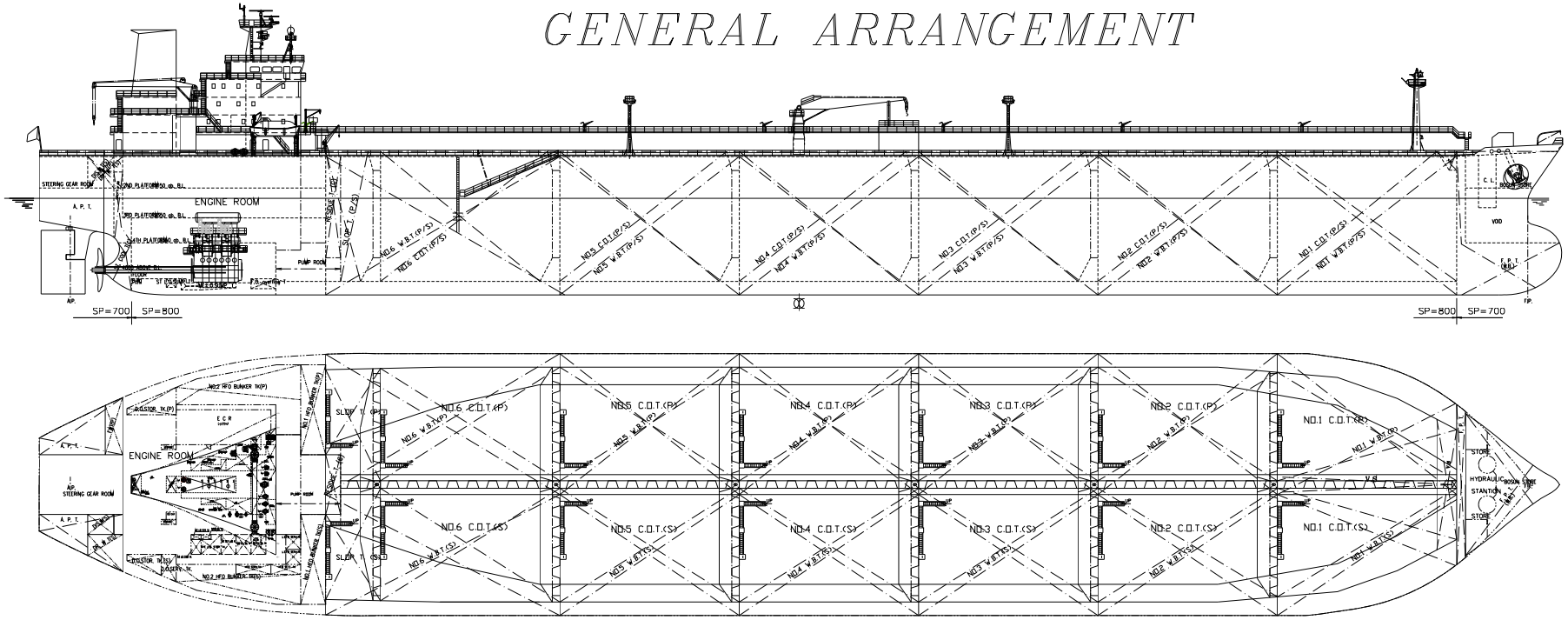
2. General Design

2. General Design

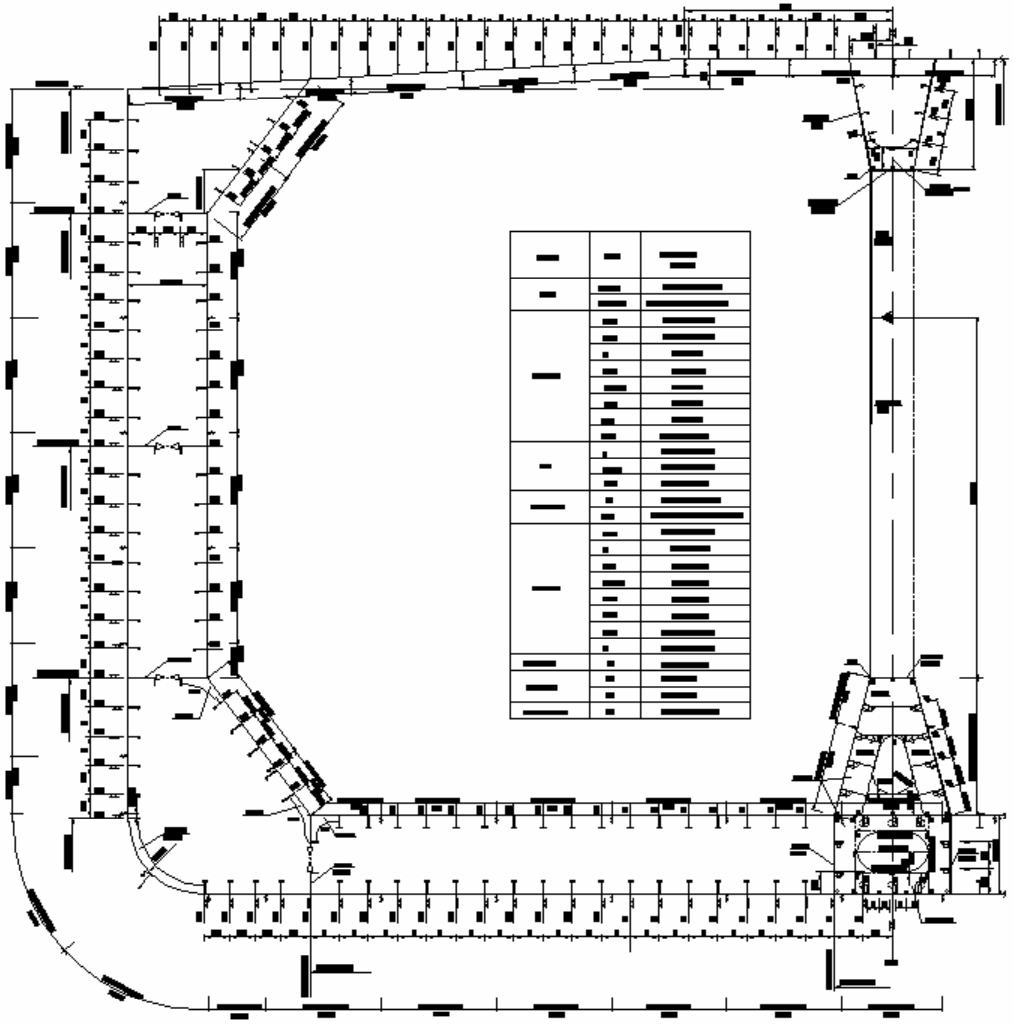
Principal particulars

Loa	abt. 244.60	m
Breadth	42.00	m
Depth	22.20	m
Ts	15.50	m
Deadweight	110,000	t
C.O.T. capacity	123,500	m^3
Speed	15.6	kn
Main engine	MAN B&W 6S60ME-C8	
	MCR 14,280kW	

2. General Design



3. CSR Structure Design



3. CSR Structure design

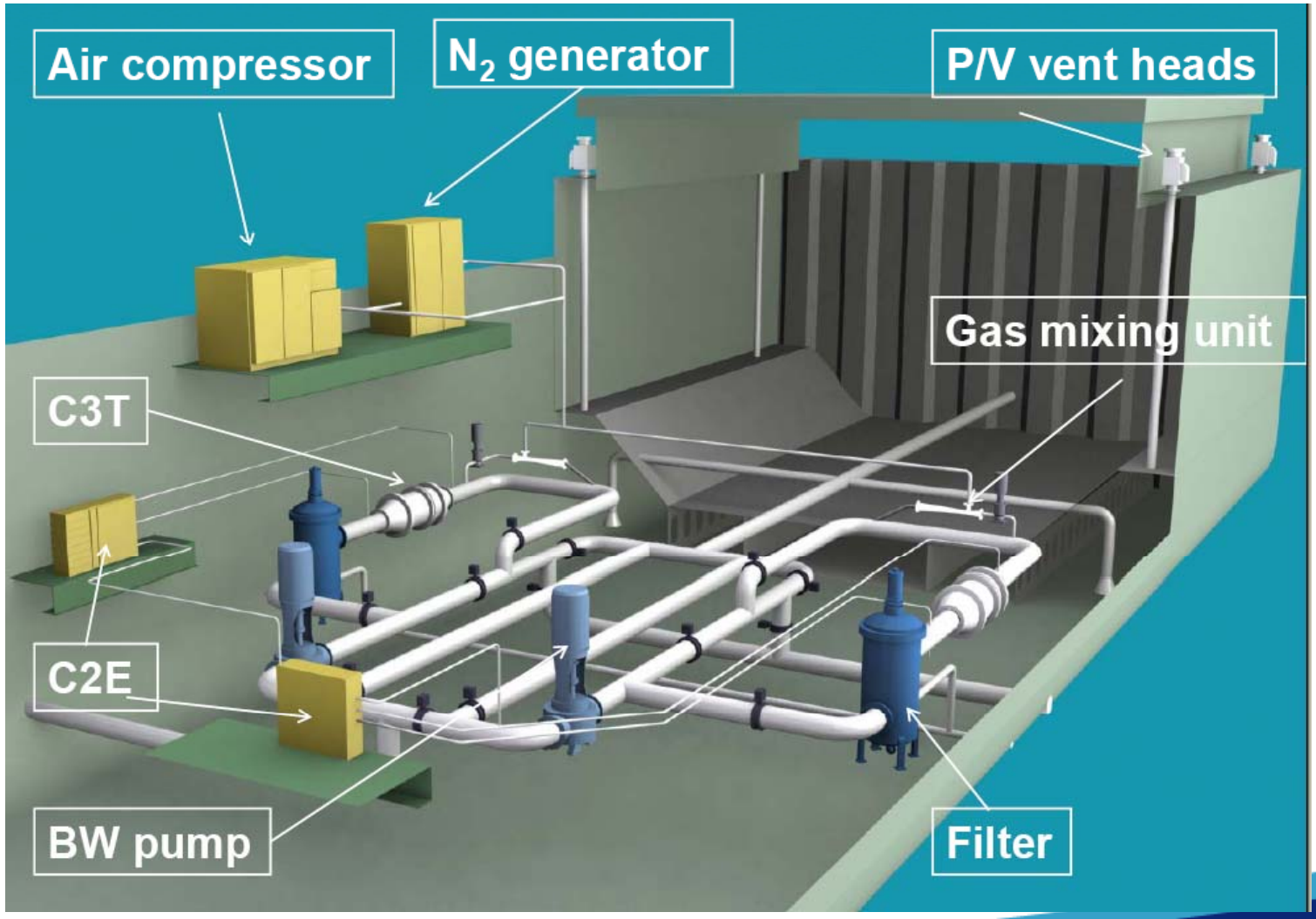
- **IACS CSR**
- **SOLAS II-1/3-6.2 Permanent means of access**
- **MARPOL Reg.12A Oil fuel tank protection**
- **MARPOL Reg.22 Pump-room bottom protection**
- **MARPOL Reg.23 Accidental oil outflow performance**

4. Ballast Water Treatment System

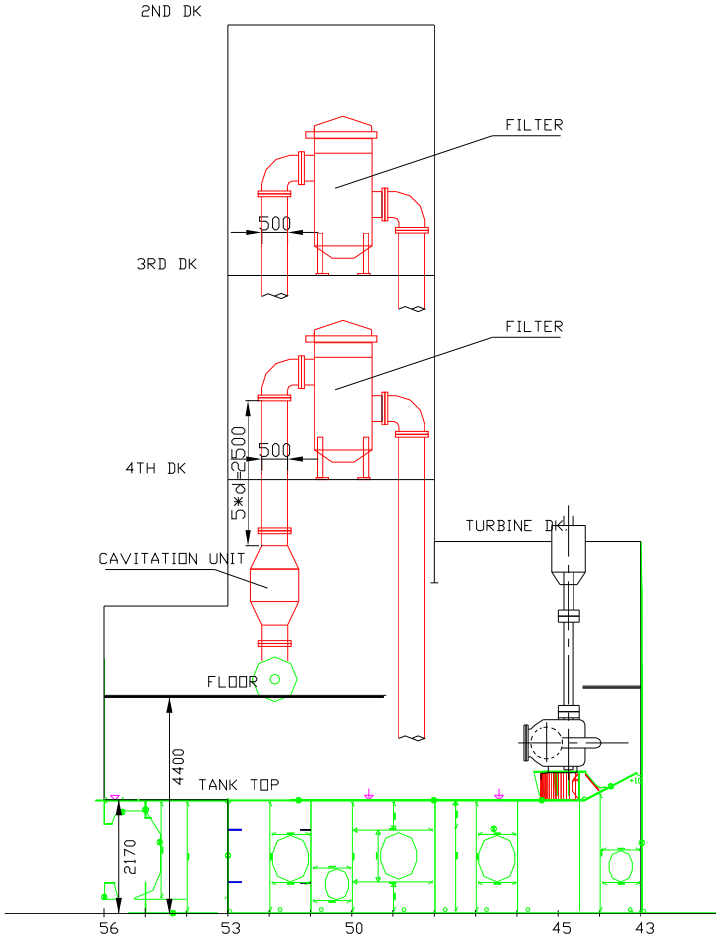
International Convention for the Control and Management of Ship's Ballast Water and Sediments

- Adopted February 2004
- Entry into force not yet …
- To date 18 States ratifications representing 15.36% of world merchant shipping tonnage

4. Ballast Water Treatment System



4. Ballast Water Treatment System



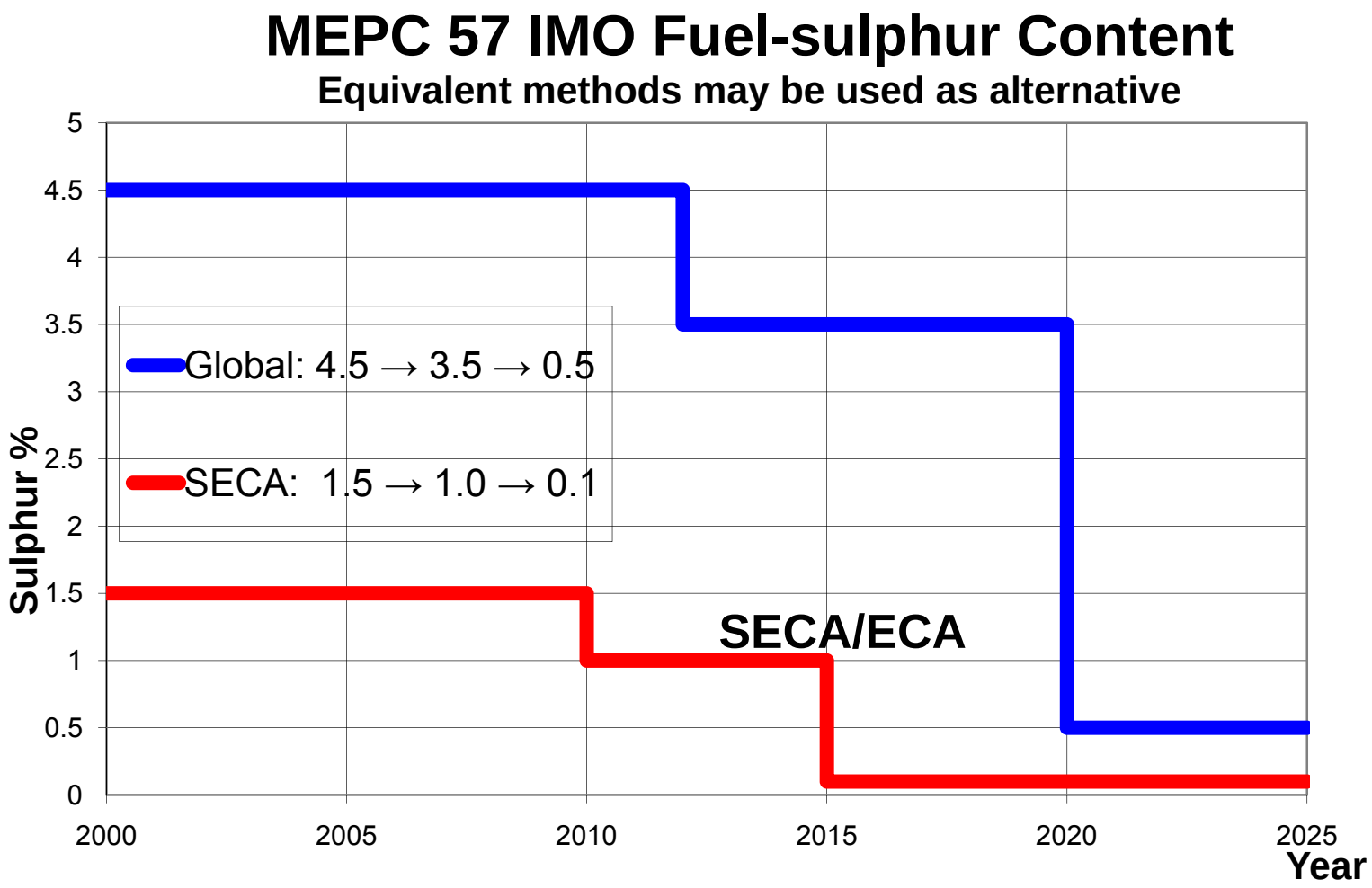
The ballast water treatment system have an impact on the arrangement of ER & PR, HFO & COT capacity, diesel generator capacity, endurance etc.

5. Decreasing Emission from Ships

MARPOL Annex VI – NOx Emission Standards

Adoption	At MEPC 58 in October 2008
Entry into force	1 July 2010
Tier I	Engines＞130kW, ships constructed before 1 January 2011
Tier II	Engines＞130kW, ships constructed on/after 1 January 2011
Tier III	Engines on ships constructed on/after 1 January 2016

5. Decreasing Emission from Ships



5. Decreasing Emission from Ships

EU Directive 2005/33/EC

on or after 1 January 2010

- A 0.1% sulphur limit on fuel used by inland vessels and by seagoing ships at berth in EU ports

California Air Resource Board – Marine Notice 2009-2

on or after 1 January 2012

- MGO (DMA)≤0.1% sulphur content or
- MDO (DMB)≤0.1% sulphur content

5. Decreasing Emission from Ships

- EEDI Guideline was published at MEPC 59 in July 2009
- Baseline and future limits are subject to discussion

  - Baseline submitted by Denmark

    $Y=1950.7x110000^{(-0.5337)} =3.977$

  - Baseline submitted by China

    $Y= 1127.1x110000^{(-0.4832)} =4.130$

5. Decreasing Emission from Ships

Based on Interim Guidelines on the method of calculation of the EEDI for new ships

$$\frac{\left(\prod_{j=1}^{M} f_j\right)\left(\sum_{i=1}^{nME} P_{ME(i)} \cdot C_{FME(i)} \cdot SFC_{ME(i)}\right) + \left(P_{AE} \cdot C_{FAE} \cdot SFC_{AE}\right) + \left(\left(\prod_{j=1}^{M} f_j \cdot \sum_{i=1}^{nPTI} P_{PTI(i)} - \sum_{i=1}^{neff} f_{eff(i)} \cdot P_{AEeff(i)}\right) C_{FAE} \cdot SFC_{AE}\right) - \left(\sum_{i=1}^{neff} f_{eff(i)} \cdot P_{eff(i)} \cdot C_{FME} \cdot SFC_{ME}\right)}{f_i \cdot Capacity \cdot V_{ref} \cdot f_w}$$

★ 110,000DWT Product Oil Tanker EEDI=**3.732**

5. Decreasing Emission from Ships

		Difference (EEDI - baseline)	Difference Ratio
EEDI	3.732		
Baseline Denmark	3.977	-0.245	6.16%
Baseline China	4.130	-0.398	9.64%

6. Green Shipbuilding Technology

- Improve painting production design
- Improve piping flushing and protection


➢Thank you !