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Foreword

Chapter

1

Marine Boiler Water Management

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1. Importance of marine boiler water quality management

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2. Marine boiler overview

- 2.1 Marine boiler types
- 2.2 Marine boiler plants
 - 2.2.1 Auxiliary boilers (1MPaG class or below)
 - 2.2.2 Auxiliary boilers (2.0MPaG class)
 - 2.2.3 Main boilers (6.0MPaG class)

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3. Substances found in water, their concentration units and terminology

- 3.1 Substances contained in water
- 3.2 Common water treatment units and terminology
 - 3.2.1 Units and their concentrations
 - 3.2.2 Common terminology
 - [1] pH
 - [2] Alkalinity
 - [3] Chloride ion concentration
 - [4] Electrical conductivity
 - [5] Water hardness
 - [6] Phosphate ion concentration
 - [7] Turbidity

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4. Water-induced boiler trouble and its countermeasures

- 4.1 Scale
 - 4.1.1 Scaling
 - 4.1.2 Oil cake adhesion
 - 4.1.3 Distilled water and seawater components
- 4.2 Corrosion

4.2.1 Effects of electrochemical corrosion and dissolved oxygen

- [1] Pitting
- [2] Magnetic iron oxide (magnetite) and high-temperature corrosion

4.2.2 Effects of pH

- [1] Corrosion by acid
- [2] Alkali corrosion

4.2.3 Effects of impurities (dissolved salts)

4.2.4 Effects of corrosive elements introduced externally

4.2.5 Effects of M alkalinity components in feed water

4.2.6 Effects of residual stress

4.3 Carry-over (Priming)

4.3.1 How carry-over takes place

4.3.2 Silica carry-over (Selective carry-over)

4.3.3 Carry-over related trouble and countermeasures

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5. External water treatment (Treatment using equipment)

- 5.1 Cascade tank
- 5.2 Ion-exchange treatment (Water softener and deionizer)
 - 5.2.1 Water softener
 - 5.2.2 Deionizer
- 5.3 Distilling plant
- 5.4 Deaerator

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6. Internal water treatment (Chemical treatment)

- 6.1 Types of cleaner and their uses
 - 6.1.1 Types of cleaner
 - 6.1.2 Cleaner actions
- 6.2 Boiler compounds
 - 6.2.1 Features of main boiler compounds
 - [1] Sodium hydroxide
 - [2] Sodium phosphate
 - 6.2.2 Hardness components and removal methods
 - [1] Calcium hardness
 - [2] Magnesium hardness
 - [3] Silica

- [4] Basic method for removing hardness components
- 6.3 Sludge dispersants
- 6.4 Oxygen scavengers
 - 6.4.1 Hydrazine
 - 6.4.2 Sodium sulfite
- 6.5 Anticorrosives for feed water/condensate systems

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7. Water quality management and standard values for marine boiler plants

- 7.1 Marine boiler plants and water treatment methods
 - 7.1.1 Overview of boiler water treatment
 - 7.1.2 Boiler water blow
 - 7.1.3 Input of boiler compound (example)
 - 7.1.4 Water quality management for idle boilers
- 7.2 Water quality management and standard values for auxiliary boilers
 - 7.2.1 Water quality management for auxiliary boilers
 - 7.2.2 Water quality management criteria for auxiliary boilers
- 7.3 Water quality management and standard values for main boilers
 - 7.3.1 Water quality management for main boilers
 - 7.3.2 Phosphate treatment
 - 7.3.3 Phosphate ion hide-out
 - 7.3.4 Water quality management criteria and elements for main boilers

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8. Water quality tests for marine boilers

- 8.1 Sampling
- 8.2 Examples of water quality test
 - 8.2.1 pH measurement methods
 - 8.2.2 Alkalinity measurement methods
 - 8.2.3 Chloride ion measurement method
 - 8.2.4 Phosphate ion measurement methods
- 8.3 Water quality analyzers

Reference material [1]:

Cleaners available from chemicals manufacturers

Chapter 2

Marine Cooling Water Management

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1. Cooling water management: its purposes and criteria
2. Management of cooling fresh water
3. Management of cooling seawater
4. Trouble with marine diesel engine cooling water systems and anticorrosives

Reference material [1]:

Anticorrosives for cooling water system

Chapter 3

Marine Distilling Plants

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1. Distilling plants
2. Types of marine distilling plants
3. The principle of distilling plants
4. Example of piping for distilling plants
 - 4.1 Fresh water generator
 - 4.2 Two-stage flash type distilling plant
 - 4.3 Plate type distilling plant
5. Management of distilling plant operations
 - 5.1 Fresh water generator for diesel ships (ex. Sasakura KM40)
 - 5.2 Two-stage flash type distilling plant for turbine ships
 - 5.3 Plate type distilling plant for turbine ships

Reference material [1]:

Applicable distillate amount ranges by type of distilling plant (Sasakura Engineering Co., Ltd.)

Reference material [2]:

Examples of marine distilling plant operations

Abbreviation