Marine propulsion systems with internal combustion engines

1. History of marine diesel plants development

1.1. Historical information about the development of marine diesel engine
1.2. Development of the theory of marine internal combustion engines
1.3. The main trends of modern marine diesel engine

2. Marine diesel engines

2.1. Technical requirements for marine diesel engines
2.2. The types and symbols of marine diesel engines
2.3. The characteristics of marine diesel engines: slow-speed diesel engines; medium-speed diesel engines; high-speed diesel engines

3. Classes of commercial vessels and their main characteristics

3.1. General concepts about the ship and its structure; ships classification
3.2. Classes of commercial vessels, depending on their purpose: transport vessels; fishing vessels; supply vessels; service-auxiliary vessels; vessels of technical fleet
3.3. The basic seaworthiness and operational characteristics of ships: structural sections of ship's hull; dimensions of the vessel; carrying capacity and tonnage; velocity, propulsion power, range, autonomy; buoyancy, stability and unsinkability; controllability; marine testing of vessels

4. The set of marine diesel propulsion system

4.1. Basic requirements for marine diesel power plants
4.2. The main elements of diesel marine power plants
4.3. Classification of marine diesel power plants
4.4. Purpose and marine shafting device
4.5. Ship propellers: fixed pitch propellers; controllable pitch propellers; water-jets and cycloidal propulsion units
4.6. Structural options of the power transmission to the propulsor and the rational application of options: diesel plants with direct transmissions; diesel - gear sets; hydraulic transmissions; electrical transmissions; combined transmissions; drives of shaft generators
4.7. Advantages and disadvantages of different types of transmission, impact engine type on the choice of transmission: direct transmission; gear transmission; advantages and disadvantages of hydraulic and electrical transmissions
4.8. Influence of vessel class for choice of ship diesel power plant characteristics: diesel power plants of the commercial vessels; power plants of fishing vessels and vessels of technical fleet

5. Operating modes of ship's main engine

5.1. The characteristics of propulsion set: hydrodynamic resistance of the ship; propulsive characteristics of propellers; interaction of the propeller with the engine
5.2. Diagram of main engine loads: modes of engine power (terminology); chart of the main engine loads selection
5.3. Steady modes of the propulsion system: joint working mode of main engine with direct transmission to fixed pitch propeller; mode of the engine with gear transmission to fixed pitch propeller; mode of the engine with clutch slip transmission; characteristics of marine diesel engine work in a multi-shaft and multi-engine system; modes of engine joint working with variable-pitch propeller; characteristics of the propulsion system with controllable pitch propeller; performance indexes of propulsion system with electric power transmission to the propeller

5.4. Transient modes of propulsion: the vessel to move up and acceleration; reversal of the propulsion system with a fixed pitch propeller; reversal of the propulsion system with a fixed pitch propeller; reversal of the propulsion system with hydraulic transmission and reverse clutch; features of the ship's power plant at the circulation path of the vessel, and in raw sea; maneuvering modes
5.5. Choice the transmission type and the main engine: types of couplings, choice the type of coupling; types of gears and their choice; the choice of the transmission type; the choice of the main engine type; the choice of the number of shaftings and how to maneuver the ship with reversing of the propellers

6. Feasibility study of choice of main engine and transmission

6.1. Feasibility indexes of marine diesel plant: power Indicators; performance indicators of efficiency; weight and size parameters; basic reliability indexes
6.2. Feasibility study marine diesel plant construction: economic feasibility analysis for the main engine choice of the existing of model list; calculation of economic effect for the cycle of production and productive use of new marine engine; economic feasibility assessment of the ship's diesel engine plant, criterion of the net present income

7. Systems of marine diesel power plant

7.1. The purpose of systems of marine diesel power plant and general technical requirements
7.2. Fuel systems, the calculation of the basic elements of marine engine fuel system
7.3. Lubricating systems and cooling oil: lubrication system of a camshaft and cylinder group; gravitational systems; the oil supply system slow-speed crosshead diesel engines; calculation of oil supply system
7.4. Cooling systems: flow cooling system; cooling system of closed cycle; central cooling system; the main characteristics of the cooling system
7.5. The air supply systems: air supply system for the fuel mixture; compressed air system; injection system and storage of compressed air
7.6. Systems of exhaust gases: system of exhaust gases in the main engine; system of gas outlet

8. Arrangement of the mechanisms of serial vessels in the engine room

8.1. The location of the engine room on the length of ship’s hull
8.2. The location of the main engine and auxiliary equipment in the engine room
8.3. Technical requirements for the accommodation of systems equipment in the engine room
8.4. Foundations for the installation of machinery in the engine room of the vessel
8.5. Mounting of the mechanisms at the power plant foundations
8.6. Examples of the mechanisms of power plant accommodation in the engine room

9. Ecological characteristics of marine diesel engines

9.1. Human exposure of mechanical noise and vibration
9.2. Noise and vibration characteristics
9.3. Measurement of engine noise and vibration
9.4. Methods for reducing noise and vibration and the maximum permissible standards of noise and vibration
9.5. The influence of shipping on marine ecology
9.6. The main components of the exhaust gases and their effects on the human body
9.7. The concentration of smoke in exhaust: test modes and methods of measurement of smoke concentration; rate of concentration of smoke exhaust

9.8. Emissions of harmful substances in exhaust gases: rules and methods for measuring of harmful substances in exhaust gases emissions; gas analyzers and equipment of measurement stations; characteristics of hazardous substances; methods to reduce emissions of harmful substances in exhaust gases