

TABLE OF CONTENTS

LIST OF MAIN SYMBOLS	7
LIST OF MAIN ABBREVIATIONS	8
PREFACE	11
1. DESIGN CHARACTERISTICS OF MARINE RECIPROCATING COMBUSTION ENGINES	13
1.1. General remarks	13
1.2. General principles of engine design	15
2. ENGINE BLOCKS	21
2.1. Construction of blocks	21
2.2. High speed and medium speed engine blocks	23
2.3. Cylinder blocks	25
2.4. Engine bedplates	26
2.5. Components fixing the engine to its foundation	29
3. CYLINDER LINERS	33
4. CYLINDER HEADS	37
5. AIR INLET AND GAS EXHAUST SYSTEMS	41
5.1. Air inlet system pipelines	42
5.2. Exhaust gas system pipelines	43
5.3. Noise silencers	45
6. ELEMENTS OF PISTON AND CRANK SYSTEMS	47
6.1. Piston assembly	48
6.2. Construction of pistons	52
6.3. Piston rings	57
6.4. Piston pins	62
6.5. Piston rods and cross-head stubs	64
6.6. Connecting rods	65
6.7. Crankshafts	71
6.8. Main bearings and crank bearings	78
6.9. Bearing alloys	83
7. ADDITIONAL ELEMENTS OF CRANK SYSTEMS	87
7.1. Flywheels	87
7.2. Counterweights	89
7.3. Vibration dampers and suppressors	91

8. TIMING GEAR SYSTEMS	95
8.1. Camshafts	104
8.2. Tappets	107
8.3. Tappet push rods	109
8.4. Valve rockers	109
8.5. Valves.....	113
9. ROTATIONAL SPEED CONTROL SYSTEMS	119
9.1. Single- and dual-range governors.....	130
9.2. Characteristic indicators of rotational governors.....	132
9.3. Direct operation multi-range speed governors	137
9.4. Indirect operation multi-range speed governors	139
9.5. Electronic digital speed governors	145
9.6. Safety controllers.....	148
10. SUPERCHARGING SYSTEMS	151
10.1. Air volumetric compressors.....	153
10.2. Dynamic air compressors	156
10.3. Mechanical supercharging.....	159
10.4. Supercharging with a turbocharger.....	163
10.5. Supercharging air coolers	172
10.6. Supercharging of two-stroke engines.....	175
10.7. Twin and sequential supercharging systems.....	179
11. FUEL SYSTEMS	183
11.1. Construction of fuel systems	183
11.2. Feed pumps	188
11.3. Fuel filters	191
11.4. Injection pumps	194
11.5. Plunger controlled injection pumps	195
11.6. Valve controlled injection pumps.....	199
11.7. Fuel injectors	202
11.8. Auxiliary equipment of the injection system.....	206
11.9. Unit pump injectors.....	211
11.10. Adjustment of injection system components	215
11.11. Electronic control of fuel injection	221
12. STARTING SYSTEMS	225
12.1. Design of starting systems.....	226
12.2. Electric starting system.....	227
12.3. Pneumatic starting system	230
12.4. Engine starting assisting equipment	239

13. REVERSING SYSTEMS	243
13.1. Reversing engines.....	244
13.2. Reversing gears	250
13.3. Controllable pitch propellers.....	254
14. COOLING SYSTEMS	257
14.1. Design of cooling systems	258
14.2. Components of cooling systems	264
15. LUBRICATION SYSTEMS	269
15.1. Design of lubrication systems.....	270
15.2. Lubrication system components	273
BIBLIOGRAPHY	279

L [m]	connecting rod length
m [kg]	weight
M [Nm]	torque
n [s ⁻¹]	rotational speed
n_p [s ⁻¹]	average value of angular speed per cycle
N [kW]	power
N_e [kW]	brake or engine power
P_e [A]	electric power
p_c [MPa]	cylinder/cylinder inlet/outlet pressure
p_c [MPa]	mean indicated pressure
p_{max} [MPa]	maximum cylinder inlet/outlet pressure
r [m]	crank radius
r [m]	radius of crank
s [m]	stroke
v [m/s]	speed
V_c [m ³]	cylinder displacement
V_c [m ³]	combustion chamber capacity
α [CA]	crankshaft/crankshaft angle
α_c [CA]	spark angle
α_c [CA]	fuel injection angle
α_{inj} [CA]	fuel timing angle
λ	engine or diesel cycle ratio
λ_c	velocity of wave of gas conductance pressure drop
λ_c	gasoline/diesel oil of combustion ratio
ν	L/D
λ	rpm
λ	crankshaft speed