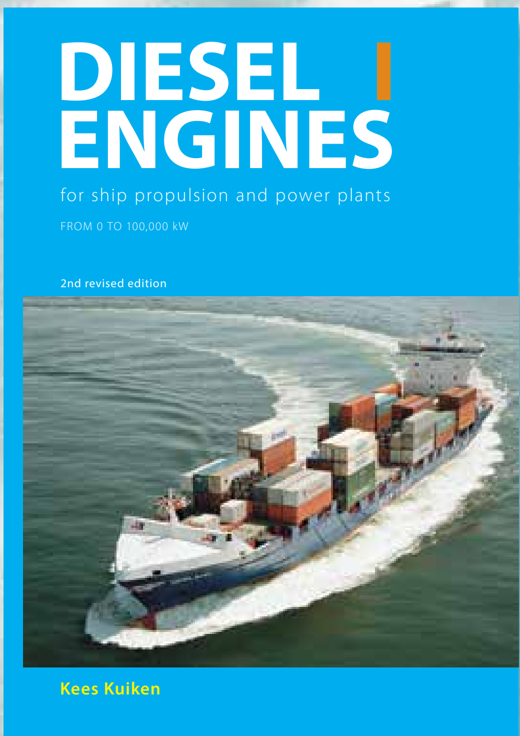
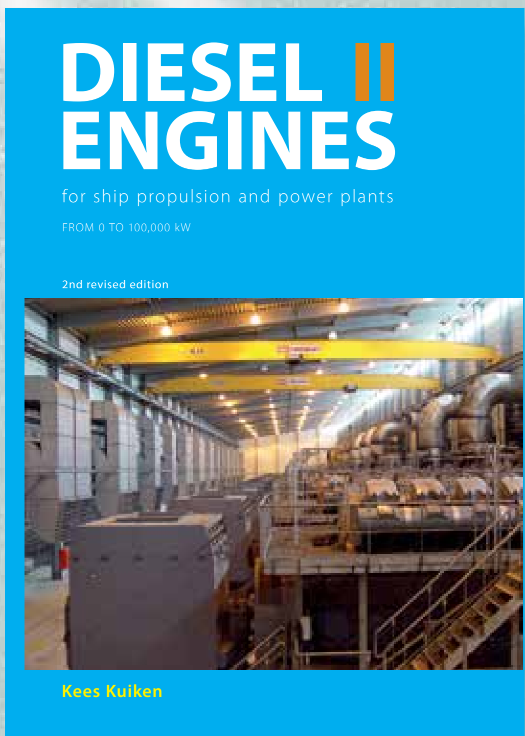
2nd completely revised edition!

The new Diesel Engine Book





Kees Kuiken
Target Global Energy Training

DIESEL ENGINES

for ship propulsion and power plants

FROM 0 TO 100,000 kW

2nd completely revised edition!

This second edition of a two-part book on diesel engines is intended for all who work with diesel engines for maritime propulsion and power generation:

- Maritime training institutes and maritime universities
- Maintenance and reconditioning companies
- Shipping companies deep-sea, inland, towage, dredging and heavy-load cargo
- Insurance companies, classification bureaus, surveyors
- Shipping industry suppliers, suppliers of engine parts, fuel and lubricating oil
- Engine manufacturers and dealers
- Power Plants

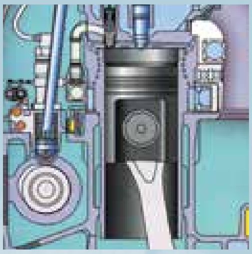
When compiling this book, a practical approach was chosen using ample authentic graphic material with detailed explanations allowing the reader to gather pertinent information without laboriously going through the main text.

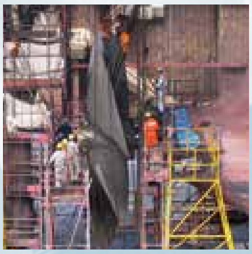
Important subjects: common-rail systems, emissions, materials, casting and forging of parts, vibrations, propellers, fuel problems, dual-fuel engines, reconditioning, regulations for testing diesel engines.

Leading companies and institutes have contributed to the realisation of this book by providing information, photographs and interviews. Ninety per cent of the more than 2000 pictures are in colour.

The English edition is used by a large number of well-known Maritime Institutes and companies, i.a.

Companies: ABB (Switzerland), ABC (Belgium), Alfa Laval Benelux (The Netherlands), Atlanship S.A. (The Netherlands), Bolier MaK (The Netherlands), Brittany Ferries (France), CMA Shipping (France), Caterpillar MaK (Germany), Cummins Holland (The Netherlands), DNV (Worldwide), Detroit Diesel (The Netherlands), Discom Silencers (The Netherlands), DNV Petroleum Services, (The Netherlands), Germanische Lloyd (Worldwide), Goltens Rotterdam (The Netherlands), Goltens (Dubai), JR Shipping (The Netherlands), Kelvin Hughes Limited (United Kingdom), Kristen Navigation (Greece), Lauritzen (Denmark), Lloyd's Register (Worldwide), Machine Support (The Netherlands), Maersk Ship Management (The Netherlands), MAN Diesel & Turbo – Prime Service (Denmark), MAN Diesel AG (Germany), Mark van Schaick Crankshaft Repair (The Netherlands), Paul Klaren OEM Parts (The Netherlands), S.M.T. Seaway Supply (The Netherlands), VAF Instruments (The Netherlands), Wagenborg Shipping (The Netherlands), Wärtsilä Service Stations (Worldwide), Wärtsilä (Switzerland).





Maritime Institutes: Chalmers Maritime Academy (Goteborg, Sweden), Faroese Maritime Engineer College (Faroer Islands, Denmark), Gdynia Maritime Academy (Poland), Kalmar Maritime Academy Kalmar (Sweden), Maine Maritime Academy (Pleasant St. Castine, USA), Maritime Academy Geneva (Italy), Maritime Institute Antwerp (Belgium), Maritime Institute Michiel de Ruyter (Flushing, The Netherlands), Maskinmesterskole Arhus (Denmark), Maskinmesterskole Fredericia (Denmark), Maskinmesterskole Lyngby (Denmark), Massachusetts Maritime Academy (Buzzards Bay, USA), Norwegian Training Institute Manila (Philippines)

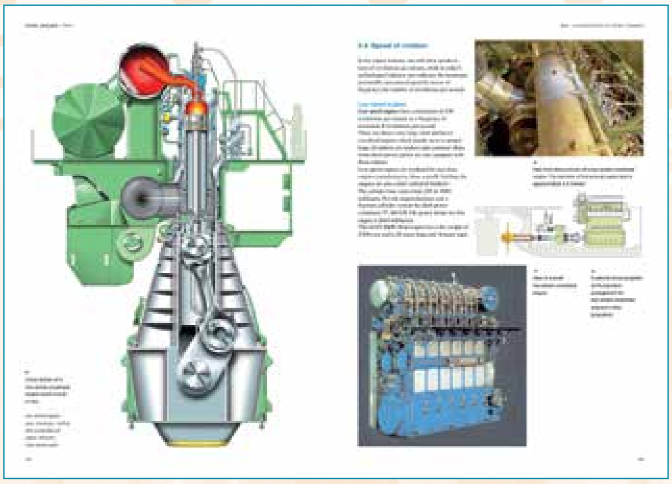
Since the first edition over 5000 books have been ordered.

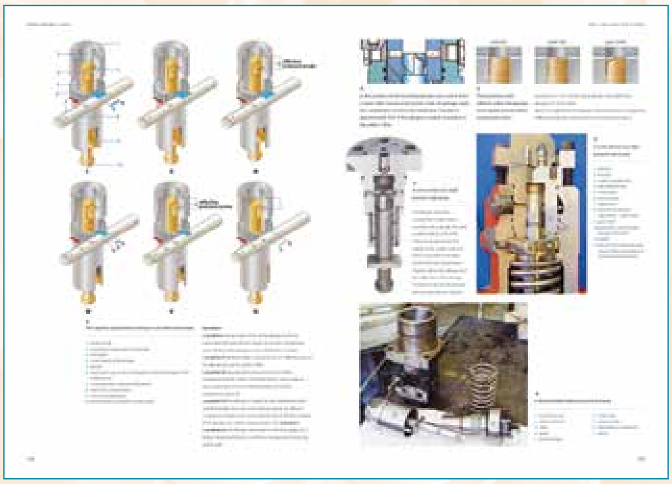
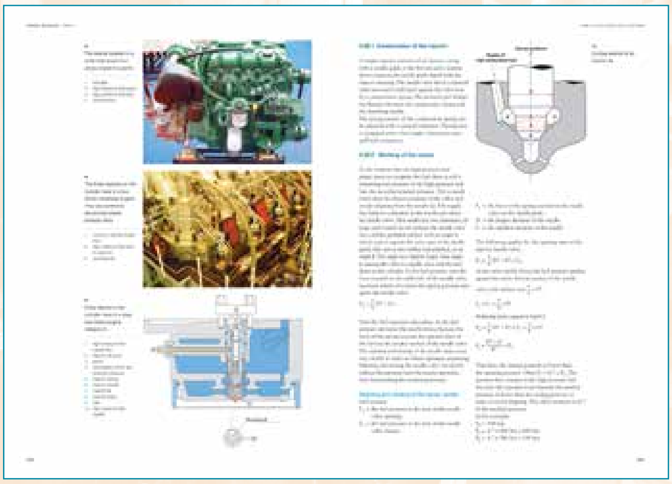
Preface to the second completely revised edition

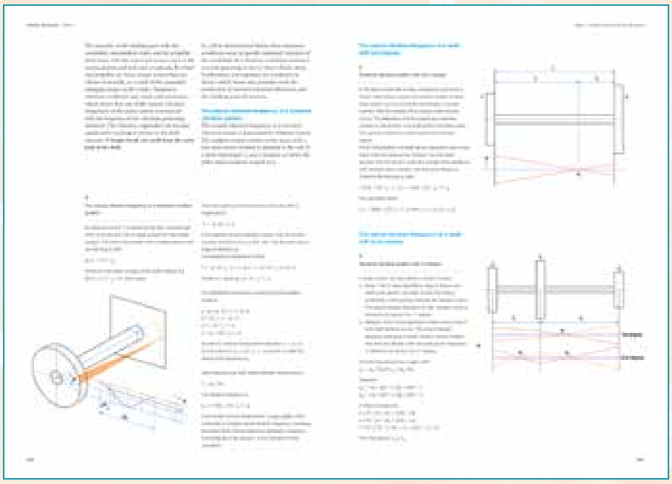
Based on feedback from various users of the first edition of this book, including companies in the diesel engine field, maritime institutes and shipping companies, we decided to add a number of topics to the second edition.
It became apparent that many users had an interest in certain subjects, but were not in the position to visit these particular businesses to learn how certain components are manufactured or repaired. Therefore, the following topics have been added:

- The manufacture of pistons, valves, cylinder liners and gear drives for the larger four-stroke and two-stroke crosshead engines. *MAHLE GmbH, Märkisches Werk GmbH, M. Jürgensen GmbH & Co KG and others.*
- A damage report of a four-stroke medium-speed diesel engine. *Target.*
- A report on the manufacture of crankshafts. *Maschinenfabrik Alfing Kessler GmbH.*
- The excessive wear on cylinder liners in two-stroke crosshead engines, called 'scuffing'. *Maersk.*
- Slower sailing larger vessels to save fuel, the so-called 'slow steaming'. *MAN Diesel AG*
- Future improvements in propulsion efficiency and the reduction of CO_2 emissions by ships. *MAN Diesel AG.*
- A third example in ship propulsion; a vibration analysis for two engines driving a single propeller. *Wärtsilä Switzerland Ltd.*
- An overview of the market share 2010 of diesel engine manufacturers worldwide. *MAN Diesel AG.*
- The Hercules Project, a collaboration between various parties, including the engine manufacturers for the purpose of improving efficiency and reducing emissions. *Target.*
- A new thrust measurement system. *VAF Instruments B.V.*
- The theoretical background of and damage to bearings. *Bearing Group, Miba Gleitlager GmbH.*
- A new method for the alignment of amongst others, engines and shafts. *SKF Marine Service Centre.*
- Additional theoretical calculations for the aeration of engines. *Maritime Institute 'Willem Barentsz'.*
- Additional theoretical calculations of the efficiencies of engines. *Maritime Institute 'Willem Barentsz'.*
- Improvements to both images and text. *Target.*

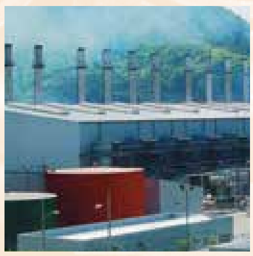
Both volumes consist of 568 pages each.
Price of one book (two parts), 2013, € 145,- exclusive of packing and shipping costs. Discounts for orders over 25 books. Maritime Institutes and Technical Schools up to 20% discount. Both parts will be sealed and delivered in heavy-duty carton packaging at cost price.

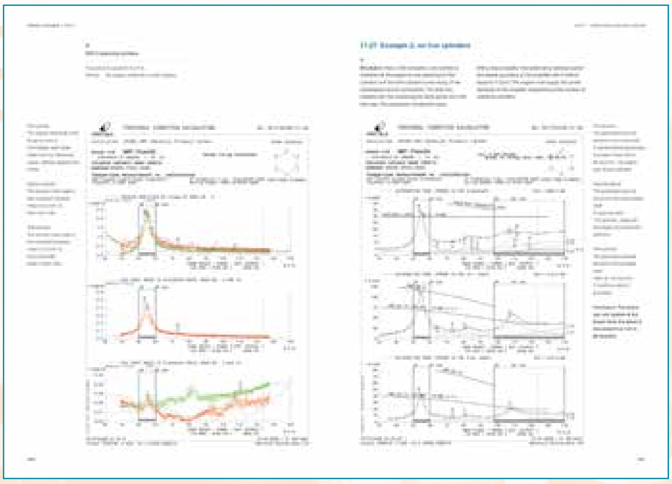
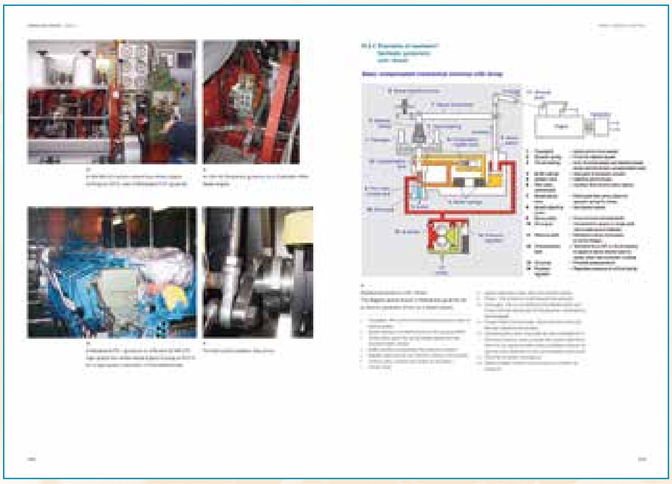
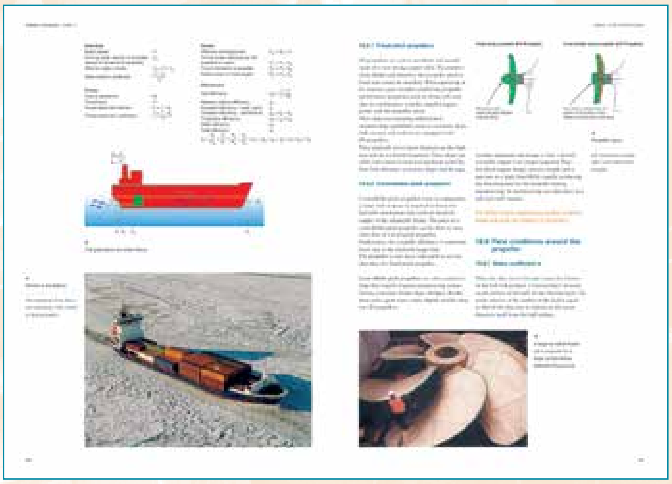
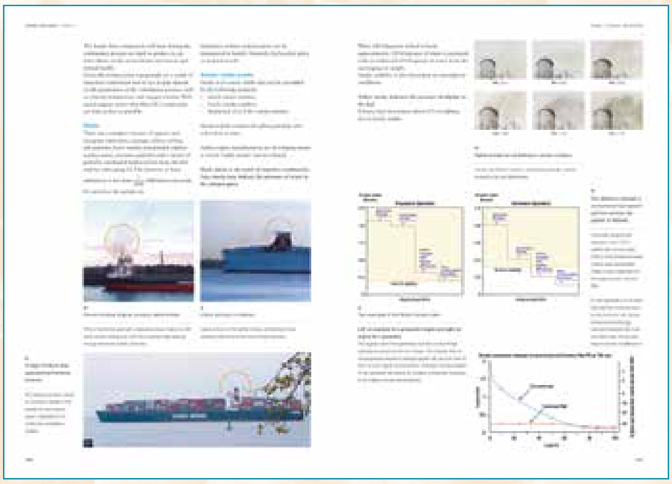
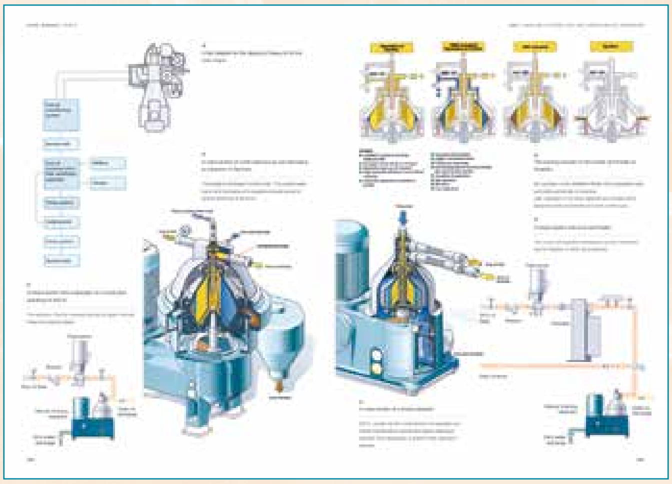
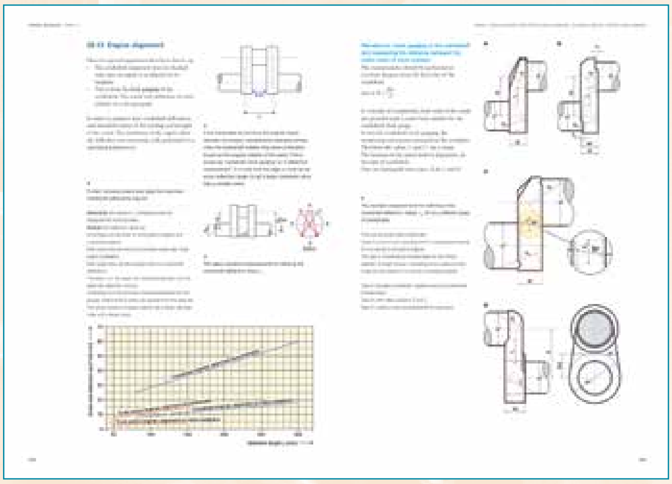




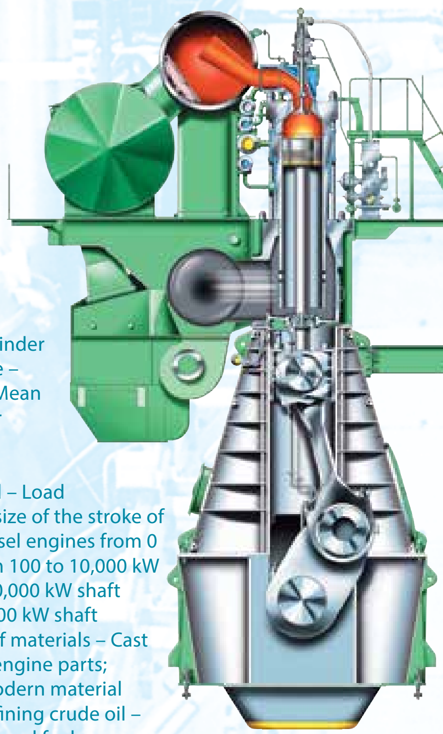


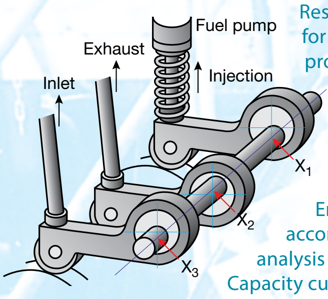







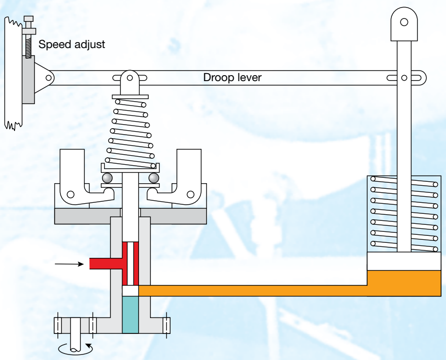


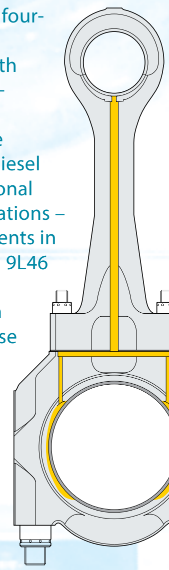

Book 1

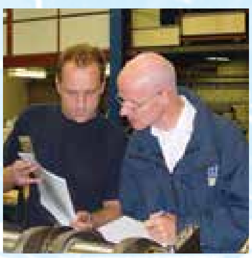


1 The use of industrial diesel engines Otto cycle – Diesel cycle – The use of Otto engines – The use of Diesel engines – Properties of both principles **2 Classification of diesel engines** Working principle – Design – Rotational speed – Power output or shaft power – Fuel used – Use of engines – Other characteristics of diesel engines – The use of in-line and V-engines – Direction of rotation of the diesel engine – Cylinder number – Natural aspiration and turbocharging **3 Working principles of diesel engines** Working principles – Two-stroke engine build – Four-stroke engine build/set-up – A few significant differences between the two-stroke and four-stroke cycles – Examples of supply programmes of engine manufacturers – Important terms and definitions – Some engine names **4 Efficiency and losses of diesel engines** Efficiency and losses – Indicator diagram – Parameters of both working principles – Determining cylinder output using an indicator diagram and the mean induced pressure – Determining the mean induced pressure – Engine formula – Induced thermal efficiency – Mechanical and total efficiency – Specific fuel consumption – Mean effective pressure – Thermal energy balances or Sankey-diagrams – Efficiencies of diesel-engine driven power plants – More complex ship propulsion – Propulsion of water pumps, dredging pumps, crude-oil pumps or compressor drives – Theoretical background of the processes in an internal combustion engine - the diesel engine **5 Standard figures of various types of diesel engines** Mean effective pressure – Mean piston speed – Load parameters – Compression ratio – Power density – Number of revolutions of diesel engines in relation to the size of the stroke of an engine – Rpm of generators **6 Construction of various types of diesel engines** Category I: Industrial diesel engines from 0 to 100 kW shaft power, fuel MDO, four-stroke, high-speed engines – Category II: Industrial diesel engines from 100 to 10,000 kW shaft power, fuel MDO, four-stroke, high-speed engines – Category III: Industrial diesel engines from 500 to 30,000 kW shaft power, fuel HFO, four-stroke, medium-speed engines – Category IV: Industrial diesel engines of 1500 to 100,000 kW shaft power, fuel HFO, two-stroke with crosshead, low-speed **7 Use of materials for diesel engines** General use of materials – Cast iron – Steel – Cast steel – Forged steel – Steel alloys – Aluminium – Ceramic materials – Specific materials for engine parts; engine classification according to the four categories – Special finishes and heat treatments – Examples of modern material usage **8 Fuel, fuel-line systems and fuel cleaning** Composition of liquid fuels – Definition of heavy oil – Refining crude oil – Chemical composition of hydrocarbon compounds – Standardisation of liquid fuels – Fuel properties – Additional fuel specifications – Decreasing the sulphur content in fuels – Bunkering – Fuel-line systems according to the engine classification – Modular fuel-treatment systems – Bunkering fuels **9 Fuel-injection systems** Examples of injection times – Ignition delay – Partial-load conditions – Processes in the cylinder; injection, ignition and combustion – The four phases by Ricardo – Ignition delay; causes – Nature of atomisation – Ignition quality of the fuel – Examples of combustion processes – Injection pressure and droplet size – Injection principles – Shape of the combustion chamber – Fuel-injection mechanism: the fuel pump – Fuel-capacity adjustments – Working of a plunger pump – Valve-controlled fuel pumps – Common-rail system – Injector system – Fuel injectors – Residual-pressure valves – Cavitation – Fuel-injection characteristics **10 Cooling diesel engines** Introduction – Cooling agents for diesel engines – Cooling-water treatment – Corrosion – Products for cooling-water treatment – Cooling-water treatment products, brands – Cleaning cooling-water systems contaminated with oil – Bacteriological contamination – Testing cooling water – Macro-biological growth in seawater-cooling systems – Design of cooling-water systems – Cooling-water system defects – Damaged engine parts – Standard cooling-water system – Cooling systems according to the engine classification – Examples of cooling methods for engine parts – Examples according to the engine classification – Combustion-air cooling – Special cooling systems – Pipe coolers and plate coolers – Cooling systems in a diesel-power plant – Cogeneration systems – Summary for cooling-water systems **11 Lubrication of engines** The purpose of lubrication – Three types of lubrication – Engine parts that require lubrication and cooling – Common lubricating-oil system – Examples of lubricating-oil systems according to their classification in the four categories – Lubricating-oil properties – Cleaning lubricating oil – Lubricating-oil analysis **12 Air supply** The amount of air – Air supply to the engine – Principle of turbo-charging – Turbocharger manufacturers – Capacity curves – Description of three turbocharger manufacturers – development of modern turbochargers – Small turbochargers, engine categories I and II – Supercharger with a separate power turbine – Power turbines with generator – Air supply in four-stroke engines – Air supply in two-stroke crosshead engines – Various approaches to supercharging in two-stroke crosshead engines – Some important points of interest with regard to the air supply in diesel engines – Maintenance of turbochargers – Problems with supercharging – Engine load – Flow performance of scavenging- and combustion-air in a four-stroke trunk piston engine and a two-stroke crosshead engine **13 Driving gears** Driving gear of four-stroke diesel engines – Driving gears in two-stroke crosshead engines – Thrust blocks and thrust bearings **14 Starting systems of diesel engines** Starting methods – Reversing the engine **15 Speed control** Summary – Types of governors – Examples of engine configurations with different types of governors – Theoretical background of governors **16 Noise, origin and damping** Origin of noise in diesel engines – Sound-transmission paths – Silencers for diesel engines – choosing a silencer – Noise reduction of diesel engines in categories I and II – Turbocharger noise – Sound levels in diesel engines – Examples of the engine arrangement with silencers **17 Vibrations and balancing** Methods to reduce torsional vibration using dampers – Main causes of vibration – Forces exerted on the driving gear and engine block – Resonance – Balancing diesel engines – Principle of an internal combustion engine – Crank - connecting rod mechanism – Forces in a two-stroke crosshead engine – Vibrational levels, acceptable values – Tangential-force diagram – Degree of cyclic irregularity – Vibrations in engine frame and propeller shaft – Axial vibrations – Engine balancing: theoretical background – Forces and moments – Resultant forces and moments in the engine block – External forces and moments – Example of the balancing used in a Wärtsilä 9L46 four-stroke engine, category III – Balancing V-engines – Balancing examples for two-stroke crosshead engines, category IV – Shaft generators in two-stroke crosshead engines – Vibration numbers and orders – Vibrational frequencies – Example 1: Adjusting the engine speed because of damaged cylinder liners – Example 2a: Simulation on six cylinders – Example 2b: Simulation on five cylinders – Example 3: Simulation of two engines and one propeller shaft – Examples of engine-frame tearing – Measurements for vibration dampers – Measuring equipment – Vibrational energy – Design of a propulsion installation – Effects of vibrational frequencies – Flywheel – Examples of crankshafts, either with or without counterweights – Combustion forces exerted on the driving gear **18 Diesel-Power Plants** Classification of diesel-power plants – Uses for diesel-power plants – Types of diesel-power plants – Special performances of diesel-power plants – An example of a large diesel-power plant for the generation of electricity – Auxiliary engines – Outside the engine hall – Fuel quality – A few particulars – Examples of power plants

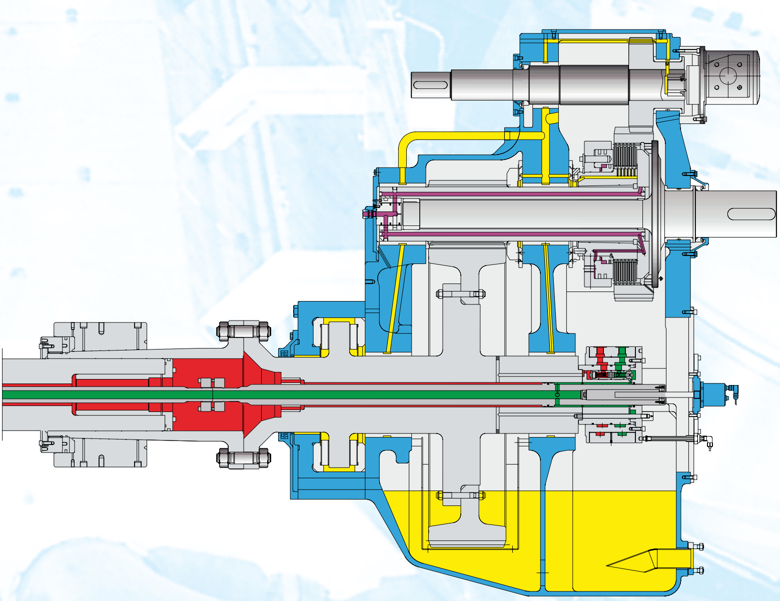


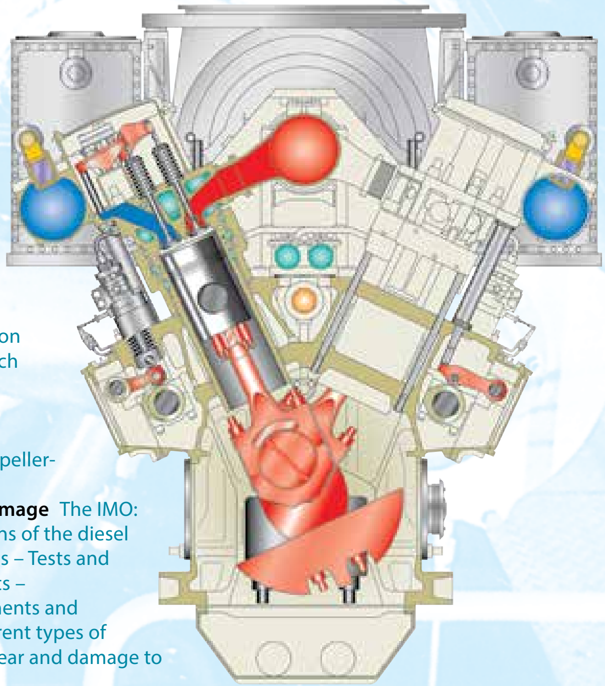


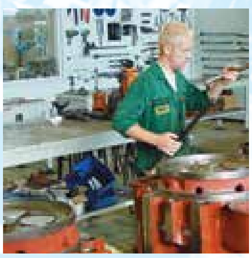
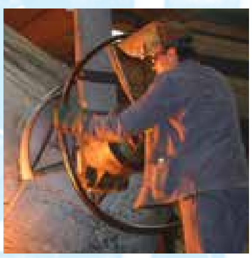




Book 2

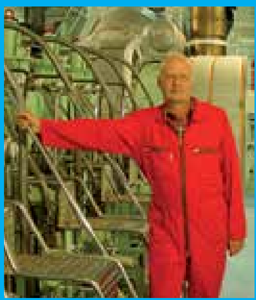










The author

Kees Kuiken started his career in 1963 by enrolling as a marine engineering student at the Hogere Zeevaartschool, Terschelling, The Netherlands.
After graduation he joined the United Dutch Shipping Company (Verenigde Nederlandse Scheepvaartmaatschappij, VNS).
In 1978, he went on to become a lecturer in marine engineering at the Hogere Zeevaartschool in Delfzijl and Groningen, and also worked in the mechanical engineering and operational technology departments.
His was passionate about building a large and advanced practical lab for both intermediate and higher maritime education, as well as for trade and industry.
In 1995 he founded the European Training Centre for engine technology, the ETM, an educational foundation.
In 2000, he left regular teaching and established Target Global Energy Training.
The company conducts training sessions worldwide in diesel- and gas-engine technologies, gas- and steam turbines, compressors and cogeneration.
Furthermore, Target provides solutions for a myriad of technical problems and publishes books and manuals.
All the training programs are tailor-made and given on location.
In 2008 the first edition of the English version came on the market, ‘Diesel engines for ship propulsion and power plants’, and now in 2013 the second English version of this book.

This book can be ordered directly from
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