

The New Diesel-Engine Book

DIESEL I ENGINES

for ship propulsion and power plants
FROM 9 TO 700,000 kW



Kees Kuiken

DIESEL II ENGINES

for ship propulsion and power plants
FROM 9 TO 100,000 kW



Kees Kuiken

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Target Global Energy Training

DIESEL ENGINES

for ship propulsion and power plants

FROM 0 TO 100,000 kW



This first 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
- Maintenance and reconditioning companies
- Shipping companies deep-sea, inland, towage, dredging, heavy-load cargo
- Insurance companies
- Classification bureaus
- Shipping industry suppliers
- Engine manufacturers and dealers
- Suppliers of engine parts
- Surveyors
- Suppliers of fuel and lubricating oil
- Maritime Universities
- 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

Volume I comprises 512 pages, Volume II has 442.



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 1800 pictures are in colour.

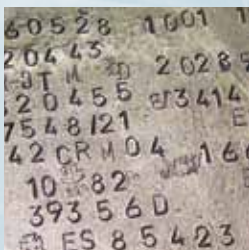
The Maritime Institute Willem Barentsz, Terschelling, The Netherlands, has collaborated exhaustively on the production of the Dutch edition and introduced it as a pilot for Maritime Officer training.




Bulk orders:

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Price of one book (two volumes), 2009, € 135,- excl. packing and shipping costs. Discount for 25 books 5%, 50 books 10%, 100 books 15%. Books are sealed and delivered in heavy-duty carton at cost price.




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1.1.2 Bauart der Pleuelstange




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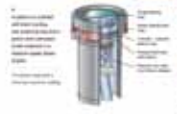
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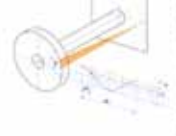
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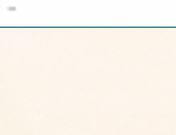
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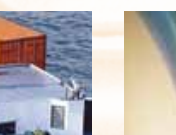
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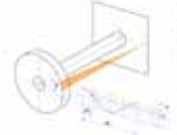
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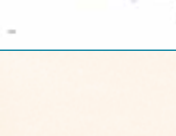
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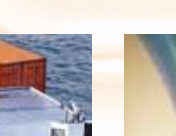
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11.2.1.1 **11.2.1.1.1** **11.2.1.1.2**

Chromatograms showing detector response over time for different samples. The x-axis represents time in minutes, and the y-axis represents detector response. The plots show peaks corresponding to the components of the samples.

11.2.1.1 **11.2.1.1.1** **11.2.1.1.2**

Four photographs showing laboratory equipment and a schematic diagram of a chromatography system. The photographs show various components of the system, including the detector, injector, and columns. The schematic diagram illustrates the flow of the mobile phase through the system.

11.2.1.1 **11.2.1.1.1** **11.2.1.1.2**

A red cargo ship, a large cargo ship, and a close-up of a propeller. The images illustrate the design and components of a cargo ship.

11.2.1.1 **11.2.1.1.1** **11.2.1.1.2**

A large cargo ship, a smaller cargo ship, and a graph showing performance metrics. The graph plots a variable against time or distance, showing the performance of the ships.

11.2.1.1 **11.2.1.1.1** **11.2.1.1.2**

A detailed schematic diagram of a complex mechanical system, showing various components and their interconnections. The diagram includes a large central component and several smaller sub-components.

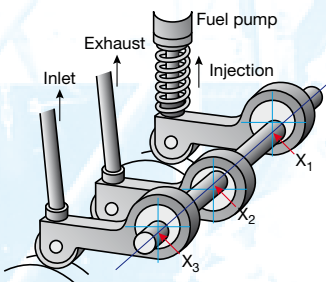
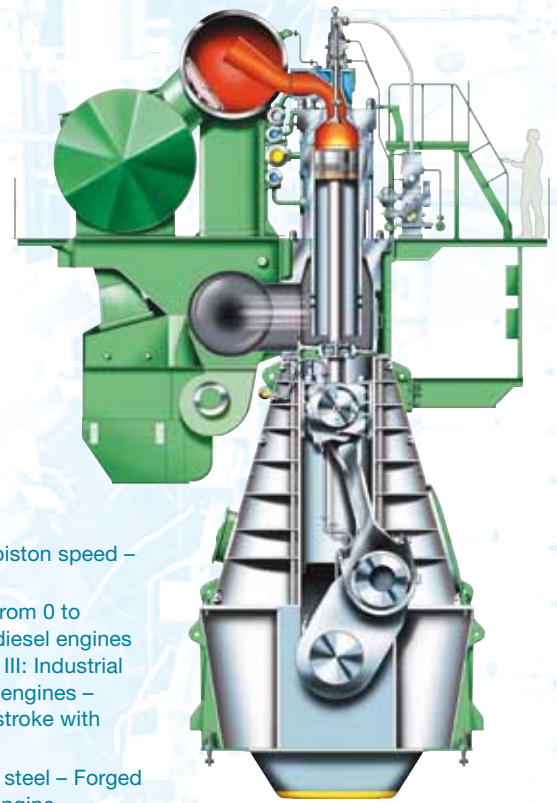
11.2.1.1 **11.2.1.1.1** **11.2.1.1.2**

A graph showing performance metrics and several technical diagrams of mechanical parts. The graph plots a variable against time or distance, and the diagrams show the internal structure of the parts.



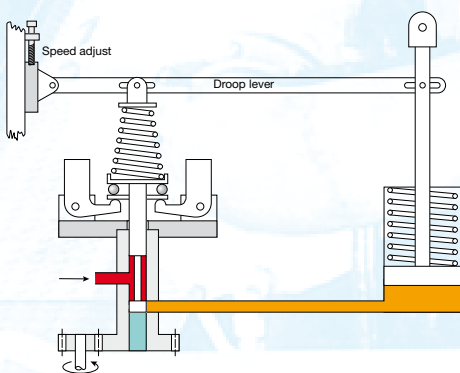
Book 1

- 1 The use of industrial diesel engines** Otto process – Diesel process – The use of Otto engines – The use of Diesel engines – Properties of both principles
- 2 Classification of diesel engines** Working principle – Design – Speed of rotation – Power output or shaft power – Fuel used – Use of engines – Natural aspiration and turbo-charging
- 3 Working principles of diesel engines** Two-stroke engine build – Four-stroke engine set-up – A few remarkable differences between the two-stroke and four-stroke cycles – Examples of supply programmes of engine manufacturers – Important terms and definitions
- 4 Efficiency and losses of diesel engines** Indicator diagram – Parameters of both working principles – Determining the mean induced pressure – Engine formula – Induced thermal efficiency – Mechanical and total efficiency – Specific fuel consumption – Mean effective pressure – Sankey-diagrams – More complex ship propulsion
- 5 Standard figures of various types of diesel engines** Mean effective pressure – Mean piston speed – Load parameters – Compression ratio – Power density
- 6 Construction of various types of diesel engines** Category I: Industrial diesel engines from 0 to 100 kW shaft power, fuel M.D.O., four-stroke, high-speed engines – Category II: Industrial diesel engines from 100 to 5000 kW shaft power, fuel M.D.O., four-stroke, high-speed engines – Category III: Industrial diesel engines from 500 to 30,000 kW shaft power, fuel H.F.O., four-stroke, medium-speed engines – Category IV: Industrial diesel engines of 1500 to 100,000 kW shaft power, fuel H.F.O., 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

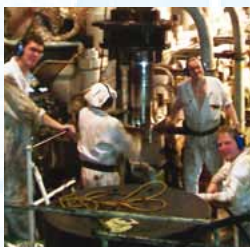
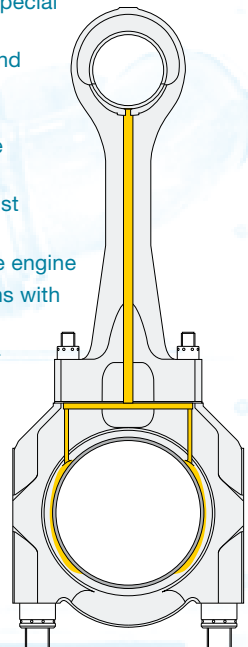


- 8 Fuels, fuel-line systems and fuel cleaning** Composition of liquid fuels – Definition of heavy oil – Refining crude oil – Standardisation of liquid fuels – Fuel properties – Bunkering – Fuel-line systems according to the engine classification – Bunkering
- 9 Fuel-injection systems** Examples of injection times – Ignition delay – Partial-load conditions – Processes in the cylinder; injection, ignition and combustion – The four phases by Ricardo – Ignition delay; causes – Ignition quality of the fuel – Examples of combustion processes – Injection pressure and droplet size – Shape of the combustion chamber – Fuel-capacity adjustments – Common-rail system – Fuel injectors – Cavitation – Fuel-injection characteristics
- 10 Cooling diesel engines** Cooling agents for diesel engines – Cooling-water treatment – Corrosion – Bacteriological contamination – Testing cooling water – Design of cooling-water systems – Damaged engine parts – Standard cooling-water system – Examples of cooling methods for engine parts – Special cooling systems – Pipe coolers and plate coolers

- 11 Lubrication of engines** The purpose of lubrication – Three types of lubrication – Engine parts that require lubrication and cooling – Examples of lubricating-oil systems in accordance with the classification – Lubricating-oil properties
- 12 Air supply** Air supply to the engine – Principle of turbo-charging – Turbo-blower manufacturers – Capacity curves – Supercharger with a separate power turbine – Air supply in four-stroke engines – Air supply in two-stroke crosshead engines – Supercharging in two-stroke crosshead engines – Problems with supercharging
- 13 Driving gears** Driving gear of four-stroke diesel engines – Engine-driving gears in two-stroke crosshead engines – Thrust blocks and thrust bearings

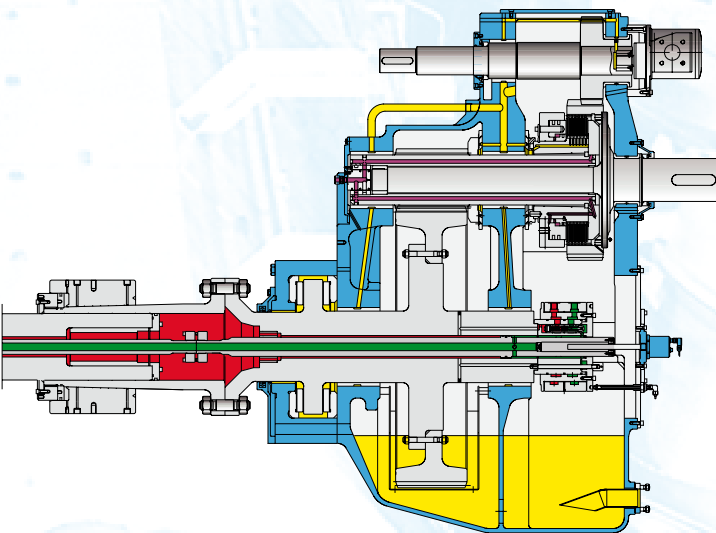


- 14 Starting systems of diesel engines** Starting methods – Reversing the engine
- 15 Speed control** Types of governors – Examples of engine configurations with different types of governors – Theoretical background of speed governors
- 16 Noise, origin and damping** Origin of noise in diesel engines – Sound-transmission paths – Silencers for diesel engines
- 17 Vibrations and Balancing** Main causes of vibration – Resonance – Forces exerted on the driving gear and engine block – Principle of an internal combustion engine – Forces in a two-stroke crosshead engine – Tangential force diagram – Vibrations in engine frame and propeller shaft – Resultant forces and moments in the engine block – External forces and moments – Balancing of V-engines – Balancing examples for two-stroke crosshead engines, category IV – Axial vibrations – Vibration numbers and orders – Vibration frequencies – Methods to reduce torsional vibration by means of dampers – Mass-inertia moment of a flywheel



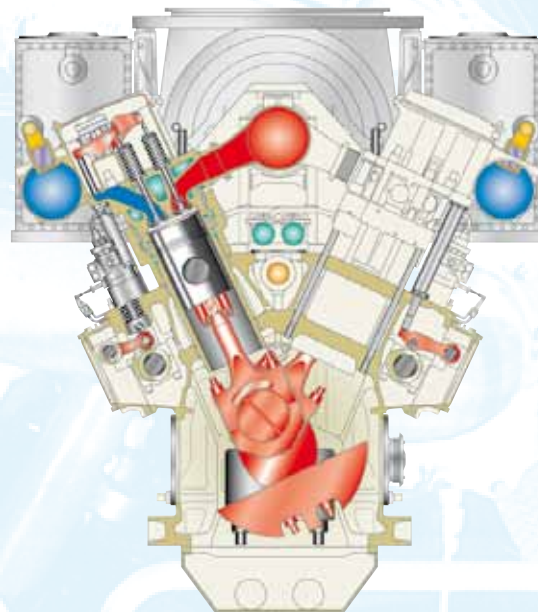
Book 2

- 18 Diesel-Power Plants** Classification of diesel-power plants –Types of diesel-power plants – Special applications of diesel-power plants – An example of a large diesel-power plant for the generation of electricity – Examples of power plants
- 19 Ship propulsion** Ship types and hull resistances – Load-lines of a ship – Ship dimensions and their values – Hull forms – Ship's resistance – Screw propulsion – Propeller types – Flow conditions around the propeller – Propeller dimensions – Operating conditions of a propeller – Increasing ship speeds – Parameters causing heavy-running conditions – Manoeuvring speed –Engine lay-outs and load diagrams
- 20 Transmission gears, flexible couplings, vibration dampers, shafting and shaft-generator drives** Diesel-engine arrangements – Gear transmission – Various constructions and designs of gear transmissions –Types of teeth – Couplings – Torsional vibration dampers – Examples of complete systems with diesel engines, reduction gearing, shafting, couplings and vibration dampers below the engine frame
- 21 Diesel-engine manufacturers** Engine categories
- 22 Engine emissions** Introduction to 'the fossil fuel' society – Exhaust-gas composition – Units of contamination – Methods for the reduction of exhaust-gas emissions – Removal of fine particles from exhaust gases – Examples of techniques engine manufacturers apply to reduce emissions – New techniques: the Miller process – New developments: the Hercules project
- 23 Calculating fuel and lubricating-oil consumption** Diesel-engine efficiency – Specific fuel consumption – Fuel consumption for engines in diesel-power plants – Fuel consumption for propulsion diesel engines – Lubricating-oil consumption and specific lubricating-oil consumption



- 24 Auxiliary systems: Fuel and lubricating-oil separators** Fuels – The principle of centrifugal separators – Separation with a centrifugal separator – Types of separators – Examples of cleaning systems for lubricating oil, fuel, sludge and bilge water
- 25 Operational management and automation** Automation of diesel engines – Examples of automation systems – Complete systems for diesel engines, some examples
- 26 Reconditioning engines and their parts** Four-stroke engines – Two-stroke engines
- 27 Maintenance and repairs** Types of maintenance – Instruction manuals/Maintenance manuals
- 28 Casting of engine parts** Cast-iron parts of diesel engines –Foundries – Casting process – Casting location – Moulds – Filling the casting moulds – Mould assembly – Cleaning the castings – Casting stresses – Checking air inclusions and damage – Operations in the machining factory – Manufacturing crankshafts
- 29 New fuel developments** Use of combination fuels

- 30 Bedplates and engine alignments, gear-boxes, shafts, propeller shafts and generators** Ship propulsion – Construction of the bedplate, Engine category IV– Resilient mounting of propulsion engines – Alignment of engines – Flexible arrangement of diesel engines, piping, cables and other fittings connected to the engine
- 31 Propellers** Fixed-pitch propellers – Use of controllable-pitch propellers for the engine categories – Fixed-pitch propellers, construction – Controllable-pitch propellers, construction – Propeller shaft and coupling flange – Stern tube – Stern tube seals – Propeller design – Cavitation – Examples of other propulsion systems with controllable-pitch propellers
- 32 Regulations for propulsion engines, classification, repair and damage** The IMO: International Maritime Organization – Classification societies – Periodic inspections of the diesel engine and its parts – The tests of mass-produced engines – Regulations for propulsion engines – Engine alignment – Procedure for reconditioning parts – Damage to the engine or engine parts – Examples of certificates





The author.

Kees Kuiken began his career in 1963 by enrolling as a marine engineering student at the Hogere Zeevaartschool, Terschelling, The Netherlands.

After graduation he joined United Dutch Shipping Company (Verenigde Nederlandse Scheepvaartmaatschappij, the V.N.S.).

In 1978, he went on to become a lecturer in marine engineering at the Hogere Zeevaartschool, Delfzijl, Groningen and also worked in the engine construction and operational techniques departments.

His great passion was the establishment of a large, modern practical lab for intermediate and higher maritime education as well as for trade and industry.

In 1995, he founded the European Training Centre for engine technology, the E.T.M., an educational foundation.

In 2000, he left regular teaching and established Target Global Energy Training.

This enterprise provides worldwide training sessions in the field of diesel and gas engines, gas and steam turbines, compressors and cogeneration.

Furthermore, Target provides solutions for divers technical problems and publishes books and manuals.

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