



10	History of the diesel engine	82	Fuel supply system to the low-pressure stage	131	Types of governor/control system
11	Rudolf Diesel	82	Overview	136	Overview of governor types
12	Mixture formation in the first diesel engines	84	Fuel filter	142	Timing device
13	Use of the first vehicle diesel engines	86	Fuel-supply pump	144	Electric actuator mechanisms
16	Bosch diesel fuel injection	90	Miscellaneous components	146	Control-sleeve in-line fuel-injection pumps
20	Areas of use for diesel engines	92	Supplementary valves for in-line fuel-injection pumps	147	Design and method of operation
20	Suitability criteria	94	Overview of in-line fuel-injection pump systems	150	Overview of distributor fuel-injection pump systems
20	Applications	94	Areas of application	150	Areas of application
23	Engine characteristic data	94	Types	150	Designs
24	Basic principles of the diesel engine	95	Design	152	Helix and port-controlled systems
24	Method of operation	95	Control	154	Solenoid-valve-controlled systems
27	Torque and power output	98	Presupply pumps for in-line fuel-injection pumps	158	Helix and port-controlled distributor injection pumps
28	Engine efficiency	98	Applications	159	Applications and installation
31	Operating states	99	Design and method of operation	161	Design
34	Operating conditions	101	Manual priming pumps	164	Low-pressure stage
37	Fuel-injection system	101	Preliminary filter	167	High-pressure pump with fuel distributor
38	Combustion chambers	101	Gravity-feed fuel-tank system	176	Auxiliary control modules for distributor injection pumps
42	Fuels	102	Type PE standard in-line fuel-injection pumps	176	Overview
42	Diesel fuel	103	Fitting and drive system	178	Governors
48	Alternative fuels	103	Design and method of operation	185	Timing device
50	Cylinder-charge control systems	112	Design variations	188	Mechanical torque-control modules
50	Overview	122	Type PE in-line fuel-injection pumps for alternative fuels	201	Load switch
51	Turbochargers and superchargers	123	Operating in-line fuel-injection pumps	202	Delivery-signal sensor
60	Swirl flaps	124	Governors and control systems for in-line fuel-injection pumps	203	Shutoff devices
61	Intake air filters	124	Open- and closed-loop control	204	Electronic Diesel Control
64	Basic principles of diesel fuel-injection	126	Action of the governor/control system	207	Diesel-engine immobilizers
64	Mixture distribution	126	Definitions	208	Solenoid-valve-controlled distributor injection pumps
66	Fuel-injection parameters	127	Proportional response of the governor	208	Areas of application
75	Nozzle and nozzle holder designs	128	Purpose of the governor/control system	208	Designs
76	Overview of diesel fuel-injection systems			210	Fitting and drive system
76	Designs				

212 Design and method of operation	264 Method of operation	334 Exhaust-gas treatment
214 Low-pressure stage	268 Common-rail system for passenger cars	335 NO _x storage catalyst
216 High-pressure stage of the axial-piston distributor injection pump	273 Common-rail system for commercial vehicles	338 Selective catalytic reduction of nitrogen oxides
220 High-pressure stage of the radial-piston distributor injection pump	276 High-pressure components of common-rail system	344 Diesel Particulate Filter (DPF)
224 Delivery valves	276 Overview	352 Diesel oxidation catalyst
226 High-pressure solenoid valve	278 Injector	354 Electronic Diesel Control (EDC)
228 Injection timing adjustment	288 High-pressure pumps	354 System overview
234 Electronic control unit	294 Fuel rail (high-pressure accumulator)	357 In-line fuel-injection pumps
235 Summary	296 Pressure-control valve	358 Helix-and-port-controlled axial-piston distributor pumps
236 Overview of discrete cylinder systems	297 Pressure-relief valve	359 Solenoid-valve-controlled axial-piston and radial-piston distributor pumps
236 Single-plunger fuel-injection pumps PF	298 Injection nozzles	360 Unit Injector System (UIS) for passenger cars
238 Unit Injector System (UIS) and Unit Pump System (UPS)	300 Pintle nozzles	361 Unit Injector System (UIS) and Unit Pump System (UPS) for commercial vehicles
240 System diagram of UIS for cars	302 Hole-type nozzles	362 Common Rail System (CRS) for passenger cars
242 System diagram of UIS/UPS for commercial vehicles	306 Future development of the nozzle	363 Common Rail System (CRS) for commercial vehicles
244 Single-plunger fuel-injection pumps PF	308 Nozzle holders	364 Data processing
244 Design and method of operation	308 Overview	366 Fuel-injection control
246 Sizes	310 Standard nozzle holders	377 Further special adaptations
248 Unit Injector System (UIS)	311 Stepped nozzle holders	378 Lambda closed-loop control for passenger-car diesel engines
248 Installation and drive	312 Two-spring nozzle holders	383 Torque-controlled EDC systems
249 Design and construction	313 Nozzle holders with needle-motion sensors	386 Control and triggering of the remaining actuators
252 Method of operation	314 High-pressure lines	387 Substitute functions
256 High-pressure solenoid valve	314 High-pressure connection fittings	388 Data exchange with other systems
258 Unit Pump System (UPS)	315 High-pressure delivery lines	389 Serial data transmission (CAN)
258 Installation and drive	318 Start-assist systems	394 Application-related adaptation of car engines
258 Design and construction	318 Overview	398 Application-related adaptation of commercial-vehicle engines
260 Current-controlled rate shaping (CCRS)	319 Preheating systems	403 Calibration tools
262 Overview of common-rail systems	324 Minimizing emissions inside of the engine	
262 Areas of application	325 Combustion process	
263 Design	327 Other impacts on pollutant emissions	
	329 Development of homogeneous combustion process	
	330 Exhaust-gas recirculation	
	333 Positive crankcase ventilation	

406 Electronic Control Unit (ECU)	462 Exhaust-gas emissions	41 Fuel consumption in every-day practice
406 Operating conditions	462 Overview	46 Fuel parameters
406 Design and construction	462 Major components	81 History of diesel fuel injection
406 Data processing	464 Combustion byproducts	91 Diesel aircraft engines of the 1920s and 30s
412 Sensors	466 Emission-control legislation	109 History of in-line fuel-injection pumps
412 Automotive applications	466 Overview	113 1978 diesel speed records
413 Temperature sensors	468 CARB legislation (passenger cars/LDT)	125 History of the governor
414 Micromechanical pressure sensors	472 EPA legislation (passenger cars/LDT)	172 Off-road applications
417 High-pressure sensors	474 EU legislation (passenger cars/LDT)	175 Diesel records in 1972
418 Inductive engine-speed sensors	476 Japanese legislation (passenger cars/LDT)	177 History of the mechanically controlled distributor injection pump from Bosch
419 Rotational-speed (rpm) sensors and incremental angle-of-rotation sensors	477 U.S. legislation (heavy-duty trucks)	206 Measured variables on diesel engines
420 Hall-effect phase sensors	478 EU legislation (heavy-duty trucks)	209 Family tree of Bosch electronically controlled distributor injection pumps
422 Accelerator-pedal sensors	480 Japanese legislation (heavy-duty trucks)	211 1998 Diesel Records
424 Hot-film air-mass meter HFM5	481 U.S. test cycles for passenger cars and LDTs	225 Micromechanics
426 LSU4 planar broad-band Lambda oxygen sensors	483 European test cycle for passenger cars and LDTs	261 The history and the future of the Unit Injector (UI)
428 Half-differential short-circuiting-ring sensors	483 Japanese test cycle for passenger cars and LDTs	267 Diesel boom in Europe
429 Fuel-level sensor	484 Test cycles for heavy-duty trucks	272 Overview of diesel fuel-injection systems
430 Fault diagnostics	486 Exhaust-gas measuring techniques	277 The piezoelectric effect
430 Monitoring during vehicle operation (on-board diagnosis)	486 Exhaust-gas test for type approval	295 Cleanliness requirements
433 On-board diagnosis system for passenger cars and light-duty trucks	489 Exhaust-gas measuring devices	299 Dimensions of diesel fuel-injection technology
440 On-board diagnosis system for heavy-duty trucks	491 Exhaust-gas measurement in engine development	307 High-precision technology
442 Service technology	493 Emissions testing (opacity measurement)	317 Cavitation in the high-pressure system
442 Workshop business	494 Index of technical terms	356 Where does the word "electronics" come from?
446 Diagnostics in the workshop	494 Technical terms	373 Injector delivery compensation
448 Testing equipment	499 Acronyms	377 Racing trucks
450 Fuel-injection pump test benches	Editorial boxes	382 Closed-loop and open-loop control
452 Testing in-line fuel-injection pumps	37 Size of injection	402 Engine test bench
456 Testing helix- and port-controlled distributor injection pumps	40 M System	411 Very severe demands are made on the ECU
460 Nozzle tests		441 Global service
		465 Greenhouse effect
		480 Ozone and smog