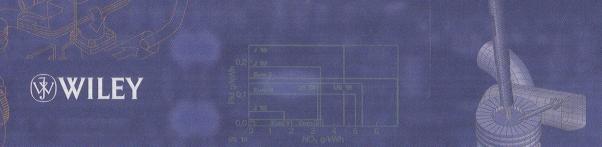
Robert Bosch GmbH

Diesel-Engine Management







10 History of the diesel

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

128 Purpose of the governor/

control system

208 Designs

210 Fitting and drive system

82 Fuel supply system to the 131 Types of governor/control

212	Design and method of	264	Method of operation		Exhaust-gas treatment
	operation	268	Common-rail system for		NO _x storage catalyst
214	Low-pressure stage		passenger cars	338	Selective catalytic reduction
216	High-pressure stage of	273	Common-rail system for		of nitrogen oxides
	the axial-piston distributor injection pump		commercial vehicles	344	Diesel Particulate Filter (DPF)
220	High-pressure stage of	276	High-pressure compo-	352	Diesel oxidation catalyst
	the radial-piston distributor		nents of common-rail		
	injection pump		system	354	Electronic Diesel Control
224	Delivery valves	276	Overview		(EDC)
226	High-pressure solenoid valve	278	Injector	354	System overview
228	Injection timing adjustment	288	High-pressure pumps	357	In-line fuel-injection pumps
234	Electronic control unit	294	Fuel rail (high-pressure	358	Helix-and-port-controlled
235	Summary		accumulator)		axial-piston distributor
		296	Pressure-control valve		pumps
236	Overview of discrete	297	Pressure-relief valve	359	Solenoid-valve-controlled
	cylinder systems		·		axial-piston and radial-pis-
236	Single-plunger fuel-injection	298	Injection nozzles		ton distributor pumps
	pumps PF	300	Pintle nozzles	360	Unit Injector System (UIS)
238	Unit Injector System (UIS)	302	Hole-type nozzles		for passenger cars
	and Unit Pump System	306	Future development of the	361	Unit Injector System (UIS)
	(UPS)		nozzle		and Unit Pump System
240	System diagram of UIS for				(UPS) for commercial
	cars	308	Nozzle holders		vehicles
242	System diagram of UIS/UPS	308	Overview	362	Common Rail System (CRS)
	for commercial vehicles	310	Standard nozzle holders		for passenger cars
		311	Stepped nozzle holders	363	Common Rail System (CRS)
244	Single-plunger fuel-injec-	312	Two-spring nozzle holders		for commercial vehicles
	tion pumps PF	313	Nozzle holders with needle-		Data processing
244	Design and method of		motion sensors		Fuel-injection control
	operation				Further special adaptations
246	Sizes		High-pressure lines	378	Lambda closed-loop control
		314	High-pressure connection		for passenger-car diesel
248	Unit Injector System (UIS)		fittings		engines
	Installation and drive	315	High-pressure delivery lines	383	Torque-controlled EDC
	Design and construction				systems
	Method of operation		Start-assist systems	386	Control and triggering of
256	High-pressure solenoid valve		Overview		the remaining actuators
		319	Preheating systems		Substitute functions
	Unit Pump System (UPS)			388	Data exchange with other
	Installation and drive	324	Minimizing emissions	200	systems
	Design and construction	005	inside of the engine	308	Serial data transmission
260	Current-controlled rate		Combustion process	204	(CAN) Application related adapts
	shaping (CCRS)	327	Other impacts on pollutant emissions	394	Application-related adapta- tion of car engines
262	Overview of common-rail	329	Development of homoge-	398	Application-related adapta-
	systems		neous combustion process		tion of commercial-vehicle
262	! Areas of application	330	Exhaust-gas recirculation		engines
	B Design		Positive crankcase ventilation	403	3 Calibration tools

406 Electronic Control Unit (ECU)

- 406 Operating conditions
- 406 Design and construction
- 406 Data processing

412 Sensors

- 412 Automotive applications
- 413 Temperature sensors
- 414 Micromechanical pressure sensors
- 417 High-pressure sensors418 Inductive engine-speed
- sensors 419 Rotational-speed (rpm)
- sensors and incremental angle-of-rotation sensors
- 420 Hall-effect phase sensors
- 422 Accelerator-pedal sensors
- 424 Hot-film air-mass meter HFM5
- 426 LSU4 planar broad-band Lambda oxygen sensors
- 428 Half-differential short-circuiting-ring sensors
- 429 Fuel-level sensor

430 Fault diagnostics

- 430 Monitoring during vehicle operation (on-board diagnosis)
- 433 On-board diagnosis system for passenger cars and light-duty trucks
- 440 On-board diagnosis system for heavy-duty trucks

442 Service technology

- 442 Workshop business
- 446 Diagnostics in the workshop
- 448 Testing equipment
- 450 Fuel-injection pump test benches
- 452 Testing in-line fuel-injection pumps
- 456 Testing helix- and port-controlled distributor injection pumps
- 460 Nozzle tests

462 Exhaust-gas emissions

- 462 Overview
- 462 Major components
- 464 Combustion byproducts

466 Emission-control legislation

- 466 Overview
- 468 CARB legislation (passenger cars/LDT)
- 472 EPA legislation (passenger cars/LDT)
- 474 EU legislation (passenger cars/LDT)
- 476 Japanese legislation (passenger cars/LDT)
- 477 U.S. legislation (heavy-duty trucks)
- 478 EU legislation (heavy-duty trucks)
- 480 Japanese legislation (heavyduty trucks)
- 481 U.S. test cycles for passenger cars and LDTs
- 483 European test cycle for passenger cars and LDTs
- 483 Japanese test cycle for passenger cars and LDTs
- 484 Test cycles for heavy-duty trucks

486 Exhaust-gas measuring techniques

- 486 Exhaust-gas test for type approval
- 489 Exhaust-gas measuring devices
- 491 Exhaust-gas measurement in engine development
- 493 Emissions testing (opacity measurement)

494 Index of technical terms

- 494 Technical terms
- 499 Acronyms

Editorial boxes

- 37 Size of injection
- 40 M System

- 41 Fuel consumption in everyday practice
- 46 Fuel parameters
- 81 History of diesel fuel injection
- 91 Diesel aircraft engines of the 1920s and 30s
- 109 History of in-line fuel-injection pumps
- 113 1978 diesel speed records
- 125 History of the governor172 Off-road applications
- 175 Diesel records in 1972
- 177 History of the mechanically controlled distributor injec-
- controlled distributor injection pump from Bosch
- 206 Measured variables on diesel engines
- 209 Family tree of Bosch electronically controlled distributor injection pumps
- 211 1998 Diesel Records
- 225 Micromechanics
- 261 The history and the future of the Unit Injector (UI)
- 267 Diesel boom in Europe
- 272 Overview of diesel fuelinjection systems
- 277 The piezoelectric effect
- 295 Cleanliness requirements
- 299 Dimensions of diesel fuelinjection technology
- 307 High-precision technology
- 317 Cavitation in the high-pressure system
- 356 Where does the word "electronics" come from?
- 373 Injector delivery compensation
- 377 Racing trucks
- 382 Closed-loop and open-loop control
- 402 Engine test bench
- 411 Very severe demands are made on the ECU
- 441 Global service
- 465 Greenhouse effect
- 480 Ozone and smog