

CPC COOPERATIVE PATENT CLASSIFICATION

F MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING (NOTE omitted)

ENGINES OR PUMPS

F02 COMBUSTION ENGINES; HOT-GAS OR COMBUSTION-PRODUCT ENGINE PLANTS

F02D CONTROLLING COMBUSTION ENGINES (cyclically operating valves for combustion engines [F01L](#); controlling combustion engine lubrication [F01M](#); cooling internal combustion engines [F01P](#); supplying combustion engines with combustible mixtures or constituents thereof, e.g. carburettors, injection pumps [F02M](#); starting of combustion engines [F02N](#); controlling of ignition [F02P](#); controlling gas-turbine plants, jet-propulsion plants, or combustion-product engine plants, [see the relevant subclasses for these plants](#))

NOTES

1. Attention is drawn to the notes preceding class [F01](#).
2. In this subclass, the following words are used with the meanings indicated:
 - "Fuel injection" means the introduction of a combustible substance into a space, e.g. cylinder, by means of a pressure source, e.g. a pump, continuously or cyclically acting behind the substance;
 - "Supercharging" means supplying to the working space, e.g. cylinder, combustion-air pressurised by means of a pressure source, e.g. a pump.

WARNING

In this subclass non-limiting references (in the sense of paragraph 39 of the Guide to the IPC) may still be displayed in the scheme.

Controlling, e.g. regulating, fuel injection (peculiar to engines characterised by their use of non-liquid fuels, pluralities of fuels, or non-fuel substances added to the combustible mixtures [F02D 19/00](#); peculiar to supercharged engines [F02D 23/00](#); automatic controllers for prime movers, in general [G05D](#))

1/00 Controlling fuel-injection pumps, e.g. of high pressure injection type ([F02D 3/00](#) takes precedence; controlling fuel-injection electrically [F02D 41/30](#) {pumping elements on fuel pressure acting for varying fuel delivery in quantity or timing [F02M](#)})

NOTE

- in this subclass the following indexing codes are used:

[F02D 2700/0282](#) and [F02D 2700/10](#)

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|-----------|---|-----------|---|
| 2001/0005 | . {Details, component parts or accessories of centrifugal governors} | 2001/004 | . . {Arrangement of linkages between governor sleeve and pump control} |
| 2001/001 | . . {Arrangement of centrifugal weights} | 2001/0045 | . . {Arrangement of means for influencing governor characteristics by operator} |
| 2001/0015 | . . . {the weights being cup-shaped and carrying governor springs} | 2001/005 | . . . {varying main spring tension} |
| 2001/002 | . . {Arrangement of governor springs} | 2001/0055 | . . . {varying pivotal point of linkages between governor sleeve and pump control} |
| 2001/0025 | . . . {having at least two springs, one of them being idling spring} | 2001/006 | . . {Assembling; Disassembling; Replacing} |
| 2001/003 | . . . {the main spring being active at maximum speed only} | 2001/0065 | . . {Selection of particular materials} |
| 2001/0035 | . . . {the main spring being active at all speeds, e.g. its tension varying with the load, i.e. the position of pump control} | 2001/007 | . {Means for adjusting stops for minimum and maximum fuel delivery} |
| | | 2001/0075 | . . {using engine temperature, e.g. to adjust the idling speed at cold start} |
| | | 2001/008 | . . {using intake air pressure, e.g. adjusting full load stop at high supercharging pressures} |
| | | 2001/0085 | . {Arrangements using fuel pressure for controlling fuel delivery in quantity or timing} |
| | | 2001/009 | . . {Means for varying the pressure of fuel supply pump according to engine working parameters} |
| | | 2001/0095 | . {Mounting of control means with respect to injection apparatus or the engine} |
| | | 1/02 | . not restricted to adjustment of injection timing, e.g. varying amount of fuel delivered |
| | | 1/025 | . . {by means dependent on engine working temperature (F02D 1/08 takes precedence)} |
| | | 1/04 | . . by mechanical means dependent on engine speed, e.g. using centrifugal governors (F02D 1/08 takes precedence) |
| | | 1/045 | . . . {characterised by arrangement of springs or weights} |

- 1/06 . . . by means dependent on pressure of engine working fluid ([F02D 1/08](#) takes precedence)
- 1/065 {of intake of air}
- 1/08 . . . Transmission of control impulse to pump control, e.g. with power drive or power assistance
- 2001/082 {electric}
- 2001/085 {using solenoids}
- 2001/087 {using step motors}
- 1/10 mechanical
- 1/12 non-mechanical, e.g. hydraulic
- 1/122 {control impulse depending only on engine speed}
- 1/125 {using a centrifugal governor}
- 1/127 {using the pressure developed in a pump}
- 1/14 pneumatic
- 1/16 . . . Adjustment of injection timing ([F02D 1/02](#) takes precedence {rotary distributor pumps [F02M 41/00](#); by adjustment of pumping elements [F02M 59/20](#)})
- 1/162 . . . {by mechanical means dependent on engine speed for angular adjustment of driving and driven shafts}
- 2001/165 . . . {by means dependent on engine load}
- 2001/167 . . . {by means dependent on engine working temperature, e.g. at cold start}
- 1/18 . . . with non-mechanical means for transmitting control impulse; with amplification of control impulse
- 1/183 {hydraulic}
- 2001/186 {using a pressure-actuated piston for adjustment of a stationary cam or roller support}

3/00 Controlling low-pressure fuel injection, i.e. where the air-fuel mixture containing fuel thus injected will be substantially compressed by the compression stroke of the engine, by means other than controlling only an injection pump (controlling fuel-injection electrically [F02D 41/30](#); {controlling the feeding of liquid fuel from storage containers to carburettors or fuel-injection apparatus [F02D 33/003](#); } carburettors [F02M](#))

NOTE

When the control apparatus or system forms part of the low-pressure fuel-injection apparatus it is classified in group [F02M 69/00](#).

- 3/02 . . . with continuous injection or continuous flow upstream of the injection nozzle
- 3/04 . . . Controlling fuel-injection and carburation, e.g. of alternative systems

7/00 Other fuel-injection control

- 7/002 . . . {Throttling of fuel passages between pumps and injectors or overflow passages (low-pressure fuel injection [F02M 69/00](#))}
- 7/005 . . . {by mechanical means, e.g. using a centrifugal governor}
- 7/007 . . . {by fluid actuated means, e.g. slide valves}
- 7/02 . . . Controlling fuel injection where fuel is injected by compressed air
- 2007/025 . . . {Controlling compressed air quantity or pressure}

NOTES

1. accelerator lever means a lever actuated by foot or hand (e.g. pedal).

2. throttle lever means a lever connected to the accelerator lever via a force transmitting element (e.g. cable, link) and mounted on the throttle axis.

9/00 Controlling engines by throttling air or fuel-and-air induction conduits or exhaust conduits

NOTE

- in this group the following indexing codes are used: [F02D 2700/00](#), [F02D 2700/02](#), [F02D 2700/04](#), [F02D 2700/09](#)

- 9/02 . . . concerning induction conduits (throttle valves, or arrangements thereof in conduits [F02D 9/08](#))
- 2009/0201 . . . {Arrangements; Control features; Details thereof}
- 2009/0203 {Mechanical governor}
- 2009/0205 {working on the throttle valve and another valve, e.g. choke}
- 2009/0206 {specially positioned with relation to engine or engine housing}
- 2009/0208 {for small engines}
- 2009/021 {combined with an electromechanical governor, e.g. centrifuged governor and electric governor acting on the governor lever}
- 2009/0211 {combined with another mechanical or pneumatic governor}
- 2009/0213 {Electronic or electric governor}
- 2009/0215 {Pneumatic governor}
- 2009/0216 {of the air-vane type}
- 2009/0218 {Details of governor springs}
- 2009/022 {Throttle control function parameters}
- 2009/0222 {Exhaust gas temperature}
- 2009/0223 {Cooling water temperature}
- 2009/0225 {Intake air or mixture temperature}
- 2009/0227 {Atmospheric pressure}
- 2009/0228 {Manifold pressure}
- 2009/023 {Engine speed}
- 2009/0232 {Fuel pump rack position}
- 2009/0233 {Engine vibration}
- 2009/0235 {Throttle control functions}
- 2009/0237 {Increasing combustion chamber gas temperature}
- 2009/0238 {Increasing ignition delay}
- 2009/024 {Increasing intake vacuum}
- 2009/0242 {Increasing exhaust brake effect}
- 2009/0244 {Choking air flow at low speed and load}
- 2009/0245 {Shutting down engine, e.g. working together with fuel cut-off}
- 2009/0247 {Opening the throttle a little on engine shutdown}
- 2009/0249 {Starting engine, e.g. closing throttle in Diesel engine to reduce starting torque}
- 2009/025 {Opening the throttle a little during starting}
- 2009/0252 {Opening a special valve-controlled intake passage (by-pass) during starting}
- 2009/0254 {Mechanical control linkage between accelerator lever and throttle valve}
- 2009/0255 {with means for correcting throttle position, e.g. throttle cable of variable length}
- 2009/0257 {having a pin and slob connection ("Leerweg")}

2009/0259	. . . {having a dashpot, e.g. working in the throttle opening and closing directions}	9/08	. Throttle valves specially adapted therefor; Arrangements of such valves in conduits (throttle valves modified for use in or arranged in carburetors F02M; throttle valves in general F16K)
2009/0261	. . . {having a specially shaped transmission member, e.g. a cam, specially toothed gears, with a clutch}	9/10	. . having pivotally-mounted flaps
2009/0262	. . . {having two or more levers on the throttle shaft}	9/1005	. . . {Details of the flap}
2009/0264	. . . {in which movement is transmitted through a spring}	9/101	. . . . {Special flap shapes, ribs, bores or the like}
2009/0266	. . . {in which movement is transmitted through a vacuum motor}	9/1015	. . . . . {Details of the edge of the flap, e.g. for lowering flow noise or improving flow sealing in closed flap position}
2009/0267	. . . {for simultaneous action of a governor and an accelerator lever on the throttle}	9/102	. . . . . {the flap having movable parts fixed onto it}
2009/0269	. . . {Throttle closing springs; Acting of throttle closing springs on the throttle shaft}	9/1025	. . . . . {the rotation axis of the flap being off-set from the flap center axis}
2009/0271	. . . {with means for closing the throttle other than throttle closing springs}	9/103	. . . . . {the rotation axis being located at an edge}
2009/0272	. . . {Two or more throttles disposed in series}	9/1035	. . . {Details of the valve housing}
2009/0274	. . . {one being controlled by pressure in intake conduit, e.g. for slowly opening the throttle as the other valve is suddenly opened}	9/104	. . . . . {Shaping of the flow path in the vicinity of the flap, e.g. having inserts in the housing}
2009/0276	. . . {Throttle and EGR-valve operated together}	9/1045	. . . . . {for sealing of the flow in closed flap position, e.g. the housing forming a valve seat}
2009/0277	. . . {Fail-safe mechanisms, e.g. with limp-home feature, to close throttle if actuator fails, or if control cable sticks or breaks}	9/105	. . . . . {having a throttle position sensor (detection of actuation F02D 11/106)}
2009/0279	. . . {Throttle valve control for intake system with two parallel air flow paths, each controlled by a throttle, e.g. a resilient flap disposed on a throttle}	9/1055	. . . . . {having a fluid by-pass}
2009/0281	. . . {with means for detecting malfunction of one throttle and actuating only the correctly working throttle}	9/106	. . . . . {Sealing of the valve shaft in the housing, e.g. details of the bearings}
2009/0283	. . . {Throttle in the form of an expander}	9/1065	. . . {Mechanical control linkage between an actuator and the flap, e.g. including levers, gears, springs, clutches, limit stops of the like}
2009/0284	. . . {Throttle control device with means for signalling a certain throttle opening, e.g. by a steplike increase of throttle closing spring force}	9/107	. . . {Manufacturing or mounting details}
2009/0286	. . . {Throttle control device with accelerator lever defining a stop for opening the throttle, e.g. the throttle itself being opened by air flow, a spring}	9/1075	. . . {Materials, e.g. composites}
2009/0288	. . . {Throttle control device specially adapted for spark-assisted compression-ignition engine (Diesel engine)}	9/108	. . . . . {Plastics}
2009/0289	. . . {Throttle control device with means for establishing a variable resistance torque during throttle opening}	9/1085	. . . . . {Non-organic materials, e.g. metals, alloys, ceramics}
2009/0291	. . . {Throttle control device for throttle being disposed in a two-stroke engine transfer passage}	9/109	. . . {having two or more flaps}
2009/0293	. . . {Throttle control device adapted to limit power development at low attitude}	9/1095	. . . . . {Rotating on a common axis, e.g. having a common shaft}
2009/0294	. . . {Throttle control device with provisions for actuating electric or electronic sensors}	9/12	. . having slidably-mounted valve members; having valve members movable longitudinally of conduit
2009/0296	. . . {Throttle control device with stops for limiting throttle opening or closing beyond a certain position during certain periods of operation}	9/14	. . . the members being slidable transversely of conduit
2009/0298	. . . {Throttle control device with holding devices, i.e. to hold throttle in a predetermined position}	9/16	. . . the members being rotatable
9/04	. concerning exhaust conduits (throttle valves, or arrangements thereof in conduits F02D 9/08)	9/18	. . having elastic-wall valve members
9/06	. . Exhaust brakes	11/00	Arrangements for, or adaptations to, non-automatic engine control initiation means, e.g. operator initiated (specially for reversing F02D 27/00; arrangement or mounting of prime-mover control devices in vehicles B60K 26/00)
		11/02	. characterised by hand, foot, or like operator controlled initiation means
		11/04	. characterised by mechanical control linkages (with power drive or assistance F02D 11/06)
		11/06	. characterised by non-mechanical control linkages, e.g. fluid control linkages or by control linkages with power drive or assistance
		11/08	. . of the pneumatic type
		11/10	. . of the electric type
		2011/101	. . . {characterised by the means for actuating the throttles}
		2011/102	. . . . . {at least one throttle being moved only by an electric actuator}
		2011/103	. . . . . {at least one throttle being alternatively mechanically linked to the pedal or moved by an electric actuator}

2011/104	. . . . {using electric step motors}	15/00	Varying compression ratio (modifying valve gear F01L)
11/105	. . . {characterised by the function converting demand to actuation, e.g. a map indicating relations between an accelerator pedal position and throttle valve opening or target engine torque}		NOTE
11/106	. . . {Detection of demand or actuation}		- in this group the following indexing codes are used:
11/107	. . . {Safety-related aspects}		F02D 2700/03
2011/108	. . . {with means for detecting or resolving a stuck throttle, e.g. when being frozen in a position}	15/02	. by alteration or displacement of piston stroke
		15/04	. by alteration of volume of compression space without changing piston stroke
13/00	Controlling the engine output power by varying inlet or exhaust valve operating characteristics, e.g. timing (modifying valve gear F01L)	17/00	Controlling engines by cutting out individual cylinders; Rendering engines inoperative or idling (controlling or rendering inoperative by varying inlet or exhaust valve operating characteristics F02D 13/00)
2013/005	. {of throttleless spark ignited engines}		NOTE
13/02	. during engine operation		- in this group the following indexing codes are used:
13/0203	. . {Variable control of intake and exhaust valves}		F02D 2700/05
13/0207	. . . {changing valve lift or valve lift and timing}		
13/0211	. . . . {the change of valve timing is caused by the change in valve lift, i.e. both valve lift and timing are functionally related}	17/02	. Cutting-out (cutting-out engines in multiple engine arrangements F02D 25/04)
13/0215	. . . {changing the valve timing only}	17/023	. . {the inactive cylinders acting as compressor other than for pumping air into the exhaust system}
13/0219	. . . . {by shifting the phase, i.e. the opening periods of the valves are constant}	17/026	. . . {delivering compressed fluid, e.g. air, reformed gas, to the active cylinders other than during starting}
13/0223	. . {Variable control of the intake valves only}	17/04	. rendering engines inoperative or idling, e.g. caused by abnormal conditions (dependent on lubricating conditions F01M 1/22 ; dependent on cooling F01P 5/14)
13/0226	. . . {changing valve lift or valve lift and timing}		
13/023	. . . . {the change of valve timing is caused by the change in valve lift, i.e. both valve lift and timing are functionally related}		
13/0234	. . . {changing the valve timing only}		
13/0238	. . . . {by shifting the phase, i.e. the opening periods of the valves are constant}		
13/0242	. . {Variable control of the exhaust valves only}		
13/0246	. . . {changing valve lift or valve lift and timing}		
13/0249	. . . {changing the valve timing only}		
13/0253	. . {Fully variable control of valve lift and timing using camless actuation systems such as hydraulic, pneumatic or electromagnetic actuators, e.g. solenoid valves}		
13/0257	. . {Independent control of two or more intake or exhaust valves respectively, i.e. one of two intake valves remains closed or is opened partially while the other is fully opened}		
13/0261	. . {Controlling the valve overlap}		
13/0265	. . . {Negative valve overlap for temporarily storing residual gas in the cylinder}		
13/0269	. . {Controlling the valves to perform a Miller-Atkinson cycle}		
13/0273	. . {Multiple actuations of a valve within an engine cycle}		
13/0276	. . {Actuation of an additional valve for a special application, e.g. for decompression, exhaust gas recirculation or cylinder scavenging}		
13/028	. . {for two-stroke engines}		
13/0284	. . . {Variable control of exhaust valves only}		
2013/0288	. . . . {for cleaning the valves}		
2013/0292	. . {in the start-up phase, e.g. for warming-up cold engine or catalyst}		
2013/0296	. . {Changing the valve lift only}		
13/04	. . using engine as brake		
13/06	. . Cutting-out cylinders		
13/08	. for rendering engine inoperative or idling		
			Controlling peculiar to specified types or adaptations of engines
		19/00	Controlling engines characterised by their use of non-liquid fuels, pluralities of fuels, or non-fuel substances added to the combustible mixtures (the non-fuel substances being gaseous F02D 21/00)
		19/02	. peculiar to engines working with gaseous fuels (apparatus, or control parts thereof, for mixing gas and air F02M)
		19/021	. . {Control of components of the fuel supply system}
		19/022	. . . {to adjust the fuel pressure, temperature or composition}
		19/023	. . . {to adjust the fuel mass or volume flow}
		19/024	. . . . {by controlling fuel injectors}
		19/025	. . {Failure diagnosis or prevention; Safety measures; Testing}
		19/026	. . {Measuring or estimating parameters related to the fuel supply system}
		19/027	. . . {Determining the fuel pressure, temperature or volume flow, the fuel tank fill level or a valve position}
		19/028	. . . . {by estimation, i.e. without using direct measured parameter of a corresponding sensor}
		19/029	. . . {Determining density, viscosity, concentration or composition}
		19/04	. peculiar to engines working with solid fuels, e.g. pulverised coal
		19/06	. peculiar to engines working with pluralities of fuels, e.g. alternatively with light and heavy fuel oil, other than engines indifferent to the fuel consumed

- 19/0602 . . . {Control of components of the fuel supply system}
- 19/0605 . . . {to adjust the fuel pressure or temperature}
- 19/0607 . . . {to adjust the fuel mass or volume flow}
- 19/061 {by controlling fuel injectors}
- 19/0613 {Switch-over from one fuel to another (F02D 19/081 takes precedence)}
- 19/0615 {being initiated by automatic means, e.g. based on engine or vehicle operating conditions}
- 19/0618 {depending on the engine's or vehicle's position, e.g. on/off road or proximity to a harbor}
- 19/0621 {Purging of the fuel system}
- 19/0623 . . . {Failure diagnosis or prevention; Safety measures; Testing}
- 19/0626 . . . {Measuring or estimating parameters related to the fuel supply system}
- 19/0628 . . . {Determining the fuel pressure, temperature or flow, the fuel tank fill level or a valve position}
- 19/0631 {by estimation, i.e. without using direct measurements of a corresponding sensor}
- 19/0634 . . . {Determining a density, viscosity, composition or concentration (F02D 19/087 takes precedence)}
- 19/0636 {by estimation, i.e. without using direct measurements of a corresponding sensor}
- 19/0639 . . . {characterised by the type of fuels}
- 19/0642 . . . {at least one fuel being gaseous, the other fuels being gaseous or liquid at standard conditions}
- 19/0644 {the gaseous fuel being hydrogen, ammonia or carbon monoxide}
- 19/0647 {the gaseous fuel being liquefied petroleum gas [LPG], liquefied natural gas [LNG], compressed natural gas [CNG] or dimethyl ether [DME]}
- 19/0649 . . . {Liquid fuels having different boiling temperatures, volatilities, densities, viscosities, cetane or octane numbers}
- 19/0652 {Biofuels, e.g. plant oils}
- 19/0655 {at least one fuel being an alcohol, e.g. ethanol (F02D 19/084 takes precedence)}
- 19/0657 {Heavy or light fuel oils; Fuels characterised by their impurities such as sulfur content or differences in grade, e.g. for ships}
- 19/066 . . . {Retrofit of secondary fuel supply systems; Conversion of engines to operate on multiple fuels}
- 19/0663 . . . {Details on the fuel supply system, e.g. tanks, valves, pipes, pumps, rails, injectors or mixers}
- 19/0665 {Tanks, e.g. multiple tanks}
- 19/0668 {Treating or cleaning means; Fuel filters}
- 19/0671 {Means to generate or modify a fuel, e.g. reformers, electrolytic cells or membranes}
- 19/0673 {Valves; Pressure or flow regulators; Mixers}
- 19/0676 {Multi-way valves; Switch-over valves}
- 19/0678 {Pressure or flow regulators therefor; Fuel metering valves therefor}
- 19/0681 {Shut-off valves; Check valves; Safety valves; Pressure relief valves}
- 19/0684 {High pressure fuel injection systems; Details on pumps, rails or the arrangement of valves in the fuel supply and return systems}
- 19/0686 {Injectors}
- 19/0689 {for in-cylinder direct injection}
- 19/0692 {Arrangement of multiple injectors per combustion chamber}
- 19/0694 {operating with a plurality of fuels}
- 19/0697 {Arrangement of fuel supply systems on engines or vehicle bodies; Components of the fuel supply system being combined with another device}
- 19/08 simultaneously using pluralities of fuels (F02D 19/12 takes precedence)
- 19/081 {Adjusting the fuel composition or mixing ratio; Transitioning from one fuel to the other}
- 19/082 {Premixed fuels, i.e. emulsions or blends}
- 19/084 {Blends of gasoline and alcohols, e.g. E85}
- 19/085 {Control based on the fuel type or composition}
- 19/087 {with determination of densities, viscosities, composition, concentration or mixture ratios of fuels}
- 19/088 {by estimation, i.e. without using direct measurements of a corresponding sensor}
- 19/10 peculiar to compression-ignition engines in which the main fuel is gaseous
- 19/105 {operating in a special mode, e.g. in a liquid fuel only mode for starting}
- 19/12 peculiar to engines working with non-fuel substances or with anti-knock agents, e.g. with anti-knock fuel (apparatus, or control parts thereof for delivering such substances or agents F02M)
- 21/00 Controlling engines characterised by their being supplied with non-airborne oxygen or other non-fuel gas**
- 21/02 peculiar to oxygen-fed engines
- 21/04 with circulation of exhaust gases in closed or semi-closed circuits
- 21/06 peculiar to engines having other non-fuel gas added to combustion air
- 21/08 the other gas being the exhaust gas of engine (circulation of exhaust gas in oxygen-fed engines F02D 21/04)
- 2021/083 {controlling exhaust gas recirculation electronically}
- 2021/086 {the exhaust gas recirculation valve being controlled by fuel pressure, e.g. indirectly}
- 21/10 having secondary air added to the fuel-air mixture (apparatus, or control parts thereof, for delivering secondary air F02M)
- 23/00 Controlling engines characterised by their being supercharged**
- 23/005 {with the supercharger being mechanically driven by the engine (supercharger drives F02B 39/00)}
- 23/02 the engines being of fuel-injection type
- 25/00 Controlling two or more co-operating engines**
- 25/02 to synchronise speed
- 25/04 by cutting-out engines
- 27/00 Controlling engines characterised by their being reversible**
- 27/02 by performing a programme

28/00	Programme-control of engines (programme-control specific to a type or purpose covered by one of the groups of this subclass except groups F02D 29/00 , F02D 39/00 , or by one group of another subclass, e.g. F01L , see that group; programme-control in general G05B 19/00)	35/0053 . . . {by means of a carburettor}	35/0061 {Controlling the emulsifying air only (F02D 35/0076 , F02D 35/0084 take precedence)}
29/00	Controlling engines, such controlling being peculiar to the devices driven thereby, the devices being other than parts or accessories essential to engine operation, e.g. controlling of engines by signals external thereto	35/0069 {Controlling the fuel flow only (F02D 35/0076 , F02D 35/0084 take precedence)}	35/0076 {using variable venturi carburettors}
	NOTE	35/0084 {using two barrel carburettors}	35/0092 . . . {by means of fuel injection}
	- in this group the following indexing codes are used: F02D 2700/07	35/02 . . on interior conditions	35/021 . . {using an ionic current sensor}
29/02	. peculiar to engines driving vehicles; peculiar to engines driving variable pitch propellers	35/022 . . {using an optical sensor, e.g. in-cylinder light probe}	35/023 . . {by determining the cylinder pressure}
29/04	. peculiar to engines driving pumps	35/024 . . . {using an estimation}	35/025 . . {by determining temperatures inside the cylinder, e.g. combustion temperatures}
29/06	. peculiar to engines driving electric generators	35/026 . . . {using an estimation}	35/027 . . {using knock sensors}
Other controlling of engines		35/028 . . {by determining the combustion timing or phasing}	
31/00	Use of speed-sensing governors to control combustion engines, not otherwise provided for	37/00	Controlling conjointly two or more functions of engines, not otherwise provided for
31/001	. {Electric control of rotation speed}	37/02	. one of the functions being ignition (ignition control per se F02P {, automatically advancing or retarding ignition combined with electronic control of other engine functions, e.g. fuel injection F02P 5/045 })
31/002	. . {controlling air supply}	39/00	Other non-electrical control
31/003	. . . {for idle speed control}	39/02	. for four-stroke engines
31/004	. . . . {by controlling a throttle stop}	39/04	. for engines with other cycles than four-stroke, e.g. two-stroke
31/005	. . . . {by controlling a throttle by-pass}	39/06	. for engines adding the fuel substantially at the end of compression stroke
31/006	. . . {for maximum speed control}	39/08	. for engines adding the fuel substantially before compression stroke
31/007	. . {controlling fuel supply}	39/10	. for free-piston engines; for engines without rotary main shaft
31/008	. . . {for idle speed control}		
31/009	. . . {for maximum speed control}		
33/00	Controlling delivery of fuel or combustion-air, not otherwise provided for {(using exhaust gas sensors F02D 35/0023 , F02D 35/0046)}	Electrical control of combustion engines	
33/003	. {Controlling the feeding of liquid fuel from storage containers to carburettors or fuel-injection apparatus (control of electrical fuel pumps F02D 41/3082 , controlling fuel flow to a common rail F02D 41/3845); Failure or leakage prevention; Diagnosis or detection of failure; Arrangement of sensors in the fuel system; Electric wiring; Electrostatic discharge}	NOTES	
33/006	. . {depending on engine operating conditions, e.g. start, stop or ambient conditions}	1. Groups F02D 41/00 - F02D 45/00 cover electrical aspects of electrically controlled devices.	
33/02	. of combustion-air	2. Groups F02D 41/00 - F02D 45/00 do not cover	
35/00	Controlling engines, dependent on conditions exterior or interior to engines, not otherwise provided for	<ul style="list-style-type: none"> non-electrical aspects of electrically controlled devices, which are covered by groups F02D 1/00 - F02D 39/00 or by subclass F02M; both electrical and non-electrical aspects of electrically controlled devices, which are covered by groups F02D 1/00 - F02D 39/00 or by subclass F02M 	
35/0007	. {using electrical feedback (F02D 35/0015 takes precedence)}	41/00	Electrical control of supply of combustible mixture or its constituents (F02D 43/00 takes precedence {; control of engine starters F02N 11/08 , electrical control of engine ignition timing F02P 5/145 })
	NOTE	41/0002	. {Controlling intake air}
	Attention is drawn to the note preceding F02D 41/00 .	41/0005	. . {during deceleration}
35/0015	. {using exhaust gas sensors (F02D 41/14 takes precedence)}	41/0007	. . {for control of turbo-charged or super-charged engines (control of the pumps per se F02B 37/12)}
35/0023	. . {Controlling air supply}	2041/001	. . {for engines with variable valve actuation}
35/003	. . . {by means of by-pass passages}	2041/0012	. . . {with selective deactivation of cylinders}
35/0038	. . . {by means of air pumps}		
35/0046	. . {Controlling fuel supply}		

- 2041/0015 . . {for engines with means for controlling swirl or tumble flow, e.g. by using swirl valves}
- 2041/0017 . . {by simultaneous control of throttle and exhaust gas recirculation}
- 2041/002 . . {by simultaneous control of throttle and variable valve actuation}
- 2041/0022 . . {for diesel engines by throttle control}
- 41/0025 . {Controlling engines characterised by use of non-liquid fuels, pluralities of fuels, or non-fuel substances added to the combustible mixtures}
- 41/0027 . . {the fuel being gaseous ([non-electrical control F02D 19/02](#))}
- 41/003 . . {Adding fuel vapours, e.g. drawn from engine fuel reservoir}
- 41/0032 . . . {Controlling the purging of the canister as a function of the engine operating conditions}
- 41/0035 {to achieve a special effect, e.g. to warm up the catalyst}
- 41/0037 {for diagnosing the engine ([diagnosis of purge control systems F02M 25/0809](#))}
- 41/004 {Control of the valve or purge actuator, e.g. duty cycle, closed loop control of position}
- 41/0042 . . . {Controlling the combustible mixture as a function of the canister purging, e.g. control of injected fuel to compensate for deviation of air fuel ratio when purging}
- 41/0045 . . . {Estimating, calculating or determining the purging rate, amount, flow or concentration}
- 41/0047 . . {Controlling exhaust gas recirculation [EGR] ([temperature control with cooler in recirculation circuit F02M 26/33](#))}
- 41/005 . . . {according to engine operating conditions}
- 41/0052 {Feedback control of engine parameters, e.g. for control of air/fuel ratio or intake air amount}
- 41/0055 {Special engine operating conditions, e.g. for regeneration of exhaust gas treatment apparatus}
- 41/0057 {Specific combustion modes ([combustion modes per se F02D 41/3017](#))}
- 41/006 . . . {using internal EGR ([control of valve overlap for internal EGR F02D 13/0261](#); [arrangements for internal EGR F02M 26/01](#))}
- 41/0062 {Estimating, calculating or determining the internal EGR rate, amount or flow}
- 41/0065 . . . {Specific aspects of external EGR control ([constructional details of EGR system F02M 26/00](#))}
- 2041/0067 {Determining the EGR temperature}
- 2041/007 {by estimation}
- 41/0072 {Estimating, calculating or determining the EGR rate, amount or flow ([sensors in EGR systems F02M 26/45](#))}
- 2041/0075 {by using flow sensors}
- 41/0077 . . . {Control of the EGR valve or actuator, e.g. duty cycle, closed loop control of position ([EGR valve position sensor F02M 26/48](#))}
- 41/008 . {Controlling each cylinder individually}
- 41/0082 . . {per groups or banks ([F02D 41/0087 takes precedence](#))}
- 41/0085 . . {Balancing of cylinder outputs, e.g. speed, torque or air-fuel ratio}
- 41/0087 . . {Selective cylinder activation, i.e. partial cylinder operation ([deceleration cut-off F02D 41/123](#))}
- 41/009 . . {using means for generating position or synchronisation signals}
- 2041/0092 . . {Synchronisation of the cylinders at engine start}
- 2041/0095 . . {Synchronisation of the cylinders during engine shutdown}
- 41/0097 . {using means for generating speed signals}
- 41/02 . Circuit arrangements for generating control signals
- 41/0205 . . {using an auxiliary engine speed control ([engine speed control per se F02D 31/00](#))}
- 41/021 . . {Introducing corrections for particular conditions exterior to the engine ([conjoint control of vehicle sub-units for propelling the vehicle B60W 30/18](#))}
- 41/0215 {in relation with elements of the transmission}
- 41/022 {in relation with the clutch status}
- 41/0225 {in relation with the gear ratio or shift lever position}
- 41/023 {in relation with the gear ratio shifting ([conjoint control for improving gear change B60W 30/19](#))}
- 41/0235 . . . {in relation with the state of the exhaust gas treating apparatus ([control of exhaust gas treating apparatus per se F01N](#))}
- 41/024 {to increase temperature of the exhaust gas treating apparatus}
- 41/0245 {by increasing temperature of the exhaust gas leaving the engine}
- 41/025 {by changing the composition of the exhaust gas, e.g. for exothermic reaction on exhaust gas treating apparatus}
- 41/0255 {to accelerate the warming-up of the exhaust gas treating apparatus at engine start}
- 2041/026 {using an external load, e.g. by increasing generator load or by changing the gear ratio}
- 2041/0265 {to decrease temperature of the exhaust gas treating apparatus}
- 41/027 {to purge or regenerate the exhaust gas treating apparatus}
- 41/0275 {the exhaust gas treating apparatus being a NOx trap or adsorbent}
- 41/028 {Desulfurisation of NOx traps or adsorbent}
- 41/0285 {the exhaust gas treating apparatus being a SOx trap or adsorbent}
- 41/029 {the exhaust gas treating apparatus being a particulate filter}
- 41/0295 {Control according to the amount of oxygen that is stored on the exhaust gas treating apparatus}
- 41/04 . . Introducing corrections for particular operating conditions ([F02D 41/14 takes precedence](#))}
- 41/042 . . . {for stopping the engine}
- 41/045 . . . {Detection of accelerating or decelerating state ([detection thereof in general G01P](#))}
- 41/047 . . . {Taking into account fuel evaporation or wall wetting; ([special correction after fuel cut-off F02D 41/126](#))}
- 41/06 . . . for engine starting or warming up ([F02D 41/0255 takes precedence](#))}
- 41/061 {the corrections being time dependent}
- 41/062 {for starting ([F02D 41/061 takes precedence](#))}

- 41/064 {at cold start ([F02D 41/067](#) takes precedence)}
- 41/065 {at hot start or restart ([F02D 41/067](#) takes precedence)}
- 41/067 {with control of the choke (non electronic control of choke see [F02M 1/10](#))}
- 41/068 {for warming-up}
- 41/08 for idling ([F02D 41/06](#), [F02D 41/16](#) take precedence)
- 41/083 {taking into account engine load variation, e.g. air-conditioning}
- 41/086 {taking into account the temperature of the engine}
- 41/10 for acceleration
- 41/102 {Switching from sequential injection to simultaneous injection}
- 41/105 {using asynchronous injection}
- 41/107 {and deceleration}
- 41/12 for deceleration {([F02D 41/0005](#), [F02D 41/107](#) take precedence)}
- 41/123 {the fuel injection being cut-off}
- 41/126 {transitional corrections at the end of the cut-off period}
- 41/14 Introducing closed-loop corrections
- 41/1401 {characterised by the control or regulation method ([F02D 41/1473](#), [F02D 41/1477](#) take precedence)}
- 41/1402 {Adaptive control}
- 41/1403 {Sliding mode control}
- 41/1404 {Fuzzy logic control}
- 41/1405 {Neural network control}
- 41/1406 {with use of a optimisation method, e.g. iteration}
- 41/1408 {Dithering techniques}
- 2041/1409 {using at least a proportional, integral or derivative controller}
- 2041/141 {using a feed-forward control element}
- 2041/1411 {using a finite or infinite state machine, automaton or state graph for controlling or modelling}
- 2041/1412 {using a predictive controller}
- 2041/1413 {Controller structures or design}
- 2041/1415 {using a state feedback or a state space representation}
- 2041/1416 {Observer}
- 2041/1417 {Kalman filter}
- 2041/1418 {Several control loops, either as alternatives or simultaneous}
- 2041/1419 {the control loops being cascaded, i.e. being placed in series or nested}
- 2041/142 {using different types of control law in combination, e.g. adaptive combined with PID and sliding mode}
- 2041/1422 {Variable gain or coefficients}
- 2041/1423 {Identification of model or controller parameters}
- 2041/1424 {Pole-zero cancellation}
- 2041/1425 {using a bond graph model or models with nodes}
- 2041/1426 {taking into account control stability}
- 2041/1427 {Decoupling, i.e. using a feedback such that one output is controlled by only one input}
- 2041/1429 {Linearisation, i.e. using a feedback law such that the system evolves as a linear one}
- 2041/143 {the control loop including a non-linear model or compensator}
- 2041/1431 {the system including an input-output delay}
- 2041/1432 {the system including a filter, e.g. a low pass or high pass filter}
- 2041/1433 {using a model or simulation of the system}
- 2041/1434 {Inverse model}
- 2041/1436 {Hybrid model}
- 2041/1437 {Simulation}
- 41/1438 {using means for determining characteristics of the combustion gases; Sensors therefor}
- 41/1439 {characterised by the position of the sensor}
- 41/144 {Sensor in intake manifold}
- 41/1441 {Plural sensors}
- 41/1443 {with one sensor per cylinder or group of cylinders}
- 41/1444 {characterised by the characteristics of the combustion gases}
- 41/1445 {the characteristics being related to the exhaust flow}
- 41/1446 {the characteristics being exhaust temperatures}
- 41/1447 {with determination means using an estimation}
- 41/1448 {the characteristics being an exhaust gas pressure}
- 41/145 {with determination means using an estimation}
- 41/1451 {the sensor being an optical sensor}
- 41/1452 {the characteristics being a CO_x content or concentration}
- 41/1453 {the characteristics being a CO content or concentration}
- 41/1454 {the characteristics being an oxygen content or concentration or the air-fuel ratio}
- 41/1455 {with sensor resistivity varying with oxygen concentration ([F02D 41/1456](#) takes precedence)}
- 41/1456 {with sensor output signal being linear or quasi-linear with the concentration of oxygen}
- 41/1458 {with determination means using an estimation}
- 41/1459 {the characteristics being a hydrocarbon content or concentration}
- 41/146 {the characteristics being an NO_x content or concentration}
- 41/1461 {of the exhaust gases emitted by the engine}
- 41/1462 {with determination means using an estimation}
- 41/1463 {of the exhaust gases downstream of exhaust gas treatment apparatus}
- 41/1465 {with determination means using an estimation}
- 41/1466 {the characteristics being a soot concentration or content}
- 41/1467 {with determination means using an estimation}

- 2041/1468 {the characteristics being an ammonia content or concentration of the exhaust gases}
- 2041/1469 {with determination means using an estimation}
- 2041/147 {the characteristics being a hydrogen content or concentration of the exhaust gases}
- 2041/1472 {the characteristics being a humidity or water content of the exhaust gases}
- 41/1473 {characterised by the regulation method}
- 41/1474 {by detecting the commutation time of the sensor}
- 41/1475 {Regulating the air fuel ratio at a value other than stoichiometry}
- 41/1476 {Biasing of the sensor}
- 41/1477 {characterised by the regulation circuit or part of it,(e.g. comparator, PI regulator, output)}
- 41/1479 {Using a comparator with variable reference}
- 41/148 {Using a plurality of comparators}
- 41/1481 {Using a delaying circuit}
- 41/1482 {Integrator, i.e. variable slope}
- 41/1483 {Proportional component}
- 41/1484 {Output circuit}
- 41/1486 {with correction for particular operating conditions}
- 41/1487 {Correcting the instantaneous control value}
- 41/1488 {Inhibiting the regulation}
- 41/1489 {Replacing of the control value by a constant}
- 41/149 {Replacing of the control value by an other parameter}
- 41/1491 {Replacing of the control value by a mean value}
- 41/1493 {Details}
- 41/1494 {Control of sensor heater}
- 41/1495 {Detection of abnormalities in the air/fuel ratio feedback system}
- 41/1496 {Measurement of the conductivity of a sensor (F02D 41/1455 takes precedence)}
- 41/1497 {With detection of the mechanical response of the engine}
- 41/1498 {measuring engine roughness}
- 41/16 for idling
- 41/18 by measuring intake air flow (measuring flow in general G01F)
- 41/182 {for the control of a fuel injection device}
- 41/185 {using a vortex flow sensor}
- 41/187 {using a hot wire flow sensor}
- 41/20 Output circuits, e.g. for controlling currents in command coils (current control in inductive loads in general H03K 17/64)
- 2041/2003 {using means for creating a boost voltage, i.e. generation or use of a voltage higher than the battery voltage, e.g. to speed up injector opening}
- 2041/2006 {by using a boost capacitor}
- 2041/201 {by using a boost inductance}
- 2041/2013 {by using a boost voltage source}
- 2041/2017 {using means for creating a boost current or using reference switching}
- 2041/202 {characterised by the control of the circuit}
- 2041/2024 {the control switching a load after time-on and time-off pulses}
- 2041/2027 {Control of the current by pulse width modulation or duty cycle control}
- 2041/2031 {Control of the current by means of delays or monostable multivibrators}
- 2041/2034 {Control of the current gradient}
- 2041/2037 {for preventing bouncing of the valve needle}
- 2041/2041 {for controlling the current in the free-wheeling phase}
- 2041/2044 {using pre-magnetisation or post-magnetisation of the coils}
- 2041/2048 {said control involving a limitation, e.g. applying current or voltage limits}
- 2041/2051 {using voltage control}
- 2041/2055 {with means for determining actual opening or closing time}
- 2041/2058 {using information of the actual current value}
- 2041/2062 {the current value is determined by simulation or estimation}
- 2041/2065 {the control being related to the coil temperature}
- 2041/2068 {characterised by the circuit design or special circuit elements}
- 2041/2072 {Bridge circuits, i.e. the load being placed in the diagonal of a bridge to be controlled in both directions}
- 2041/2075 {Type of transistors or particular use thereof}
- 2041/2079 {the circuit having several coils acting on the same anchor}
- 2041/2082 {the circuit being adapted to distribute current between different actuators or recuperate energy from actuators}
- 2041/2086 {with means for detecting circuit failures}
- 2041/2089 {detecting open circuits}
- 2041/2093 {detecting short circuits}
- 41/2096 {for controlling piezo-electric injectors (drive and control circuit for piezo-electric devices in general H01L 41/042)}
- 41/22 Safety or indicating devices for abnormal conditions {(in air/fuel ratio feedback systems F02D 41/1495, in electric control linkage F02D 11/107, in purge control systems F02M 25/0809)}
- 41/221 {relating to the failure of actuators or electrically driven elements}
- 41/222 {relating to the failure of sensors or parameter detection devices}
- 2041/223 {Diagnosis of fuel pressure sensors}
- 2041/224 {Diagnosis of the fuel system}
- 2041/225 {Leakage detection}
- 2041/226 {Fail safe control for fuel injection pump}
- 2041/227 {Limping Home, i.e. taking specific engine control measures at abnormal conditions}
- 2041/228 {Warning displays}
- 41/24 characterised by the use of digital means
- 41/2403 {using essentially up/down counters}
- 41/2406 {using essentially read only memories}
- 41/2409 {Addressing techniques specially adapted therefor}
- 41/2412 {One-parameter addressing technique}
- 41/2416 {Interpolation techniques}

- 41/2419 {Non-linear variation along at least one coordinate}
- 41/2422 {Selective use of one or more tables}
- 41/2425 . . . {Particular ways of programming the data}
- 41/2429 {Methods of calibrating or learning}
- 41/2432 {Methods of calibration}
- 41/2435 {characterised by the writing medium, e.g. bar code}
- 41/2438 {Active learning methods}
- 41/2441 {characterised by the learning conditions}
- 41/2445 {characterised by a plurality of learning conditions or ranges}
- 41/2448 {Prohibition of learning}
- 41/2451 {characterised by what is learned or calibrated}
- 41/2454 {Learning of the air-fuel ratio control}
- 41/2458 {with an additional dither signal}
- 41/2461 {by learning a value and then controlling another value}
- 41/2464 {Characteristics of actuators}
- 41/2467 {for injectors}
- 41/247 {Behaviour for small quantities}
- 41/2474 {Characteristics of sensors}
- 41/2477 {characterised by the method used for learning}
- 41/248 {using a plurality of learned values}
- 41/2483 {restricting learned values}
- 41/2487 {Methods for rewriting}
- 41/249 {Methods for preventing the loss of data}
- 41/2493 {Resetting of data to a predefined set of values}
- 41/2496 . . . {the memory being part of a closed loop}
- 41/26 . . . using computer, e.g. microprocessor
- 41/263 . . . {the program execution being modifiable by physical parameters}
- 41/266 . . . {the computer being backed-up or assisted by another circuit, e.g. analogue}
- 41/28 . . . Interface circuits
- 2041/281 {between sensors and control unit}
- 2041/283 {the sensor directly giving at least one digital reading}
- 2041/285 {the sensor having a signal processing unit external to the engine control unit}
- 2041/286 {comprising means for signal processing}
- 2041/288 {for performing a transformation into the frequency domain, e.g. Fourier transformation}
- 41/30 . . . Controlling fuel injection ([F02D 41/182](#), [F02D 41/24](#) take precedence)}
- 41/3005 . . {Details not otherwise provided for}
- 41/3011 . . {according to or using specific or several modes of combustion}
- 41/3017 . . . {characterised by the mode(s) being used}
- 41/3023 {a mode being the stratified charge spark-ignited mode}
- 41/3029 {further comprising a homogeneous charge spark-ignited mode}
- 41/3035 {a mode being the premixed charge compression-ignition mode}
- 41/3041 {with means for triggering compression ignition, e.g. spark plug}
- 41/3047 {said means being a secondary injection of fuel}
- 2041/3052 {the mode being the stratified charge compression-ignition mode}
- 41/3058 {the engine working with a variable number of cycles}
- 41/3064 {with special control during transition between modes}
- 41/307 {to avoid torque shocks}
- 41/3076 {with special conditions for selecting a mode of combustion, e.g. for starting, for diagnosing}
- 41/3082 . . . {Control of electrical fuel pumps}
- 2041/3088 . . . {for air assisted injectors}
- 41/3094 . . . {the fuel injection being effected by at least two different injectors, e.g. one in the intake manifold and one in the cylinder}
- 41/32 . . . of the low pressure type ([F02D 41/3082](#) takes precedence)}
- 41/34 . . . with means for controlling injection timing or duration ([ignition timing F02P 5/00](#))
- 41/345 {Controlling injection timing ([F02D 41/365](#) takes precedence)}
- 41/36 . . . with means for controlling distribution (arrangement of ignition distributors [F02P 7/00](#))
- 41/365 {with means for controlling timing and distribution}
- 41/38 . . . of the high pressure type
- 41/3809 {Common rail control systems ([common rail apparatus F02M 55/025](#), [F02M 63/0225](#))}
- 41/3818 {for petrol engines}
- 41/3827 {for diesel engines}
- 41/3836 {Controlling the fuel pressure}
- 41/3845 {by controlling the flow into the common rail, e.g. the amount of fuel pumped}
- 41/3854 {with elements in the low pressure part, e.g. low pressure pump}
- 41/3863 {by controlling the flow out of the common rail, e.g. using pressure relief valves}
- 41/3872 {characterised by leakage flow in injectors}
- 2041/3881 {with multiple common rails, e.g. one rail per cylinder bank, or a high pressure rail and a low pressure rail}
- 2041/389 . . . {for injecting directly into the cylinder}
- 41/40 . . . with means for controlling injection timing or duration
- 41/401 {Controlling injection timing ([F02D 41/402](#) takes precedence)}
- 41/402 {Multiple injections}
- 41/403 {with pilot injections}
- 41/405 {with post injections}
- 41/406 {Electrically controlling a diesel injection pump ([F02D 41/401](#) takes precedence)}
- 41/407 {of the in-line type}
- 41/408 {of the distributing type}
- 43/00** . . . **Conjoint electrical control of two or more functions, e.g. ignition, fuel-air mixture, recirculation, supercharging, exhaust-gas treatment (electrical control of exhaust gas treating apparatus per se [F01N 9/00](#))**
- 43/02 . . . using only analogue means
- 43/04 . . . using only digital means

45/00 **Electrical control not provided for in groups F02D 41/00 - F02D 43/00** (electrical control of exhaust gas treating apparatus F01N 9/00; electrical control of one of the functions; ignition, lubricating, cooling, starting, intake-heating, see relevant subclasses for such functions)

2200/00 **Input parameters for engine control**

2200/02 . the parameters being related to the engine

2200/021 . . Engine temperature

2200/022 . . . Estimation of engine temperature

2200/023 . . Temperature of lubricating oil or working fluid

2200/024 . . Fluid pressure of lubricating oil or working fluid

2200/025 . . Engine noise, e.g. determined by using an acoustic sensor

2200/04 . . Engine intake system parameters

2200/0402 . . . the parameter being determined by using a model of the engine intake or its components

2200/0404 . . . Throttle position

2200/0406 . . . Intake manifold pressure

2200/0408 Estimation of intake manifold pressure

2200/0411 . . . Volumetric efficiency

2200/0414 . . . Air temperature

2200/0416 Estimation of air temperature

2200/0418 . . . Air humidity

2200/06 . . Fuel or fuel supply system parameters

2200/0602 . . . Fuel pressure

2200/0604 Estimation of fuel pressure

2200/0606 . . . Fuel temperature

2200/0608 Estimation of fuel temperature

2200/0611 . . . Fuel type, fuel composition or fuel quality

2200/0612 determined by estimation

2200/0614 . . . Actual fuel mass or fuel injection amount

2200/0616 determined by estimation

2200/0618 . . . Actual fuel injection timing or delay, e.g. determined from fuel pressure drop

2200/0625 . . . Fuel consumption, e.g. measured in fuel liters per 100 kms or miles per gallon

2200/063 . . . Lift of the valve needle

2200/08 . . Exhaust gas treatment apparatus parameters

2200/0802 . . . Temperature of the exhaust gas treatment apparatus

2200/0804 Estimation of the temperature of the exhaust gas treatment apparatus

2200/0806 . . . NOx storage amount, i.e. amount of NOx stored on NOx trap

2200/0808 . . . NOx storage capacity, i.e. maximum amount of NOx that can be stored on NOx trap

2200/0811 . . . NOx storage efficiency

2200/0812 . . . Particle filter loading

2200/0814 . . . Oxygen storage amount

2200/0816 . . . Oxygen storage capacity

2200/0818 . . . SOx storage amount, e.g. for SOx trap or NOx trap

2200/10 . . Parameters related to the engine output, e.g. engine torque or engine speed

2200/1002 . . . Output torque

2200/1004 Estimation of the output torque

2200/1006 . . . Engine torque losses, e.g. friction or pumping losses or losses caused by external loads of accessories

2200/101 . . . Engine speed

2200/1012 . . . Engine speed gradient

2200/1015 . . . Engines misfires

2200/50 . said parameters being related to the vehicle or its components

2200/501 . . Vehicle speed

2200/502 . . Neutral gear position

2200/503 . . Battery correction, i.e. corrections as a function of the state of the battery, its output or its type

2200/60 . said parameters being related to the driver demands or status

2200/602 . . Pedal position

2200/604 . . Engine control mode selected by driver, e.g. to manually start particle filter regeneration or to select driving style

2200/606 . . Driving style, e.g. sporty or economic driving

2200/70 . said parameters being related to the vehicle exterior

2200/701 . . Information about vehicle position, e.g. from navigation system or GPS signal

2200/702 . . Road conditions

2200/703 . . Atmospheric pressure

2200/704 . . . Estimation of atmospheric pressure

Controlling, e.g. regulating, fuel injection (peculiar to engines characterised by their use of non-liquid fuels, pluralities of fuels, or non-fuel substances added to the combustible mixtures F02D 19/00; peculiar to supercharged engines F02D 23/00; automatic controllers for prime movers, in general G05D)

2250/00 **Engine control related to specific problems or objectives**

2250/02 . Fuel evaporation in fuel rails, e.g. in common rails

2250/04 . Fuel pressure pulsation in common rails

2250/06 . Reverse rotation of engine

2250/08 . Engine blow-by from crankcase chamber

2250/11 . Oil dilution, i.e. prevention thereof or special controls according thereto

2250/12 . Timing of calculation, i.e. specific timing aspects when calculation or updating of engine parameter is performed

2250/14 . Timing of measurement, e.g. synchronisation of measurements to the engine cycle

2250/16 . End position calibration, i.e. calculation or measurement of actuator end positions, e.g. for throttle or its driving actuator

2250/18 . Control of the engine output torque

2250/21 . . during a transition between engine operation modes or states

2250/22 . . by keeping a torque reserve, i.e. with temporarily reduced drive train or engine efficiency

2250/24 . . by using an external load, e.g. a generator

2250/26 . . by applying a torque limit

2250/28 . Control for reducing torsional vibrations, e.g. at acceleration

2250/31 . Control of the fuel pressure

2250/32 . Air-fuel ratio control in a diesel engine

2250/34 . Control of exhaust back pressure, e.g. for turbocharged engines

2250/36 . Control for minimising NOx emissions

2250/38 . Control for minimising smoke emissions, e.g. by applying smoke limitations on the fuel injection amount

- 2250/41 . . . Control to generate negative pressure in the intake manifold, e.g. for fuel vapor purging or brake booster
- 2400/00 Control systems adapted for specific engine types; Special features of engine control systems not otherwise provided for; Power supply, connectors or cabling for engine control systems**
- 2400/02 . . . Four-stroke combustion engines with electronic control
- 2400/04 . . . Two-stroke combustion engines with electronic control
- 2400/06 . . . Small engines with electronic control, e.g. for hand held tools
- 2400/08 . . . Redundant elements, e.g. two sensors for measuring the same parameter
- 2400/11 . . . After-sales modification devices designed to be used to modify an engine afterwards
- 2400/12 . . . Engine control specially adapted for a transmission comprising a torque converter or for continuously variable transmissions
- 2400/14 . . . Power supply for engine control systems
- 2400/16 . . . Adaptation of engine control systems to a different battery voltages, e.g. for using high voltage batteries
- 2400/18 . . . Packaging of the electronic circuit in a casing
- 2400/21 . . . Engine cover with integrated cabling
- 2400/22 . . . Connectors or cables specially adapted for engine management applications
- 2700/00 Mechanical control of speed or power of a single cylinder piston engine**
- 2700/02 . . . Controlling by changing the air or fuel supply
- 2700/0202 . . . for engines working with gaseous fuel, including those working with an ignition liquid
- 2700/0205 . . . Controlling the air supply as well as the fuel supply
- 2700/0207 . . . Controlling the air or mixture supply
- 2700/021 Engines without compressor
- 2700/0212 Engines with compressor
- 2700/0215 . . . Controlling the fuel supply
- 2700/0217 . . . for mixture compressing engines using liquid fuel
- 2700/022 . . . Controlling the air or the mixture supply as well as the fuel supply
- 2700/0223 Engines with fuel injection
- 2700/0225 . . . Control of air or mixture supply
- 2700/0228 Engines without compressor
- 2700/023 by means of one throttle device
- 2700/0233 depending on several parameters
- 2700/0235 depending on the pressure of a gaseous or liquid medium
- 2700/0238 depending on the number of revolutions of a centrifugal governor
- 2700/0241 depending on another parameter
- 2700/0243 by means of a plurality of throttle devices
- 2700/0246 for engines with compressor
- 2700/0248 by means of throttle devices
- 2700/0251 in the intake conduit
- 2700/0253 in the outlet conduit
- 2700/0256 by changing the speed of the compressor
- 2700/0258 by other means
- 2700/0261 . . . Control of the fuel supply
- 2700/0264 for engines with a fuel jet working with depression
- 2700/0266 for engines with fuel injection
- 2700/0269 . . . for air compressing engines with compression ignition
- 2700/0271 Controlling the air supply as well as the fuel supply
- 2700/0274 Controlling the air supply
- 2700/0276 Engines without compressor
- 2700/0279 Engines with compressor
- 2700/0282 Control of fuel supply
- 2700/0284 by acting on the fuel pump control element
- 2700/0287 depending on several parameters
- 2700/0289 depending on the pressure of a gaseous or liquid medium
- 2700/0292 depending on the speed of a centrifugal governor
- 2700/0294 depending on another parameter
- 2700/0297 by control means in the fuel conduit between pump and injector
- 2700/03 . . . Controlling by changing the compression ratio
- 2700/035 . . . without modifying the volume of the compression space, e.g. by changing the valve timing
- 2700/04 . . . Controlling by throttling the exhaust conduit
- 2700/05 . . . Controlling by preventing combustion in one or more cylinders
- 2700/052 . . . Methods thereof
- 2700/054 by keeping the exhaust valves open
- 2700/056 by interrupting the medium supply
- 2700/058 by another method
- 2700/07 . . . Automatic control systems according to one of the preceding groups in combination with control of the mechanism receiving the engine power
- 2700/09 . . . Other ways of controlling
- 2700/10 . . . Control of the timing of the fuel supply period with relation to the piston movement