

**ECLA****EUROPEAN CLASSIFICATION****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) [M1204]

**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.

**Guide heading:**

**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 F02D19/00; peculiar to supercharged engines F02D23/00; automatic controllers for prime movers, in general G05D)

**F02D1/00**

**Controlling fuel-injection pumps, e.g. of high pressure injection type** (F02D3/00 takes precedence; controlling fuel-injection electrically F02D41/30) [N: pumping elements on fuel pressure acting for varying fuel delivery in quantity or timing F02M] [M1204]

**[N: Note**

- in this subclass the following indexing codes are used:

R02D700/02D5 and R02D700/10

**]**

**F02D1/02**

- . not restricted to adjustment of injection timing, e.g. varying amount of fuel delivered

**F02D1/02B**

- . . [N: by means dependent on engine working temperature (F02D1/08 takes precedence)]

**F02D1/04**

- . . [N: by mechanical means dependent on engine speed, e.g. using centrifugal governors (F02D1/08 takes precedence)]

**F02D1/04B**

- . . . [N: characterised by arrangement of springs or weights]

**F02D1/06**

- . . by means dependent on pressure of engine working fluid (F02D1/08 takes precedence)

**F02D1/06B**

- . . . [N: of intake of air]

**F02D1/08**

- . . Transmission of control impulse to pump control, e.g. with power drive or power

- assistance
  - F02D1/10 . . . mechanical
  - F02D1/12 . . . non-mechanical, e.g. hydraulic
  - F02D1/12B . . . . [N: control impulse depending only on engine speed]
  - F02D1/12B2 . . . . . [N: using a centrifugal governor]
  - F02D1/12B4 . . . . . [N: using the pressure developed in a pump]
  - F02D1/14 . . . . pneumatic
- F02D1/16 . Adjustment of injection timing ([F02D1/02 takes precedence](#)) [N: rotary distributor pumps [F02M41/00](#); by adjustment of pumping elements [F02M59/20](#)]
- F02D1/16B . . [N: by mechanical means dependent on engine speed for angular adjustment of driving and driven shafts]
- F02D1/18 . . [N: with non-mechanical means for transmitting control impulse; with amplification of control impulse]
- F02D1/18B . . . [N: hydraulic]
- F02D3/00** **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 F02D41/30; [N: controlling the feeding of liquid fuel from storage containers to carburettors or fuel-injection apparatus F02D33/00B;] carburettors F02M) [C0707]**

**Note**  
When the control apparatus or system forms part of the low-pressure fuel-injection apparatus it is classified in group [F02M69/00](#).

  - F02D3/02 . with continuous injection or continuous flow upstream of the injection nozzle
  - F02D3/04 . Controlling fuel-injection and carburation, e.g. of alternative systems
- F02D7/00** **Other fuel-injection control**
  - F02D7/00B . [N: Throttling of fuel passages between pumps and injectors or overflow passages (low-pressure fuel injection [F02M69/00](#))]
  - F02D7/00B2 . . [N: by mechanical means, e.g. using a centrifugal governor]
  - F02D7/00B3 . . [N: by fluid actuated means, e.g. slide valves]
  - F02D7/02 . Controlling fuel injection where fuel is injected by compressed air
- F02D9/00** **Controlling engines by throttling air or fuel-and-air induction conduits or exhaust conduits [M1204]**

[N: **Note**  
- in this group the following indexing codes are used: [R02D700/00](#), [R02D700/02](#), [R02D700/04](#), [R02D700/09](#)  
]

  - F02D9/02 . concerning induction conduits (throttle valves, or arrangements thereof in conduits

[F02D9/08](#)

- [F02D9/04](#) . concerning exhaust conduits ([throttle valves, or arrangements thereof in conduits F02D9/08](#))
- [F02D9/06](#) . . Exhaust brakes
- [F02D9/08](#) . Throttle valves specially adapted therefor; Arrangements of such valves in conduits ([throttle valves modified for use in or arranged in carburettors F02M](#); [throttle valves in general F16K](#))
- [F02D9/10](#) . . having pivotally-mounted flaps
- [F02D9/10F](#) . . . [\[N: Details of the flap\] \[N0404\]](#)
- [F02D9/10F2](#) . . . . [\[N: Special flap shapes, ribs, bores or the like\] \[N0404\]](#)
- [F02D9/10F2E](#) . . . . . [\[N: Details of the edge of the flap, e.g. for lowering flow noise or improving flow sealing in closed flap position\] \[N0404\]](#)
- [F02D9/10F4](#) . . . . [\[N: the flap having movable parts fixed onto it\] \[N0404\]](#)
- [F02D9/10F6](#) . . . . [\[N: the rotation axis of the flap being off-set from the flap center axis\] \[N0404\]](#)
- [F02D9/10F6E](#) . . . . . [\[N: the rotation axis being located at an edge \] \[N0404\]](#)
- [F02D9/10H](#) . . . [\[N: Details of the valve housing\] \[N0404\]](#)
- [F02D9/10H2](#) . . . . [\[N: Shaping of the flow path in the vicinity of the flap, e.g. having inserts in the housing\] \[N0404\]](#)
- [F02D9/10H2S](#) . . . . . [\[N: for sealing of the flow in closed flap position, e.g. the housing forming a valve seat\] \[N0404\]](#)
- [F02D9/10H4](#) . . . . [\[N: having a throttle position sensor \(\[detection of actuation F02D11/10D\]\(#\)\)\] \[N0404\]](#)
- [F02D9/10H6](#) . . . . [\[N: having a fluid by-pass\] \[N0404\]](#)
- [F02D9/10H8](#) . . . . [\[N: Sealing of the valve shaft in the housing, e.g. details of the bearings\] \[N0404\]](#)
- [F02D9/10L](#) . . . [\[N: Mechanical control linkage between an actuator and the flap, e.g. including levers, gears, springs, clutches, limit stops of the like\] \[N0404\]](#)
- [F02D9/10M](#) . . . [\[N: Manufacturing or mounting details\] \[N0404\]](#)
- [F02D9/10P](#) . . . [\[N: Materials, e.g. composites\] \[N0404\]](#)
- [F02D9/10P2](#) . . . . [\[N: Plastics\] \[N0404\]](#)
- [F02D9/10P4](#) . . . . [\[N: Non-organic materials, e.g. metals, alloys, ceramics\] \[N0404\]](#)
- [F02D9/10T](#) . . . [\[N: having two or more flaps\] \[N0404\]](#)
- [F02D9/10T2](#) . . . . [\[N: Rotating on a common axis, e.g. having a common shaft\] \[N0404\]](#)
- [F02D9/12](#) . . having slidably-mounted valve members; having valve members movable longitudinally of conduit
- [F02D9/14](#) . . . the members being slidable transversely of conduit
- [F02D9/16](#) . . . the members being rotatable
- [F02D9/18](#) . . having elastic-wall valve members

[F02D11/00](#)

**Arrangements for, or adaptations to, non-automatic engine control initiation means, e.g. operator initiated (specially for reversing F02D27/00; arrangement or mounting of prime-mover control devices in vehicles B60K26/00) [0610]**

- [F02D11/02](#) . characterised by hand, foot, or like operator controlled initiation means

- F02D11/04
  - characterised by mechanical control linkages ([with power drive or assistance F02D11/06](#))
- F02D11/06
  - characterised by non-mechanical control linkages, e.g. fluid control linkages or by control linkages with power drive or assistance
- F02D11/08
  - . . of the pneumatic type
- F02D11/10
  - . . of the electric type
- F02D11/10B
  - . . . [N: 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] [\[N1204\]](#)
- F02D11/10D
  - . . . [\[N: Detection of demand or actuation\]](#)
- F02D11/10F
  - . . . [\[N: Safety-related aspects\]](#)
  
- F02D13/00**
**Controlling the engine output power by varying inlet or exhaust valve operating characteristics, e.g. timing ([modifying valve gear F01L](#))**
- F02D13/02
  - during engine operation
- F02D13/02A
  - . . [N: Variable control of intake and exhaust valves] [\[N0609\]](#)
- F02D13/02A2
  - . . . [N: changing valve lift or valve lift and timing] [\[N0609\]](#)
- F02D13/02A2F
  - . . . . [N: the change of valve timing is caused by the change in valve lift, i.e. both valve lift and timing are functionally related] [\[N0609\]](#)
- F02D13/02A4
  - . . . [N: changing the valve timing only] [\[N0609\]](#)
- F02D13/02A4P
  - . . . . [N: by shifting the phase, i.e. the opening periods of the valves are constant] [\[N0609\]](#)
- F02D13/02C
  - . . [N: Variable control of the intake valves only] [\[N0609\]](#)
- F02D13/02C2
  - . . . [N: changing valve lift or valve lift and timing] [\[N0609\]](#)
- F02D13/02C2F
  - . . . . [N: the change of valve timing is caused by the change in valve lift, i.e. both valve lift and timing are functionally related] [\[N0609\]](#)
- F02D13/02C4
  - . . . [N: changing the valve timing only] [\[N0609\]](#)
- F02D13/02C4P
  - . . . . [N: by shifting the phase, i.e. the opening periods of the valves are constant] [\[N0609\]](#)
- F02D13/02E
  - . . [N: Variable control of the exhaust valves only] [\[N0609\]](#)
- F02D13/02E2
  - . . . [N: changing valve lift or valve lift and timing] [\[N0609\]](#)
- F02D13/02E4
  - . . . [N: changing the valve timing only] [\[N0609\]](#)
- F02D13/02H
  - . . [N: Fully variable control of valve lift and timing using camless actuation systems such as hydraulic, pneumatic or electromagnetic actuators, e.g. solenoid valves] [\[N0609\]](#)
- F02D13/02K
  - . . [N: 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] [\[N0609\]](#)
- F02D13/02L
  - . . [N: Controlling the valve overlap] [\[N0609\]](#)
- F02D13/02L2
  - . . . [N: Negative valve overlap for temporarily storing residual gas in the cylinder] [\[N0609\]](#)
- F02D13/02M
  - . . [N: Controlling the valves to perform a Miller-Atkinson cycle] [\[N0609\]](#)
- F02D13/02N
  - . . [N: Multiple actuations of a valve within an engine cycle] [\[N0609\]](#)
- F02D13/02P
  - . . [N: Actuation of an additional valve for a special application, e.g. for decompression, exhaust gas recirculation or cylinder scavenging] [\[N0609\]](#)

- F02D13/02R . . [N: for two-stroke engines] [N0609]
- F02D13/02R2 . . . [N: Variable control of exhaust valves only] [N0609]
- F02D13/04 . . Using engine as brake
- F02D13/06 . . Cutting-out cylinders
- F02D13/08 . for rendering engine inoperative or idling
- F02D15/00 Varying compression ratio (modifying valve gear F01L) [M1204]**
  - [N: **Note**
  - in this group the following indexing codes are used:
  - [R02D700/03](#)
  - ]
- F02D15/02 . by alteration or displacement of piston stroke
- F02D15/04 . by alteration of volume of compression space without changing piston stroke
- F02D17/00 Controlling engines by cutting out individual cylinders; Rendering engines inoperative or idling (controlling or rendering inoperative by varying inlet or exhaust valve operating characteristics F02D13/00) [M1204]**
  - [N: **Note**
  - in this group the following indexing codes are used:
  - [R02D700/05](#)
  - ]
- F02D17/02 . Cutting-out (cutting-out engines in multiple engine arrangements [F02D25/04](#))
- F02D17/02A . . [N: the inactive cylinders acting as compressor other than for pumping air into the exhaust system]
- F02D17/02A1 . . . [N: delivering compressed fluid, e.g. air, reformed gas, to the active cylinders other than during starting]
- F02D17/04 . rendering engines inoperative or idling, e.g. caused by abnormal conditions (dependent on lubricating conditions [F01M1/22](#); dependent on cooling [F01P5/14](#))
- Guide heading: Controlling peculiar to specified types or adaptations of engines**
- F02D19/00 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 F02D21/00)**
  - F02D19/02 . peculiar to engines working with gaseous fuels (apparatus, or control parts thereof, for mixing gas and air [F02M](#))
  - F02D19/02C . . [N: Control of components of the fuel supply system] [N1202]
  - F02D19/02C2 . . . [N: to adjust the fuel pressure, temperature or composition] [N1202]
  - F02D19/02C4 . . . [N: to adjust the fuel mass or volume flow] [N1202]
  - F02D19/02C4F . . . . [N: by controlling fuel injectors] [N1202]
  - F02D19/02D . . [N: Failure diagnosis or prevention; Safety measures; Testing] [N1202]

F02D19/02E	. . [N: Measuring or estimating parameters related to the fuel supply system] [N1202]
F02D19/02E2	. . . [N: Determining the fuel pressure, temperature or volume flow, the fuel tank fill level or a valve position] [N1202]
F02D19/02E2E	. . . . [N: by estimation, i.e. without using direct measured parameter of a corresponding sensor] [N1202]
F02D19/02E4	. . . [N: Determining density, viscosity, concentration or composition] [N1202]
F02D19/04	. peculiar to engines working with solid fuels, e.g. pulverised coal
F02D19/06	. 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
F02D19/06C	. . [N: Control of components of the fuel supply system] [N1204]
F02D19/06C2	. . . [N: to adjust the fuel pressure or temperature] [N1204]
F02D19/06C4	. . . [N: to adjust the fuel mass or volume flow] [N1204]
F02D19/06C4F	. . . . [N: by controlling fuel injectors] [N1204]
F02D19/06C6	. . . [N: Switch-over from one fuel to another (F02D19/08C takes precedence)] [N1204]
F02D19/06C6D	. . . . [N: being initiated by automatic means, e.g. based on engine or vehicle operating conditions] [N1204]
F02D19/06C6L	. . . . [N: depending on the engine's or vehicle's position, e.g. on/off road or proximity to a harbor] [N1204]
F02D19/06C6P	. . . . [N: Purging of the fuel system] [N1204]
F02D19/06D	. . [N: Failure diagnosis or prevention; Safety measures; Testing] [N1204]
F02D19/06E	. . [N: Measuring or estimating parameters related to the fuel supply system] [N1204]
F02D19/06E2	. . . [N: Determining the fuel pressure, temperature or flow, the fuel tank fill level or a valve position] [N1204]
F02D19/06E2E	. . . . [N: by estimation, i.e. without using direct measurements of a corresponding sensor] [N1204]
F02D19/06E4	. . . [N: Determining a density, viscosity, composition or concentration (F02D19/08P4D takes precedence)] [N1204]
F02D19/06E4E	. . . . [N: by estimation, i.e. without using direct measurements of a corresponding sensor] [N1204]
F02D19/06F	. . [N: characterised by the type of fuels] [N1204]
F02D19/06F2	. . . [N: at least one fuel being gaseous, the other fuels being gaseous or liquid at standard conditions] [N1204]
F02D19/06F2H	. . . . [N: the gaseous fuel being hydrogen, ammonia or carbon monoxide] [N1204]
F02D19/06F2L	. . . . [N: the gaseous fuel being liquefied petroleum gas (LPG), liquefied natural gas (LNG), compressed natural gas (CNG) or dimethyl ether (DME)] [N1204]
F02D19/06F4	. . . [N: Liquid fuels having different boiling temperatures, volatilities, densities, viscosities, cetane or octane numbers] [N1204]
F02D19/06F4B	. . . . [N: Biofuels, e.g. plant oils] [N1204]
F02D19/06F4B2	. . . . . [N: at least one fuel being an alcohol, e.g. ethanol (F02D19/08P2 takes precedence)] [N1204]
F02D19/06F4H	. . . . [N: Heavy or light fuel oils; Fuels characterised by their impurities such as sulfur content or differences in grade, e.g. for ships] [N1204]
F02D19/06R	. . [N: Retrofit of secondary fuel supply systems; Conversion of engines to operate on multiple fuels] [N1204]
F02D19/06S	. . [N: Details on the fuel supply system, e.g. tanks, valves, pipes, pumps, rails,

	ectors or mixers] [N1204]
F02D19/06S2	. . . [N: Tanks, e.g. multiple tanks] [N1204]
F02D19/06S4	. . . [N: Treating or cleaning means; Fuel filters] [N1204]
F02D19/06S4R	. . . . [N: Means to generate or modify a fuel, e.g. reformers, electrolytic cells or membranes] [N1204]
F02D19/06S6	. . . [N: Valves; Pressure or flow regulators; Mixers] [N1204]
F02D19/06S6M	. . . . [N: Multi-way valves; Switch-over valves] [N1204]
F02D19/06S6P	. . . . [N: Pressure or flow regulators therefor; Fuel metering valves therefor] [N1204]
F02D19/06S6S	. . . . [N: Shut-off valves; Check valves; Safety valves; Pressure relief valves] [N1204]
F02D19/06S8	. . . [N: High pressure fuel injection systems; Details on pumps, rails or the arrangement of valves in the fuel supply and return systems] [N1204]
F02D19/06S10	. . . [N: Injectors] [N1204]
F02D19/06S10D	. . . . [N: for in-cylinder direct injection] [N1204]
F02D19/06S10M	. . . . [N: Arrangement of multiple injectors per combustion chamber] [N1204]
F02D19/06S10S	. . . . [N: operating with a plurality of fuels] [N1204]
F02D19/06S12	. . . [N: Arrangement of fuel supply systems on engines or vehicle bodies; Components of the fuel supply system being combined with another device] [N1204]
F02D19/08	. . . simultaneously using pluralities of fuels ( <a href="#">F02D19/12</a> takes precedence)
F02D19/08C	. . . [N: Adjusting the fuel composition or mixing ratio; Transitioning from one fuel to the other] [N1204]
F02D19/08P	. . . [N: Premixed fuels, i.e. emulsions or blends] [N1204]
F02D19/08P2	. . . . [N: Blends of gasoline and alcohols, e.g. E85] [N1204]
F02D19/08P4	. . . . [N: Control based on the fuel type or composition] [N1204]
F02D19/08P4D	. . . . . [N: with determination of densities, viscosities, composition, concentration or mixture ratios of fuels] [N1204]
F02D19/08P4D2	. . . . . [N: by estimation, i.e. without using direct measurements of a corresponding sensor] [N1204]
F02D19/10	. . . peculiar to compression-ignition engines in which the main fuel is gaseous
F02D19/10L	. . . . [N: operating in a special mode, e. g. in a liquid fuel only mode for starting] [N1204]
F02D19/12	. . . peculiar to engines working with non-fuel substances or with anti-knock agents, e.g. with anti-knock fuel ( <a href="#">apparatus, or control parts thereof for delivering such substances or agents F02M</a> )
<b>F02D21/00</b>	<b>Controlling engines characterised by their being supplied with non-airborne oxygen or other non-fuel gas</b>
F02D21/02	. . . peculiar to oxygen-fed engines
F02D21/04	. . . with circulation of exhaust gases in closed or semi-closed circuits
F02D21/06	. . . peculiar to engines having other non-fuel gas added to combustion air
F02D21/08	. . . the other gas being the exhaust gas of engine ( <a href="#">circulation of exhaust gas in oxygen-fed engines F02D21/04</a> )



F02D21/10	<ul style="list-style-type: none"> <li>having secondary air added to the fuel-air mixture (apparatus, or control parts thereof, for delivering secondary air <a href="#">F02M</a>)</li> </ul>
<b>F02D23/00</b>	<b>Controlling engines characterised by their being supercharged</b>
F02D23/00A	<ul style="list-style-type: none"> <li>[N: with the supercharger being mechanically driven by the engine (supercharger drives <a href="#">F02B39/00</a>)]</li> </ul>
F02D23/02	<ul style="list-style-type: none"> <li>the engine being of fuel-injection type</li> </ul>
<b>F02D25/00</b>	<b>Controlling two or more co-operating engines</b>
F02D25/02	<ul style="list-style-type: none"> <li>to synchronise speed</li> </ul>
F02D25/04	<ul style="list-style-type: none"> <li>by cutting-out engines</li> </ul>
<b>F02D27/00</b>	<b>Controlling engines characterised by their being reversible</b>
F02D27/02	<ul style="list-style-type: none"> <li>by performing a programme</li> </ul>
<b>F02D28/00</b>	<b>Programme-control of engines</b> (programme-control specific to a type or purpose covered by one of the groups of this subclass except groups <a href="#">F02D29/00</a> , <a href="#">F02D39/00</a> , or by one group of another subclass e.g. <a href="#">F01L</a> , see that group; programme-control in general <a href="#">G05B19/00</a> )
<b>F02D29/00</b>	<p><b>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 [M1204]</b></p> <p>[N: <b>Note</b> - in this group the following indexing codes are used: <a href="#">R02D700/07</a> ]</p>
F02D29/02	<ul style="list-style-type: none"> <li>peculiar to engines driving vehicles; peculiar to engines driving variable pitch propellers</li> </ul>
F02D29/04	<ul style="list-style-type: none"> <li>peculiar to engines driving pumps</li> </ul>
F02D29/06	<ul style="list-style-type: none"> <li>peculiar to engines driving electric generators</li> </ul>
<b>Guide heading:</b>	<b><u>Other controlling of engines</u></b>
<b>F02D31/00</b>	<b>Use of speed-sensing governors to control combustion engines, not otherwise provided for</b>
F02D31/00B	<ul style="list-style-type: none"> <li>[N: Electric control of rotation speed]</li> </ul>
F02D31/00B2	<ul style="list-style-type: none"> <li>[N: controlling air supply]</li> </ul>
F02D31/00B2B	<ul style="list-style-type: none"> <li>[N: for idle speed control]</li> </ul>



- F02D31/00B2B2 . . . . [N: by controlling a throttle stop]
- F02D31/00B2B4 . . . . [N: by controlling a throttle by-pass]
- F02D31/00B2D . . . . [N: for maximum speed control]
- F02D31/00B4 . . . . [N: controlling fuel supply]
- F02D31/00B4B . . . . [N: for idle speed control]
- F02D31/00B4D . . . . [N: for maximum speed control]

**F02D33/00** **Controlling delivery of fuel or combustion-air, not otherwise provided for** [N: (using exhaust gas sensors [F02D35/00D2](#), [F02D35/00D4](#))]

- F02D33/00B . . . Controlling the feeding of liquid fuel from storage containers to carburettors or fuel-injection apparatus (control of electrical fuel pumps F02D41/30D, controlling fuel flow to a common rail F02D41/38C6B); Failure or leakage prevention; Diagnosis or detection of failure; Arrangement of sensors in the fuel system; Electric wiring; Electrostatic discharge] [N0707]
- F02D33/00B2 . . . [N: depending on engine operating conditions, e.g. start, stop or ambient conditions] [N0707]
- F02D33/02 . . . of combustion-air

**F02D35/00** **Controlling engines, dependent on conditions exterior or interior to engines, not otherwise provided for**

- F02D35/00B . . . [N: using electrical feedback ([F02D35/00D](#) takes precedence)]

**Note**

Attention is drawn to the note preceding [F02D41/00](#).

- F02D35/00D . . . [N: using exhaust gas sensors ([F02D41/14](#) takes precedence)]
- F02D35/00D2 . . . [N: Controlling air supply]
- F02D35/00D2B . . . . [N: by means of by-pass passages]
- F02D35/00D2D . . . . [N: by means of air pumps]
- F02D35/00D4 . . . [N: Controlling fuel supply]
- F02D35/00D4B . . . . [N: by means of a carburettor]
- F02D35/00D4B2 . . . . [N: Controlling the emulsifying air only ([F02D35/00D4B6](#), [F02D35/00D4B8](#) take precedence)]
- F02D35/00D4B4 . . . . [N: Controlling the fuel flow only ([F02D35/00D4B6](#), [F02D35/00D4B8](#) take precedence)]
- F02D35/00D4B6 . . . . [N: using variable venturi carburettors]
- F02D35/00D4B8 . . . . [N: using two barrel carburettors]
- F02D35/00D4D . . . . [N: by means of fuel injection]
- F02D35/02 . . . on interior conditions
- F02D35/02B . . . [N: using an ionic current sensor] [N0611]
- F02D35/02C . . . [N: using an optical sensor, e.g. in-cylinder light probe] [N1204]
- F02D35/02D . . . [N: by determining the cylinder pressure] [N1204]
- F02D35/02D2 . . . . [N: using an estimation] [N1204]

- F02D35/02F . . [N: by determining temperatures inside the cylinder, e.g. combustion temperatures] [N1204] [M1207]
- F02D35/02F2 . . . [N: using an estimation] [N1204]
- F02D35/02K . . [N using knock sensors] [N1204]
- F02D35/02T . . [N: by determining the combustion timing or phasing] [N1204]

## **F02D37/00 Controlling conjointly two or more functions of engines, not otherwise provided for**

- F02D37/02 . one of the functions being ignition (ignition control per se F02P, [N: automatically advancing or retarding ignition combined with electronic control of other engine functions, e.g. fuel injection F02P5/04C])

## **F02D39/00 Other non-electrical control**

- F02D39/02 . for four-stroke engines
- F02D39/04 . for engines with other cycles than four-stroke, e.g. two-stroke
- F02D39/06 . for engines adding the fuel substantially at the end of compression stroke
- F02D39/08 . for engines adding the fuel substantially before compression stroke
- F02D39/10 . for free-piston engines; for engines without rotary main shaft

## **Guide heading: Electrical control of combustion engines**

### **Notes**

1. Groups [F02D41/00](#) to [F02D45/00](#) cover electrical aspects of electrically controlled devices.
2. Groups [F02D41/00](#) to [F02D45/00](#) do not cover
  - non-electrical aspects of electrically controlled devices, which are covered by groups [F02D1/00](#) to [F02D39/00](#) or by subclass [F02M](#);
  - both electrical and non-electrical aspects of electrically controlled devices, which are covered by groups [F02D1/00](#) to [F02D39/00](#) or by subclass [F02M](#).

## **F02D41/00 Electrical control of supply of combustible mixture or its constituents ([F02D43/00](#) takes precedence)**

- F02D41/00D . [N: Controlling intake air][N0303]
- F02D41/00D2 . . [N: during deceleration] [N0303]
- F02D41/00D4 . . [N: for control of turbo-charged or super-charged engines (control of the pumps per se [F02B37/12](#))] [N0303]
- F02D41/00F . [N: Controlling engines characterised by use of non-liquid fuels, pluralities of fuels, or non-fuel substances added to the combustible mixtures][N0501]

- F02D41/00F2 . . [N: the fuel being gaseous (non-electrical control [F02D19/02](#))] [N0501]
- F02D41/00F4 . . [N: Adding fuel vapours, e.g. drawn from engine fuel reservoir] [N0501]
- F02D41/00F4B . . . [N: Controlling the purging of the canister as a function of the engine operating conditions] [N0501]
- F02D41/00F4B2 . . . . [N: to achieve a special effect, e.g. to warm up the catalyst] [N0501]
- F02D41/00F4B2B . . . . . [N: for diagnosing the engine (diagnosis of purge control systems [F02M25/08B](#))] [N0501]
- F02D41/00F4B4 . . . . [N: Control of the valve or purge actuator, e.g. duty cycle, closed loop control of position] [N0501]
- F02D41/00F4D . . . [N: 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] [N0501]
- F02D41/00F4E . . . [N: Estimating, calculating or determining the purging rate, amount, flow or concentration] [N0501]
- F02D41/00F6 . . [N: Controlling exhaust gas recirculation [EGR] (temperature control with cooler in recirculation circuit [F02M25/07P6T](#))] [N0501] [C1004]
- F02D41/00F6B . . . [N: according to engine operating conditions] [N1004]
- F02D41/00F6B2 . . . . [N: Feedback control of engine parameters, e.g. for control of air/fuel ratio or intake air amount] [N1004]
- F02D41/00F6B4 . . . . [N: Special engine operating conditions, e.g. for regeneration of exhaust gas treatment apparatus] [N1004]
- F02D41/00F6B6 . . . . [N: Specific combustion modes (combustion modes per se [F02D41/30C2](#))] [N1004]
- F02D41/00F6D . . . [N: using internal EGR (control of valve overlap for internal EGR [F02D13/02L](#); arrangements for internal EGR [F02M25/07R](#))] [N1004]
- F02D41/00F6D2 . . . . [N: Estimating, calculating or determining the internal EGR rate, amount or flow] [N1004]
- F02D41/00F6E . . . [N: Specific aspects of external EGR control (constructional details of EGR system [F02M25/07](#))] [N1004]
- F02D41/00F6E2 . . . . [N: Estimating, calculating or determining the EGR rate, amount or flow (sensors in EGR systems [F02M25/07S](#))] [N1004]
- F02D41/00F6V . . . [N: Control of the EGR valve or actuator, e.g. duty cycle, closed loop control of position (EGR valve position sensor [F02M25/07S6](#))] [N1004]
  
- F02D41/00H . . [N: Controlling each cylinder individually] [N0801]
- F02D41/00H2 . . [N: per groups or banks ([F02D41/00H6](#) takes precedence)] [N0801]
- F02D41/00H4 . . [N: Balancing of cylinder outputs, e.g. speed, torque or air-fuel ratio] [N0801]
- F02D41/00H6 . . [N: Selective cylinder activation, i.e. partial cylinder operation (deceleration cut-off [F02D41/12B](#))] [N0801]
  
- F02D41/00P . . using means for generating position or synchronisation signals [N1204]
  
- F02D41/00S . . using means for generating speed signals [N1204]
  
- F02D41/02 . . Circuit arrangements for generating control signals
- F02D41/02B . . [N: using an auxiliary engine speed control (engine speed control per se [F02D31/00](#))]
- F02D41/02C . . N: Introducing corrections for particular conditions exterior to the engine (conjoint control of vehicle sub-units for propelling the vehicle [B60W30/18](#)) [N9804] [C0902]

F02D41/02C2	. . .	[N: in relation with elements of the transmission] [N9804] [C0902]
F02D41/02C2C	. . . .	[N: in relation with the clutch status] [N0902]
F02D41/02C2G	. . . .	[N: in relation with the gear ratio or shift lever position] [N0902]
F02D41/02C2S	. . . .	[N: in relation with the gear ratio shifting (conjoint control for improving gear change B60W30/18M)] [N0902]
F02D41/02C4	. . .	[N: in relation with the state of the exhaust gas treating apparatus (control of exhaust gas treating apparatus per se F01N)] [N9804] [C0211]
F02D41/02C4B	. . . .	[N: to increase temperature of the exhaust gas treating apparatus] [N9804] [C0211]
F02D41/02C4B2	. . . . .	[N: by increasing temperature of the exhaust gas leaving the engine] [N0211]
F02D41/02C4B4	. . . . .	[N: by changing the composition of the exhaust gas, e.g. for exothermic reaction on exhaust gas treating apparatus] [N0211]
F02D41/02C4B6	. . . . .	[N: to accelerate the warming-up of the exhaust gas treating apparatus at engine start] [N0211]
F02D41/02C4D	. . . .	[N: to purge or regenerate the exhaust gas treating apparatus] [N9804] [C0211]
F02D41/02C4D1	. . . . .	[N: the exhaust gas treating apparatus being a NOx trap or adsorbent] [N9906] [C0211]
F02D41/02C4D1A	. . . . .	[N: Desulfurisation of NOx traps or adsorbent] [N9906] [C0211]
F02D41/02C4D3	. . . . .	[N: the exhaust gas treating apparatus being a SOx trap or adsorbent] [N9906] [C0211]
F02D41/02C4D5	. . . . .	[N: the exhaust gas treating apparatus being a particulate filter] [N0211]
F02D41/02C4F	. . . .	[N: Control according to the amount of oxygen that is stored on the exhaust gas treating apparatus] [N0211]
F02D41/04	. .	Introducing corrections for particular operating conditions (F02D41/14 takes precedence)
F02D41/04B	. . .	[N: for stopping the engine] [N0303]
F02D41/04D	. . .	[N: Detection of accelerating or decelerating state (detection thereof in general G01P)]
F02D41/04W	. . .	[N: Taking into account fuel evaporation or wall wetting; (special correction after fuel cut-off F02D41/12B2)]
F02D41/06	. . .	for engine starting or warming up [N: (F02D41/02C4B6 takes precedence)] [C0211]
F02D41/06B	. . . .	[N: the corrections being time dependent]
F02D41/06D	. . . .	[N: for starting (F02D41/06B takes precedence)] [C0211]
F02D41/06D2	. . . . .	[N: at cold start (F02D41/06D6 takes precedence)]
F02D41/06D4	. . . . .	[N: at hot start or restart (F02D41/06D6 takes precedence)]
F02D41/06D6	. . . . .	[N: with control of the choke (non electronic control of choke see F02M1/10)]
F02D41/06F	. . . .	[N: for warming-up]
F02D41/08	. . .	for idling (F02D41/06, F02D41/16 take precedence)
F02D41/08B	. . . .	[N: taking into account engine load variation, e.g air-conditionning]
F02D41/08C	. . . .	[N: taking into account the temperature of the engine]
F02D41/10	. . .	for acceleration
F02D41/10B	. . . .	[N: Switching from sequential injection to simultaneous injection]
F02D41/10D	. . . .	[N: using asynchronous injection]

F02D41/10F	. . . .	[N: and deceleration]
F02D41/12	. . .	for deceleration [N: ( <a href="#">F02D41/00D2</a> , <a href="#">F02D41/10F</a> take precedence)][C0303]
F02D41/12B	. . . .	[N: the fuel injection being cut-off]
F02D41/12B2	. . . . .	[N: transitionnal corrections at the end of the cut-off period]
F02D41/14	. .	Introducing closed-loop corrections
F02D41/14B	. . .	[N: characterised by the control or regulation method ( <a href="#">F02D41/14D5</a> , <a href="#">F02D41/14D7</a> take precedence)] [C0107]
F02D41/14B2	. . . .	[N: Adaptive control] [C0107]
F02D41/14B4	. . . .	[N: Sliding mode control] [C0107]
F02D41/14B6	. . . .	[N: Fuzzy logic control] [N0107]
F02D41/14B8	. . . .	[N: Neural network control] [N0107]
F02D41/14B10	. . . .	[N: with use of a optimisation method, e.g. iteration] [N0107]
F02D41/14B12	. . . .	[N: Dithering techniques] [N0107]
F02D41/14D	. . .	[N: using means for determining characteristics of the combustion gases; Sensors therefor] [N1204]
F02D41/14D1	. . . .	[N: characterised by the position of the sensor]
F02D41/14D1B	. . . . .	[N: Sensor in intake manifold]
F02D41/14D1D	. . . . .	[N: Plural sensors]
F02D41/14D1D2	. . . . .	[N: with one sensor per cylinder or group of cylinders]
F02D41/14D3	. . . .	[N: characterised by the characteristics of the combustion gases] [N1204]
F02D41/14D3A	. . . . .	[N: the characteristics being related to the exhaust flow] [N1204]
F02D41/14D3B	. . . . .	[N: the characteristics being exhaust temperatures] [N1204]
F02D41/14D3B2	. . . . .	[N: with determination means using an estimation] [N1204]
F02D41/14D3C	. . . . .	[N: the characteristics being an exhaust gas pressure] [N1204]
F02D41/14D3C2	. . . . .	[N: with determination means using an estimation] [N1206]
F02D41/14D3D	. . . . .	[N: the sensor being an optical sensor]
F02D41/14D3F	. . . . .	[N: the characteristics being a COx content or concentration] [N1204]
F02D41/14D3F2	. . . . .	[N: the characteristics being a CO content or concentration] [N1204]
F02D41/14D3H	. . . . .	[N: the characteristics being an oxygen content or concentration or the air-fuel ratio] [N1204]
F02D41/14D3H2	. . . . .	[N: with sensor resistivity varying with oxygen concentration (F02D41/14D3H4 takes precedence)] [N1204]
F02D41/14D3H4	. . . . .	[N: with sensor output signal being linear or quasi-linear with the concentration of oxygen] [N1204]
F02D41/14D3H6	. . . . .	[N: with determination means using an estimation] [N1204]
F02D41/14D3J	. . . . .	[N: the characteristics being a hydrocarbon content or concentration] [N1204]
F02D41/14D3L	. . . . .	[N: the characteristics being an NOx content or concentration] [N1204]
F02D41/14D3L2	. . . . .	[N: of the exhaust gases emitted by the engine] [N1204]
F02D41/14D3L2E	. . . . .	{7 dots} [N: with determination means using an estimation] [N1204]
F02D41/14D3L4	. . . . .	[N: of the exhaust gases downstream of exhaust gas treatment apparatus] [N1204]
F02D41/14D3L4E	. . . . .	{7 dots} [N: with determination means using an estimation] [N1204]
F02D41/14D3M	. . . . .	[N: the characteristics being a soot concentration or content] [N1204]

F02D41/14D3M2	. . . . .	[N: with determination means using an estimation] [N1204]
F02D41/14D5	. . . . .	[N: characterised by the regulation method]
F02D41/14D5B	. . . . .	[N: by detecting the commutation time of the sensor]
F02D41/14D5D	. . . . .	[N: Regulating the air fuel ratio at a value other than stoichiometry]
F02D41/14D5D2	. . . . .	[N: Biasing of the sensor]
F02D41/14D7	. . . . .	[N: characterised by the regulation circuit or part of it, (e.g. comparator, PI regulator, output)]
F02D41/14D7B	. . . . .	[N: Using a comparator with variable reference]
F02D41/14D7D	. . . . .	[N: Using a plurality of comparators]
F02D41/14D7F	. . . . .	[N: Using a delaying circuit]
F02D41/14D7H	. . . . .	[N: Integrator, i.e. variable slope]
F02D41/14D7J	. . . . .	[N: Proportional component]
F02D41/14D7L	. . . . .	[N: Output circuit]
F02D41/14D9	. . . . .	[N: with correction for particular operating conditions]
F02D41/14D9B	. . . . .	[N: Correcting the instantaneous control value]
F02D41/14D9D	. . . . .	[N: Inhibiting the regulation]
F02D41/14D9D2	. . . . .	[N: Replacing of the control value by a constant]
F02D41/14D9D4	. . . . .	[N: Replacing of the control value by an other parameter]
F02D41/14D9D6	. . . . .	[N: Replacing of the control value by a mean value]
F02D41/14D11	. . . . .	[N: Details]
F02D41/14D11B	. . . . .	[N: Control of sensor heater]
F02D41/14D11C	. . . . .	[N: Detection of abnormalities in the air/fuel ratio feedback system]
F02D41/14D11D	. . . . .	[N: Measurement of the conductivity of a sensor ( <a href="#">F02D41/14D3H2</a> takes precedence)]
F02D41/14F	. . . . .	[N: With detection of the mechanical response of the engine]
F02D41/14F2	. . . . .	[N: measuring engine roughness]
F02D41/16	. . . . .	for idling
F02D41/18	. . . . .	by measuring intake air flow ( <a href="#">measuring flow in general G01F</a> )
F02D41/18A	. . . . .	[N: for the control of a fuel injection device]
F02D41/18B	. . . . .	[N: using a vortex flow sensor]
F02D41/18D	. . . . .	[N: using a hot wire flow sensor]
F02D41/20	. . . . .	Output circuits, e.g. for controlling currents in command coils ( <a href="#">current control in inductive loads in general H03K17/64</a> )
F02D41/20P	. . . . .	[N: for controlling piezo-electric injectors ( <a href="#">drive and control circuit for piezo-electric devices in general H01L41/04B</a> )] [N0006]
F02D41/22	. . . . .	Safety or indicating devices for abnormal conditions [N: (in air/fuel ratio feedback systems F02D41/14D11C, in electric control linkage F02D11/10F, in purge control systems F02M25/08B)] [N9602] [C0611]
F02D41/22B	. . . . .	[N: relating to the failure of actuators or electrically driven elements] [N9602]
F02D41/22D	. . . . .	[N: relating to the failure of sensors or parameter detection devices] [N9602]
F02D41/24	. . . . .	characterised by the use of digital means
F02D41/24B	. . . . .	[N: using essentially up/down counters]

F02D41/24D	. .	[N: using essentially read only memories]
F02D41/24D2	. . .	[N: Addressing techniques specially adapted therefor]
F02D41/24D2B	. . . .	[N: One-parameter addressing technique]
F02D41/24D2D	. . . .	[N: Interpolation techniques]
F02D41/24D2F	. . . .	[N: Non-linear variation along at least one coordinate]
F02D41/24D2H	. . . .	[N: Selective use of one or more tables]
F02D41/24D4	. . .	[N: Particular ways of programming the data]
F02D41/24D4L	. . . .	[N: Methods of calibrating or learning] [N1206]
F02D41/24D4L2	. . . . .	[N: Methods of calibration] [N1206]
F02D41/24D4L2B	. . . . .	[N: characterised by the writing medium, e.g. bar code] [N1206]
F02D41/24D4L4	. . . . .	[N: Active learning methods] [N1206]
F02D41/24D4L8	. . . . .	[N: characterised by the learning conditions] [N1206]
F02D41/24D4L8B	. . . . .	[N: characterised by a plurality of learning conditions or ranges] [N1206]
F02D41/24D4L8D	. . . . .	[N: Prohibition of learning] [N1206]
F02D41/24D4L10	. . . . .	[N: characterised by what is learned or calibrated] [N1206]
F02D41/24D4L10B	. . . . .	[N: Learning of the air-fuel ratio control] [N1206]
F02D41/24D4L10B2	. . . . .	{7 dots} [N: with an additional dither signal] [N1206]
F02D41/24D4L10B4	. . . . .	{7 dots} [N: by learning a value and then controlling another value] [N1206]
F02D41/24D4L10D	. . . . .	[N: Characteristics of actuators] [N1206]
F02D41/24D4L10D2	. . . . .	{7 dots} [N: for injectors] [N1206]
F02D41/24D4L10D2B	. . . . .	{8 dots} [N: Behaviour for small quantities] [N1206]
F02D41/24D4L10F	. . . . .	[N: Characteristics of sensors] [N1206]
F02D41/24D4L12	. . . . .	[N: characterised by the method used for learning] [N1206]
F02D41/24D4L12B	. . . . .	[N: using a plurality of learned values] [N1206]
F02D41/24D4L12D	. . . . .	[N: restricting learned values] [N1206]
F02D41/24D4R	. . . .	[N: Methods for rewriting] [N1206]
F02D41/24D4R2	. . . . .	[N: Methods for preventing the loss of data] [N1206]
F02D41/24D4R6	. . . . .	[N: Resetting of data to a predefined set of values] [N1206]
F02D41/24D6	. . .	[N: the memory being part of a closed loop]
F02D41/26	. .	using computer, e.g. microprocessor
F02D41/26B	. . .	[N: the program execution being modifiable by physical parameters]
F02D41/26D	. . .	[N: the computer being backed-up or assisted by another circuit, e.g. analogue]
F02D41/28	. . .	Interface circuits [N1204]
F02D41/30	. .	[N: Controlling fuel injection ([N: <a href="#">F02D41/18A</a> ,] <a href="#">F02D41/24</a> take precedence)]
F02D41/30B	. .	[N: Details not otherwise provided for]
F02D41/30C	. .	[N: according to or using specific or several modes of combustion] [N9903] [C0503]
F02D41/30C2	. . .	[N: characterised by the mode(s) being used] [N0503]
F02D41/30C2B	. . . .	[N: a mode being the stratified charge spark-ignited mode] [N0503]
F02D41/30C2B2	. . . . .	[N: further comprising a homogeneous charge spark-ignited mode] [N0503]



F02D41/30C2D	. . . .	[N: a mode being the premixed charge compression-ignition mode] [N0503]
F02D41/30C2D2	. . . . .	[N: with means for triggering compression ignition, e.g. spark plug] [N0503]
F02D41/30C2D2B	. . . . .	[N: said means being a secondary injection of fuel] [N0503]
F02D41/30C2H	. . . .	[N: the engine working with a variable number of cycles] [N0503]
F02D41/30C4	. . .	[N: with special control during transition between modes] [N0503]
F02D41/30C4B	. . . .	[N: to avoid torque shocks] [N0503]
F02D41/30C6	. . .	[N: with special conditions for selecting a mode of combustion, e.g. for starting, for diagnosing] [N0503]
F02D41/30D	. .	[N: Control of electrical fuel pumps]
F02D41/30M	. .	[N: the fuel injection being effected by at least two different injectors, e.g. one in the intake manifold and one in the cylinder] [N1204]
F02D41/32	. .	of the low pressure type [N: ( <a href="#">F02D41/30D</a> takes precedence)]
F02D41/34	. . .	with means for controlling injection timing or duration ( <a href="#">ignition timing F02P5/00</a> )
F02D41/34B	. . . .	[N: Controlling injection timing ( <a href="#">F02D41/36B</a> takes precedence)]
F02D41/36	. . .	with means for controlling distribution ( <a href="#">arrangement of ignition distributors F02P7/00</a> )
F02D41/36B	. . . .	[N: with means for controlling timing and distribution]
F02D41/38	. .	of the high pressure type
F02D41/38C	. . .	[N: Common rail control systems ( <a href="#">common rail apparatus F02M55/02B</a> , <a href="#">F02M63/02C</a> )] [N9902]
F02D41/38C2	. . . .	[N: for petrol engines] [N9902]
F02D41/38C4	. . . .	[N: for diesel engines] [N9902]
F02D41/38C6	. . . .	[N: Controlling the fuel pressure] [N0209]
F02D41/38C6B	. . . . .	[N: by controlling the flow into the common rail, e.g. the amount of fuel pumped] [N0611]
F02D41/38C6B2	. . . . .	[N: with elements in the low pressure part, e.g. low pressure pump] [N0611]
F02D41/38C6D	. . . . .	[N: by controlling the flow out of the common rail, e.g. using pressure relief valves] [N0611]
F02D41/38C6D2	. . . . .	[N: characterised by leakage flow in injectors] [N0611]
F02D41/40	. . .	with means for controlling injection timing or duration
F02D41/40B	. . . .	[N: Controlling injection timing ( <a href="#">F02D41/40D</a> takes precedence)] [C9902]
F02D41/40D	. . . .	[N: Multiple injections] [N9902]
F02D41/40D2	. . . . .	[N: with pilot injections] [N9902]
F02D41/40D4	. . . . .	[N: with post injections] [N9903]
F02D41/40P	. . . .	[N: Electrically controlling a diesel injection pump ( <a href="#">F02D41/40B</a> takes precedence)] [N9902]
F02D41/40P2	. . . . .	[N: of the in-line type] [N9902]
F02D41/40P4	. . . . .	[N: of the distributing type] [N9902]
<b>F02D43/00</b>		<b>Conjoint electrical control of two or more functions, e.g. ignition, fuel-air mixture, recirculation, supercharging, exhaust-gas treatment (<a href="#">electrical control of exhaust gas treating apparatus per se F01N9/00</a>)</b>
F02D43/02	. .	using only analogue means

F02D43/04

- . using only digital means

F02D45/00

**Electrical control not provided for in groups [F02D41/00](#) to [F02D43/00](#)** (electrical control of exhaust gas treating apparatus [F01N9/00](#); electrical control of one of the functions; ignition, lubricating, cooling, starting, intake-heating, see relevant subclasses for such functions)