

**CPC****COOPERATIVE PATENT CLASSIFICATION****F01P**

**COOLING OF MACHINES OR ENGINES IN GENERAL; COOLING OF INTERNAL-COMBUSTION ENGINES** (arrangements in connection with cooling of propulsion units in vehicles [B60K 11/00](#); heat-transfer, heat-exchange or heat-storage materials [C09K 5/00](#); {cooling of gas-turbine engines [F02C 7/12](#)}; heat exchange in general, radiators [F28](#))

**NOTES**

1. In this subclass, the following terms or expressions are used with the meanings indicated:
  - "air" also includes other gaseous cooling fluids;
  - "liquid cooling" also includes cooling where liquid is used as the heat transferring fluid between parts to be cooled and the air, e.g. using radiators;
  - "air cooling" means direct air cooling and thus excludes indirect air cooling occurring in liquid cooling systems as explained herefore;
  - "cooling-air" includes directly or indirectly acting cooling-air.
2. Attention is drawn to the notes preceding class [F01](#), especially as regards Note (3).
3. Cooling by lubricant is classified in subclass [F01M](#) when the lubrication aspect predominates and in subclass [F01P](#) when the cooling aspect predominates.

**Air cooling; Liquid cooling** (propelling cooling-air or liquid coolants [F01P 5/00](#); controlling supply or circulation of coolants [F01P 7/00](#); cylinders, pistons, valves, fuel injectors, sparking-plugs, or other engine or machine parts, modified to facilitate cooling, see the relevant classes for such parts)

**F01P 1/00****Air cooling**

- [F01P 2001/005](#)
  - {Cooling engine rooms}
- [F01P 1/02](#)
  - Arrangements for cooling cylinders or cylinder heads, e.g. ducting cooling-air from its pressure source to cylinders or along cylinders
- [F01P 2001/023](#)
  - • {Cooling cylinders ([F01P 2003/022](#) takes precedence)}
- [F01P 2001/026](#)
  - • {Cooling cylinder heads ([F01P 2003/025](#) takes precedence)}
- [F01P 1/04](#)
  - Arrangements for cooling pistons
- [F01P 1/06](#)
  - Arrangements for cooling other engine or machine parts
- [F01P 1/08](#)
  - • for cooling intake or exhaust valves
- [F01P 1/10](#)
  - • for cooling fuel injectors or sparking-plugs

**F01P 3/00****Liquid cooling**

- [F01P 2003/001](#)
  - {Cooling liquid}
- [F01P 2003/003](#)
  - • {having boiling-point higher than 100°C}
- [F01P 2003/005](#)
  - {the liquid being fuel}
- [F01P 2003/006](#)
  - {the liquid being oil}
- [F01P 2003/008](#)
  - {the liquid being water and oil}

- F01P 3/02
  - Arrangements for cooling cylinders or cylinder heads
- F01P 2003/021
  - • {Cooling cylinders}
- F01P 2003/022
  - • • {combined with air cooling}
- F01P 2003/024
  - • {Cooling cylinder heads}
- F01P 2003/025
  - • • {combined with air cooling}
- F01P 2003/027
  - • {Cooling cylinders and cylinder heads in parallel}
- F01P 2003/028
  - • {Cooling cylinders and cylinder heads in series}
- F01P 3/04
  - • Liquid-to-air heat-exchangers combined with, or arranged on, cylinders or cylinder heads
- F01P 3/06
  - Arrangements for cooling pistons
- F01P 3/08
  - • Cooling of piston exterior only, e.g. by jets
- F01P 3/10
  - • Cooling by flow of coolant through pistons
- F01P 3/12
  - Arrangements for cooling other engine or machine parts
- F01P 3/14
  - • for cooling intake or exhaust valves
- F01P 3/16
  - • for cooling fuel injectors or sparking-plugs
- F01P 3/18
  - Arrangements or mounting of liquid-to-air heat-exchangers (such arrangements on cylinders or cylinder heads [F01P 3/04](#); relative to vehicles [B60K 11/04](#))
- F01P 2003/182
  - • {with multiple heat-exchangers}
- F01P 2003/185
  - • {arranged in parallel}
- F01P 2003/187
  - • {arranged in series}
- F01P 3/20
  - Cooling circuits not specific to a single part of engine or machine ([F01P 3/22](#) takes precedence)
- F01P 3/202
  - • {for outboard marine engines}
- F01P 3/205
  - • • {Flushing}
- F01P 3/207
  - • {liquid-to-liquid heat-exchanging relative to marine vessels}
- F01P 3/22
  - characterised by evaporation and condensation of coolant in closed cycles (other cooling by evaporation [F01P 9/02](#)); characterised by the coolant reaching higher temperatures than normal atmospheric boiling-point
- F01P 3/2207
  - • {characterised by the coolant reaching temperatures higher than the normal atmospheric boiling point}
- F01P 2003/2214
  - • {Condensers}
- F01P 2003/2221
  - • • {of the horizontal type}
- F01P 2003/2228
  - • • {of the upflow type}
- F01P 2003/2235
  - • • {of the downflow type}
- F01P 2003/2242
  - • • {Steam-to-steam condensers}
- F01P 2003/225
  - • • {Steam-to-liquid condensers}
- F01P 2003/2257
  - • • {Rotating condensers}
- F01P 2003/2264
  - • • {Separators}
- F01P 3/2271
  - • {Closed cycles with separator and liquid return}
- F01P 2003/2278
  - • {Heat pipes}
- F01P 3/2285
  - • {Closed cycles with condenser and feed pump}
- F01P 2003/2292
  - • {with thermostatically controlled by-pass}

**Pumping cooling-air or liquid coolants; Controlling circulation or supply of coolants****F01P 5/00****Pumping cooling-air or liquid coolants** (controlling circulation or supply of coolants by influencing drive of pumps [F01P 7/00](#))

- F01P 5/02 . Pumping cooling-air; Arrangements of cooling-air pumps, e.g. fans or blowers
- F01P 2005/025 . . {using two or more air pumps}
- F01P 5/04 . . Pump-driving arrangements
- F01P 5/043 . . . {Pump reversing arrangements}
- F01P 2005/046 . . . {with electrical pump drive}
- F01P 5/06 . . Guiding or ducting air to, or from, ducted fans
- F01P 5/08 . . Use of engine exhaust gases for pumping cooling-air
- F01P 5/10 . Pumping liquid coolant; Arrangements of coolant pumps
- F01P 2005/105 . . {Using two or more pumps}
- F01P 5/12 . . Pump-driving arrangements
- F01P 2005/125 . . . {Driving auxiliary pumps electrically}
- F01P 5/14 . Safety means against, or active at, failure of coolant-pump drives, e.g. shutting engine down; Means for indicating functioning of coolant pump

**F01P 7/00****Controlling of coolant flow**

- F01P 7/02 . the coolant being cooling-air
- F01P 7/023 . . {Cowlings for airplane engines}
- F01P 7/026 . . {Thermostatic control}
- F01P 7/04 . . by varying pump speed, e.g. by changing pump-drive gear ratio
- F01P 7/042 . . . {using fluid couplings (couplings or clutches of this type per se [F16D 35/00](#))}
- F01P 7/044 . . . {using hydraulic drives}
- F01P 7/046 . . . {using mechanical drives}
- F01P 7/048 . . . {using electrical drives}
- F01P 7/06 . . by varying blade pitch
- F01P 7/08 . . by cutting in or out of pumps
- F01P 7/081 . . . {using clutches, e.g. electro-magnetic or induction clutches}
- F01P 7/082 . . . . {using friction clutches}
- F01P 7/084 . . . . . {actuated electromagnetically}
- F01P 7/085 . . . . . {actuated by fluid pressure}
- F01P 7/087 . . . . . {actuated directly by deformation of a thermostatic device}
- F01P 7/088 . . . . . {actuated in response to driving speed, e.g. by centrifugal devices}
- F01P 7/10 . . by throttling amount of air flowing through liquid-to-air heat exchangers
- F01P 7/12 . . . by thermostatic control
- F01P 7/14 . the coolant being liquid
- F01P 2007/143 . . {using restrictions}

- F01P 2007/146 . . {using valves}
- F01P 7/16 . . by thermostatic control
- F01P 7/161 . . . {by bypassing pumps}
- F01P 7/162 . . . {by cutting in and out of pumps}
- F01P 7/164 . . . {by varying pump speed}
- F01P 7/165 . . . {characterised by systems with two or more loops}
- F01P 7/167 . . . {by adjusting the pre-set temperature according to engine parameters, e.g. engine load, engine speed}
- F01P 2007/168 . . . {By varying the cooling capacity of a liquid-to-air heat-exchanger}

**F01P 9/00** **Cooling having pertinent characteristics not provided for in, or of interest apart from, groups [F01P 1/00](#) to [F01P 7/00](#) (profiting from waste heat of combustion-engine cooling [F02G 5/00](#))**

- F01P 2009/005 . {Cooling with melting solids}
- F01P 9/02 . Cooling by evaporation, e.g. by spraying water on to cylinders ([evaporation and condensation of liquid coolant in closed cycles \[F01P 3/22\]\(#\); {evaporation or evaporation apparatus for physical or chemical purposes, e.g. evaporation of liquids for gas phase reactions \[B01B 1/005\]\(#\)}](#))
- F01P 9/04 . by simultaneous or alternative use of direct air-cooling and liquid cooling ([F01P 9/02](#) takes precedence)
- F01P 9/06 . by use of refrigerating apparatus, e.g. of compressor or absorber type

**F01P 11/00** **Component parts, details, or accessories not provided for in, or of interest apart from, groups [F01P 1/00](#) to [F01P 9/00](#)**

- F01P 11/02 . Liquid-coolant {filling}, overflow, venting, or draining devices ([automatic draining during freezing conditions \[F01P 11/20\]\(#\)](#))
- F01P 11/0204 . . {Filling}
- F01P 11/0209 . . . {Closure caps}
- F01P 11/0214 . . . . {Mounting}
- F01P 2011/0219 . . . . . {using bayonet connections}
- F01P 2011/0223 . . . . . {Decoration}
- F01P 2011/0228 . . . . . {Sealing}
- F01P 2011/0233 . . . . . {Venting}
- F01P 11/0238 . . . . {with overpressure valves or vent valves}
- F01P 2011/0242 . . . . . {setting the pressure valve}
- F01P 11/0247 . . . . {Safety; Locking against opening}
- F01P 2011/0252 . . . . . {Venting before opening}
- F01P 2011/0257 . . . . . {with theft preventing means}
- F01P 2011/0261 . . . . . {activated by temperature}
- F01P 2011/0266 . . . . . {activated by pressure}
- F01P 2011/0271 . . . . {Semi-permeable, e.g. using Gore-Tex c fibres}
- F01P 11/0276 . . {Draining or purging}
- F01P 11/028 . . {Deaeration devices}

F01P 11/0285	. . {Venting devices}
F01P 11/029	. . {Expansion reservoirs}
F01P 11/0295	. . {Condensers for radiators}
F01P 11/04	. Arrangements of liquid pipes or hoses
F01P 11/06	. Cleaning (in general <a href="#">B08B</a> ); Combating corrosion (in general <a href="#">C23F</a> )
F01P 2011/061	. . {Cleaning or combatting corrosion using filters}
F01P 2011/063	. . {Cleaning ( <a href="#">F01P 2011/061</a> takes precedence)}
F01P 2011/065	. . {Flushing}
F01P 2011/066	. . {Combating corrosion ( <a href="#">F01P 2011/061</a> takes precedence)}
F01P 2011/068	. . . {chemically}
F01P 11/08	. Arrangements of lubricant coolers (in lubrication apparatus <a href="#">F01M</a> )
F01P 11/10	. Guiding or ducting cooling-air, to, or from, liquid-to-air heat exchangers
F01P 11/12	. Filtering, cooling, or silencing cooling-air
F01P 11/14	. Indicating devices; Other safety devices
F01P 11/16	. . concerning coolant temperature ( <a href="#">F01P 11/20</a> takes precedence)
F01P 11/18	. . concerning coolant pressure, coolant flow, or liquid-coolant level
F01P 11/20	. . concerning atmospheric freezing conditions, e.g. automatically draining or heating during frosty weather
F01P 2011/205	. . {using heat-accumulators}

## **F01P 2023/00**      **Signal processing; Details thereof**

F01P 2023/08	. Microprocessor; Microcomputer
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**Air cooling; Liquid cooling** (propelling cooling-air or liquid coolants [F01P 5/00](#); controlling supply or circulation of coolants [F01P 7/00](#); cylinders, pistons, valves, fuel injectors, sparking-plugs, or other engine or machine parts, modified to facilitate cooling, see the relevant classes for such parts)

## **F01P 2025/00**      **Measuring**

F01P 2025/04	. Pressure
F01P 2025/06	. . for determining flow
F01P 2025/08	. Temperature
F01P 2025/12	. . Cabin temperature
F01P 2025/13	. . Ambient temperature
F01P 2025/30	. . Engine incoming fluid temperature
F01P 2025/31	. . Cylinder temperature
F01P 2025/32	. . Engine outgoing fluid temperature
F01P 2025/33	. . Cylinder head temperature
F01P 2025/34	. . Heat exchanger incoming fluid temperature
F01P 2025/36	. . Heat exchanger mixed fluid temperature
F01P 2025/40	. . Oil temperature
F01P 2025/42	. . Intake manifold temperature

- F01P 2025/44
  - . . . Outlet manifold temperature
- F01P 2025/46
  - . . . Engine parts temperature
- F01P 2025/48
  - . . . Engine room temperature
- F01P 2025/50
  - . . . using two or more temperature sensors
- F01P 2025/52
  - . . . Heat exchanger temperature
- F01P 2025/60
  - . . . Operating parameters
- F01P 2025/62
  - . . . Load
- F01P 2025/64
  - . . . Number of revolutions
- F01P 2025/66
  - . . . Vehicle speed
- F01P 2025/70
  - . . . Level
- F01P 2025/80
  - . . . Concentration anti-freeze

**F01P 2031/00****Fail safe**

- F01P 2031/16
  - . . . using melting materials
- F01P 2031/18
  - . . . Detecting fluid leaks
- F01P 2031/20
  - . . . Warning devices
- F01P 2031/22
  - . . . using warning lamps
- F01P 2031/24
  - . . . for freezing
- F01P 2031/30
  - . . . Cooling after the engine is stopped
- F01P 2031/32
  - . . . Deblocking of damaged thermostat
- F01P 2031/34
  - . . . Limping home
- F01P 2031/36
  - . . . Failure of coolant pump

**F01P 2037/00****Controlling**

- F01P 2037/02
  - . . . starting

**F01P 2050/00****Applications**

- F01P 2050/02
  - . . . Marine engines
- F01P 2050/04
  - . . . using direct cooling
- F01P 2050/06
  - . . . using liquid-to-liquid heat exchangers
- F01P 2050/08
  - . . . Engine room
- F01P 2050/10
  - . . . Z-type engine
- F01P 2050/12
  - . . . Outboard engine
- F01P 2050/16
  - . . . Motor-cycles
- F01P 2050/20
  - . . . Aircraft engines
- F01P 2050/22
  - . . . Motor-cars
- F01P 2050/24
  - . . . Hybrid vehicles
- F01P 2050/30
  - . . . Circuit boards

**F01P 2060/00****Cooling circuits using auxiliaries**

- F01P 2060/02
  - . . . Intercooler

- F01P 2060/04 . Lubricant cooler
- F01P 2060/045 . . for transmissions
- F01P 2060/06 . Retarder
- F01P 2060/08 . Cabin heater
- F01P 2060/10 . Fuel manifold
- F01P 2060/12 . Turbo charger
- F01P 2060/14 . Condenser
- F01P 2060/16 . Outlet manifold
- F01P 2060/18 . Heater
- F01P 2060/185 . . for alternators or generators

**F01P 2070/00****Details**

- F01P 2070/02 . using shape memory alloys
- F01P 2070/04 . using electrical heating elements
- F01P 2070/06 . Using intake pressure as actuating fluid
- F01P 2070/08 . Using lubricant pressure as actuating fluid
- F01P 2070/10 . using electrical or electromechanical means
- F01P 2070/30 . Rotating radiators
- F01P 2070/32 . Ring-shaped heat exchangers
- F01P 2070/50 . mounting fans to heat-exchangers
- F01P 2070/52 . mounting heat-exchangers