

**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](#))

**NOTE**

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.

Attention is drawn to the notes preceding class [F01](#), especially as regards Note (3).

Cooling by lubricant is classified in subclass [F01M](#) when the lubrication aspect predominates and in subclass [F01P](#) when the cooling aspect predominates.

**Guidance heading:** **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

<b>F01P 3/00</b>	<b>Liquid cooling</b>
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 ( <a href="#">such arrangements on cylinders or cylinder heads F01P 3/04; relative to vehicles B60K 11/04</a> )
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 ( <a href="#">F01P 3/22 takes precedence</a> )
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 ( <a href="#">other cooling by evaporation F01P 9/02</a> ); 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 }

**Guidance heading:** 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 B08B](#)); Combating corrosion ([in general C23F](#))
- F01P 2011/061    ..    { Cleaning or combatting corrosion using filters }
- F01P 2011/063    ..    { Cleaning ([F01P 2011/061 takes precedence](#))}
- F01P 2011/065    ..    { Flushing }
- F01P 2011/066    ..    { Combatting corrosion ([F01P 2011/061 takes precedence](#))}
- F01P 2011/068    ...    { chemically }
- F01P 11/08      .    Arrangements of lubricant coolers ([in lubrication apparatus F01M](#))
- 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 takes precedence</a> )
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	..	{ <a href="#">using heat-accumulators</a> }

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

F01P 2023/08	.	Microprocessor; Microcomputer
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**Guidance heading:** **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
<b>F01P 2031/00</b>	<b>Fail safe</b>
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
<b>F01P 2037/00</b>	<b>Controlling</b>
F01P 2037/02	. starting
<b>F01P 2050/00</b>	<b>Applications</b>
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