

**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 1/02**

- . Arrangements for cooling cylinders or cylinder heads, e.g. ducting cooling-air from its pressure source to cylinders or along cylinders

**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 3/02**

- . Arrangements for cooling cylinders or cylinder heads

**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 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 3/2271 . . . { [Closed cycles with separator and liquid return](#) }
- F01P 3/2285 . . . { [Closed cycles with condenser and feed pump](#) }

**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 5/04 . . . Pump-driving arrangements
- F01P 5/043 . . . { [Pump reversing arrangements](#) }
- 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 5/12 . . . Pump-driving arrangements
- 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 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 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 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 11/0238	.... { with overpressure valves or vent valves }
F01P 11/0247	.... { Safety; Locking against opening }
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 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
<b>F01P 2001/00</b>	<b>Air cooling</b>
F01P 2001/005	. Cooling engine rooms
F01P 2001/02	. 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 ( <a href="#">F01P 2003/022</a> takes precedence )
F01P 2001/026	.. Cooling cylinder heads ( <a href="#">F01P 2003/025</a> takes precedence )
<b>F01P 2003/00</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 2003/02	. Arrangements for cooling cylinders or cylinder heads
F01P 2003/021	.. Cooling cylinders

<a href="#">F01P 2003/022</a>	...	combined with air cooling
<a href="#">F01P 2003/024</a>	..	Cooling cylinder heads
<a href="#">F01P 2003/025</a>	...	combined with air cooling
<a href="#">F01P 2003/027</a>	..	Cooling cylinders and cylinder heads in parallel
<a href="#">F01P 2003/028</a>	..	Cooling cylinders and cylinder heads in series
<a href="#">F01P 2003/18</a>	.	Arrangements or mounting of liquid-to-air heat-exchangers ( <a href="#">such arrangements on cylinders or cylinder heads F01P 3/04</a> ; <a href="#">relative to vehicles B60K 11/04</a> )
<a href="#">F01P 2003/182</a>	..	with multiple heat-exchangers
<a href="#">F01P 2003/185</a>	..	arranged in parallel
<a href="#">F01P 2003/187</a>	..	arranged in series
<a href="#">F01P 2003/22</a>	.	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
<a href="#">F01P 2003/2214</a>	..	Condensers
<a href="#">F01P 2003/2221</a>	...	of the horizontal type
<a href="#">F01P 2003/2228</a>	...	of the upflow type
<a href="#">F01P 2003/2235</a>	...	of the downflow type
<a href="#">F01P 2003/2242</a>	...	Steam-to-steam condensers
<a href="#">F01P 2003/225</a>	...	Steam-to-liquid condensers
<a href="#">F01P 2003/2257</a>	...	Rotating condensers
<a href="#">F01P 2003/2264</a>	...	Separators
<a href="#">F01P 2003/2278</a>	..	Heat pipes
<a href="#">F01P 2003/2292</a>	..	with thermostatically controlled by-pass
<b>F01P 2005/00</b>		<b>Pumping cooling-air or liquid coolants</b> ( <a href="#">controlling circulation or supply of coolants by influencing drive of pumps F01P 7/00</a> )
<a href="#">F01P 2005/02</a>	.	Pumping cooling-air; Arrangements of cooling-air pumps, e.g. fans or blowers
<a href="#">F01P 2005/025</a>	..	using two or more air pumps
<a href="#">F01P 2005/04</a>	..	Pump-driving arrangements
<a href="#">F01P 2005/046</a>	...	with electrical pump drive
<a href="#">F01P 2005/10</a>	.	Pumping liquid coolant; Arrangements of coolant pumps
<a href="#">F01P 2005/105</a>	..	Using two or more pumps
<a href="#">F01P 2005/12</a>	..	Pump-driving arrangements
<a href="#">F01P 2005/125</a>	...	Driving auxiliary pumps electrically
<b>F01P 2007/00</b>		<b>Controlling of coolant flow</b>
<a href="#">F01P 2007/14</a>	.	the coolant being liquid
<a href="#">F01P 2007/143</a>	..	using restrictions
<a href="#">F01P 2007/146</a>	..	using valves
<a href="#">F01P 2007/16</a>	..	by thermostatic control

- F01P 2007/168** . . . By varying the cooling capacity of a liquid-to-air heat-exchanger
- F01P 2009/00** **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 2011/00** **Component parts, details, or accessories not provided for in, or of interest apart from, groups [F01P 1/00](#) to [F01P 9/00](#)**
- F01P 2011/02** . Liquid-coolant { [filling](#) }, overflow, venting, or draining devices ( [automatic draining during freezing conditions \[F01P 11/20\]\(#\)](#) )
- F01P 2011/0204** . . { [Filling](#) }
- F01P 2011/0209** . . . { [Closure caps](#) }
- F01P 2011/0214** . . . . { [Mounting](#) }
- F01P 2011/0219** . . . . . using bayonet connections
- F01P 2011/0223** . . . . . Decoration
- F01P 2011/0228** . . . . . Sealing
- F01P 2011/0233** . . . . . Venting
- F01P 2011/0238** . . . . { [with overpressure valves or vent valves](#) }
- F01P 2011/0242** . . . . . setting the pressure valve
- F01P 2011/0247** . . . . { [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 2011/06** . 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** . . Combating corrosion ( [F01P 2011/061](#) takes precedence )
- F01P 2011/068** . . . chemically
- F01P 2011/14** . Indicating devices; Other safety devices
- F01P 2011/205** . . using heat-accumulators
- F01P 2023/00** **Signal processing; Details thereof**
- F01P 2023/08** . Microprocessor; Microcomputer

**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

## **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