

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

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

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	..	Combating 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 (F01P 11/20 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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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