

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
--------------	---	-------------------------------

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