

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](#))

1/00	Air cooling
2001/005	. {Cooling engine rooms}
1/02	. Arrangements for cooling cylinders or cylinder heads, e.g. ducting cooling-air from its pressure source to cylinders or along cylinders
2001/023	. . {Cooling cylinders (F01P 2003/022 takes precedence)}
2001/026	. . {Cooling cylinder heads (F01P 2003/025 takes precedence)}
1/04	. Arrangements for cooling pistons
1/06	. Arrangements for cooling other engine or machine parts
1/08	. . for cooling intake or exhaust valves
1/10	. . for cooling fuel injectors or sparking-plugs
3/00	Liquid cooling
2003/001	. {Cooling liquid}
2003/003	. . {having boiling-point higher than 100°C}
2003/005	. {the liquid being fuel}
2003/006	. {the liquid being oil}
2003/008	. {the liquid being water and oil}
3/02	. Arrangements for cooling cylinders or cylinder heads
2003/021	. . {Cooling cylinders}
2003/022	. . . {combined with air cooling}
2003/024	. . {Cooling cylinder heads}
2003/025	. . . {combined with air cooling}
2003/027	. . {Cooling cylinders and cylinder heads in parallel}
2003/028	. . {Cooling cylinders and cylinder heads in series}
3/04	. . Liquid-to-air heat-exchangers combined with, or arranged on, cylinders or cylinder heads
3/06	. Arrangements for cooling pistons
3/08	. . Cooling of piston exterior only, e.g. by jets
3/10	. . Cooling by flow of coolant through pistons
3/12	. Arrangements for cooling other engine or machine parts

3/14	. . for cooling intake or exhaust valves
3/16	. . for cooling fuel injectors or sparking-plugs
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)
2003/182	. . {with multiple heat-exchangers}
2003/185	. . {arranged in parallel}
2003/187	. . {arranged in series}
3/20	. Cooling circuits not specific to a single part of engine or machine (F01P 3/22 takes precedence)
3/202	. . {for outboard marine engines}
3/205	. . . {Flushing}
3/207	. . {Liquid-to-liquid heat-exchanging relative to marine vessels}
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
3/2207	. . {characterised by the coolant reaching temperatures higher than the normal atmospheric boiling point}
2003/2214	. . {Condensers}
2003/2221	. . . {of the horizontal type}
2003/2228	. . . {of the upflow type}
2003/2235	. . . {of the downflow type}
2003/2242	. . . {Steam-to-steam condensers}
2003/225	. . . {Steam-to-liquid condensers}
2003/2257	. . . {Rotating condensers}
2003/2264	. . . {Separators}
3/2271	. . {Closed cycles with separator and liquid return}
2003/2278	. . {Heat pipes}
3/2285	. . {Closed cycles with condenser and feed pump}
2003/2292	. . {with thermostatically controlled by-pass}

Pumping cooling-air or liquid coolants; Controlling circulation or supply of coolants

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

5/02	• Pumping cooling-air; Arrangements of cooling-air pumps, e.g. fans or blowers	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 })
2005/025	• . {using two or more air pumps}		
5/04	• . Pump-driving arrangements		
5/043	• . . {Pump reversing arrangements}		
2005/046	• . . . {with electrical pump drive}	9/04	• by simultaneous or alternative use of direct air-cooling and liquid cooling (F01P 9/02 takes precedence)
5/06	• . Guiding or ducting air to, or from, ducted fans	9/06	• by use of refrigerating apparatus, e.g. of compressor or absorber type
5/08	• . Use of engine exhaust gases for pumping cooling-air		
5/10	• Pumping liquid coolant; Arrangements of coolant pumps		
2005/105	• . {Using two or more pumps}	11/00	Component parts, details, or accessories not provided for in, or of interest apart from, groups F01P 1/00 - F01P 9/00
5/12	• . Pump-driving arrangements		
2005/125	• . . {Driving auxiliary pumps electrically}	11/02	• Liquid-coolant {filling}, overflow, venting, or draining devices (automatic draining during freezing conditions F01P 11/20)
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		
7/00	Controlling of coolant flow	11/0204	• . {Filling}
7/02	• the coolant being cooling-air	11/0209	• . . {Closure caps}
7/023	• . {Cowlings for airplane engines}	11/0214	• . . . {Mounting}
7/026	• . {Thermostatic control}	2011/0219	• {using bayonet connections}
7/04	• . by varying pump speed, e.g. by changing pump-drive gear ratio	2011/0223	• {Decoration}
7/042	• . . {using fluid couplings (couplings or clutches of this type per se F16D 35/00)}	2011/0228	• {Sealing}
7/044	• . . {using hydraulic drives}	2011/0233	• {Venting}
7/046	• . . {using mechanical drives}	11/0238	• {with overpressure valves or vent valves}
7/048	• . . {using electrical drives}	2011/0242	• {setting the pressure valve}
7/06	• . by varying blade pitch	11/0247	• {Safety; Locking against opening}
7/08	• . by cutting in or out of pumps	2011/0252	• {Venting before opening}
7/081	• . . {using clutches, e.g. electro-magnetic or induction clutches}	2011/0257	• {with theft preventing means}
7/082	• . . . {using friction clutches}	2011/0261	• {activated by temperature}
7/084	• {actuated electromagnetically}	2011/0266	• {activated by pressure}
7/085	• {actuated by fluid pressure}	2011/0271	• {Semi-permeable, e.g. using Gore-Tex c fibres}
7/087	• {actuated directly by deformation of a thermostatic device}	11/0276	• . {Draining or purging}
7/088	• {actuated in response to driving speed, e.g. by centrifugal devices}	11/028	• . {Deaeration devices}
7/10	• . by throttling amount of air flowing through liquid-to-air heat exchangers	11/0285	• . {Venting devices}
7/12	• . . by thermostatic control	11/029	• . {Expansion reservoirs}
7/14	• the coolant being liquid	11/0295	• . {Condensers for radiators}
2007/143	• . {using restrictions}	11/04	• Arrangements of liquid pipes or hoses
2007/146	• . {using valves}	11/06	• Cleaning (in general B08B); Combating corrosion (in general C23F)
7/16	• . by thermostatic control	2011/061	• . {Cleaning or combatting corrosion using filters}
7/161	• . . {by bypassing pumps}	2011/063	• . {Cleaning (F01P 2011/061 takes precedence)}
7/162	• . . {by cutting in and out of pumps}	2011/065	• . {Flushing}
7/164	• . . {by varying pump speed}	2011/066	• . {Combating corrosion (F01P 2011/061 takes precedence)}
7/165	• . . {characterised by systems with two or more loops}	2011/068	• . . {chemically}
7/167	• . . {by adjusting the pre-set temperature according to engine parameters, e.g. engine load, engine speed}	11/08	• Arrangements of lubricant coolers (in lubrication apparatus F01M)
2007/168	• . . {By varying the cooling capacity of a liquid-to-air heat-exchanger}	11/10	• Guiding or ducting cooling-air, to, or from, liquid-to-air heat exchangers
9/00	Cooling having pertinent characteristics not provided for in, or of interest apart from, groups F01P 1/00 - F01P 7/00 (profiting from waste heat of combustion-engine cooling F02G 5/00)	11/12	• Filtering, cooling, or silencing cooling-air
2009/005	• {Cooling with melting solids}	11/14	• Indicating devices; Other safety devices
		11/16	• . concerning coolant temperature (F01P 11/20 takes precedence)
		11/18	• . concerning coolant pressure, coolant flow, or liquid-coolant level
		11/20	• . concerning atmospheric freezing conditions, e.g. automatically draining or heating during frosty weather
		2011/205	• . {using heat-accumulators}

<hr/>		2060/00	Cooling circuits using auxiliaries
2023/00	Signal processing; Details thereof	2060/02	. Intercooler
2023/08	. Microprocessor; Microcomputer	2060/04	. Lubricant cooler
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2025/00	Measuring	2060/06	. Retarder
2025/04	. Pressure	2060/08	. Cabin heater
2025/06	. . for determining flow	2060/10	. Fuel manifold
2025/08	. Temperature	2060/12	. Turbo charger
2025/12	. . Cabin temperature	2060/14	. Condenser
2025/13	. . Ambient temperature	2060/16	. Outlet manifold
2025/30	. . Engine incoming fluid temperature	2060/18	. Heater
2025/31	. . Cylinder temperature	2060/185	. . for alternators or generators
2025/32	. . Engine outcoming fluid temperature	2070/00	Details
2025/33	. . Cylinder head temperature	2070/02	. using shape memory alloys
2025/34	. . Heat exchanger incoming fluid temperature	2070/04	. using electrical heating elements
2025/36	. . Heat exchanger mixed fluid temperature	2070/06	. Using intake pressure as actuating fluid
2025/40	. . Oil temperature	2070/08	. Using lubricant pressure as actuating fluid
2025/42	. . Intake manifold temperature	2070/10	. using electrical or electromechanical means
2025/44	. . Outlet manifold temperature	2070/30	. Rotating radiators
2025/46	. . Engine parts temperature	2070/32	. Ring-shaped heat exchangers
2025/48	. . Engine room temperature	2070/50	. mounting fans to heat-exchangers
2025/50	. . using two or more temperature sensors	2070/52	. mounting heat-exchangers
2025/52	. . Heat exchanger temperature		
2025/60	. Operating parameters		
2025/62	. . Load		
2025/64	. . Number of revolutions		
2025/66	. . Vehicle speed		
2025/70	. Level		
2025/80	. Concentration anti-freeze		
2031/00	Fail safe		
2031/16	. using melting materials		
2031/18	. Detecting fluid leaks		
2031/20	. Warning devices		
2031/22	. using warning lamps		
2031/24	. for freezing		
2031/30	. Cooling after the engine is stopped		
2031/32	. Deblocking of damaged thermostat		
2031/34	. Limping home		
2031/36	. Failure of coolant pump		
2037/00	Controlling		
2037/02	. starting		
2050/00	Applications		
2050/02	. Marine engines		
2050/04	. . using direct cooling		
2050/06	. . using liquid-to-liquid heat exchangers		
2050/08	. . Engine room		
2050/10	. . Z-type engine		
2050/12	. . Outboard engine		
2050/16	. Motor-cycles		
2050/20	. Aircraft engines		
2050/22	. Motor-cars		
2050/24	. Hybrid vehicles		
2050/30	. Circuit boards		