

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	3/12	• Arrangements for cooling other engine or machine parts
2001/005	• {Cooling engine rooms}	3/14	• • for cooling intake or exhaust valves
1/02	• Arrangements for cooling cylinders or cylinder heads, e.g. ducting cooling-air from its pressure source to cylinders or along cylinders	3/16	• • for cooling fuel injectors or sparking-plugs
2001/023	• • {Cooling cylinders (F01P 2003/022 takes precedence)}	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)
2001/026	• • {Cooling cylinder heads (F01P 2003/025 takes precedence)}	2003/182	• • {with multiple heat-exchangers}
1/04	• Arrangements for cooling pistons	2003/185	• • {arranged in parallel}
1/06	• Arrangements for cooling other engine or machine parts	2003/187	• • {arranged in series}
1/08	• • for cooling intake or exhaust valves	3/20	• Cooling circuits not specific to a single part of engine or machine (F01P 3/22 takes precedence)
1/10	• • for cooling fuel injectors or sparking-plugs	3/202	• • {for outboard marine engines}
3/00	Liquid cooling	3/205	• • • {Flushing}
2003/001	• {Cooling liquid}	3/207	• • {Liquid-to-liquid heat-exchanging relative to marine vessels}
2003/003	• • {having boiling-point higher than 100°C}	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
2003/005	• {the liquid being fuel}	3/2207	• • {characterised by the coolant reaching temperatures higher than the normal atmospheric boiling point}
2003/006	• {the liquid being oil}	2003/2214	• • {Condensers}
2003/008	• {the liquid being water and oil}	2003/2221	• • • {of the horizontal type}
3/02	• Arrangements for cooling cylinders or cylinder heads	2003/2228	• • • {of the upflow type}
2003/021	• • {Cooling cylinders}	2003/2235	• • • {of the downflow type}
2003/022	• • • {combined with air cooling}	2003/2242	• • • {Steam-to-steam condensers}
2003/024	• • {Cooling cylinder heads}	2003/225	• • • {Steam-to-liquid condensers}
2003/025	• • • {combined with air cooling}	2003/2257	• • • {Rotating condensers}
2003/027	• • {Cooling cylinders and cylinder heads in parallel}	2003/2264	• • • {Separators}
2003/028	• • {Cooling cylinders and cylinder heads in series}	3/2271	• {Closed cycles with separator and liquid return}
3/04	• • Liquid-to-air heat-exchangers combined with, or arranged on, cylinders or cylinder heads	2003/2278	• {Heat pipes}
3/06	• Arrangements for cooling pistons	3/2285	• {Closed cycles with condenser and feed pump}
3/08	• • Cooling of piston exterior only, e.g. by jets	2003/2292	• • {with thermostatically controlled by-pass}
3/10	• • Cooling by flow of coolant through pistons		

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

- 11/20 . . concerning atmospheric freezing conditions, e.g. automatically draining or heating during frosty weather
- 2011/205 . . {using heat-accumulators}

2023/00 Signal processing; Details thereof

- 2023/08 . Microprocessor; Microcomputer

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2025/00 Measuring

- 2025/04 . Pressure
- 2025/06 . . for determining flow
- 2025/08 . Temperature
- 2025/12 . . Cabin temperature
- 2025/13 . . Ambient temperature
- 2025/30 . . Engine incoming fluid temperature
- 2025/31 . . Cylinder temperature
- 2025/32 . . Engine outgoing fluid temperature
- 2025/33 . . Cylinder head temperature
- 2025/34 . . Heat exchanger incoming fluid temperature
- 2025/36 . . Heat exchanger mixed fluid temperature
- 2025/40 . . Oil temperature
- 2025/42 . . Intake manifold temperature
- 2025/44 . . Outlet manifold temperature
- 2025/46 . . Engine parts temperature
- 2025/48 . . Engine room temperature
- 2025/50 . . using two or more temperature sensors
- 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

2060/00 Cooling circuits using auxiliaries

- 2060/02 . Intercooler
- 2060/04 . Lubricant cooler
- 2060/045 . . for transmissions
- 2060/06 . Retarder
- 2060/08 . Cabin heater
- 2060/10 . Fuel manifold
- 2060/12 . Turbo charger
- 2060/14 . Condenser
- 2060/16 . Outlet manifold
- 2060/18 . Heater
- 2060/185 . . for alternators or generators

2070/00 Details

- 2070/02 . using shape memory alloys
- 2070/04 . using electrical heating elements
- 2070/06 . Using intake pressure as actuating fluid
- 2070/08 . Using lubricant pressure as actuating fluid
- 2070/10 . using electrical or electromechanical means
- 2070/30 . Rotating radiators
- 2070/32 . Ring-shaped heat exchangers
- 2070/50 . mounting fans to heat-exchangers
- 2070/52 . mounting heat-exchangers