

CPC COOPERATIVE PATENT CLASSIFICATION

F MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING (NOTE omitted)

ENGINES OR PUMPS

F01 MACHINES OR ENGINES IN GENERAL; ENGINE PLANTS IN GENERAL; STEAM ENGINES

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

- 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.

WARNING

In this subclass non-limiting references (in the sense of paragraph 39 of the Guide to the IPC) may still be displayed in the scheme.

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	2003/028	. . {Cooling cylinders and cylinder heads in series}
2001/005	. {Cooling engine rooms}	3/04	. . Liquid-to-air heat-exchangers combined with, or arranged on, cylinders or cylinder heads
1/02	. Arrangements for cooling cylinders or cylinder heads, e.g. ducting cooling-air from its pressure source to cylinders or along cylinders	3/06	. Arrangements for cooling pistons
2001/023	. . {Cooling cylinders (F01P 2003/022 takes precedence)}	3/08	. . Cooling of piston exterior only, e.g. by jets
2001/026	. . {Cooling cylinder heads (F01P 2003/025 takes precedence)}	3/10	. . Cooling by flow of coolant through pistons
1/04	. Arrangements for cooling pistons	3/12	. Arrangements for cooling other engine or machine parts
1/06	. Arrangements for cooling other engine or machine parts	3/14	. . for cooling intake or exhaust valves
1/08	. . for cooling intake or exhaust valves	3/16	. . for cooling fuel injectors or sparking-plugs
1/10	. . 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)
3/00	Liquid cooling	2003/182	. . {with multiple heat-exchangers}
2003/001	. {Cooling liquid}	2003/185	. . {arranged in parallel}
2003/003	. . {having boiling-point higher than 100°C}	2003/187	. . {arranged in series}
2003/005	. {the liquid being fuel}	3/20	. Cooling circuits not specific to a single part of engine or machine (F01P 3/22 takes precedence)
2003/006	. {the liquid being oil}	3/202	. . {for outboard marine engines}
2003/008	. {the liquid being water and oil}	3/205	. . . {Flushing}
3/02	. Arrangements for cooling cylinders or cylinder heads	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	7/087	. . . . . {actuated directly by deformation of a thermostatic device}
3/2207	. . {characterised by the coolant reaching temperatures higher than the normal atmospheric boiling point}	7/088	. . . . . {actuated in response to driving speed, e.g. by centrifugal devices}
2003/2214	. . {Condensers}	7/10	. . by throttling amount of air flowing through liquid-to-air heat exchangers
2003/2221	. . . {of the horizontal type}	7/12	. . . by thermostatic control
2003/2228	. . . {of the upflow type}	7/14	. the coolant being liquid
2003/2235	. . . {of the downflow type}	2007/143	. . {using restrictions}
2003/2242	. . . {Steam-to-steam condensers}	2007/146	. . {using valves}
2003/225	. . . {Steam-to-liquid condensers}	7/16	. . by thermostatic control
2003/2257	. . . {Rotating condensers}	7/161	. . . {by bypassing pumps}
2003/2264	. . . {Separators}	7/162	. . . {by cutting in and out of pumps}
3/2271	. . {Closed cycles with separator and liquid return}	7/164	. . . {by varying pump speed}
2003/2278	. . {Heat pipes}	7/165	. . . {characterised by systems with two or more loops}
3/2285	. . {Closed cycles with condenser and feed pump}	7/167	. . . {by adjusting the pre-set temperature according to engine parameters, e.g. engine load, engine speed}
2003/2292	. . {with thermostatically controlled by-pass}	2007/168	. . . {By varying the cooling capacity of a liquid-to-air heat-exchanger}
<u>Pumping cooling-air or liquid coolants; Controlling circulation or supply of coolants</u>			
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		
5/043	. . . {Pump reversing arrangements}	9/04	. by simultaneous or alternative use of direct air-cooling and liquid cooling (F01P 9/02 takes precedence)
2005/046	. . . {with electrical pump drive}	9/06	. by use of refrigerating apparatus, e.g. of compressor or absorber type
5/06	. . Guiding or ducting air to, or from, ducted fans		
5/08	. . Use of engine exhaust gases for pumping cooling-air		
5/10	. Pumping liquid coolant; Arrangements of coolant pumps	11/00	Component parts, details, or accessories not provided for in, or of interest apart from, groups F01P 1/00 - F01P 9/00
2005/105	. . {Using two or more pumps}	11/02	. Liquid-coolant {filling}, overflow, venting, or draining devices (automatic draining during freezing conditions F01P 11/20)
5/12	. . Pump-driving arrangements	11/0204	. . {Filling}
2005/125	. . . {Driving auxiliary pumps electrically}	11/0209	. . . {Closure caps}
5/14	. Safety means against, or active at, failure of coolant-pumps drives, e.g. shutting engine down; Means for indicating functioning of coolant pumps	11/0214	. . . . {Mounting}
7/00	Controlling of coolant flow	2011/0219	. . . . . {using bayonet connections}
7/02	. the coolant being cooling-air	2011/0223	. . . . . {Decoration}
7/023	. . {Cowlings for airplane engines}	2011/0228	. . . . . {Sealing}
7/026	. . {Thermostatic control}	2011/0233	. . . . . {Venting}
7/04	. . by varying pump speed, e.g. by changing pump-drive gear ratio	11/0238	. . . . . {with overpressure valves or vent valves}
7/042	. . . {using fluid couplings (couplings or clutches of this type per se F16D 35/00)}	2011/0242	. . . . . {setting the pressure valve}
7/044	. . . {using hydraulic drives}	11/0247	. . . . . {Safety; Locking against opening}
7/046	. . . {using mechanical drives}	2011/0252	. . . . . {Venting before opening}
7/048	. . . {using electrical drives}	2011/0257	. . . . . {with theft preventing means}
7/06	. . by varying blade pitch	2011/0261	. . . . . {activated by temperature}
7/08	. . by cutting in or out of pumps	2011/0266	. . . . . {activated by pressure}
7/081	. . . {using clutches, e.g. electro-magnetic or induction clutches}	2011/0271	. . . . . {Semi-permeable, e.g. using Gore-Tex c fibres}
7/082	. . . . {using friction clutches}	11/0276	. . {Draining or purging}
7/084	. . . . . {actuated electromagnetically}	11/028	. . {Deaeration devices}
7/085	. . . . . {actuated by fluid pressure}	11/0285	. . {Venting devices}

11/029	. . {Expansion reservoirs}
11/0295	. . {Condensers for radiators}
11/04	. Arrangements of liquid pipes or hoses
11/06	. Cleaning (in general B08B); Combating corrosion (in general C23F)
2011/061	. . {Cleaning or combating corrosion using filters}
2011/063	. . {Cleaning (F01P 2011/061 takes precedence)}
2011/065	. . {Flushing}
2011/066	. . {Combating corrosion (F01P 2011/061 takes precedence)}
2011/068	. . . {chemically}
11/08	. Arrangements of lubricant coolers (in lubrication apparatus F01M)
11/10	. Guiding or ducting cooling-air, to, or from, liquid-to-air heat exchangers
11/12	. Filtering, cooling, or silencing cooling-air
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}

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
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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